COPPABELLA
Wind Farm

SSD 6698
Modification Application No. 2
Environmental Assessment Report

Date: 26 November 2025

Prepared by: Goldwind Australia Pty Ltd
On behalf of: Coppabella Wind Farm Pty Ltd

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EXECUTIVE SUMMARY

The Coppabella Wind Farm (CWF) approved project area (formerly known as Yass Valley Wind Farm) is located approximately 30 kilometre (km) west of the township of Yass within the Hilltops and Yass Valley Local Government Areas (LGAs). Coppabella Wind Farm (CWF) was originally approved in 2016 as State Significant Development (SSD) 6698 under the *Environmental Planning and Assessment Act 1979* (EP&A Act) and was subsequently modified in 2018 (Mod 1) to allow for the construction, operation and decommissioning of up to 75 wind turbines to a maximum tip height of 171m.

Coppabella Wind Farm Pty Ltd (CPWPL) intends to progress the development in the near future and, has further reviewed the CWF design in the context of current renewable energy developments and recent requirements and direction for integration of renewables in the National Electricity Market. Most studies into challenges of the renewable energy transition are now flagging the importance of additional energy storage together with the increase in renewable energy generation.

Accordingly, CWFPL has recognised the need to align the project with an inclusion of storage capacity and is now seeking a modified consent to enhance the benefits of the CWF development as follows:

- Enhancement of CWF through the inclusion of a Battery Energy Storage System (BESS). BESS are increasingly an integral part of renewable energy projects to reduce intermittency of the supply regime where generation is dependent entirely on the wind or solar resource. The proposed BESS units will be DC-Coupled BESS which will be co-located at a high proportion of the individual turbines, to provide the benefit of storing the excess energy produced by the turbine when winds are favourable but grid demand is low and releasing to the National Energy Market (NEM) when conditions are more favourable due to greater market demand but where the wind resource may be low
- No change to the CWF turbine components is required, and the approved turbine layout of up to 75 wind turbines is retained with the same turbine dimensions as per the Mod 1 approval
- Associated facilities remain generally consistent with the approved project and include access tracks, 33kV internal electrical network, grid connection at 132kV, permanent meteorological (met) masts, operation and maintenance facilities and temporary construction infrastructure.

As described in this document, the project remains essentially the same, as the approved CWF project:

- CWF remains a moderate scale renewable energy project
- The location and dimensions of the wind turbines remain consistent with the Mod 1 approval
- Access infrastructure is unchanged and, grid connection is consistent with the CWF approval
- The maximum output to the grid is unchanged
- The inclusion of BESS optimises the wind farm performance but does not introduce significant environmental impacts as the BESS utilises the wind farm disturbance footprint, comprises infrastructure of low height and limited visibility, will not increase project noise levels at neighbouring dwellings and shares the wind turbine access and grid connection infrastructure
- The modified CWF project will be better aligned with the NEM electricity supply regimes and operate more efficiently in the NEM. Inclusion of BESS is increasingly being adopted for renewable energy projects across NSW.

This Modification No. 2 Environmental Assessment Report has been prepared by Goldwind Australia (GWA) on behalf of CPWPL to support the application for the modification of the Development Consent under Section 4.55(2) of the EP&A Act. For this Modification Application, GWA has updated the Project description to include the BESS equipment to be installed at Turbine sites and reflect outcomes of CWF detail design since 2018. Environmental assessments for BESS are also provided within this document.

In summary the proposed project modifications for inclusion of BESS relate to:

- Transport of containerised BESS units to the site from Port Kembla, utilising the same route as previously identified for the Project
- BESS units placed at up to 71% of approved turbine locations and, placement to be within the necessary areas to be cleared at each turbine site
- Connection of BESS to each of the turbines via short underground cables beneath/adjacent to the hardstand
- Operations, maintenance and decommissioning of BESS aligned with the operational timeframe of the CWF.

The inclusion of BESS units at individual turbine sites will add significant benefit and value to the Project with the value extending to the NSW consumer and the broader electricity market. The design of the DC-Coupled BESS has the advantage of storing excess energy from each turbine which may have otherwise been lost, which occurs when wind turbine generators are either constrained by the Australian Energy Market Organisation (AEMO) or the wholesale market price is negative. The "excess" energy which is stored in the BESS units can be released at times of high energy demand or times of low wind conditions thereby aligning output better with NEM supply objectives. With the substantial challenges facing NSW for the energy transition, optimising the projects to be developed to support the transition provides a more efficient development model enhancing the value of each renewable energy development as parts of the transition solution.

The CWF BESS units at the turbine sites will comprise up to six 40 ft (12.2 m) open framed containers which are pre-fitted with BESS and pre-wired prior to delivery to site. Each of the six BESS units will be placed on or adjacent to the hardstand within the area either previously cleared for the blade laydown and/ or on part of the turbine hardstand

Each of the six BESS Container Units will consist of the following:

- Up to four Goldblock battery cabinets and one DC-DC converter
- Each Goldblock battery cabinet has a maximum rated output power of approximately 836 kW
- Power rate of batteries at each WTG of approximately 5020 kW
- The energy storage capacity of up to 19.86 MWh is available at each turbine site from the six containers.

Environmental impacts assessed as part of the modification 2 application have included hazard and risk, bushfire, traffic, noise and visual. As the modification will not require any works to be undertaken outside of the approved construction footprint, additional studies relating to biodiversity and heritage were not considered necessary. The potential impacts associated with the inclusion of BESS are minimal and additional mitigation measures where necessary, have been detailed.

Consultation was undertaken, during preparation of this application, with relevant stakeholders including Hilltops and Yass Valley Councils, NSW Fire and Rescue, NSW Rural Fire Service, landowners and members of the community.

This Mod 2 Assessment report includes the following:

- Updated Project description, focused on the BESS inclusion
- Updated mitigation measures
- Statutory compliance table
- Preliminary Hazard Analysis
- Radiant Heat Analysis
- Bush Fire Assessment Report
- BESS Environmental Noise Assessment
- Updated Traffic Assessment
- Visual Impacts

For the reasons given in this assessment report, it is considered that the Project remains essentially the same from the perspective of its purpose in supplying renewable energy from the local wind resource but is improved through:

- More efficient wind farm design to optimise generation from the site
- Its improved ability to align with NEM requirements

- No significant increase in environmental impacts arising due to co-location of wind turbine and BESS equipment.

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1.0 INTRODUCTION

This report has been prepared to support an application to modify the State Significant Development (SSD) 6698 Development Consent that was granted for the Coppabella Wind Farm (CWF) project (formally known as Yass Valley Wind Farm) under Section 89E of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Development Consent was originally granted under delegation from the Minister for Planning on the 30th March 2016 for the construction, operation and decommissioning of up to 79 wind turbines with a maximum tip height of 150 metres (m) and associated infrastructure.

The Development Consent was subsequently modified (Mod 1) on the 10th of December 2018 which allowed for an increase in wind turbine height to 171 m, reduction to 75 turbines and permitted an amendment to vegetation clearing limits.

Coppabella Wind Farm Pty Ltd (CPWPL) is now seeking to modify the Development Consent under Section 4.55(2) of the EP&A Act (Mod 2) to allow for the inclusion of a Battery Energy Storage System (BESS) into the Project. The BESS units will comprise DC-Coupled BESS co-located at nominated wind turbines, which provides the benefit of storing excess energy produced by the turbine and releasing the stored energy when conditions are favourable. The proposed wind turbine dimensions remain consistent with those allowed for under the Mod 1 Consent.

1.1 Approved Project Overview

The CWF project area is located approximately 30 kilometre (km) west of the township of Yass within the Hilltops and Yass Valley Local Government Areas (LGAs). CWF covers an area of dimensions 12 km west to east and 10 kilometres north to south along the Coppabella Hills near the villages of Bookham and Binalong.

The Mod 1 approval allows for the construction of up to 75 wind turbines and associated infrastructure. Current planning has considered a range of options, some of which involve less than the 75 approved turbine sites, Current planning is well advanced for 69 turbine sites (Layout 54), associated access tracks, 33kV internal electrical network, grid connection at 132kV, permanent meteorological (met) masts, operation and maintenance facilities and temporary construction infrastructure. The final design for implementation is still subject to detail tendering and financial investment decisions that may see less than 75 turbine sites developed. The proposed BESS would be co-located at turbine sites on land where landowners have agreed to the BESS on their property and within areas that are part of the disturbance footprint for installation of the turbines and associated construction activities.

The location of the site and the approved infrastructure layout is shown on **Figure 1-1**. The Project area comprises eleven host landowner properties, of which nine properties have agreement of landowners to host BESS at the approved turbine locations.

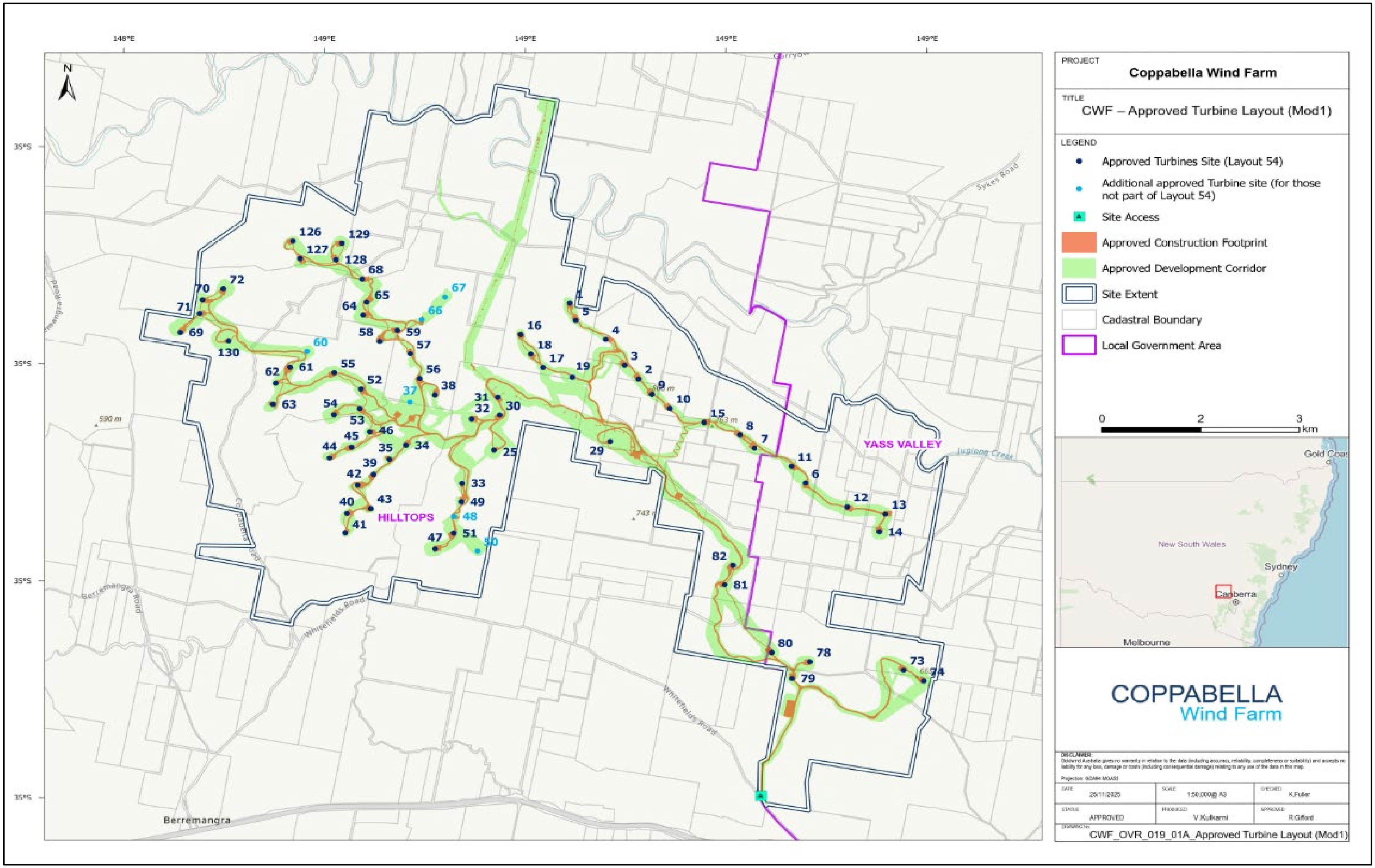


Figure 1-1: Project Location with Regional Context

1.2 Proposed Modifications

The proposed modifications include:

- Inclusion of dedicated BESS at each of up to 71% of the approved wind turbine sites
- Turbine locations and dimensions remain as approved for Mod 1
- Associated equipment are generally consistent with Mod 1 Approval.

The above project aspects are outlined in the following sections.

1.2.1 Inclusion of BESS at a high proportion of approved turbine sites

The BESS units will be co-located at up to 71% of the approved wind turbine locations which are to be constructed, operated and decommissioned. Details of the proposed BESS units and associated infrastructure are provided in detail in **Section 3.0** and **APPENDIX A**: Updated Project Description**.** In summary the proposed project modifications for inclusion of BESS relate to:

- Transport of containerised BESS units to the site from Port Kembla, utilising the same route as previously identified for the Project
- BESS units placed at up to 71% of approved wind turbine locations and BESS placement to be within the approved construction footprint areas to be cleared for each turbine installation
- Connection to each of the turbines via a short length of underground cables beneath/adjacent to the hardstand
- Operations, maintenance and at end of life, decommissioning of the BESS which will be aligned with the operational timeframe of the CWF.

The inclusion of BESS units at each of the turbines will add significant value to the Project with the value extending beyond the developer’s interests and including for NSW and the electricity market customers. The design of the DC-Coupled BESS has the advantage of storing excess energy from each turbine which may have otherwise been lost, which occurs when wind turbine generators are either constrained by the Australian Energy Market Organisation (AEMO) or the price is negative. The “excess” energy which is stored in the BESS units can be released at times of high energy demand or times of low speed wind conditions, thereby aligning output better with NEM supply objectives.

The alternative to the DC-coupled BESS units is to include a centralised BESS to the Project. This option was not pursued for CWF as:

- A centralised BESS would not be able to be accommodated within the currently approved Mod 1 disturbance footprint, as is proposed for DC-Coupled BESS and, accordingly, would require additional clearing of vegetation, which is avoided by Mod 2
- Centralised BESS would require additional electrical infrastructure such as an additional substation and cabling which would also require further vegetation clearing that is also avoided by the Mod 2 application.

1.2.2 Approval History

CWF was originally approved as Yass Valley Wind Farm in 2016 as SSD 6698. The assessment and approval of the project took place over several years from December 2008 to 30 March 2016. That process involved various iterations of the project, with initial planning by Epuron for three precincts (Coppabella, Marilba and Carrolls Creek) that proposed 186 wind turbines. An Environmental Assessment (November 2009) addressed two of the precincts Coppabella and Marilba, based on 152 turbines with maximum tip height of 150m. After detailed reviews, several changes of proponent, and consideration of two separate connection options, approval was gained for the project in 2016 covering only the Coppabella precinct and allowing up to 79 turbines with maximum height of 150 m (Original approval).

In 2018 a modification to the Project (Mod 1) was approved, which involved the installation of taller turbines (up to maximum height of 171 m), amendments to vegetation clearances limits and other minor infrastructure changes, including a reduction in the number of the wind turbines to only 75.

Mod 2 retains all 75 approved turbine locations and the same turbine dimensions (up to 171 m height) but introduces co-located BESS at a high proportion of the approved turbine sites improving NEM supply options.

The Project also holds a Commonwealth approval (EPBC 2017/8129) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) which was issued on the 12th November 2018. The basis of the EPBC approval is described in the CWF EPBC Referral documents and consistent with the original Development Consent related to 79 wind turbines.

1.3 The Proponent

Coppabella Wind Farm Pty Ltd (ACN 141 003 161) is owned by Goldwind Australia Pty Ltd (GWA).

GWA was established in Australia in 2009 and now has main offices in Sydney, Melbourne and Perth, as well as site offices at six project sites and two regional centres, which together employ more than 250 people across Australia.

GWA is involved in the development and operation of wind farm projects across Australia and the supply of wind turbines and BESS to the Australian energy market. GWA's parent company is Goldwind Science & Technology Co Ltd (GSTCL) which is a major manufacturer of wind turbine technology and energy solutions, now including BESS systems through Goldwind Carbon Neutral. GWA operates under Goldwind International (GWI) a subsidiary of GSTCL.

1.4 Proponent Details

Contact and business information for the Proponent organisation (CWFPL) is listed in **Table 1-1.**

Table 1-1: Proponent details

Coppabella Wind Farm Pty Ltd	
ABN	72 141 003 161
Postal Address	Level 25, 100 Barangaroo Avenue, Barangaroo NSW 2000
Email address?	info@coppabellawindfarm.com

1.5 Purpose and Structure of this document

This report has been prepared to support an application to modify Development Consent SSD-6698 (Modification Application) for the CWF (Mod 2). Preparation of this report has been undertaken with reference to Appendix E to *State Significant Guidelines, Preparing a Modification Report* (DPIE, 2021) and prior approvals.

This Report provides context and detailed assessment to support modification application 2 including:

- **Section 1** – Introduction – provides a summary of the Project and proposed modification by the proponent
- **Section 2** – Strategic Context – provides a summary of the regional and local context, including alignment with International, Federal and local policy and strategic goals, land use planning of the Project Area and provides a preliminary project justification.
- **Section 3** – Description of the Modification – description of the proposal and the integration with approved Project elements.
- **Section 4** – Statutory Context – summarised permissibility of the Project, power to grant approval and other approvals for consideration.
- **Section 5** – Engagement – summarises engagement undertaken with the community and other stakeholders.
- **Section 6**- Assessment of Impacts – provides an assessment of key environmental and social aspects, potential impacts and proposed mitigation measures to be incorporated in the modified project.
- **Section 7** – Justification of the Modified Project – justification of the modification with reference to Ecological Sustainable Development objectives.

- **Section 8** and **9** – Reference and Abbreviations
- **Appendices A – J** – providing supporting technical information

2.0 STRATEGIC CONTEXT

This section identifies the updated strategic context issues that are relevant to the assessment of the Modification.

2.1 Site Setting and Features

2.1.1 Regional Context

The Project is located within the Yass Valley and Hilltops Regional Local Government Areas (LGA).

The Project is located on rural land which is primarily used for grazing. Native vegetation is in discrete areas across the site, near watercourses and road verges. The project will not significantly limit existing grazing activities and the power generation and grazing activities are able to co-exist on the same lands. The diversification of land use on the host landowner properties strengthens the resilience of the rural businesses that are supporting the Project.

The closest communities are, Bookham which is approximately 7.5 km south and, Binalong which is approximately 8km northeast from the Project boundary. Based on the Census Data, Bookham's population is 127 and Binalong's populations is 302 (Census 2021, 2024). Near neighbours are being offered neighbour agreements to share benefits of the development with neighbours that wish to participate.

2.1.2 Bioregional Context

The Project is located within the South Western Slopes bioregion which extends from Albury in the south to Dubbo to the north and includes extensive area of foothills and isolated ranges comprising the lower inland slopes of the Great Dividing Range. The bioregion has some of the most highly cleared and altered landscapes in New South Wales (NSW). The bioregion includes parts of the Murray, Murrumbidgee, Lachlan and Macquarie River catchments (NSW Environment and Heritage, 2025) .

The CWF is within the mid Murrumbidgee Catchment north of the Murrumbidgee River, which is the largest river in the vicinity of the Project. The site is located within the Jugiong Creek sub-catchment, with several smaller creeks running into the Jugiong Creek which is a tributary of the Murrumbidgee River.

The Project is mostly within Riverina Local Land Services (LLS) region with some areas to the east of the Project area located in South East LLS. Land use in the Riverina LLS area is mainly agricultural with dry land grazing and cereal based cropping accounting for over 80% of land use. Irrigation farming in the region covers over 5% of the area (Local Land Services, 2025). The CWF site includes areas of steep land that are more suited to grazing than cropping.

The climate is temperate with warm to hot summers and cool winters with marginally more rain falling during summer months than in cooler months. However, lower evaporation in winter periods can mean soil moisture remains higher and in some places boggy soils prior to formation of project access tracks. Being a temperate climate both dry and wet conditions may be experienced over the years.

2.1.3 Key Landscape Features

The landscape within the Project area and immediate surrounds comprises:

- Rural pastures comprising native and exotic grasslands with sporadic trees of medium height in places clumped into small residual woodlands
- Terrain varying from lower-level pastures and higher hills and ridge, in places with very steep slopes. (topographic levels vary from approximately 450 m to 780 m)
- Rock exposures include granite, volcanic and metamorphic rock outcrops
- In places eroded gullies are present, more often on the steeper slopes
- Sparsely scattered rural dwellings, farm buildings, fencing and farm dams
- There are no listed significant landscape features within the Project area
- The closest reserve is the Burrinjuck Nature Reserve which is located approximately 15km south of the Project
- The Hume Highway passes to the south of the Project area

- Local roads oriented generally north/south occur to the east and west of the Project area
- Coppabella Road, an unsealed local road passes through the western part of the Project area
- Binalong and Bookham at 7.5 and 8 km from the project have partial views to the Project.

As shown in **Plate 2-1**, the Project site is largely cleared and used for grazing.

Plate 2-1: Photo of typical Project landscape

2.1.4 Soils and Geomorphology

The predominant soil landscape of the Project area is Oak Creek (on higher slopes) and Coppabella Creek (at lower gradients). Both landscapes have high to extreme erosion potential. The geology of the project location is dominated by Silurian igneous volcanic rocks but can be quite variable in terms of soil characteristics and erosivity. Variation in the erosivity of the rocks at the location have influenced the geometry of the terrain and provide a guide to stability.

Current, Sharing and Enabling Environmental Data (SEED), mapping shows the Project area primarily comprised of Land and Soil Capability Class 7 soil on the upper slopes and Class 6 on the lower slopes. Class 6 and 7 soils have limited agricultural value and are most suitable to low level grazing and forestry.

No Biophysical Strategic Agricultural Land (BSAL) occurs within the study area.

2.2 Infrastructure

The main transport route in the vicinity of the Project is the Hume Highway which runs generally east to west to the south of the site. This is a major transport route for freight and passenger vehicles which connects greater Sydney to Melbourne. The site is accessed via Whitefields Rd which intersects with the Hume Highway. Whitefields Road is unsealed local road which runs east west where it connects with Coppabella Road. Coppabella Road is unsealed and runs from the south through to the northern boundary of the east of CWF.

The main rail line (Sydney to Melbourne) is located approximately 6 km to the north-east of the Project boundary, connecting townships to the west of CWF to regional centres of Yass and Goulburn. The closest commercial airport is located at Canberra approximately 80 km to the southeast. Telecommunication services cross the locality and have been considered in developing the layout.

2.3 The Project Site

The Project area covers approximately 6,450 hectares (ha) and is comprised of eleven rural properties, with each of the properties comprising the land titles listed in **Table 2-1**. A Crown Land Licence (Licence 644433) has been obtained for the areas where the development corridor intersects with Crown Land.

The addition of BESS to the approved turbine locations is only proposed for Landowners 1 to 7 and 11 and 12 (hosting 53 turbine sites) and excludes properties 10 and 13 (as indicated by shading within the Table).

Table 2-1: Project Area: List of Lot and Deposited Plan (DP) Numbers (turbines in red not currently in layout)

Landowner	Lot(s)	DP	Turbines	No of Turbines	Other infrastructure
1	101	881434	126-129	4	Temporary Meteorological Masts x 2
2	293	721898	52-55, 58, 60, 61-63, 69, 130	11	Temporary Meteorological Masts x 1
	Y	382611	70-72	3	Permanent Temporary Meteorological Masts x 1
	1	659797	Nil	0	
3	284	753602	34, 35, 39, 40-46	10	Construction Compound O& M Compound
4	1	717646	68	1	Permanent Met Mast x1
5	2	717646	37,38, 56, 57,59, 64, 65, 66,67	9	Overhead Lines
6	285	753602	25, 30-33, 47, 49, 48, 50,51	10	Overhead Lines
7	260, 268	753602	1, 5, 16-19	6	Overhead Lines
Properties 8 and 9 were deleted from the original consent granted on 30 March 2016					
10	1, 2	593527	6-8	3	
	31, 41-43, 86-92, 135, 137, 138, 197, 200, 211-213, 230, 234, 235	753602	2-4, 9, 10, 15, 29, 81, 82	9	Sub-Station Overhead Lines Temporary Construction Compound No BESS
	61	753595	Nil	0	No BESS
	194, 201	753626	11	1	No BESS
11	344	753595	78-80	3	Permanent O&M
	1	1199238	Nil	0	
12	307, 314	753595	73, 74	2	
13	51, 76-78, 91, 106, 119, 136-138, 146-148, 155, 180-184, 186, 222	753626	12-14	3	No BESS
	57, 59, 60, 123-126,	753595	Nil	0	No BESS
		Total	Layout 54: 69 WTG Other approved: 6	**75 approved**	

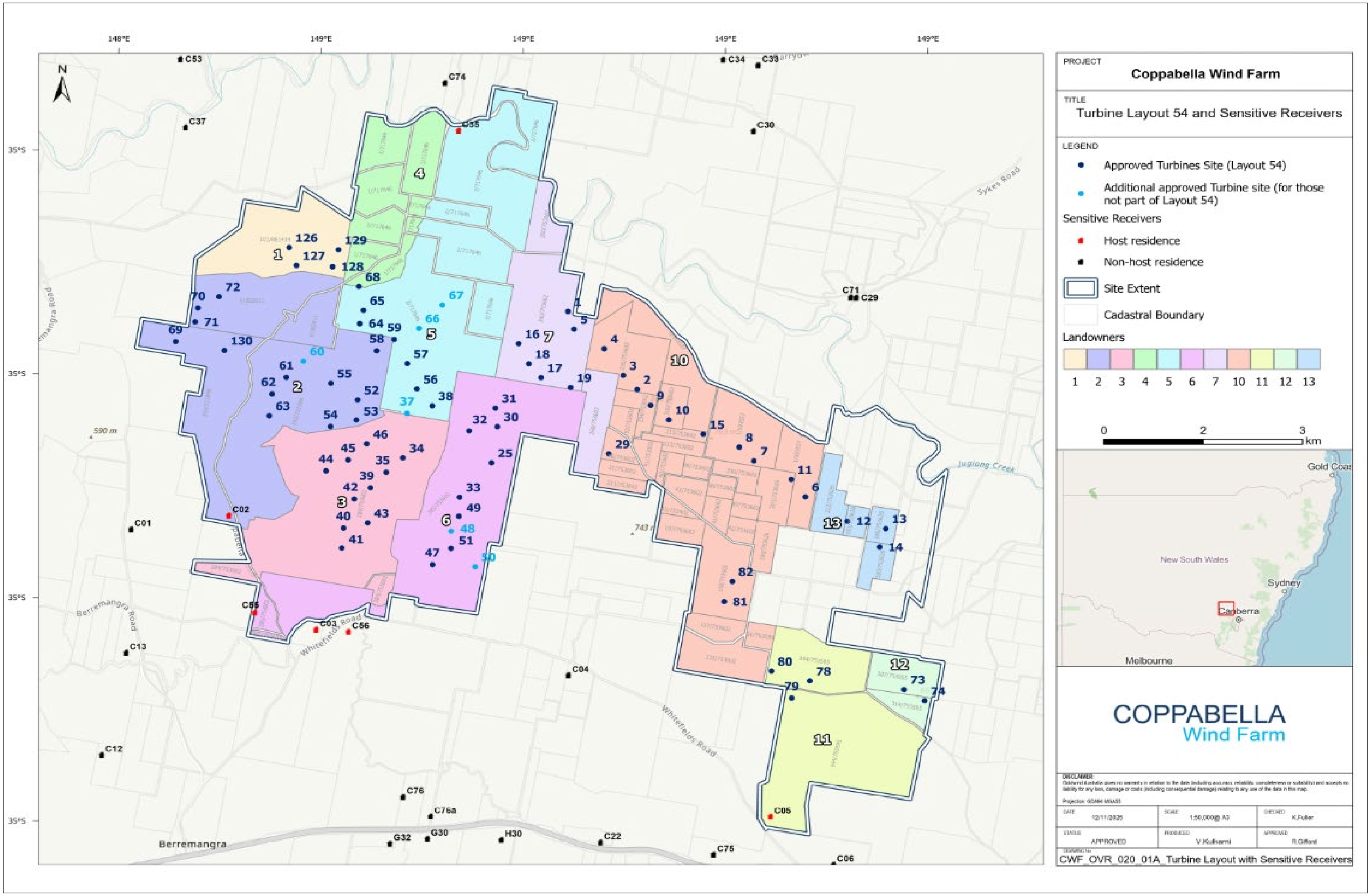


Figure 2-1: Project Area: Map of Lots and DP numbers

2.4 Local Context

The Project is located on land classified as RU1 Primary Production in the *Hilltops Local Environment Plan* (LEP) *2022* and *Yass Valley Local Environment Plan 2013*. The Council Shire boundary is shown in **Figure 1-1**. The land within the Project boundary is predominantly freehold with a few government roads and waterways which are administered by the Crown and Council.

The main access to the Project is from the Hume Highway to the south of the Project area via Whitefields Rd. Coppabella Rd crosses the western part of the site aligned generally north-south and, there are several unsealed local roads and farm tracks which intersect the Project area (refer **Figure 1-1**).

2.5 Strategic Framework

2.5.1 Overview

Provided in **Table 2-2** is a summary of the alignment of the proposed modification with the current strategic context.

Table 2-2: Alignment with Strategic Framework

Strategy, Policy or Plan	Description	Project Alignment
National Context		
Large Scale Renewable Energy Target (LRET)	The LRET was established to incentivise the development of renewable energy projects in Australia involving the development of market involving the creation and sale of certificates known as large-scale Generation Certificates (LGCs). The LRET requires electricity retailers to source up to 20% of their electricity from renewable energy sources such as PV, wind or hydro.	Once operational the CWF will participate in the LRET scheme. The inclusion of the BESS will improve delivery of renewable energy to the NEM.
United Nations Framework Convention on Climate Change Conference of Parties (COP28) – Dubai 2023	COP29 was the 29th climate change COP held in Azerbaijan in November 2024. A key focus for COP29 was the issue of climate financing the establishment of a new finance goal. In the Federal governments statement to COP28 it confirmed its commitment to accelerating the energy transition through the CIS as well as partnering with our Pacific partners.	The inclusion of BESS into the CWF will provide a significant value add to the Project and therefore increase the attractiveness of the wind farm from an investor perspective.
Integrated System Plan 2024	In June 2024, the recent integrated roadmap for the development of the NEM was released (AEMO, 2024). The 2024 ISP and its optimal development path support Australia's complex and rapid energy transformation towards net zero emissions, enabling low-cost firmed renewable energy and essential transmission to provide consumers in the NEM with reliable, secure and affordable power. The ISP identifies several step change scenarios including the significant increase of storage capacity to increase from 3 GW in 2024 to 49 GW by 2050.	The proposal to include DC-coupled BESS into the CWF aligns with the ISP roadmap by increasing the energy storage capacity in the NEM.
National Energy Performance Strategy 2024	In 2024 the federal government released the National Energy Performance Strategy. The strategy aims to improve energy performance for consumers and businesses whilst supporting the transition to Net Zero.	The BESS will improve the energy performance of the wind farm by storing energy which may have been otherwise wasted. The improvement in performance has the potential to contribute to lower energy prices.
NSW Context		
Net Zero Plan Stage 1: 2020:2030	The NSW Department of Planning and Environment released the Net Zero Plan Stage 1: 2020-2030, in March 2020 along with the establishment of Renewable Energy Zones in regional NSW. The goal of establishing this Net Zero plan is to assist the State in the delivery of a 35% cut in CO_2 emissions by 2030, when compared to 2005 levels. The plan highlights several key initiatives and is the first of three 10-year plans that set a pathway to net zero emissions by 2050.	The proposed modification to the wind farm will enable a valuable enhancement of CWF operation and enable additional CWF contribution towards NSW achieving its targets.

Strategy, Policy or Plan	Description	Project Alignment
NSW Electricity Strategy, 2019	The NSW Electricity Strategy is the NSW Government's plan for a reliable, affordable and sustainable electricity future that supports a growing economy. One of the key objectives is to increase reliability in the electricity system	The project will assist in meeting the predicted increase in demand and need for sustainable energy supplies and assist in offsetting the closure of fossil fuelled generators. The inclusion of BESS will improve energy efficiency and improve reliability.
NSW Network Infrastructure Strategy, 2023	The NSW Network Infrastructure Strategy is the NSWs governments plan to encourage private investment in energy infrastructure projects. It builds upon the broader objective of making energy more affordable and securing energy supplies. The Network infrastructure Strategy aims to increase NSWs connections with Victoria, South Australia and Queensland as well as increase NSWs energy capacity through the REZ areas.	The development of the project will contribute by increasing generational capacity from the region. The Network Infrastructure Strategy is required for planning distribution of the energy generated and enabling NEM Demands to be met. The connection option for CWF has been established with TransGrid via an existing infrastructure connection route. This infrastructure will be upgraded together with a dedicated transmission line in parallel with CWF construction to facilitate CWF implementation.
NSW Electricity Infrastructure Roadmap, 2020	The NSW Electricity Infrastructure Roadmap was released in November 2020. The Roadmap provides industry and investors the certainty they need to invest in the infrastructure we need, with more than $32 billion of private sector investment to be injected into the NSW economy by 2030. The delivery of the roadmap involves numerous government and private sector stakeholders. The roadmap provides for long duration storage Long Term Energy Service Agreements (LTESAs), the first of which began in 2022.	The operation of the project will assist in NSW reaching the emission reduction targets through the generation of renewable wind energy. Multiple renewable energy developments will be needed to ensure successful transition in NSW and CWF is an important contributor to the process.
Wind Energy Framework 2024	The Framework was released in November 2024 to streamline planning for large-scale renewable energy and transmission projects, it consists of several guidelines including the Wind Energy Guideline. The guidelines provide additional assessment considerations with particular reference to visual impacts, decommissioning and landholder agreements.	This modification report has been prepared with reference to the current wind energy framework documents. It is anticipated that DPHI will undertake its review of the application in accordance with the applicable guidelines
Climate Change (Net Zero Future) Act 2023	Climate Change (Net Zero Future) Act 2023 proclaimed November 2023 sets out pathway of emission reductions to 2050, through Net Zero Priorities, as follows • Drive uptake of proven emissions reduction technologies • Empower consumers and businesses to make sustainable choices • Invest in the next wave of emissions reduction innovation	The Project aligns with the four priorities as detailed in the Net Zero Plan through contributing to the reduction in greenhouse gas emissions through the generation and storage of electricity via wind resource. The DC-coupled BESS represents an innovative application of energy storage with wind power

Strategy, Policy or Plan	Description	Project Alignment
	- Ensure NSW Government leads by example. Emissions reduction targets as set out in the Act for NSW are: - 50% reduction on 2005 levels by 2030 - 70% reduction on 2005 levels by 2035 - Net zero by 2050.	generation and has potential benefits for the NEM system management.
Regional Context		
South East and Tablelands Regional Plan 2036	Direction 6 of Goal One of the Regional Plan is to “*Position the region as a hub of renewable excellence”*	The inclusion of DC-Coupled BESS to the Project is utilising a grid-following technology. The modification to include innovative BESS-Wind Turbine coupling technology supports this goal.
Local Context		
Yass Valley Local Strategic Planning Statement 2020	The Yass Valley Local Strategic Planning Statement (2020) sets the framework for the Shire’s economic, social and environmental land use needs over the next 20 years. The LSPS was adopted by Council in May 2021.	Priority 3 of the LSPS is for “Protect and conserve the natural environment, built and Aboriginal cultural heritage of Yass Valley”. The Project has been designed to minimise its impacts in native vegetation and Aboriginal heritage. The inclusion of BESS as part of Mod 2 Application will not require any additional vegetation clearing. CWF will occupy only a small part of the project lands providing for co-use of the rural properties and strengthening the commercial status of each of the host landowner properties, while also offering benefit sharing to near neighbours. Benefits will also flow to the wider region through increased economic activity and community benefit funding.
Hilltops 2040 Local Strategic Planning Statement 2020 - 2040	The Planning Statement recognises that for the shire to grow it needs to accommodate *“renewable energy sources such as wind and solar generation with ready access to national energy grids and markets.”*	The Project with the inclusion of BESS will provide a renewable energy source which will efficiently connect into the NEM. The local area is likely to experience increased commercial opportunities that can flow towards a stronger rural economy.

2.6 Project Benefits

The Project benefits remain substantially the same as the approved Project (Mod 1).

The Project's maximum generation capacity of 289 MW (limited to 270MW at the point of grid connection in TransGrid's Yass Sub-station) remains unchanged, however the modification (Mod 2) will provide the opportunity to store excess energy which can be discharged to the NEM when conditions are favourable. As detailed in **Table 2-2**, the Project will align with Federal and NSW government policies that will need transformation of existing energy systems to reduce greenhouse gas emissions with a target of achieving Net Zero by 2050. This will in large part be achievable through the increased development of low emission, renewable energy projects but integrated energy storage is a necessary part of a successful transition.

The modified project (Mod 2) will enable the Project to better align supply of generated electricity to the demands of the NEM. The grid-following BESS delivers fast frequency stabilisation, enables energy shifting to maximise value, and helps smooth market price volatility while strengthening overall grid reliability. This capability improves alignment with NEM demands and offers a significant advantage for the Mod 2 project and benefit to NSW electricity grid. The benefits of the inclusion of the BESS units are that they can be accommodated with the approved construction footprint and therefore provide significant benefit with minimal additional impact.

3.0 DESCRIPTION OF THE MODIFICATIONS

This section provides a description of the Modification and its preliminary design, layout and features.

3.1 Substantially the Same Project

The modified project will be substantially the same project for which Development Consent (as modified) was granted on the 10th December 2018 (Mod 1). The approved project comprises of a wind farm of up to 75 wind turbines with associated access tracks, 33kV internal electrical reticulation system, grid connection at 132 kV, permanent meteorological masts and temporary construction infrastructure. No changes to this general description are proposed as part of this modification.

Provided in **Table 3-1** is a summary of key elements of the Project and identification of where changes (if any) are proposed as part of the modification. The table demonstrates that the Project remains largely unchanged with the inclusion of BESS.

Table 3-1: Overview of Modification

Element	Originally Approved Project	Approved CWF Mod 1 Project	CWF Mod 2 Application
Project	Yass Valley Wind Farm	Coppabella Wind Farm	No Change from Mod 1
Proponent	Epuron Projects Pty Ltd	Coppabella Wind Farm Pty Ltd	No Change from Mod 1
Indicative Capacity	289 MW	289 MW	No Change from Mod 1
Site Boundary	Appendix 2 General Layout	6,450 Ha	No Change
Site Description	Appendix 2 General Layout and as per Schedule 2 Condition 5	As per Appendix 1 of SSD 6698	No Change
Vegetation Clearance Limits (total)	68.3 ha Box Gum Woodland EEC	179.8 ha (Endangered Ecological Community)	No Change
Wind Turbines	Approved for up to 79	Up to 75 turbines (Mod 1)	No Change from Mod 1
	Hub Height 78-100m	Hub Height 100m	No Change from Mod 1
	Tip height 150 m	Tip Height 171m	No Change from Mod 1
BESS	Nil	Nil	Up to 53 co-located DC-Coupled BESS Maximum of 4 hour storage 19.86 MWh per turbine location
Connection to Grid	A 330kV connection option was part of original application but not part of the Approval on 30 March 2016.	Construction of a new 132 KV transmission line which connects into existing 132 kV transmission line route to the north of the Project area.	No Change. Existing transmission line route with dedicated new line and Point of Connection and capacity remain the same as Mod 1.
OSOM Transport Route	Appendix 7 of Original Approval and Environmental Assessment	From Port Kembla to Project site via Hume Highway	No Change
Site Access	Access via Hume Highway and Whitefields Road	Via Hume Highway and Whitefields Road	No Change

Road Upgrades	Upgrade of intersection of Hume Highway and Whitefields Road. Upgrade of 2km section of Whitefields Road	Upgrade of intersection of Hume Highway and Whitefields Road. Upgrade of 2km section of Whitefields Road	No Change
Construction Personnel	Up to 200	Up to 200	Up to 210
Operational Personnel	Up to 15	Up to 15	Up to 15
Operational Life	25 years	25 years	25 years

As per Appendix E of the SSD Guidelines a consolidated project description is provided in **APPENDIX A**: Updated Project Description.

3.2 Indicative Layout

As described in **Section 1.2,** the wind turbine layout is unchanged from the Mod 1 Approval.

In relation to BESS units, these will be co-located at up to 71% of the approved wind turbine locations. BESS units will be located at up to 53 Turbine Sites that are selected as suitable for DC Coupled BESS. Placement of the BESS units at each of the turbine sites will be within the previously identified disturbance areas at each turbine site, that may involve the turbine site sub-areas as follows:

- On the cleared blade laydown areas, or
- Elsewhere on the existing hardstand areas, or
- Alternate BESS area (as per **Figure 3-1).**

Placement of the BESS units within the identified and assessed disturbance areas for turbine installation will ensure there will not be any additional vegetation clearing required to accommodate the BESS facilities and the disturbance footprint remains consistent with the approved construction footprint.

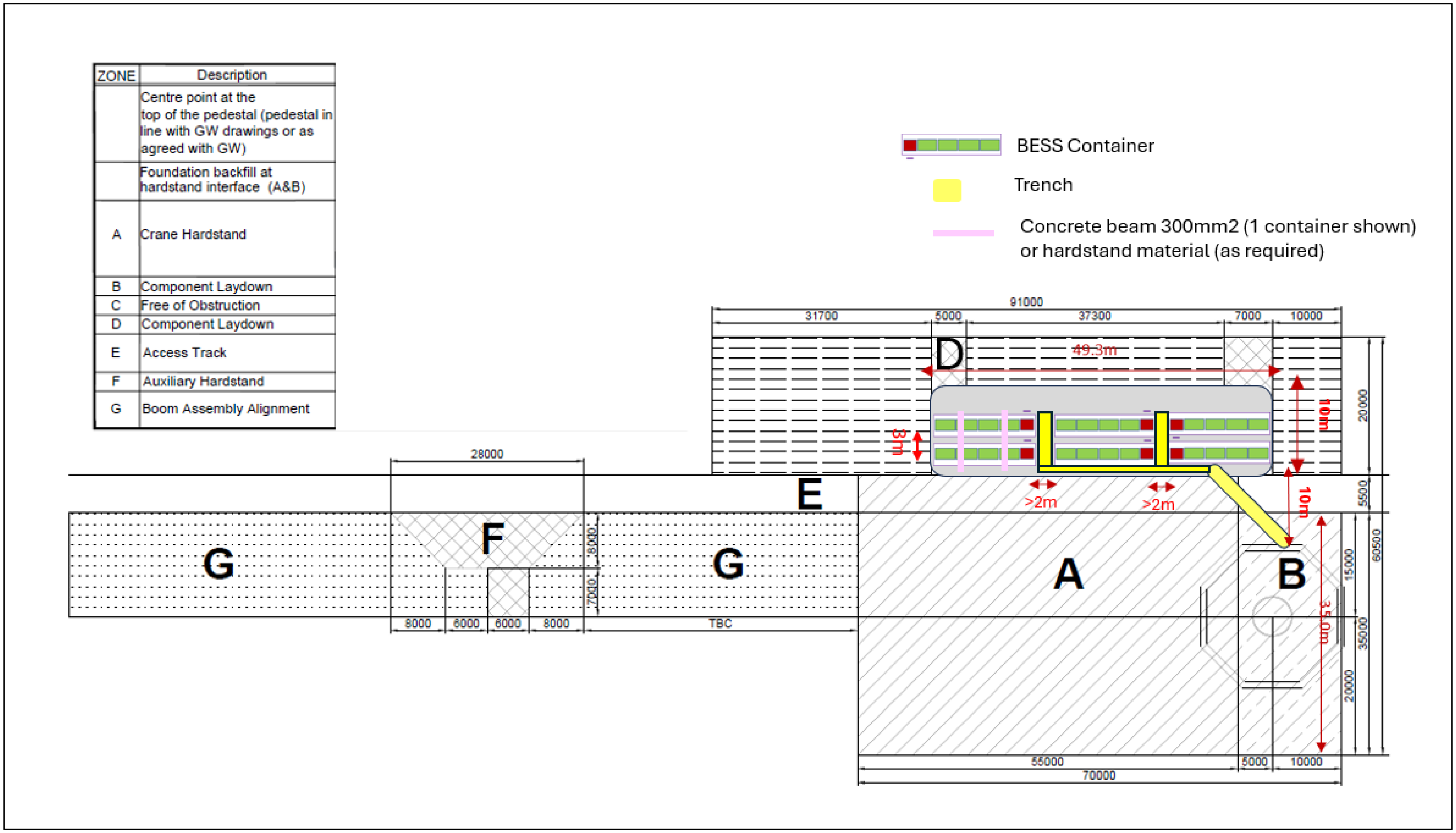
Provided in **Figure 3-1**, is an indicative layout of a BESS unit which is based on a 4-hour battery which comprises 6 BESS containers. This is the maximum proposed BESS footprint at each turbine location based on 4-hour discharge BESS.

It is possible to vary the configuration of BESS at individual turbine sites which could include having one or more of the turbine sites having the DC-coupled BESS configured for 2-hour discharge. In that case, only 3 containers would be utilised for the BESS installation at the particular turbine site. This could be considered at any sites for varying reasons and would be documented in the detailed design phase.

In either case, whether the 4-hour or an alternative 2-hour configuration, the layout is informed by required separation distances between BESS components as detailed in the hazard and bushfire risk studies as detailed in **Section 6.0.**

The storage capacity (kWh) and discharge rate (kW) for a four-hour BESS at each WTG is as follows:

- Rated Power per Container = 836 kW
- Power rating of batteries at each WTG = 5020 kW
- Battery energy (before losses) per WTG (4 hrs) = 19,86 MWh
- CWF BESS Site storage capacity = 1053 MWh (assumes 53 WTGs)



ZONE	Description
	Centre point at the top of the pedestal (pedestal in line with GW drawings or as agreed with GW)
	Foundation backfill at hardstand interface (A&B)
A	Crane Hardstand
B	Component Laydown
C	Free of Obstruction
D	Component Laydown
E	Access Track
F	Auxiliary Hardstand
G	Boom Assembly Alignment

Figure 3-1: Indicative BESS Layout (Not to Scale)

3.3 Modification Category

The EP&A Act provides an ability of a Consent Authority to modify a Consent (in response to an application) subject to the nature of the modification as prescribed in Section 4.55 of the Act. This Modification Application is being submitted in accordance with Section 4.55(2) *Other modifications* (i.e. not addressing S 4.55 (1) or (1A)).

Section 4.55(2) of the EP&A Act provides that a Development Consent can be modified where the consent authority:

- Is satisfied that the development to which the consent as modified relates is substantially the same development as the development for which consent was originally granted;
- Has notified the application as required; and
- Has considered any submissions made concerning the proposed modification.

On the 13th March 2025, GWA wrote to DPHI to provide notification that CWF Pty Ltd were intending on submitting an application to modify SSD 6698. This letter provided an overview of the proposed modification and the legislative context.

As provided in **Table 3-1**, the Project remains substantially the same as the development for which consent was originally granted. The generation output of the Project remains unchanged, and the development is within the approved construction footprint and complies with the approved vegetation clearance limits.

The inclusion of DC-coupled BESS units to the Project does not substantially alter the impacts of the assessed Project. Further investigations to determine any additional impacts were undertaken for noise, hazard and risk, bushfire, traffic and visual. As detailed in **Section 6.0** of this report the environmental and amenity impacts are considered to result in no more than minimal impacts and updated mitigation measures have been proposed to address BESS inclusion and are provided in **APPENDIX C:** Updated Mitigation Measures**.**

In summary the mitigated impacts are as follows:

- Hazards and Risk – the BESS units include a lithium iron phosphate chemistry. Tests which have been undertaken on the Goldblock BESS units to demonstrate compliance with UL9540A concluded that under forced thermal runaway there were no flames generated. This is also supported by other industry sources (Power Tech Systems, 2022) which conclude that the risk of fire is highly unlikely (refer **Section 6.3.2**).
- Traffic – an updated traffic impact assessment concluded that the additional heavy vehicle movements associated with the BESS can be accommodated and the Level of Service at the Hume Highway and Whitefields Rd intersection remains unchanged. (refer **Section 6.3.6**)
- Bushfire –The elevated risk can be mitigated to an acceptable level through detailed design and the provision of key treatments including Asset Protection Zones, the management of fuel, and the selection of BESS equipment that demonstrates a heightened level of fire safety. Additional mitigation measures to capture these provisions are included (refer **Section 6.3.4**).
- Noise and vibration – There will be no increase in noise impacts to noise sensitive receivers surrounding CWF relative to assessed and permitted noise emissions (refer **Section 6.3.5**)
- Visual - the scale of the BESS in comparison to the wind turbines is minor and would have a negligible visual impact (refer **Section 6.3.7**).

3.4 Conditions of Consent

Modification to the current Conditions of Consent to reflect the proposed Modification 2, are summarised in **Table 3-2**.

Table 3-2: Proposed Modifications to the Conditions of Consent

Development Consent SSD 6698	Updates Required
Definitions	Definition of "EA" to be updated to include this Modification Report
	Definition of "Battery Storage" to include as Battery Energy Storage System
Schedule 3 Environmental Conditions – General	**Condition 41 (Bushfire)** to be amended to include: The Applicant must: (a) Minimise the fire risks of the development, including managing vegetation fuel loads onsite; (b) Ensure that the development: (i) Complies with the relevant asset protection requirements in the RFS's Planning for Bushfire Protection 2019 and Standards for Asset Protection Zones; and (ii) Is suitably equipped to respond to any fires on site including the provision of: • A dedicated water supply tank fitted with a 65 mm Storz fitting (c) Ensure that the development, including battery storage areas: • Access must allow for safe and effective firefighting operations around the perimeter of each BESS. • Is managed as an asset protection zone (d) Assist the RFS, FRNSW and emergency services as much as practicable if there is a fire in the vicinity of the site; and (e) Notify the relevant local emergency management committee following construction of the development and prior to commencement of operations.
	New Condition Emergency Plan Prior to the commencement of construction of the wind farm and commissioning of the battery storage, the Applicant must develop and implement an Emergency Response Plan and detailed emergency procedures for the development in consultation with the relevant local emergency management committee and the RFS and provide a copy to the local Fire Control Centre, FRNSW, the NSW State Emergency Service and relevant local councils. The plan must: (a) Be consistent with RFS's *Planning for Bushfire Protection 2019* (or equivalent) (b) Be consistent with the NSW RFS document: A Guide to Developing a Bush Fire Emergency Management and Evacuation Plan; (c) Include details on how the battery storage and sub-systems can be safely isolated in an emergency; (d) Identify the fire risks and hazards and detailed measures for the development to prevent fire igniting; (e) Include availability for fire suppression equipment, access and water;

Development Consent SSD 6698	Updates Required
	(f) Include bushfire emergency management planning. Two copies of the Emergency Plan are to be located at a prominent position adjacent to the site entry at all times.

3.5 Supporting information

To support the Modification application the following supporting information has been provided: provides supporting information, including:

A. Updated Project description (APPENDIX A: Updated Project Description)
B. Review of Statutory Compliance (APPENDIX B: Statutory Compliance Table)
C. Updated mitigation measures table (APPENDIX C: Updated Mitigation Measures)

Supporting information relating to the assessment of impacts of the proposed BESS:

D. Radiant Heat Analysis (APPENDIX D: Radiant Heat Analysis)
E. Preliminary Hazards Analysis (PHA) (APPENDIX E: Preliminary Hazard Analysis)
F. Risk Assessment (APPENDIX F: SFRAIP Risk Assessment)
G. Bushfire Assessment (APPENDIX G: Bushfire Assessment)
H. Environmental Noise Assessment (Appendix H: Environmental Noise Assessment**)**
I. Updated Traffic Assessment (APPENDIX I: Updated Traffic Assessment)
J. Visual Representation (APPENDIX J: TrueVisual BESS Representation

4.0 STATUTORY PLANNING CONTEXT

This section outlines the key statutory requirements for the modification under relevant NSW legislation.

4.1 Planning Context

The statutory requirements relevant to the modification are provided in **Table 4-1**. As required in the DPIE *SSD Guidelines Appendix E Preparing a Modification Report* (DPIE, 2021), a statutory compliance tables for the modified project are included as **APPENDIX B:** Statutory Compliance Table**.**

Table 4-1: Modification Statutory Context

Statutory Reference	Comment
Power to grant approval	Consent is sought for the proposed modification to SSD 6698 under section 4.55 (2) of the EP&A Act. The Project is defined as electricity generating works. The Project is a SSD according to Section 4.36 or the EP&A Act, as declared so by the State Environmental Planning Policy (Planning Systems) 2021. Accordingly, the Minister for Planning or delegate is the consent authority for this modification application.
Permissibility	The proposed modification is sought under Section 4.55 (2) of the EP&A Act. Section 4.55(2) of the EP&A Act provides that a Development Consent can be modified where the consent authority: *a) it is satisfied that the development to which the consent as modified relates is substantially the same development as the development for which consent was originally granted and before that consent as originally granted was modified (if at all), and* *(b) it has consulted with the relevant Minister, public authority or approval body (within the meaning of Division 4.8) in respect of a condition imposed as a requirement of a concurrence to the consent or in accordance with the general terms of an approval proposed to be granted by the approval body and that Minister, authority or body has not, within 21 days after being consulted, objected to the modification of that consent, and* *(c) it has notified the application in accordance with—* *(i) the regulations, if the regulations so require, or* *(ii) a development control plan, if the consent authority is a council that has made a development control plan that requires the notification or advertising of applications for modification of a development consent, and* *(d) it has considered any submissions made concerning the proposed modification within the period prescribed by the regulations or provided by the development control plan, as the case may be.*
Other approvals	Section 4.42 of the EP&A Act outlines that these approvals cannot be refused if necessary for carrying out an approved SSD and are to be consistent with the terms of the SSD approval. **APPENDIX B**: Statutory Compliance Table provides a summary of these approvals and compliance of the modification.
Pre-conditions to exercising the power to grant approval	As outlined above, the consent authority may modify a development consent if it is satisfied of the relevant matters under section 4.55 of the EP&A Act.

5.0 STAKEHOLDER ENGAGEMENT

This section provides an overview of the stakeholder engagement which has been undertaken by GWA for the Modification.

5.1 Introduction

Goldwind representatives have been engaging with a range of stakeholders throughout the development of the Project. The means of engagement have included face to face individual and group meetings, community liaison at the existing community information centre, emails and phone calls. Engagement with the local community is undertaken by regular meetings with the established Community Consultative Committee (CCC). Goldwind has developed a BESS Stakeholder and Community Engagement Plan which will build upon the engagement undertaken to date.

The Stakeholder and Community Engagement has been developed with reference to the following guidelines:

- *Undertaking Engagement Guidelines for State Significant Projects* (DPIE, 2021)
- *Social Impact Assessment Guidelines* (DPIE, 2021a)
- *Technical Supplement Social Impact Assessment Guidelines for State Significant Projects* (Technical Supplement) (DPIE, 2021)
- *Community Engagement Guidelines for the Australian Wind Industry* (CEC, 2018)
- *Wind Energy Guideline for State Significant wind energy development* (DPE, 2016).

5.2 Engagement Methods

Stakeholder and community engagement is about making better and sustainable decisions through a process that engenders trust, credibility, and feedback. A detailed plan of this engagement can be found in the BESS Stakeholder and Community Engagement Plan. Our approach will inform about BESS addition to landowners and council members prior to broader community engagement activities related to the planning modification.

- A strong and robust engagement program can facilitate the following outcomes
- Build respectful relationships with stakeholders and community members to support and identify project operations and goals
- Decrease the levels of misinformation about the project and wind energy
- Maintain company reputation by reducing the risk of reputational damage
- Reduce the strategic and practical financial and legal costs for developers.

5.3 Diverse Stakeholder Consultation

Consultation planning and collaboration will provide guidance to present team members and contractors with the conduct expected while communicating with stakeholders. All participants will adhere to these guidelines, to prevent unnecessary or ineffective communication or engagement.

Project team members will consider how stakeholders require distinct types of information sharing throughout the project lifecycle. Before communicating, it is an individual’s responsibility to consider and appropriately accommodate the potential differences between themselves, the company, the intended recipient, and the wider audience:

- Project involvement (including historical knowledge)
- Project interest
- Technical knowledge
- Capability to understand concepts or themes
- Language barriers
- Cultural differences

- Local knowledge and familiarity with local community

Communication styles will need to be adapted for different situations and individuals. Working to actively anticipate divergent needs and planning to accommodate them through correct information sharing processes can help discussions proceed more easily.

If a potential issue is identified, this should be recorded in Simply Stakeholders and the risk register. Data will then be shared with supervisors and/or managers to help appropriately mitigate possible risks.

Goldwind recognises the importance of managing stakeholder expectations by ensuring engagement tools are underpinned by the principles of openness, inclusiveness, responsiveness and accountability – and therefore the goal and/or promises facilitated via each tool is outlined.

5.3.1 Engagement Schedule

Provided in **Table 5-1** is a summary of the engagement undertaken to inform stakeholders of the proposed modification for the inclusion of BESS at the CWF.

Table 5-1: Engagement schedule

Date	Stakeholder	Engagement method	Issues raised
11 March 2025	DPHI	On line meeting	Planning pathway Timeframes
4 June 2025	Landowner Group	In person meeting	Fire and hazards Traffic Visual
11 June 2025	Fire and Rescue NSW	Email	Will provide a response when modification submitted. Fire Safety Study
11 June 2025	NSW Rural Fire Service	Email	Request preparation of Bushfire Risk Assessment
5 June 2025	CCC	In person meeting	Hazard and Risk Fire
2 July 2025	Hilltops Council	On line meeting	Community benefits Traffic
5 August 2025	Yass Valley Council	In person meeting	Community benefits Fire risk Visual
20 August 2025	TfNSW	On line meeting	Ability of intersection and upgrades to accommodate additional heave vehicles
4 September 2025	DPHI	On line meeting	Timeframes of submission and content
16 October 2025	CCC	In person meeting	Biodiversity Hazard risks and fire Construction

5.3.2 Key Community Concerns

Consultation undertaken to date has identified several areas of potential concern to the community. The concerns in **Table 5-2** cover a wide range of themes where a targeted communication approach is required during the modification public exhibition.

Table 5-2: Summary of key community concerns

Topic Area	Mitigation
Noise	Updated Noise Impact Assessment. - Noise limits will meet existing NSW Government standards that influenced the CWF planning consent.
Fire Safety	Preparation of the following: • Preliminary Hazard Analysis • Risk Assessment • Radiant Heat Analysis • Bushfire Assessment - This proposal advances fire safety by using new technologies, with lithium iron phosphate improving the safe temperature ranges allowed during operation.
Visual Amenity	Limit to 2.9 m height on a hardstand base adjacent to each Wind Turbine Generator. - New visual imagery of the Coppabella site to show the visual impact to the community. This is provided in **APPENDIX J**.
Traffic Management	Updated Traffic Management Plan - New details in the Traffic Management Plan will allow us to alleviate the increases in traffic haulage required during construction.
Community Perception	Be clear and transparent about the inclusion of BESS to meet planning regulations through new safety, noise, visual and traffic assessments. - BESS will improve project outcomes, namely in energy efficiency through new storage capacity.
Community Benefit Sharing	Offer sufficient community benefits in line with the scale of development. -the BESS addition will provide infrastructure capacity to the proposed wind farm development, to improve the site with the latest technology. No additional energy will be produced as a result of this proposed modification.

5.4 Planned Engagement Tools

The Proponent will continue to engage with the community and other stakeholders as the project progresses through the various stages of development, construction, and operations. Following this submission of the modification report, the community engagement strategy will continue to ensure all possible stakeholders are consulted about the project and feedback is considered and incorporated into the Project design.

The Proponent will implement the BESS SaCEP including:

- Updated information on the project website
- Community information provided at the existing information centre in Binalong (in-person)
- Discussions with near neighbours (face to face, telephone etc.)
- Attendance at local community events, to provide information, listen to feedback and answer questions
- Consultation on the framework for a Community Benefits Package
- Maintain the voice of the project's existing Community Consultative Committee (CCC)
- Council and other political briefings.

Proposed future engagement with the identified stakeholders is provided in **Table 5-3**.

Table 5-3: Future engagement strategies with stakeholders

Group Type	Future Engagement Activities
Host Landowners	Face to face meetings Email and phone calls Information Centre Website and newsletters Direct contact (phone and email)
Near Neighbours	Face to face meetings Email and phone calls Information Centre Website and newsletters Direct contact (phone and email)
Wider Community	Information sessions Website and newsletters Direct contact (phone and email) Local paper advertisements
Local Businesses	Information sessions Meetings and project briefings Website and newsletters
Local Community Groups	Meetings and project briefings Website and newsletters
Local Community Services	Meetings and project briefings Website and newsletters
Local Aboriginal Groups	Meetings and project briefings Website and newsletters
Federal Government	Meetings / Presentations
State Government	Meetings / Presentations
Local Government	Meetings / Presentations
Media	Project Briefings Website and newsletters

6.0 ASSESSMENT OF POTENTIAL IMPACTS

This section outlines the assessment of potential impacts relating to the proposed modifications for the Project.

6.1 Planning pathway

CWF is an approved State Significant Development as it is an electricity generating project with a capital investment value greater than $30 million. The Project has been granted consent as follows:

- Original approval granted consent on the 30th March 2016
- Modification 1 was approved on the 10th December 2018.

This application is for Modification 2 for SSSD 6698. As outline in **Section 3.2**, This Modification Application is being submitted as an "Other Modification" in accordance with Section 4.55(2) of the EP&A Act.

6.1.1 Works required

The inclusion of BESS will provide the ability of the wind farm to store energy which can be discharged to the NEM when conditions are favourable. In terms of construction impacts, it would:

- Not require additional infrastructure other than BESS and associated components, with BESS cabling undertaken within the disturbance footprint
- Be located entirely within the approved disturbance footprint on areas previously cleared at each turbine location
- No higher impacts than that assessed for the EIS and Environmental Assessment (Mod 1)
- Require no alterations to the approved access and traffic arrangements
- Require no increase in the construction timing or work hours.

6.2 Assessment of modification related impacts

As detailed in **Section 3.0** the proposed modification is for the inclusion of DC-coupled BESS units at up to 71% of the approved wind turbine locations. Provided in **Table 6-1** is a summary of the technical assessment which have been prepared to support the modification report.

Table 6-1: Technical Assessment

Aspect	Technical Assessment	Appendix Reference
Hazard and Risk	Radiant Heat Analysis prepared by RiskCon Pty Ltd	**Appendix D**
	Preliminary Hazard Assessment prepared by RiskCon Pty Ltd	**Appendix E**
	Risk Assessment prepared by RiskCon Pty Ltd	**Appendix F**
	Bushfire Assessment Prepared by Waratah Bushfire Consultants	**Appendix G**
Traffic Impacts	Traffic Impact Assessment prepared by Amber	**Appendix I**
Noise Impacts	Environmental Noise Assessment prepared by Sonus	**Appendix H**
Visual	TrueVisual graphics	**Appendix J**

Provided in **Table 6-2** is a summary of environmental aspects and risks and identification of those issues which require additional assessment and are addressed by this modification Environmental Assessment Report. Details of the assessments are provided in **Section 6.3**.

Table 6-2: Aspects considered and level of assessment in Modification Report

Aspect	Existing approved Project environmental considerations	Nature and extent of modification impacts	Environmental risk rating	Additional assessment required?
Noise	Construction noise was predicted to exceed at a small number of non-associated receivers for short durations during the day. The approved project is predicted to achieve operational noise compliance at all receivers with the exception of one non-associated receiver 1.7 dBA above the base criteria.	The modification would result in negligible construction related noise emissions. The noise levels of the BESS units will be significantly lower than that of the co-located turbines. However the BESS does introduce a new noise source which needs to be considered.	Low	A noise assessment to consider the inclusion of BESS is provided in Appendix H: Environmental Noise Assessment
Hazards and Risk	The approved project is to provide for asset protection against bushfires and have procedures in place to manage potential fires.	The inclusion of BESS alters the risk profile of the Project. Whilst the likelihood is considered low, the risk of a fire due to a lithium iron phosphate thermal runaway event needs further assessment.	Medium	A PHA is provided in APPENDIX E: Preliminary Hazard Analysis A Bushfire Assessment is provided in APPENDIX G: Bushfire Assessment
Biodiversity	The Project has approval limits in place for the removal of threatened ecological communities required for the construction of the project. There are also limitations to infrastructure in proximity to, and the removal of, hollow bearing trees.	The modification will not require any further clearing of native vegetation. Placement of BESS will be undertaken in compliance with existing approvals	Nil	Nil
Soils	Earthworks are required for the construction of hardstand areas, access roads and associated infrastructure of the wind farm. Erosion and sediment controls will be in place to minimise impacts.	The modification will not require additional land disturbance.	Nil	Nil

Aspect	Existing approved Project environmental considerations	Nature and extent of modification impacts	Environmental risk rating	Additional assessment required?
Traffic and Transport	The transport route for turbine components is from Port Kembla to the site via the Hume Highway. Road upgrades are permitted at the intersection of the Hume Highway and Whitefields Rd, as well as upgrade of Whitefields Rd. An approved Traffic Management Plan is in place.	The modification would require up to an additional 318 heavy vehicle movements into and out of the project site. Consideration of the additional traffic movements may have a potential impact which needs to be assessed.	Medium	An updated traffic assessment is provided APPENDIX I: Updated Traffic Assessment
Visual	The approved project was assessed as having a low visual magnitude and would not result in unacceptable levels of risk to surrounding key receivers.	The BESS units are approximately 2.9m in height which is approximately 35 times magnitude smaller than the hub height of the turbine (100m). The visual impact with the inclusion of BESS will be low.	Low	A representation of the visual impact of BESS was prepared. Refer to APPENDIX J: TrueVisual BESS Representation.
Land Use	The existing land use is predominantly agricultural used for grazing. This would continue occur within the Project during the wind farm operations.	The BESS units will be placed on the previously cleared areas of the hardstand and within the approved construction footprint. There would be no further changes to land use than with that of the approved project.	Nil	Nil
Aviation Hazards	Once erected the location of the turbines will be reported to CASA in accordance with appropriate guidelines.	The BESS units are located on the ground surface and therefore no further reporting requirements will be required.	Nil	Nil
Social and Economic	The approved project is required for Voluntary Planning Agreements be in place with both Hilltops and Yass Valley Councils. The Project has an established CCC which is a forum to inform the community of project updates.	The modification would not result in any changes to the social impact of the Project. The inclusion of BESS would have a beneficial economic impact to the Project by storing excess power which would otherwise been lost under certain wind farm operating conditions.	Nil	Nil
Hydrology and water quality	Turbines and associated infrastructure have been located out of floodplain and hydrology lines.	The BESS would be co-located on the hardstand of the approved turbine locations. There would be no additional impacts to hydrology or water quality.	Nil	Nil

Aspect	Existing approved Project environmental considerations	Nature and extent of modification impacts	Environmental risk rating	Additional assessment required?
	Erosion and sediment control will be in place during construction to minimise any impacts to water quality.			
Aboriginal heritage, historical heritage	Aboriginal artefacts are located within the development footprint. Mitigation measures are documented in the approved management plan to minimise impacts including salvage of known artefacts.	The modification does not require additional surface or sub-soil disturbance within the construction footprint. .	Nil	Nil
Air quality	The air quality of the Project area is that generally anticipated of a rural environment. There are no significant emission sources in proximity to the area.	The BESS do not have any emissions which would have any notable impact.	Nil	Nil
Cumulative	Cumulative impacts were assessed as acceptable for the approved project.	No changes are proposed for construction and operation duration or methodology area proposed.	Nil	Nil

6.3 Detailed Assessment

6.3.1 Radiant Heat Analysis

A Radiant Heat Analysis was prepared for the Project based on the BESS configuration located on adjacent laydown areas proposed at CWF and is included as **APPENDIX D**: Radiant Heat Analysis. The radiant heat modelling was prepared utilising the view factor method from a thermal runaway BESS and subsequently identify the heat impact contours surrounding the BESS.

Large Fire Scale Test and Heat Impacts

There is limited data available from previous testing to ascertain radiant heat emitted from BESS lithium fire, however a Large Fire Scale Test (LFSC) has been previously conducted on a BESS unit of similar capacity (exact details are under non-disclosure). The flame characteristics from the unit observed are as follows:

- A maximum temperature of 675.3°C was recorded
- Peak flame extended 1.8 m vertically and 1.2 m horizontally
- Maximum heat flux is 48.72 kW/m at a distance of 1.2 m
- No adjacent units have initiated thermal runaway due to the fire event in the initiating unit; hence, a full BESS unit is not considered to be credible.

Provided in **Table 6-3** are heat radiation values and the corresponding physical effects of an observer exposed to these values.

Table 6-3: Heat Radiation and Associated Physical Impacts

Heat Radiation (kW/m^2)	Impact
35	• Cellulosic material will pilot ignite within one minute’s exposure • Significant chance of a fatality for people exposed instantaneously
23	• Likely fatality for extended exposure and chance of a fatality for instantaneous exposure • Spontaneous ignition of wood after long exposure • Unprotected steel will reach thermal stress temperatures which can cause failure • Pressure vessel needs to be relieved or failure would occur
12.6	• Significant chance of a fatality for extended exposure. High chance of injury • Causes the temperature of wood to rise to a point where it can be ignited by a naked flame after long exposure • Thin steel with insulation on the side away from the fire may reach a thermal stress level high enough to cause structural failure
4.7	• Will cause pain in 15-20 seconds and injury after 30 seconds exposure (at least second degree burns will occur)
3.0	• Firefighters will not enter areas that are exposed to radiant heat equal or above this threshold.

The modelling of the BESS units was carried out using a manual view factor calculation method. The results of the calculation are provided in **Table 6-4**. The results do not consider the effect of safeguards that are included in the BESS such as the aerosol fire extinguisher system and actual radiant heat values may be less.

Table 6-4: Radiant Heat Impact from a BESS Container Fire

Heat Radiation (kW/m^2)	Distance (m)
48.72	1.2
35	1.3
23	2.0
12.6	2.8
4.7	4.2
3.0	5.9

Comparing the values provided in **Table 6-4**, it is shown that the 12.6 kW/m ^{2} heat contour, which is the minimum threshold for potential structural damage, does not have the required distance to affect the wind turbine assuming that the BESS are placed at the proposed minimum 10 m distance.

6.3.2 Preliminary Hazard Analysis

6.3.2.1 Background

RiskCon Consulting were engaged to prepare a Preliminary Hazard Analysis (PHA) to address the inclusion of BESS to the Project (included as **APPENDIX E**: Preliminary Hazard Analysis). The PHA was prepared in accordance with the following guidelines:

- Hazardous Industry Planning Advisory Paper (HIPAP) No.6 – Hazard Analysis (Department of Planning, 2011);
- HIPAP No. 4 – Risk Criteria for Land Use Planning ((Department of Planning, 2011).

The key objective of the PHA was to demonstrate compliance with requirements of the *Environmental Planning and Assessment Regulation 2000* and the *Work Health and Safety Act 2017*.

6.3.2.2 Methodology

A Multi-Level Risk Assessment approach was adopted as the basis for the analysis to determine the level of risk assessment required. This approach considers a development in the context of its location, the quantity and type (i.e. hazardous nature) of Dangerous Goods (DGs) stored and used, and the project's technical and safety management control.

There are three levels of risk assessment set out in Multi-Level Risk Assessment which may be appropriate for a PHA, as detailed in **Table 6-5**.

Table 6-5: Level of Risk Assessment

Level	Type of Analysis	Appropriate if:
1	Qualitative	No major offsite consequences and societal risk is negligible
2	Partially Quantitative	Off-site consequences but with low frequency of occurrence
3	Quantitative	Where 1 and 2 are exceeded

Based on the type of DGs to be used and handled at the proposed project, a Level 2 Assessment was selected for the Project. Lithium Iron Phosphate is a Class 9 Miscellaneous dangerous good. There are no manifest quantities relevant to Class 9 dangerous goods in accordance with the *Work Health and Safety Regulation 2025*. The PHA approach provides a qualitative assessment of those DGs of lesser quantities and hazard, and a quantitative approach for the more hazardous materials to be used on-site.

The methodology approach used for the PHA is as follows:

- *Hazard Analysis* - A detailed hazard identification was conducted for the proposed Project facilities and operations. Each hazardous incident scenario was assessed qualitatively considering proposed safeguards (technical and management controls). Where a potential offsite impact was identified, the incident was carried into the main report for further analysis
- *Consequence Analysis* - For those incidents qualitatively identified in the hazard analysis to have a potential offsite impact, a detailed consequence analysis was conducted
- *Frequency Analysis* - In the event a simple solution for managing consequence impacts was not evident, each incident identified to have potential offsite impact was subjected to a frequency analysis. The analysis considered the initiating event and probability of failure of the safeguards
- *Risk Assessment and Reporting* - Where incidents were identified to impact offsite and where a consequence and frequency analysis was conducted, the consequence and frequency analysis for each incident were combined to determine the risk and then compared to the risk criteria published in HIPAP No. 4.

6.3.2.3 Risk Assessment Results

A hazard identification table was developed which provides a summary of potential hazards, consequences and safeguards at the site. To determine acceptable impact criteria for incidents that would not be considered for further analysis, due to limited impact offsite, the following approach has been applied:

- *Fire Impacts* – HIPAP 4 provides a criterion for the maximum permissible heat radiation at the Project boundary of 4.7 kW/m^2 above which the risk of injury may occur and therefore the risk must be assessed. Incidents that result in a heat radiation less that at 4.7 kW/m^2, at the Project Boundary, are screened from further assessment.
- *Explosion* – HIPAP 4 provides a criterion for the maximum permissible explosion overpressure at the Project Boundary of 7 kPa. Incidents that result in an explosion overpressure less than 7 kPa, at the Project Boundary, are screened from further assessment.
- *Toxicity* - toxic byproducts of combustion may be generated by a BESS fire; hence, toxicity has been assessed with criteria based upon the Emergency Response Planning Guidelines (ERPG).
- *Property Damage and Accident Propagation* - HIPAP No. 4 provides a criterion for the maximum permissible heat radiation/explosion overpressure at the Project Boundary (23 kW/m /14 kPa) above which the risk of property damage and accident propagation to neighbouring sites must be assessed.
- *Societal Risk* - HIPAP No. 4 indicates that where a development proposal involves a significant intensification of population, in the vicinity of such a project, the change in societal risk needs to be considered. In the case of the proposed Project, there is currently no significant intensification of population around the Project Area; hence, societal risk has not been considered in this assessment.

Based on the hazard identification table the following hazardous scenarios were subject to Hazard Analysis and further considered on whether those incidents should be carried forward for further analysis as outlined in methodology approach for the PHA. These are summarised in the following sections.

1. Flammable material spill and flash fire or vapour cloud explosion

Flammable liquids and gases are stored in workshops and maintenance areas containing small containers of brake cleaner, resins and various other chemicals for maintenance activities. All chemicals are stored in DG cabinets which are compliant with the relevant DG standards (AS 1940:2017).

In the event of a fire initiated in a DG cabinet, the quantities of goods kept are extremely small relative to the scale of the site and will not be able to produce a radiant heat which could impact over the boundary. Additionally, all flammable gas and liquid storage cabinets require extinguishers to be provided nearby, therefore a fire would likely be extinguished prior to any incident escalation.

Due to the small quantities, the risk of impact across the site boundary is negligible and this incident **has not been** carried forward for further analysis.

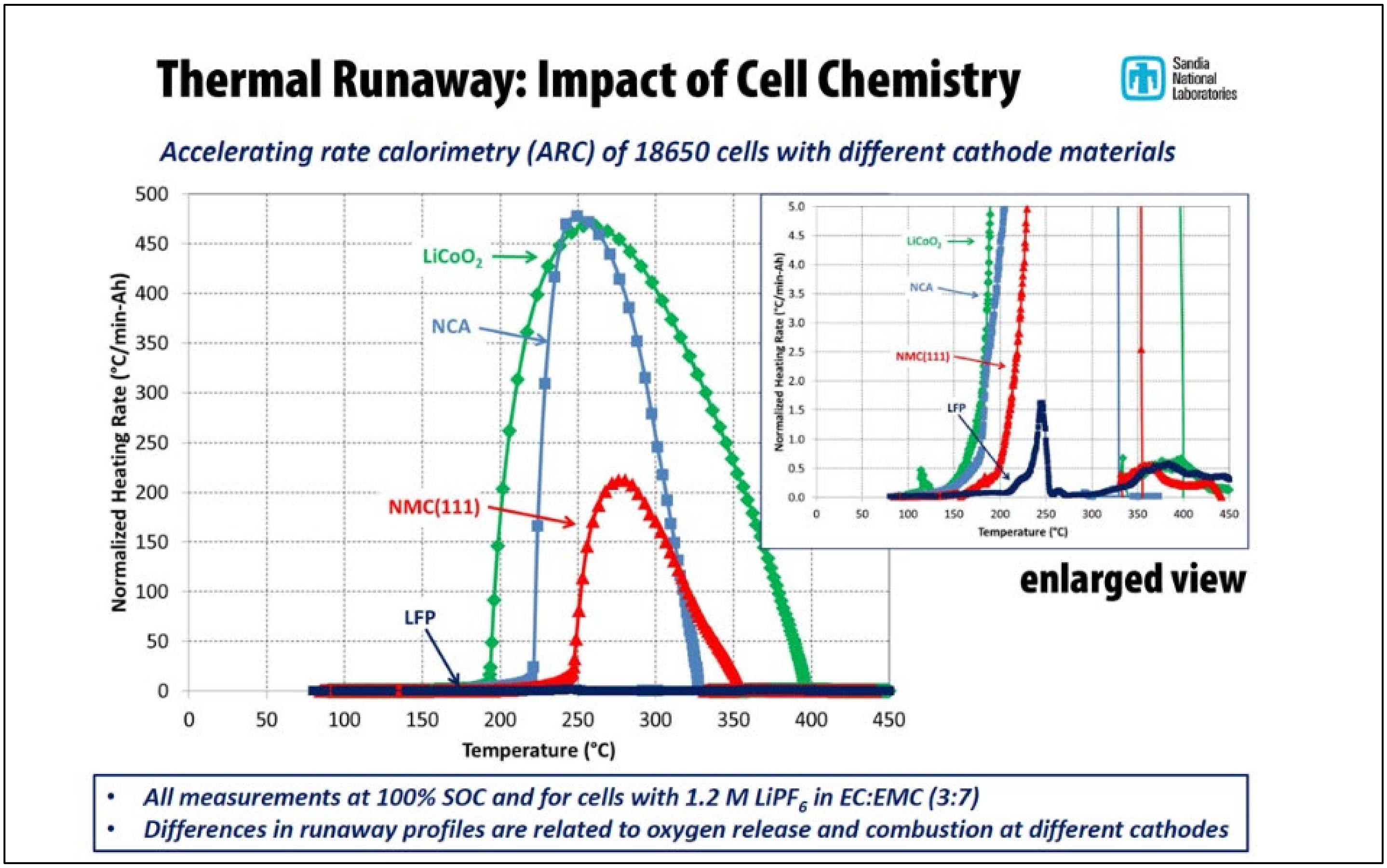
2. Li-ion battery fault, thermal runaway and fire

There are several degradation mechanisms that are present within a lithium-Ion battery which can result in thermal runaway. These include:

- Chemical reduction of the electrolyte at the anode
- Thermal decomposition of the electrolyte
- Chemical reduction of the electrolyte at the cathode
- Thermal decomposition by the cathode and the anode
- Internal short circuit by charge effects

These effects arise primarily because of high discharge, overcharging, or water ingress into the battery which results in a host of by-products being formed within the battery during charge and discharge cycles. When exposed to external heat the thermal rise of particular lithium-ion battery chemistries is 200-400^{0}C/min resulting in thermal run away and fire which can then propagate to adjacent batteries escalating the incident to a full container fire. As a consequence of the Li-ion fire risks, safety protection measures to prevent thermal runaway are standard in lithium-ion batteries, hence the potential for thermal runaway to occur in normal operation is very low.

The battery chemistry of the Goldblock is Lithium Iron Phosphate (LFP) which is one of the safest battery chemistries in the industry. For LFP batteries (as distinct from Li-ion batteries), the thermal rise of the batteries at peak is 1.5^{o}C/min which is significantly lower and results in a gradual temperature rise and typically does not result in fire and thus incident propagation to other batteries. Provided in **Figure 6-1** is a comparison of lithium-ion battery chemistries thermal runaway heating rates. The LFP heating rates shown in Figure 6-1 are significantly below those of the other Li-ion battery chemistries.



Thermal Runaway: Impact of Cell Chemistry

Accelerating rate calorimetry (ARC) of 18650 cells with different cathode materials

- *All measurements at 100% SOC and for cells with 1.2 M $LiPF_6$ in EC:EMC (3:7)*
- *Differences in runaway profiles are related to oxygen release and combustion at different cathodes*

Figure 6-1: Temperature Rise of Lithium Ion Battery Chemistries (Power Tech Systems, 2022)[1]

The Goldblock battery has passed the UL9540A test which demonstrated that a triggered thermal runaway is contained to the battery cell, does not cause fire nor transfer to adjacent ones. Furthermore, each container battery has multiple built-in fire protection devices that work in conjunction, including smoke and thermal sensors, combustible gas detector, pressure relief system, and aerosol and remote and local emergency shutdown. Therefore, a battery unit will automatically detect an internal fire in the first instance with executive action to release an aerosol extinguishant.

In consideration of the safety controls in place within BESS and the battery chemistry it was concluded unlikely to cause thermal runaway and **was not carried forward** for further analysis.

3. Victorian Big Battery fire review.

Notwithstanding the findings above, a review of the recent large scale BESS fires was undertaken to determine whether similar incidents could occur on the Project.

The investigation undertaken on the Victorian Big Battery Fire (VBB) concluded that the cause of the fire was strong wind blowing flames from one Megapack into the unprotected vent atop of an adjacent Megapack which resulted in ignition. Lessons learnt from the VBB incident results in fire safety precautions on the design of the Project. The vent atop the containers shall be made of metal instead of plastic and covered by a metallic mesh shield. Based on the

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[1] Nickel Manganese Cobalt (NMC) red line. Nickel Cobalt Aluminium (NCA) blue line. Lithium Cobalt Oxide (LiCoO2) green line.

designs incorporated (for this aspect) it is considered that the propagation between two units is considered unlikely; hence this incident **was not carried forward**.

4. Li-ion battery fire and toxic gas dispersion

If a BESS failure occurs resulting in a fire, toxic byproducts of combustion may form including carbon dioxide (CO_2), carbon monoxide (CO) and fluorine (F -) gases.

A qualitative review was conducted on the mechanism of harm for CO_2 and potential for off-site impact. Carbon dioxide is an asphyxiant and can cause harm to people via the displacement of oxygen leading to dizziness, confusion, headaches and in extreme circumstances loss of consciousness and death. This risk is most prevalent immediately adjacent to a CO_2 release (such as loss of containment of a pressurised CO_2 cylinder or tank) or indoors / in confined areas as CO_2 is denser than air and can accumulate at low levels. As CO_2 is odourless, it poses a high risk in indoor scenarios as without detection and visual / audible warnings, occupants are unable to identify the presence of the hazard.

However, during a BESS thermal runaway event, the off-gas (a portion of which is CO_2) is released at a high temperature creating buoyancy effects which cause the plume to travel vertically and horizontally in the presence of wind. If the plume has sufficient buoyant energy, it will penetrate the inversion layer in the atmosphere and stay suspended, if the plume does not have sufficient energy it will spread under the inversion layer and be diluted as it travels horizontally. This can occur over a scale of hundreds of metres to kilometres.

The closest receptor to the site is approximately 1.2 km from the nearest BESS. In the event of a BESS fire, the concentration of CO_2 experienced by the closest receptor shall be either zero (due to the plume remaining suspended) or negligible as significant dilution and mixing with the air will have occurred prior to settling.

In terms of carbon dioxide and carbon monoxide, the assessment concluded that there would be insufficient production of carbon dioxide to generate a plume of sufficient concentration to displace the required oxygen for a significant downwind consequence to occur. Therefore, this incident has **not been carried forward** for further analysis.

The electrolyte used in Li-ion batteries typically is lithium hexafluorophosphate (LiPF6) or other li-salts containing fluorine. In the event of a thermal runaway, the electrolyte will expand and be vented from the battery. However, as the potential for a fire to occur is considered negligible, this incident has **not been carried forward**.

5. Electrical equipment failure and fire.

Electrical equipment is located within the switch rooms which may fail resulting in overheating, arcing, etc. which could initiate a fire. In the event of a fire, it may begin to propagate to adjacent combustible materials (i.e. wiring). It is noted that electrical equipment fires typically start by smouldering before flame ignition occurs resulting in a slow fire development. Based upon fire development within switch rooms the fire would be relatively slow in growth and unlikely to result in offsite impacts, therefore this incident **was not carried forward** for further analysis.

6. Transformer internal arcing, oil spill, ignition and bund fire (at Coppabella sub-station)

Transformers contain oil which is used to insulate the transformers during operation. If arcing occurs within the transformer (e.g. due to a low oil level), the high energy passing through the coolant vaporises the oil into light hydrocarbons (methane, ethane, acetylene, etc.) resulting in rapid pressurisation within the reservoir. Notwithstanding this, transformers have a low potential for failure and the separation distance to the Project Boundary and other adjacent units would be unlikely to result in incident propagation and offsite impacts. Therefore, this incident has **not been carried forward** for further analysis.

7. Transformer electrical surge protection failure and explosion (at Coppabella sub-station)

Transformers generate large amounts of heat due to the high electrical currents that pass through them. In the event of a large surge of energy, protection measures can fail and result in an explosion. To protect against this transformers have surge protection devise which shunt electrical surges to safety of ground. However, surge protection does not protect against all events and therefore there is a potential for explosion. However, these units are ubiquitous and have a low potential for failure. Therefore, this incident has **not been carried forward** for further analysis.

8. Electromagnetic field impacts (EMFs)

BESS create EMFs from operational electrical equipment from the electrical components found within BESS units, inverters, etc. This equipment has the potential to produced Extremely Low Frequency EMF's in the range of 30 to 300 Hz.

A review of the site indicates there are no immediate residences adjacent to the area where the BESS will be developed providing substantial distance for attenuation of EMFs. In addition, the closest residence is over 1 km away from the EMF generating sources at the BESS; hence, the potential for the EMF to exceed the accepted levels is considered negligible. As the potential for exposure to EMF exceeding the international guidelines is negligible, this incident has **not been carried forward** for further analysis.

6.3.2.4 Conclusion

Based on the identified hazards, a range of scenarios that may result in an incident with the potential for offsite impacts were considered. It was concluded that each of the scenarios detailed above, would not result in offsite impacts. These scenarios were therefore not carried forward to consequence or frequency analysis.

6.3.2.5 Additional Mitigation Measures

Based on the results of the PHA, the following additional mitigation measures have been recommended and provided in **APPENDIX C**: Updated Mitigation Measures**:**

- The flammable DG cabinets shall be subject to hazardous area classification in accordance with AS/NZS 60079.10.1:2022
- Any electrical equipment to be installed within the defined hazardous areas shall be installed in accordance with AS/NZS 60079.14:2022
- BESS must be tested in accordance with UL9540A
- Testing to demonstrate clearances required to prevent propagation of fires between separated BESS units
- BESS to be installed in accordance with manufacturer and UL9540A report recommended clearances based on testing
- BESS to be installed with fire protection systems specified by the manufacturer and UL9540A report
- Before construction, detailed design to validate the BESS can be installed in the project area whilst meeting the recommended clearances
- UL testing information shall be made available to the certifying authority. It is noted that a confidentiality agreement may be required
- The vent covers of the BESS shall be constructed of non-combustible material
- The vents shall not be located above battery packs within the BESS container.

6.3.3 Risk Assessment

6.3.3.1 Background

A risk assessment was prepared to consider all risks associated with the operations of the site and to demonstrate that these have been minimised So Far As Is Reasonably Practicable (SFAIRP), meaning all reasonable steps are taken to minimize risks, considering factors like cost, time, and effort. The risk assessment conducted demonstrates compliance with the *Work Health and Safety Regulation 2017*. This is provided in **APPENDIX F**: SFRAIP Risk Assessment**.**

6.3.3.2 Methodology

The assessment of the risks associated with the operation of the CWF were conducted using a quantitative analysis, resulting in the expression of risks in the following forms:

- Individual fatality – expressed as the chance of fatality in a million per year (pmpy)

- Individual injury risk – expressed as the chance of injury pmpy
- Incident propagation – determined by consequence analysis.

The assessment of risk, in quantitative terms, would be meaningless unless this can be compared to some acceptable risk criteria. Hence, for this analysis, several acceptable risk criteria were reviewed and the proposed criteria developed for this project. These included:

- United Kingdom Health and Safety Executive – Control of Major Accident Hazards (COMAH)
- European Union - Seveso II
- Industry Fatal Accident Rate (FAR) data
- NSW Department of Planning – Hazardous Industry Planning Advisory Paper No.4, Risk Criteria for Land Use Safety Planning.

6.3.3.3 Results

Hazard Analysis

The following hazards scenarios were identified for the Project and are summarised in the following table.

Table 6-6: Hazard Analysis Summary

Hazard Scenario	Analysis Summary	Carried Forward?
Flammable material spill and flash fire or vapour cloud explosion.	Small amounts stored on site and located with appropriate DG cabinets	No
Li-ion battery fault, thermal runaway and fire	Battery chemistry and inbuilt safety systems and controls, reduce the risks.	Yes
Electrical equipment failure and fire.	Equipment to be used on site ubiquitous around the well. Safety precautions are well documented and understood.	No
Transformer internal arcing, oil spill, ignition and bund fire.	Arcing within the transformer resulting in rapid pressurization within the transformers reservoir. If the structural integrity of the reservoir is exceeded, and the installed pressure relief devices, the reservoir can rupture allowing the release of oil into the bund. The rupture also allows oxygen to enter the reservoir.	Yes
Transformer electrical surge protection failure and explosion	To protect against overheating and explosions, transformers generally have surge protection. However, if this surge detection and protection devices are not universally installed nor do they protect against all events. Risk of explosion to personnel exists.	Yes

6.3.3.4 Consequence Analysis

As detailed in **Table 6-6** the following incidents were carried forward for consequence analysis:

- Li-ion battery fault, thermal runaway and fire (Worse case as LFP is safer technology and lower fire risk)
- Transformer internal arcing, oil spill, ignition and bund fire
- Transformer electrical surge protection failure and explosion

Each of these have been assessed to determine the consequence from the incident as it relates to individual injury, fatality and incident propagation based on the criteria in HIPAP No.4 (Department of Planning, 2011).

- Fatality – 23 kW/m and 21 kPa
- Incident propagation – 23 kW/m 2 and 21 kPa
- Injury – 12.6 kw/m 2 and 14 kPa

Any event which produces consequences up to these limits would be further assessed for frequency.

BESS Container Thermal Runaway

In the event that thermal runaway did occur, the BESS units may produce radiant heat which has potential to harm personnel and cause risk incident propagation. A detailed analysis of this risk was undertaken and summarised in **Section 6.3.1** and **APPENDIX F**: SFRAIP Risk Assessment.

The radiant heat distances in the event of a thermal runaway are provided in **Table 6-4**. Both the fatality and injury radiant heat thresholds (23 kW/m^2 and 12.6 m^2 respectively) have been exceeded. Therefore, to determine the frequency of these events, and the likelihood that they result in injury or fatality, this event has been further assessed for frequency analysis.

Additionally, the potential for radiant heat to impact adjacent BESS containers and WTG was assessed based on the 23 kW/m^2 heat radiation contour. This showed that at 2m distance from the container on fire, a heat contour of 23kW/m^2 would be experienced.

As indicated in **Figure 3-1** the minimum distance between BESS containers and the WTGs is approximately 10 m which is sufficient to prevent risk of propagation. However, if the distance between adjacent BESS containers is proposed as 1.4 m this may present a propagation risk. It was therefore recommended that a minimum distance of 1.5m be adopted, however to ensure a conservative approach, a distance of 3m has been adopted between the BESS units. From an incident propagation perspective, adopting this recommendation will ensure risk is minimised SFAIRP.

Transformer Arcing, Oil Spill, Ignition and Bund Fire (at Coppabella sub-station)

There is potential that arcing may occur within the transformers which may lead to generation of gases and pressure above the structural integrity of the oil reservoir which may rupture leaking oil into the bund. As a result of the arcing and rupture, the oil may ignite leading to a bund fire within the dimensions of the bund. A detailed analysis of was undertaken and summarised in **Table 6-7**.

Table 6-7: Bund Fire Heat Radius

Heat Radiation (KW/m^2)	Distance(m)
35	7
23	10
12.6	13
4.7	19
3	22

As the 23 kW/m^2 heat radiation contour extends 10 m from the transformer in the event of a fire, there is potential for incident propagation. However, as the transformers are in the substation which must be designed in accordance with strict standards, the risks associated with incident propagation are considered be managed SFAIRP via adherence with the relevant standards.

Transformer Electrical Surge Protection Failure and Explosion (at Coppabella sub-station)

There is potential for a transformer to be impacted by an extreme electricity surge, such as in the event of a lightning strike. Although considered unlikely a detailed analysis was undertaken. The fatality (21 kPA) and injury (14 kPA) were exceeded and were therefore brought forward into frequency analysis.

As the 21 kPa overpressure contour extends 50m from the transformer in the event of an explosion, there is potential for incident propagation. However, as the transformers are located in the substation which must be designed in accordance with strict standards, the risks associated with incident propagation are considered be managed SFAIRP via adherence with the relevant standards. Further assessment of the site indicates the closet infrastructure to the substation is more than 200 m away, therefore there is minimal risk of other structures being damaged or incident escalation.

6.3.3.5 Frequency Analysis

Li-Ion Battery Fault, Thermal Runaway and Fire

To estimate the potential for a fatality to occur it is necessary to estimate the initiating event frequency. Based upon the total installed capacity for this project (1091 MWh or 1.091 GWh) the potential for a fire to occur within a BESS unit is 7.4×10^{-2} per GWh/year x 1.091 = 8.02×10^{-2} p.a.

For the purpose of this assessment, it was assumed that the required maintenance hours on a BESS are 24 hours per year or a rate of 0.0027.

To estimate the probability of fatality it is necessary to review the susceptibility to personnel exposed to radiant heat that may occur. Tolerance to an exposure (i.e. radiant heat or toxicity) differs across a population which may be estimated using Probit analysis. The adopted criteria using the probit method to determine injury and fatality risk was adopted as 12.6 kW/m^2 and 23 kW/m^2 respectively. The calculated probits for the 12.6 kW/m^2 and 23 kW/m^2 probit, with this exposure durations considered resulted in probabilities of 30% and 16%.

A fatality or injury can only occur if a person is exposed to sufficient radiant heat. Therefore, it is necessary for a person to be located adjacent to a BESS when it is on fire to result in injury or fatality risk. A person would need to be within 3 m to receive a heat radiation dose high enough to have potential for injury or fatality, therefore, operators will only be exposed to that risk while performing maintenance directly on the BESS containers.

Based on the assessment, the estimated injury and fatality risk associated with a BESS fire are:

- Injury: $8.02 \times 10^{-2} \times 0.0027 \times 0.3 = 6.59 \times 10^{-5}$
- Fatality: $4.53 \times 10^{-2} \times 0.0027 \times 0.16 = 3.52 \times 10^{-5}$

As these are below the selected risk criteria, the risks associated with a BESS fire are managed so far as is reasonably practicable and no further action is required.

Transformer Internal Arcing, Oil Spill, Ignition and Bund Fire (at Coppabella sub-station)

As noted previously, a fatality or injury can only occur if a person is exposed to sufficient radiant heat. Therefore, it is necessary to have a person to be located adjacent to the transformer when it is on fire to result in injury or fatality risk. As the HV transformers are located in the substation, access to them is extremely controlled and limited. As such it has been assumed that an equivalent of 1-hour per day of worker activity shall take place in the vicinity of the transformers for a total of 365 hours per year or a rate of 0.0417.

The probit method used in Section 6.2 has been used to calculate the injury and fatality risk to workers. Resulting in the following:

- Injury: $1.1 \times 10^{-3} \times 0.0417 \times 0.3 = 1.38 \times 10^{-5}$
- Fatality: $1.1 \times 10^{-3} \times 0.0417 \times 0.16 = 7.33 \times 10^{-6}$

As these are below the selected risk criteria, the risks associated with a transformer bund fire are managed so far as is reasonably practicable and no further action is required.

Transformer Electrical Surge Protection Failure and Explosion (at Coppabella sub-station)

The initiating event for a transformer explosion is a transformer failure, for which the frequency was established in **Section 6.3.3.4** as 1.1×10^{-3} p.a. To determine the incidence of transformer failures resulting in an explosion a literature review was undertaken.

For the purpose of this assessment, it has been assumed that personnel will be in the proximity of the transformer for 1 hour per day, every day of the year for a total of 365 hours per year or 0.0417 per year. To estimate the probability of injury, the area of effect calculated in Section 5.3 for the 14 kPa overpressure contoured was compared to the 21 kPa contour and the fatality probability scaled accordingly.

The chance of fatality due to a transformer explosion is then given by:

- Injury: $1.1x10^{-3}$ x 0.027 x 0.0417 x 1.8 = 2.24 x 10^{-6} p.a.
- Fatality: $1.1x10^{-3}$ x 0.027 x 0.0417 = 1.24 x 10^{-6} p.a.

As these are below the selected risk criteria, the risks associated with a transformer failure and explosion are managed so far as is reasonably practicable and no further action is required.

6.3.3.6 Mitigation Measures

The consequence and frequency analysis determined that the risk associated with these scenarios was controlled SFAIRP as the estimated frequency of events was below the selected criteria.

The following recommendation was made based on an assessment of current FM Global and NFPA requirement regarding BESS systems:

- Minimum spacing between adjacent BESS units shall be increased to minimum of 1.5 m (noting 3m has been adopted).

6.3.4 Bushfire

6.3.4.1 Background

A Bushfire Assessment (BRA) was prepared by Waratah Bushfire Planning to support the modification and is provided in **APPENDIX G**: Bushfire Assessment.

6.3.4.2 Methodology

The BRA was prepared with reference to the Planning for Bushfire Protection (PBP) 2019 (NSW Rural Fire Service, 2019) which provides a series of bushfire protection principles which are to be achieved for developments which are located within bush fire prone land (BFPL) in NSW.

The CWF is partially located on BFPL which is mapped predominantly as Category 3 (medium risk) with smaller areas as Category 1 (highest risk) therefore the PBP applies to the Project. Section 8.3.5 of PBP states that specific consideration should be provided for wind farms with adequate clearance to combustible vegetation, firefighting access and water supply. The wind farm component of the project has been approved, with the following measures incorporated into the CWF Environmental Strategy:

- A minimum 10m APZ for structures and associated buildings/infrastructure (as outlined in Section 4.11 of the document)
- Emergency response plan to identify relevant risks and mitigation measures associated with the construction and operation of the wind farm.

The PBP requires the identification of the predominant vegetation formation. Hazardous vegetation is calculated for a distance of at least 140m from the proposed development envelope. Topography also has a significant effect on bushfire behaviour, with fire moving faster uphill than downhill. The effective slope was assessed within the vegetation up to 100m from the construction footprint to determine the minimum Asset Protection Zones (APZs) required and the expected setbacks to avoid flame zone (FZ) contact in a bush fire event.

6.3.4.3 Results

The BRA determined the minimum required APZ to avoid flame zone (FZ) contact on BESS infrastructure as well as the maximum expected radiant heat impact adopting Table A1.12.6 of the PBP. Where slopes exceeded 20 degrees a performance assessment was undertaken based on the effective slope, fuel loads associated with the vegetation classification and the elevation of the receiver.

It was concluded that the majority of the locations where BESS are proposed would comply. There was a total of three locations (WTG 1, 38 & 41) where the FZ encroaches on the blade finger area. These BESS units will require location to other hardstand areas within the construction footprint adjacent to those wind turbines.

6.3.4.4 Mitigation Measures

Several mitigation measures were provided in the BRA based on the PBP and are summarised below.

Construction and Decommissioning

- Provision of appropriate fire fighting equipment in vehicles
- No external hot works on total fire ban days
- Update Emergency Response Plan to include risks of vehicles driven over long grass, storage of dangerous goods, checking of electrical equipment, first aid and location of extinguishers.

Operations

- Maintenance of APZs by reducing fuel loads, maintenance of grassland, removal of vegetation debris, vegetation screening outside of APZ
- Comply with the performance criteria requirements for fire fighting access as per the PBP
- Firefighting water supply be provided at the primary vehicle access point to the project
- Comply with performance criteria for water supply as provided in the PBP.

6.3.5 Noise

6.3.5.1 Background

An environmental noise assessment was prepared by Sonus to predict the potential noise from the proposed BESS at CWF. The assessment is included as **Appendix H**: Environmental Noise Assessment.

6.3.5.2 Methodology

The noise emissions from the BESS units were assessed in accordance with the *NSW Noise Policy for Industry* (NSW EPA, 2000). The NSW Noise Policy for Industry establishes noise trigger levels based on the existing background noise environment (intrusiveness noise levels) and the amenity for particular land uses (amenity noise levels).

The noise trigger levels are the lower values provided by the two methods. The most onerous criteria are assigned to locations with low background noise levels in a rural area. In these circumstances night time project intrusiveness noise level is 35 dB(A) and the project amenity noise level is 38 dB(A).

Based on the above, the preliminary assessment has assumed a Policy noise trigger level of 35 dB(A) for the operation of the BESS at all locations.

Environmental noise predictions have been made using the CONCAWE noise propagation model as implemented in the SoundPLAN noise modelling software. The CONCAWE noise propagation model accounts for the following influences:

- Sound power levels and locations of noise sources (including the height of sources)
- Separation distances between noise sources and receivers
- Shielding provided by the ground topography
- Influence of the ground and air absorption
- Meteorological conditions.

Unless an analysis of historical meteorological; conditions is conducted, the Policy requires the use of noise enhancing meteorological conditions to be included in the noise model.

This predictions of noise at receivers have therefore considered worst-case (Category 6) meteorological conditions i.e. those that are most conducive to noise propagation).

6.3.5.3 Results

The highest noise level predicted at any receiver is 21 dB(A) at receiver ID “C35” and 20 dB(A) and “C56” both of which easily achieves the 35 dB(A) noise trigger level (refer to **Figure 2-1** for locations). The BESS noise levels are not such as to introduce risk of non-compliance through cumulative wind farm and BESS noise impacts.

6.3.6 Traffic and Transport

6.3.6.1 Background

Amber Organisation was engaged to provide an updated Traffic Assessment to assess the impact of additional heavy vehicle movement which would be generated due to the transportation of BESS to the Project. The Traffic Assessment is provided in **APPENDIX I**: Updated Traffic Assessment.

6.3.6.2 Methodology

Existing Traffic

A turning movement survey was conducted at the intersection of the Hume Highway and Whitefields Road which is the nominated entrance to the wind farm. Traffic counts were undertaken on Thursday 8th May from 6.00am – 10.00am and 3:00pm -7:00pm. The survey results indicate the intersection currently carries a moderate to high level of traffic in the order of 585 and 782 vehicles in the morning and evening peak hour, respectively. The morning peak hour was recorded from 9:00am to 10:00am and the evening peak hour was recorded from 3:00pm to 4:00pm.

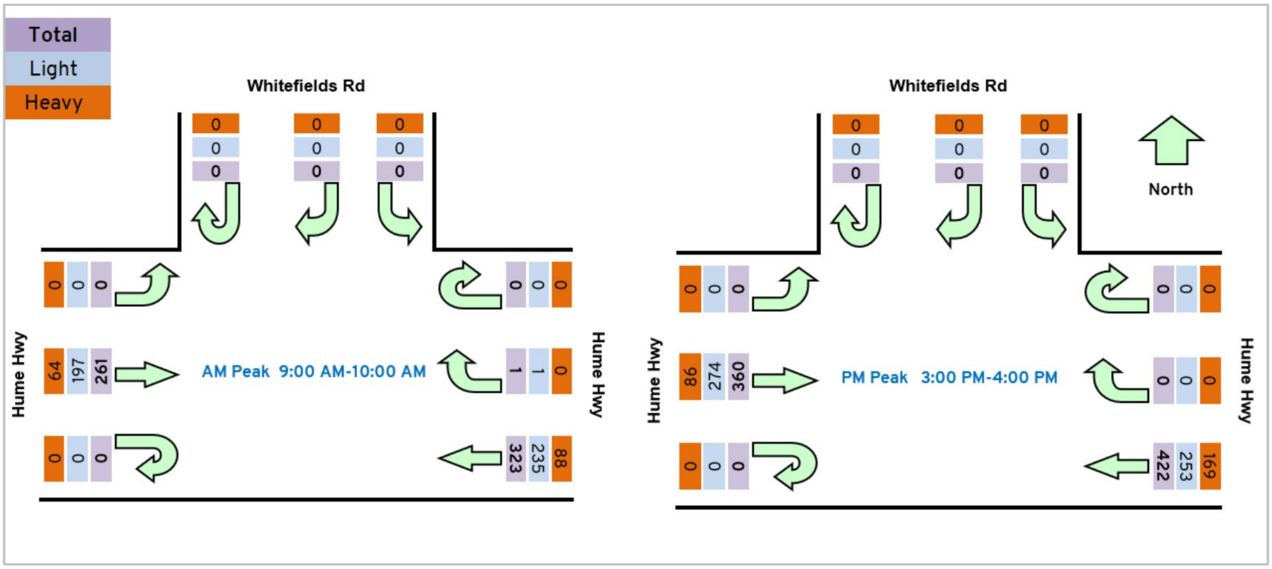


Figure 6-2: Turning Movement Survey Peak Hour Results – Hume Highway and Whitefields Road

The results indicate there is currently minimal traffic entering or existing Whitefield Road during these periods. Overall, the results indicated that both roads are able to accommodate an increase in vehicle trips, noting Hume Highway is a major State Highway which provides a dual carriageway with two travel lanes in each direction.

Traffic Generation (for BESS Components)

The traffic assessment provided an updated construction traffic volumes to include up to an additional 318 traffic movements to account for the transportation of each BESS unit for each of the 53 turbines. Predicted traffic generation during the construction period is presented in **Table 6-8**. Oversize Over Mass (OSOM) vehicles are not included as they will be under escort and subject to specific traffic management measures and do not overlap with BESS delivery to site.

Table 6-8: Traffic Generation During BESS Construction Period

Vehicle Type	Average		Peak	
	Vehicle trips per day (vpd)	Peak hour vehicle trips (vph)	Vehicles trips per day (vpd)	Peak Hour Vehicle Trips (vph)
Light Vehicles	50	25	104	52
Heavy Vehicles (excluding OSOM)	74	8	112	11
Total	124	33	216	63

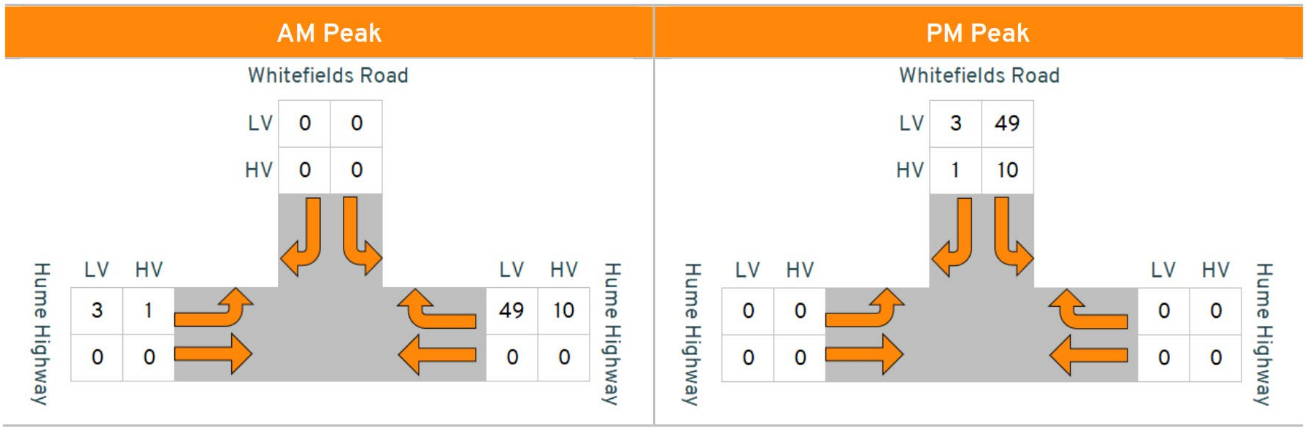
It is estimated that during peak construction periods, traffic volumes may be up to 50% higher than the average volumes, which would result in up to 104 light vehicle trips and 112 heavy vehicle trips per day. Light vehicles will generally be highest between 6.00 am and 7.00 am and 5.00 pm and 7.00pm. Heavy vehicles will generally be distributed throughout the day.

Traffic Distribution

All construction traffic will access the site via Hume Highway and Whitefields Road. The majority of vehicle trips are expected to originate from the east including Port Kembla, Yass and surrounding areas. For the purposes of the assessment, it is estimated that 95% of vehicles would travel to/from the east with the remaining 5% traveling to/from the west.

The resulting project peak hour traffic volumes at the Hume Highway / Whitefields Road intersection are outlined in **Figure 6-3.**

Figure 6-3: CWF BESS Project Traffic at Am and PM Peak Times



6.3.6.3 Results

Signalised Intersection Design and Research Ais (SIDRA) Analysis

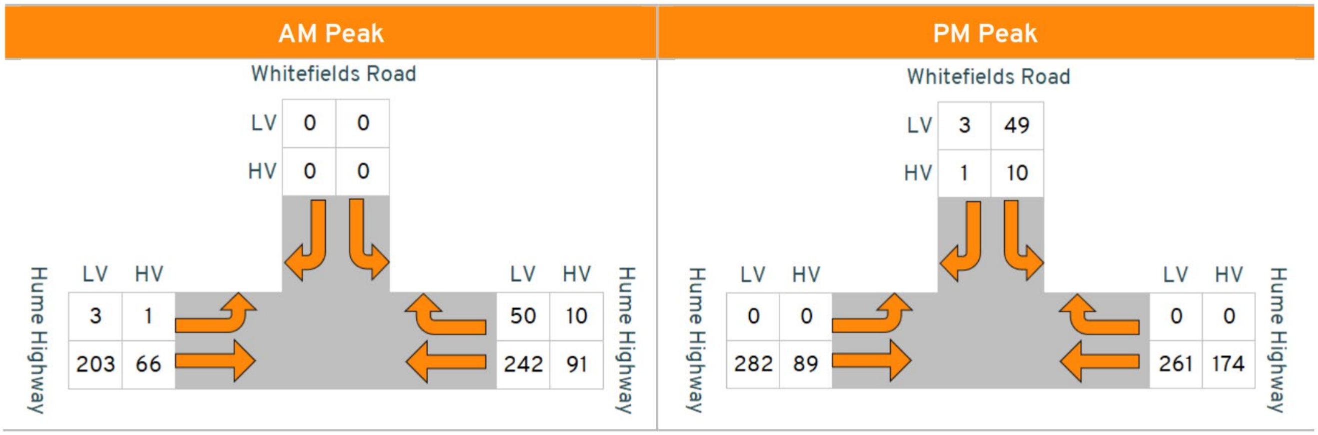
To determine the ability of the road network to accommodate the expected traffic volumes generated during construction, an analysis of the Hume Highway and Whitefields Road intersection was undertaken using the SIDRA computer modelling program.

The total traffic volumes at the site access intersection consist of the sum of the following:

- Existing surveyed peak hour traffic volumes outlined within **Figure 6-3** adjusted by a 1.5% compounded annual growth rate to reflect the end of the construction period in 2029.
- Construction traffic volumes outlined within **Figure 6-4**.

The resulting total traffic volumes used for the assessment are provided in **Figure 6-4**.

Figure 6-4: Total Peak Hour Volumes During Peak Construction



The results of the SIDRA analysis for the morning and evening peak hours are provided are summarised in the following table.

Table 6-9: Sidra Analysis Results Summary

Approach	Movement	AM Peak Hour			PM Peak Hour		
		Average Delay (sec)	95% Queue (m)	Level of Service	Average Delay (sec)	95% Queue (m)	Level of Service
Hume Highway (East)	Through	0.0	0.0	A	0.0	0.0	A
	Right	12.4	2.7	A	12.0	0.0	A
Whitefield Road (North)	Left	7.5	0.1	A	8.4	2.1	A
	Right	10.3	0.1	A	13.7	2.1	A
Hume Highway (West)	Left	8.9	0.0	A	8.2	0.0	A
	Through	0.0	0.0	A	0.0	0.0	A

Intersection Design

The requirement to provide turn facilities at the Hume Highway / Whitefields Road intersection is primarily generated during the morning peak hour when the workforce accesses the site. *Austroads Guide to Traffic Management Part 6:*

Intersections, Interchanges, and Crossings specifies the turning treatments required at intersections. The traffic volumes which were used in the assessment (refer **Figure 6-4**) were used to determine the adequacy of turn treatments at the intersection.

The assessment concluded that the morning peak volumes right turn at Hume Highway / Whitefields Road intersection exceeded the graph axis. The current right-hand turn is proposed to be extended to for a Channelised Right Turn treatment, which is the highest order turn treatment and was concluded to be appropriate. The left-hand turn is appropriate as it exceeds the Basic Left Turn (BAL) requirement.

The Traffic Assessment also reviewed the design of the intersection of the Hume Highway / Whitefields Road. The following conclusions were made:

- The available storage for vehicles exiting right (i.e. westbound) is limited to 19m (e.g 19 m semi-trailer). Given that the large majority of movements will be left this is not considered a limitation to the Project.
- The speed limit of the Hume Highway is 110 km/hr which would theoretically requires an acceleration land length of 1,500 m, to provide for a semi-trailer to reach 90 km/hr from stationary position. However, given the temporary nature of construction of the wind turbine farm this is not considered necessary. The current intersection provides suitable safe intersection sign distance exceeding 341 m based on a design speed of 120 km/hr and a reaction time of 2.5 seconds. It is therefore considered suitable to allow vehicles to safely enter the highway.

6.3.6.4 Additional Mitigation Measures

The additional mitigation measures to be included are:

- Vehicles exiting right from Whitefields Road and travelling west along the Hume Highway are to be limited to 19m.

6.3.7 Visual

The BESS units are within an open container and arrive to site pre-assembled. They are off-white in colour to assist in maintaining the units safe operating temperature. The dimensions of the BESS containers proposed to be installed at CWF are as follows:

- Height 2.9m
- Length 12.2m
- Width 2.44m

Provided in **Plate: 6-1** is an installed Goldwind BESS at the Moorabool Wind Farm in Victoria which provides an example of the physical appearance of the GoldBlock BESS containers.

Plate: 6-1 GoldBlock BESS Installed at Moorabool Wind Farm (Victoria)

To provide a visual representation of the BESS units at the turbines, True View Visuals platform was utilised. The True View Visuals is an iPad-based tool which provides the ability to visual structures before they are built. Based on the current layout of the CWF, BESS were added to the base of the turbines at the blade finger laydown area.

A visit to the CWF was undertaken to capture various viewpoints of the wind farm public viewpoints. Photos were taken at a distance of approximately 2km to the nearest turbine.

Provided in **APPENDIX J**: TrueVisual BESS Representation examples of where the view of the BESS was possible based on the orientation of the blade finger area. Other locations the BESS could not be seen either due to the distance or the BESS laydown area orientation. Views of the BESS will depend on the distance, location of vegetation, terrain and BESS orientation and would differ at each location due to their size.

Given that the turbine hub height is an order of 34 times higher than the BESS, the visual impact would be minimal to the surrounding receivers.

6.3.8 Social Impacts

The modified project would continue to provide positive social benefits to the local community. CWF has an existing community fund which has been funding a variety of community programs. This has now been in place for 7 years providing over $190,000 of funding.

Prior to construction, in accordance with Schedule 2 Condition 18, Voluntary Planning Agreements (VPA) with each Council will be in place to provides for the establishment of community benefit funding which will be administered through the Community Enhancement Fund Committee. Goldwind Australia has also committed an additional $100,000 per year for a supplementary community investment fund.

As identified in **Table 3-1**, it is estimated there may be an increase of 5% construction personnel as part of the modified project. It is anticipated that the additional personnel would be specialised in the installation of BESS and would only be required on site during the installation process which is over an approximate period of 10 months. The increase of 5% construction personnel can be accommodated in nearby townships such as Yass.

Goldwind Australia has been contacted by various accommodation providers in the local area in preparation for construction. This, along with extensive research by the Community Engagement team, has established an accommodation strategy that seeks to plan the extensive local accommodation sites that are currently available. It is also a goal of the project to employ a locally based workforce where minimal additional accommodation will be required.

7.0 JUSTIFICATION OF MODIFIED PROJECT

The proposed modification is consistent with the justification of the approved (Mod 1) project. The Mod 2 project will *"deliver an efficient, constructible and commercially viable project"* with the inclusion of BESS into the Project, while having essentially the same impacts as for the Mod 1 Project.

BESS technology is now a common inclusion in many renewable energy projects. A grid-following BESS is added using the existing wind farm's grid-following control approach, requiring minimal changes to the current setup while still delivering the full benefits of a BESS. It provides fast frequency support by rapidly injecting or absorbing power to stabilise the system, and enables energy shifting by storing excess low-price generation and supplying it during high-demand periods. This improves grid stability, supports FCAS requirements, and helps smooth market price volatility. Inclusion of BESS enables storage of energy from the turbines which would have otherwise been lost, which can then be discharged to the grid under favourable conditions. As a result, the proportion of available wind energy resource that can be accessed by each wind turbine is increased, essentially increasing the effectiveness of each of the installed wind turbines.

The BESS would be placed on previously cleared disturbance footprint at selected turbine sites and will be within the approved development footprint. The BESS would not require any additional infrastructure and will be connected to the wind turbines via short lengths of underground cabling. The impacts of this modification with the adoption of additional mitigation measures (**APPENDIX C**: Updated Mitigation Measures), are considered to have no more than minimal environmental impact.

Project objectives remain unchanged with the modification but are enhanced with the inclusion of BESS. Specifically, these objectives are:

- To develop a project which:
    - meets or exceeds the environmental regulatory requirements
    - aligns with government legislation and policies for reducing carbon emissions and achieving net zero by 2050
    - Is assured of access to the Grid and will meet AEMO requirements for power supply to the NEM
- To work with the local community and other relevant stakeholders in identifying community benefits and local employment opportunities through construction and operation of the Project
- To provide additional renewable energy resource into the NEM that can replace retired fossil fuel generation.
- Minimise extent of vegetation clearance and habitat impacts through design optimisation processes.

This report has demonstrated that the proposed modification is substantially the same Project as originally approved and that impacts are consistent with the approved project. Accordingly, Mod 2 project may be approved under Section 4.55(2) of the EP&A Act, subject to completion of the required notifications, exhibition of the application, response to submissions, DPHI review of all relevant information and, ensuring that the consent is appropriately conditioned.

For the reasons given in this assessment report, it is considered that the Project remains essentially the same from the perspective of its purpose in supplying renewable energy from the local wind resource but is improved through:

- More efficient wind farm design to optimise generation from the site
- The grid-following BESS delivers fast frequency stabilisation, enables energy shifting to maximise value, and helps smooth market price volatility while strengthening overall grid reliability.No significant increase in environmental impacts arising due to co-location of wind turbine and BESS equipment

8.0 ACRONYMS AND ABBREVIATIONS

Name	Description
ABN	Australian Business Number
AEMO	Australian Energy Market Operator
AHD	Australian Height Datum
APZ	Asset Protection Zone
AS	Australian Standard
BAL	Basic Left Turn
BESS	Battery Energy Storage System
BFMP	Bush Fire Management Plan
BFPL	Bush Fire Prone Land
BSAL	Biophysical Strategic Agricultural Land
CCC	Community Consultative Committee
CWF	Coppabella Wind Farm
CWFPL	Coppabella Wind Farm Pty Ltd
DA	Development Application
DCCEEW	Department of Climate Change Energy, the Environment and Water (federal)
DP	Deposited Plan
DPHI	Department of Planning, Housing and Industry
EIS	Environmental Impact Statement
EMF	Electromagnetic Field
EMS	Environmental Management System
EPBC Act	*Environmental Protection Biodiversity Conservation Act 1999*
EP&A Act	*Environmental Planning and Assessment Act 1979*
FZ	Flame Zone
GIS	Geographical Information System
GW	Gigawatt
GWA	Goldwind Australia
Ha	Hectare
HIPAP	Hazard Industry Planning Advisory Paper
Km	Kilometre
Kw	Kilowatt
KwH	Kilowatt Hour
LEP	Local Environment Plan
LGA	Local Government Area
LLS	Local Land Services
LRET	Large-scale Renewable Energy Target
LTESAs	Long Terms Energy Service Agreements
m	Metre
Mod	Modification
MW	Megawatt
MWh	Megawatt Hour
NEM	National Electricity Market
NIA	Noise Impact Assessment
NSW	New South Wales
NSW DCCEEW	New South Wales Department Climate Change, Energy, the Environment and Water
OSOM	Oversize and Over mass
PBP	Planning for Bushfire Protection 2019

Name	Description
PHA	Preliminary Hazard Assessment
RFS	Rural Fire Service
REZ	Renewable Energy Zone
SEED	Sharing and Enabling Environmental Data
SCEP	Stakeholder and Community Engagement Plan
SFAIRP	So Far As Is Reasonably Practicable
SSD	State Significant Development
TTIA	Traffic and Transport Impact Assessment
WTG	Wind Turbine Generator
VBB	Victorian Big Battery
VPA	Voluntary Planning Agreement
vph	Vehicles per Hour

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APPENDIX A: UPDATED PROJECT DESCRIPTION

A. Updated Project Description

A-1 Project Summary

This section provides a summary of the key aspects relevant to the development, operation and decommissioning of the CWF including the inclusion of BESS as proposed for Modification 2 (Mod 2) of SSD 6698.

Provided in **Table A-1** is a summary of the key features of the Project as modified.

Table A-1 Summary of key features of the Project (Mod 2)

Element	Current Approved Project (Mod1 SSD 6698)
Project	Coppabella Wind Farm
Proponent	Coppabella Wind Farm Pty Ltd
Indicative Generation Capacity	289 MW
Project Area within CWF Boundary	6450 Ha
Site Description	As per Appendix 1 of SSD 6698
Vegetation Clearance Limits	179.8 ha of EEC (N.B Clearing Limits amended and approved under Schedule 3 Condition 19 in May 2025)
Local Government Area	Hilltops Shire Council Yass Valley Shire Council
Wind Turbines	Up to 75 turbines
	Hub Height 100m
	Tip Height 171m
BESS	Goldblock DC-coupled BESS Units at high proportion of turbine sites
Connection to Grid	Construction of approximately 8 km of new 132 KV transmission line which connects into existing 132 kV transmission line to the north of the Project area.
Substation & Switchyard	33 kV/132 kV substation and 13 2kV switchyard
Ancillary Infrastructure	1 X O&M Building 2X Construction Compounds
OSOM Transport Route	From Port Kembla to Project site via Hume Highway
Site Access	Via Hume Highway and Whitefields Road
Road Upgrades	Upgrade of intersection of Hume Highway and Whitefields Road. Upgrade of 2km section of Whitefields Road
Indicative Construction Timing	3 to 3 ½ years

Element	Current Approved Project (Mod1 SSD 6698)
Indicative Construction Personnel	Up to 210
Indicative Operational Personnel	Up to 15
Indicative Operational Life	25 years
Community Benefits	Voluntary Planning Agreements with Hilltops and Yass Valley Councils as per CoC S2 Condition 18.

A-2 Proposed Infrastructure

Wind Turbines

It is currently proposed to construct 69 of the 75 approved wind turbines. The final selection will be confirmed during the detailed design for the project, prior to commencement of construction. However, the current design model is the Goldwind 4.2 MW.

Hardstands at each wind turbine will progressively be constructed as part of site civil works and as access road construction progresses to each turbine site. Hardstand areas are required at each turbine site to facilitate the delivery and assembly of the turbine components, and to enable sufficient crane access during construction and maintenance during operation. Hardstands are constructed as relatively flat benches from soil and rock material that is compacted and levelled with compacted gravel surface designed to a specified bearing capacity. The hardstand construction may involve varying degrees of cut and fill depending on the slope of surrounding land. The more steeply sloping sites will require more extensive cut and fill with batters adjacent to the hardstand.

Hardstand dimensions will be constructed indicatively of 75 metres length and 40 metres width and approximate area of 3,000 m^2, though the dimensions may vary across the site.

Civil works for hardstands and turbine footings may occur at approximately the same time. Once excavated and, after geotechnical inspection, a thin concrete blinding would be poured as a base for the footing. The excavation will be fenced for safety and have an access ramp that would allow for fauna egress if required. Steel reinforcing and formwork will be established prior to the pouring of approximately 500m3 of concrete to form the turbine footing. Concrete will be batched onsite. Concrete pours for each footing must be poured in a single event for structural integrity and each will occur continuously over much of the day. The concrete foundations take approximately one month to cure before the base section of the tower and remaining above ground components can be installed. The excavated area around the reinforced concrete foundation is backfilled.

Erection of the turbines typically requires a large crane and an auxiliary crane to assemble the turbine components. Components are temporarily stored on the adjacent hardstand or blade laydown area or delivered to the site “just-in-time” from a central storage laydown. The various sections of the turbine are lifted in a series of lifts that can be spread over days depending on the suitability of weather conditions as high winds are prohibitive for lifting components. The rotor (hub and three blades) are assembled on the ground before lifting into place on the front of the nacelle.

Once the turbines have been erected, kiosk transformers and coolers are installed near the base of the towers.

Provided sufficient foundations are completed, wind turbine erection can proceed at the rate of about two wind turbines per week, subject to suitable weather conditions, the number of large cranes on site and the ease of moving the cranes between turbine sites.

Turbine details are provided below:

- 69 of the approved 75 Goldwind GW140 turbines will be installed
- Each wind turbine will be mounted on a tower with a hub height of approximately 100 metres
- The rotor for the wind turbine will have a diameter of up to approximately 136m (blade length 66.9m)
- Total height of the wind turbines will be up to 171 m
- A steel staircase will provide access to the turbine tower
- A kiosk transformer will be located on a small concrete pad near the base of each tower. The kiosk will be finished with a colour to blend with the surrounding landscape.
- Coolers will be located near the base of each tower consisting of two banks of fans each with approximately 160 litres of coolant and will be off-white/grey in colour, similar to the turbines.
- The wind turbines will be off-white/grey and will not show any logos visible from surrounding locations.
- Only switchable low intensity lighting at the base of wind turbine will be provided (as required) for safe access at night

A-3 Battery Energy Storage System (BESS)

BESS Model

BESS are now commonly used to address the intermittent characteristic of renewable energy supplies and have the additional benefit to consumers of mitigating spikes in energy costs during times that would otherwise be subject to supply shortfall. The modification involves the connection of the Goldwind GoldBlock BESS located at up to 71% of the approved wind turbine locations at the CWF.

The BESS units will be DC-Coupled directly into the wind turbines. A grid-following BESS is added using the existing wind farm's grid-following control approach, requiring minimal changes to the current setup while still delivering the full benefits of a BESS. It provides fast frequency support by rapidly injecting or absorbing power to stabilise the system, and enables energy shifting by storing excess low-price generation and supplying it during high-demand periods. This improves grid stability, supports FCAS requirements, and helps smooth market price volatility

Goldwind GoldBlock has a lithium iron phosphate (LiFePO4) battery which is more thermally and chemically stable than other battery configurations. The lithium serves as the primary cation, iron as the transition metal, and phosphate as the anion. In addition to higher stability than other lithium ion batteries which use cobalt or nickel, they have an added advantage of a significantly longer life cycle and lower cost. Iron and phosphate are also plentiful elements globally when compared to nickel and cobalt which are resourced constrained.

BESS Unit

The BESS unit comprises of up to six (for a 4 hour duration) 40 ft open framed containers which are pre-fitted and wired prior to delivery to site. BESS units will be placed within the approved construction footprint on hardstand or the construction blade laydown area. The BESS Units consists of the following:

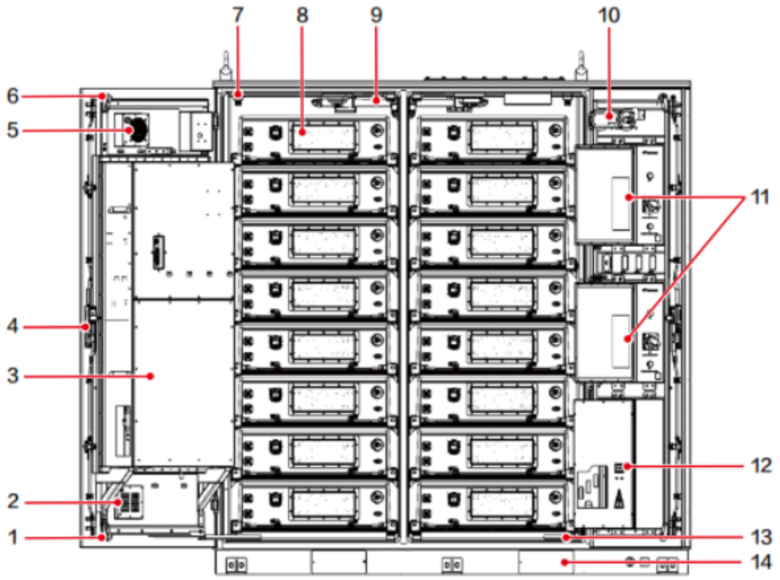
- Four Goldblock battery cabinets and one DC-DC converter;
- Each Goldblock is composed of battery packs, up to a nominal capacity of 836 kW each
- Power delivery rate per hour of batteries at each WTG = 5020 kW
- Battery energy (before losses) per WTG (4 hrs) = 19.86 MWh

Provided in T**able A-2** is a summary of the key dimensions of each BESS container which together make up the BESS unit.

Table A-2: BESS Dimensions (Exterior)

Aspect	Dimensions
Length	12.2 m
Width	2.4 m
Height	2.9 m
Weight	35 MT
Distance between Units	Up to 3 m
Total footprint of BESS Unit	Up to 500 m^2

Provided in **Figure A-1** is a schematic of the Goldblock BESS container with the door open indicting the BESS components.

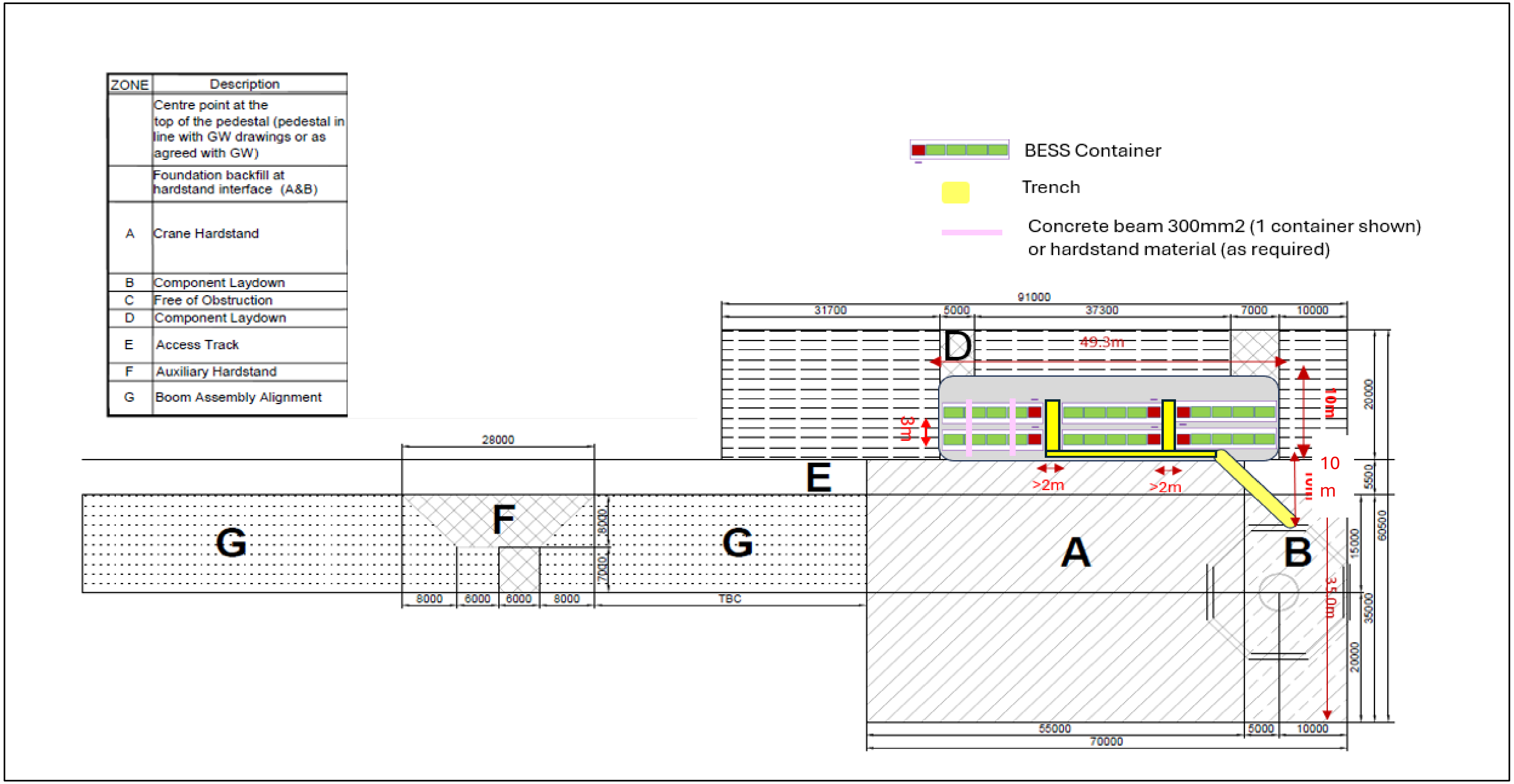


No.	Name	Quantity	No.	Name	Quantity
1	Lower Load-Bearing Wheel	1	8	Battery Pack	16
2	Intake Fan	1	9	Water Spray Pipeline	3
3	Liquid Cooling Chiller	1	10	Aerosol Fire Extinguishing Device	1
4	Lock	3	11	Battery Cluster Protection Panel	2
5	Exhaust Fan	1	12	Distribution Box	1
6	Upper Load-Bearing Wheel	1	13	Water Immersion Sensor	1
7	Travel Switch	3	14	Forklift Hole	8

Figure A-1: BESS Components

Provided in **Figure A-2** is a proposed configuration of the BESS Unit at each turbine. It is proposed that the two of the BESS containers will be placed parallel to each other in a row of three. There will be a minimum distance of 3 m between each BESS container. This is based on advice from the risk studies and to provide for access between the BESS containers for maintenance via the access door. This configuration may change during detailed design, however remaining complaint with the required set back and separation distances which have been detailed in the modification report.

Figure A-2: Proposed BESS Configuration Layout



ZONE	Description
	Centre point at the top of the pedestal (pedestal in line with GW drawings or as agreed with GW)
	Foundation backfill at hardstand interface (A&B)
A	Crane Hardstand
B	Component Laydown
C	Free of Obstruction
D	Component Laydown
E	Access Track
F	Auxiliary Hardstand
G	Boom Assembly Alignment

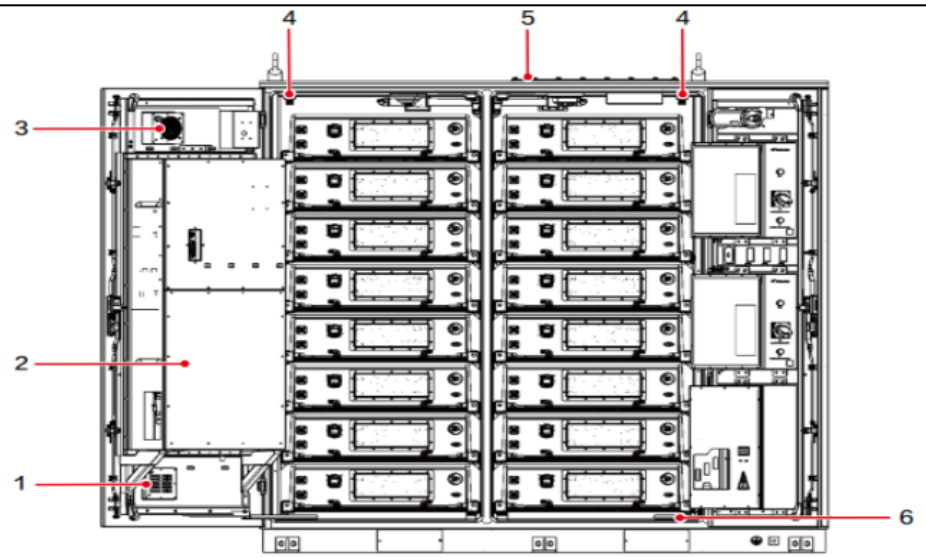
BESS Connection to Turbines

The BESS unit will be connected to each turbine via underground cabling under the hardstand area. Each container will be connected to the turbine as follows:

- DC cable pairs connecting directly into the Turbine DC bus;
- One AC cable
- One SCADA table

BESS units will be monitored remotely via the SCADA system. In the event of a fault or triggering of any of the inbuilt fire monitoring systems an alarm will be activated both remotely and at the BESS unit. Detailed procedures for emergency response scenarios will be detailed in the updated Emergency Response Plan.

Figure A-3 provides a schematic of the environmental and monitoring systems which are present within each BESS container. The operation of each of these systems is provided in more detail in the following section.



No.	Name	Description
1	Intake Fan	Natural air supply.
2	Liquid Cooling Chiller	
3	Exhaust Fan	When the detector senses flammable gas, it triggers the exhaust fan to vent it out or activate mechanical ventilation.
4	Travel Switch	Monitors the door status.
5	Explosion Vent Panel	Releases pressure when the air pressure is high above normal level due to battery thermal runaway.
6	Water Immersion Sensor	Monitors water accumulation inside the cabinet.

Figure A-3: Proposed BESS Fire Protection System

The Goldwind GoldBlock has an inbuilt Fire Protection System (FPS) which will be activated on the unlikely event of a thermal runaway or fire.

The FPS operates on the principle of early detection and early intervention. The FPS consists of a fire detection and alarm system, aerosol fire suppression system, water sprinkler fire suppression system, explosion prevention system and ventilation system. These are explained in further detail below.

Fire Detection and Alarm System

The battery cabinet is fitted with smoke and thermal detectors which continually monitor and analyse the characteristic quantities of thermal runaway of batteries. There is an alarm signal connected to the fire alarm control panel and a gas detector within the cabinet which monitors the concentration of combustible gas. When any one of the parameters (smoke, temperature, or combustible gas) reaches the alarm threshold, a first-level alarm is triggered. When both smoke and temperature parameters simultaneously reach their alarm thresholds, the second-level alarm is triggered.

When a first-level alarm or a second-level alarm is triggered, the fire alarm horns/strobes of the AC combiner cabinet and the corresponding battery cabinet are activated.

Aerosol Fire Suppression System

Each energy storage cabinet is designated as an independent protection unit, equipped with the aerosol fire suppression device. In the event of a second-level alarm, it outputs the start electrical signal (with an optional delay setting) to trigger the internal starting device, which then releases the fire-suppressing aerosol agents to achieve rapid cooling and fire extinguishment.

Water Sprinkler System

Each unit also has a water sprinkler fire suppression system installed within the cabinet. The fire water connection is reserved at the top of the battery cabinet for connection to the fire water supply pipe of the site (if required).

Explosion Prevention System

The system primarily includes the explosion prevention panel. The explosion prevention panel is installed at the top of the battery cabinet to release internal pressure in the event of an uncontrolled explosion, preventing harm to surrounding equipment and personnel.

Ventilation System

The system comprises primarily of the air inlet and outlet which is fitted to each battery cabinet. The cabinet door is equipped with an air outlet and an air inlet. When the combustible gas detector detects the concentration inside the energy storage cabinet reaches the low alarm threshold, the air inlet and outlet are opened to reduce the gas levels. If the concentration of combustible gas reaches the high alarm threshold, the air inlet and outlet are closed.

A-4 WTG Underground Cabling

From each wind turbine, the power voltage is stepped up from the turbine generator voltage to 33kV for reticulation to the substation. The cabling will be arranged in 9 Collector Circuits with between 7 and 10 wind turbines per circuit, subject to final design and energy loss calculations. A total of about 80 km of 33kV underground cables will be established to connect the wind turbines to the substation.

Underground cables will require a trench of 0.75m to 1m depth and be typically 0.3m – 1m wide for each circuit. Trenches will be excavated, a bed of sand placed in the trench and 33kv cables installed before being backfilled with suitable material. Blasting or rock cutting methods may be utilised in locations not suitable for trenching. The earth grid and communications cables will be co-located with the 33kv cables. Some cable routes will require placing more than one collector group cables side by side.

A-5 O&M Building

Operation and maintenance (O&M) facilities would be established during the construction period in readiness for site operations. The main O&M facility would be located adjacent to the main construction facility, approximately 1.5km north of the Whitefields Rd site entrance. A satellite O&M facility may also be established ~400m northeast of T46.

Operations and Maintenance facilities may include, offices, amenities, storage and workshop facilities.

A-6 Substation

One combined 33kV/132kV substation and 132kV switchyard (hereafter referred to as substation) will be established in the central portion of the site. It will include all necessary ancillary equipment such as control room and amenities, communication equipment, control cubicles, voltage and current transformers and associated High Voltage equipment for control and protection of the substation and switchyard.

Details of the substation are provided below:

- It will be constructed in the central portion of the site
- It will be surrounded by security fencing to meet security requirements
- The ground surface would be covered partly by gravel and partly by concrete pads for equipment, walkways and cable covers, and would have an underground earth grid extending outside of the boundary of the security fence
- The visual appearance of the substation will seek to blend in with the surrounding landscape as feasible to comply with Ministers Condition of Consent (MCoC) Schedule 3, Condition 3.

Within the secure area there will be:

- A 33kV/132kV transformer with suitable bunding and containment
- 132kV switchgear, bus bars and gantries consistent with electrical safety clearances
- Electrical protection and control equipment, 33kV switch gear, a battery bank, amenities, offices, workshop and storage in one or more buildings/enclosures
- Controllable low intensity lighting for security purposes
- Parking area.

A-7 Overhead Transmission Line

The overhead transmission line for the project will consist:

- Approximately 8km of twin circuit 132kV overhead transmission line from the project substation to join parallel to the existing TransGrid 99M transmission line to the north of the site. From there TransGrid is upgrading the existing 99M line (under a separate approval) to cater for the additional wind farm circuit between the wind farm and Yass Substation, where it will join the National Electricity Market
- Single (or in some cases double) pole design proposed with construction hardstand at base of each structure
- An unsealed access track will be needed for construction of the line (i.e. to access each structure) and will be retained for ongoing maintenance.

A-8 Permanent Monitoring Masts

Up to two permanent monitoring masts and approximately four temporary monitoring masts will be installed during the construction period. Each mast will have a height of approximately 100m and be supported by guy wires. The masts are required to collect wind data required for performance assessment, ongoing operations and for obtaining reference wind speeds for noise monitoring studies. The permanent monitoring masts may also be used for other telecommunications purposes. The temporary masts will be located at turbine sites and will be removed before the turbines are installed at each location.

A-9 Decommissioning of temporary infrastructure

Temporary construction facilities that are not required for the ongoing operation of the wind farm will be removed once they are no longer required for the construction and site restoration works.

Site restoration works will involve stabilising disturbed ground that can be rehabilitated. Site restoration works will be implemented progressively as soon as practical following disturbance.

A-10 Operational Activities

The following activities are expected to be associated with the operation and maintenance of CWF:

- Generation of electricity via 69 wind turbines
- Operation of the wind turbines
- Maintenance of mechanical, electrical and structural components of wind turbines (including nacelles, blades and towers), kiosk transformers and cooling systems
- Scheduled or unscheduled outage maintenance for individual wind turbines or the wind farm as a whole
- Maintenance of the on-site substation

- Maintenance of 132 kV transmission line from the substation to the TransGrid 132kV transmission line to the north of the site, including maintenance of safe clearances
- Use of the Operations and Maintenance (O&M) facilities including, office, amenities, storage facilities and workshop
- Maintenance of other electrical infrastructure (e.g. 33kV cables and infrastructure)
- Maintenance of access roads, drainage and other civil infrastructure
- Waste management
- Land management, maintenance of rehabilitation and weed control.

The wind turbines and BESS units will be available to operate 24 hours per day, seven days per week all year round and generate / store electricity whenever conditions are favourable. The CWF is expected to operate for at least 25 years from the completion of construction.

The Project will be operated from the primary O&M Compound and is also capable of being operated remotely.

Approximately 15 full-time staff members will operate and maintain the Project. Contractors and extra staff members will work on-site as required.

The majority of inspections and maintenance for the Project will be scheduled, primarily requiring light vehicle traffic to and around the site with occasional truck deliveries to the O&M Compound. Major repairs or maintenance activities may require larger cranes, trucks and possibly replacement turbine components to be brought onto site.

Maintenance activities will be carried out primarily during the standard working hours of Monday to Friday, 7am - 6pm and Saturday, 8am-1pm. Exceptions to the above working hours may include:

- Deliveries of replacement parts or plant and equipment
- Cranage activities at turbine or substation sites to effect repairs in a timely manner during suitable weather conditions
- Onsite activities required to respond to an emergency situation or unscheduled maintenance events
- Activities that are non-audible at non-associated residences (e.g. office work, instrument adjustments, inspections, etc.).

In the event that the above exceptions are necessary outside the standard work hours and are potentially noticeable at non-associated residences, then an internal risk assessment process would be undertaken to assess and manage those activities.

Decommissioning of Permanent Facilities and Turbines

At the end of the operational life of the CWF, infrastructure will be either upgraded or decommissioned. When the wind farm is to be decommissioned, an appropriate contractor will be engaged to undertake decommissioning and rehabilitation works.

Generally, aboveground infrastructure would be removed to a depth of 300mm and the land restored to preconstruction conditions. Consultation with landowners would be undertaken prior to decommissioning to determine which elements of the roads and hardstands landowners wish to retain. Materials would be onsold or recycled wherever feasible. Details of the decommissioning will be provided in the approved Decommissioning and Rehabilitation Plan.

A-11 Supply of Raw Materials

Water used for dust suppression and for the placement of material will predominantly be sourced on-site from farm dams and/or groundwater bores. CWFPL has obtained the relevant Water Access Licences and associated water allocations to enable the use of this water.

Water for concrete batching is anticipated to be sourced from Yass Valley Council as this water is required to meet stringent quality parameters for its purpose. The final source of water would be confirmed by the Balance of Plant (BoP) Contractor.

The majority of gravel required for the project is expected to be sourced on site through the cut and fill of materials associated with the wind farm design. This strategy would minimise truck movements on offsite roads. There are various local quarries from which additional materials may be sourced from as necessary.

A-12 Site Access

Primary site access to CWF, including all over dimensional vehicles carrying turbine components and heavy vehicles, is via the Hume Highway and entry to the site via Whitefields Road. The Hume Hwy is controlled by TfNSW and the relevant portion of Whitefields Road is controlled by Yass Valley Council.

Whitefields Road is currently an unsealed road that intersects with Hume Highway at a priority controlled T-intersection. The access point to the CWF is located approximately 1.2km from the Hume Highway / Whitefields Road intersection. The 1.2km of Whitefields Road will be upgraded prior to commencement of major construction activities. The road upgrade design and accompanying Roadside Vegetation Management and Landscaping Plan (RVMLP) has been developed (and approved) in consultation with Yass Valley Council and the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW).

The Hume Highway / Whitefields Road intersection will also be upgraded prior to commencement of construction (other than pre-construction minor works). The intersection upgrade will include:

- widening of the intersection to allow over-dimensional vehicle access
- extension of the turning lane into Whitefields Road from Yass (southbound)
- extension of the merging lane onto Hume Hwy heading towards Yass (northbound)
- removal of planted vegetation in medium to improve driver visibility and safety.

The intersection upgrade is to be approved by TfNSW and will be completed by the BoP contractor.

It is expected that the majority of construction traffic will arrive to the Whitefields Road intersection from the Yass direction, and leave site in towards Yass (northbound) also.

A-13 OSOM

Over-dimensional turbine components from overseas will be delivered by ship to Port Kembla Port. The haulage route from Port Kembla to site covers a distance of approximately 275 km. Key roads utilized include the Princes Highway, Picton Road, Hume Highway and then Whitefields Road into site. An updated detailed haulage report was undertaken in October 2025. It is expected that generally three pilot vehicles will accompany each OSOM vehicle to guide the OSOM vehicle and manage traffic under the direction of police where required. The requirements for police escorts and / or police traffic management will be confirmed once the logistics contractor has been engaged.

Suitable arrangements and permits with the relevant road authorities must be in place prior to the commencement of turbine component haulage (e.g. any modifications to road furniture, etc). These arrangements will be confirmed by the successful transport contractor (yet to be engaged). It is noted that several other wind farms have completed construction in the Goulburn / Yass region. These other projects have also hauled turbine components from Port Kembla therefore it is expected that most amendments to road furniture will already be in place by the time CWF haulage commences.

An updated Traffic Impact Assessment (TIA) was prepared to support the modification and is included as **Appendix I** of the modification report. The assessment concluded that the increase in heavy vehicle movements can be accommodated with the current intersection arrangements.

CWF are also currently initiating with TfNSW the process of having the works authorisation deed in place to facilitate the upgrade of the Hume Highway/ Whitefields Rd intersection. Further review of the OSOM assessment will be undertaken as part of this process to ensure it reflects the current road conditions.

During operations the volume will reduce significantly and be mainly limited to the operational site team (~15 people), occasional contractors, visitors and site deliveries. This is expected to average approximately 15 loads (30 movements) per day, with peaks during periods of deep maintenance.

The project is anticipated to have a minimum 25 year life after which it would be upgraded or decommissioned. For decommissioning or upgrading, similar general measures would be necessary as those detailed in this report for construction works. This TMP would be revised to address traffic operation and volume changes in the future years during the decommissioning or upgrading phase.

A-14 Staging

Provided in Table A-3 is an indicative timeframe of the construction and operational phases of the project.

Table A-3: Project Timeframes

Phase	Approximate Duration
Pre-Construction (Approval to commencement of construction)	Up to 1 Year

Construction including civil works, installation, and commissioning	3 to 3 1/2 years
Operations and Maintenance	25 years
Decommissioning	1 to 2 years

APPENDIX B: STATUTORY COMPLIANCE TABLE

Statutory Reference	Requirements	Relevance	Section in the Report
Power to grant approval			
Environmental Planning and Assessment Act 1979	The Project is defined as electricity generating works. The Project is considered State Significant Development (SSD) according to section 4.36 of the EP&A Act, as it is declared so by the State Environmental Planning Policy (Planning Systems) 2021. Accordingly, the Minister for Planning or delegate is the consent authority for this modification application.	Consent is sought for the proposed develop under section 4.55 (2) of the EP&A Act (other modification). The modification report has assessed the environmental impacts of the proposal. Updated mitigation measures have been proposed to reflect the modification. The potential impacts can be mitigated by the proposed measures.	Section 4.1
Permissibility			
Environmental Planning and Assessment Act 1979	The consent authority may modify a development consent pursuant to section 4.55 of the EP&A Act. The modification is permissible if the consent authority is satisfied that the proposed modification is of minimal environmental impact, and the development to which the consent as modified relates is substantially the same development as the development for which the consent was originally granted and before that consent as originally granted was modified (if at all).	The modification report has assessed the environmental impacts. It has been demonstrated that the Project is of minimal environmental impact and is substantially the same as the approved development.	Section 3.1 Section 4.1
State Environmental Planning Policy (Transport and Infrastructure) 2021	The Project is defined remains consistent with the definition of electricity generating works, which are permitted with consent in	As addressed	

Statutory Reference	Requirements	Relevance	Section in the Report
	the RU1 zone under section 2.36 the TI SEPP.		
Other approvals			
Environmental Planning and Assessment Act 1979	Pursuant to section 4.41 of the EP&A Act, other approvals are integrated into the SSD assessment process. For SSD, any integrated approvals must be substantially consistent with the development consent for the Project.	No other approvals would be affected by the proposed modification.	NA
Pre-conditions to exercising the power to grant approval			
Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act)	Under the EPBC Act, if the Minister determines that an action is a 'controlled action' which would have or is likely to have a significant impact on a Matter of National Environmental Significance (MNES) or Commonwealth land, then the action may not be undertaken without prior approval of the Minster.	The Project was referred as controlled action due to potential impacts on MNES. The Project holds EPBC approval (2017/8129) which was varied on the 12 May 2025. The modification is within the approved disturbance footprint and will not have any impact on MNES.	NA
State Environmental Planning Policy Resilience and Hazards 2021 (SEPP Resilience and Hazards)	Section 3.12 of the SEPP Resilience and Hazards requires consent authorities to consider the Project's preliminary hazard analysis (PHA).	The Project includes a BESS which requires the preparation of a PHA. This has been included as Appendix E and summarised in Section 6.3.3.	Section 6.3.2 & 6.3.3 APPENDIX E: Preliminary Hazard Analysis
National Parks and Wildlife Act 1974 (NPW Act)	The NPW Act is responsible for the conservation of objects, places or features of cultural value within the landscape, such as but not limited to places, object and features of significance to Aboriginal people, places of social value and places of historic,	The EIS included an assessment of Aboriginal heritage and a Aboriginal Cultural Heritage Management Plan has been prepared and approved.	NA

Statutory Reference	Requirements	Relevance	Section in the Report
	architectural or scientific value.	The modification is within the approved construction footprint therefore no further assessment is warranted.	
Roads Act 1993 (Roads Act)	Under section 138 of the Roads Act, work cannot be carried out over a public road without consent of the appropriate roads authority.	Approvals for works within the road corridor as required under Section 138 of the Roads Act will be sought prior to construction from the relevant road authority. The modification has not resulted in any amendment to the proposed road improvements.	NA
Biodiversity Conservation Act 2016 (BC Act)	Section 7.9 of the BC Act requires a biodiversity development assessment report (BDAR) to be prepared for SSD unless determined otherwise by the Planning Agency Head and the Environment Agency Head.	The Project was approved prior to the BC Act. To determine the offset requirements of the project baseline mapping was updated and offset liabilities were calculated in accordance with S3 Condition 19A. The modification remains within the disturbance footprint therefore there is no need to amend the offset liabilities for the development.	NA
Waste Avoidance and Resource Recovery Act 2001 (WARR Act)	The WARR Act includes resource management hierarchy principles to encourage the most efficient use of resources and to reduce environmental harm. The Project's resource management options would be considered against a hierarchy.	Waste management and avoidance is assessed in the approved project and also detailed in the approved Environmental Management Strategy. No changes are generated by the Modification.	NA

APPENDIX C: UPDATED MITIGATION MEASURES

Additional mitigation measures have been added in red text

<table>
<tr><th>ID</th><th>Safeguards and Mitigation Measures (Mod 2)</th><th>Project Phase</th></tr>
<tr><td colspan="3">Visual</td></tr>
<tr><td>V1</td><td>

Prior to the commencement of construction, the Proponent shall notify in writing the owner of:

(a) any non-associated residence listed in Table 1; or

(b) any other non-associated residence within 5 kilometres of any wind turbine, that they have the right to request implementation of visual impact mitigation measures at their residence (including its curtilage).

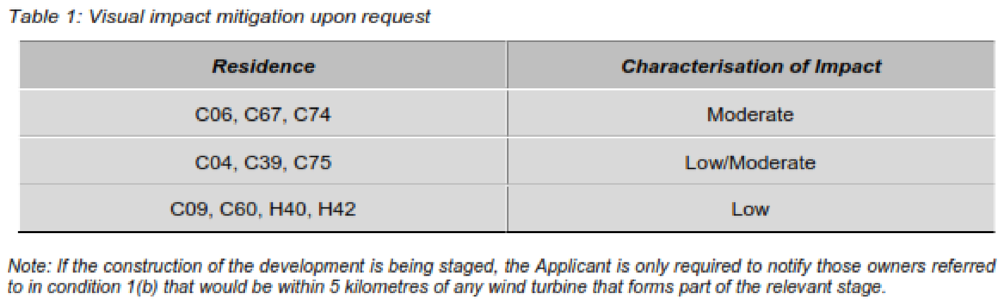


Table 1: Visual impact mitigation upon request

<table>
<tr><th>Residence</th><th>Characterisation of Impact</th></tr>
<tr><td>C06, C67, C74</td><td>Moderate</td></tr>
<tr><td>C04, C39, C75</td><td>Low/Moderate</td></tr>
<tr><td>C09, C60, H40, H42</td><td>Low</td></tr>
</table>

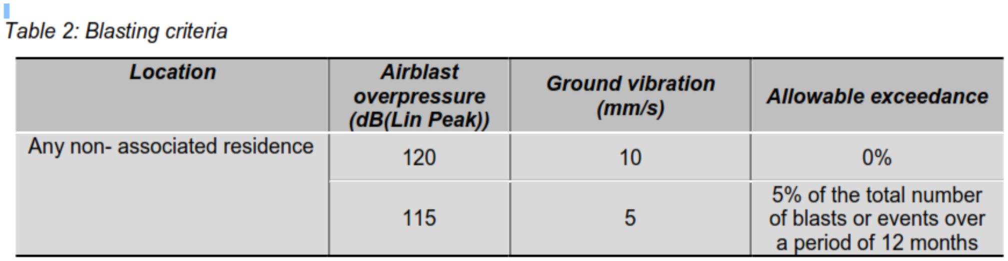
Note: If the construction of the development is being staged, the Applicant is only required to notify those owners referred to in condition 1(b) that would be within 5 kilometres of any wind turbine that forms part of the relevant stage.

</td><td>Detailed design</td></tr>
</table>

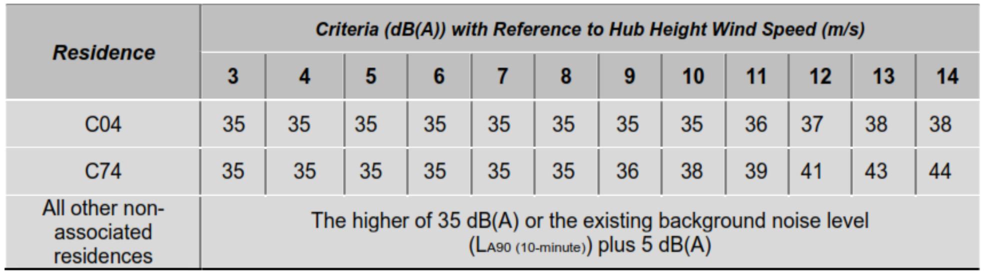
ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
V2	If following the commencement of construction, the Proponent receives a written request from the owner of any residence referred to in condition 1 above for the implementation of visual impact mitigation measures (such as landscaping, vegetation screening, provision of awnings/blinds), then the Proponent shall implement measures at the residence (including its curtilage) in consultation with the landowner. These mitigation measures must be reasonable and feasible, directed towards reducing the visual impacts of the wind turbines on the residence (including its curtilage), and commensurate with the level of visual impact. The mitigation measures must be implemented within 12 months of receiving the written request, unless the Secretary agrees otherwise. If the Proponent and the owner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution. *Notes:* *• To identify the residences referred to in Table 1, see the figures in Appendix 2.* *• To avoid any doubt, the visual impact mitigation measures must be aimed at reducing the visibility of the wind turbines from the residence and its curtilage. Mitigation measures are not required to be implemented to reduce the visibility of wind turbines from other locations on the property.* *• In some cases, mitigation measures may not be warranted as the wind turbines would not be visible from the residence and its curtilage.* *• The identification of appropriate visual impact mitigation measures will be easier following the construction of the wind turbines. While landowners may ask for the implementation of visual impact mitigation measures shortly after the commencement of construction, they should consider the merits of delaying this request until the wind turbines are visible from their residence.*	Construction and Operations

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
V3	The Proponent shall: (a) implement all reasonable and feasible measures to minimise the off-site visual impacts of the development; (b) ensure the wind turbines are: • painted off white/grey; and • finished with a surface treatment that minimises the potential for glare and reflection; (c) ensure the visual appearance of all ancillary infrastructure (including paint colours, specifications and screening) blends in as far as possible with the surrounding landscape; and (d) not mount any advertising signs or logos on wind turbines or ancillary infrastructure.	Detailed Design
	The Proponent shall: (a) implement all reasonable and feasible measures to minimise the off-site lighting impacts of the development; (b) ensure that any aviation hazard lighting installed utilises an aircraft detection lighting system, unless otherwise agreed by CASA; (c) ensure that all external lighting associated with the development (apart from any aviation hazard lighting): • is installed as low intensity lighting (except where required for safety or emergency purposes); • does not shine above the horizontal; • uses best management practice for bat deterrence; and • complies with Australian Standard AS4282 (INT) 1997 – Control of obtrusive Effects of Outdoor Lighting, or its latest version.	Detailed Design
Construction Noise		
CN1	The Proponent shall implement all reasonable and feasible measures to minimise the construction or decommissioning noise of the development, including any associated traffic noise.	Construction
CN2	The Proponent shall ensure that the noise generated by any construction or decommissioning activities is managed in accordance with the best practice requirements outlined in the Interim Construction Noise Guideline (DECC, 2009), or its latest version.	Construction

<table>
<tr><th>ID</th><th>Safeguards and Mitigation Measures (Mod 2)</th><th>Project Phase</th></tr>
<tr><td>CN3</td><td>Unless the Secretary agrees otherwise, the Proponent shall only undertake construction or decommissioning activities between:
(a) 7 am to 6 pm Monday to Friday;
(b) 8 am to 1 pm Saturdays; and
(c) at no time on Sundays and NSW public holidays.

The following construction activities may be undertaken outside these hours without the approval of the Secretary:
• activities that are inaudible at non-associated residences;
• the delivery of materials as requested by the NSW Police Force or other authorities for safety reasons; or
• emergency work to avoid the loss of life, property and/or material harm to the environment.</td><td>Construction</td></tr>
<tr><td>CN4</td><td>The Proponent shall only carry out blasting on site between 9 am and 5 pm Monday to Saturday inclusive. No blasting is allowed on Sundays or public holidays.</td><td>Construction</td></tr>
<tr><td>CN5</td><td>The Proponent shall ensure that any blasting carried out during the construction of the development does not
exceed the criteria in Table 2.

<i>Table 2: Blasting criteria</i>
<table>
<tr><th>Location</th><th>Airblast overpressure (dB(Lin Peak))</th><th>Ground vibration (mm/s)</th><th>Allowable exceedance</th></tr>
<tr><td>Any non- associated residence</td><td>120</td><td>10</td><td>0%</td></tr>
<tr><td></td><td>115</td><td>5</td><td>5% of the total number of blasts or events over a period of 12 months</td></tr>
</table></td><td>Construction</td></tr>
<tr><td colspan="3">Operational Noise</td></tr>
</table>

<table>
<tr><th>ID</th><th>Safeguards and Mitigation Measures (Mod 2)</th><th>Project Phase</th></tr>
<tr><td>ON1</td><td>The Proponent shall ensure that the noise generated by the operation of wind turbines does not exceed the relevant criteria in Table 3 at any non-associated residence.

Table 3: Noise criteria dB(A)

<table>
<tr><th rowspan="2">Residence</th><th colspan="12">Criteria (dB(A)) with Reference to Hub Height Wind Speed (m/s)</th></tr>
<tr><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th></tr>
<tr><td>C04</td><td>35</td><td>35</td><td>35</td><td>35</td><td>35</td><td>35</td><td>35</td><td>35</td><td>36</td><td>37</td><td>38</td><td>38</td></tr>
<tr><td>C74</td><td>35</td><td>35</td><td>35</td><td>35</td><td>35</td><td>35</td><td>36</td><td>38</td><td>39</td><td>41</td><td>43</td><td>44</td></tr>
<tr><td>All other non-associated residences</td><td colspan="12">The higher of 35 dB(A) or the existing background noise level ($L_{A90\ (10\text{-minute})}$) plus 5 dB(A)</td></tr>
</table>
</td><td>Operation</td></tr>
<tr><td>ON2</td><td>The Proponent will ensure final turbine selection and layout complies with the World Health Organisation Guidelines for Community Noise requiring 45 dB(A) or background plus 5 dB(A) (whichever is higher) for all involved residential receivers and all non-involved residential receivers which have entered into noise agreement with the Proponent in accordance with the

SA EPA Noise Guidelines</td><td>Detailed Design</td></tr>
<tr><td>ON3</td><td>The Proponent shall ensure that the noise generated by the operation of ancillary infrastructure does not exceed 35 dB(A) LAeq(15 minute) at any non-associated residence.

Noise generated by the operation of ancillary infrastructure is to be measured in accordance with the relevant requirements of the NSW Noise Policy for Industry (or its equivalent)</td><td>Operation</td></tr>
<tr><td>ON4</td><td>If operational monitoring identifies exceedances, the Proponent would give consideration to providing mechanical ventilation (to remove the requirement for open windows) building acoustic treatment (improving glazing) or using turbine control features manage excessive noise under particular conditions.</td><td>Operation</td></tr>
<tr><td>ON5</td><td>Within 3 months of the commencement of operations (or the commencement of operation of a cluster turbines, if the development is to be staged), unless the Secretary agrees otherwise, the Proponent shall:</td><td>Operation</td></tr>
</table>

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
	(a) undertake noise monitoring to determine whether the development is complying with the relevant conditions of this consent; and (b) submit a copy of the monitoring results to the Department and the EPA.	
ON6	The Proponent shall undertake further noise monitoring of the development if required by the Secretary.	
Biodiversity		
B1	The Proponent must: (a) ensure that no more than 179.8 hectares (ha) of EEC is cleared for the development, including: • 31.4 ha of Blakely's Red Gum – Yellow Box Gum Woodland (MR528); • 148.1 ha of Blakely's Red Gum – Yellow Box Gum Woodland – Derived Grassland (MR528); and • 0.27 ha Yellow Box – River Red Gum and Riparian Woodland (MR616), unless the Secretary agrees otherwise; (b) remove no more than 4 hollow-bearing trees along Whitefields Road, unless the Secretary agrees otherwise; (c) implement all reasonable and feasible measures to: • minimise the limb lopping on hollow-bearing trees and mature trees along Whitefields Road; • avoid impacts to the Yass Daisy (*Ammobium craspedioides*), Dwarf Bush-pea (*Pultenaea humilis*) and Small Purple-pea (*Swainsona recta*); • minimise impacts on threatened bird and bat populations; and • minimise the approved clearing of hollow-bearing trees, native vegetation and key habitat within the approved disturbance footprint	Detailed Design
B2	Prior to the commencement of construction, the Proponent must: (a) update the baseline mapping of the vegetation and key habitat within the final disturbance area; and	Pre-Construction

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
	(b) calculate the biodiversity offset credit liabilities for the development in accordance with the Framework for Biodiversity Assessment under the NSW Biodiversity Offsets Policy for Major Projects, in consultation with OEH, and to the satisfaction of the Secretary.	
B3	Within 2 years of the commencement of construction, unless otherwise agreed by the Secretary, the Proponent must retire the required biodiversity offset credits, to the satisfaction of BCS. The retirement of these credits must be carried out in accordance with the NSW Biodiversity Offsets Policy for Major Projects, and can be achieved by: (a) acquiring or retiring 'biodiversity credits' within the meaning of the Biodiversity Conservation Act 2016; (b) making payments into an offset fund that has been established by the NSW Government; or (c) providing suitable supplementary measures.	Post Construction
B4	Should dams be required to be removed during site development, alternative watering points would be established to compensate for their loss, where practical and with the agreement of the landowner.	Detailed Design and Construction
B5	Additional targeted surveys would be undertaken as part of the pre-construction surveys, if the identified areas would be impacted by the proposal. These areas include: • Coppabella: Hollow-bearing trees targeted for removal.	Pre-Construction
B6	Contractors and staff would be made aware of the significance and sensitivity of the constraints identified in the Biodiversity Assessment constraint map set for each precinct or stage during the site induction process.	Construction
B7	In relation to temporary construction activities, a buffer twice the distance of the tree drip-line would be established in sensitive areas identified in the Biodiversity Assessments for each precinct to ensure indirect impacts (such as compaction, noise and dust) are minimised where practical.	Construction
B8	Prior to the commencement of construction, the Proponent shall prepare a Biodiversity Management Plan for the development to the satisfaction of the Secretary. This plan must: (a) be prepared in consultation with BCS; and (b) include a: • description of the measures that would be implemented for:	Pre-Construction

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
	- minimising the amount of clearing within the approved development footprint as far as practicable; - managing potential indirect impacts on threatened plant species, including the Yass Daisy (*Ammobium craspedioides*), Dwarf Bush-pea (*Pultenaea humilis*) and Small Purple-pea (Swainsona recta); - rehabilitating and revegetating temporary disturbance areas; - protecting vegetation and fauna habitat outside the approved disturbance area; - maximising the salvage of resources within the approved disturbance area – including vegetative and soil resources – for beneficial reuse (including fauna habitat enhancement) on site and/or in the biodiversity offset area; - collecting and propagating seed (where relevant); - minimising impacts on tree hollows as far as practicable; - minimising the impacts on fauna on site, including undertaking pre-clearance surveys; - controlling weeds and feral pests; - controlling erosion; - controlling access; and - bushfire management; (c) include a detailed program to monitor and report on the performance of these measures over time. Following approval, the Proponent must implement the measures described in the Biodiversity Management Plan.	

B9	Prior to the commissioning of any wind turbines, the Proponent must prepare a Bird and Bat Adaptive Management Plan for the development in consultation with BCS, and to the satisfaction of the Secretary. This plan must include: (a) at least 12 month's worth of baseline data on threatened and 'at risk' bird and bat species and populations in the locality that could be affected by the development; (b) a detailed description of the measures that would be implemented on site for minimising bird and bat strike during operation of the development, including: • minimising the availability of raptor perches on wind turbines; • prompt carcass removal; • controlling pests; and • using best practice methods for bat deterrence, including managing potential lighting impacts; (c) trigger levels for further investigation of the potential impacts of the project on particular bird or bat species or populations; (d) an adaptive management program that would be implemented if the development is having an adverse impact on a particular threatened or 'at risk' bird and/or bat species or populations; including the implementation of measures to: • reduce the mortality of those species or populations; or • enhance and propagate those species or populations in the locality; and (e) a detailed ongoing program to monitor and report on: • direct and indirect impacts of the development on bird and bat fauna; • the effectiveness of these adaptive management measures; and • any bird and bat strikes on site; (f) provisions for a copy of all raw data collected as part of the monitoring program to be submitted to BCS and the Secretary. Following the Secretary's approval, the Proponent must implement the Bird and Bat Adaptive Management Plan	Operations

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
Indigenous Heritage		
IH1	A salvage program of archaeological excavation and analysis would be undertaken in a sample of impact areas prior to construction. The development of an appropriate research project would be undertaken in consultation with an archaeologist, the relevant Aboriginal communities and Heritage NSW.	Pre-Construction
IH2	The Proponent would minimize the extent of impacts to areas assessed to be of low/moderate or moderate archaeological significance where possible. A program of salvage subsurface excavation would be undertaken in impact areas at these locales prior to construction as a form of impact mitigation. The scope of this program is provided in Tables 19, 20 and 21 of Section 12 of the Archaeological Assessment, which identify the survey units that would be targeted in the program.	Detailed Design
IH3	The Proponent must: (a) ensure the development does not cause any direct or indirect impacts on Aboriginal heritage items located outside the approved disturbance area; and (b) avoid (as far as practicable) and otherwise minimise any impacts on Aboriginal heritage items identified in Table 1 in Appendix 5; and (c) undertake a salvage program for the Aboriginal heritage items identified in Table 1 in Appendix 5, if impacts to them cannot be avoided.	Construction
IH4	The Proponent shall ensure that the development does not cause any direct or indirect impact on any historic heritage items located outside the approved disturbance area.	Construction and Operations
IH5	Prior to the commencement of construction, the Proponent must prepare a Heritage Management Plan for the development to the satisfaction of the Secretary. This plan must: (a) be prepared by a suitably qualified and experienced person whose appointment has been endorsed by the Secretary; (b) be prepared in consultation with OEH and Aboriginal stakeholders;	Pre-Construction

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
	(c) include up to date baseline mapping of the heritage items within and adjoining the development disturbance area; and (d) include a description of the measures that would be implemented for: • minimising ground disturbance within the project area during construction and decommissioning works; • protecting the Aboriginal heritage items located outside the approved development corridor; • minimising and managing impacts to Aboriginal heritage items identified in Table 1 in Appendix 5, including: - undertaking salvage excavations and collections where impacts cannot be avoided; and - a strategy for the long-term management of any Aboriginal heritage items or material collected during the salvage activities; • a contingency plan and reporting procedure if: - Aboriginal heritage items outside the approved disturbance area are harmed; - previously unidentified Aboriginal heritage items are found; or - Aboriginal skeletal material is discovered; • ensuring workers on site receive suitable heritage inductions prior to carrying out any development on site, and that suitable records are kept of these inductions; and • ongoing consultation with Aboriginal stakeholders during the implementation of the plan; (e) a program to monitor and report on the effectiveness of these measures and any heritage impacts of the project.	
Aviation safety		
A1	Prior to the construction of any wind turbines, the Proponent shall: (a) prepare a detailed report to the satisfaction of Airservices Australia on all the potential aviation-related impacts of the development, including any potential impacts on the operation of the Mt Majura	Pre-Construction

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
	PSR/SSR Air Traffic Control radar, Mt Bobbara SSR Air Traffic Control radar, and any other Airservices Australia infrastructure or facilities. This report must: • be prepared by a suitably independent, qualified and experienced person acceptable to Airservices Australia; • be prepared in accordance with EUROCONTROL Guidelines on how to assess the potential impact of Wind Turbines on Surveillance Sensors, September 2014, or its latest version; • include a review of the findings of previous assessments in respect of the development; and • include recommendations for reasonable and feasible measures to mitigate or manage the potential impacts, that are acceptable to Airservices Australia; (b) prepare, an Aviation Impact Management Plan to the satisfaction of Airservices Australia. This plan must: • describe the measures that would be implemented to mitigate and/or manage the aviation-related impacts of the development, having regard to the recommendations in the detailed report required in (a) above; and • include a program for the implementation of these measures, having regard to any regulatory approvals that may need to be obtained, Airservices Australia's statutory and operational priorities and the proposed construction program for the development; and (c) enter into a legally binding agreement with Airservices Australia articulating further details to give effect to the implementation of the Aviation Impact Management Plan, including the provision of adequate security for implementation of the measures in the plan and any associated costs	
A2	Following approval of the Aviation Impact Management Plan changes are proposed to the location and/or dimensions of any wind turbines, then the Proponent shall assess the aviation-related impacts of the proposed	Detailed Design

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
	changes and update the Aviation Impact Management Plan to the satisfaction of Airservices Australia prior to constructing the wind turbines in the revised location.	
A3	The Proponent shall be liable for all costs associated with the implementation of the Aviation Impact Management Plan, including the reimbursement of all of Airservices Australia's costs, including (but not limited to): (a) Airservices Australia's internal time and materials costs; (b) the costs of Airservices Australia's project management and subcontracting arrangements (including any procurement costs); (c) project and equipment costs; (d) public and stakeholder engagement and consultation costs; (e) alternative site licensing or leasing costs; (f) the costs associated with obtaining regulatory approvals or complying with any regulatory requirements (including any environmental impact studies and community consultation costs); and (g) any other associated costs identified by Airservices Australia.	Operations
A4	Prior to the commencement of construction of the development, the Proponent must provide the following information to CASA, Airservices Australia, and the RAAF (together the authorities): (a) coordinates in latitude and longitude of each wind turbine and wind monitoring mast; (b) final height of each wind turbine and wind monitoring mast in Australian Height Datum; (c) ground level at the base of each wind turbine and wind monitoring mast in Australian Height Datum; (d) confirmation of compliance with any OLS; and (e) details of aviation hazard lighting.	Pre-Construction
A5	Within 30 days of the practical completion of any turbine or mast, the Proponent shall: (a) provide confirmation to the authorities and local aviation users that the information that was previously provided remains accurate; or (b) update the information previously provided.	Pre-Operations
Telecommunication interference		

ID	**Safeguards and Mitigation Measures (Mod 2)**	**Project Phase**
TC1	The Proponent would located wind turbines to avoid existing microwave link paths that cross each the area, or liaise with the owners of such links to relocate services to avoid potential impacts from turbines.	Detailed Design
TC2	If the development results in the disruption to radio or telecommunications services (including point-to-point microwave links) in the area, then the Proponent must make good any disruption to these services as soon as possible following the disruption, but no later than 1 month following the disruption of the service unless the relevant service provider or user or Secretary agrees otherwise. If there is a dispute about the mitigation measures to be implemented or the implementation of these mitigation measures, then either party may refer the matter to the Secretary for resolution.	Operations
TC3	Ensure adequate television reception is maintained for neighbouring residences as follows: • Undertake a monitoring program of houses within 5km of the wind farm site or construction stage, if requested by the owners, to determine a baseline of reception against which to review any loss in television signal strength. • In the event that after construction television interference (TVI) is experienced by existing receivers within 5km of the site or construction stage, investigate the source and nature of the interference. • Where investigations determine that the interference is cause by the wind farm, establish appropriate mitigation measures at each of the affected receivers in consultation and agreement with the landowners. Specific mitigation measures may include: • Modification to, or replacement of receiving antenna • Provision of a land line between the effected receiver and an antenna located in an area of favourable reception • Improvement of the existing antenna system • Installation of a digital set top box or	Operations

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
	- In the event that interference cannot be overcome by other means, negotiating an arrangement for the installation and maintenance of a satellite receiving antenna at the Proponents cost.	
Transport		
T1	Prior to the construction of the proposed upgrade to Whitefields Road, the Proponent shall prepare detailed plans for the upgrade in consultation with the relevant Council, and to the satisfaction of the Secretary. In preparing these plans, the Proponent must seek to avoid and/or minimise the clearing of mature vegetation adjacent to the road. Further, the detailed plans must include a landscaping plan for replacing the removal of any existing vegetation and/or augmenting the existing vegetation adjacent to the upgraded road, with species that are endemic to the locality.	Pre-Construction
T2	Prior to the commencement of construction (other than pre-construction minor works), the Proponent must: (a) upgrade the existing intersection at the Hume Highway and Whitefields Road in accordance with Austroads Guide to Road Design (as amended by RMS supplements); (b) upgrade the section of Whitefields Road to be used as a primary access route (and shown in the figure in Appendix 6 of CoC), including widening and sealing to a minimum width of 5 m, with 0.5 m gravel shoulders; (c) upgrade the section of Coppabella Road to be used as a secondary access route (and shown in the figure in Appendix 6 of CoC), including applying an all-weather gravel surface seal; to the satisfaction of the relevant roads authority.	Pre-Construction

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
T3	The Proponent must: (a) prepare a dilapidation survey in accordance with the guidelines and standards established by Austroads of the designated vehicle route on Whitefields Road and Coppabella Road, as identified in the figure in Appendix 6 (of CoC): • prior to the commencement of any construction and/or decommissioning works; and • within 1 month of the completion of any construction and/or decommissioning works; (b) rehabilitate and/or make good any development-related damage: • identified during the carrying out of the relevant construction and/or decommissioning works if it could endanger road safety, as soon as possible after the damage is identified, but within 7 days at the latest; and • identified during any dilapidation survey carried out following the completion of the relevant construction and/or decommissioning works within 2 months of the completion of the survey, unless the relevant roads authority agrees otherwise, to the satisfaction of the relevant roads authority. If the construction and/or decommissioning of the development is to be staged, the obligations in this condition apply to each stage of construction and/or decommissioning. If there is a dispute about the scope of any remedial works or the implementation of the works, then either party may refer the matter to the Secretary for resolution.	Pre-Construction
T4	The Proponent shall ensure any unformed Crown road reserves affected by the development are maintained for future use, unless otherwise agreed with the NSW Department of Industry – Lands and Water.	Operations

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
T5	The Proponent shall ensure that all over-dimensional and heavy vehicle access to and from the site is via the primary access routes identified in the EA (and shown in the figure in Appendix 6 of CoC) unless the applicable roads authority approves otherwise.	Construction
T6	Prior to the commencement of construction, the Proponent shall prepare a Traffic Management Plan for the development to the satisfaction of the Secretary. This plan must be prepared in consultation with RMS and the Councils, and include: (a) details of all transport routes and traffic types to be used for development-related traffic; (b) a protocol for undertaking dilapidation surveys to assess the: • existing condition of the transport route/s prior to construction or decommissioning works; and • condition of the transport route/s following construction or decommissioning works; (c) a protocol for the repair of any roads identified in the dilapidation surveys to have been damaged during construction or decommissioning works; (d) details of the measures that would be implemented to minimise traffic safety issues and disruption to local road users during construction or decommissioning works, including: • temporary traffic controls, including detours and signage; • notifying the local community about project-related traffic impacts; • minimising potential for conflict with school buses and rail services; • responding to any emergency repair requirements or maintenance during construction and/or decommissioning; and • a traffic management system for managing over-dimensional vehicles; and (e) a drivers code of conduct that addresses: • travelling speeds; • procedures to ensure that drivers adhere to the designated transport routes; and	Pre-Construction

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
	• procedures to ensure that drivers implement safe driving practices. If the construction and/or decommissioning of the development is to be staged, the obligations in this condition apply to each stage of construction and/or decommissioning.	
T6	Vehicles exiting right from Whitefields Road and travelling west along the Hume Highway are to be limited to 19m.	
Electromagnetic Fields		
EF1	Adhere to standard industry approaches and policies with respect to EMF through maintenance of adequate easements around transmission lines.	Operations
EF2	The turbines, control building, substation and transmission lines would be located as far as practical from residences, farm sheds, and yards in order to reduce the potential for both chronic and acute exposures.	Operations
Fire and Bushfire		
BF1	The Proponent would prepare a Bushfire Management Plan. The Rural Fire Service and NSW Fire Brigade would be consulted in regard to its adequacy to manage bushfire risks during construction, operation and decommissioning. The plan would as a minimum include: • Hot-work procedures, asset protection zones, safety, communication, site access and response protocol in the event of a fire originating in the wind farm infrastructure, or in the event of an external wild fire threatening the wind farm or nearby persons or property • Flammable materials and ignition sources brought onto the site, such as hydrocarbons, would be handle and stored as per manufacturer's instructions. • During the construction phase, appropriate fire fighting equipment would be held onsite and in vehicles ~~when the firdanger is very high to extreme~~, and a minimum of one person on site would be trained in its use. The equipment and level of training would be determined in consultation with the local RFS • Substations would be bunded with a capacity exceeding the volume of the transformer oil to contain the oil in the event of a major leak or fire. The facilities would be regularly inspected and maintained to ensure leaks do not present a fire hazard, and to ensure the bunded area is clear (including removing any rainwater)	Pre-Construction

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
	• Substations would be surrounded by a gravel and concrete area free of vegetation to prevent the spread of fire from the substation and reduce the impact of bushfire on the structure. The substation area would also be surrounded by a security fence as a safety precaution to prevent trespassers and stock ingress • Asset protection zones (APZs), based on the RFS Planning for Bushfire Protection, would be maintained around the control room, sub-station and in electricity transmission easements. Workplace health and safety protocols would be developed to minimise the risk of fire for workers during construction and during maintenance in the control room and amenities • Fire extinguishers would be stored onsite in the control building and within the substation building • Shut down of turbines would commence if components reach critical temperatures or if directed by the RFS in the case of a nearby wildfire being declared (an all hours contact point would be available to the RFS during the bushfire period). Remote alarming and maintenance procedures would also be used to minimise risks • Overhead transmission easements would be periodically inspected to monitor regrowth of encroaching vegetation • Procedures for vehicles driving over long grass • Water supply for firefighting purposes is located at the primary vehicle access point to the project	
BF2	• The construction footprint surrounding each BESS is maintained to the standard of an inner protection area (IPA) in accordance with the requirements of Appendix 4 of Planning for Bush Fire Protection2019. • The BESS must be located to avoid flame zone (FZ) contact.	Preconstruction/ Construction & operation
BF3	• Access roads are to comply with the property access road requirements as outlined in Table 7.4a of Planning for Bush Fire Protection 2019 • Connecting 5.5m wide (minimum) access tracks to facilitate access to all wind turbines and BESS infrastructure. • Access must allow for safe and effective firefighting operations around the perimeter of each BESS (where slopes allow)	Preconstruction/ construction

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
BF4	Water supply for firefighting purposes must be located at the primary vehicle access point to the facility and elsewhere in consultation with the NSW RFS District Office for the NSW Rural Fire Service, Fire and Rescue NSW and the fire Safety Study. Further: • a SWS must be provided on site located within the IPA or non hazard side and away from structures; • unobstructed access is to be provided within 4m of the SWS at all times; • a 65mm Storz connection with a ball valve is fitted to the outlet of the SWS; • ball valve and pipes are adequate for water flow and are metal; • supply pipes from tank to ball valve have the same bore size to ensure flow volume; • underground tanks (if implemented) have an access hole of 200mm to allow tankers to refill direct from the tank and a hardened ground surface for truck access is supplied within 4m; • underground tanks are clearly marked; • above-ground tanks are manufactured from concrete or metal; • raised tanks have their stands constructed from non-combustible material or bush fire-resisting timber (see Appendix F of AS 3959); • tanks on the hazard side of a building are provided with adequate shielding for the protection of firefighters; • all exposed water pipes external to the building are metal including any fittings; • where pumps are provided, they are a minimum 5hp or 3kWpetrol or diesel-powered pump, and are shielded against bushfire attack; • any hose and reel for firefighting connected to the pump must be 19mm internal diameter; and • any fire hose reels are constructed in accordance with AS/NZ1221:1997 and installed in accordance with the relevant clauses of AS 2441:2005.	Construction & Operation
BF5	The Emergency Response Plan (inclusive of Section 4.11 Bushfire Risk Management) in the existing Coppabella Wind Farm Environmental Management Strategy must be updated for the project to incorporate the BESS.	Pre-Construction
Battery Storage		
	• Flammable Dangerous Goods cabinets shall be subject to hazardous area classification in accordance with AS/NZS 60079.10.1:2022.	Pre Construction / Construction & Operations

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
	• Any electrical equipment to be installed within the defined hazardous areas shall be installed in accordance with AS/NZS 60079.14:2022. • BESS must be tested in accordance with UL9540A. • Testing to demonstrate clearances required to prevent propagation of fires between separated BESS units. • BESS to be installed in accordance with manufacturer and UL9540A report recommended clearances based on testing. • BESS to be installed with fire protection systems specified by the manufacturer and UL9540A report. • Before construction, detailed design to validate the BESS can be installed in the project area whilst meeting the recommended clearances. • UL testing information shall be made available to the certifying authority. It is noted that a confidentiality agreement may be required. • The vent covers of the BESS shall be constructed of non-combustible material. • The vents shall not be located above battery packs within the BESS container.	
Hydrology		
H1	The Proponent shall ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of the development to match its available water supply.	Construction, Operation and Decommissioning
H2	Undertake liaison with representatives of Goldenfields Water County Council regarding the potential supply of construction water	Pre-Construction
H3	Unless an EPL authorises otherwise, the Proponent must comply with Section 120 of the POEO Act	Construction, Operation and Decommissioning
H4	The Proponent must: (a) ensure the wind turbines and ancillary infrastructure, particularly any access roads on steep slopes, are designed, constructed and maintained to minimise any soil erosion;	Construction, Operation and Decommissioning

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
	(b) minimise any soil erosion associated with the construction and decommissioning of the development by implementing the relevant mitigation measures in Managing Urban Stormwater: Soils and Construction (Landcom, 2004), or its latest version; (c) ensure all waterway crossings are constructed in accordance with: • Water Guidelines for Controlled Activities on Waterfront Land (2012), or its latest version; and • Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (2004), or its latest version, (d) store and handle all dangerous goods or hazardous materials on site in accordance with AS19402004: • The storage and handling of flammable and combustible liquids, or its latest version; (e) ensure the concrete batching plants and substation are suitably bunded; and (f) minimise any spills of hazardous materials or hydrocarbons, and clean up any spills as soon as possible after they occur.	
Soils and Landform		
S1	Where soil is excavated subsoil would be separated from topsoil for rehabilitation purposes.	Construction
S2	Topsoil from the excavation sites would be stockpiled and replaced. On steep slopes, topsoil would be stabilised. Any excess subsoil would be removed from the site and disposed of at an appropriate fill storage area.	Construction
S3	Avoid compaction of soil resulting from vehicle access and laying materials particularly during saturated soil conditions, and remediate as necessary.	Construction
S4	The Proponent would prepare a protocol for instances of suspected contamination being unexpectedly found. Should contamination or potential contamination be disturbed during excavation works, the area would be assessed by appropriately qualified consultants. BCS would be notified if warranted.	Construction
S5	Concrete wash would be deposited in an excavated area, below the level of topsoil, or in an approved landfill site. Where possible, waste water and solids would be reused onsite.	Construction

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
S6	Access routes and tracks would be confined to already disturbed areas where possible. All contractors would be advised to keep to established tracks.	Construction
Economic		
E1	Liaise with local industry representatives to maximise the use of local contractors and manufacturing facilities in the construction and decommissioning phases of the project.	Construction, Operation and Decommissioning
E2	Liaise with the local visitors information centre to ensure that construction and decommissioning timing and haulage routes are known well in advance of works and to the extent practical coordinated with local events	Construction, Operation and Decommissioning
E3	Liaise with Yass Valley and Hilltops Councils to provide information to assist in attracting people to the local area to facilitate meeting the expected demand for human resources for both construction and operation of the project.	Construction, Operation and Decommissioning
E4	Make available employment opportunities and training for the ongoing operation of the wind farm to local residents where reasonable	Construction, Operation and Decommissioning
Community		
C1	Dissemination of accessible and independent information on wind farm impacts	Construction, Operation and Decommissioning
C2	The Proponent shall establish and operate a Community Consultative Committee (CCC) for the development to the satisfaction of the Secretary. This CCC must be established and operated in accordance with the Community Consultative Committee Guidelines for State Significant Projects (2016), or its latest version.	Construction, Operation and Decommissioning
C3	From commissioning the Proponent will contribute $2,500 per wind turbine built per annum to a Community Enhancement Program. The Proponent will pay the annual contribution to the CCC for distribution. At least 50% of the funds may be allocated to residential clean energy improvements such as solar water heating or solar PV panels or similar benefit to non-involved properties within 5kms of a wind turbine.	Operations

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
	When the wind farm construction contracts are finalised a new CCC is to be elected to represent the neighbouring community and Councils through the construction and operation phase and manage the Community Enhancement Program. The CCC is to be constituted in line with Appendix C of the Draft NSW Planning Guidelines: Wind Farms or as updated. The allocation of funds will be determined by the elected CCC to ensure the community benefit is distributed in line with the impacted community's own view of an equitable distribution of funds.	
Agriculture		
AG1	Stock would be restricted from works areas where there is a risk of stock injury or where disturbed areas are being stabilised	Construction
AG2	Prior to the construction of the proposed upgrade to Whitefields Road, the Proponent shall prepare detailed plans for the upgrade in consultation with the relevant Council, and to the satisfaction of the Secretary. In preparing these plans, the Proponent must seek to avoid and/or minimise the clearing of mature vegetation adjacent to the road. Further, the detailed plans must include a landscaping plan for replacing the removal of any existing vegetation and/or augmenting the existing vegetation adjacent to the upgraded road, with species that are endemic to the locality.	Pre Construction
AG3	Should the costs of aerial agriculture (as undertaken at any non-associated property adjacent to the site prior to construction) increase as a result of the operation of the proposed wind turbines, the proponent of the relevant stage shall fully refund to the affected landowner the increase in costs of that aerial agriculture attributable to the operation of the wind turbines.	Operations
Health and Safety		
HS1	The Proponent shall:	Pre-Construction

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
	(a) prepare a Safety Management System for the development in accordance with the Department's Hazardous Industry Planning Advisory Paper No. 9, 'Safety Management' prior to commissioning any wind turbines on site; and (b) implement, and if necessary update, the system over the remaining life of the development.	
HS2	The Proponent shall ensure that shadow flicker associated with wind turbines does not exceed 30 hours per annum at any non-associated residence. Shadow flicker effects on motorists would be monitored following commissioning and any remedial measures to address concerns would be developed in consultation with TfNSW and the Department of Planning, Housing and Infrastructure.	Operations
Historic Heritage		
HH1	The Proponent would limit the extent of impacts to items of historic heritage.	Construction
Climate and Air Quality		
AQ1	The Proponent shall: (a) implement best management practice to minimise the off-site dust, fume and blast emissions of the development; and (b) minimise the surface disturbance of the site.	Construction and Decommissioning
AQ2	Should blasting be required, it would be carried out in accordance with all relevant statutory requirements and residences within 1km of blasting activities would be informed prior to blasting.	Construction
Waste		

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
W1	The Proponent must: (a) minimise the waste generated by the development; (b) classify all waste generated on site in accordance with the EPA's Waste Classification Guidelines 2014(or its latest version); (c) store and handle all waste generated on site in accordance with its classification; (d) not receive or dispose of any waste on site; and (e) ensure all waste is disposed of at appropriately licensed waste facilities.	Construction, Operation and Decommissioning
Rehabilitation and Decommissioning		
RD1	The Proponent must: (a) rehabilitate all areas of the site not proposed for future disturbance progressively, that is, as soon as reasonably practicable following construction or decommissioning; (b) minimise the total area exposed at any time; and (c) employ interim rehabilitation strategies to minimise dust generation, soil erosion and weed incursion on parts of the site that cannot yet be permanently rehabilitated.	Decommissioning
RD2	Within 18 months of the cessation of operations, unless the Secretary agrees otherwise, the Proponent must rehabilitate the site to the satisfaction of the Secretary. This rehabilitation must comply with the objectives of Table 4.	Decommissioning

<table>
<tr><th>ID</th><th>Safeguards and Mitigation Measures (Mod 2)</th><th>Project Phase</th></tr>
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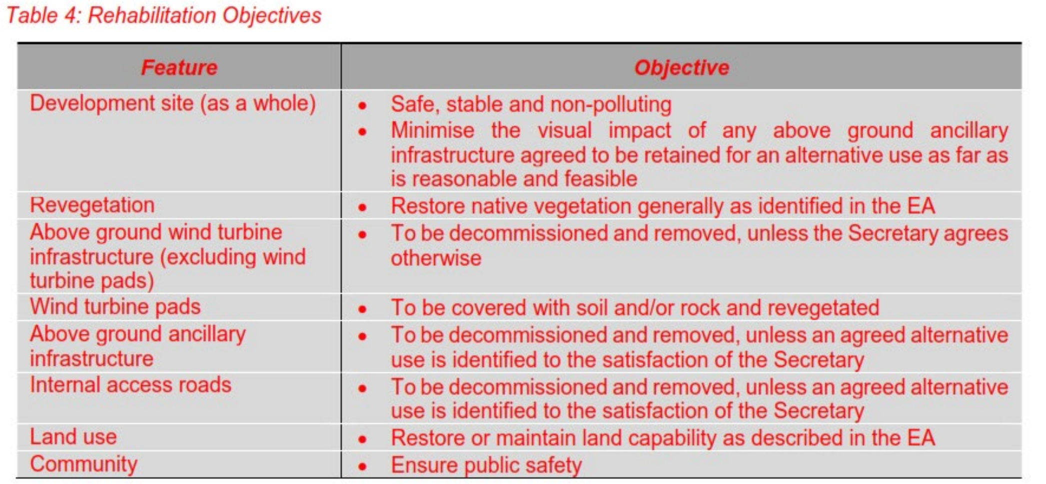

Table 4: Rehabilitation Objectives

<table>
<tr><th>Feature</th><th>Objective</th></tr>
<tr><td>Development site (as a whole)</td><td>• Safe, stable and non-polluting
• Minimise the visual impact of any above ground ancillary infrastructure agreed to be retained for an alternative use as far as is reasonable and feasible</td></tr>
<tr><td>Revegetation</td><td>• Restore native vegetation generally as identified in the EA</td></tr>
<tr><td>Above ground wind turbine infrastructure (excluding wind turbine pads)</td><td>• To be decommissioned and removed, unless the Secretary agrees otherwise</td></tr>
<tr><td>Wind turbine pads</td><td>• To be covered with soil and/or rock and revegetated</td></tr>
<tr><td>Above ground ancillary infrastructure</td><td>• To be decommissioned and removed, unless an agreed alternative use is identified to the satisfaction of the Secretary</td></tr>
<tr><td>Internal access roads</td><td>• To be decommissioned and removed, unless an agreed alternative use is identified to the satisfaction of the Secretary</td></tr>
<tr><td>Land use</td><td>• Restore or maintain land capability as described in the EA</td></tr>
<tr><td>Community</td><td>• Ensure public safety</td></tr>
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</td><td></td></tr>
<tr><td>RD2</td><td>Any individual wind turbines which cease operating for more than 12 consecutive months must be dismantled within 18 months after that 12 month period, unless the Secretary agrees otherwise.</td><td>Decommissioning</td></tr>
<tr><td colspan="3">Additional Commitments</td></tr>
<tr><td>AC1</td><td>The Proponent may elect to construct and/ or operate the Development in stages. Where staging is proposed, the Proponent shall submit a Staging Report to the Director-General prior to the commencement of the first proposed stage. The Staging Report shall provide details of:
a) how the Development would be staged, including general details of work activities associated with each stage and the general timing of when each stage would commence; and
b) details of the relevant conditions of consent, which would apply to each stage and how these shall be complied with across and between the stages of the Development.
Where staging of the Development is proposed, these conditions of consent are only required to be complied with</td><td>Detailed Design</td></tr>
</table>

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
	at the relevant time and to the extent that they are relevant to the specific stage(s). The Proponent shall ensure that an updated Staging Report (or advice that no changes to staging are proposed) is submitted to the Director-General prior to the commencement of each stage, identifying any changes to the proposed staging or applicable conditions.	
AC2	Unless the Proponent and the applicable authority agree otherwise, the Proponent shall: (a) repair, or pay the full costs associated with repairing, any public infrastructure that is damaged by the development; and (b) relocate, or pay the full costs associated with relocating, any public infrastructure that needs to be relocated as a result of the development. This condition does not apply to the upgrade and maintenance of the road network, which is expressly provided for in the conditions of this consent.	Construction, Operation and Decommissioning
AC3	The Proponent shall ensure that all plant and equipment used on site, or in connection with the development, is: (a) maintained in a proper and efficient condition; and (b) operated in a proper and efficient manner.	Construction, Operation and Decommissioning
AC4	Prior to the commencement of construction, unless the Secretary agrees otherwise, the Proponent shall enter into VPAs with the Councils in accordance with: (a) Division 7.1 of Part 7 of the EP&A Act; and (b) the terms of the applicable offer in Appendix 4	Pre-Construction
AC5	Access to property shall be maintained during construction unless otherwise agreed with the property owner in advance. Access that is physically affected by the Development shall be reinstated to at least an equivalent standard, in consultation with the property owner.	Construction

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
	Any damage caused to property as a result of the Development shall be rectified or the property owner compensated, within a reasonable timeframe, with the costs borne by the Proponent.	
AC6	Prior to the commencement of construction of the Development, the Proponent shall consult with and comply with the requirements of the DPI – Crown Land Division in relation to any Crown Land affected by the Development to enable the lawful use of that land by the Development.	Pre-Construction
AC7	Disturbance to Trigonometric Reserves shall be avoided during the life of the Development, unless otherwise approved by the Surveyor General and the relevant licence under the Crown Lands Act 1989 is obtained by the Proponent.	Construction, Operation and Decommissioning
AC8	Utilities, services and other infrastructure potentially affected by construction and operation shall be identified prior to construction to determine requirements for access to, diversion, protection, and/or support. Consultation with the relevant owner and/or provider of services that are likely to be affected by the Development shall be undertaken to make suitable arrangements for access to, diversion, protection, and/or support of the affected infrastructure as required. The cost of any such arrangements shall be borne by the Proponent	Construction, Operation and Decommissioning

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
AC9	Prior to the commencement of construction, the Proponent shall prepare an Environmental Management Strategy for the development to the satisfaction of the Secretary. This strategy must: (a) provide the strategic framework for environmental management of the development; (b) identify the statutory approvals that apply to the development; (c) describe the role, responsibility, authority and accountability of all key personnel involved in the environmental management of the development; (d) describe the procedures that would be implemented to: • keep the local community and relevant agencies informed about the operation and environmental performance of the development; • receive, handle, respond to, and record complaints; • resolve any disputes that may arise; • respond to any non-compliance; • respond to emergencies; and (e) include: • copies of any strategies, plans and programs approved under the conditions of this consent; and • a clear plan depicting all the monitoring to be carried out in relation to the development. Following approval, the Proponent shall implement the Environmental Management Strategy.	Pre-Construction

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
AC10	The Department must be notified in writing to compliance@planning.nsw.gov.au immediately after the Proponent becomes aware of the incident. The notification must identify the development, including the development application number and the name of the development, and set out the location and nature of the incident.	Construction, Operation and Decommissioning
AC11	The Department must be notified in writing to compliance@planning.nsw.gov.au immediately after the Proponent becomes aware of the incident. The notification must identify the development, including the development application number and the name of the development, and set out the location and nature of the incident.	Construction, Operation and Decommissioning
AC12	The Proponent Shall (a) make the following information publicly available on its website as relevant to the stage of the development: • the EA; • the final layout plans for the development; • current statutory approvals for the development; • approved strategies, plans or programs required under the conditions of this consent; • the proposed staging plans for the development if the construction, operation and/or decommissioning of the development is to be staged; • a comprehensive summary of the monitoring results of the development, which have been reported in accordance with the various plans and programs approved under the conditions of this consent; • a complaints register, which is to be updated on a monthly basis; • minutes of CCC meetings; • the annual Statement of Compliance with the EPL; • any independent environmental audit, and the Proponent's response to the recommendations in any	Construction, Operation and Decommissioning

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
	audit; and • any other matter required by the Secretary; and (b) keep this information up to date.	
AC13	Within 6 months of the commencement of construction, and every 3 years thereafter, unless the Secretary directs otherwise, the Proponent shall commission and pay the full cost of an Independent Environmental Audit of the development. These audits must: (a) be led and conducted by a suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary; (b) be carried out in consultation with the relevant agencies; (c) assess whether the development complies with the relevant requirements in this consent, and any strategy, plan or program required under this consent; (d) if directed by the Secretary, assess whether the performance of any noise mitigation measures implemented, including sector management and sound management mode, ensure compliance with the noise criteria in this consent; and (e) recommend appropriate measures or actions to improve the environmental performance of the development, and any strategy, plan or program required under this consent.	Operations

ID	Safeguards and Mitigation Measures (Mod 2)	Project Phase
	Within 3 months of commissioning this audit, or as otherwise agreed by the Secretary, the Proponent shall submit a copy of the audit report to the Secretary, and any other NSW agency that requests it, together with its response to any recommendations contained in the audit report, and a timetable for the implementation of the recommendations. The recommendations must be implemented to the satisfaction of the Secretary.	

APPENDIX D: RADIANT HEAT ANALYSIS

Riskcon Engineering Pty Ltd
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Consultant's Advice Notice

Project:	Battery Thermal Modelling	**Ref No.:**	RCE-25200
From:	Ezra Bagaskara	**Date:**	9 June 2025
		Revision:	C

	Attention	Company	Email
To:	Renae Gifford	Goldwind Australia Pty Ltd	renaegifford@goldwindaustralia.com

1.0 Preamble

1.1 Background

Goldwind Australia Pty Ltd (Goldwind) is a wind farm and wind turbine manufacturer. Goldwind has proposed to incorporate Battery Energy Storage Systems (BESS) directly connected into the wind turbine as part of their product offering. BESS' have the potential to thermally runaway; hence, it has been proposed to undertake thermal modelling of the BESS connected into the wind turbine to determine the potential for incident propagation / damage to occur in the event of thermal runaway.

To assist with the modelling, Goldwin has requested Riskcon to prepare a Consultant Advice Notice (CAN) to identify radiant heat impacts from the BESS.

1.2 Scope of Services

The scope of work is to undertake radiant heat modelling of the BESS connected wind turbines to understand the potential radiant heat impacts on the windfarm infrastructure.

1.3 Methodology

The following methodology is proposed:

- Conduct radiant heat modeling using a view factor method from a thermally running away BESS and identify the radiant heat impact contours surrounding the BESS.
- Discuss the potential impacts from the contours on the wind turbine infrastructure.
- Prepare a Consultant's Advice Notice (CAN) outlining the assessment for submission to Goldwind.

2.0 BESS Description

A Battery Energy Storage System (BESS) is an integrated solution that stores electrical energy using rechargeable batteries for later use. These systems are often composed of multiple battery units, power conversion systems (such as inverters and rectifiers), control systems, and thermal management equipment. BESS installations can range in size from small residential units to utility-scale setups capable of storing several megawatt-hours of energy. The primary function of a BESS is to provide energy during times when production is low or demand is high, thereby enhancing the reliability and flexibility of the power grid.

The core of a BESS lies in its batteries, which can be based on a variety of chemistries, including lithium-ion, lead-acid, sodium-sulfur, and flow batteries. Among these, lithium-ion batteries are the most widely used due to their high energy density, efficiency, and declining costs. The system's power conversion unit ensures that the stored DC electricity is converted to AC for use on the grid, and vice versa during charging. Control software monitors energy levels, battery health, and operational parameters to ensure safety and optimise performance.

The specific BESS model used in the Project is the 745 kWh GoldBlock L700Pro manufactured by Goldwind. The equipment uses battery chemistry that is lithium iron phosphate due to its superior safety characteristics in comparison to other chemistries. A 3D model of the Goldwind battery has been provided in **Figure 2-1** below.

Figure 2-1: 745 kWh GoldBlock L700 Pro

.

3.0 Radiant Heat Modelling

3.1 LFST Data and Heat Impacts

Currently, there are little established data to ascertain the radiant heat emitted from a BESS lithium fire. However, a Large Fire Scale Test (LFST) has been conducted on a BESS for a past project with similar capacity noting that the exact details of the test are under a non-disclosure agreement. The results from the test indicated that fire propagation is minimal and only the unit that was initiated to undergo thermal runaway had caught on fire. It was observed that the adjacent unit suffered only cosmetic damage; however, it remained operational throughout the duration of fire from the initiating unit. The flame characteristics from the unit observed are as follows:

- A maximum temperature of 675.3°C was recorded.
- Peak flame extended 1.8 m vertically and 1.2 m horizontally.
- Maximum heat flux is 48.72 kW/m^2 at a distance of 1.2 m.
- No adjacent units have initiated thermal runaway due to the fire event in the initiating unit; hence, a full BESS unit is not considered to be credible.

Additionally, **Table 3-1** provides noteworthy heat radiation values and the corresponding physical effects of an observer exposed to these values (Ref. [3]).

Table 3-1: Heat Radiation and Associated Physical Impacts

Heat Radiation (kW/m^2)	Impact
35	• Cellulosic material will pilot ignite within one minute's exposure • Significant chance of a fatality for people exposed instantaneously
23	• Likely fatality for extended exposure and chance of a fatality for instantaneous exposure • Spontaneous ignition of wood after long exposure • Unprotected steel will reach thermal stress temperatures which can cause failure • Pressure vessel needs to be relieved or failure would occur
12.6	• Significant chance of a fatality for extended exposure. High chance of injury • Causes the temperature of wood to rise to a point where it can be ignited by a naked flame after long exposure • Thin steel with insulation on the side away from the fire may reach a thermal stress level high enough to cause structural failure
4.7	• Will cause pain in 15-20 seconds and injury after 30 seconds exposure (at least second degree burns will occur)
3.0	• Firefighters will not enter areas that are exposed to radiant heat equal or above this threshold.

3.2 View Factor Radiant Heat Model

The modelling for the BESS units was carried out using a manual view factor calculation method outlined below.

3.2.1 Radiant Heat Flux

The heat flux (Q) for the view factor model is given by **Equation A-1**.

$$Q = \tau E F$$ **Equation A-1**

Where;

- Q = heat flux (kW/m^2) at the target
- F = geometric view factor
- τ = transmissivity
- E = SEP (kW/m^2)

Each of the required inputs is determined in the following sections.

3.2.2 View Factor

The view factor for a flat surface fire is estimated using the scenario shown in **Figure 3-1** where the flame is the vertical surface of height L and length 2b with receiver located centrally and at a distance of X. Two dimensionless parameters are calculated, and the view factor read from **Figure 3-2**. The dimensionless parameters are shown in **Equation A-2** and **Equation A-3**.

$$L_r = \frac{L}{b}$$ **Equation A-2**

$$X_r = \frac{x}{b}$$ **Equation A-3**

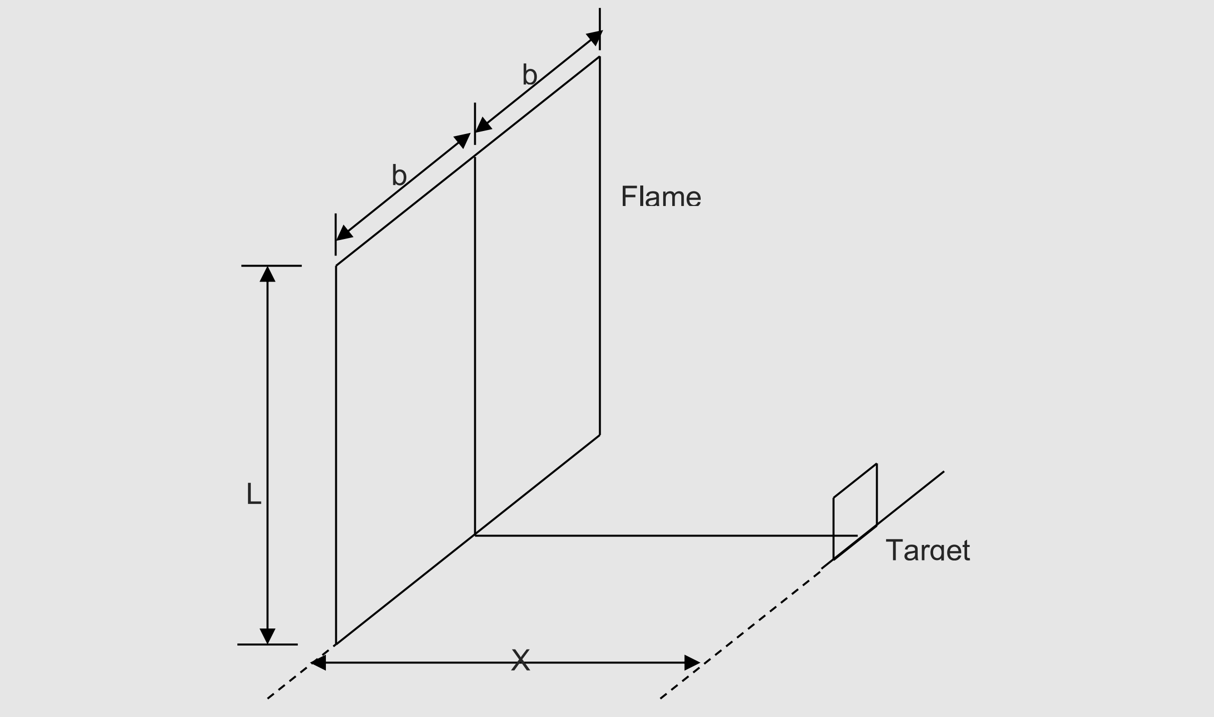

Figure 3-1: Vertical Flame Geometry View Factor Geometry

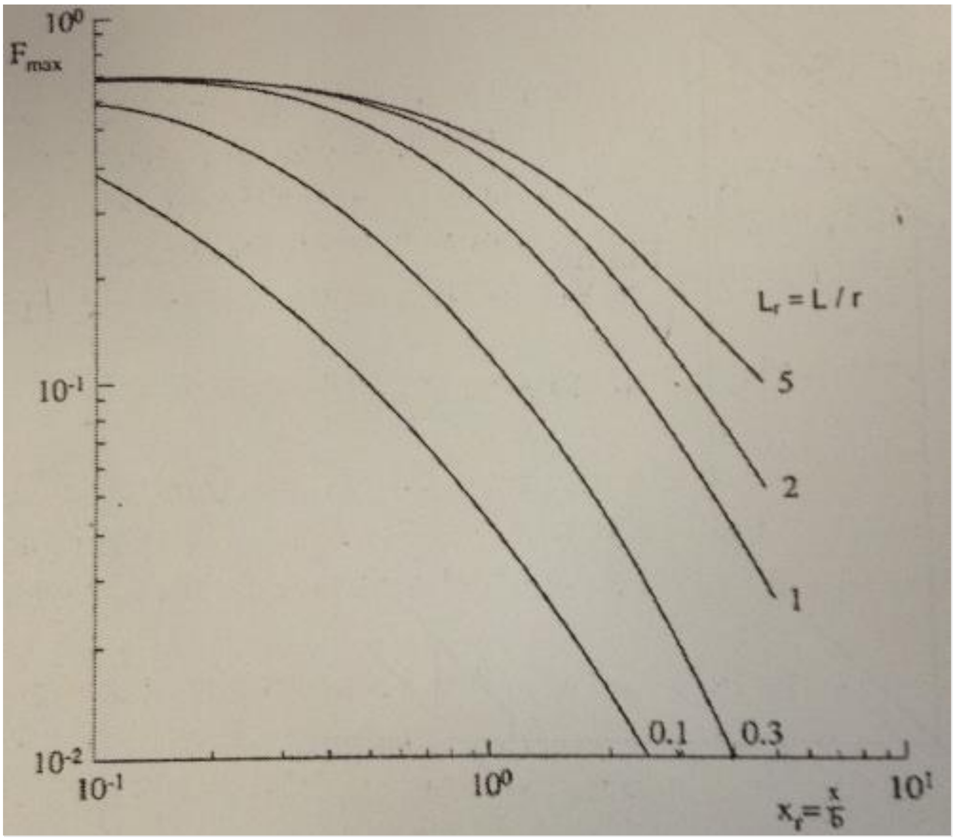

Figure 3-2: Vertical Flame Maximum View Factor

3.2.3 Transmissivity

The transmissivity is estimated using **Equation A-4**.

$$\tau = 1.006 - 0.01171(\log_{10} X(H_2O) - 0.02368(\log_{10} X(H_2O))^2 - 0.03188(\log_{10} X(CO_2) + 0.001164(\log_{10} X(CO_2))^2 \qquad \textbf{Equation A-4}$$

Where:

- $X(H_2O) = (R_H \times L \times S_{mm} \times 2.88651 \times 10^2)/T$
- $X(CO_2) = L \times 273/T$

And;

- R_H = percentage relative humidity
- L = distance to target (m)
- S_{mm} = saturated water vapour pressure in mm mercury at temperature (at 200°C S_{mm} = 11549)
- T = temperature (473 K assumed air is heated to 200°C)

3.3 Separation Distance Assessment

3.3.1 View Factor Distances

Based on the data provided, the radiant heat contour impacts can be determined by using the known maximum heat flux at the measured distance and the view factor methodology provided in **Section 3.2**. The maximum view factor can be derived using the graph in **Figure 3-2** and the variables discerned from the LSFT summarised in **Section 3.0**, which yielded a Fmax of 0.5. **Equation A-1** can then output a SEP value of 95.6 kW/m^2 which will be used as the basis to calculate the distances of radiant heat impacts. This has been summarised in **Table 3-2** below. Note that the assessment does not consider the effect of safeguards that are available in the BESS, such as the aerosol fire extinguishing device and primary firefighting equipment.

Table 3-2: Radiant Heat Impact from a BESS Unit Fire

Heat Radiation (kW/m^2)	Distance (m)
48.72	1.2
35	1.3
23	2.0
12.6	2.8
4.7	4.2
3.0	5.9

3.3.2 Separation Distance between BESS and Turbine

Comparing the values provided in **Table 3-2** with the distances shown in Error! Reference source not found., it is shown that the 12.6 kW/m^2 heat contour, which is the minimum threshold for potential structural damage, does not have the required distance to affect the wind turbine. Provided in **Figure 3-3** is a diagram to serve as a visual aid.

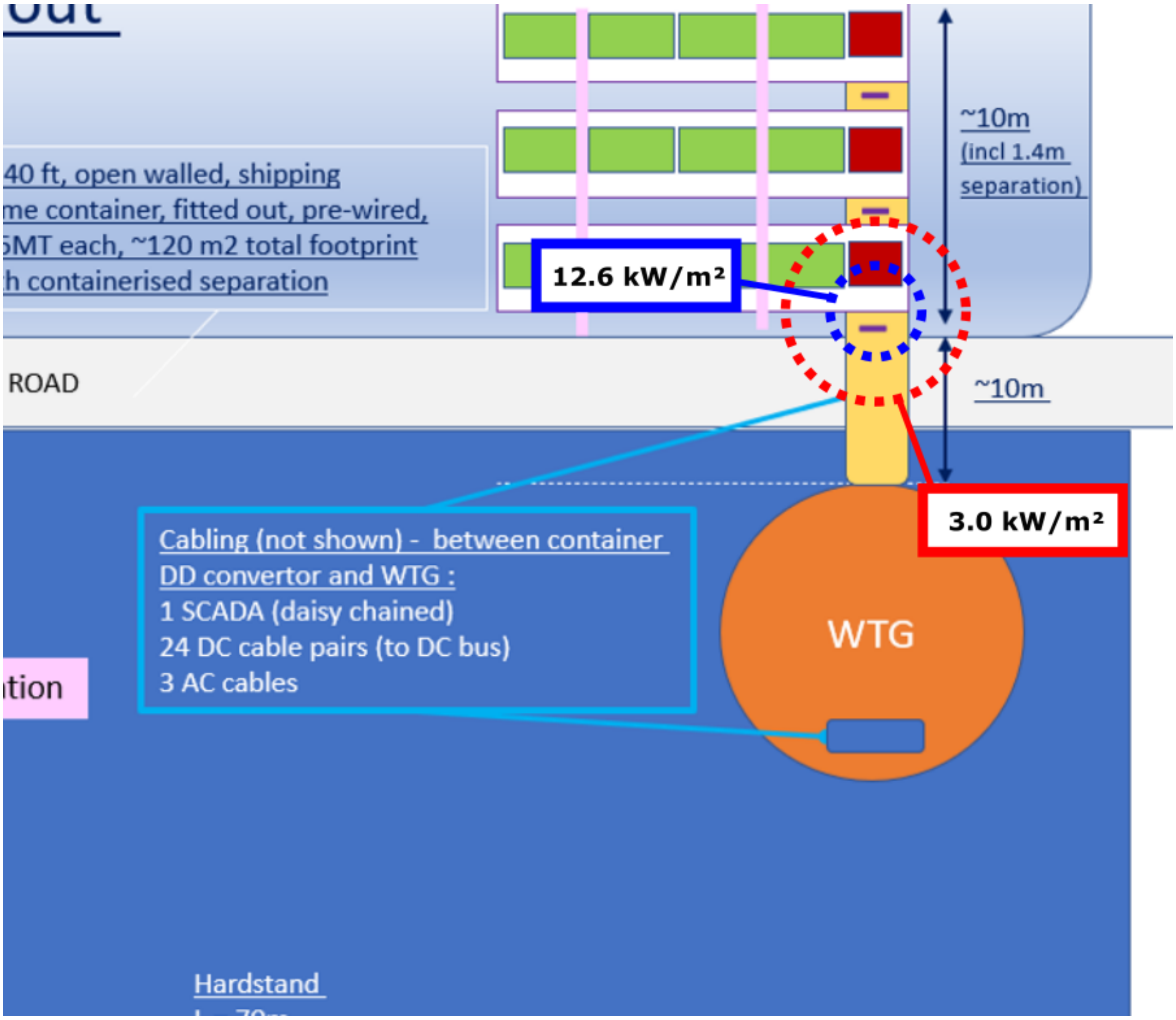

Figure 3-3: Radiant Heat Impact Extents

4.0 Conclusion and Recommendations

A radiant heat impact assessment has been conducted using LFST data and view factor modelling based on a BESS unit fire. The radiant heat impact threshold (12.6 kW/m^2) for potential structural damage is noted to have an extent of 2.8 m. Comparing the distance between the Distributed BESS and the turbine indicates that a BESS fire will not affect the wind turbine, with the conservative assumption that safeguards fail; hence, no recommendations have been made.

Regards,

Riskcon Engineering Pty Ltd

ABN 74 626 753 820

Renton Parker
Managing Director – Risk Engineering
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+61 438 749 181

APPENDIX E: PRELIMINARY HAZARD ANALYSIS

Preliminary Hazard Analysis

Coppabella Wind Farm BESS

Coppabella Wind Farm Pty Ltd
Document No. RCE-25201_CoppabellaWF_PHA_Final_19Sep25_Rev(3)
Date 19/09/2025

Preliminary Hazard Analysis

Coppabella Wind Farm BESS

Coppabella Wind Farm Pty Ltd

Prepared by

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Quality Management

Rev	Date	Remarks	Prepared By	Reviewed By
A	26th May 2025	Draft issued for comment	Chris Butson	Renton Parker
0	19th June 2025	Updated based on comments from Goldwind		
1	28th August 2025	Updated based on increased BESS units at each site		
2	10th September 2025	Updated based in increased energy density of new battery modules		
3	19th September 2025	Updated based on decrease number of WTGs		

Executive Summary

Background

Goldwind Australia Pty Ltd (Goldwind) on behalf of Coppabella Wind Farm Pty Ltd (CWFPL) are developing the Coppabella Wind Farm which received development consent in 2016 (SSD 6698). Goldwind are now seeking a modification to SSD 6698 to provide for the inclusion of a Battery Energy Storage System (BESS) into the Project. The BESS exceeds the 30 MW limit and therefore requires a Preliminary Hazard Analysis (PHA) to investigate the potential impacts on the surrounding environment. To support the modification application a PHA has been prepared in accordance with Hazardous Industry Planning Advisory Papers (HIPAP) No. 6 (Ref. [1]) and No. 4 (Ref. [2]) as part of the State Significant Development Application (SSDA).

Impacts assessed from the construction, operation and decommissioning phases of the Project are addressed in this report in accordance with relevant regulatory requirements and guidelines.

Conclusion

A hazard identification table was developed for Coppabella Wind Farm BESS Project to identify potential hazards that may be present as a result of the operations or storage of materials. Based on the identified hazards, a range of scenarios that may result in an incident with the potential for offsite impacts were considered. These potential scenarios were discussed qualitatively and any scenarios that would not impact offsite were eliminated from further assessment. Scenarios not eliminated were then carried forward for consequence analysis.

A review of the incidents carried forward for further analysis indicates that there were no observed offsite impacts; therefore, based on the analysis conducted, it is concluded that the risks at the Project Boundary are not considered to exceed the acceptable risk criteria; hence, the Project would not be classified as potentially hazardous and would be permitted within the current land zoning for the Project Area.

Recommendations

The following mitigation measures are recommended as a result of the assessment:

- The flammable DG cabinets shall be subject to hazardous area classification in accordance with AS/NZS 60079.10.1:2022.
- Any electrical equipment to be installed within the defined hazardous areas shall be installed in accordance with AS/NZS 60079.14:2022.
- BESS must be tested in accordance with UL9540A.
- Testing to demonstrate clearances required to prevent propagation of fires between separated BESS units.
- BESS to be installed in accordance with manufacturer and UL9540A report recommended clearances based on testing.
- BESS to be installed with fire protection systems specified by the manufacturer and UL9540A report.
- Before construction, detailed design to validate the BESS can be installed in the project area whilst meeting the recommended clearances.

- UL testing information shall be made available to the certifying authority. It is noted that a confidentiality agreement may be required.
- The vent covers of the BESS shall be constructed of non-combustible material.
- The vents shall not be located above battery packs within the BESS container.

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Abbreviations

Abbreviation	Description
AC	Alternating Current
ADG	Australian Dangerous Goods Code
AS	Australian Standard
BESS	Battery Energy Storage System
DC	Direct Current
DGs	Dangerous Goods
EIS	Environmental Impact Statement
ELF	Extra Low Frequency
EMF	Electric and Magnetic Field
ERPG	Emergency Response Planning Guideline
FCAS	Frequency Control Ancillary Services
FHA	Final Hazard Analysis
HF	Hydrogen Fluoride
HIPAP	Hazardous Industry Planning Advisory Paper
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IDLH	Immediately Dangerous to Life and Health
LFP	LiFePO4 (Lithium Iron Phosphate)
MVPS	Medium Voltage Power Station
NMC	Nickel-Manganese-Cobalt
PHA	Preliminary Hazard Analysis
Pmpy	Per million per year
PV	Photovoltaic
SEARs	Secretary’s Environmental Assessment Requirements
SEP	Surface Emissive Power
SEPP	State Environmental Planning Policy
SOC	State of Charge
SSDA	State Significant Development Application
STEL	Short Term Exposure Limit
VBB	Victorian Big Battery

1.0 Introduction

1.1 Background

Goldwind Australia Pty Ltd (Goldwind) on behalf of Coppabella Wind Farm Pty Ltd (CWFPL) are developing the Coppabella Wind Farm which received development consent in 2016 (SSD 6698). Goldwind are now seeking a modification to SSD 6698 to provide for the inclusion of a Battery Energy Storage System (BESS) into the Project. The BESS exceeds the 30 MW limit and therefore requires a Preliminary Hazard Analysis (PHA) to investigate the potential impacts on the surrounding environment. To support the modification application a PHA has been prepared in accordance with Hazardous Industry Planning Advisory Papers (HIPAP) No. 6 (Ref. [1]) and No. 4 (Ref. [2]) as part of the State Significant Development Application (SSDA).

Impacts assessed from the construction, operation and decommissioning phases of the Project are addressed in this report in accordance with relevant regulatory requirements and guidelines.

1.2 Scope and Objectives

The scope of work is to complete a PHA study for the Project which addresses the anticipated SEARs for the project.

The key objectives of this PHA are to:

- Complete the PHA according to the Hazardous Industry Planning Advisory Paper (HIPAP) No. 6 – Hazard Analysis (Ref. [1]);
- Assess the PHA results using the criteria in HIPAP No. 4 – Risk Criteria for Land Use Planning (Ref. [2]); and
- Demonstrate compliance of the site with the relevant codes, standards and regulations (i.e. Planning and Environment Regulation, WHS Regulation, 2017 Ref. [3]).

2.0 Methodology

2.1 Multi-Level Risk Assessment

The Multi-Level Risk Assessment approach (Ref. [4]) published by the former NSW Department of Planning, Industry and Environment (DPIE), has been used as the basis for the study to determine the level of risk assessment required. This approach considers a development in the context of its location, the quantity and type (i.e. hazardous nature) of Dangerous Goods (DGs) stored and used, and the project's technical and safety management control. The Multi-Level Risk Assessment Guidelines are intended to assist industry, consultants and the consent authorities to carry out and evaluate risk assessments at an appropriate level for the project being studied.

There are three (3) levels of risk assessment set out in Multi-Level Risk Assessment which may be appropriate for a PHA, as detailed in **Table 2-1**.

Table 2-1: Level of Assessment PHA

Level	Type of Analysis	Appropriate If:
1	Qualitative	No major off-site consequences and societal risk is negligible
2	Partially Quantitative	Off-site consequences but with low frequency of occurrence
3	Quantitative	Where 1 and 2 are exceeded

The Multi-Level Risk Assessment approach is schematically presented in **Figure 2-1**.

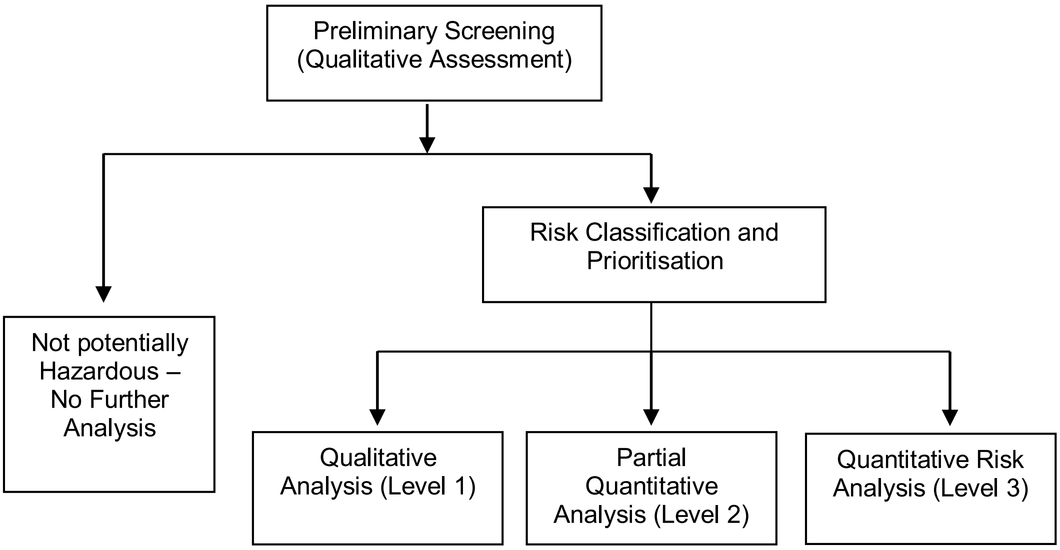


Figure 2-1: The Multi-Level Risk Assessment Approach

Based on the type of DGs to be used and handled at the proposed project, a **Level 2 Assessment** was selected for the Project. This approach provides a qualitative assessment of those DGs of lesser quantities and hazard, and a quantitative approach for the more hazardous materials to be used on-site. This approach is commensurate with the methodologies recommended in "Applying SEPP 33's" Multi Level Risk Assessment approach (DPIE, 2011).

2.2 Risk Assessment Study Approach

The methodology used for the PHA is as follows:

Hazard Analysis – A detailed hazard identification was conducted for the proposed Project facilities and operations. Where an incident was identified to have a potential off-site impact, it was included in the recorded hazard identification word diagram (**Appendix A**). The hazard identification word diagram lists incident type, causes, consequences and safeguards. This was performed using the word diagram format recommended in HIPAP No. 6 (Ref. [1]).

Each hazardous incident scenario was assessed qualitatively in light of proposed safeguards (technical and management controls). Where a potential offsite impact was identified, the incident was carried into the main report for further analysis. Where the qualitative review in the main report determined that the safeguards were adequate to control the hazard, or that the consequence would obviously have no offsite impact, no further analysis was performed. **Section 3.1** of this report provides details of values used to assist in selecting incidents required to be carried forward for further analysis.

Consequence Analysis – For those incidents qualitatively identified in the hazard analysis to have a potential offsite impact, a detailed consequence analysis was conducted. The analysis modelled the various postulated hazardous incidents and determined impact distances from the incident source. The results were compared to the consequence criteria listed in HIPAP No. 4 (Ref. [2]). The criteria selected for screening incidents is discussed in **Section 3.1**.

Where an incident was identified to result in an offsite impact, it was carried forward for frequency analysis. Where an incident was identified to not have an offsite impact, and a simple solution was evident (i.e. move the proposed equipment further away from the Project Boundary), the solution was recommended, and no further analysis was performed.

Frequency Analysis – In the event a simple solution for managing consequence impacts was not evident, each incident identified to have potential offsite impact was subjected to a frequency analysis. The analysis considered the initiating event and probability of failure of the safeguards (both hardware and software). The results of the frequency analysis were then carried forward to the risk assessment and reduction stage for combination with the consequence analysis results.

Risk Assessment and Reduction – Where incidents were identified to impact offsite and where a consequence and frequency analysis was conducted, the consequence and frequency analysis for each incident were combined to determine the risk and then compared to the risk criteria published in HIPAP No. 4 (Ref. [2]). Where the criteria were exceeded, a review of the major risk contributors was performed, and the risks reassessed incorporating the recommended risk reduction measures. Recommendations were then made regarding risk reduction measures.

Reporting – On completion of the study, a draft report was developed for review and comment. A final report was then developed, incorporating the comments received for submission to the regulatory authority.

3.0 Site Description

3.1 Site Location

The Coppabella Wind Farm (CWF) is located approximately 30km west of the township of Yass within the Hilltops and Yass Valley Local Government Areas (LGAs). The CWF covers an area of dimensions 12 kilometres west to east and 10 kilometres north to south along the Coppabella Hills near the towns of Bookham and Binalong. **Figure 3-1** show the regional location of the site.

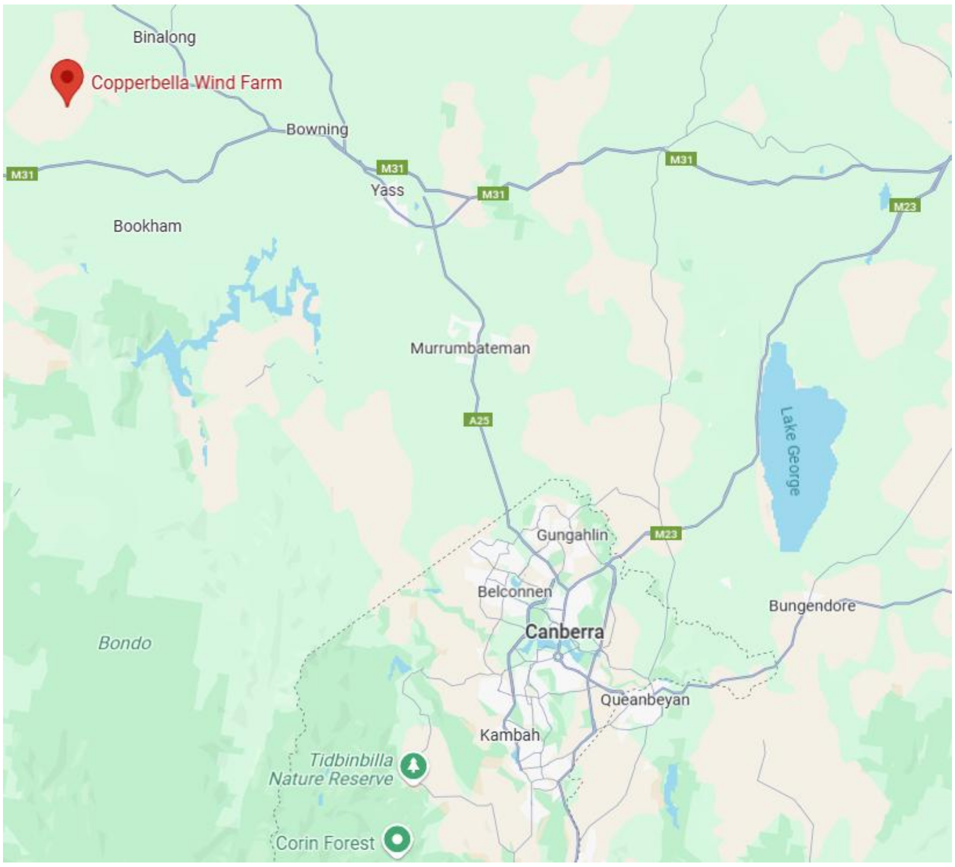


Figure 3-1: Regional Site Location (Google Maps)

3.2 Surrounding Land Uses

The surrounding land is privately owned land across eleven (11) landowners. There are seventeen (17) houses located within 2 km of the turbines with the closest to turbines being located along the southern and south-western site boundary. The shortest distance from a turbine to any house is 1,280 m between turbine 41 and residence 56. **Figure 3-2** shows the proposed site layout including location of residences. Additionally, there is at minimum 100 m from any wind turbine to the site boundary.

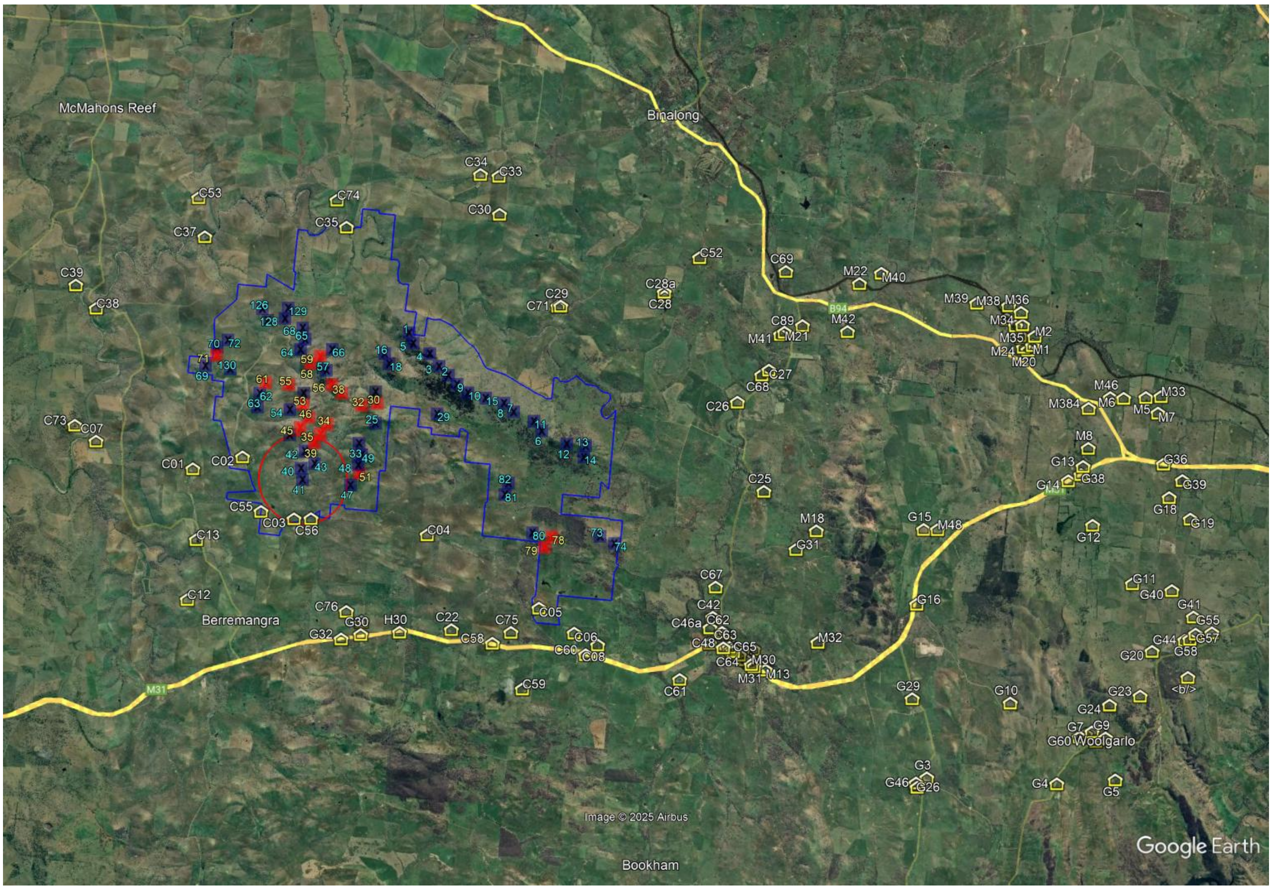


Figure 3-2: Site Layout

3.3 General Description

The key components of the Project include:

- Fifty-three (53) wind-turbine generators (WTGs), with a maximum blade-tip height of 171 metres (m) above ground
- BESS installations at each WTG:
  - Six (6) containers providing energy storage capacity of 5.0 MW / 20.6 MWh (4-hour duration) per WTG
  - Total site storage capacity of 265.5 MW / 1,091 MWh (4-hour duration)
- Electrical connections and substations.
- Control and maintenance facilities.
- Infrastructure for internal access roads.
- Wind and weather monitoring equipment.
- Construction support services such as temporary power and site offices

The development would be completed in three phases:

- Construction

- Operation
- Decommissioning

3.4 Detailed Description

The purpose of the Project is to provide renewable energy to the NSW grid and contribute towards the goals of the NSW Government's NSW Electricity Infrastructure Roadmap.

The electricity will be capable of storage in 265.5 MW / 1,091 MWh BESS which can be dispatched based on electricity demand fluctuations, providing the opportunity for greater supply dispatch flexibility when electricity demand is highest. This is enabled by the fast response times achievable through lithium-ion battery storage.

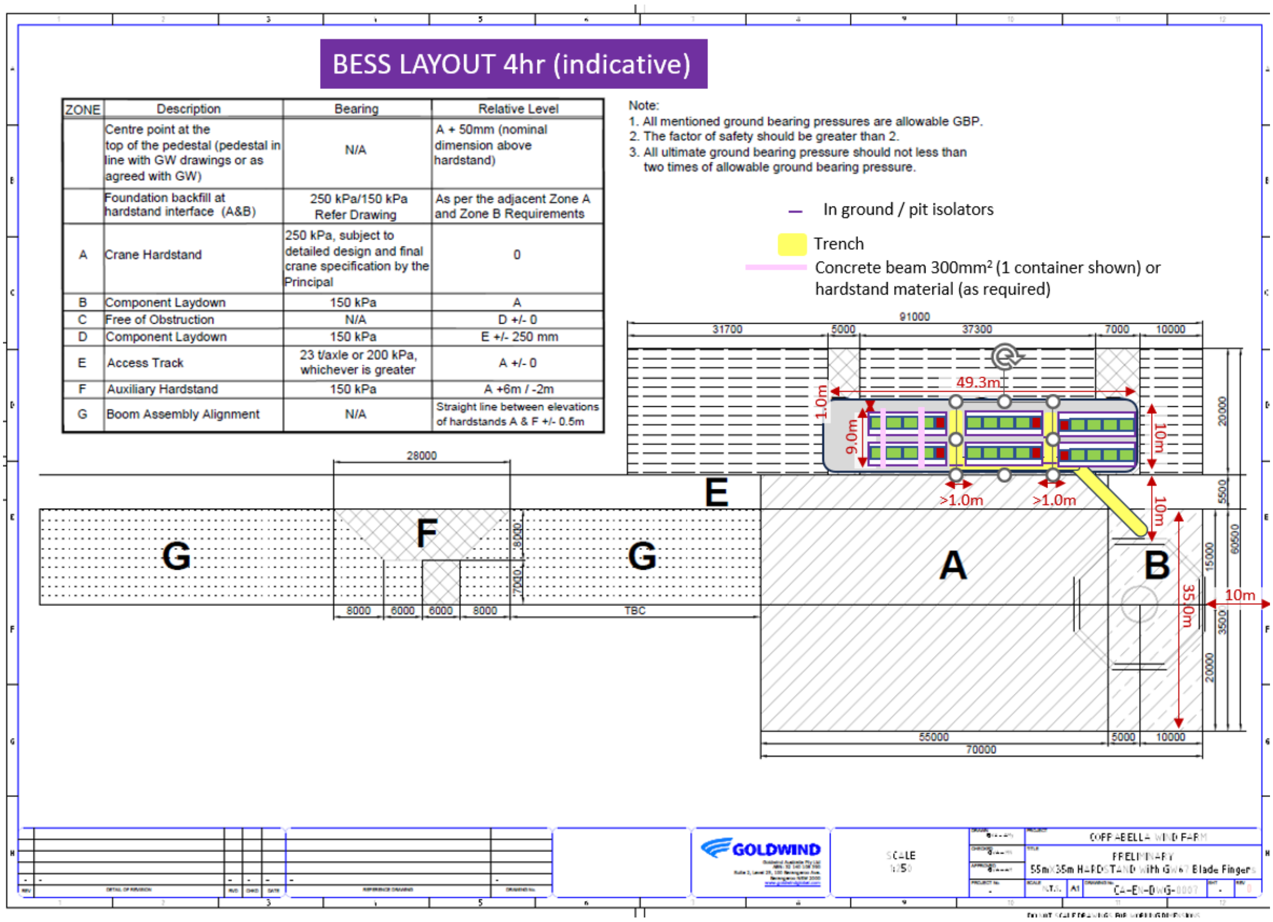
3.4.1 Battery Storage

The BESS will be decentralised, with a BESS containers situated directly adjacent to each wind turbine. Each arrangement shall be made of six (6) 40ft shipping container style installations with each container including four (4) Goldblock battery cabinets for a total of twenty-four (24) individual battery cabinets per WTG. Per WTG, this results in an energy storage capacity of 5.0 MW / 20.6 MWh (4-hour duration). The BESS containers will be configured at each WTG site in a 3 x 2 layout on an area with dimensions of approximately 50 m x 10 m (500 m^2).

At the time of assessment layouts have not been prepared for the installations however the separation distances are as follows:

- WTG to BESS hardstand – 10 m
- Between BESS containers (long-edge) – 4 m
- Between BESS containers (short-edge) – 1 m

Figure 3-3 has been provided as an indicative layout of the BESS containers adjacent to the wind turbines. Note that this layout is not finalised.



BESS LAYOUT 4hr (indicative)

ZONE	Description	Bearing	Relative Level
	Centre point at the top of the pedestal (pedestal in line with GW drawings or as agreed with GW)	N/A	A + 50mm (nominal dimension above hardstand)
	Foundation backfill at hardstand interface (A&B)	250 kPa/150 kPa Refer Drawing	As per the adjacent Zone A and Zone B Requirements
A	Crane Hardstand	250 kPa, subject to detailed design and final crane specification by the Principal	0
B	Component Laydown	150 kPa	A
C	Free of Obstruction	N/A	D +/- 0
D	Component Laydown	150 kPa	E +/- 250 mm
E	Access Track	23 t/axle or 200 kPa, whichever is greater	A +/- 0
F	Auxiliary Hardstand	150 kPa	A +6m / -2m
G	Boom Assembly Alignment	N/A	Straight line between elevations of hardstands A & F +/- 0.5m

Note:
1. All mentioned ground bearing pressures are allowable GBP.
2. The factor of safety should be greater than 2.
3. All ultimate ground bearing pressure should not less than two times of allowable ground bearing pressure.

Figure 3-3: Indicative BESS Layout

3.5 Quantities of Dangerous Goods

Table 3-1 summarises the classes and quantities of dangerous goods to be stored on site.

Table 3-1: Maximum Quantities of Dangerous Goods

Class	PG	Description	Quantity
C1	n/a	Diesel fuel	35,000 L*
C2	n/a	Transformer oils	90,000 L*
2.1	n/a	Flammable gases (aerosols, degreaser, brake cleaner)	1,000 L*
3	II & III	Flammable liquids (sanitiser, brake cleaner, binder, paint)	250 L*
8	II & III	Corrosive substances (Curing agent, degrease, resin)	200 L*
9	III	Miscellaneous dangerous goods (resin, conductive paste)	250 L*
	n/a	Lithium batteries	7,546 T

*Estimates based on previous similar projects

4.0 Hazard Identification

4.1 Introduction

A hazard identification table has been developed and is presented at **Appendix A**. This table has been developed following the recommended approach in Hazardous Industry Planning Advisory Paper No. 6, Hazard Analysis Guidelines (Ref. [1]). The Hazard Identification Table provides a summary of the potential hazards, consequences and safeguards at the site. The table has been used to identify the hazards for further assessment in this section of the study. Each hazard is identified in detail and no hazards have been eliminated from assessment by qualitative risk assessment prior to detailed hazard assessment in this section of the study.

In order to determine acceptable impact criteria for incidents that would not be considered for further analysis, due to limited impact offsite, the following approach has been applied:

- *Fire Impacts* - It is noted in Hazardous Industry Planning Advisory Paper (HIPAP) No. 4 (Ref. [2]) that a criterion is provided for the maximum permissible heat radiation at the Project Boundary (4.7 kW/m^2) above which the risk of injury may occur and therefore the risk must be assessed. Hence, to assist in screening those incidents that do not pose a significant risk, for this study, incidents that result in a heat radiation less that at 4.7 kW/m^2, at the Project Boundary, are screened from further assessment.

  Those incidents exceeding 4.7 kW/m^2 at the Project Boundary are carried forward for further assessment (i.e. frequency and risk). This is a conservative approach, as HIPAP No. 4 (Ref. [2]) indicates that values of heat radiation of 4.7 kW/m^2 should not exceed 50 chances per million per year at sensitive land uses (e.g. residential).

- *Explosion* - It is noted in HIPAP No. 4 (Ref. [2]) that a criterion is provided for the maximum permissible explosion over pressure at the Project Boundary (7 kPa) above which the risk of injury may occur and therefore the risk must be assessed. Hence, to assist in screening those incidents that do not pose a significant risk, for this study, incidents that result in an explosion overpressure less than 7 kPa, at the Project Boundary, are screened from further assessment. Those incidents exceeding 7 kPa, at the Project Boundary, are carried forward for further assessment (i.e. frequency and risk).

- *Toxicity* – Toxic byproducts of combustion may be generated by a BESS fire; hence, toxicity has been assessed with criteria based upon the Emergency Response Planning Guidelines (ERPG).

- *Property Damage and Accident Propagation* - It is noted in HIPAP No. 4 (Ref. [2]) that a criterion is provided for the maximum permissible heat radiation/explosion overpressure at the Project Boundary (23 kW/m^2/14 kPa) above which the risk of property damage and accident propagation to neighbouring sites must be assessed. Hence, to assist in screening those incidents that do not pose a significant risk to incident propagation, for this study, incidents that result in a heat radiation less than 23 kW/m^2 and explosion over pressure less than 14 kPa, at the Project Boundary, are screened from further assessment. Those incidents exceeding 23 kW/m^2 at the Project Boundary are carried forward for further assessment with respect to incident propagation (i.e. frequency and risk).

- *Societal Risk* – HIPAP No. 4 (Ref. [2]) discusses the application of societal risk to populations surrounding the Project. It is noted that HIPAP No. 4 indicates that where a development proposal involves a significant intensification of population, in the vicinity of such a project, the change in societal risk needs to be taken into account. In the case of the proposed Project, there is currently no significant intensification of population around the Project Area; hence, societal risk has not been considered in this assessment.

4.2 Properties of Dangerous Goods

The type of DGs and quantities stored and used at the site has been described in **Section 3**. **Table 4-1** provides a description of the DGs to be stored and handled at the site, including the Class and the hazardous material properties of the DG Class.

Table 4-1: Properties* of the Dangerous Goods and Materials Stored at the Site

Class	Hazardous Properties
2.1 – Flammable gases	Class 2.1 flammable gases are gases which at 20°C and a standard pressure of 101.3 kPa; are ignitable when in a mixture of 13 percent or less by volume with air; or have a flammable range with air of at least 12 percent regardless of the lower flammability limit.
3 – Flammable liquids	Class 3 flammable liquids are liquids, or mixtures of liquids, or liquids containing solids in solution or suspension (for example, paints, varnishes, lacquers, etc., but not including substances otherwise classified on account of their dangerous characteristics) which give off a flammable vapour at temperatures of not more than 60° C, closed-cup test, or not more than 65.6° C, open-cup test, normally referred to as the flash point.
8 – Corrosive substances	Class 8 corrosive substances are substances which, by chemical action, will cause irreversible damage to the skin, or, in the case of leakage, will materially damage, or even destroy, other goods or the means of transport.
9 – Miscellaneous DGs	Class 9 substances and articles (miscellaneous dangerous substances and articles) are substances and articles which, during transport present a danger not covered by other classes. Releases to the environment may cause damage to sensitive receptors within the environment. It is noted that the Class 9s stored within this project are lithium-ion batteries which may undergo thermal runaway (i.e. escalating reaction resulting in heat which ultimately leads to failure of the battery and a fire).
C1/2 - Combustible Liquids	Combustible liquids are typically long chain hydrocarbons with flash points exceeding 60.5°C. Combustible liquids are difficult to ignite as the temperature of the liquid must be heated to above the flash point such that vapours are generated which can then ignite. This process requires either sustained heating or a high-energy ignition source.

* The Australian Code for the Transport of Dangerous Goods by Road and Rail (Ref. [5]

4.3 Hazard Identification

Based on the hazard identification table presented in **Appendix A**, the following hazardous scenarios have been developed:

- Flammable material spill and flash fire or vapour cloud explosion.
- Li-ion battery fault, thermal runaway and fire.
- Victorian Big Battery fire review.
- Li-ion battery fire and toxic gas dispersion.
- Electrical equipment failure and fire.
- Transformer internal arcing, oil spill, ignition and bund fire.

- Transformer electrical surge protection failure and explosion
- Electromagnetic field impacts.

Each identified scenario is discussed in further detail in the following sections.

4.4 Flammable material spill and flash fire or vapour cloud explosion

Flammable liquids and gases are stored in workshops and maintenance areas containing small containers of brake cleaner, resins and various other chemicals for maintenance activities. All chemicals are stored in DG cabinets which are compliant with the relevant DG standards (AS 1940:2017 (Ref. [6]).

A requirement of the standards and the Work Health and Safety Regulation 2017 (Ref. [3]) is to eliminate ignition sources. Therefore, to confirm that DG cabinets containing flammable liquids and gases have been assessed as required by the WHS Regulation, the following recommendation has been made:

- The flammable DG cabinets shall be subject to hazardous area classification in accordance with AS/NZS 60079.10.1:2022.
- Any electrical equipment to be installed within the defined hazardous areas shall be installed in accordance with AS/NZS 60079.14:2022.

In the event of a fire initiated in a DG cabinet, the quantities of goods kept are extremely small relative to the scale of the site and will not be able to produce a radiant heat which could impact over the boundary. Additionally, all flammable gas and liquid storage cabinets require extinguishers to be provided nearby, therefore a fire would likely be extinguished prior to any incident escalation. Due to the small quantities, the risk of impact across the site boundary is negligible and this incident has not been carried forward for further analysis.

4.5 Li-ion Battery Fault, Thermal Runaway and Fire

Lithium ion (Li-ion) batteries are composed of a metallic anode and cathode which allows for electrons released from the anode to travel to the cathode where positively charged ions in the solute migrate to the cathode and are reduced. The flow of electrons provides the source of energy which is discharged from a battery and used for work. In a Li-ion battery, the lithium metal composite oxidises (loses an electron) becoming a positively charged ion in solution which migrates through the battery separator to the cathode. At the same time, the lost electron travels through the circuit to the cathode. The lithium ions in solution then recombine with the electron at the cathode forming lithium metal within the cathodic metal composite. This process is shown in **Figure 4-1**.

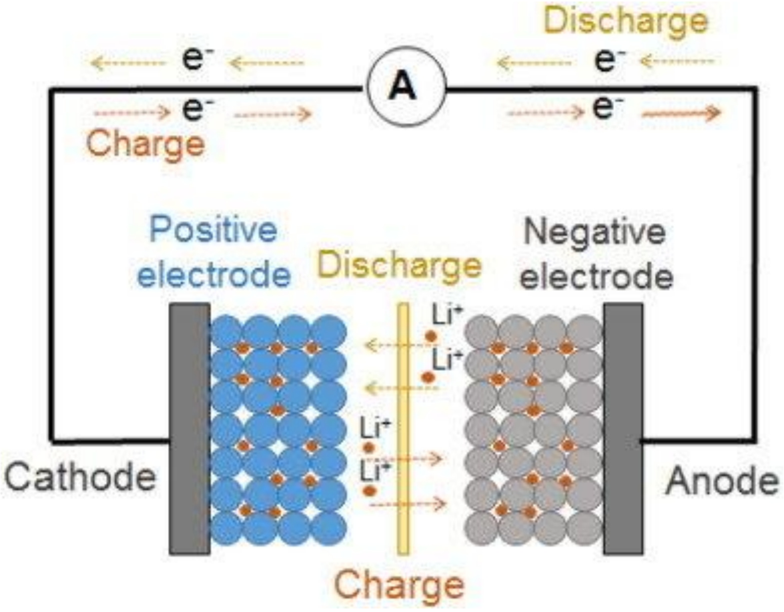


Figure 4-1: Cathode and Anode of a Battery (Source Research Gate)

Initial lithium batteries were designed around lithium metal (i.e. no composite structure) due to the high energy density yielded by the metal. However, when overcharging a battery, lithium ions can begin to plate on the anode in the form of lithium dendrites. Eventually, the dendrites pierce the separator within the battery resulting in a short of the battery which could result in heat, fire, or explosion of the battery. The technology evolved to move away from lithium metal to lithium ions (held within composite materials) which reduced the incidence of lithium dendrites forming resulting in an overall safer battery.

Despite the improvement in battery technology, there are several degradation mechanisms that are still present within the battery which can result in thermal runaway. These include:

- Chemical reduction of the electrolyte at the anode
- Thermal decomposition of the electrolyte
- Chemical reduction of the electrolyte at the cathode
- Thermal decomposition by the cathode and the anode
- Internal short circuit by charge effects

These effects arise primarily as a result of high discharge, overcharging, or water ingress into the battery which results in a host of by-products being formed within the battery during charge and discharge cycles.

As a result, Li-ion batteries are equipped with several safety features to prevent the batteries from charging or discharging at voltages which result in battery degradation, leading to shorting of the battery and thermal runaway. Safety features generally include:

- Shut-down separator (for overheating)
- Tear-away tab (for internal pressure relief)
- Vent (pressure relief in case of severe outgassing)
- Thermal interrupt (overcurrent/overcharging/environmental exposure)

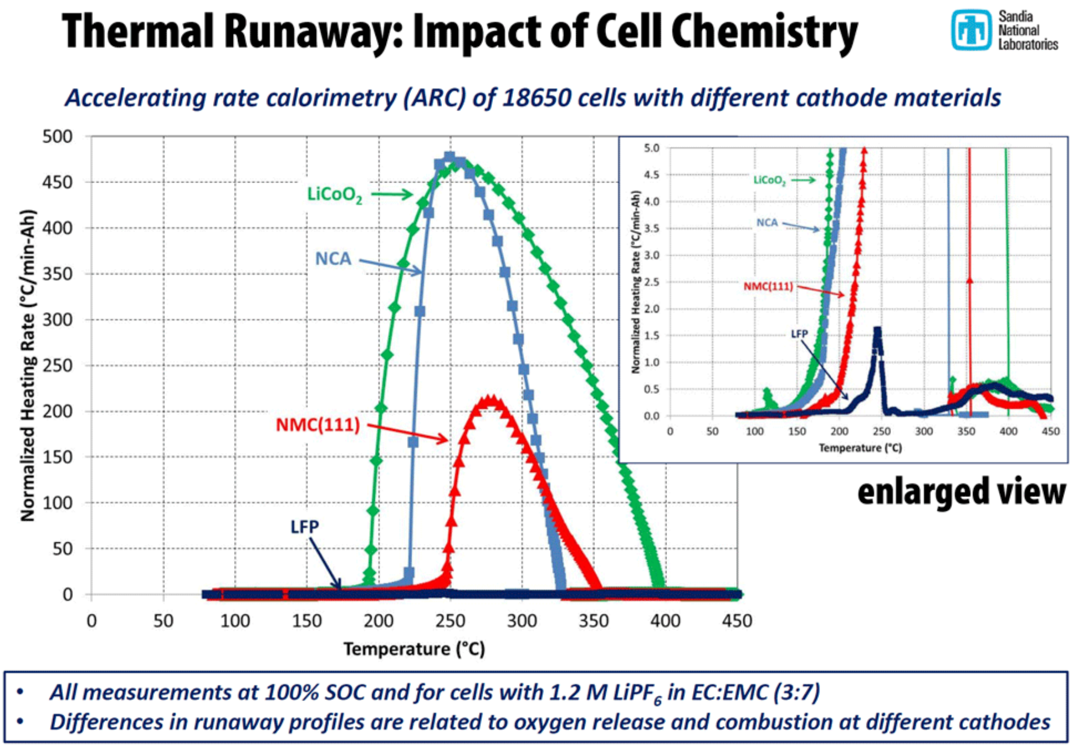
These features are designed to prevent overcharging or excessive discharge, pressurisation arising from heat generated at the anode or from battery contamination. Protection techniques for Li-ion batteries are standard; hence, the potential for thermal runaway to occur in normal operation is very low with the only exceptions being due to manufacturing faults or battery damage (i.e. battery cell is ruptured as this can short circuit the battery resulting in thermal runaway).

A review of the batteries proposed to be used as part of this Project indicates the battery chemistry is lithium-iron phosphate (LiFePO4, or simply LFP) which are considered to be one of the safest battery chemistries within the industry. When exposed to external heat the thermal rise of typical lithium-ion battery chemistries is 200-400 ^{o}C/min resulting thermal run away and fire which can then propagate to adjacent batteries escalating the incident to a full container fire. For LFP batteries, the thermal rise of the batteries at peak is 1.5^{o}C/min which results in a gradual temperature rise and typically does not result in fire and thus incident propagation to other batteries. The thermal rise of various battery chemistries is provided in **Figure 4-2** with a zoomed in temperature rise for LFP provided in the top right. The stability of the batteries is due to the cathode which does not release oxygen therefore preventing violent redox reactions resulting in rapid temperature rise as the oxygen oxides the electrolyte.

Additional testing for shock and damage to batteries (i.e. nail puncture test) has been shown that LFP batteries when punctured through membranes which typically results in a shorting of the battery and fire does not result in ignition of the battery demonstrating that the battery chemistry is protected against shock damage.

In the event that LFP chemistries do ignite by artificial means, the combustion by products release carbon dioxide which reduces the oxygen concentration within a confined space reducing the combustion rate.

In addition to this, manufacturers and integrators can implement different means of preventing battery ignition or controlling if it occurs (such as physical construction arrangements, battery monitoring, heat detection, etc). These are implemented on a system-by-system basis and are specific to the system needs.



Thermal Runaway: Impact of Cell Chemistry

Sandia National Laboratories

Accelerating rate calorimetry (ARC) of 18650 cells with different cathode materials

- *All measurements at 100% SOC and for cells with 1.2 M $LiPF_6$ in EC:EMC (3:7)*
- *Differences in runaway profiles are related to oxygen release and combustion at different cathodes*

Figure 4-2: Temperature Rise of Lithium-Ion Battery Chemistries (Ref. [7]).

Based on data shown from UL9540A reports for similar systems, the results demonstrate that when thermal runaway is triggered in one cell in a BESS container, the heat generated would neither be transferred to all cells within one battery module, nor from the test module to adjacent ones. This is attributed to the nature of LFP technology as well as the sheer mass of the battery module (heavier objects have higher thermal capacity).

Although the LFP technology does not cause fire, there can be circumstances where battery modules catch fire due to leaking coolant or electric faults. In those cases, fire will be constrained by the stainless-steel enclosure. Similar systems show that generally the container wall remains intact after sustaining heating in a furnace to over 900°C.

Furthermore, each container battery has multiple built-in fire protection devices that work collaboratively, including smoke and thermal sensors, combustible gas detector, pressure relief system, and aerosol E-Stop buttons. Therefore, a battery unit will automatically detect an internal fire in the first instance.

Different systems deploy different battery fire mitigation strategies depending on the solution, but in any case, the Project will implement the manufacturer’s recommended fire protection systems. The assessed and final selected system will hold relevant UL and IEC certifications (i.e. UL 9540A UL1973, UN3480, UN38.3, IEC:62619, 63056, 61000-6-/4, 62477-1).

In conclusion, the LFP technology is unlikely to cause fire during thermal runaway. Should fire be developed within one BESS, it would not transfer to nearby containers due to the fire safety design features and due to the battery chemistry; hence, this incident has not been carried forward for further analysis.

Notwithstanding, based on previous project conversations with and review by NSW Department of Planning, Housing and Infrastructure (DPHI), the following recommendations have been made:

- BESS must be tested in accordance with UL9540A.

- Testing to demonstrate clearances required to prevent propagation of fires between separated units.
- BESS to be installed in accordance with manufacturer and UL9540A report recommended clearances based on testing.
- BESS to be installed with fire protection systems specified by the manufacturer and UL9540A report.
- Before construction, detailed design to validate the system can be installed in the project area whilst meeting the recommended clearances.
- UL testing information shall be made available to the certifying authority. It is noted that a confidentiality agreement may be required.

4.6 Victorian Big Battery Fire Review

Notwithstanding the findings of **Section 4.5**, it is necessary to review recent large scale BESS fires to determine whether similar incidents could occur with the Project.

The Victorian Big Battery (VBB) also has a back-to-back layout. According to the independent investigation report on its fire incidence, the back-to-back layout was not the cause. The main reason for fire propagation was strong wind blowing flames from one Megapack into the unprotected vent atop of an adjacent Megapack which resulted in the ignition of the plastic fan which was able to impact the battery modules directly beneath the fan.

Lessons learnt from the VBB incident results in fire safety precautions on the design of the Project. The vent atop the containers shall be made of metal instead of plastic and covered by a metallic mesh shield. Furthermore, the placement of the fans shall be such that batteries or flammable materials shall not be located directly beneath ventilation openings. To ensure the above are captured the following recommendations have been made:

- The vent covers of the BESS shall be constructed of non-combustible material.
- The vents shall not be located above battery packs within the BESS container.

Based upon the designs incorporated with the container based upon the VBB fire, the available area assessment and the separation distance assessment, it is considered that the propagation between any two units is considered unlikely; hence, this incident has not been carried forward for further analysis.

4.7 Li-ion Battery Fire and Toxic Gas Dispersion

If a BESS failure occurs resulting in a fire, toxic byproducts of combustion may form. A literature review was conducted on lithium-ion battery fires to identify the toxic gases which may be generated in the event of a fire. The review identified the following gases or classes of gases can form:

- Carbon dioxide;
- Carbon monoxide; and
- Fluorine gases.

Each of these have been discussed in further detail in the following subsections.

4.7.1 Carbon Dioxide

Carbon dioxide is a colourless, odourless, dense gas which is naturally forming and is present in the atmosphere at concentrations around 415 ppm (0.0415%). At low concentrations carbon dioxide is physiologically impotent and at low concentrations does not appear to have any toxicological effects. However, as the concentration grows it increases the respiration rate with short term Exposure Limit (STEL) occurring at 30,000 ppm (3%), above 50,000 ppm (5%) a strong respiration effect is observed along with dizziness, confusion, headaches, and shortness of breath. Concentrations in excess of 100,000 ppm (10%) may result in coma or death.

Carbon dioxide is a by-product of combustion where hydrocarbon or carbon-based materials are involved. A typical combustion reaction producing carbon from a hydrocarbon has been provided in **Equation 4-1**. This reaction proceeds when there is an excess of oxygen to the fuel being consumed and is known as complete combustion as it is the most efficient reaction pathway.

$$C_3H_8(g) + 5O_2(g) \rightarrow 3Co_2(g) + 4H_2O(g) \qquad \textbf{Equation 4-1}$$

Li-ion batteries are predominantly composed of metal structures. However, during a fire event ancillary equipment and materials within the batteries will be involved in the fire including wiring, plastics, anodes, etc. which will liberate carbon dioxide. However, a review of the toxicological impacts indicates high concentrations would be required to result in injury or fatality. Based upon a review of the sensitive areas, and the similar BESS fires (i.e. Victoria BESS fire), it is not considered that the formation of carbon dioxide in a fire would be sufficient to result in downwind impacts sufficient to cause injury or fatality. In other words, there would be insufficient production of carbon dioxide to generate a plume of sufficient concentration to displace the required oxygen for a significant downwind consequence to occur. Therefore, this incident has not been carried forward for further analysis.

4.7.2 Carbon Monoxide

Carbon monoxide is an odourless, colourless gas which is slightly denser than air and occurs naturally in the atmosphere at concentrations around 80 ppb. Carbon monoxide is a toxic gas as it irreversibly binds with haemoglobin which prevents these molecules from carrying out the function of oxygen / carbon dioxide exchange. The loss of 50% of the haemoglobin may result in seizures, coma or death which can occur at concentration exposures of approximately 600 ppm (0.06%).

Carbon monoxide is by-product of combustion if there is insufficient oxygen to enable complete combustion. The reaction pathway for the formation of carbon monoxide is provided in **Equation 4-2**.

$$2C_3H_8(g) + 7O_2(g) \rightarrow 6CO(g) + 8H_2O(g) \qquad \textbf{Equation 4-2}$$

As noted, in **Section 4.7.1** there is the potential for a fire to occur with the BESS units which could form carbon monoxide if there is insufficient oxygen to sustain complete combustion. However, it is noted that the combustible load within the BESS which could result in the formation of carbon monoxide is relatively low compared to the available oxygen in the surrounding atmosphere. Therefore, it is considered that the formation of carbon monoxide at levels which would result in a substantial downwind impact are not considered credible and subsequent analysis of, this incident is not required.

4.7.3 Fluoride Gases

The electrolyte used in Li-ion batteries typically is lithium hexafluorophosphate ($LiPF_6$) or other li-salts containing fluorine. In the event of a thermal runaway, the electrolyte will expand and be vented from the battery. In the event of a fire, the vented gas and other components such as the polyvinylidene fluoride binders may form gases such as hydrogen fluoride (HF), phosphorous pentafluoride (PF_5) and phosphoryl fluoride (POF_3) (Ref. [8]).

The decomposition of $LiPF_6$ can be promoted by the presence of water / humidity according to reactions **Equation 4-3** to **Equation 4-5**.

$LiPF_6 \rightarrow LiF + PF_5$	**Equation 4-3**
$PF_5 + H_2O \rightarrow POF_3 + 2HF$	**Equation 4-4**
$LiPF_6 + H_2O \rightarrow LiF + POF_3 + 2HF$	**Equation 4-5**

Of the fluorine gases formed, PF_5 is a short-lived gas while POF_3 is a reactive intermediate. Thermal destruction of a several battery chemistry, configurations and State of Charge (SOC) indicated the vast majority of these did not produce observable POF_3 with the only observance occurring in a specific battery chemistry at 0% SOC (Ref. [8]). Therefore, the main fluorine gas of concern in a Li-ion battery fire is HF.

HF gas is hydroscopic readily dissolving into water vapour / humidity or moisture in airways forming hydrofluoric acid. Hydrofluoric acid is a weak acid although is highly corrosive and may result in chemical burns. In addition, it is calcium scavenging. Hence, it will readily bind with calcium in cells and tissues disrupting the nerve signalling. The immediately dangerous to life or Health (IDLH) for HF is 30 ppm and the 10-minute lethal concentration is 170 ppm.

For a toxic gas dispersion, a battery container fire is necessary as the initiating event. As discussed in **Section 4.5** the potential for a fire to occur is very low due to the highly stable and safe battery chemistries used. Due to the remote location of the site, any release will be rapidly dispersed. As UL9540 A testing shows that thermal runaway doesn't propagate to adjacent modules, the extent of gas released during a thermal runaway event is negligible. Therefore, this incident has not been carried forward for further analysis.

4.8 Electrical Equipment Failure and Fire

Electrical equipment is located within the switch rooms which may fail resulting in overheating, arcing, etc. which could initiate a fire. In the event of a fire, it may begin to propagate to adjacent combustible materials (i.e. wiring). It is noted that electrical equipment fires typically start by smouldering before flame ignition occurs resulting in a slow fire development.

The type of equipment used within the Project is ubiquitous throughout the world and across industry segments and is therefore not a unique fire scenario. Based upon fire development within switch rooms the fire would be considered to be relatively slow in growth and would be unlikely to result in substantial impacts in terms of offsite impact or incident propagation. Therefore, this incident has not been carried forward for further analysis.

4.9 Transformer Internal Arcing, Oil Spill, Ignition and Bund Fire

Transformers contain oil which is used to insulate the transformers during operation. If arcing occurs within the transformer (e.g. due to a low oil level), the high energy passing through the coolant vaporises the oil into light hydrocarbons (methane, ethane, acetylene, etc.) resulting in rapid pressurisation within the reservoir.

Notwithstanding the protection systems, if the pressure rise exceeds the structural integrity of the reservoir, and the installed pressure relief devices, the reservoir can rupture allowing the release of oil into the bund. The rupture also allows oxygen to enter the reservoir. The temperature of the gases is above the auto ignition point, but this does not occur until oxygen is present. When oxygen enters the reservoir, the gases auto ignite which generates sufficient heat to ignite the oil in the bund.

Notwithstanding this, transformers are ubiquitous units with a low potential for failure and the separation distance to the Project Boundary and other adjacent units would be unlikely to result in incident propagation and offsite impacts. Therefore, this incident has not been carried forward for further analysis.

4.10 Transformer Electrical Surge Protection Failure and Explosion

Transformers generate large amounts of heat as a result of the high electrical currents that pass through them; hence, oil is used as an insulating material within the transformers to protect the mechanical components. However, if the transformer gets an extreme surge of energy, such as that which could occur due to a lightning strike, and the electrical surge protection measures fail, the mineral oil may start to decompose and vapourise, resulting in gas bubbles of hydrogen and methane (Ref. [9]) as temperatures above the autoignition of the gases.

The formation of gases will increase the pressure within the transformer which can result in the transformer structure rupturing which allows the ingress of oxygen. As the oxygen enters, the concentration of flammable gases falls within the explosive limits which are above their autoignition temperatures which ignite resulting in increased formation of hot gaseous products resulting in an explosion. The explosion may generate significant overpressure, sparks and fire and would result in a whole transformer fire, as discussed in **Section 4.9**.

In order to protect against overheating and explosions, transformers generally have surge protection devices which shunt electrical surges safely to ground. However, this surge detection and protection devices are not universally installed nor do they protect against all events such as in the case of a major lightning strike or significant oil deterioration, leakage of water into the transformer, and physical damage such as a fallen tree (Ref. [10]). Therefore, there is the potential for an explosion to occur which may result in offsite impacts; however, as previously noted, these units are ubiquitous and have a low potential for failure. Therefore, this incident has not been carried forward for further analysis.

4.11 Electromagnetic Field Impacts

4.11.1 Introduction

Electric and Magnetic Fields (EMFs) are associated with a wide range of sources and occur both naturally as well as man-made. Naturally occurring EMFs, occurring during lightning storms, are generated from Earth’s magnetic field. Man-made EMFs are present wherever there is electricity; hence, EMFs are present in almost all built environments where electricity is used.

Extremely low frequency (ELF) electric and magnetic fields (EMF) occupy the lower part of the electromagnetic spectrum in the frequency range 0-3,000 Hz which is the current will change direction 0-3,000 times a second. ELF EMF result from electrically charged particles. Artificial sources are the dominant sources of ELF EMF and are usually associated with the generation, distribution and use of electricity at the frequency of 50 Hz in Australia. The electric field is produced by the voltage whereas the magnetic field is produced by the current.

BESS create EMFs from operational electrical equipment, such as transmission lines, transformers and the electrical components found within BESS units, inverters, etc. This equipment has the potential to produced ELF EMF's in the range of 30 to 300 Hz.

4.11.2 Existing Standards

There are currently no existing standards in Australia for governing the exposure limits to ELF EMFs; however, the International Commission on Non-Ionizing Radiation Protection (ICNIRP) has provided some guidelines around exposure limits for prolonged exposure which limits the exposure to 2,000 milligauss (mG) for members of the public in a 24 hour period (Ref. [11]).

Table 4-2 provides typical magnetic field measurements and ranges associated with EMF sources. It is noted that electric fields around devices are generally close to 0 due to the shielding provided around the equipment. In addition, EMF levels drop away quickly with distance; hence, while a value may be measurable at the source, within a short distance the EMF is undetectable.

Table 4-2: EMF Sources and Magnetic Field Strength

Source	Typical Measurement (mG)	Measurement Range (mG)
Television	1	0.2 – 2
Refrigerator	2	2 – 5
Kettle	3	2 – 10
Personal computer	5	2 – 20
Electric blanket	20	5 – 30
Hair dryer	25	10 – 70
Distribution powerline (under the line)	10	2 – 20
Transmission power line (under the line)	20	10 – 200
Edge of easement	10	2 – 50

4.11.3 Exposure Discussion

A review of the site indicates there are no immediate residences adjacent to the area where the BESS will be developed providing substantial distance for attenuation of EMFs. Based upon the typical levels which may be generated by transmission equipment the cumulative effect would not exceed the 2,000 mG limit for prolonged exposure. In addition, the closest residence is over 1 km away from the EMF generating sources at the BESS; hence, the potential for the EMF to exceed the accepted levels is considered negligible.

As the potential for exposure to EMF exceeding the international guidelines is negligible, this incident has not been carried forward for further analysis.

5.0 Conclusion and Mitigation Measures

5.1 Conclusion

A hazard identification table was developed for Coppabella Wind Farm BESS Project to identify potential hazards that may be present as a result of the operations or storage of materials. Based on the identified hazards, a range of scenarios that may result in an incident with the potential for offsite impacts were considered. These potential scenarios were discussed qualitatively and any scenarios that would not impact offsite were eliminated from further assessment. Scenarios not eliminated were then carried forward for consequence analysis.

A review of the incidents carried forward for further analysis indicates that there were no observed offsite impacts; therefore, based on the analysis conducted, it is concluded that the risks at the Project Boundary are not considered to exceed the acceptable risk criteria; hence, the Project would not be classified as potentially hazardous and would be permitted within the current land zoning for the Project Area.

5.2 Recommendations

The following mitigation measures are recommended as a result of the assessment:

- The flammable DG cabinets shall be subject to hazardous area classification in accordance with AS/NZS 60079.10.1:2022.
- Any electrical equipment to be installed within the defined hazardous areas shall be installed in accordance with AS/NZS 60079.14:2022.
- BESS must be tested in accordance with UL9540A.
- Testing to demonstrate clearances required to prevent propagation of fires between separated BESS units.
- BESS to be installed in accordance with manufacturer and UL9540A report recommended clearances based on testing.
- BESS to be installed with fire protection systems specified by the manufacturer and UL9540A report.
- Before construction, detailed design to validate the BESS can be installed in the project area whilst meeting the recommended clearances.
- UL testing information shall be made available to the certifying authority. It is noted that a confidentiality agreement may be required.
- The vent covers of the BESS shall be constructed of non-combustible material.
- The vents shall not be located above battery packs within the BESS container.

6.0 References

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[12] Standards Australia, “AS/NZS 3000:2018 - Wiring Rules,” Standards Australia, Sydney, 2018.

[13] Standards Australia, “AS 3833:2024 - Storage and Handling of Mixed Classes of Dangerous Goods, in Packages and Intermediate Bulk Containers,” Standards Australia, Sydney, 2024.

Appendix A

Hazard Identification Table

Appendix A

A1. Hazard Identification Table

Area/Operation	Hazard Cause	Hazard Consequence	Safeguards
Flammable dangerous goods storage	• Spill or flammable liquids or release of flammable gases	• Fire • Explosion	• All flammable liquids and gases stored in Dangerous Goods cabinets compliant with relevant standards (AS 1940:2017 (Ref. [6]). • Mostly stored in small containers. • Provision of firefighting equipment (extinguishers). • Exclusion zones for ignition sources provided around cabinets.
Battery Storage	• Failure of Li-ion battery protection systems	• Thermal runaway resulting in fire or explosion • Incident propagation through battery cells • Toxic smoke dispersion	• Batteries are tested by manufacturer prior to sale / installation • Overcharging and electrical circuit protection • Battery monitoring systems • Batteries composed of subcomponents (i.e. BBU, cells) reducing risk of substantial component failure • Batteries are not located in areas where damage could easily occur (i.e. within the fenced property) • Electrical systems designed per AS/NZS 3000:2018 (Ref. [12]) • UL9540A testing
Switch rooms, communications, etc.	• Arcing, overheating, sparking, etc. of electrical systems	• Ignition of processors and other combustible material within servers and subsequent fire	• Fires tend to smoulder rather than burn • Isolated location • Switch room separation from other sources of fire
Substation, PCUs	• Arcing within transformer, vaporisation of oil and rupture of oil reservoir	• Transformer oil spill into bund and bund fire	• Bunded • Isolated location
	• Power surge to transformers (e.g. from lightning)	• Major failure of surge protection in transformer, vapourisation of mineral oil, ignition and explosion	• Transformers have surge protection system to shut down upon detection of extreme energy input • Lightning protection to prevent lightning strikes impacting transformers

Area/Operation	Hazard Cause	Hazard Consequence	Safeguards
			• Control of ignition sources – no smoking / open flames around the transformers
EMF	• Electric and magnetic equipment	• Generation of ELF EMF and injury / nuisance to surrounding area	• Large separation distances allow for attenuation of EMFs • Cumulative impacts from equipment below acceptable thresholds. • Low occupancy density within vicinity of the development

APPENDIX F: SFRAIP RISK ASSESSMENT

Risk Assessment

Coppabella Wind Farm BESS

Coppabella Wind Farm Pty Ltd
Document No. RCE-25279_CoppabellaWF_RA_Final_19Sep25_Rev(2)
Date 19/09/2025

Risk Assessment

Coppabella Wind Farm BESS

Coppabella Wind Farm Pty Ltd

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Quality Management

Rev	Date	Remarks	Prepared By	Reviewed By
A	8th July 2025	Draft issued for comment	Chris Butson	Renton Parker
0	28th August 2025	Updated to final including additoinal BESS units at each site		
1	10th September 2025	Updated based on increased energy density of battery modules		
2	19th September 2025	Updated based on decrease number of WTGs		

Executive Summary

Background

Goldwind Australia Pty Ltd (Goldwind) on behalf of Coppabella Wind Farm Pty Ltd (CWFPL) are developing the Coppabella Wind Farm which received development consent in 2016 (SSD 6698). Goldwind are now seeking a modification to SSD 6698 to provide for the inclusion of a Battery Energy Storage System (BESS) into the Project. The BESS exceeds the 30 MW limit and therefore requires a Preliminary Hazard Analysis (PHA) to investigate the potential impacts on the surrounding environment which has been completed previously.

The PHA is used to assess potential off-site impact including potential for environmental and societal risk. However, the WHS Regulation 2017 (Ref. [1]) requires that risks associated with the operations of the site be minimised so far as is reasonably practicable (SFAIRP). To demonstrate this, it has been proposed to conduct a Risk Assessment in reference to the site infrastructure, in particular, the wind turbines, transformers and BESS units.

This report provides the Risk Assessment conducted to demonstrate compliance with the WHS Regulation 2017 (Ref. [1]).

Conclusion

A hazard identification for the Coppabella BESS Project was undertake to identify hazards which pose a risk of injury, fatality or incident propagation. From the hazards identified, three (3) were assessed further do identify magnitude and frequency of impact against the selected criteria which was developed in **Section 2**. The reviewed incidents included:

- Li-Ion battery fault, thermal runaway and fire.
- Transformer internal arcing, oil spill, ignition and bund fire.
- Transformer electrical surge protection failure and explosion.

The consequence and frequency analysis determined that the risk associated with these scenarios was controlled SFAIRP as the estimated frequency of events was below the selected criteria.

Notwithstanding the SFAIRP assessment, additional recommendations were made.

Recommendations

The following recommendation was made based on an assessment of current FM Global and NFPA requirement regarding BESS systems:

- Minimum spacing between adjacent BESS units shall be increased to 1.5 m in all directions.

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Abbreviations

Abbreviation	Description
AC	Alternating Current
ADG	Australian Dangerous Goods Code
AS	Australian Standard
BESS	Battery Energy Storage System
DC	Direct Current
DGs	Dangerous Goods
EIS	Environmental Impact Statement
ELF	Extra Low Frequency
EMF	Electric and Magnetic Field
ERPG	Emergency Response Planning Guideline
FCAS	Frequency Control Ancillary Services
FHA	Final Hazard Analysis
HF	Hydrogen Fluoride
HIPAP	Hazardous Industry Planning Advisory Paper
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IDLH	Immediately Dangerous to Life and Health
LFP	LiFePO4 (Lithium Iron Phosphate)
MVPS	Medium Voltage Power Station
NMC	Nickel-Manganese-Cobalt
PHA	Preliminary Hazard Analysis
Pmpy	Per million per year
PV	Photovoltaic
SEARs	Secretary’s Environmental Assessment Requirements
SEP	Surface Emissive Power
SEPP	State Environmental Planning Policy
SOC	State of Charge
SSDA	State Significant Development Application
STEL	Short Term Exposure Limit
VBB	Victorian Big Battery

1.0 Introduction

1.1 Background

Goldwind Australia Pty Ltd (Goldwind) on behalf of Coppabella Wind Farm Pty Ltd (CWFPL) are developing the Coppabella Wind Farm which received development consent in 2016 (SSD 6698). Goldwind are now seeking a modification to SSD 6698 to provide for the inclusion of a Battery Energy Storage System (BESS) into the Project. The BESS exceeds the 30 MW limit and therefore requires a Preliminary Hazard Analysis (PHA) to investigate the potential impacts on the surrounding environment which has been completed previously.

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This report provides the Risk Assessment conducted to demonstrate compliance with the WHS Regulation 2017 (Ref. [1]).

1.2 Scope and Objectives

The scope of work is to complete a Risk Assessment for the Project which addresses the requirements of the WHS Regulation 2017 (Ref. [1]).

2.0 Methodology

2.1 Background

The assessment of the risks associated with the operation of the Coppabella WF will be conducted using a quantitative analysis, resulting in the expression of risks in the following forms:

- Individual fatality – expressed as the chance of fatality in a million per year (pmpy).
- Individual injury risk – expressed as the chance of injury pmpy.
- Incident propagation – determined by consequence analysis.

The assessment of risk, in quantitative terms, would be meaningless unless this can be compared to some acceptable risk criteria. Hence, for this analysis, a number of acceptable risk criteria have been reviewed and the proposed criteria developed for this project.

The following sources were reviewed to identify existing risk criteria and to develop applicable risk criteria that would be applicable to the Coppabella Wind Farm:

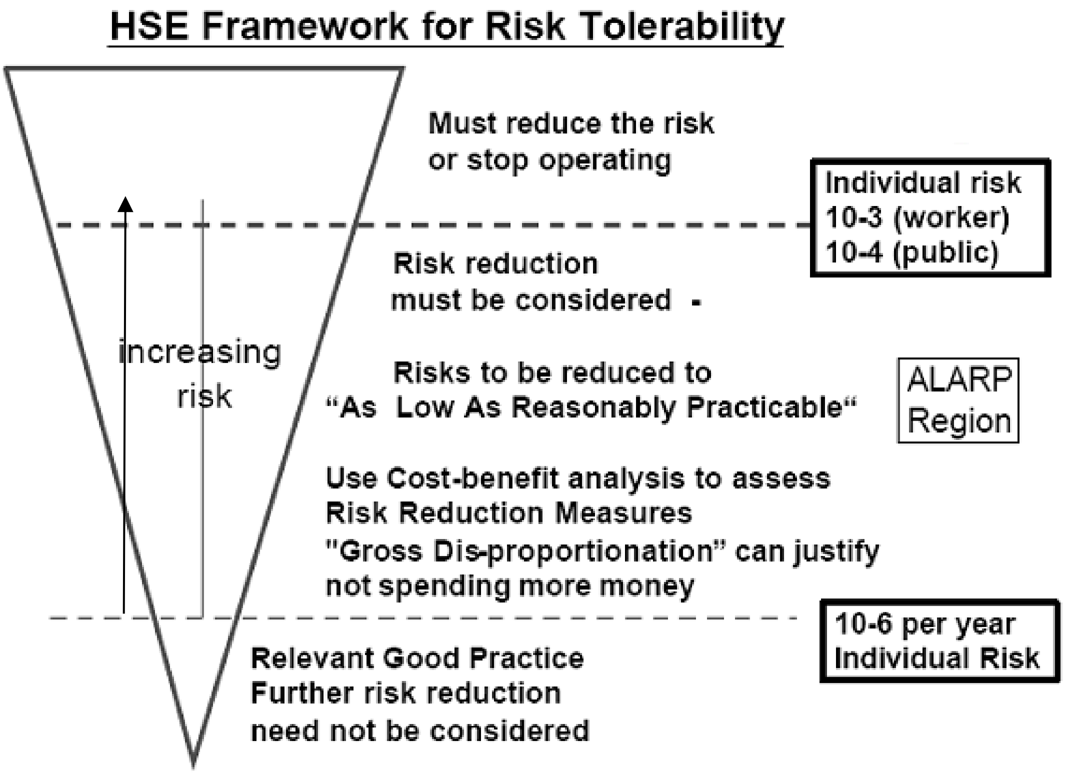
- United Kingdom Health and Safety Executive – Control of Major Accident Hazards (COMAH);
- European Union - Seveso II;
- Industry Fatal Accident Rate (FAR) data;
- NSW Department of Planning – Hazardous Industry Planning Advisory Paper No.4, Risk Criteria for Land Use Safety Planning;

2.2 United Kingdom Health & Safety Executive

In the 1970's and 80's a number of incidents, involving United Kingdom chemical plants, oil refineries and offshore oil rigs, resulted in large loss of life (both within and external to the facilities) and significant plant and community damage. To address the potential hazards and risks associated with the operation of hazardous plants, the United Kingdom Health and Safety Executive (HSE), implemented the Control of Major Accident Hazards (COMAH) legislation, which came into force in 1999.

The COMAH regulation requires an operator to assess the risks and ensure that these risks are within acceptable levels. To assist industry in determining the acceptability of potentially hazardous facilities, the HSE published a number of risk criteria which are detailed in **Figure 6-1**. Note that this figure has been modified to provide more context around the threshold values.

Based on the COMAH regulation, 'reasonably practicable' in terms of individual risk would fall in between 10^{-3} and 10^{-6} per year.



(Ref:3)

Figure 2-1: HSE Acceptable Risk Framework

2.3 SEVESO II

In 1976, a dioxin release occurred in a small chemical manufacturer in the town of Seveso, Italy. The release resulted in the exposure of people in the town to, and the contamination of the surrounding countryside with, dioxin. The incident resulted in the requirement to slaughter over 80,000 animals that had been contaminated by the dioxin, hospitalisation of a number of children with skin complaints and the ongoing clean up and monitoring of the area (including people and land). The total cost of this incident is estimated to be around 120bn liras.

To minimise the potential for this type of incident to occur in the future, the European Union (EU) enforced the Seveso II regulations, requiring operators of potentially hazardous facilities to assess the safety of their operations and to ensure these operations were within acceptable safety limits. The EU has published a number of criteria with respect to risk; these are as follows:

Individual fatality risk:

- Less Vulnerable Objects – 1X10^{-5} p.a.
- Vulnerable Objects – 1X10^{-6} p.a.

2.4 Fatal Accident Rates (FAR)

In 2023 (1-year statistics), SafeWork Australia reported that there were 1.4 fatalities per 100,000 workers nationwide (Ref. [2]). Based on an average number of hours worked by an individual worker of 1920 per annum, the fatal accident rate would be:

FAR = $[1.4/(100,000 \times 1920)]\times10^8$ = 0.73 fatalities per 100 million worker hours.

The general FAR for industry is composed of a number of industries Australia wide, including the road transport, agriculture, forestry, fishing, construction, mining, oil/gas and chemical industries. During 2023 the electricity, gas, water and waste services industry had an FAR in the order of 2.5 fatalities per 100 million worker hours which is a rate more than three times the national average. Hence, an FAR of 2.5 fatalities per 100 million worker hours was used to determine the potential loss of life (PLL) for comparison with the selected criteria.

The PLL at any facility may be estimated by multiplying the FAR for the facility or industry x the total hours worked. The site will include approximately 15 full-time operational staff. To take a conservative approach to this assessment, it has been assumed that each staff member will work 12-hours per day, 7 days per week for a total of 48-weeks per year. Based on this highly conservative assumption, the total hours worked per annum by individuals at the site is therefore 15x12x7x48 = 60,480 hours.

PLL = $2.5\text{x}60,480/10^8$ = **$1.5\text{x}10^{-3}$p.a.**

2.5 Selected Risk Criteria

Based on the above information, it is evident that the majority of regulatory authorities reviewed set a public fatality risk criterion in the order of $1\text{x}10^{-6}$p.a. However, injury risk criteria are not as clear. As the study will be performed in NSW, the closest criteria that would apply is that published by the NSW Department of Planning in HIPAP No.4. Hence, based on the information reviewed, the following risk criteria is proposed for use in the risk assessment:

- Fatality Risk – $1\text{x}10^{-3}$ p.a. (in line with HSE criteria and slightly more conservative than the PLL value)
- Injury Risk – $1\text{x}10^{-2}$ p.a. (one order of magnitude higher than Fatality Risk)

The onsite (worker) fatality risk criterion has been selected in line with the HSE criteria and slightly more conservative than the PLL estimated as a result of current Australian FAR levels. Injury risk criterion for workers has been selected as one order of magnitude higher than fatality risk.

2.6 Risk Assessment Study Approach

The methodology used for the Risk Assessment is as follows:

Hazard Analysis – A detailed hazard identification was conducted for the Project facilities and operations. Where an incident was identified to have a potential risk for workers, it was included in the recorded hazard identification word diagram (**Appendix A**). The hazard identification word diagram lists incident type, causes, consequences and safeguards. This was performed using the word diagram format recommended in HIPAP No. 6 (Ref. [3]).

Each hazardous incident scenario was assessed qualitatively in light of proposed safeguards (technical and management controls). Where a potential for injury was identified, the incident was carried into the main report for further analysis. Where the qualitative review in the main report determined that the safeguards were adequate to control the hazard, or that the consequence would obviously have injury or fatality risk, no further analysis was performed. Quantitative analysis was performed where it was determined that the hazard has potential for injury or fatality.

Consequence Analysis – For those incidents qualitatively identified in the hazard analysis to have an injury or fatality risk, a detailed consequence analysis was conducted. The analysis modelled the various postulated hazardous incidents and determined impact distances from the incident source to determine the impact distance and magnitude. These were compared with the consequence tables in HIPAP No. 4 (Ref. [4]) to determine the injury and / or fatality potential.

Where an incident had injury or fatality potential it was carried forward for frequency analysis.

Frequency Analysis – In the event a simple solution for managing consequence impacts was not evident, each incident identified to have injury or fatality risk was subjected to a frequency analysis. The results of the frequency analysis were then carried forward to the risk assessment and reduction stage for combination with the consequence analysis results.

Risk Assessment – Where incidents were identified to have injury or fatality risk and where a consequence and frequency analysis was conducted, the consequence and frequency analysis for each incident were combined to determine the risk and then compared to the risk criteria proposed in **Section 2.5**. Where the criteria were exceeded, a review of the major risk contributors was performed, and the risks reassessed incorporating the recommended risk reduction measures. Recommendations were then made regarding risk reduction measures.

Reporting – On completion of the study, a draft report was developed for review and comment. A final report was then developed, incorporating the comments received for submission to the regulatory authority.

3.0 Site Description

3.1 Site Location

The Coppabella Wind Farm (CWF) is located approximately 30km west of the township of Yass within the Hilltops and Yass Valley Local Government Areas (LGAs). The CWF covers an area of dimensions 12 kilometres west to east and 10 kilometres north to south along the Coppabella Hills near the towns of Bookham and Binalong. **Figure 3-1** show the regional location of the site.

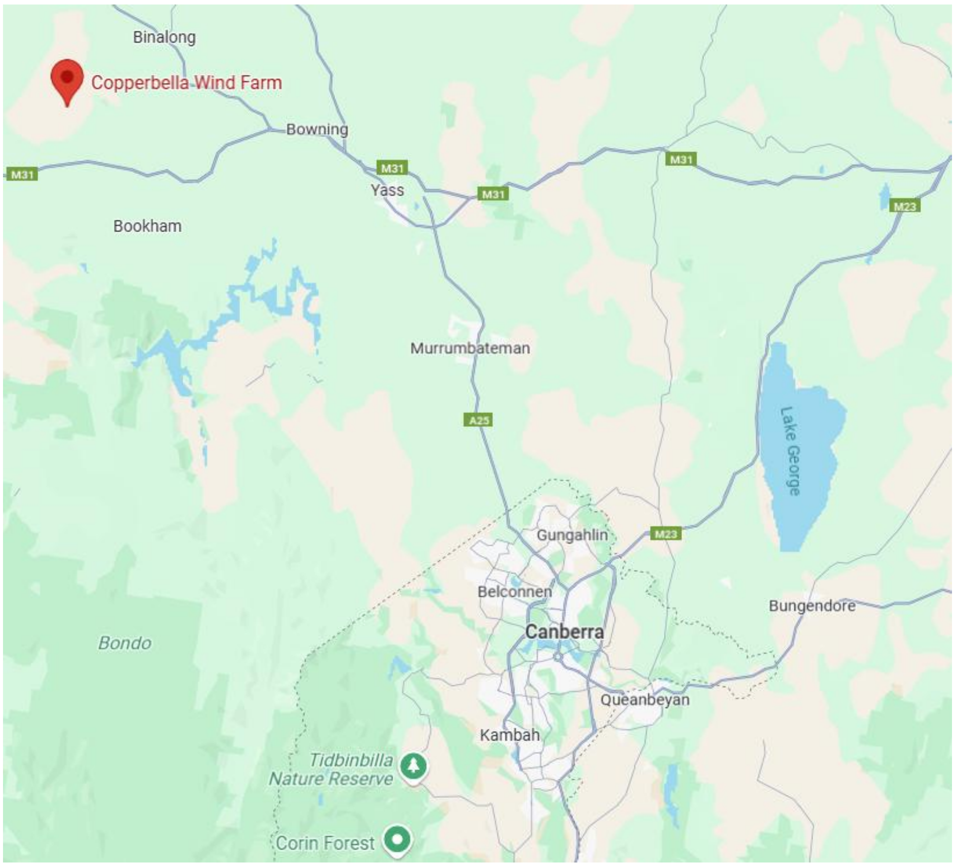


Figure 3-1: Regional Site Location (Google Maps)

3.2 General Description

The key components of the Project include:

- Fifty-three (53) wind-turbine generators (WTGs), with a maximum blade-tip height of 171 metres (m) above ground
- BESS installations at each WTG:
  - Six (6) containers providing energy storage capacity of 5.0 MW / 20.6 MWh (4-hour duration) per WTG
  - Total site storage capacity of 265.5 MW / 1,091 MWh (4-hour duration)
- Electrical connections and substations.
- Control and maintenance facilities.

- Infrastructure for internal access roads.
- Wind and weather monitoring equipment.
- Construction support services such as temporary power and site offices

The development would be completed in three phases:

- Construction
- Operation
- Decommissioning

3.3 Detailed Description

The purpose of the Project is to provide renewable energy to the NSW grid and contribute towards the goals of the NSW Government's NSW Electricity Infrastructure Roadmap.

The electricity will be capable of storage in 265.5 MW / 1,091 MWh BESS which can be dispatched based on electricity demand fluctuations, providing the opportunity for greater supply dispatch flexibility when electricity demand is highest. This is enabled by the fast response times achievable through lithium-ion battery storage.

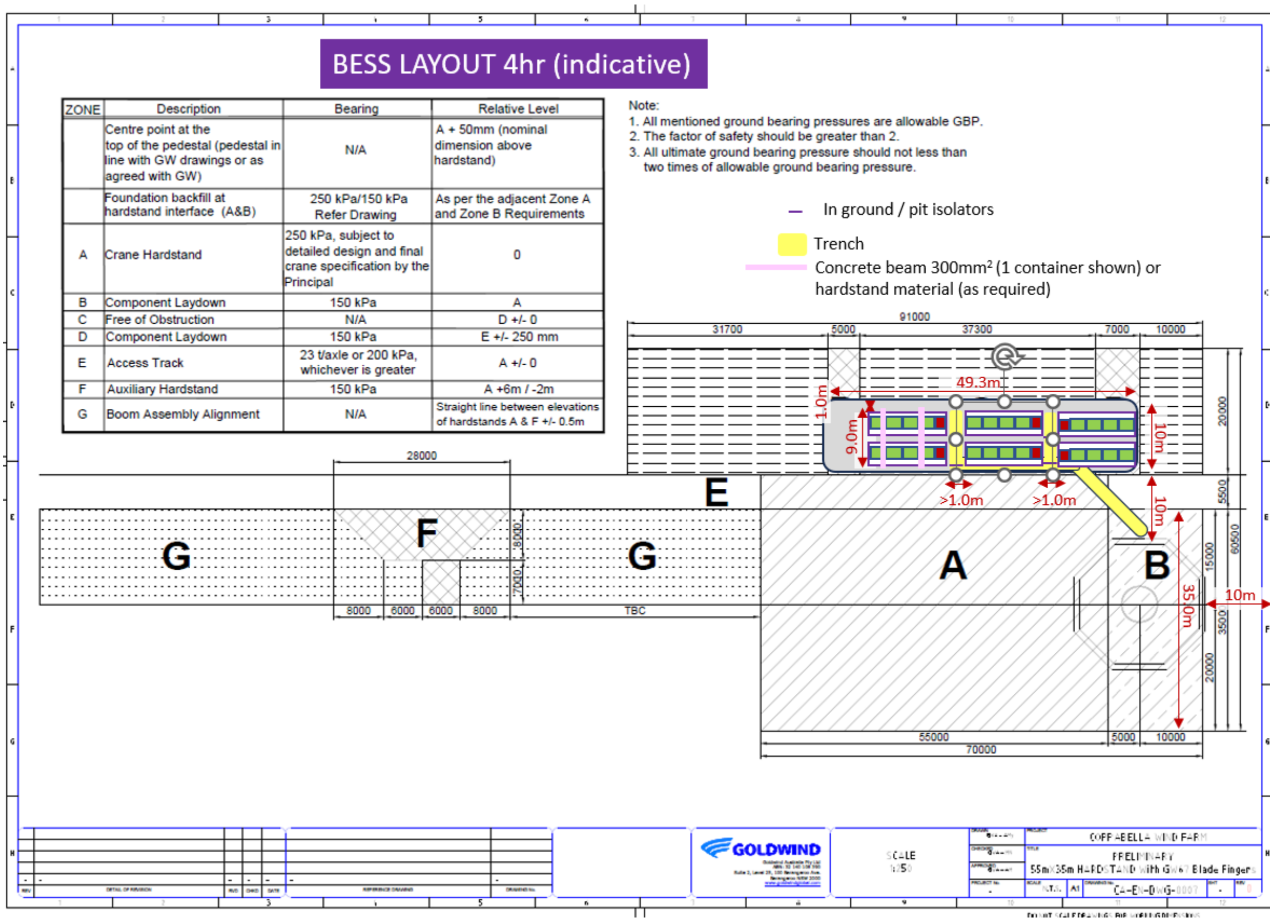
3.3.1 Battery Storage

The BESS will be decentralised, with a BESS containers situated directly adjacent to each wind turbine. Each arrangement shall be made of six (6) 40ft shipping container style installations with each container including four (4) Goldblock battery cabinets for a total of twenty-four (24) individual battery cabinets per WTG. Per WTG, this results in an energy storage capacity of 5.0 MW / 20.6 MWh (4-hour duration). The BESS containers will be configured at each WTG site in a 3 x 2 layout on an area with dimensions of approximately 50 m x 10 m (500 m^2).

At the time of assessment layouts have not been prepared for the installations however the separation distances are as follows:

- WTG to BESS hardstand – 10 m
- Between BESS containers (long-edge) – 4 m
- Between BESS containers (short-edge) – 1 m

Figure 3-2 has been provided as an indicative layout of the BESS containers adjacent to the wind turbines. Note that this layout is not finalised.



BESS LAYOUT 4hr (indicative)

ZONE	Description	Bearing	Relative Level
	Centre point at the top of the pedestal (pedestal in line with GW drawings or as agreed with GW)	N/A	A + 50mm (nominal dimension above hardstand)
	Foundation backfill at hardstand interface (A&B)	250 kPa/150 kPa Refer Drawing	As per the adjacent Zone A and Zone B Requirements
A	Crane Hardstand	250 kPa, subject to detailed design and final crane specification by the Principal	0
B	Component Laydown	150 kPa	A
C	Free of Obstruction	N/A	D +/- 0
D	Component Laydown	150 kPa	E +/- 250 mm
E	Access Track	23 t/axle or 200 kPa, whichever is greater	A +/- 0
F	Auxiliary Hardstand	150 kPa	A +6m / -2m
G	Boom Assembly Alignment	N/A	Straight line between elevations of hardstands A & F +/- 0.5m

Note:
1. All mentioned ground bearing pressures are allowable GBP.
2. The factor of safety should be greater than 2.
3. All ultimate ground bearing pressure should not less than two times of allowable ground bearing pressure.

Figure 3-2: Indicative BESS Layout

3.4 Dangerous Goods Stored on Site

Table 3-1 summarises the classes and quantities of dangerous goods to be stored on site. Most of the dangerous goods are contained within plant and equipment, for example batteries contained within BESS containers and transformer oils contained within transformers.

The remaining dangerous goods are contained within small quantity containers, stored in DG cabinets and used for regular maintenance and repair activities.

Table 3-1: Maximum Quantities of Dangerous Goods

Class	PG	Description	Quantity
C1	n/a	Diesel fuel	35,000 L*
C2	n/a	Transformer oils	90,000 L*
2.1	n/a	Flammable gases (aerosols, degreaser, brake cleaner)	1,000 L*
3	II & III	Flammable liquids (sanitiser, brake cleaner, binder, paint)	250 L*
8	II & III	Corrosive substances (Curing agent, degrease, resin)	200 L*
9	III	Miscellaneous dangerous goods (resin, conductive paste)	250 L*
	n/a	Lithium batteries	7,546 T

*Estimates based on previous similar projects

4.0 Hazard Identification

4.1 Introduction

A hazard identification table has been developed and is presented at **Appendix A**. The Hazard Identification Table provides a summary of the potential hazards, consequences and safeguards at the site. The table has been used to identify the hazards for further assessment in this section of the study. Each hazard is identified in detail and no hazards have been eliminated from assessment by qualitative risk assessment prior to detailed hazard assessment in this section of the study.

4.2 Hazard Identification

Based on the hazard identification table presented in **Appendix A**, the following hazardous scenarios have been identified:

- Flammable material spill and flash fire or vapour cloud explosion.
- Li-ion battery fault, thermal runaway and fire.
- Electrical equipment failure and fire.
- Transformer internal arcing, oil spill, ignition and bund fire.
- Transformer electrical surge protection failure and explosion

Each identified scenario is discussed in further detail in the following sections.

4.3 Flammable material spill and flash fire or vapour cloud explosion

Flammable liquids and gases are stored in workshops and maintenance areas containing small containers of brake cleaner, resins and various other chemicals for maintenance activities. All chemicals are stored in DG cabinets which are compliant with the relevant DG standards (AS 1940:2017 (Ref. [5]).

A requirement of the standards and the Work Health and Safety Regulation 2017 (Ref. [1]) is to conduct a hazardous area classification in accordance with AS/NZS 60079.10.1:2022 where there is the potential for an atmosphere with 5% of the lower explosive limit (LEL) to exist. This will ensure that any electrical equipment installed around the flammable DG storages will either be relocated or suitably rated for use in a hazardous area, significantly reducing the probability of an ignition should a release of flammable material occur.

Even in the event of a fire initiated in a DG cabinet, the total quantities of goods kept are small as are the individual container sizes reducing both the extent and severity of a potential incident. Additionally, all flammable gas and liquid storage cabinets require extinguishers to be provided nearby, therefore a fire would likely be extinguished prior to any incident escalation. Due to the small quantities and compliance with standards the risk to people due to the storage of flammable dangerous goods is minimised SFAIRP and no further analysis is required.

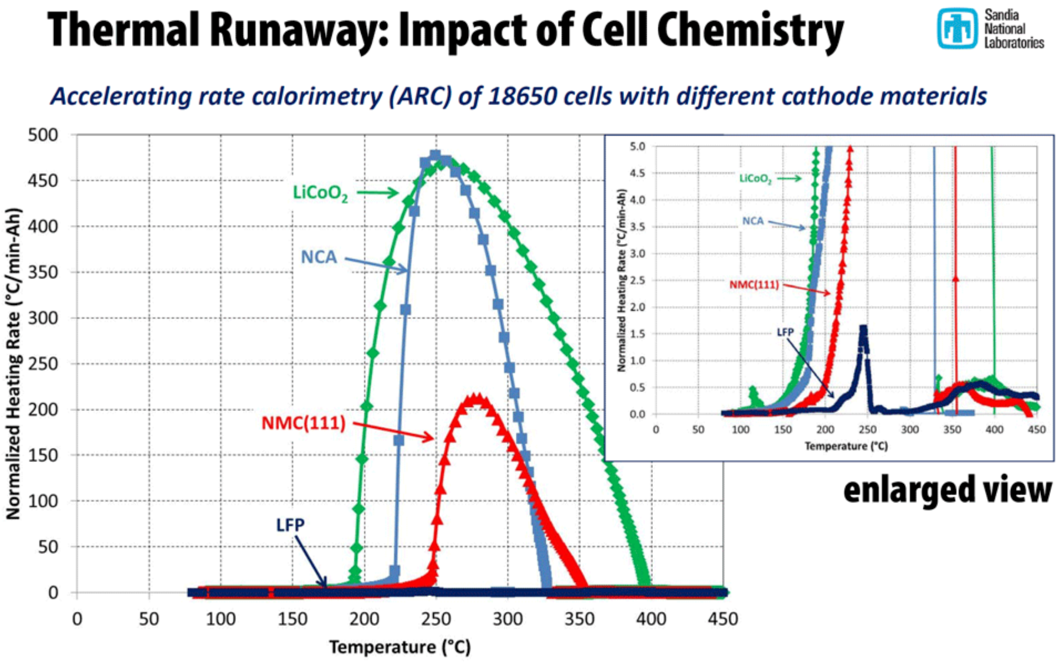
4.4 BESS Fire

Each WTG will include six (6) BESS units which are comprised of lithium-ion battery modules. The battery chemistry for the site shall be lithium iron phosphate (LFP) which, compared to other earlier iterations of lithium batteries, is widely accepted within energy infrastructure industry to be one of the safest chemistries available.

When exposed to external heat the thermal rise of typical lithium-ion battery chemistries is 200-400 °C/min resulting thermal run away and fire which can then propagate to adjacent batteries escalating the incident to a full container fire. For LFP batteries, the thermal rise of the batteries at peak is 1.5°C/min which results in a gradual temperature rise and typically does not result in fire and thus incident propagation to other batteries. The thermal rise of various battery chemistries is provided in **Figure 4-1** with a zoomed in temperature rise for LFP provided in the top right.

Additional testing for shock and damage to batteries (i.e. nail puncture test) has been shown that LFP batteries when punctured through membranes which typically results in a shorting of the battery and fire does not result in ignition of the battery demonstrating that the battery chemistry is protected against shock damage.

In the event that LFP chemistries do ignite by artificial means, the combustion by products release carbon dioxide which reduces the oxygen concentration within a confined space reducing the combustion rate.



- *All measurements at 100% SOC and for cells with 1.2 M $LiPF_6$ in EC:EMC (3:7)*
- *Differences in runaway profiles are related to oxygen release and combustion at different cathodes*

Figure 4-1: Temperature Rise of Lithium-Ion Battery Chemistries (Ref. [6]).

Despite the improvement in battery technology, there are several degradation mechanisms that are still present within the battery which can result in thermal runaway. These include:

- Chemical reduction of the electrolyte at the anode
- Thermal decomposition of the electrolyte
- Chemical reduction of the electrolyte at the cathode
- Thermal decomposition by the cathode and the anode
- Internal short circuit by charge effects

These effects arise primarily as a result of high discharge, overcharging, or water ingress into the battery which results in a host of by-products being formed within the battery during charge and discharge cycles. As a result, BESS units are equipped with several safety features to prevent the batteries from charging or discharging at voltages which result in battery degradation, leading to shorting of the battery and thermal runaway. Safety features generally include:

- Shut-down separator (for overheating)
- Tear-away tab (for internal pressure relief)
- Vent (pressure relief in case of severe outgassing)
- Thermal interrupt (overcurrent/overcharging/environmental exposure)

These features are designed to prevent overcharging or excessive discharge, pressurisation arising from heat generated at the anode or from battery contamination. Protection techniques for Li-ion batteries are standard; hence, the potential for thermal runaway to occur in normal operation is very low with the only exceptions being due to manufacturing faults or battery damage (i.e. battery cell is ruptured as this can short circuit the battery resulting in thermal runaway).

In addition to the battery chemistry being relatively safe comparable to other Li-Ion battery chemistries and battery safety features improving, the BESS unit construction include several fire detection, prevention and protection features which act to prevent a localised thermal run-away event escalating to a full-unit fire including:

- Smoke and thermal sensors
- Gas detection
- Pressure relief system
- Suppression system (typically aerosol-based)
- E-Stop buttons
- Battery management system (BMS)
- Audio and visual alarms

The combination of these controls mean that if runaway events occur, they are identified quickly, and the system responds to minimised damage to the BESS units, adjacent infrastructure and personnel. Operators at the control room have visibility of the status of the BESS units and will be alerted by sirens and klaxons should there be an emergency.

Another factor which impacts, the safety of the system for personnel is the installation location. Each group of six (6) BESS units is located next to a WTG in open space an no obstruction for egress in the event of an emergency. Due to this the risk of personnel becoming trapped in a dangerous location during an emergency is significantly reduced. Notwithstanding this, this scenario has been carried forward for consequence analysis.

4.5 Electrical Equipment Failure and Fire

Electrical equipment is located within the switch rooms which may fail resulting in overheating, arcing, etc. which could initiate a fire. In the event of a fire, it may begin to propagate to adjacent combustible materials (i.e. wiring). It is noted that electrical equipment fires typically start by smouldering before flame ignition occurs resulting in a slow fire development.

The type of equipment used within the Project is ubiquitous throughout the world and across industry segments and is therefore not a unique fire scenario. Additionally, there are highly regulated standards and requriements which must be met for the design, installation, operation an maintenance of equipment in switch rooms.

Therefore, all equipment will be installed, operated and maintained in accordance with Regulations, the risk associated with this scenario is minimised SFAIRP and this incident has not been carried forward for further analysis.

4.6 Transformer Internal Arcing, Oil Spill, Ignition and Bund Fire

Transformers contain oil which is used to insulate the transformers during operation. If arcing occurs within the transformer (e.g. due to a low oil level), the high energy passing through the coolant vaporises the oil into light hydrocarbons (methane, ethane, acetylene, etc.) resulting in rapid pressurisation within the reservoir.

Notwithstanding the protection systems, if the pressure rise exceeds the structural integrity of the reservoir, and the installed pressure relief devices, the reservoir can rupture allowing the release of oil into the bund. The rupture also allows oxygen to enter the reservoir. The temperature of the gases is above the auto ignition point, but this does not occur until oxygen is present. When oxygen enters the reservoir, the gases auto ignite which generates sufficient heat to ignite the oil in the bund. Therefore, this incident has been carried forward for further analysis.

4.7 Transformer Electrical Surge Protection Failure and Explosion

Transformers generate large amounts of heat as a result of the high electrical currents that pass through them; hence, oil is used as an insulating material within the transformers to protect the mechanical components. However, if the transformer gets an extreme surge of energy, such as that which could occur due to a lightning strike, and the electrical surge protection measures fail, the mineral oil may start to decompose and vapourise, resulting in gas bubbles of hydrogen and methane (Ref. [7]) as temperatures above the autoignition of the gases.

The formation of gases will increase the pressure within the transformer which can result in the transformer structure rupturing which allows the ingress of oxygen. As the oxygen enters, the concentration of flammable gases falls within the explosive limits which are above their autoignition temperatures which ignite resulting in increased formation of hot gaseous products resulting in an explosion. The explosion may generate significant overpressure, sparks and fire and would result in a whole transformer fire, as discussed in **Section 4.6**.

To protect against overheating and explosions, transformers generally have surge protection devices which shunt electrical surges safely to ground. However, this surge detection and protection devices are not universally installed nor do they protect against all events such as in the case of a major lightning strike or significant oil deterioration, leakage of water into the transformer, and physical damage such as a fallen tree (Ref. [8]). Therefore, there is the potential for an explosion to occur which has potential to cause harm to people working near the transformers. Therefore, this incident has been carried forward for further analysis.

5.0 Consequence Analysis

The following incidents have been carried forward for consequence analysis:

- Li-ion battery fault, thermal runaway and fire

- Transformer internal arcing, oil spill, ignition and bund fire
- Transformer electrical surge protection failure and explosion

Each of these have been assessed to determine the consequence from the incident as it relates to individual injury, fatality and incident propagation. **Table 5-1** and **Table 5-2** summarise the criteria used to determine the consequences for heat radiation and explosion overpressure respectively. These tables have been taken from HIPAP No.4 (Ref. [4]).

Based on **Table 5-1** and **Table 5-2** the criteria used to determine if there is risk of injury or fatality shall be:

- Fatality – 23 kW/m^2 and 21 kPa
- Incident propagation – 23 kW/m^2 and 21 kPa
- Injury – 12.6 kw/m^2 and 14 kPa

Any event which produces consequences up to these limits shall be further assessed for frequency.

Table 5-1: Consequences of Heat Radiation

Heat Radiation (kW/m^2)	Impact
35	• Cellulosic material will pilot ignite within one minute's exposure • Significant chance of a fatality for people exposed instantaneously
23	• Likely fatality for extended exposure and chance of a fatality for instantaneous exposure • Spontaneous ignition of wood after long exposure • Unprotected steel will reach thermal stress temperatures which can cause failure • Pressure vessel needs to be relieved or failure would occur
12.6	• Significant chance of a fatality for extended exposure. High chance of injury • Causes the temperature of wood to rise to a point where it can be ignited by a naked flame after long exposure • Thin steel with insulation on the side away from the fire may reach a thermal stress level high enough to cause structural failure
4.7	• Will cause pain in 15-20 seconds and injury after 30 seconds exposure (at least second degree burns will occur)
2.1	• Minimum to cause pain after 1 minute.
1.2	• Received from the sun at noon in summer.

Table 5-2: Effects of Explosion Overpressure

Explosion overpressure (kPa)	Impact
70	• Threshold of lung damage. • 100% chance of fatality for a person in a building or in the open. • Complete demolition of houses.
35	• House uninhabitable. • Wagons and plants items overturned.

Explosion overpressure (kPa)	Impact
	• Threshold of eardrum damage. • 50% chance of fatality for a person in a building and 15% chance of fatality for a person in the open.
21	• Reinforced structures distort. • Storage tanks fail. • 20% chance of fatality to a person in a building.
14	• House uninhabitable and badly cracked.
7	• Damage to internal partitions and joinery but can be repaired. • Probability of injury is 10%. No fatality.
3.5	• 90% glass breakage • No fatality and very low probability of injury

5.1 Li-Ion Battery Fault, Thermal Runaway and Fire

In the event that thermal runaway did occur, the BESS units may produce radiant heat which has potential to harm personnel and risk incident propagation. To estimate the radiant heat of the BESS units, a detailed analysis was undertaken in **Appendix B**. The heat radiation distances from the assessment are summarised in **Table 5-3**.

Explosion impacts were not considered in this assessment as the results from UL 9540A reports do not indicate that LFP batteries explode due to thermal runaway events. The battery packs within the Goldblock unit include a blast valve to relieve pressure within the unit should an overpressure rapidly develop.

Table 5-3: Radiant Heat Impact from a BESS Unit Fire

Heat Radiation (kW/m^2)	Distance (m)
35	1.3
23	**2.0**
12.6	**2.8**
4.7	4.2
3.0	5.9

Based on the assessment in **Appendix B** and presented in **Table 5-3** both the fatality and injury radiant heat thresholds (23 kW/m^2 and 12.6 m^2 respectively) have been exceeded. Therefore, to determine the frequency of these events, and the likelihood that they result in injury of fatality, this event has been further assessed in the following section.

Additionally, the potential for radiant heat to impact adjacent BESS containers and WTG was assessed based on the 23 kW/m^2 heat radiation contour. This showed that at 2 m distance from the container on fire a heat contour of 23 kW/m^2 would be experienced.

As indicated in **Figure 3-2**, the minimum distance between BESS containers and the WTGs is approximately 10 m which is sufficient to prevent risk of propagation. The proposed distances between adjacent BESS containers is 4 m on the long sides and 1 m on the short sides. Due to the design of BESS containers, heat from a fire is more likely to propagate from the long side due to openings. To determine the appropriateness of these separation distances, standards for BESS installations were consulted including FM Global Data Sheet (FMDS) 5-33 (Ref. [9]) and NFPA 855 (Ref. [10]).

FM Global Data Sheet (FMDS) 5-33 (Ref. [9]) specifies a minimum distance of 1.5 m between BESS units on sides that contain access panels, doors or deflagration vents. Separation between BESS units on sides where no openings are present can be based on installation-level testing that demonstrates thermal runaway cannot propagate between containers. As this information is not available for this particular unit, FMDS 5-33 (Ref. [9]) enforces 1.5 m separation on these sides as well.

NFPA 855 (Ref. [10]) specifies that the minimum distance between groups shall be a minimum of 0.9 m, however this is based on a maximum capacity of 50 kWh which is exceeded by almost all modern BESS containers. NFPA 855 (Ref. [10]) then directs energy capacities and spacings to be based on performance criteria from UL 9540A test reports which have shown no flaming outside of the unit. Based on the requirements of FMDS 5-33 (Ref. [9]) and NFPA 855 (Ref. [10]), the following recommendation has been made:

- Minimum spacing between adjacent BESS units shall be increased to 1.5 m in all directions.

From an incident propagation perspective, adopting this recommendation will ensure risk is minimised SFAIRP.

5.2 Transformer Internal Arcing, Oil Spill, Ignition and Bund Fire

There is potential that arcing may occur within the transformers which may lead to generation of gases and pressure above the structural integrity of the oil reservoir which may rupture leaking oil into the bund. As a result of the arcing and rupture, the oil may ignite leading to a bund fire within the dimensions of the bund.

A detailed analysis has been conducted in **Appendix B** and the radiant heat impact distances estimated for this scenario are shown in **Table 5-4.** The radiant heat contours associated with a fire occurring within a transformer bund are shown in **Figure 5-1**.

Table 5-4: Radiant Heat from a Transformer Fire

Heat Radiation (KW/m^2)	Distance (m)
35	7
23	**10**
12.6	**13**
4.7	19
3.0	22

Based on the assessment in **Appendix B** and presented in **Table 5-4** both the fatality and injury radiant heat thresholds (23 kW/m^2 and 12.6 m^2 respectively) have been exceeded. Therefore, to determine the frequency of these events, and the likelihood that they result in injury of fatality, this event has been further assessed in the following section.

As the 23 kW/m^2 heat radiation contour extends 10 m from the transformer in the event of a fire, there is potential for incident propagation. However, as the transformers are located in the substation which must be designed in accordance with strict standards, the risks associated with incident propagation are considered be managed SFAIRP via adherence with the relevant standards.

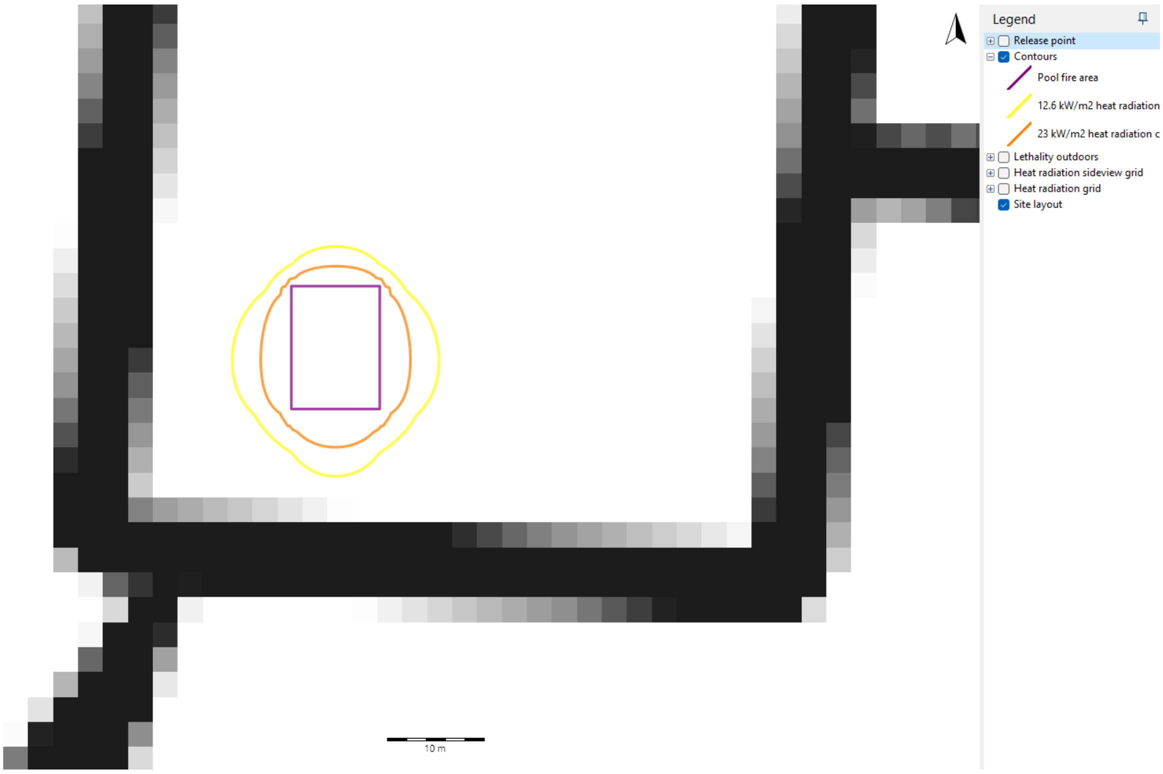


Figure 5-1: Transformer Fire Radiant Heat Contours

As recommended previously, at least 3 m should be maintained between the BESS container and the PCU systems to mitigate the risk of incident propagation between the units.

5.3 Transformer Electrical Surge Protection Failure and Explosion

There is potential for a transformer to be impacted by an extreme electricity surge, such as in the event of a lightning strike. Although this is unlikely as lightning protection is a requirement for all common structures, this may cause the ester oil within the transformer to ignite and explode resulting in substantial overpressure impacts. A detailed analysis has been conducted in **Appendix B** with the results summarised in **Table 5-5** and the overpressure contours are shown in **Figure 5-2**.

Table 5-5: Transformer Explosion Overpressures

Overpressure (kPa)	Distance (m)
70	26
35	38
21	**52**
14	**70**
7	121

Based on the assessment in **Appendix B** and presented in **Table 5-5** both the fatality and injury radiant heat thresholds (21 kPa and 14 kPa respectively) have been exceeded. Therefore, to determine the frequency of these events, and the likelihood that they result in injury of fatality, this event has been further assessed in the following section.

As the 21 kPa overpressure contour extends 50 m from the transformer in the event of an explosion, there is potential for incident propagation. However, as the transformers are located in the substation which must be designed in accordance with strict standards, the risks associated with incident propagation are considered be managed SFAIRP via adherence with the relevant standards. Further assessment of the site indicates the closet infrastructure to the substation is more than 200 m away, therefore there is minimal risk of other structures being damaged or incident escalation.

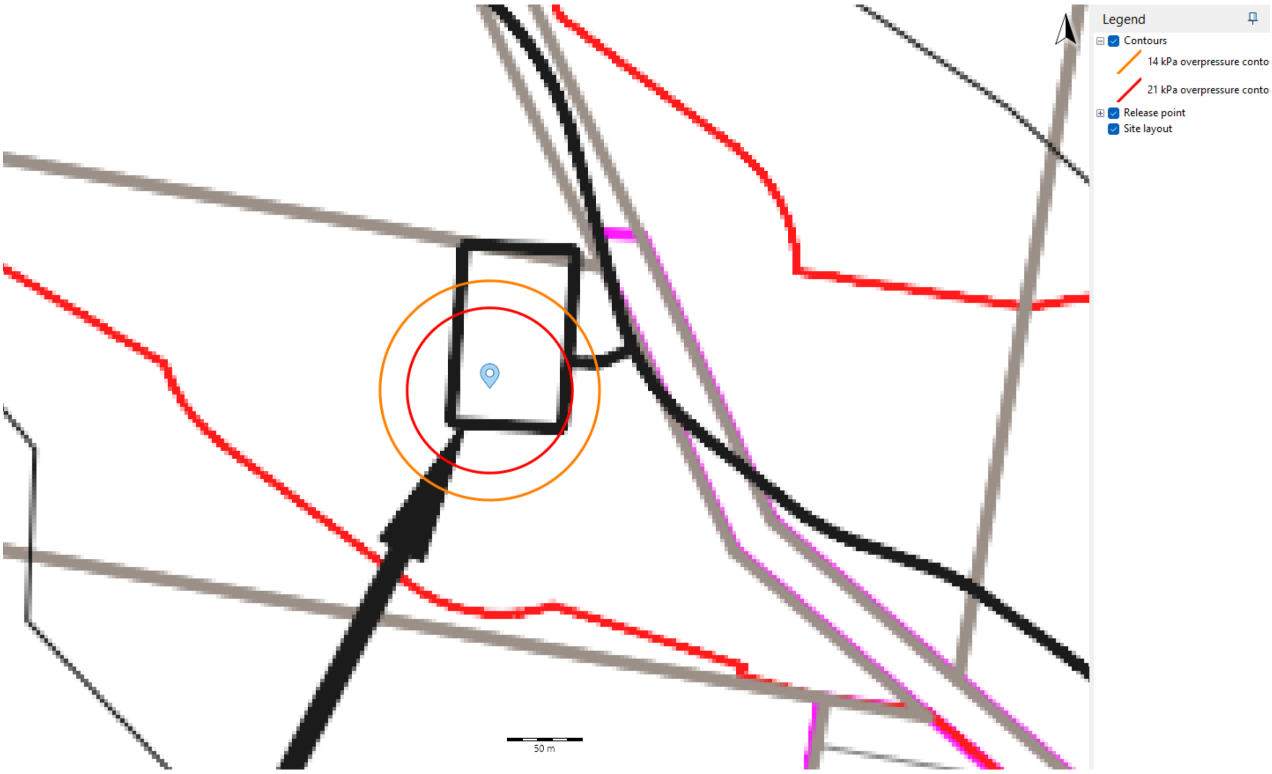


Figure 5-2: Transformer Explosion Overpressure Contours

6.0 Frequency Analysis

6.1 Incidents Carried Forward for Frequency Analysis

The following incidents were carried forward for frequency analysis, specifically regarding fatality and injury probability:

- Li-ion battery fault, thermal runaway and fire
- Transformer internal arcing, oil spill, ignition and bund fire
- Transformer electrical surge protection failure and explosion

6.2 Li-Ion Battery Fault, Thermal Runaway and Fire

To estimate the potential for a fatality to occur it is necessary to estimate the initiating event frequency. A detailed analysis has been prepared in **Appendix C** which identified an initiating event frequency of 7.4x10^{-2} per GWh/year. Based upon the total installed capacity for this project (1,091 MWh or 1.091 GWh) the potential for a fire to occur within a BESS unit is 7.4x10^{-2} per GWh/year x 1.091 = 8.02 x10^{-2} p.a.

A fatality or injury can only occur if a person is exposed to sufficient radiant heat. Therefore, it is necessary for a person to be located adjacent to a BESS when it is on fire to result in injury or fatality risk. Based on **Section 5.1**, a person would need to be within 3 m to receive a heat radiation dose high enough to have potential for injury or fatality, therefore, operators will only be exposed to that risk while performing maintenance directly on the BESS containers. For the purpose of this assessment, it has been assumed that the required maintenance hours on a BESS are 24 hours per year or a rate of 0.0027.

To estimate the probability of fatality it is necessary to review the susceptibility to personnel exposed to radiant heat that may occur. Tolerance to an exposure (i.e. radiant heat or toxicity) differs across a population which may be estimated using Probit analysis. For radiant heat exposure, the Probit equation is shown in **Eqn 6-1**.

$$Y = K_1 + K_2 lnV$$ **Eqn 6-1**

Where:

- K1 = -36.38
- K2 = 2.56
- V = $I^{4/3}$ x t
- I = radiant heat intensity (W/m^2)
- t = time (seconds)

The value obtained from the Probit equation is then read from the graph shown in **Figure 6-1**. Which yields the percentage of fatality for personnel exposed to the input radiant heat.

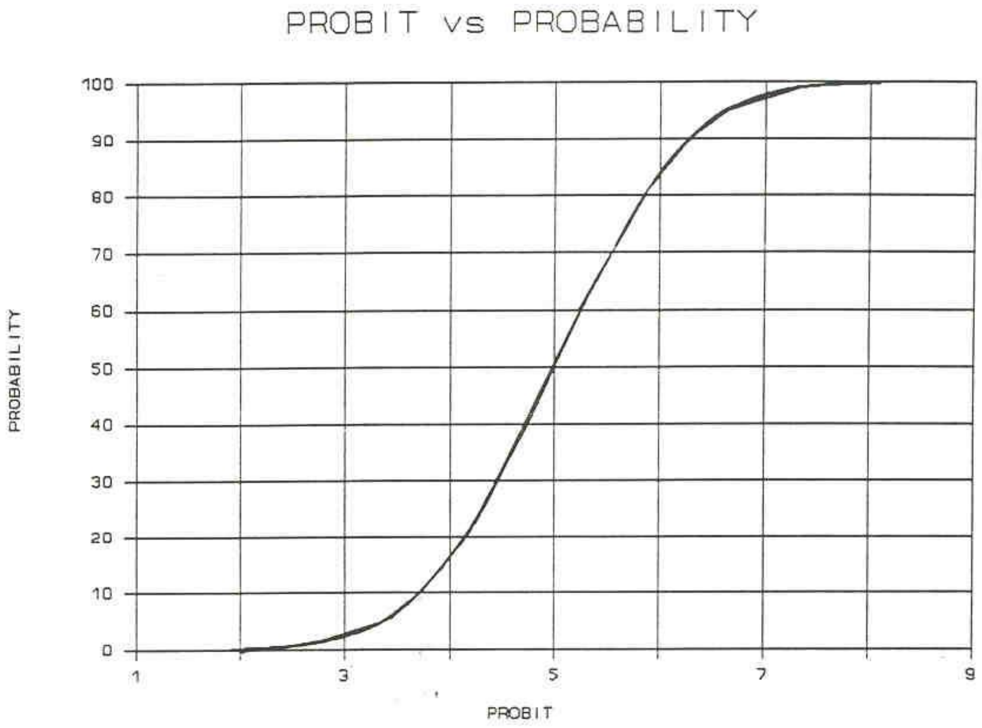


Figure 6-1: Probit vs Probability

As the criteria identified in **Section 2** to determine injury and fatality risk were 12.6 kW/m^2 and 23 kW/m^2 respectively, these were utilised to determine the probit. An exposure time of 30 s was used for the 12.6 kW/m^2 heat radiation exposure while 10 s was used for the 23 kW/m^2 exposure. This was used to capture the shorter distance of the 23 kW/m^2 contour and an increased urgency by the person exposed due to intense heat exposure. The calculated probits for the 12.6 kW/m^2 and 23 kW/m^2 probit, with these exposure durations considered, was calculated to be 4.55 and 3.8 respectively resulting in probabilities of 30% and 16%. Therefore, based on this assessment, the estimated injury and fatality risk associated with a BESS fire are:

- Injury: 8.02 x 10^{-2} x 0.0027 x 0.3 = 6.59 x 10^{-5}
- Fatality: 4.53 x 10^{-2} x 0.0027 x 0.16 = 3.52 x 10^{-5}

As these are below the selected risk criteria in **Section 2.5**, the risks associated with a BESS fire are considered to be managed so far as is reasonably practicable and no further action is required.

6.3 Transformer Internal Arcing, Oil Spill, Ignition and Bund Fire

The initiating event for a transformer fire is a major oil spill from the transformer casing. This would be classified as a catastrophic failure as all oil contained within the transformer would be released. Failure rate data from the CCPS indicates that the frequency of a catastrophic transformer failure is in the range of 0.125 to 9.26 failures per 10^6 hours (Ref. [11]).

It is noted that this data base was compiled in 1989 and as such is somewhat outdated. It would be expected that more modern equipment would be more reliable due to advances in materials, better understanding of oil management in transformers, better monitoring systems and process safety requirements. Therefore, the lower range of expected failures has been selected for this assessment to reflect the increased safety present in the transformer systems at the site. Hence, the failure frequency would be 0.125 per 10^6 hours, or 1.10x10^{-3} p.a.

As noted previously, a fatality or injury can only occur if a person is exposed to sufficient radiant heat. Therefore, it is necessary to have a person to be located adjacent to the transformer when it is on fire to result in injury or fatality risk. As the HV transformers are located in the substation, access to them is extremely controlled and limited. As such it has been assumed that an equivalent of 1-hour per day of worker activity shall take place in the vicinity of the transformers for a total of 365 hours per year or a rate of 0.0417.

The probit method used in **Section 6.2** has been used to calculate the injury and fatality risk to workers. Resulting in the following:

- Injury: $1.1 \times 10^{-3} \times 0.0417 \times 0.3 = 1.38 \times 10^{-5}$
- Fatality: $1.1 \times 10^{-3} \times 0.0417 \times 0.16 = 7.33 \times 10^{-6}$

As these are below the selected risk criteria in **Section 2.5**, the risks associated with a transformer bund fire are considered to be managed so far as is reasonably practicable and no further action is required.

6.4 Transformer Electrical Surge Protection Failure and Explosion

The initiating event for a transformer explosion is a transformer failure, for which the frequency was established in **Section 6.3** as 1.1×10^{-3} p.a. To determine the incidence of transformer failures resulting in an explosion the literature was reviewed.

Changlong Zhu et al conducted a peer review of several academically accepted methods of calculating ignition probability (Ref. [12]). The study concluded that for flammable liquids with flashpoints greater than 100°C, the probability of direct or delayed ignition was negligible. This data was taken from a number of well-established models including the BEVI Manual (Ref. [13]), the Purple Book (Ref. [14]), and studies conducted on the HMIRS database (Ref. [15]). Furthermore, an assessment of power transformer reliability conducted by Tenbohlen et al which analysed 112 major transformer failures throughout Europe indicates that most major failures do not result in any external effects (Ref. [16]). The Tenbohlen et al study indicates that only 2.7% of major transformer failures result in an explosion (Ref. [16]).

For the purpose of this assessment, it has been assumed that personnel will be in the proximity of the transformer for 1 hour per day, every day of the year for a total of 365 hours per year or 0.0417 per year. To estimate the probability of injury, the area of effect calculated in **Section 5.3** for the 14 kPa overpressure contoured was compared to the 21 kPa contour and the fatality probability scaled accordingly.

The chance of fatality due to a transformer explosion is then given by:

- Injury: $1.1 \text{x} 10^{-3} \times 0.027 \times 0.0417 \times 1.8 = 2.24 \times 10^{-6}$ p.a.
- Fatality: $1.1 \text{x} 10^{-3} \times 0.027 \times 0.0417 = 1.24 \times 10^{-6}$ p.a.

As these are below the selected risk criteria in **Section 2.5**, the risks associated with a transformer failure and explosion are considered to be managed so far as is reasonably practicable and no further action is required.

7.0 Conclusion and Mitigation Measures

7.1 Conclusion

A hazard identification for the Coppabella BESS Project was undertake to identify hazards which pose a risk of injury, fatality or incident propagation. From the hazards identified, three (3) were assessed further do identify magnitude and frequency of impact against the selected criteria which was developed in **Section 2**. The reviewed incidents included:

- Li-Ion battery fault, thermal runaway and fire.
- Transformer internal arcing, oil spill, ignition and bund fire.
- Transformer electrical surge protection failure and explosion.

The consequence and frequency analysis determined that the risk associated with these scenarios was controlled SFAIRP as the estimated frequency of events was below the selected criteria.

Notwithstanding the SFAIRP assessment, additional recommendations were made.

7.2 Recommendations

The following recommendation was made based on an assessment of current FM Global and NFPA requirement regarding BESS systems:

- Minimum spacing between adjacent BESS units shall be increased to 1.5 m in all directions.

8.0 References

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Appendix A

Hazard Identification Table

Appendix A

A1. Hazard Identification Table

Area/Operation	Hazard Cause	Hazard Consequence	Safeguards
Flammable dangerous goods storage	• Spill or flammable liquids or release of flammable gases	• Fire • Explosion	• All flammable liquids and gases stored in Dangerous Goods cabinets compliant with relevant standards (AS 1940:2017 (Ref. [5]). • Mostly stored in small containers. • Provision of firefighting equipment (extinguishers). • Exclusion zones for ignition sources provided around cabinets.
Battery Storage	• Failure of Li-ion battery protection systems	• Thermal runaway resulting in fire or explosion • Incident propagation through battery cells • Toxic smoke dispersion	• Batteries are tested by manufacturer prior to sale / installation • Overcharging and electrical circuit protection • Battery monitoring systems • Batteries composed of subcomponents (i.e. BBU, cells) reducing risk of substantial component failure • Batteries are not located in areas where damage could easily occur (i.e. within the fenced property) • Electrical systems designed per AS/NZS 3000:2018 (Ref. [17]) • UL9540A testing
Switch rooms, communications, etc.	• Arcing, overheating, sparking, etc. of electrical systems	• Ignition of processors and other combustible material within servers and subsequent fire	• Fires tend to smoulder rather than burn • Isolated location • Switch room separation from other sources of fire
Substation, PCUs	• Arcing within transformer, vaporisation of oil and rupture of oil reservoir	• Transformer oil spill into bund and bund fire	• Bunded • Isolated location

Area/Operation	Hazard Cause	Hazard Consequence	Safeguards
	• Power surge to transformers (e.g. from lightning)	• Major failure of surge protection in transformer, vapourisation of mineral oil, ignition and explosion	• Transformers have surge protection system to shut down upon detection of extreme energy input • Lightning protection to prevent lightning strikes impacting transformers • Control of ignition sources – no smoking / open flames around the transformers

Appendix B

Consequence Analysis

B1. Incidents Assessed in Detailed Consequence Analysis

The following incidents are assessed for consequence impacts.

- Li-ion battery fault, thermal runaway and fire
- Transformer internal arcing, oil spill, ignition and bund fire
- Transformer surge protection failure and explosion

Each incident has been assessed in the sections below.

B2. Radiant Heat Physical Impacts

Appendix Table B-1 provides noteworthy heat radiation values and the corresponding physical effects of an observer exposed to these values (Ref. [4]).

Appendix Table B-1: Heat Radiation and Associated Physical Impacts

Heat Radiation (kW/m^2)	Impact
35	• Cellulosic material will pilot ignite within one minute's exposure • Significant chance of a fatality for people exposed instantaneously
23	• Likely fatality for extended exposure and chance of a fatality for instantaneous exposure • Spontaneous ignition of wood after long exposure • Unprotected steel will reach thermal stress temperatures which can cause failure • Pressure vessel needs to be relieved or failure would occur
12.6	• Significant chance of a fatality for extended exposure. High chance of injury • Causes the temperature of wood to rise to a point where it can be ignited by a naked flame after long exposure • Thin steel with insulation on the side away from the fire may reach a thermal stress level high enough to cause structural failure
4.7	• Will cause pain in 15-20 seconds and injury after 30 seconds exposure (at least second degree burns will occur)
2.1	• Minimum to cause pain after 1 minute.
1.2	• Received from the sun at noon in summer.

B3. Explosion Overpressure Physical Impacts

Appendix Table B-2 provides noteworthy explosion overpressure values and the corresponding physical effects of an observer exposed to these values (Ref. [4]).

Appendix Table B-2: Explosion Overpressure and Associated Physical Impacts

Explosion overpressure (kPa)	Impact
70	• Threshold of lung damage. • 100% chance of fatality for a person in a building or in the open. • Complete demolition of houses.
35	• House uninhabitable. • Wagons and plants items overturned.

Explosion overpressure (kPa)	Impact
	• Threshold of eardrum damage. • 50% chance of fatality for a person in a building and 15% chance of fatality for a person in the open.
21	• Reinforced structures distort. • Storage tanks fail. • 20% chance of fatality to a person in a building.
14	• House uninhabitable and badly cracked.
7	• Damage to internal partitions and joinery but can be repaired. • Probability of injury is 10%. No fatality.
3.5	• 90% glass breakage • No fatality and very low probability of injury

B4. Gexcon - Effects

The modelling was prepared using Effects where appropriate, which is proprietary software owned by Gexcon and has been developed based upon the TNO Coloured books and updated based upon CFD modelling tests and physical verification experiments. The software can model a range of incidents including pool fires, flash fires, explosions, jet fires, toxic dispersions, warehouse smoke plumes, etc.

B5. Li-Ion Battery Fault, Thermal Runaway and Fire

The modelling for the BESS units was carried out using a manual calculation method to determine the radiant heat flux. This method relies on the view factor approach which has been outlined below:

B5.1 Radiant Heat Flux

The heat flux (Q) for the view factor model is given by **Equation B-1**.

$$Q = \tau E F$$ **Equation B-1**

Where;

- Q = heat flux (kW/m^2) at the target
- F = geometric view factor
- τ = transmissivity
- E = SEP (kW/m^2)

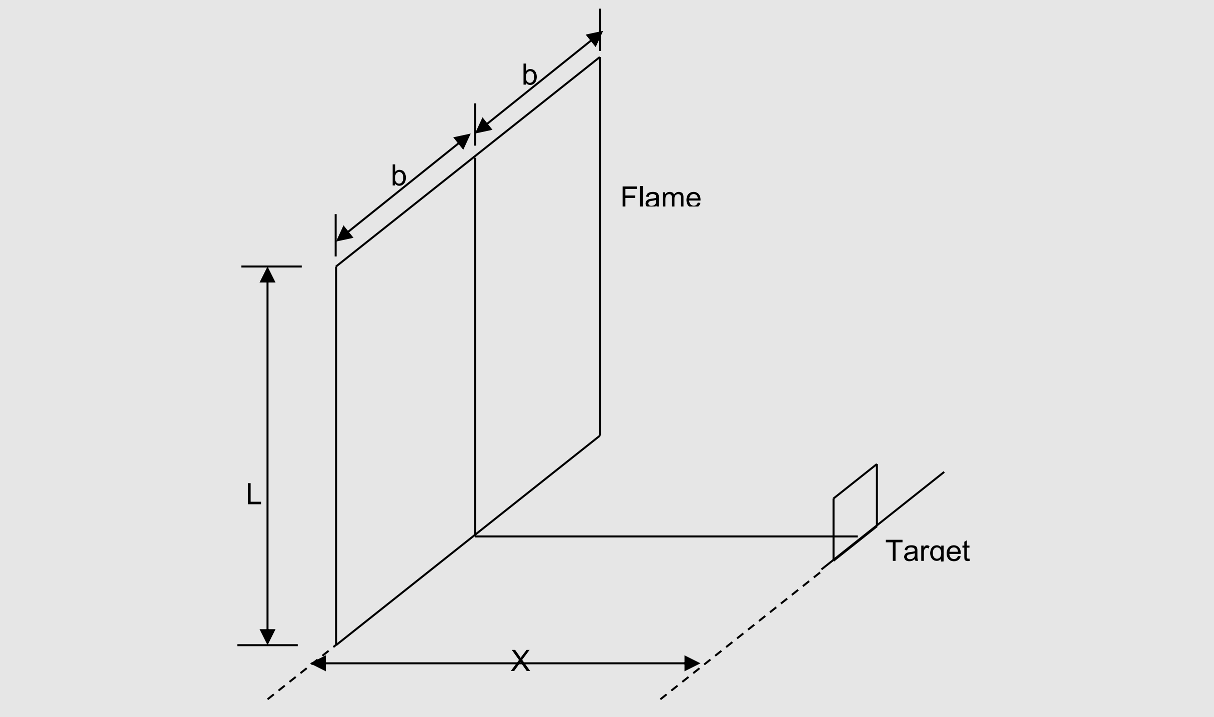
Each of the required inputs is determined in the sections following.

B5.2 View Factor

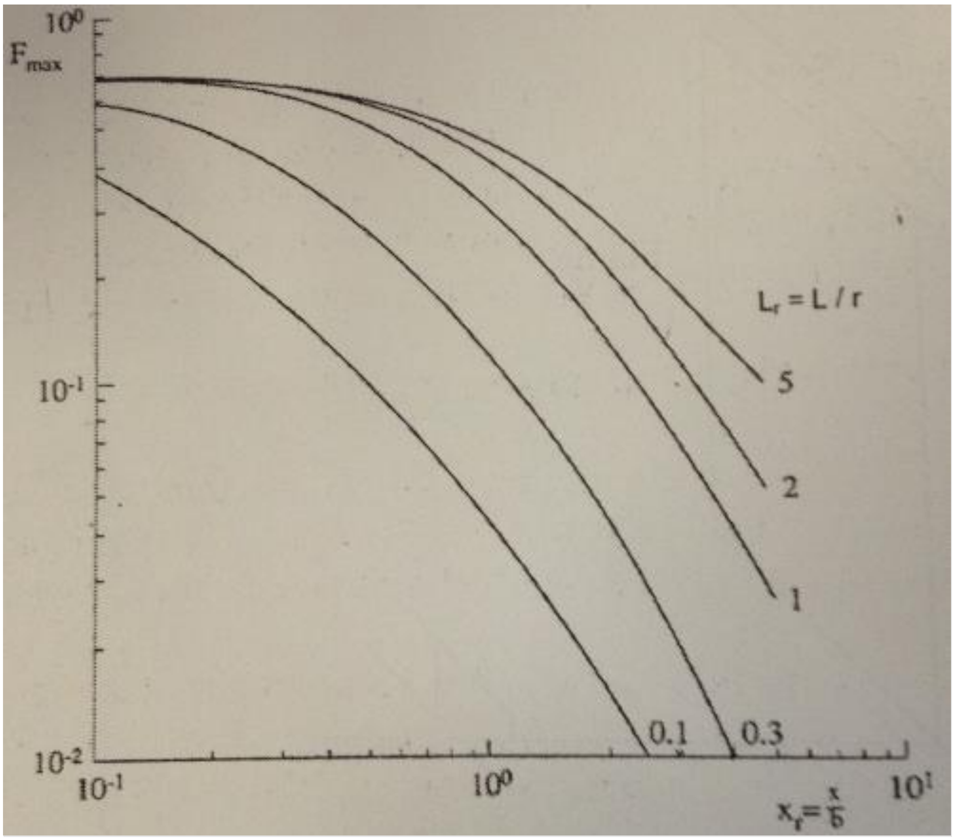
The view factor for a flat surface fire is estimated using the scenario shown in **Appendix Figure B-1** where the flame is the vertical surface of height L and length 2b with receiver located centrally and at a distance of X. Two dimensionless parameters are calculated, and the view factor read from **Appendix Figure B-2**. The dimensionless parameters are shown in **Equation B-2** and **Equation B-3**.

$$L_r = \frac{L}{b}$$ **Equation B-2**

$$X_r = \frac{X}{b}$$ **Equation B-3**



Appendix Figure B-1: Vertical Flame Geometry View Factor Geometry



Appendix Figure B-2: Vertical Flame Maximum View Factor (Ref. [18])

B5.3 Transmissivity

The transmissivity is estimated using **Equation B-4**.

$$\tau = 1.006 - 0.01171(\log_{10} X(H_2O) - 0.02368(\log_{10} X(H_2O))^2 - 0.03188(\log_{10} X(CO_2) + 0.001164(\log_{10} X(CO_2))^2 \qquad \textbf{Equation B-4}$$

Where:

- $X(H_2O) = (R_H \times L \times S_{mm} \times 2.88651 \times 10^2)/T$
- $X(CO_2) = L \times 273/T$

And;

- R_H = percentage relative humidity
- L = distance to target (m)
- S_{mm} = saturated water vapour pressure in mm mercury at temperature (at 200°C S_{mm} = 11549)
- T = temperature (473 K assumed air is heated to 200°C)

B5.4 Large Scale Fire Test Data and Heat Impacts

Currently, there are little established data to ascertain the radiant heat emitted from a BESS lithium fire. However, a Large Fire Scale Test (LFST) has been conducted on a BESS for a past project with similar capacity noting that the exact details of the test are under a non-disclosure agreement. The results from the test indicated that fire propagation is minimal and only the unit that was initiated to undergo thermal runaway had caught on fire. It was observed that the adjacent unit suffered only cosmetic damage; however, it remained operational throughout the duration of fire from the initiating unit. The flame characteristics from the unit observed are as follows:

- A maximum temperature of 675.3°C was recorded.
- Peak flame extended 1.8 m vertically and 1.2 m horizontally.
- Maximum heat flux is 48.72 kW/m^2 at a distance of 1.2 m.
- No adjacent units have initiated thermal runaway due to the fire event in the initiating unit; hence, a full BESS unit fire is not considered to be credible.

B5.6 View Factor Separation Distance Assessment

Based on the data provided, the radiant heat contour impacts can be determined by using the known maximum heat flux at the measured distance and the view factor methodology provided in previous sections. The maximum view factor can be derived using the graph in **Appendix Figure B-2** and the variables discerned from the LSFT summarised in **Section B.5.5**, which yielded an F_{max} of 0.5. **Equation B-1** can then output a SEP value of 95.6 kW/m^2 which will be used as the basis to calculate the distances of radiant heat impacts. This has been summarised in **Appendix Table B-3** below. Note that the assessment does not consider the effect of safeguards that are available in the BESS, such as the aerosol fire extinguishing device and primary firefighting equipment.

Appendix Table B-3: Radiant Heat Impact from a BESS Unit Fire

Heat Radiation (kW/m^2)	Distance (m)

48.72	1.2
35	1.3
23	2.0
12.6	2.8
4.7	4.2
3.0	5.9

B6. Transformer Internal arcing, Oil Spill, Ignition and Bund Fire

Transformers contain oil to provide cooling and insulation. If arcing occurs within the transformer, the oil will rapidly heat generating gases above their auto ignition point. The pressure of the gases may rupture the reservoir allowing oxygen to enter resulting in the gases auto igniting. The oil is released from the reservoir and is ignited by the burning gases.

The site will include two (2) transformers with 175 MVA capacity each for a total of 350 MVA. At the time of assessment, the design of the transformers and auxiliary structures (such as the bunds) is in progress. Therefore, based on previous experience the following assumptions have been made regarding the transformer and bunding.

- Transformer mineral oil volume (per transformer) – 95,000 L
- Required bund volume (110% of mineral oil volume) – 104,500 L
- Bund length – 12.5 m
- Bund width – 9 m
- Bund wall height – 0.95 m (rounded up to closest 0.05 m to achieve 110% containment capacity)
- Transformer oil to be used for assessment – Linoleic acid (see below)

The exact type of transformer oil to be used in unknown, for the purposes of this assessment, it has been assumed that a natural ester oil such as FR3 will be used which is composed of soybean oil, itself a mixture of triglycerides. These triglycerides are esters of fatty acids, predominantly linoleic acid. Linoleic acid has a flash point of approximately 200 °C, while the FR3 oil itself has a higher flash point of 300 ^{O}C. For the purposes of providing a conservative analysis, pure linoleic acid has been selected as the transformer oil. The input file used to model this scenario has been provided in **Appendix Figure B-3**.

Parameters	
Inputs	
Process Conditions	
Chemical name	LINOLEIC ACID (DIPPR)
Calculation Method	
Type of pool fire calculation	Two zone model Rew & Hulbert
Type of pool fire source	Instantaneous
Fraction combustion heat radiated (-)	0.35
Soot definition	Calculate/Default
Source Definition	
Total mass released (kg)	95000
Temperature of the pool (°C)	20
Process Dimensions	
Type of pool shape (pool fire)	Rectangular
Width of rectangle (m)	9
Length of rectangle (m)	12.5
Rotation rectangle (North = 0°) (deg)	0
Non burning area within pool (m2)	0
Height of the confined pool above ground level (m)	0
Include shielding at bottomside flame	No
Meteo Definition	
Wind speed at 10 m height (m/s)	1
Predefined wind direction	N
Environment	
Ambient temperature (°C)	20
Ambient pressure (kPa)	101.51
Ambient relative humidity (%)	60
Amount of CO2 in atmosphere (-)	0.0004

Appendix Figure B-3: BESS Fire Input File

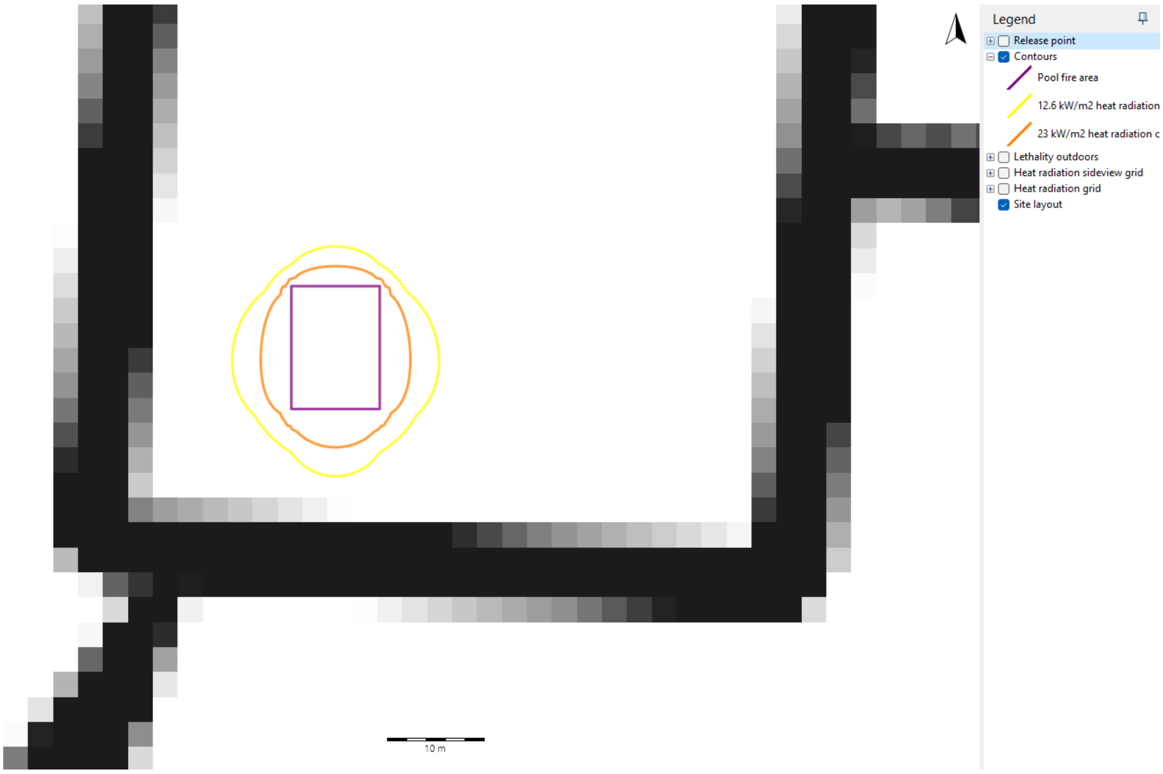
The above information was input into Effects which calculated the following outputs:

- Surface Emissive Power (SEP) – 65.8 kW/m^2
- Flame height – 10.0 m

The results of the analysis are shown in **Appendix Table B-4**, with the heat radiation contours depicted in **Appendix Figure B-4**. Note that these distances are measured from the centre of the bunded area

Appendix Table B-4: Heat Radiation Distances Transformer Bund Fire

Heat Radiation (KW/m^2)	Distance (m)
35	7
23	**10**
12.6	**13**
4.7	19
3.0	22



Appendix Figure B-4: Transformer Bund Fire Impact Contours

B7. Transformer Electrical Surge Protection Failure and Explosion

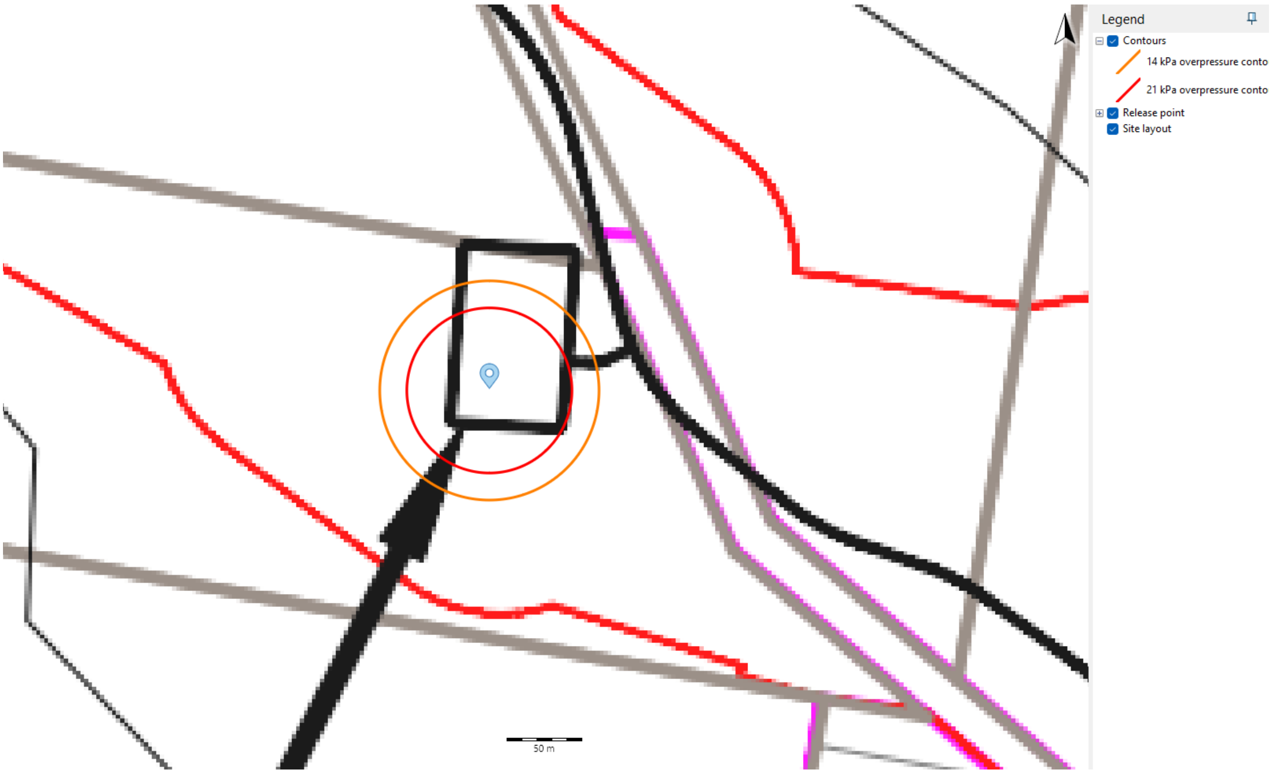
If a transformer is impacted by extreme electricity surge, such as in the event of a lightning strike, the oil within the transformer may ignite and explode resulting in substantial overpressure impacts. The following data was used to model the explosion in Effects:

- Weight – 1,000 kg (evaporated flammable mass within LEL and UEL).
- α – 0.05 for hydrocarbons (Ref. [19])

The above information was input into Gexcon Effects with the results of the explosion calculations provided in **Appendix Table B-5**, with the impact contours depicted in **Appendix Figure B-5**.

Appendix Table B-5: Overpressure from a Transformer Explosion

Overpressure (kPa)	Distance (m)
70	26
35	38
21	52
14	70
7	121



Appendix Figure B-5: Transformer Explosion Over Pressure Contours

Appendix C

Estimation of BESS Fire Frequency

C1. Introduction

A literature review to identify the frequency with which BESS fires occur did not yield any definitive results nor are there any databases which were identified containing this information. Subsequently, it is necessary to undertake a review of the BESS industry and fire incidents to estimate the frequency with which BESS units fail resulting in fire.

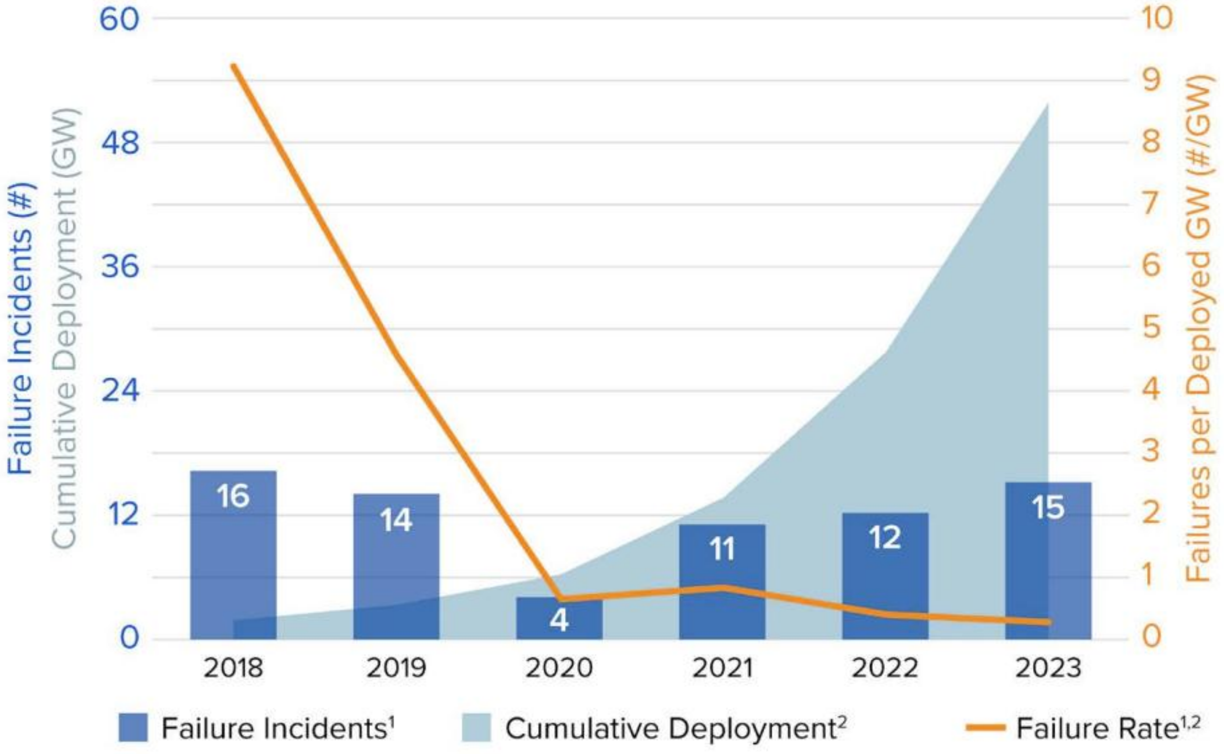
C2. Methodology

It has been proposed to identify the failure rate of BESS units on an installed capacity basis and identify how many BESS fires have occurred globally. This failure rate could then be applied to the installed capacity at a particular site as the basis for undertaking a quantitative assessment of fatality risk.

C3. BESS Fire Frequency Estimation

The Electric Power Research Institute (EPRI) previously developed a BESS Failure Incident Database to track incidents associated with BESS units in the context of root cause and failed element. In 2024, EPRI released the report *Insights from EPRI's Battery Energy Storage Systems (BESS) Failure Incident Database* (Ref. [20]) which summarised key takeaways from the database.

The report showed that while the cumulative deployment of BESS across the world was rapidly increasing, the number of BESS incidents significantly decreased between 2018 – 2020 and was not increasing at a rate relative to the deployment of the technology. As the technology was becoming more common, the industry was learning how to design, install and operate the BESS infrastructure more safely. These trends are shown in **Appendix Figure C-1** which has been extracted from the EPRI report.



Appendix Figure C-1: Global Grid-Scale BESS Deployment and Failure Statistics

Based on the most recent information, in 2023 there was a total cumulative deployment of BESS of 51 GW and 15 BESS incidents. Consistent information detailing the size of the battery storages was unable to be identified; hence, it has been assumed that the 51 GW of installed capacity represents grid scale deployment requiring 4 hours of storage resulting in total installed capacity of 204 GWh.

Therefore, based on 15 BESS fires per 204 GWh of installed capacity or a rate of 0.074 per GWh of total installed capacity. As this is the rate identified in a single year, the failure rate to be used is 7.4 x 10^{-2} per GWh/y. It should be noted that as this is based on data from two years ago, it is expected that this rate is highly conservative as battery technologies have improved in design, chemistry, safety features and through both national and international regulations.

APPENDIX G: BUSHFIRE ASSESSMENT

Bush Fire Assessment Report

Coppabella Wind Farm & Battery Energy Storage System

Prepared for Goldwind Australia, acting on behalf of Coppabella Wind Farm Pty Ltd

Date: 23 September 2025

REF: W25058

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Bush Fire Assessment Report

Coppabella Wind Farm & Battery Energy Storage System

Report Author:	Nicole van Dorst B. App. Sc., Grad. Dip., BPAD-L3 23610	
Mapping by:	Peter Tolley (B. Biotech., M. SciTech (Env. Sci), Grad. Dip. (Spatial Info.))	
File:	W25058	Version 1.0 Final
Performance-based assessment	Yes – a performance-based approach was undertaken in areas exhibiting slopes of >20 degrees to determine minimum setbacks to avoid flame contact.	

ABN: 52 280 080 023

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BPAD
Bushfire Planning & Design
Accredited Practitioner
Level 3

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EXECUTIVE SUMMARY

The Coppabella Wind Farm (CWF) (formerly known as Yass Valley Wind Farm) is located approximately 30 kilometres (km) west of the township of Yass within the Hilltops and Yass Valley Local Government Areas (LGAs). The Coppabella Wind Farm (CWF) was approved in 2016 as State Significant Development (SSD) 6698 under the *Environmental Planning and Assessment Act 1979* (EP&A Act). It was subsequently modified in 2018, allowing for the construction, operation and decommissioning of up to 75 wind turbines to a maximum tip height of 171m.

Coppabella Wind Farm Pty Ltd (CPWPL) is now seeking to enhance the project by incorporating a Battery Energy Storage System (BESS) into the Project.

The approved CWF development included a wind farm of 75 wind turbines, of which six have now been removed from the project, and only 69 comprise the currently proposed project. Associated facilities remain generally consistent with the approved project and include access tracks, a 33kV internal electrical network, a 132kV grid connection, permanent meteorological (met) masts, operation and maintenance facilities, and temporary construction infrastructure.

In summary, the project modifications proposed include:

- Transport of containerised BESS units to the site from Port Kembla, utilising the same route as previously identified for the Project.
- BESS units are placed at each wind turbine within the areas to be cleared for the turbine hardstand.
- Connection of BESS to each of the turbines via underground cables beneath/adjacent to the hardstand.
- Operations, maintenance and decommissioning of BESS aligned with the operational timeframe of the CWF.

To support the modification application, this bush fire assessment report has been prepared in accordance with *Planning for Bush Fire Protection 2019* (PBP). Section 8.3.9 of PBP outlines the requirements for hazardous industries. Whilst PBP does not specifically identify BESS as a hazardous industry, it does require developments of this nature to consider their ability to start bush fires and their susceptibility to bush fire impact.

This assessment has found that bush fires can potentially affect the project from surrounding grassland and woodland vegetation located external to the approved construction footprint. The following combination of bush fire mitigation measures will be used to address the risk of bush fire caused by the project and demonstrate compliance with the aims and objectives of PBP 2019.

- Provision for and formalisation of APZs for the proposed BESS infrastructure in accordance with Appendix 4 of *PBP 2019*.
- Location of BESS infrastructure to avoid potential flame contact.
- Provision of access and water supply in compliance with *PBP 2019*.
- Maintenance and housing of infrastructure so that it will not create a source of ignition to the surrounding vegetation.
- Preparation of an updated Emergency Response Plan (inclusive of Section 4.11 Bushfire Risk Management) in the existing Coppabella Wind Farm Environmental Management Strategy to incorporate the BESS; and
- Adoption of the recommendations outlined in the Preliminary Hazard Analysis prepared by Riskcon Engineering (2025).

GLOSSARY

AC	Alternating current
APZ	Asset Protection Zone
AS1596	Australian Standard – The storage and handling of LP Gas
AS3745	Australian Standard – Planning for emergencies in facilities
AS3959	Australian Standard – Construction of buildings in bushfire-prone areas 2018
BAL	Bushire Attack Level
BPL	Bush fire prone land
BCA	Building Code of Australia
BESS	Battery energy storage system
BPM	Bush fire protection measures
BSA	Bush Fire Safety Authority
CFA	Country Fire Authority
CWF	Coppabella Wind Farm
CWFPL	Coppabella Wind Farm Pty Ltd
DA	Development application
DCP	Development Control Plan
DPHI	Department of Planning, Housing and Infrastructure
EIS	Environmental impact statement
EP&A Act	Environmental Planning and Assessment Act 1979
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
FFDI	Forest Fire Danger Index
GFDI	Grassland Fire Danger Index
GW	Gigawatts
ha	Hectares
IPA	Inner Protection Area
km	kilometre
kV	kilovolts
LEP	Local Environmental Plan
LGA	Local Government Area
m	metres

MW	megawatt
MET mast	meteorological monitoring masts
NCC	National Construction Code
NEM	National Energy Market
NSW	New South Wales
NPWS	National Parks and Wildlife Service
OPA	Outer Protection Area
O&M building	Operations & maintenance building
PCT	Plant Community Type
PHA	Preliminary Hazard Analysis
PBP 2019	Planning for Bush Fire Protection 2019
REZ	Renewable energy zone
RF Act	Rural Fires Act 1997
RFS	Rural Fire Service
SEARs	Secretary’s Environmental Assessment Requirements
SSD	State Significant Development
SWS	Static water supply
SVTM	State Vegetation Type Map
WTG	Wind turbine generator

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TABLES

FIGURES

1. INTRODUCTION

The Coppabella Wind Farm (CWF) was approved in 2016 as a State Significant Development (SSD) 6698 under the *Environmental Planning and Assessment Act 1979* (EP&A Act). It was subsequently modified in 2018, allowing for the construction, operation and decommissioning of up to 75 wind turbines to a maximum tip height of 171m.

Coppabella Wind Farm Pty Ltd (CPWPL) is now seeking to enhance the project through the inclusion of a Battery Energy Storage System (BESS), involving the installation of BESS units at each turbine footing, with an energy storage capacity of 3.34 mWh for each BESS container.

The modification application is being lodged under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

1.1 Purpose of this report

This bush fire assessment report forms part of the modification application for the project. It has been prepared in consideration of the conditions of consent as modified by the Minister for Planning dated 10 December 2018.

Table 1-1 – Conditions of consent

Conditions of consent		Section addressed
Condition 41. The applicant shall:	Ensure that the development provides for asset protection in accordance with the RFS's Planning for Bush Fire Protection 2006 (or equivalent)	Section 4.7 & Section 5.2
	Ensure that the development is suitably equipped to respond to fires on site	Section 5
	Assist the RFS and emergency services as much as practicable if there is a fire in the vicinity of the site	Section 5
	Develop procedures to manage potential fire on site, in consultation with the RFS.	Section 5.1 & 5.2

1.2 Aims of the assessment

The aims of the bush fire assessment report are to:

- Provide recommendations for the protection of human life and to minimise impacts on property from the threat of bush fire.
- Address the bush fire risk in accordance with *PBP 2019*, through bush fire hazard identification and assessment, including a bush fire hazard site and landscape assessment.
- Reduce the occurrence and consequences of bush fires through risk-based design: and
- Enable safe and effective emergency response through the provision of fire protection systems, including:
    - safe access in and around the facility including firefighting infrastructure such as water supply,
    - management of vegetation,
    - implementation and maintenance of building construction standards,
    - prevention of fire ignition on site and prevention of fire spread to the adjoining land.

This report has been prepared following guidance from the NSW RFS document PBP 2019 and bush fire design guidelines developed for renewable energy generating systems and BESS facilities.

1.3 Referenced documents & information collation

Assessment of the bush fire risk and measures required to mitigate this risk was performed through a desktop assessment. Documents reviewed for the preparation of this report include the following:

- DGRs Proposed Yass Wind Farm, application reference 08_0246 dated 21/01/2009.
- Development Consent for Yass Valley Wind Farm issued by Minister for Planning, ref: SSD 6698, dated 10 December 2016
- Environmental Impact Statement prepared by EGH, dated 2009

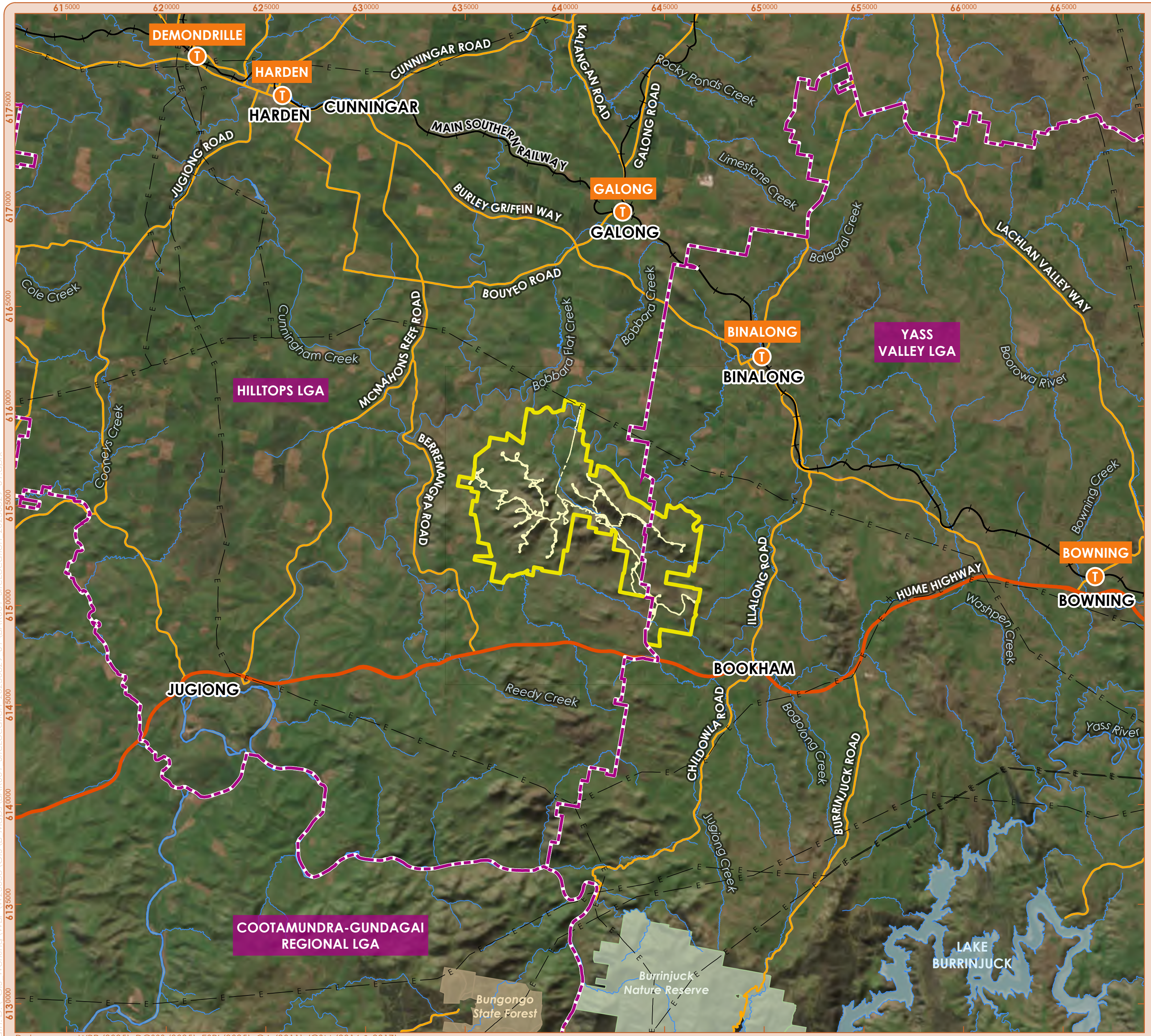
- Preliminary Hazard Analysis Coppabella Wind Farm BESS prepared by Riskcon engineering, 19/06/2025
- Bush Fire Risk Management Plan prepared by the Southern Tablelands Bush Fire Risk Management Committee, 2019.
- Bush Fire Risk Management Plan prepared by the South West Slopes Bush Fire Risk Management Committee, 2023.
- Vegetation mapping by NGH Environmental.
- Planning for Bush Fire Protection 2019 (PBP), NSW RFS.
- Comprehensive Vegetation Fuel Loads, March 2019, NSW RFS.
- Design Guidelines and Model Requirements Renewable Energy Facilities v4, August 2023 by the Country Fire Authority (CFA).
- Fire Safety Studies for Battery Energy Storage Systems, Version 1, June 2025, CFA
- Australian Standard 3959 Construction of buildings in bushfire-prone areas (2018).

1.4 Project location

The Coppabella Wind Farm (CWF) (formerly known as Yass Valley Wind Farm) is located approximately 30 kilometres (km) west of the township of Yass within the Hilltops and Yass Valley Local Government Areas (LGAs). Refer to Figure 1-1.

The CWF covers an area of dimensions 12 kilometres west to east and 10 kilometres north to south along the Coppabella Hills near the towns of Bookham and Binalong.

FIGURE 1.1 – SITE LOCATION



Data source: WBP (2025); DCSSS (2025); ESRI (2025); GA (2011); ICSM (2014 & 2017)

Path: D:_GIS_Working\WBP\W25058\GIS\B_Maps\BAR001_SiteLocation_20250829_01.aprx

LEGEND

▭	Site boundary
🟨	Construction footprint

Existing environment

T	Railway station
—E—	Electricity transmission line
—+—	Rail
—	Major road
—	Minor road
—	Named watercourse
🟦	Named waterbody
🟫	State forest
🟩	National park/reserve
▭	Local government area

Coppabella Wind Farm

29/08/2025 (v1) 1:275,000 @A4 GDA2020 MGA Zone 55

0 2.5 5 km

Disclaimer: mapping is indicative only and the data shown has an inherent level of inaccuracy that is dependent on the data source. The location of all mapped features and boundaries should be confirmed by a registered surveyor.

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2. PROJECT DESCRIPTION

2.1 Overview

The CWF was approved in 2016 and was subsequently modified in 2018, allowing for the construction, operation and decommissioning of up to 75 wind turbines to a maximum tip height of 171m.

The approved CWF development included a wind farm of 75 wind turbines, of which six have now been removed from the project, and only 69 comprise the currently proposed project. Associated facilities remain generally consistent with the approved project and include access tracks, a 33kV internal electrical network, a 132kV grid connection, permanent meteorological (met) masts, operation and maintenance facilities, and temporary construction infrastructure.

CPWPL is now seeking to enhance the project through the inclusion of a BESS into the Project. BESS are increasingly forming an integral part of renewable energy projects to mitigate the intermittency of supply regimes that are dependent entirely on wind or solar resources. The proposed BESS units will be DC-Coupled BESS, which will be co-located at each of the turbines, to provide the benefit of storing the excess energy produced by the turbine when winds are favourable, but grid demand is low and releasing to the National Energy Market (NEM) when conditions are more favourable due to greater market demand.

In summary, the project modifications proposed include:

- Transport of containerised BESS units to the site from Port Kembla, utilising the same route as previously identified for the Project.
- BESS units are placed at each wind turbine within the areas to be cleared for the turbine hardstand.
- Connection of BESS to each of the turbines via underground cables beneath/adjacent to the hardstand.

Operations, maintenance and decommissioning of BESS are aligned with the operational timeframe of the CWF

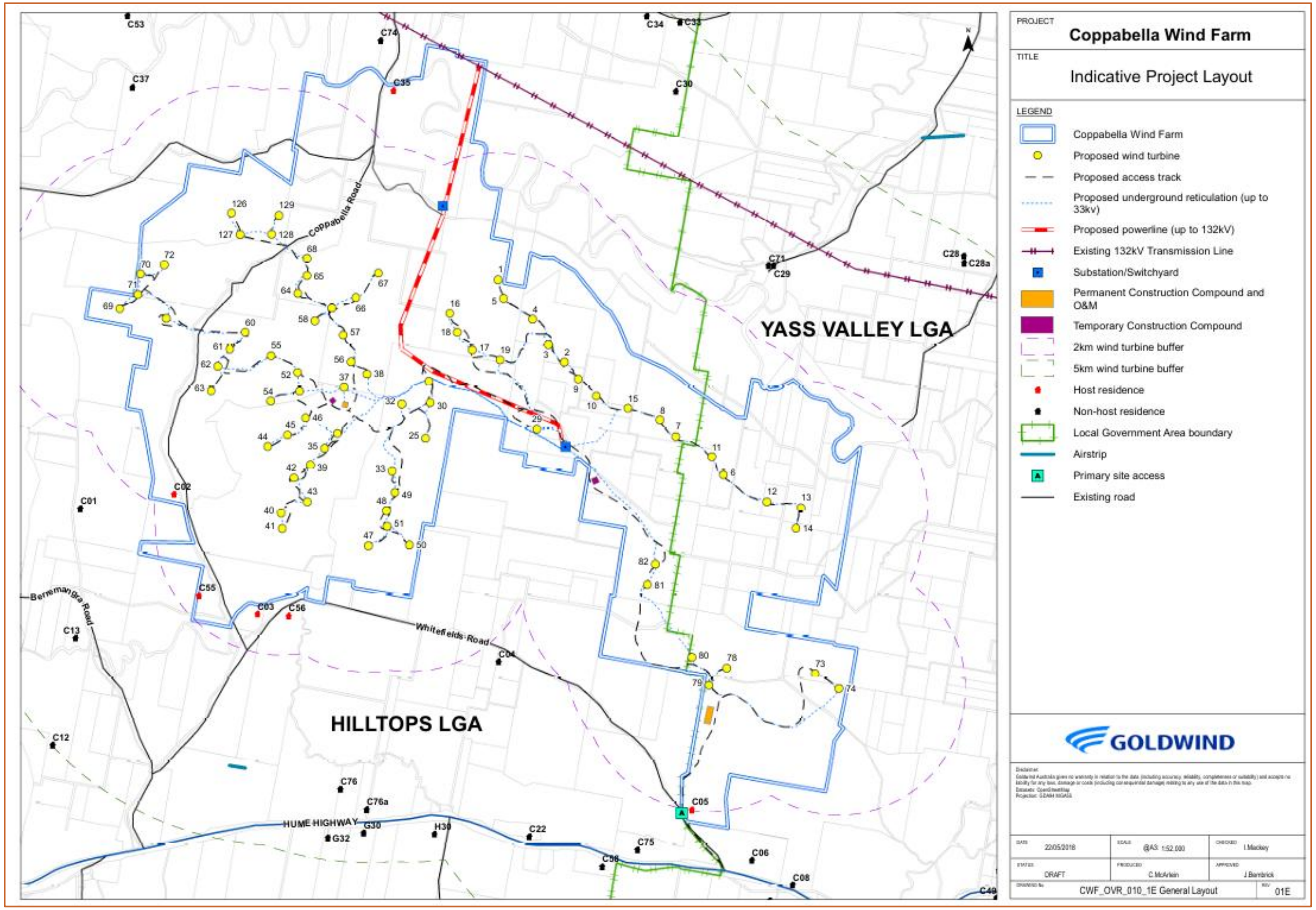


Figure 2-1 – Project layout

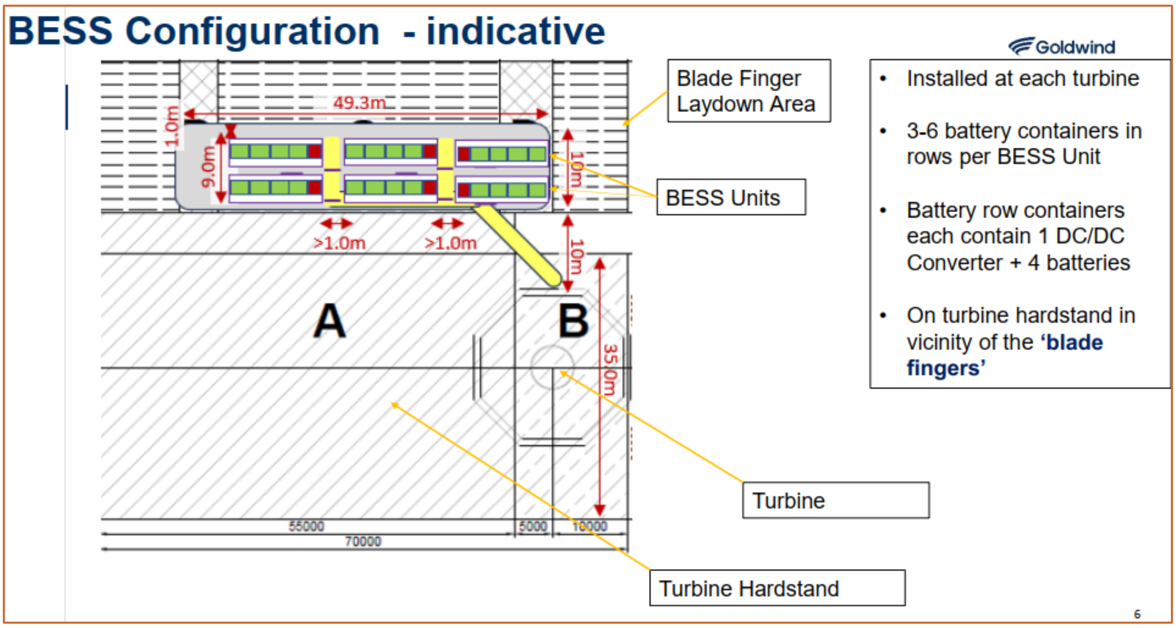
2.2 BESS

The BESS unit comprises up to six 40 ft (12.2 m) open-framed containers, which are pre-fitted and wired before delivery to the site. Each of the BESS units will be placed on the hardstand within the area either previously cleared for the blade laydown or on the turbine footing. Each of the BESS Container Units will consist of the following:

- Up to six Goldblock L700 battery cabinets and one DC-DC converter;
- Each Goldblock is composed of 4 battery packs, which together have a capacity of up to 836 kWh;
- The energy storage capacity of each BESS container is 3.34 MWh.

The specific location of each BESS has not been determined at this stage. Where there is no blade finger the BESS will be located on the hardstand at an appropriate distance (i.e. > 10m) from the wind turbine generator (WTG).

The BESS and the associated asset protection zones (APZs) will be contained within the construction footprint, which will provide the necessary flexibility for further detailed design (micro-siting). As a minimum it is recommended that BESS footprints are located too avoid flame zone (FZ) contact (refer Figures 4-3).



BESS Configuration - indicative

- Installed at each turbine
- 3-6 battery containers in rows per BESS Unit
- Battery row containers each contain 1 DC/DC Converter + 4 batteries
- On turbine hardstand in vicinity of the **'blade fingers'**

Figure 2-2 – Indicative BESS layout

2.3 Wind turbines

The approved CWF development included a wind farm of 75 wind turbines, of which six have now been removed from the project, and only 69 comprise the currently proposed project.

Components of a typical WTG are illustrated in Photo 1. Each WTG will have a foundation not exceeding 75 metres in length and 40 metres in width with a minimum area of 3,000 square metres, though the dimensions may vary across the site. Further details on the design, coordinates and specifications of the WTGs are provided in the Modification Report (Mod 1) that formed part of the approval.

Figure 3-15 Typical Components of a WTG (indicative, not to scale)

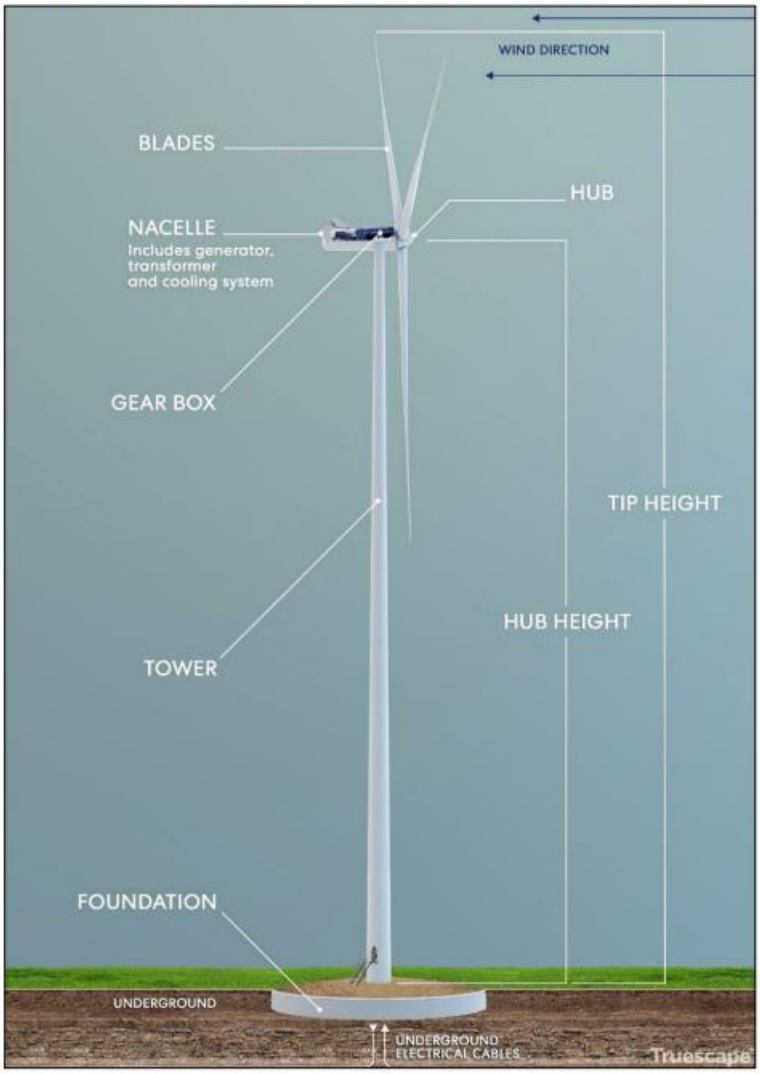


Photo 1: Typical components of a WTG

2.4 Construction phases

The approved Project includes the construction of the following key infrastructure components within the development corridor:

- 69 wind turbines (75 approved for construction however six have since been deleted) with an approximate capacity of 270 megawatts (MW).
- One 33 kilovolts (kV)/132 kV substation.
- Underground cabling and overhead electrical cabling.
- Connection to the Transgrid transmission network would be from the northern section of the Project Area where the existing Yass-Wagga Wagga 132 kV transmission line passes through the site.
- An Operations and Maintenance facility.
- Private access tracks.

Proposed construction of the BESS is forecast to take between 6 and 9 months, with a peak workforce of an additional 10 people. The construction activities would be primarily carried out during standard construction hours, as defined by the NSW Environment Protection Authority's (EPA) Draft Construction Noise Guideline (2020), being:

- 7am to 6pm, Monday to Friday
- 8am to 1pm, Saturdays
- No work on Sundays or public holidays.

2.5 Operations

The following activities are expected to be associated with the operation and maintenance of the approved Project:

- Generation of electricity via the operation of 69 wind turbines available to operate 24 hours per day, seven days per week all year round and generate electricity whenever sufficient wind is available for operation.
- Maintenance of mechanical, electrical and structural components of wind turbines (including nacelles, blades and towers), kiosk transformers and cooling systems.
- Scheduled or unscheduled outage maintenance for individual wind turbines or the wind farm as a whole.

- Maintenance of the on-site substation, 132 kV transmission line from the substation to the TransGrid 132 kV transmission line to the north of the site, including maintenance of safe clearances and of other electrical infrastructure (e.g. 33 kV cables and infrastructure).
- Use of the Operations and Maintenance (O&M) facilities including, office, amenities, storage facilities and workshop.
- Maintenance of access roads, drainage and other civil infrastructure.
- Waste management.
- Land management, maintenance of rehabilitation and weed control.

The BESS component will be operated remotely. The BESS could undergo up to four complete cycles of charging and discharging per day and could operate at any time of day or night, seven days a week.

Maintenance activities include the maintenance of plant and equipment, as well as land management. Maintenance of plant and equipment will consist of both preventative and corrective maintenance, including the replacement of BESS components from time to time, which will be undertaken by staff or contractors. Land management will include APZ maintenance, weed, pest and landscaping management which will be undertaken by local contractors on a regular basis.

2.6 Decommissioning

The Project is expected to operate for at least 25 years from the completion of construction. At the end of the wind farm's operational life, the infrastructure will be either upgraded or decommissioned.

3. LEGISLATIVE AND POLICY REQUIREMENTS

3.1 Environmental Planning and Assessment Act 1979

The project was approved as an SSD under Part 4, section 4.12(8) of the Environmental Planning and Assessment Act, 1979 (*EP&A Act)*.

The modification application is being lodged under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

3.1.1 Bush Fire Prone Land Mapping

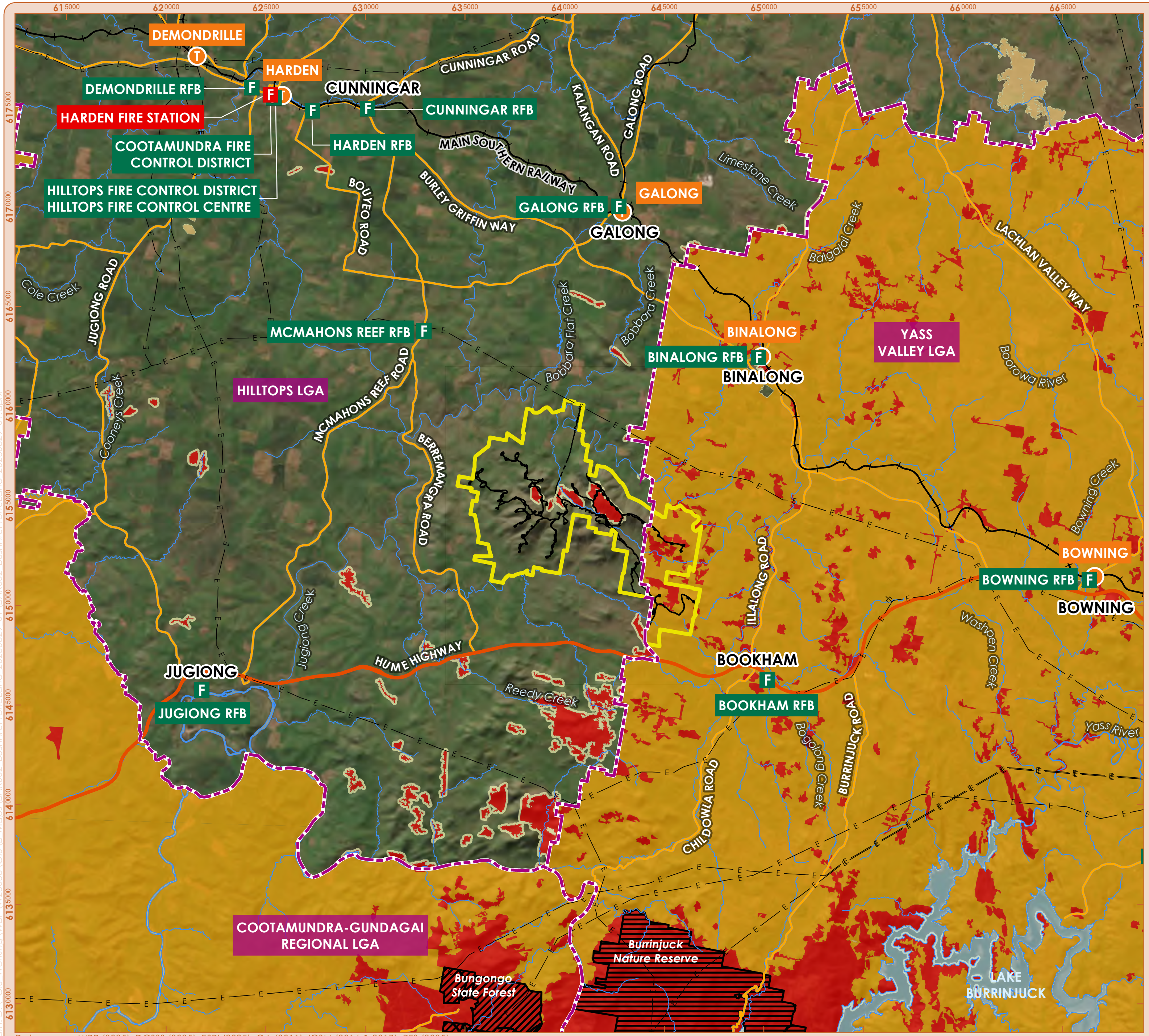
The *EP&A Act 1979* requires that any development on bush fire prone land (BPL) for any purpose complies with PBP 2019. Councils maintain and update BPL maps according to the NSW RFS *Guide for Bush Fire Prone Land Mapping,* and then they are certified by the NSW RFS. BPL maps are based on the vegetation types present, which are classified into one of four categories, as follows:

- Category 1: which includes areas of forest, woodland, heath, forested wetland and timber plantation. Highest risk category.
- Category 2: rainforests and "lower risk vegetation parcels". These parcels contain remnant vegetation that is limited in its connectivity to larger areas and land parcels with land management practices that actively reduce bush fire risk (and are subject to a bush fire plan or similar).
- Category 3: which includes grasslands, freshwater wetlands, semi-arid woodlands, alpine complex and arid shrublands. Moderate risk category; and
- Exclusion: Areas of vegetation less than 1 ha and greater than 100 m separation from category 1, 2 or 3 vegetation; small patches or strips of remnant vegetation; managed grasslands; agricultural cropland; gardens; and mangroves are not mapped as bush fire prone.

BPL is defined as land with category 1, 2 or 3 vegetation and land within 100 m of category 1 or within 30 m of category 2 or 3 vegetation.

As depicted in Figure 3-1, the project area is partially identified as bushfire-prone land.

FIGURE 3.1 – BUSH FIRE PRONE LAND MAP



Data source: WBP (2025); DCSSS (2025); ESRI (2025); GA (2011); ICSM (2014 & 2017); RFS (2025)

Path: D:_GIS_Working\WBP\W25058\GIS\B_Maps\BAR002_BushFireProneLand_20250829_01\BAR002_BushFireProneLand_20250829_01.aprx

LEGEND

🟨 Site boundary

⬛ Construction footprint

Existing environment

Ⓣ Railway station

🟥 Fire and rescue

🟩 Rural fire service

—E— Electricity transmission line

—+— Rail

— Major road

— Minor road

— Named watercourse

☐ Named waterbody

▨ State forest

▤ National park/reserve

▭ Local government area

Bush fire prone land (RFS, 2025)

🟥 Vegetation Category 1 (highest risk)

🟧 Vegetation Category 3 (medium risk)

🟨 Vegetation Category 2 (lowest risk)

☐ Vegetation Buffer

Coppabella Wind Farm

01/09/2025 (v1)   1:275,000 @A4   GDA2020 MGA Zone 55

0   2.5   5 km

Disclaimer: mapping is indicative only and the data shown has an inherent level of inaccuracy that is dependent on the data source. The location of all mapped features and boundaries should be confirmed by a registered surveyor.

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3.2 Rural Fires Act 1997

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

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

In relation to the management of bush fire fuels on public and private lands within NSW, sections 63(1) and 63(2) of the *Rural Fires Act 1997* require public authorities and owners/occupiers of land to take all practicable steps to prevent the occurrence of bush fires on their land, and to minimize the danger of the spread of bush fires.

3.3 Planning for Bush Fire Protection 2019

The NSW RFS document PBP 2019 provides and explains the legal requirements, framework and protection measures needed for all types of development on bush fire prone land in NSW.

Section 8.3.9 of PBP 2019 provides guidelines for hazardous industry. Whilst this section does not specifically include BESS infrastructure, this type of development should be considered for its ability to start a bush fire as well as its susceptibility to bush fire impacts.

Section 8.3.5 of PBP 2019 states that specific consideration should be provided for wind farms with adequate clearance to combustible vegetation, firefighting access and water supply. The wind farm component of the project has been approved, with the following measures incorporated into the Coppabella Wind Farm Environmental Strategy:

- A minimum 10m APZ for structures and associated buildings/infrastructure (as outlined in Section 4.11 of the document).
- Emergency response plan to identify relevant risks and mitigation measures associated with the construction and operation of the wind farm.

In addition to the above, essential equipment should be designed and housed in such a way as to minimise the impact of bush fires on the infrastructure. It should be designed and maintained so that it will not create a source of ignition to the surrounding vegetation and grassland.

3.4 Other guidelines relevant to renewable energy projects

Victoria's Country Fire Authority (CFA), in conjunction with industry and regulatory authorities, has developed the *Design Guidelines and Model Requirements for Renewable Energy Facilities v4* (August 2023) to support designers and operators of facilities to consider and mitigate fire risk. This includes fires that originate within the facility itself, as well as bush fire impacts on the site from external factors.

While these were developed in a Victorian context, CFA expertise and guidelines have been sought to support fire safety at renewable energy facilities across Australia and internationally. The CFA guidance represents the current leading practice and has been utilised within this document as it builds upon the principles and knowledge from fires at large-scale renewable energy facilities within Australia, including the Victoria Big Battery site in 2021.

In addition, *The Battery Energy Storage Systems Guidance Report: Australian Energy Council Limited,* dated 24th March 2023 by GHD, has also been referenced within the report as it provides a guide and resource highlighting key areas for consideration for grid-scale BESS facilities, with a focus on lithium-ion and vanadium chemistries.

4. BUSH FIRE RISK FACTORS

The following assessment employs the methodology outlined in PBP 2019 to provide a focused assessment that qualifies the risk by evaluating hazardous vegetation and the effective slope within 140m of the project, as well as conducting a review of current bushfire management controls, fire history, and potential fire behaviour.

4.1 Current bush fire management controls

The Coppabella Wind Farm (CWF) was approved in 2016 and subsequently modified in 2018. Condition 41 of the 2018 consolidated development consent states that the applicant shall ensure that the development provides for

- asset protection zones in accordance with the RFS's *Planning for Bushfire Protection 2006* (or equivalent),
- suitably equipped to respond to any fires on site
- assist the RFS and emergency services as much as practicable if there is a fire in the vicinity of the site: and
- develop procedures to manage potential fires on site, in consultation with the RFS

In response to these conditions, bush fire mitigation measures are outlined in Section 4.11 of the Coppabella Wind Farm Environmental Management Strategy, with the project's emergency response plan (ERP) provided as an appendix to that document. In summary, the following mitigation measures have been applied to the approved project

- The gravel-capped access tracks and hardstands around turbines and other project infrastructure provide for effective asset protection buffers
- Asset protection buffers are to be maintained during operations around key project infrastructure (e.g. around operations compound/s, turbines, substation, overhead transmission line)
- Provision of firefighting equipment, guidelines for hot works
- Identified static water supplies (e.g. farm dams)
- Maintenance of access and egress tracks
- Emergency management response drills, inductions and training

In addition to the above, the Southern Tablelands Bush Fire Risk Management Plan and South West Slopes Bush Fire Risk Management Plan also outlines the current local government-wide controls to reduce the overall bush fire risk in the area:

- Ensuring developments in bush fire prone land comply with PBP.
- Using LEPs to exclude development in extreme bush fire risk areas or where bush fire protection measures cannot be incorporated.
- Varying the standard bush fire danger period where required; and
- The declaration and management of burning restrictions, such as Total Fire Bans, Restricted Burning Times, Prohibited Burning Times and Harvest and Vehicle Movement Bans to reduce ignition risk.

Fire response services also serve the area. The nearest volunteer fire brigades are Bookham Rural Fire Brigade, located approximately 7 km to the southeast, and Binalong Rural Fire Brigade, approximately 13 km to the northeast of the project area.

4.2 Climate and bush fire season

The typical/average climate in the Southern Tablelands BFMC area is temperate to cool, characterised by warm to hot summers and cool winters, with peak rainfall generally occurring during winter and spring. The region experiences yearly temperatures from about -5 degrees Celsius (in the winter months of June, July and August) to 35-37 degrees Celsius in the summer months (December, January and February). However, colder and higher temperatures are not uncommon.

As the area is both extensive and diverse, rainfall varies considerably. Some areas experience average rainfall of approximately 800mm to 1000mm per year. In contrast, some areas experience a lower average annual rainfall (e.g. 600mm in the north of the Upper Lachlan Shire towards the Abercrombie River). Generally, it can be stated that rainfall is both unreliable and at its lowest during summer months, resulting in substantial curing of pastoral and grazing land, which covers a large proportion of the area.

Prevailing weather conditions associated with the bush fire season in the Southern Tablelands BFMC area are north/north-westerly winds. However, in late afternoons, southerly and easterly winds may occur for short periods. Lightning strikes during storms occur frequently in the bush fire season. The bush fire season generally runs from October to March/April.

As outlined by the Climate Council, climate change will lead to a longer fire season, drier vegetation and fuel, hotter temperatures and more lighting events which will lead to an increase in fire risk and more dangerous bush fires.

The project is expected to have a minimum operational life of 25 years and therefore should be designed to withstand bush fire events into the late 2040s.

4.3 Fire history & ignition

The Southern Tablelands BFMC area has, on average, 265 bush fires per year, of which five could be considered to be large fires. Major fires occur sporadically, with about 3 in a 5-year period. The frequency of significant or major fires has varied between the districts. Generally, Yass Valley has a 2.5-year cycle of major fires.

The main sources of ignition in the Southern Tablelands BFMC area are:

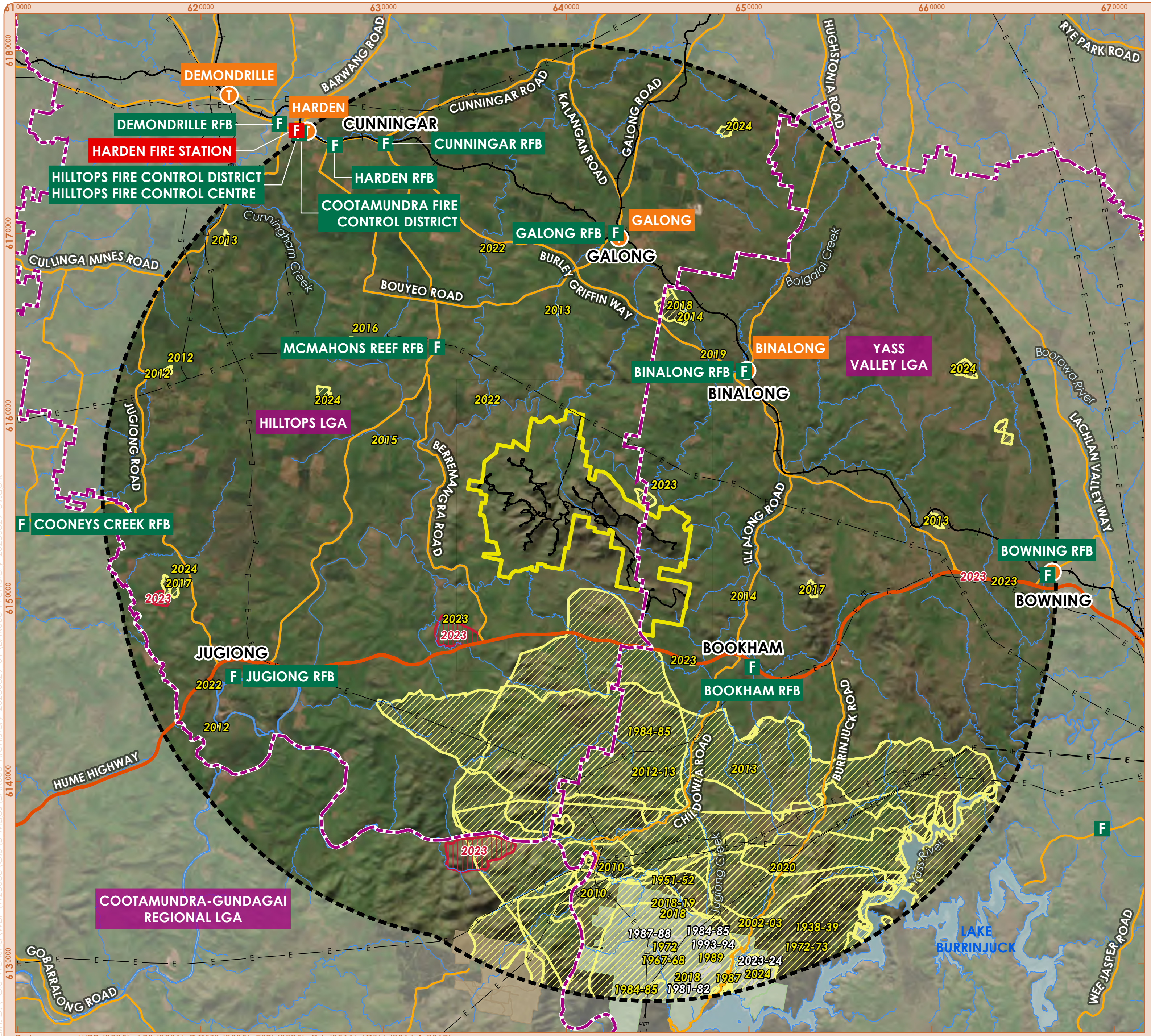
- Lightning
- Escapes from legal burning off
- Illegal burning off
- Human error
- Arson

Lightning is the most significant source of ignition within the area and is mainly associated with late spring and summer thunderstorm activity, which is usually (but not always) accompanied by some rainfall. Escapes from legal burning are primarily found in rural areas and can occur anywhere in the area. These activities are mainly, but not exclusively, from autumn through to spring. These comments apply equally to illegal burning off.

Ignition caused by human error includes the use of farm machinery (e.g., during slashing), the use of motor mowers, welding, and large numbers of tourists, all of which increase the risk of careless lighting of fires and the disposal of ignition sources (e.g., cigarette butts on major highways).

A review of NPWS Fire History – Wildfire and Prescribed Burns (downloaded on 01/09/2025 and depicted in Figure 4-1) suggests that a wildfire in 1984-85 impacted the southeast corner of the site. The cause of the wildfire is unknown and it burned approximately 13,784ha of land. This area (2km south of the site) was subject to another wildfire in 2012-13 and impacted 14,254ha of land.

FIGURE 4.1 – FIRE HISTORY & LOCATION OF EMERGENCY SERVICES



Data source: WBP (2025); ABS (2021); DCSSS (2025); ESRI (2025); GA (2011); ICSM (2014 & 2017)

LEGEND

- 🟨 Site boundary
- ⬚ Site boundary 20 km buffer
- ⬛ Construction footprint

Existing environment

- Ⓣ Railway station
- 🟥 Fire and rescue
- 🟩 Rural fire service
- —E— Electricity transmission line
- —+— Rail
- — Major road
- — Minor road
- — Named watercourse
- ▭ Named waterbody
- ▭ State forest
- ▭ National park/reserve
- ⬚ Local government area

Fire history (DCSSS, 2025)

- ▨ Wildfire
- ▨ Prescribed burn
- ▥ Unknown

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01/09/2025 (v1) 1:300,000 @A4 GDA2020 MGA Zone 55

0 2.5 5 km

Disclaimer: mapping is indicative only and the data shown has an inherent level of inaccuracy that is dependent on the data source. The location of all mapped features and boundaries should be confirmed by a registered surveyor.

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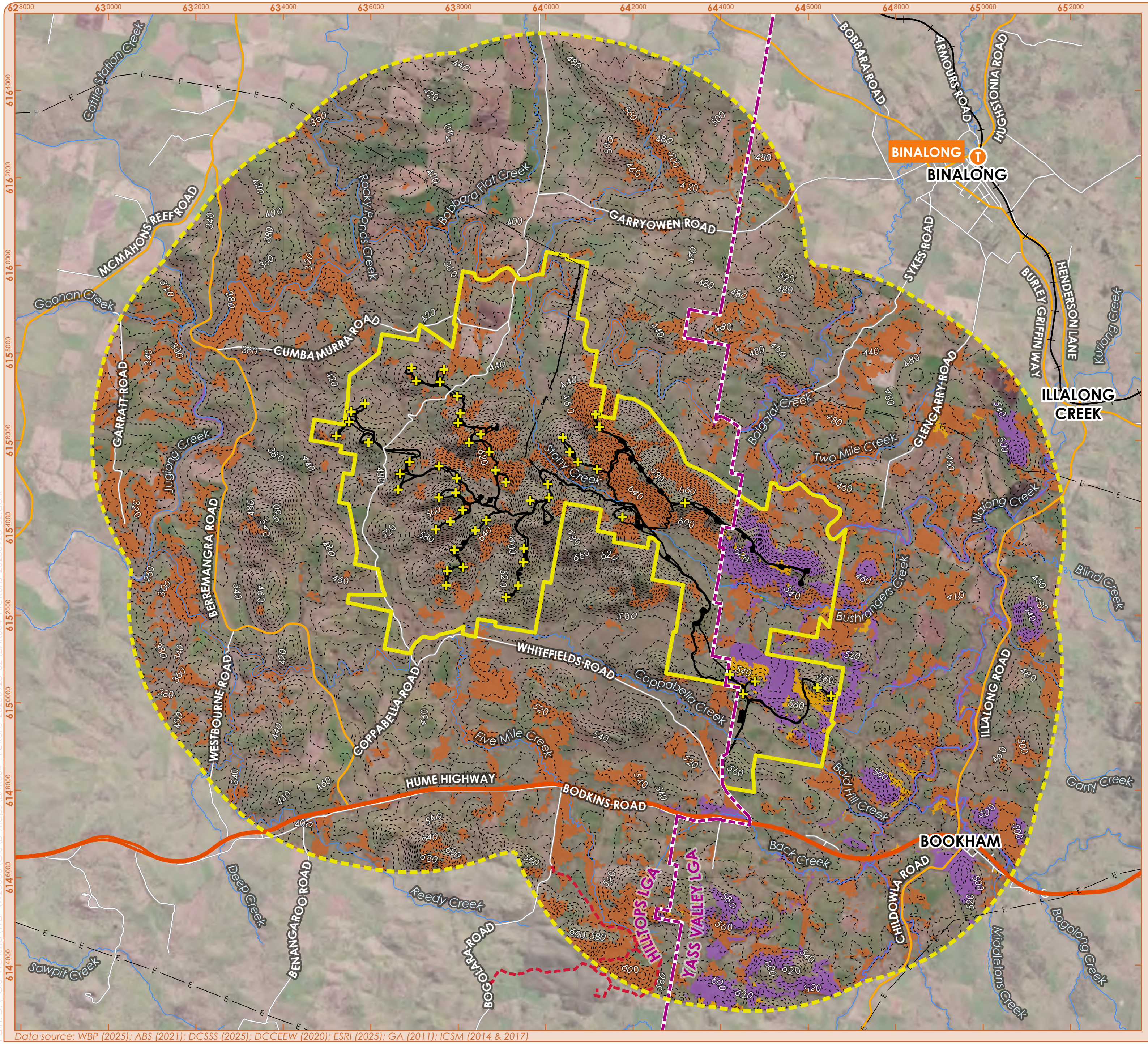
4.4 Fire behaviour potential

Grassland (subject to historical grazing) and remnant patches of woodland vegetation make up the predominant fuel for bush fire. Potential fire runs have been reviewed up to 5km from the project site and predominantly relate to the connectivity of woodland communities along the steeper ridgelines within the site boundary and extending to the east (Figure 5-2). This vegetation is fragmented by surrounding land use (cropping/grazing) with the Hume Highway in the south and Burley Griffen Way in the north-east.

There will be periods when the adjoining grazing and cropping lands are non-flammable due to climatic and agricultural practices. There will also be periods when these grassland areas are cured and highly flammable.

An ignition point takes some time to build to a quasi-steady state rate of spread; however, under extreme weather conditions, a grass fire can be expected to reach maximum rate of spread within 30 minutes or even less (Cheney and Sullivan, 2008). By this time, the fire is likely to be out of control.

It should also be assumed that, under the most extreme weather, a fire can spread even in heavily grazed grass, and embers may breach any APZ. The residence time for flames in heavily grazed pasture is likely to be very short (less than five seconds) (Cheney and Sullivan, 2008); therefore, the project area will have a similarly short exposure time to high radiant heat under such a scenario.



Data source: WBP (2025); ABS (2021); DCSSS (2025); DCCEEW (2020); ESRI (2025); GA (2011); ICSM (2014 & 2017)

Path: D:_GIS_Working\WBP\W25058\GIS\B_Maps\BAR004_FireRuns_20250923_02\BAR004_FireRuns_20250923_02.aprx

FIGURE 4.2 – POTENTIAL FIRE RUNS

LEGEND

- ▭ Site boundary
- ⬚ Site boundary 5 km buffer
- ✚ Wind turbine generator (WTG)
- ■ Construction footprint

Existing environment

- Ⓣ Railway station
- —E— Electricity transmission line
- —+— Rail
- — Major road
- — Minor road
- — Local road
- - - - Classified fire trail
- ------- Topographic contour (20 m)
- — Named watercourse
- ⬚ Local government area

State vegetation type map – formation

- 🟦 Freshwater Wetland
- 🟩 Grassland
- 🟧 Woodland
- 🟪 Forest
- 🟨 Alpine Complex

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23/09/2025 (v2) 1:125,000 @A4 GDA2020 MGA Zone 55

0 1.5 3 km

Disclaimer: mapping is indicative only and the data shown has an inherent level of inaccuracy that is dependent on the data source. The location of all mapped features and boundaries should be confirmed by a registered surveyor.

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4.5 Predominant vegetation

PBP 2019 guidelines require the identification of the predominant vegetation formation in accordance with the publication *Ocean Shores to Desert Dunes* (David Keith, 2004) if using the simplified acceptable solutions or the vegetation classification using the NSW RFS comprehensive vegetation fuel loads if a performance assessment is undertaken.

The hazardous vegetation is calculated for a distance of at least 140 meters from the proposed development envelope. The vegetation posing a bush fire threat to the project area includes:

Table 4-1 – Vegetation

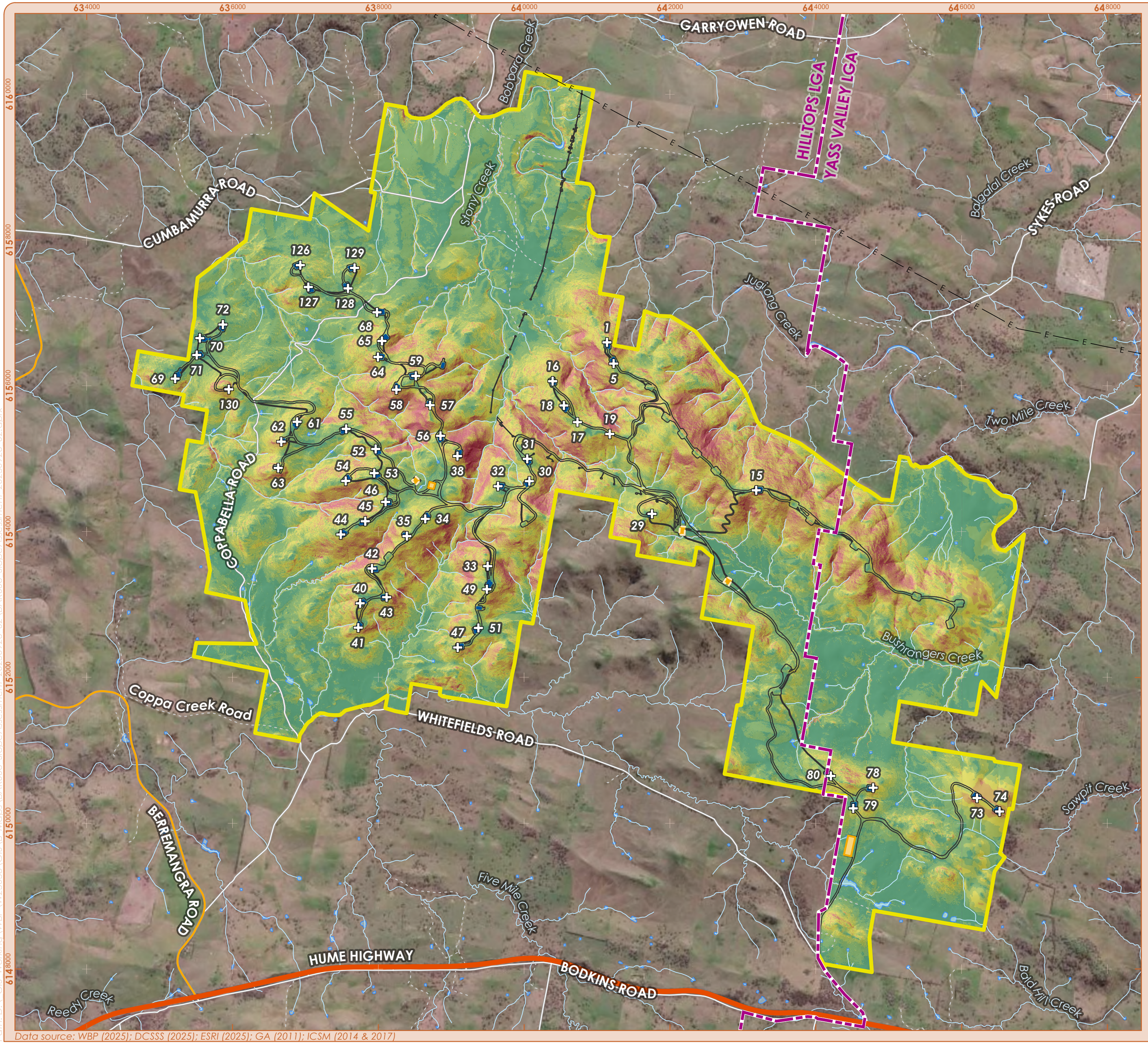
Vegetation community (Goldwind, 2025) within the development footprint.	***Plant Community Type (PCT)***	***Vegetation Classification***	***Vegetation formation***	***Acceptable solution fuel loads (t/ha) (PBP 2019)***	***Comprehensive vegetation fuel loads (NSW RFS 2019)***
Box-Gum Woodland and derived Native pasture	266	Western Slopes Grassy Woodland	Grassy Woodland	10.5/20.2	10.5/18.3
Long-leaved Box – Red Stringybark dry grass forest	316				
Modified riparian habitats: Western Slopes Riparian Moist Sedge Forest / Woodland	79	Inland Riverine Forests	Forested Wetlands	8.2/15.1	8.2/15.1
Native pasture Exotic pasture	N/A	Grassland	Grassland	6/6	6/6

4.6 Effective slope

Topography has a significant effect on bush fire behaviour and therefore can increase the risk to assets. For example, fire travels faster when moving uphill than when compared to downhill. For every 10-degree slope, the fire will double its speed and increase in intensity.

The effective slope has been assessed within the vegetation up to 100m from the construction footprint to determine the minimum APZs required and the expected setbacks to avoid flame zone (FZ) contact in a bush fire event. This is described in detail within Table 4-2 and Figure 4-3 below.

FIGURE 4.3 – SITE SLOPE ASSESSMENT



Data source: WBP (2025); DCSSS (2025); ESRI (2025); GA (2011); ICSM (2014 & 2017)

Path: D:_GIS_Working\WBP\W25058\GIS\B_Maps\BAR006_SlopeAssessment_20250923_02\BAR006_SlopeAssessment_20250923_02.aprx

LEGEND

▭ Site boundary
▭ Construction footprint
✚ Wind turbine generator (WTG)
▨ Temporary Construction Compound
▭ Permanent Construction Compound and O&M
■ Hardstand

Existing environment

—E— Electricity transmission line
— Major road
— Minor road
— Local road
- - - Vehicular track
— Watercourse/drainage line
▭ Waterbody
▭ Local government area

Slope class

🟩 0–5°
🟩 5–10°
🟩 10–15°
🟨 15–20°
🟧 20–25°
🟧 25–30°
🟥 >30°

Coppabella Wind Farm

23/09/2025 (v2) 1:75,000 @A4 GDA2020 MGA Zone 55

0 1 2 km

Disclaimer: mapping is indicative only and the data shown has an inherent level of inaccuracy that is dependent on the data source. The location of all mapped features and boundaries should be confirmed by a registered surveyor.

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4.7 Bush fire attack assessment

The following assessment has determined the minimum required APZ to avoid flame zone (FZ) contact on BESS infrastructure, as well as the maximum expected radiant heat impact using Table A1.12.6 of PBP 2019 (deemed to satisfy) in most instances.

Where slopes exceed 20 degrees, a performance assessment has been undertaken based on the effective slope, fuel loads associated with the vegetation classification, and the elevation of receiver 2.43m (i.e., the height of the BESS).

A worst-case fire danger index (FDI) of 100 has been used to calculate bush fire behaviour in the project area based on its location within the Southern Ranges region. Noting that Hilltops LGA is located within the Southern Slopes region (FDI 80).

Table 4-2 – Bush fire attack assessment

WTB / BESS no	**Aspect**	**Vegetation Formation within 140m**	**Effective Slope**	**Minimum APZ recommended (avoid flame contact)**	***Maximum expected Radiant heat impact on blade figure (BESS)***
1	East	Woodland	24^{0} downslope	29m (refer Note 1)	Position BESS to avoid FZ. $40kW/m^{2}$
	North	Woodland	$15\text{-}20^{0}$ downslope	24m	
	West	Grassland	$15\text{-}20^{0}$ downslope	13m	
5	East	Grassland	$15\text{-}20^{0}$ downslope	13m	$29kW/m^{2}$
	West	Woodland	22^{0} downslope	26m (refer Note 1)	
15	North	Grassland	$15\text{-}20^{0}$ downslope	13m	$19kW/m^{2}$

WTB / BESS no	**Aspect**	**Vegetation Formation within 140m**	**Effective Slope**	**Minimum APZ recommended (avoid flame contact)**	***Maximum expected Radiant heat impact on blade figure (BESS)***
	South	Grassland	24^0 downslope	15m (refer Note 1)	
16	North & west	Grassland	15-20^0 downslope	13m	29kW/m^2
	East	Grassland	25^0 downslope	15m (refer Note 1)	
18	South	Woodland	15-20^0 downslope	24m	Position BESS to avoid FZ. 40kW/m^2
	North & west	Grassland	15-20^0 downslope	13m	
31	North, south, east and west	Grassland	10-15^0 downslope	11m	Position BESS to avoid FZ. 40kW/m^2
30	northwest	Grassland	15-20^0 downslope	13m	19kW/m^2
	Southeast	Grassland	10-15^0 downslope	11m	
32	North	Grassland	10-15^0 downslope	11m	29kW/m^2
	West	Grassland	15-20^0 downslope	13m	
	South	Grassland	5-10^0 downslope	10m	
33	East & west	Grassland	15-20^0 downslope	13m	29kW/m^2

WTB / BESS no	**Aspect**	**Vegetation Formation within 140m**	**Effective Slope**	**Minimum APZ recommended (avoid flame contact)**	***Maximum expected Radiant heat impact on blade figure (BESS)***
49	West	Grassland	10-15^0 downslope	11m	Position BESS to avoid FZ. 40kW/m^2
	East	Grassland	15-20^0 downslope	13m	
50	West	Grassland	15-20^0 downslope	13m	29kWm^2
	South	Grassland	10-15^0 downslope	11m	
	North	Grassland	Level and upslope	8m	
51	North	Grassland	Level and upslope	8m	19kW/m^2
	East	Grassland	0-5^0 downslope	9m	
	West	Grassland	10-15^0 downslope	11m	
47	North & west	Grassland	15-20^0 downslope	13m	29kW/m^2
	South	Grassland	22^0 downslope	14m	
34 & 35	North, east & south	Grassland	15-20^0 downslope	13m	29kW/m^2
42	North	Grassland	29^0 downslope	17m (refer Note 1)	19kW/m^2

WTB / BESS no	**Aspect**	**Vegetation Formation within 140m**	**Effective Slope**	**Minimum APZ recommended (avoid flame contact)**	***Maximum expected Radiant heat impact on blade figure (BESS)***
	South & west	Grassland	10-15^0 downslope	11m	
43	Northeast & south	Grassland	15-20^0 downslope	13m	Position BESS to avoid FZ. 40kW/m^2
	East	Grassland	25^0 downslope	15m (refer Note 1)	
40	South & west	Grassland	15-20^0 downslope	13m	19kW/m^2
	North	Grassland	Upslope	8m	
41	West & south	Grassland	15-20^0 downslope	13m	Position BESS to avoid FZ. 40kW/m^2
	East	Woodland	15-20^0 downslope	24m	
46	West & south	Grassland	10-15^0 downslope	11m	19kW/m^2
	North & east		0-5^0 downslope	10m	
45	North	Grassland	21^0 downslope	14m (refer Note 1)	29kW/m^2
	South		15-20^0 downslope	13m	
44	South	Grassland	21^0 downslope	14m (refer Note 1)	40kW/m^2
	North & west		10-15^0 downslope	11m	

WTB / BESS no	**Aspect**	**Vegetation Formation within 140m**	**Effective Slope**	**Minimum APZ recommended (avoid flame contact)**	***Maximum expected Radiant heat impact on blade figure (BESS)***
53	Northeast	Woodland	5-10^0 downslope	15m	29kW/m^2
	North	Grassland	15-20^0 downslope	13m	
	Southwest	Grassland	5-10^0 downslope	10m	
54	North	Grassland	15-20^0 downslope	13m	29kW/m^2
	South	Grassland	25^0 downslope	15m (refer Note 1)	
52	East	Grassland	15-20^0 downslope	13m	19kW/m^2
	West	Grassland	10-15^0 downslope	11m	
55	South	Grassland	5-10^0 downslope	10m	19kW/m^2
	Northwest	Woodland	5-10^0 downslope	15m	
63	North & west	Grassland	15-20^0 downslope	13m	29kW/m^2
62	West & south	Woodland	15-20^0 downslope	24m	40kW/m^2
	North	Grassland	15-20^0 downslope	13m	
61	Southeast	Woodland	5-10^0 downslope	20m	29kW/m^2

WTB / BESS no	**Aspect**	**Vegetation Formation within 140m**	**Effective Slope**	**Minimum APZ recommended (avoid flame contact)**	***Maximum expected Radiant heat impact on blade figure (BESS)***
	West	Grassland	10-15^0 downslope	11m	
130	South	Woodland	21^0 downslope	25m Refer Note 1	Position BESS to avoid FZ. 40kW/m^2
	North	Grassland	15-20^0 downslope	13m	
69	East	Woodland	15-20^0 downslope	24m	40kW/m^2
	West & southwest	Woodland	5-10^0 downslope	15m	
71	North & south	Grassland	0-5^0 downslope	9m	19kWm^2
70	South & west	Grassland	Level and upslope	8m	12.5kW/m^2
	North	Grassland	5-10^0 downslope	13m	
72	North, east and west	Grassland	5-10^0 downslope	13m	19kWm^2
38	East	Western Slopes Grassy Woodland	>30^0 downslope	40m Refer Note 1	Position BESS to avoid FZ. 40kW/m^2
	South	Grassland	21^0 downslope	14m	
	West	Grassland	15-20^0 downslope	13m	

WTB / BESS no	Aspect	Vegetation Formation within 140m	Effective Slope	Minimum APZ recommended (avoid flame contact)	*Maximum expected Radiant heat impact on blade figure (BESS)*
56	East	Grassland	23^0 downslope	14m Refer Note 1	19kW/m^2
	West	Grassland	$15\text{-}20^0$ downslope	13m	
	North	Woodland	Upslope	9m	
57	East	Grassland	26^0 downslope	16m Refer Note 1	40kW/m^2
	North	Woodland	$15\text{-}20^0$ downslope	24m	
	West	Western Slopes Grassy Woodland	$>30^0$ downslope	40m	
58	West	Grassland	22^0 downslope	14m Refer Note 1	29kW/m^2
	South & east	Grassland	27^0 downslope	16m Refer Note 1	
59	Northeast	Woodland	$10\text{-}15^0$ downslope	19m	29kW/m^2
	North	Grassland	$15\text{-}20^0$ downslope	13m	
	East	Woodland	22^0 downslope	26m Refer Note 1	
66	East	Grassland	$15\text{-}20^0$ downslope	13m	

WTB / BESS no	Aspect	Vegetation Formation within 140m	Effective Slope	Minimum APZ recommended (avoid flame contact)	*Maximum expected Radiant heat impact on blade figure (BESS)*
	South	Western Slopes Grassy Woodland	24^0 downslope	29m (refer Note 1)	Position BESS to avoid FZ. 40kW/m^2
64	North	Grassland	5-10^0 downslope	10m	29kW/m^2
	West & northeast	Grassland	15-20^0 downslope	13m	
	southwest	Woodland	15-20^0 downslope	24m	
65	Northwest & northeast	Grassland	15-20^0 downslope	13m	29kW/m^2
	Southeast	Western Slopes Grassy Woodland	22^0 downslope	26m (refer Note 1)	
68	North	Grassland	10-15^0 downslope	11m	Position BESS to avoid FZ. 40kW/m^2
	South	Grassland	Upslope	8m	
128	South & west	Grassland	Level and upslope	8m	12.5 kW/m^2
	North	Grassland	0-5^0 downslope	9m	
129	North	Woodland	5-10^0 downslope	15m	29 kW/m^2
	East & west	Woodland	10-15^0 downslope	19m	

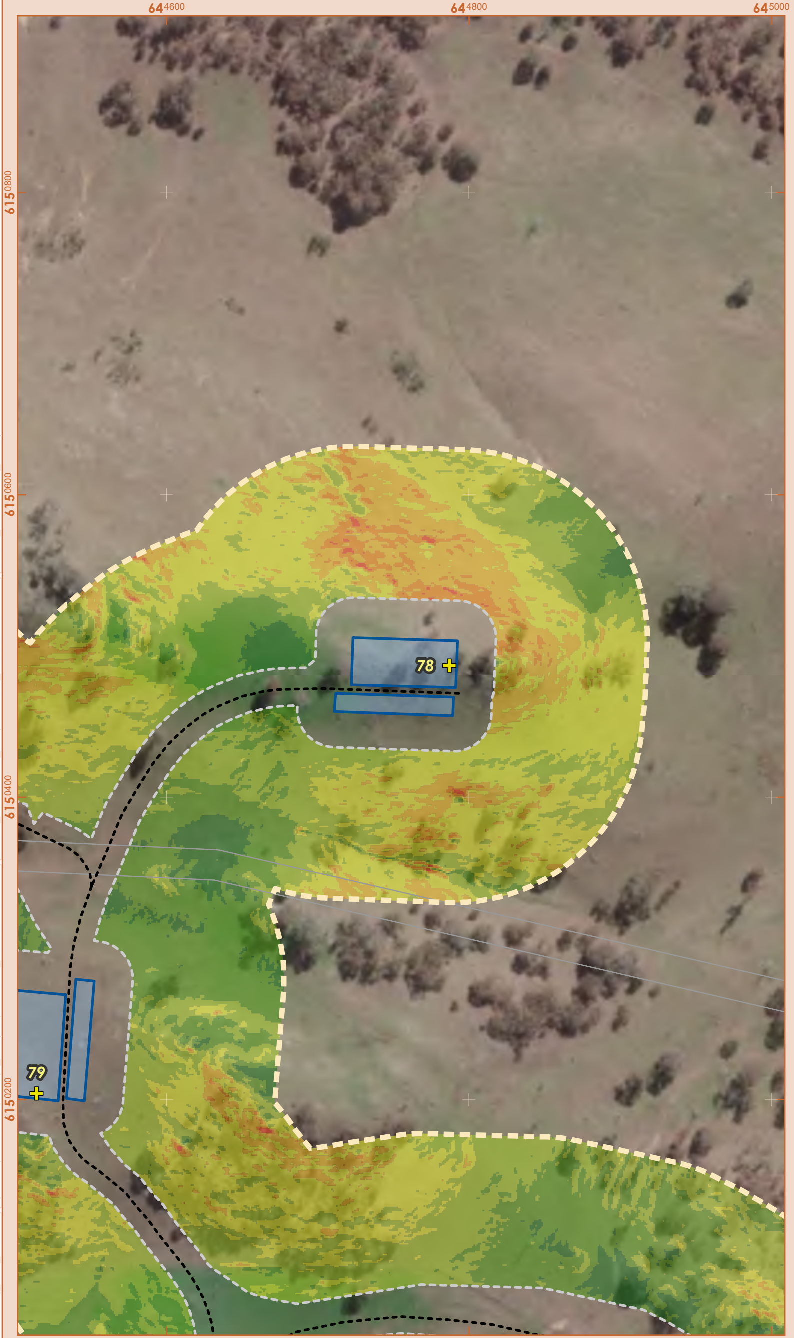
WTB / BESS no	**Aspect**	**Vegetation Formation within 140m**	**Effective Slope**	**Minimum APZ recommended (avoid flame contact)**	***Maximum expected Radiant heat impact on blade figure (BESS)***
127	South	Woodland	5-10^0 downslope	15m	29kW/m^2
	West	Woodland	10-15^0 downslope	19m	
	North	Woodland	Upslope	9m	
126	South	Woodland	Upslope	9m	19kWm^2
	North	Grassland	5-10^0 downslope	10m	
29	North, east & west	Grassland	15-20^0 downslope	13m	Position BESS to avoid FZ. 40kW/m^2
	South	Woodland	15-20^0 downslope	24m	
80	South	Grassland	10-15^0 downslope	11m	40kW/m^2
	North	Grassland	15-20^0 downslope	13m	
	South	Woodland	10-15^0 downslope	19m	
78	South	Woodland	15-20^0 downslope	24m	Position BESS to avoid FZ. 40kW/m^2
	North & east	Grassland	15-20^0 downslope	13m	
79	Southeast	Woodland	0-5^0 downslope	12m	29kW/m^2
	southwest	Woodland	10-15^0 downslope	19m	

WTB / BESS no	Aspect	Vegetation Formation within 140m	Effective Slope	Minimum APZ recommended (avoid flame contact)	*Maximum expected Radiant heat impact on blade figure (BESS)*
73	North & south	Grassland	21^{0} downslope	14m (refer Note 1)	29kW/m^{2}
	East & west	Grassland	15-20^{0} downslope	13m	
74	North	Woodland	15-20^{0} downslope	24m	29kW/m^{2}
	South	Grassland	15-20^{0} downslope	13m	

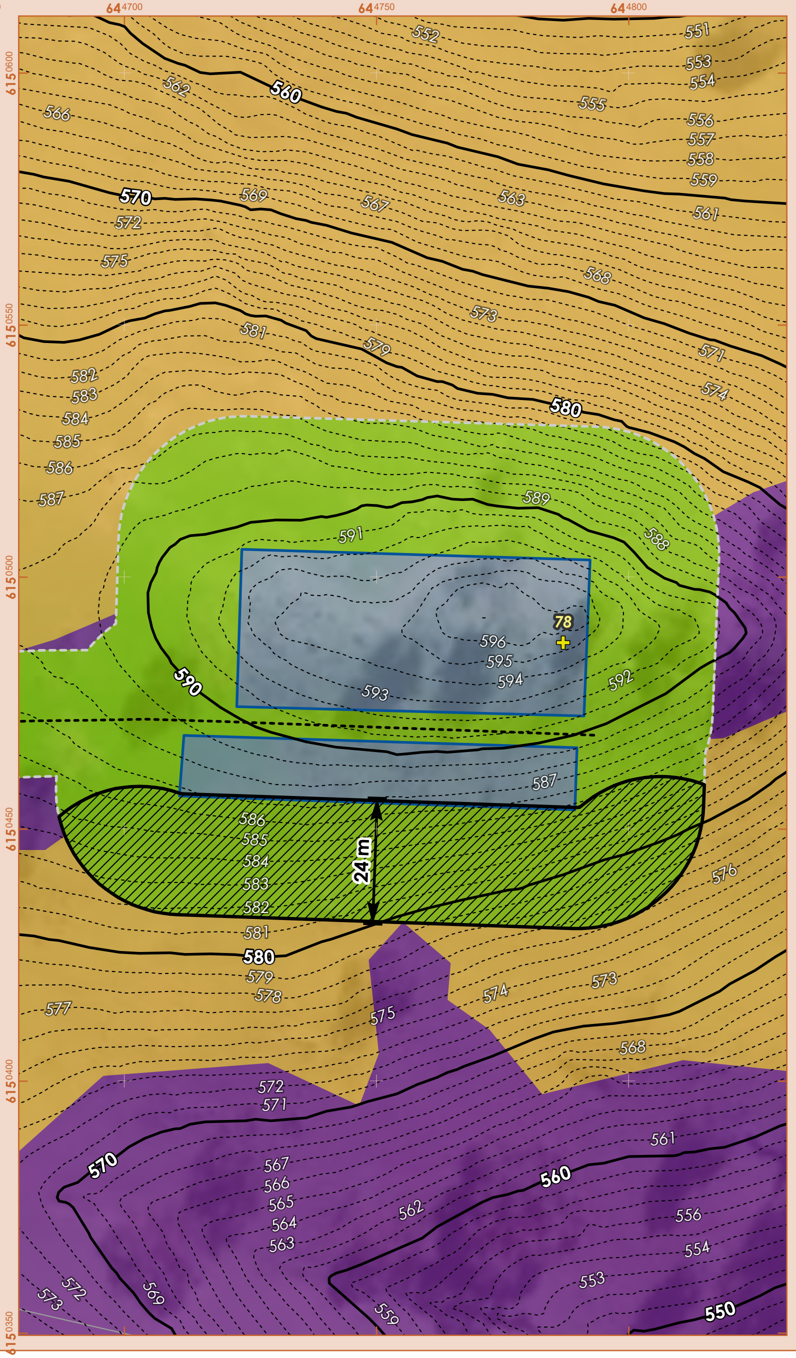
‘Note 1 – A performance assessment has been undertaken with the following inputs – battery height (elevation of receiver 2.5m), fuel loads associated with Western Slopes Grassy Woodland, grassland or woodland (PBP fuel loads) and effective slope identified in Column 4.

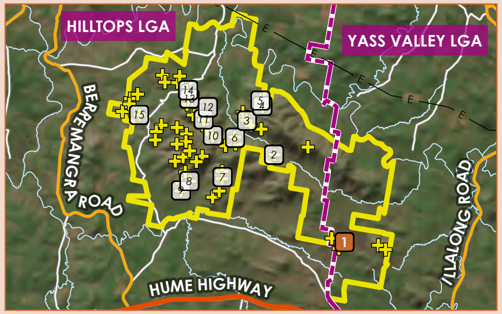
FIGURE 4.4 – BUSH FIRE ASSESSMENT & MITIGATION MEASURES (MAP 1 OF 15)

SLOPE ASSESSMENT



ASSET PROTECTION ZONE





LEGEND

- 🟨 Site boundary
- ✚ Wind turbine generator (WTG)
- ┅ Access road
- 🟦 Hardstand
- ⬚ Construction footprint
- ⬚ Slope buffer (100 m)
- 🟩 Asset protection zone (construction footprint)
- ▨ Minimum setback to avoid Flame Zone (FZ) contact

Existing environment

- —E— Electricity transmission line
- — Major road
- — Minor road
- — Local road
- ┈ Topographic contour (1 m)
- — Topographic contour (10 m)
- — Watercourse/drainage line
- ☐ Lot boundary
- ⬚ Local government area

Slope class

- 🟩 0–5°
- 🟩 5–10°
- 🟩 10–15°
- 🟨 15–20°
- 🟨 20–25°
- 🟧 25–30°
- 🟥 >30°

Vegetation formation

- 🟨 Grassland
- 🟪 Western Slopes Grassy Woodland

Coppabella Wind Farm

23/09/2025 (v2) 1:5,000 (left) 1:1,500 (right) @A4 GDA2020 MGA Zone 55

50 0 20 m
Left Right

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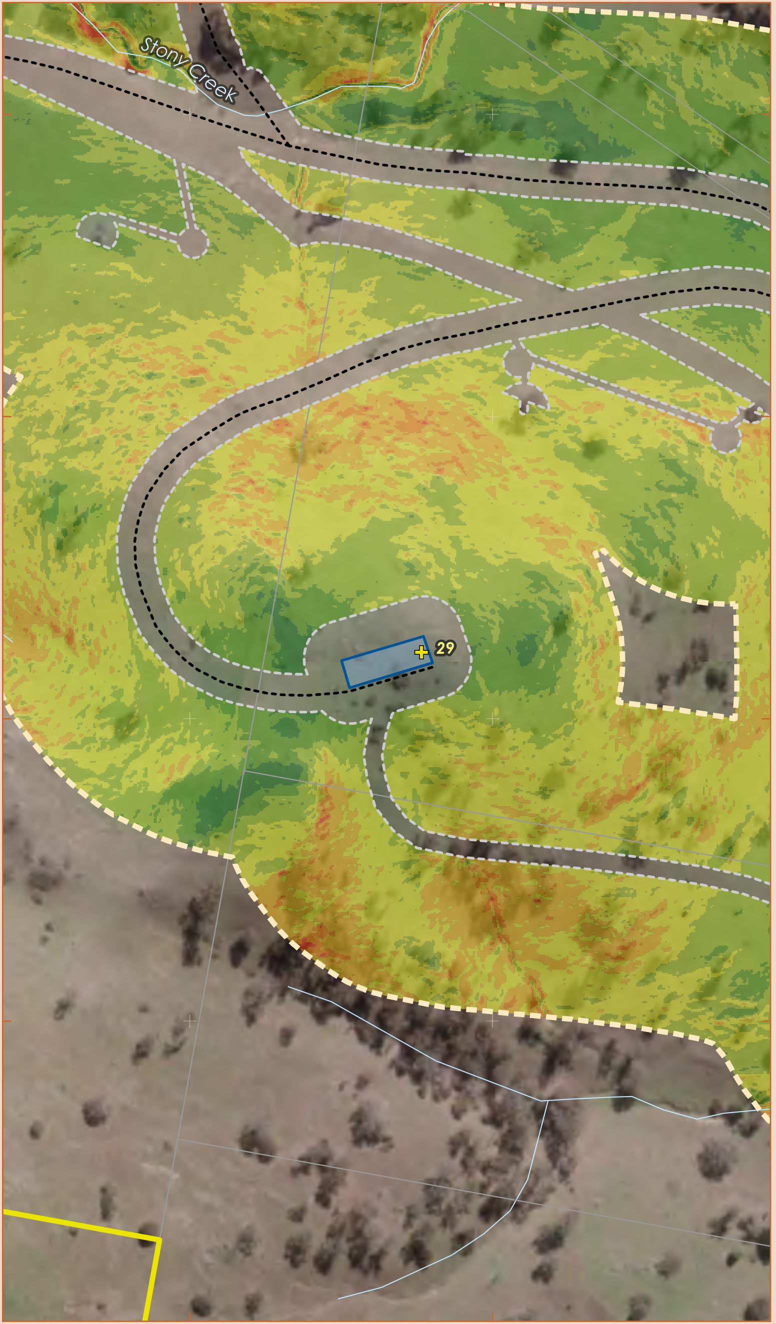
Data source: WBP (2025); DCSSS (2025); DCCEEW (2020); ESRI (2025); ICSM (2014 & 2017); RFS (2025)

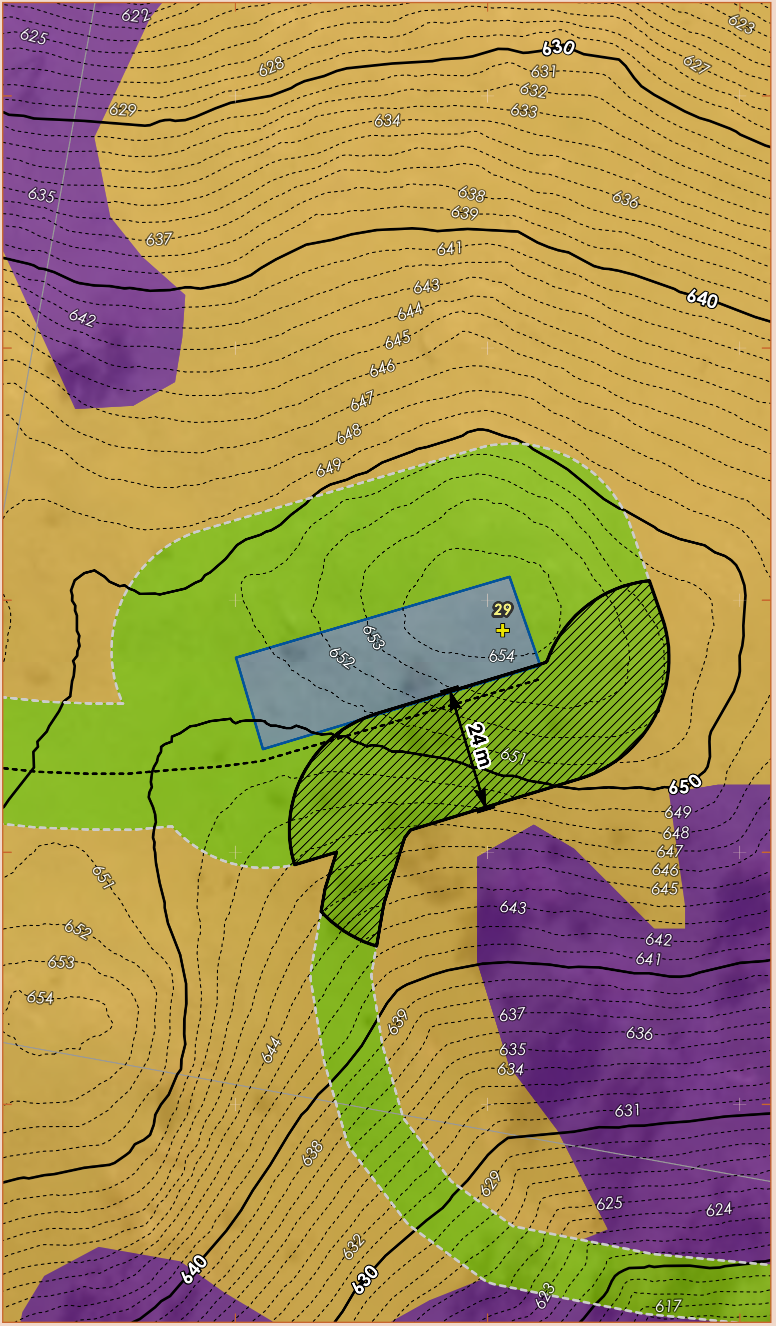
Path: D:_GIS_Working\WBP\W25058\GIS\B_Maps\BAR005_20250923_02\BAR005_AssessmentMitigation_20250923_02\BAR005_AssessmentMitigation_20250923_02.aprx

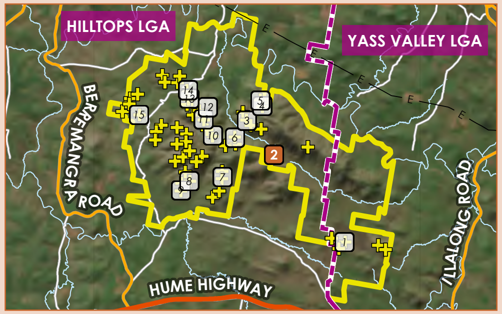
FIGURE 4.4 – BUSH FIRE ASSESSMENT & MITIGATION MEASURES (MAP 2 OF 15)

SLOPE ASSESSMENT



ASSET PROTECTION ZONE





LEGEND

- ▭ Site boundary
- ✚ Wind turbine generator (WTG)
- Access road
- ▭ Hardstand
- ▭ Construction footprint
- ▭ Slope buffer (100 m)
- 🟩 Asset protection zone (construction footprint)
- ▨ Minimum setback to avoid Flame Zone (FZ) contact

Existing environment
- Electricity transmission line
- Major road
- Minor road
- Local road
- Topographic contour (1 m)
- Topographic contour (10 m)
- Watercourse/drainage line
- ▭ Lot boundary
- ▭ Local government area

Slope class
- 0–5°
- 5–10°
- 10–15°
- 15–20°
- 20–25°
- 25–30°
- >30°

Vegetation formation
- Grassland
- Western Slopes Grassy Woodland

Coppabella Wind Farm

23/09/2025 (v2) 1:5,000 (left) 1:1,500 (right) @A4 GDA2020 MGA Zone 55

50 0 20 m
Left Right

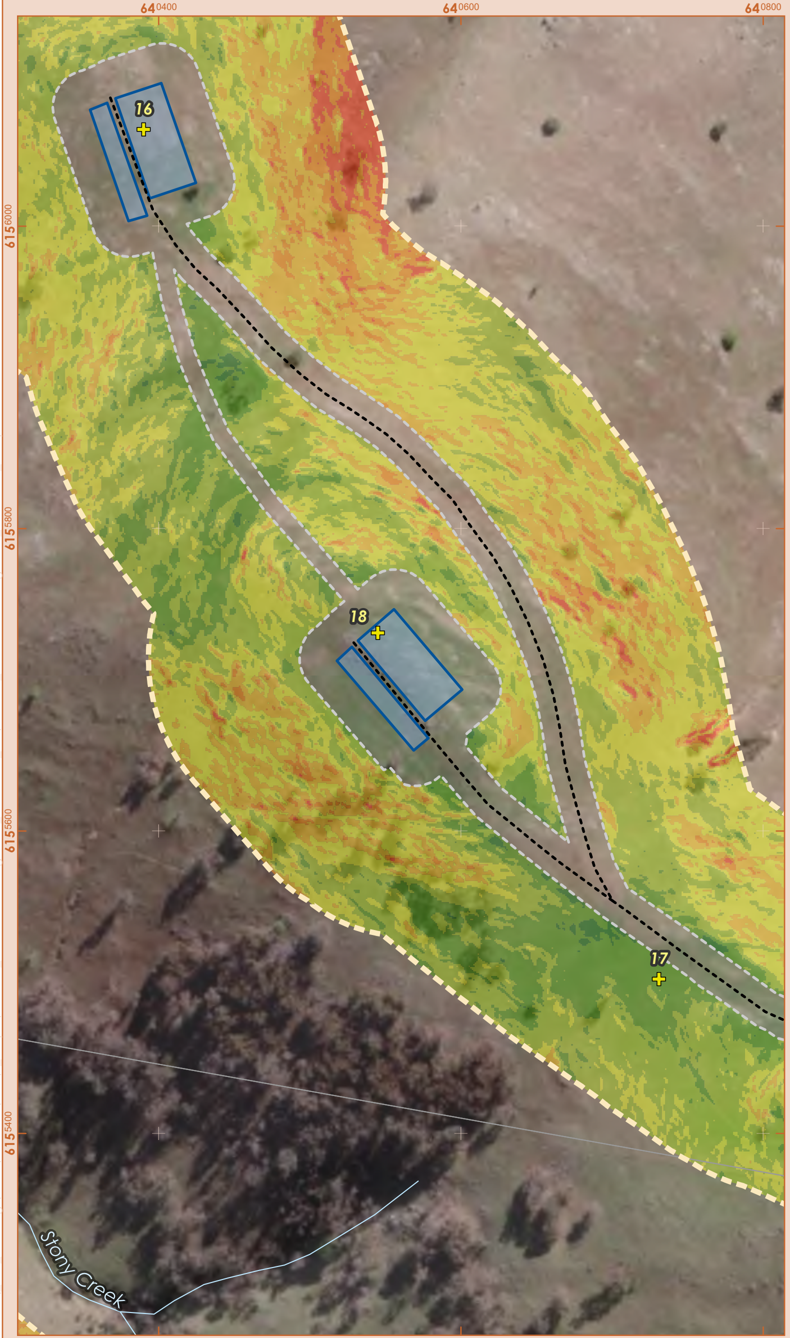
Disclaimer: mapping is indicative only and the data shown has an inherent level of inaccuracy that is dependent on the data source. The location of all mapped features and boundaries should be confirmed by a registered surveyor.

WARATAH BUSHFIRE
PLANNING | GIS | ASSESSMENT

Data source: WBP (2025); DCSSS (2025); DCCEEW (2020); ESRI (2025); ICSM (2014 & 2017); RFS (2025)

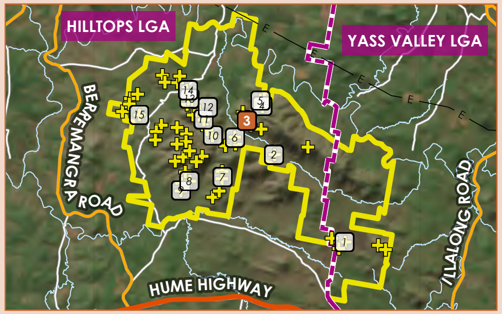
Path: D:_GIS_Working\WBP\W25058\GIS\B_Maps\BAR005_AssessmentMitigation_20250923_02\BAR005_AssessmentMitigation_20250923_02.aprx

SLOPE ASSESSMENT



ASSET PROTECTION ZONE

FIGURE 4.4 – BUSH FIRE ASSESSMENT & MITIGATION MEASURES (MAP 3 OF 15)



LEGEND
- ▭ Site boundary
- ✚ Wind turbine generator (WTG)
- ┄ Access road
- ▭ Hardstand
- ▭ Construction footprint
- ▭ Slope buffer (100 m)
- 🟩 Asset protection zone (construction footprint)
- ▨ Minimum setback to avoid Flame Zone (FZ) contact

Existing environment
- —E— Electricity transmission line
- — Major road
- — Minor road
- — Local road
- ┄ Topographic contour (1 m)
- — Topographic contour (10 m)
- — Watercourse/drainage line
- ▭ Lot boundary
- ▭ Local government area

Slope class
- 🟩 0–5°
- 🟩 5–10°
- 🟩 10–15°
- 🟨 15–20°
- 🟨 20–25°
- 🟧 25–30°
- 🟥 >30°

Vegetation formation
- 🟨 Grassland
- 🟪 Western Slopes Grassy Woodland

Coppabella Wind Farm

23/09/2025 (v2) 1:5,000 (left) 1:1,500 (right) @A4 GDA2020 MGA Zone 55

WARATAH BUSHFIRE
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Data source: WBP (2025); DCSSS (2025); DCCEEW (2020); ESRI (2025); ICSM (2014 & 2017); RFS (2025)

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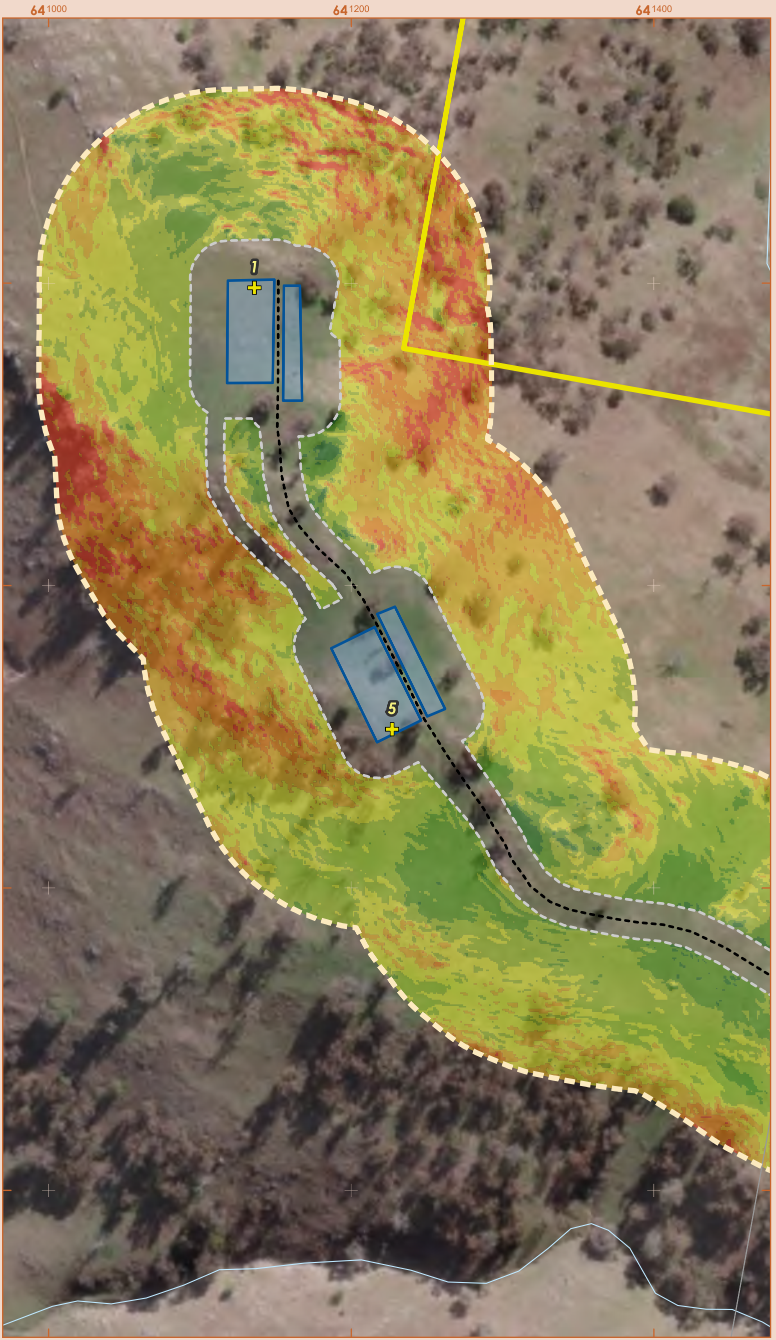
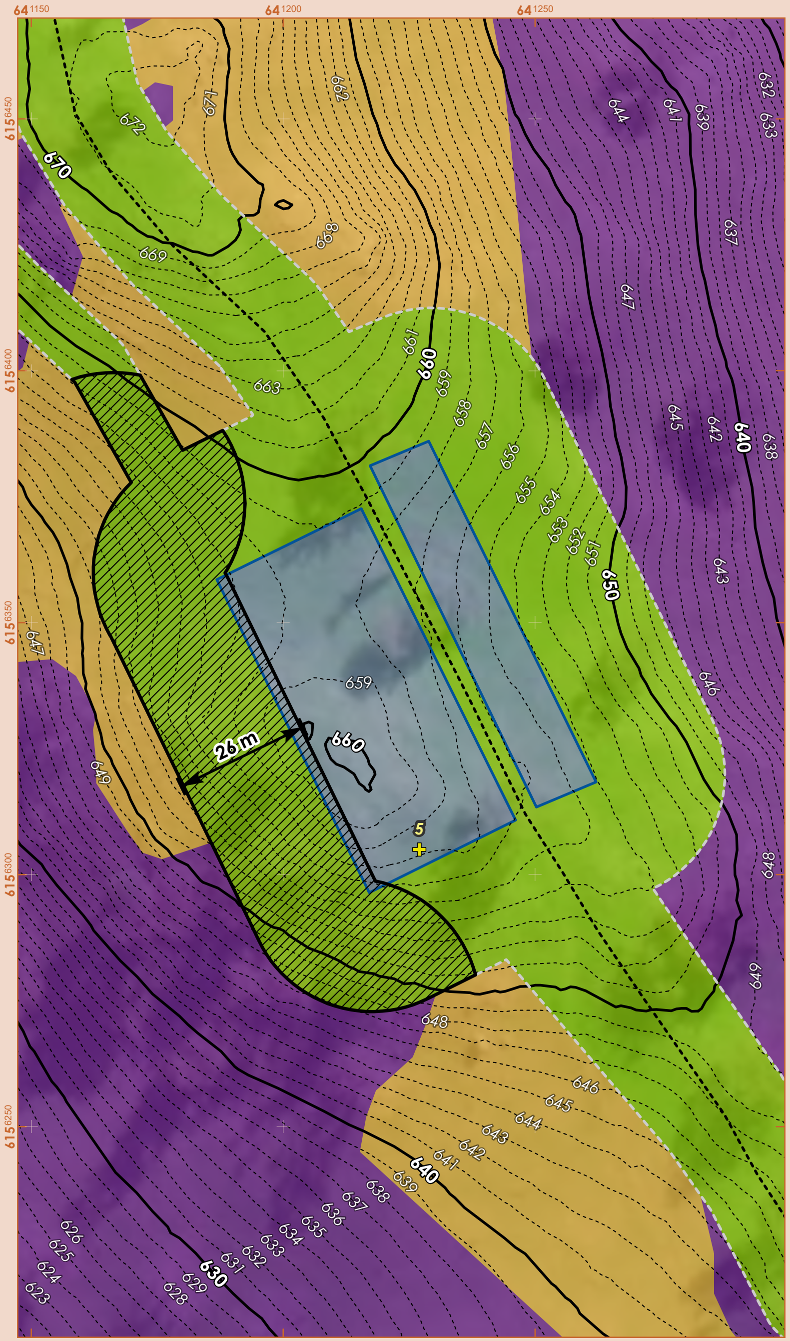
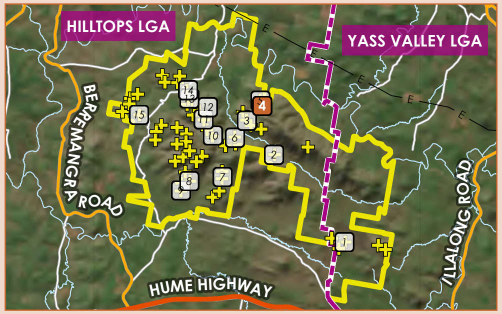
FIGURE 4.4 – BUSH FIRE ASSESSMENT & MITIGATION MEASURES (MAP 4 OF 15)

SLOPE ASSESSMENT



ASSET PROTECTION ZONE





LEGEND

▭	Site boundary
✚	Wind turbine generator (WTG)
┄	Access road
▭	Hardstand
▭	Construction footprint
▭	Slope buffer (100 m)
🟩	Asset protection zone (construction footprint)
▨	Minimum setback to avoid Flame Zone (FZ) contact

Existing environment

—E—	Electricity transmission line
—	Major road
—	Minor road
—	Local road
┄	Topographic contour (1 m)
—	Topographic contour (10 m)
—	Watercourse/drainage line
▭	Lot boundary
▭	Local government area

Slope class

🟩	0–5°
🟩	5–10°
🟩	10–15°
🟨	15–20°
🟨	20–25°
🟧	25–30°
🟥	>30°

Vegetation formation

🟨	Grassland
🟪	Western Slopes Grassy Woodland

Coppabella Wind Farm

23/09/2025 (v2) 1:5,000 (left) 1:1,500 (right) @A4 GDA2020 MGA Zone 55

50 0 20 m
Left Right

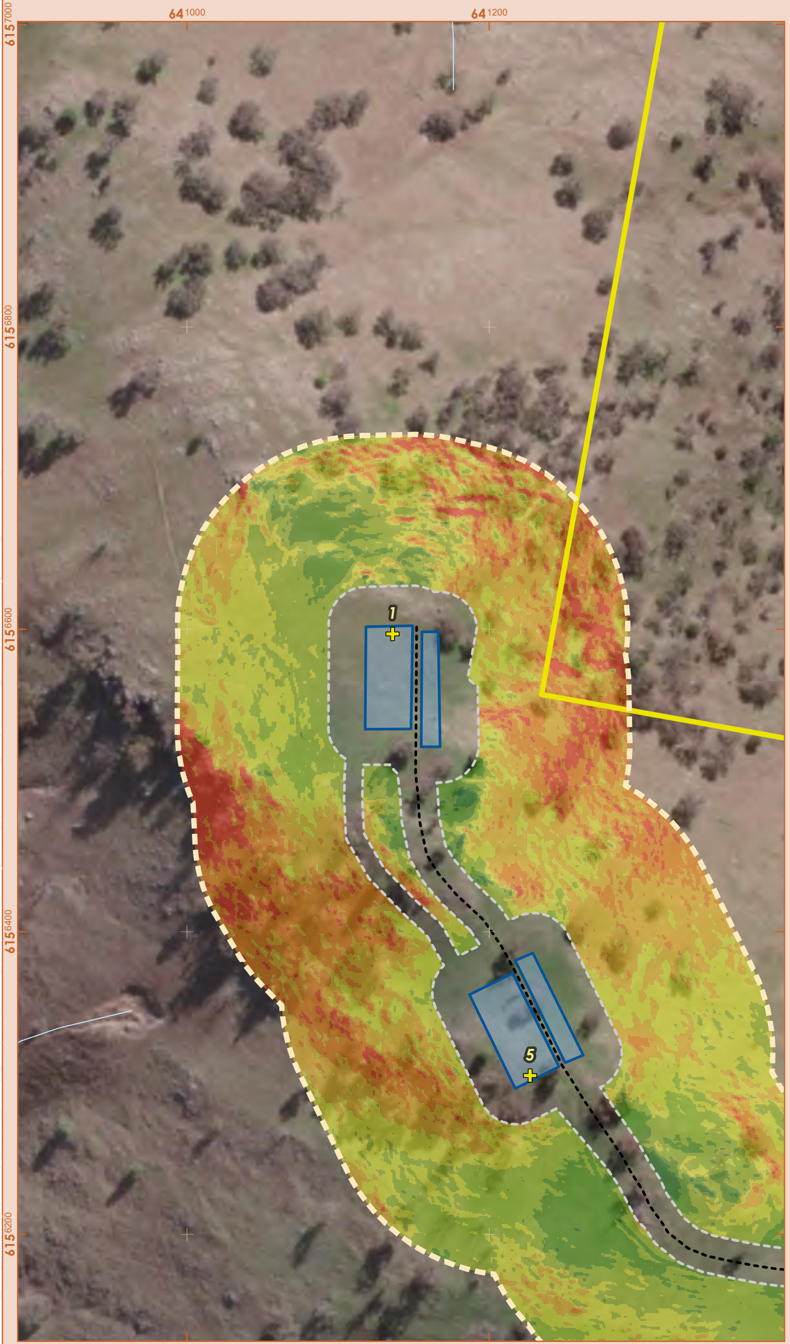
WARATAH BUSHFIRE
PLANNING | GIS | ASSESSMENT

Data source: WBP (2025); DCSSS (2025); DCCEEW (2020); ESRI (2025); ICSM (2014 & 2017); RFS (2025)

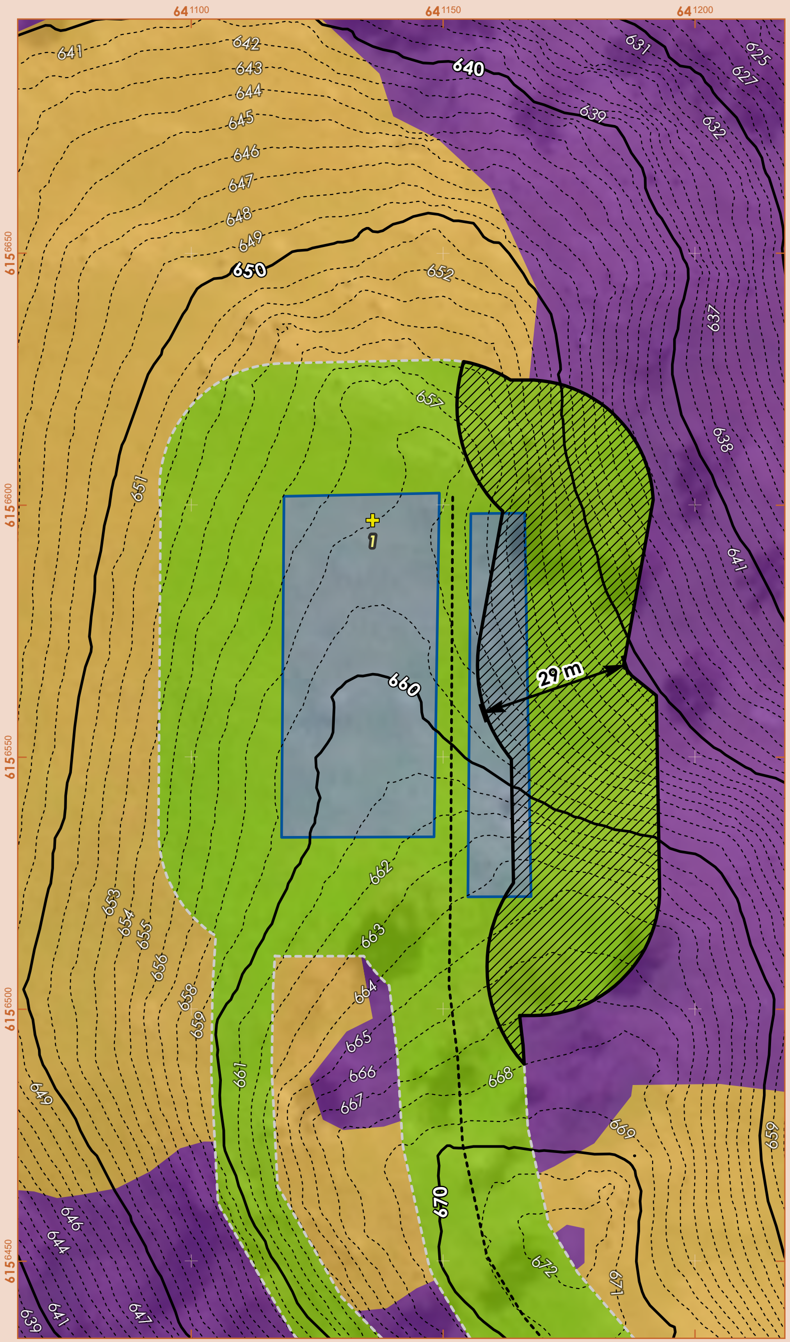
Path: D:_GIS_Working\WBP\W25058\GIS\B_Maps\BAR005_AssessmentMitigation_20250923_02\BAR005_AssessmentMitigation_20250923_02.aprx

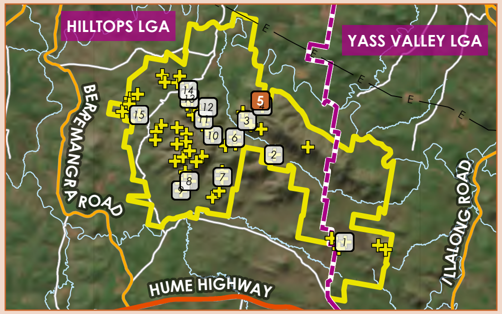
FIGURE 4.4 – BUSH FIRE ASSESSMENT & MITIGATION MEASURES (MAP 5 OF 15)

SLOPE ASSESSMENT



ASSET PROTECTION ZONE





LEGEND

▭	Site boundary
✚	Wind turbine generator (WTG)
┄	Access road
▭	Hardstand
▭	Construction footprint
▭	Slope buffer (100 m)
🟩	Asset protection zone (construction footprint)
▨	Minimum setback to avoid Flame Zone (FZ) contact

Existing environment

—E—	Electricity transmission line
—	Major road
—	Minor road
—	Local road
┄	Topographic contour (1 m)
—	Topographic contour (10 m)
—	Watercourse/drainage line
▭	Lot boundary
▭	Local government area

Slope class

🟩	0–5°
🟩	5–10°
🟩	10–15°
🟨	15–20°
🟨	20–25°
🟧	25–30°
🟥	>30°

Vegetation formation

🟨	Grassland
🟪	Western Slopes Grassy Woodland

Coppabella Wind Farm

23/09/2025 (v2) 1:5,000 (left) 1:1,500 (right) @A4 GDA2020 MGA Zone 55

50 0 20 m
Left Right

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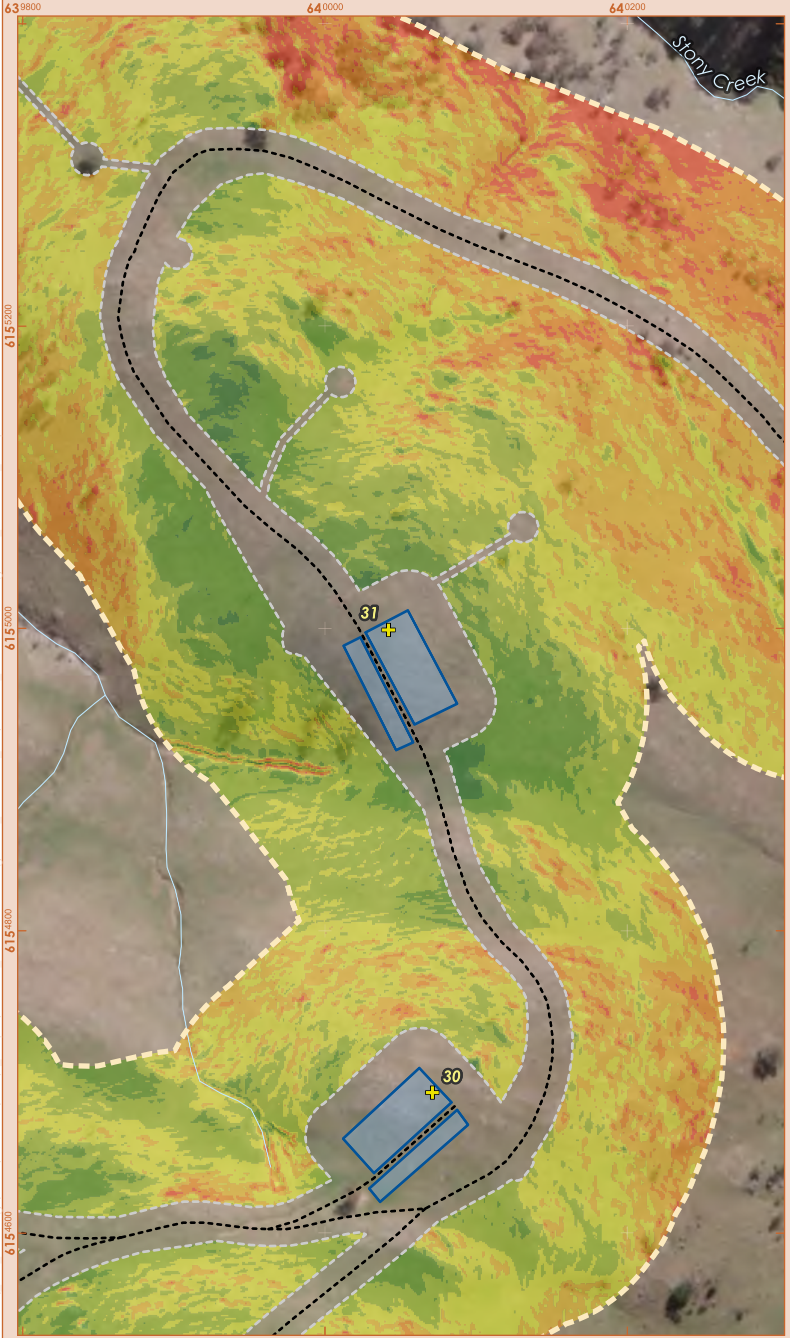
Data source: WBP (2025); DCSSS (2025); DCCEEW (2020); ESRI (2025); ICSM (2014 & 2017); RFS (2025)

FIGURE 4.4 – BUSH FIRE ASSESSMENT & MITIGATION MEASURES (MAP 6 OF 15)

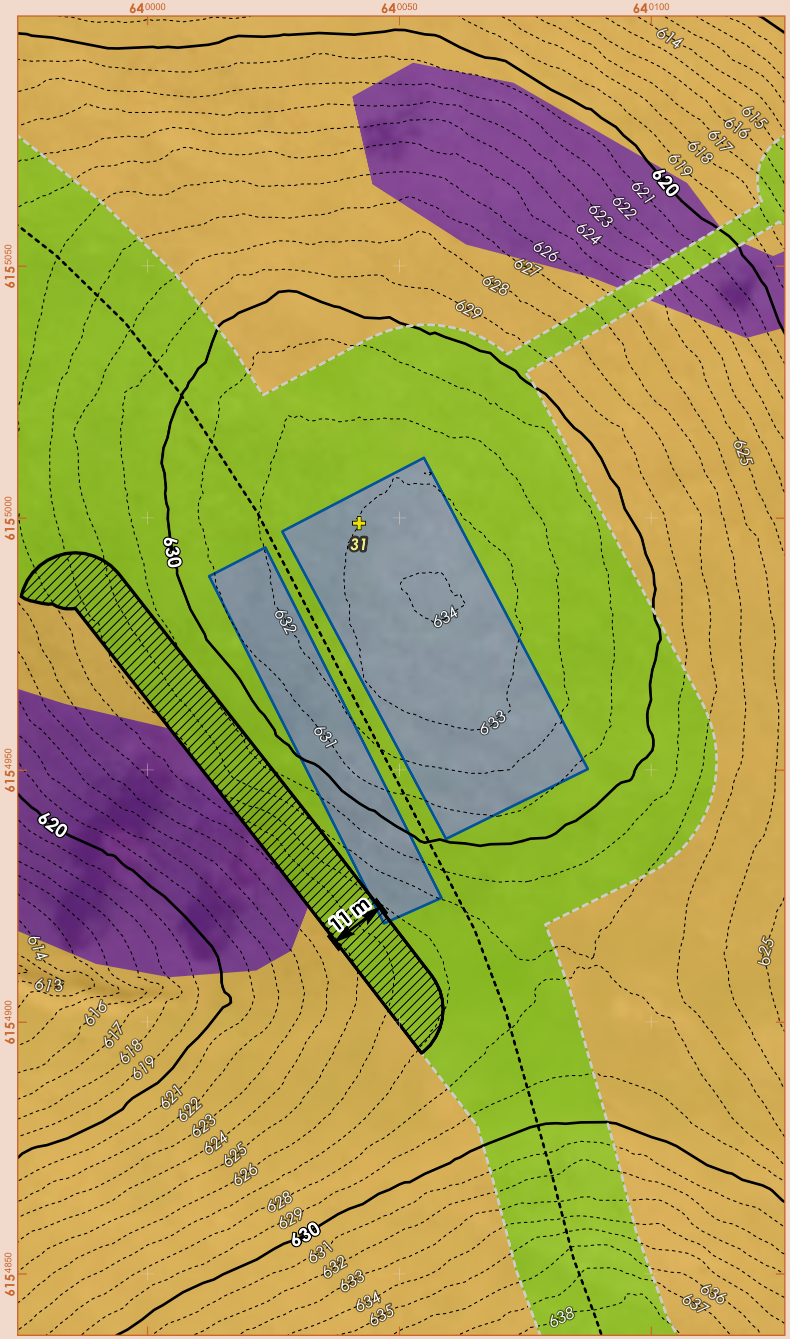
SLOPE ASSESSMENT

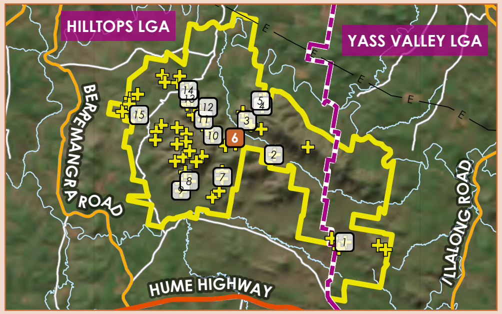


Data source: WBP (2025); DCSSS (2025); DCCEEW (2020); ESRI (2025); ICSM (2014 & 2017); RFS (2025)

Path: D:_GIS_Working\WBP\W25058\GIS\B_Maps\BAR005_AssessmentMitigation_20250923_02\BAR005_AssessmentMitigation_20250923_02.aprx

ASSET PROTECTION ZONE





LEGEND

- ▭ Site boundary
- ✚ Wind turbine generator (WTG)
- ┅ Access road
- ▭ Hardstand
- ▭ Construction footprint
- ▭ Slope buffer (100 m)
- 🟩 Asset protection zone (construction footprint)
- ▨ Minimum setback to avoid Flame Zone (FZ) contact

Existing environment

- —E— Electricity transmission line
- — Major road
- — Minor road
- — Local road
- ┄ Topographic contour (1 m)
- — Topographic contour (10 m)
- — Watercourse/drainage line
- ▭ Lot boundary
- ▭ Local government area

Slope class

- 🟩 0–5°
- 🟩 5–10°
- 🟩 10–15°
- 🟨 15–20°
- 🟨 20–25°
- 🟧 25–30°
- 🟥 >30°

Vegetation formation

- 🟨 Grassland
- 🟪 Western Slopes Grassy Woodland

Coppabella Wind Farm

23/09/2025 (v2) 1:5,000 (left) 1:1,500 (right) @A4 GDA2020 MGA Zone 55

50 0 20 m
Left Right

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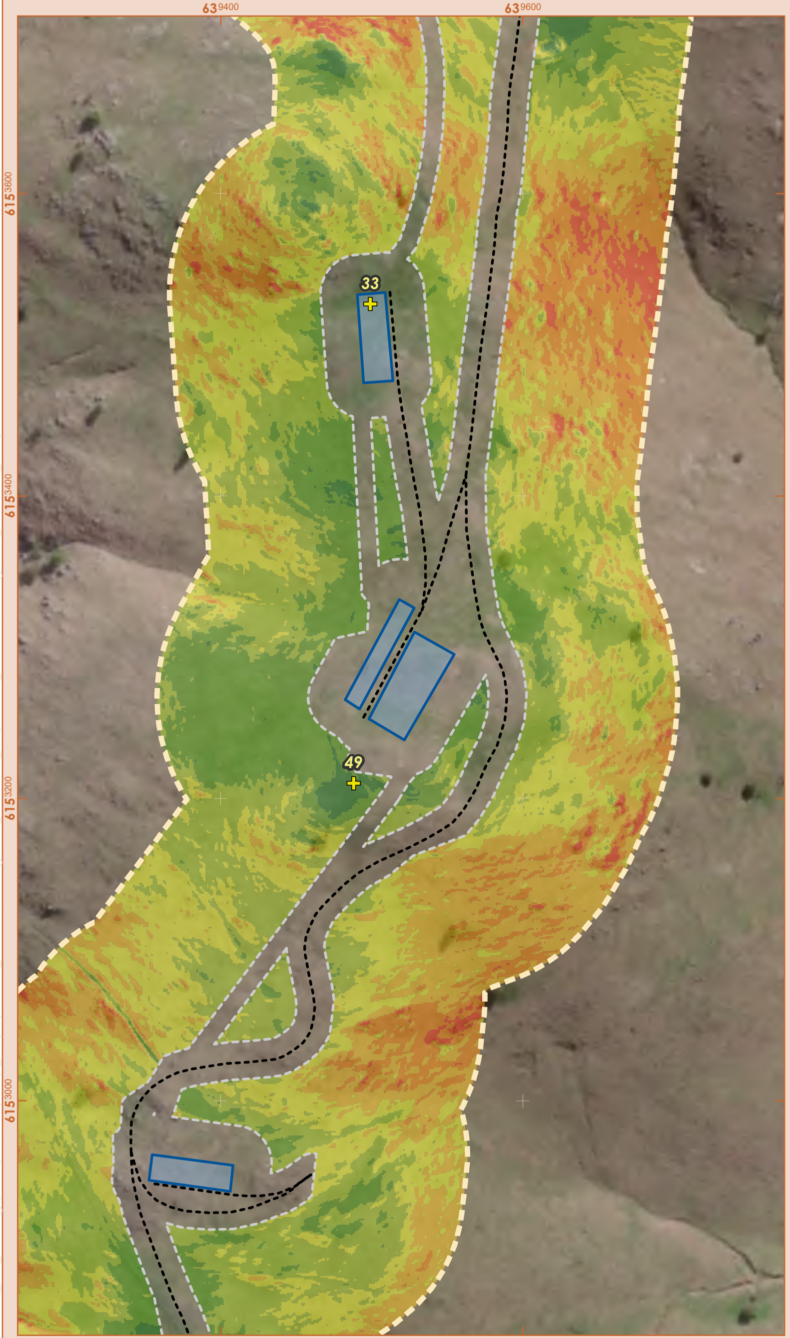
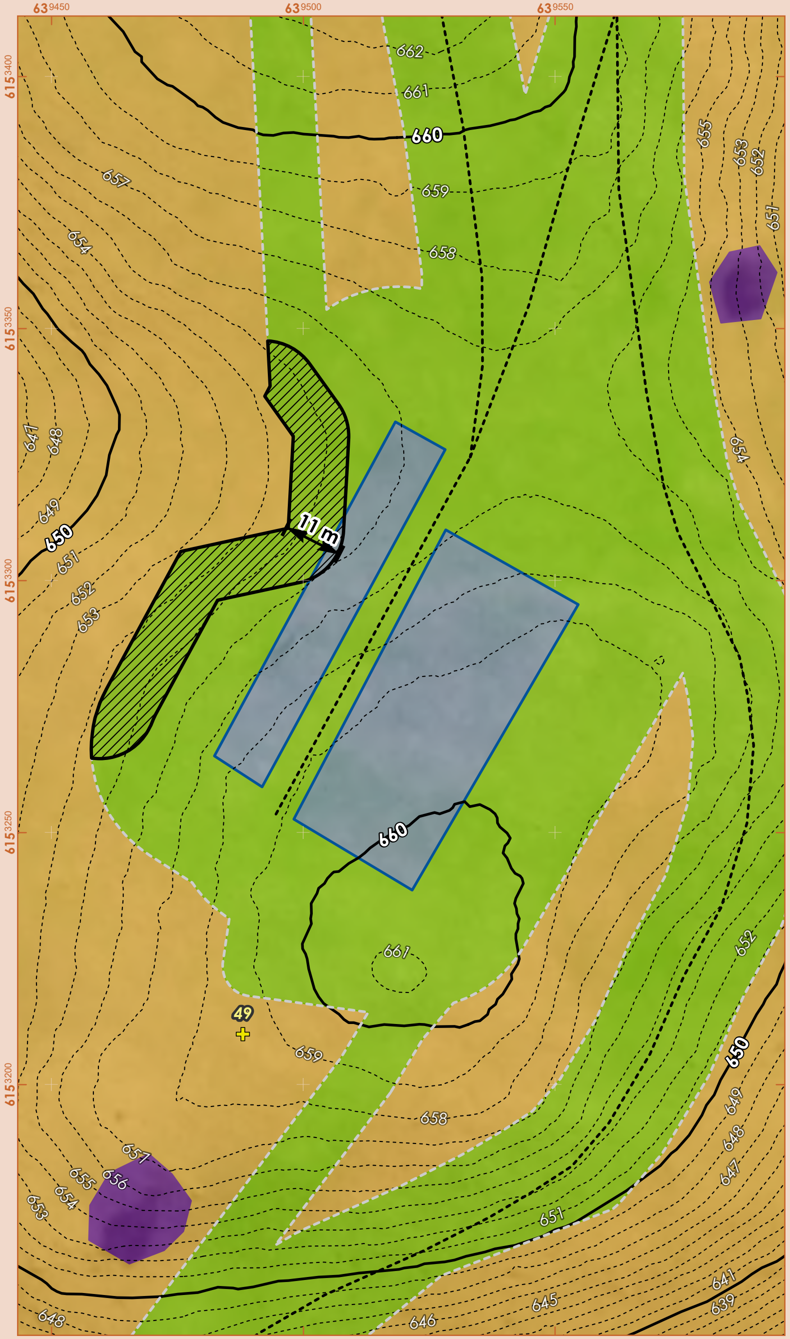
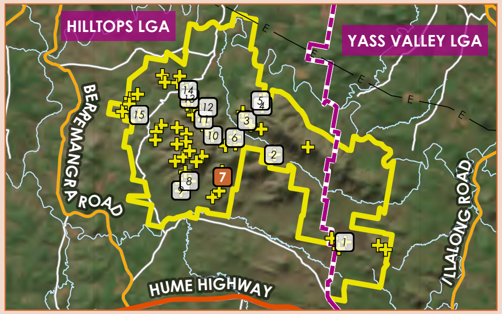
FIGURE 4.4 – BUSH FIRE ASSESSMENT & MITIGATION MEASURES (MAP 7 OF 15)

SLOPE ASSESSMENT



ASSET PROTECTION ZONE





LEGEND

- 🟨 Site boundary
- ✚ Wind turbine generator (WTG)
- ---- Access road
- 🟦 Hardstand
- ☐ Construction footprint
- ☐ Slope buffer (100 m)
- 🟩 Asset protection zone (construction footprint)
- ▨ Minimum setback to avoid Flame Zone (FZ) contact

Existing environment

- —E— Electricity transmission line
- — Major road
- — Minor road
- — Local road
- ----- Topographic contour (1 m)
- — Topographic contour (10 m)
- — Watercourse/drainage line
- ☐ Lot boundary
- ☐ Local government area

Slope class

- 🟩 0–5°
- 🟩 5–10°
- 🟩 10–15°
- 🟨 15–20°
- 🟨 20–25°
- 🟧 25–30°
- 🟥 >30°

Vegetation formation

- 🟨 Grassland
- 🟪 Western Slopes Grassy Woodland

Coppabella Wind Farm

23/09/2025 (v2) 1:5,000 (left) 1:1,500 (right) @A4 GDA2020 MGA Zone 55

50 0 20 m
Left Right

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PLANNING | GIS | ASSESSMENT

Data source: WBP (2025); DCSSS (2025); DCCEEW (2020); ESRI (2025); ICSM (2014 & 2017); RFS (2025)

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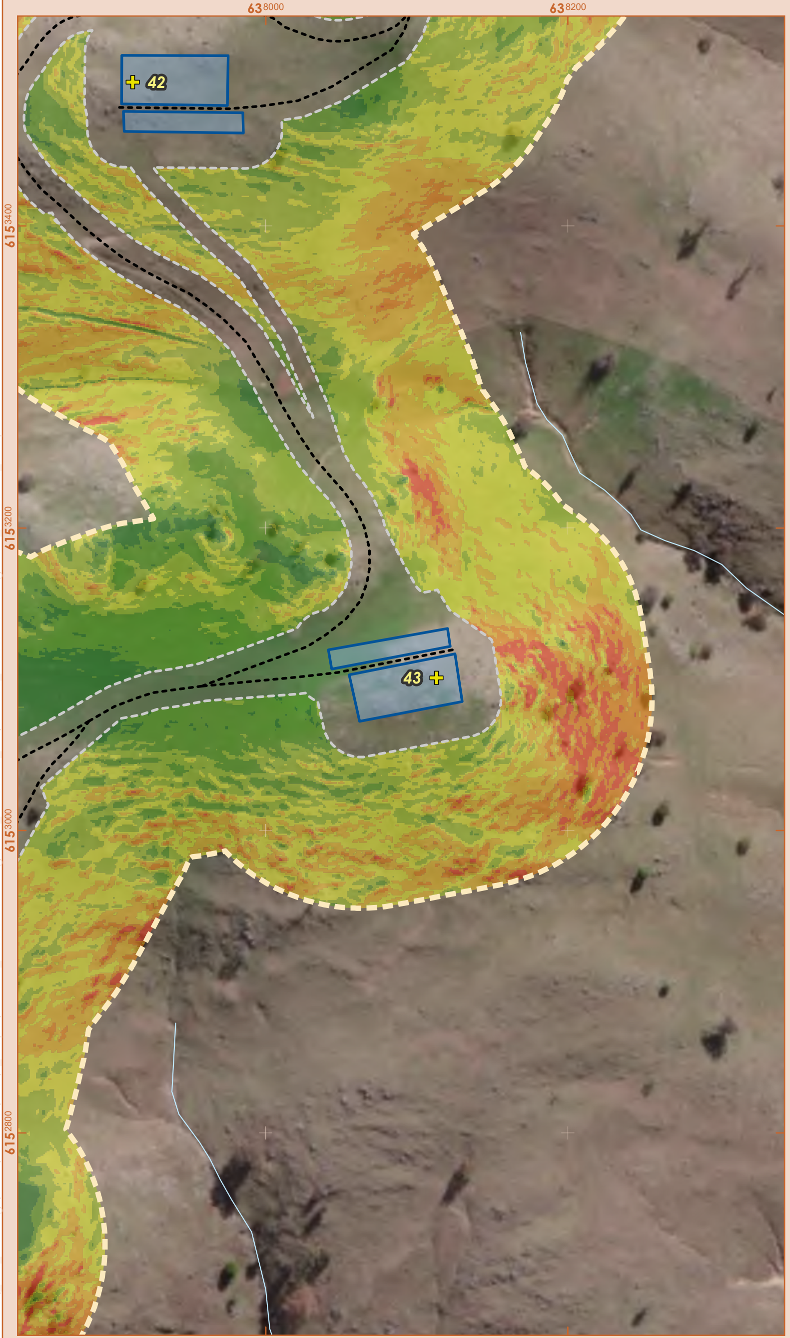
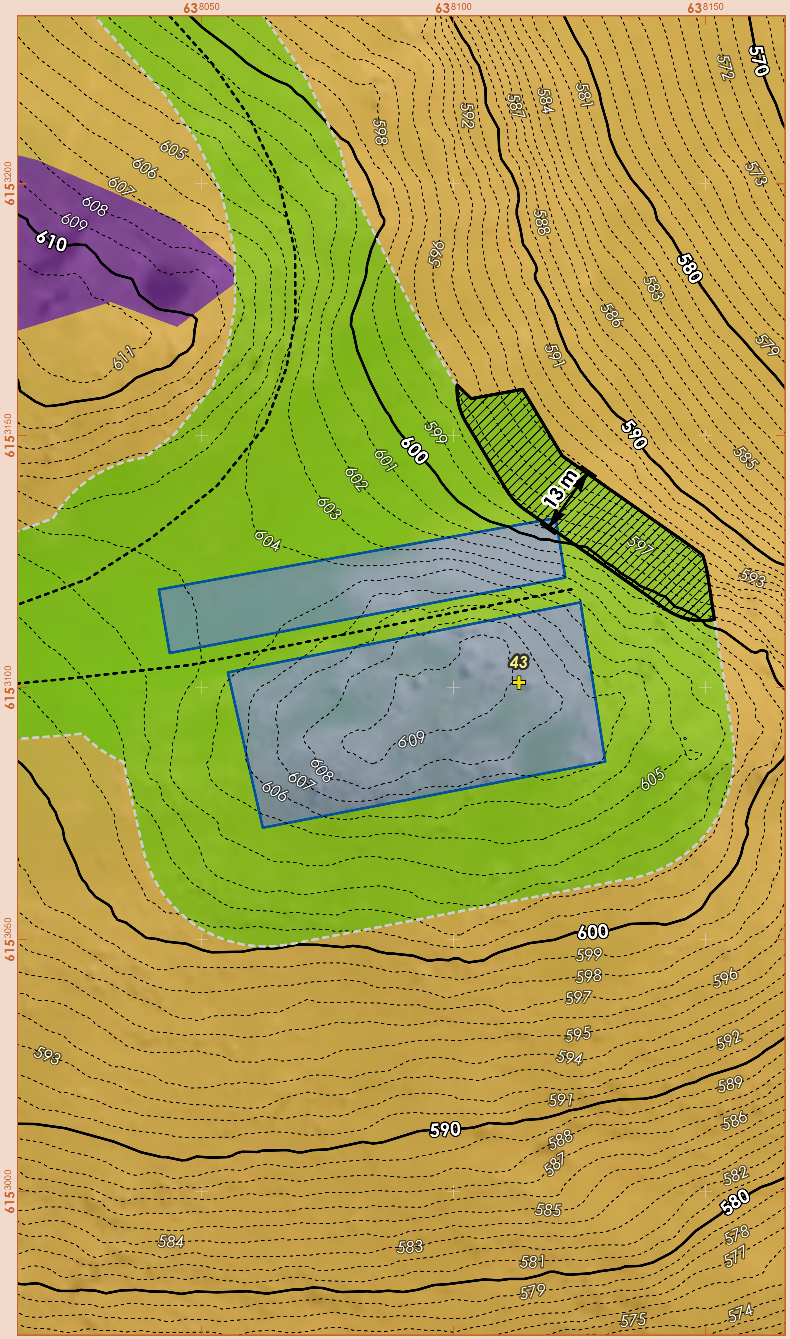
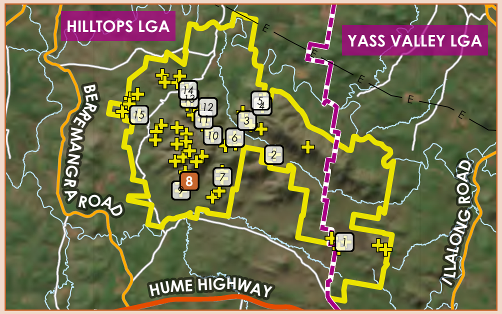
FIGURE 4.4 – BUSH FIRE ASSESSMENT & MITIGATION MEASURES (MAP 8 OF 15)

SLOPE ASSESSMENT



ASSET PROTECTION ZONE





LEGEND

- 🟨 Site boundary
- ✚ Wind turbine generator (WTG)
- ┄ Access road
- 🟦 Hardstand
- ⬚ Construction footprint
- ⬚ Slope buffer (100 m)
- 🟩 Asset protection zone (construction footprint)
- ▨ Minimum setback to avoid Flame Zone (FZ) contact

Existing environment
- —E— Electricity transmission line
- — Major road
- — Minor road
- — Local road
- ┄ Topographic contour (1 m)
- — Topographic contour (10 m)
- — Watercourse/drainage line
- ☐ Lot boundary
- ⬚ Local government area

Slope class
- 🟩 0–5°
- 🟩 5–10°
- 🟩 10–15°
- 🟨 15–20°
- 🟨 20–25°
- 🟧 25–30°
- 🟥 >30°

Vegetation formation
- 🟨 Grassland
- 🟪 Western Slopes Grassy Woodland

Coppabella Wind Farm

23/09/2025 (v2) 1:5,000 (left) 1:1,500 (right) @A4 GDA2020 MGA Zone 55

50 0 20 m
Left Right

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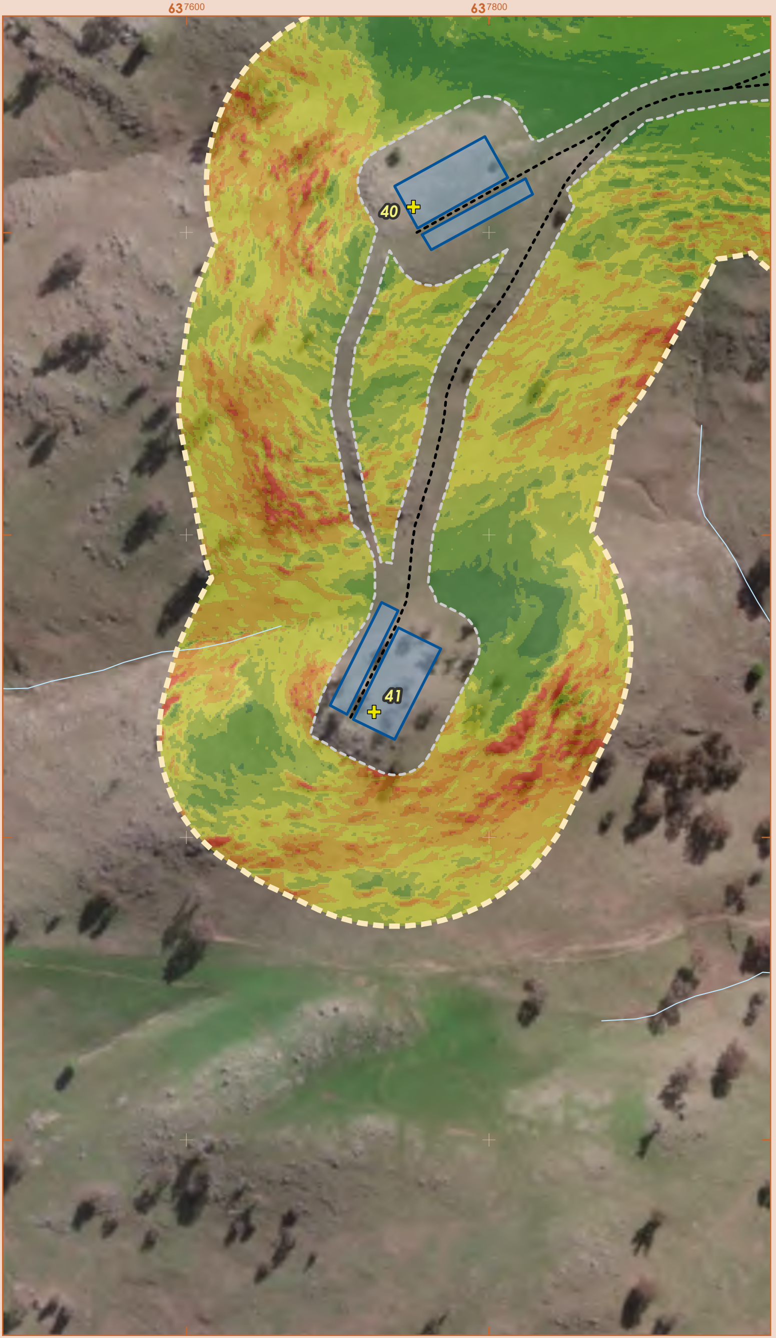
WARATAH BUSHFIRE
PLANNING | GIS | ASSESSMENT

Data source: WBP (2025); DCSSS (2025); DCCEEW (2020); ESRI (2025); ICSM (2014 & 2017); RFS (2025)

Path: D:_GIS_Working\WBP\W25058\GIS\B_Maps\BAR005_AssessmentMitigation_20250923_02\BAR005_AssessmentMitigation_20250923_02.aprx

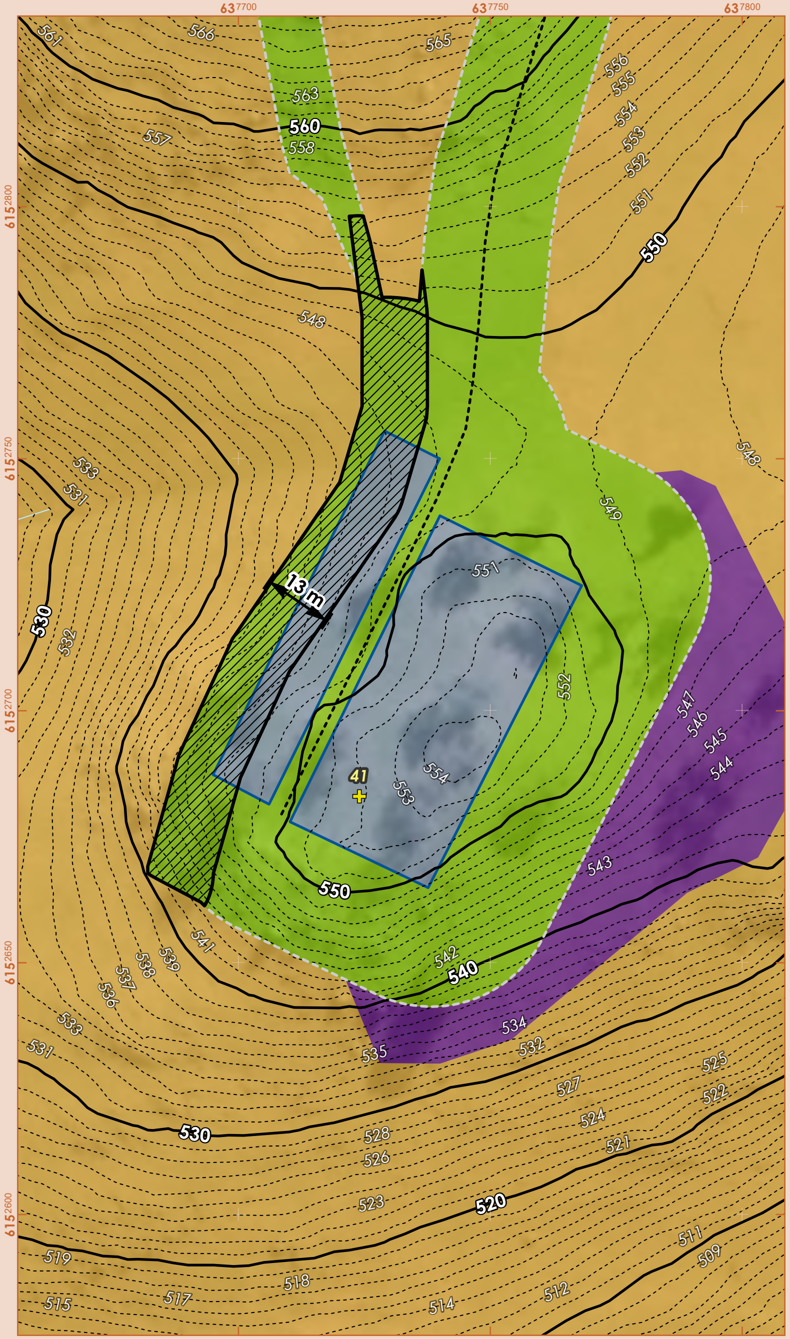
FIGURE 4.4 – BUSH FIRE ASSESSMENT & MITIGATION MEASURES (MAP 9 OF 15)

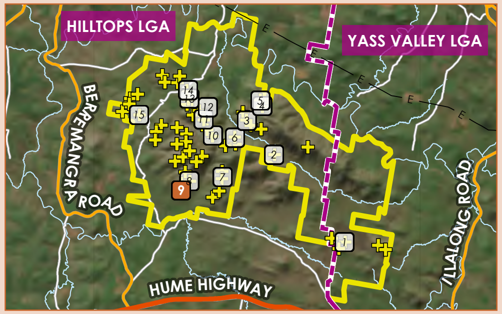
SLOPE ASSESSMENT



Data source: WBP (2025); DCSSS (2025); DCCEEW (2020); ESRI (2025); ICSM (2014 & 2017); RFS (2025)

ASSET PROTECTION ZONE





LEGEND

🟨	Site boundary
✚	Wind turbine generator (WTG)
----	Access road
▭	Hardstand
▭	Construction footprint
▭	Slope buffer (100 m)
🟩	Asset protection zone (construction footprint)
▨	Minimum setback to avoid Flame Zone (FZ) contact

Existing environment

—E—	Electricity transmission line
—	Major road
—	Minor road
—	Local road
----	Topographic contour (1 m)
—	Topographic contour (10 m)
—	Watercourse/drainage line
▭	Lot boundary
▭	Local government area

Slope class

🟩	0–5°
🟩	5–10°
🟩	10–15°
🟨	15–20°
🟨	20–25°
🟧	25–30°
🟥	>30°

Vegetation formation

🟨	Grassland
🟪	Western Slopes Grassy Woodland

Coppabella Wind Farm

23/09/2025 (v2) 1:5,000 (left) 1:1,500 (right) @A4 GDA2020 MGA Zone 55

50 0 20 m

Left Right

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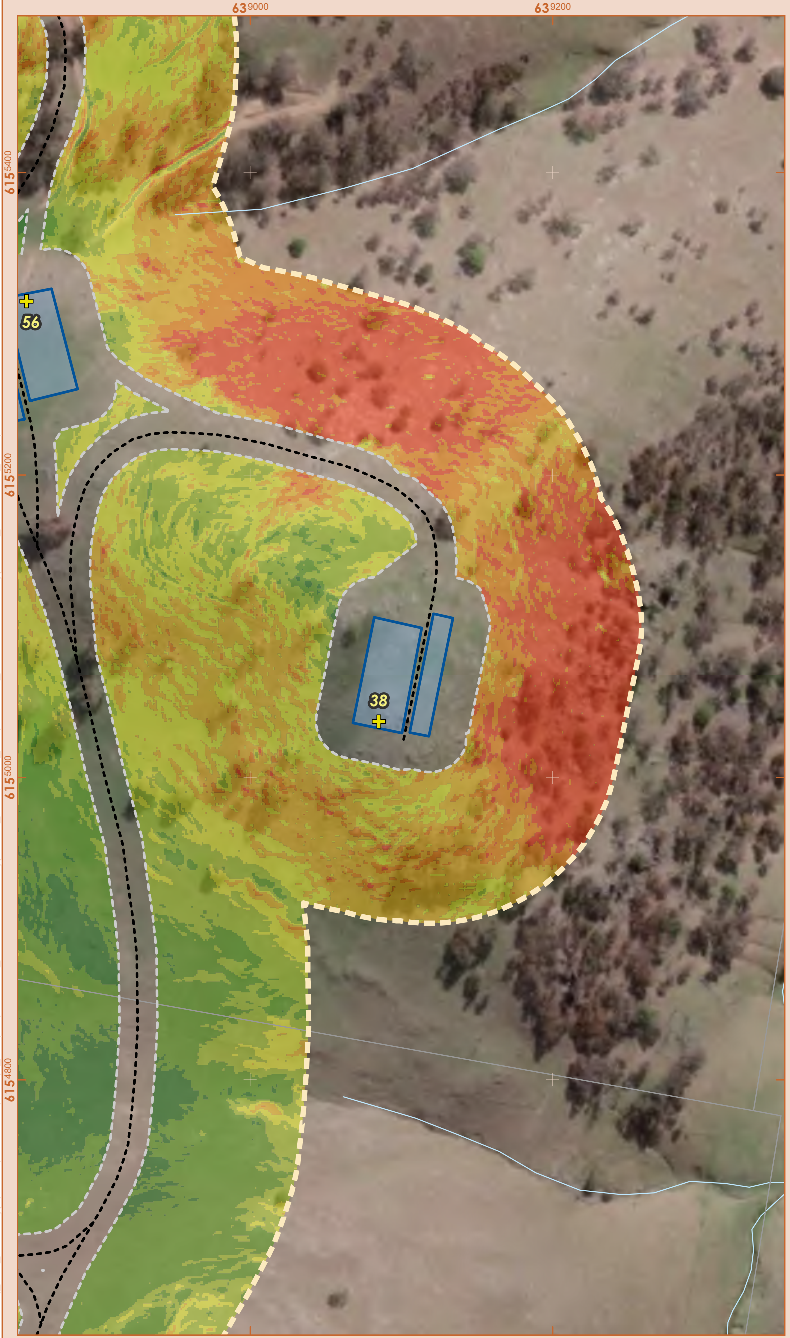
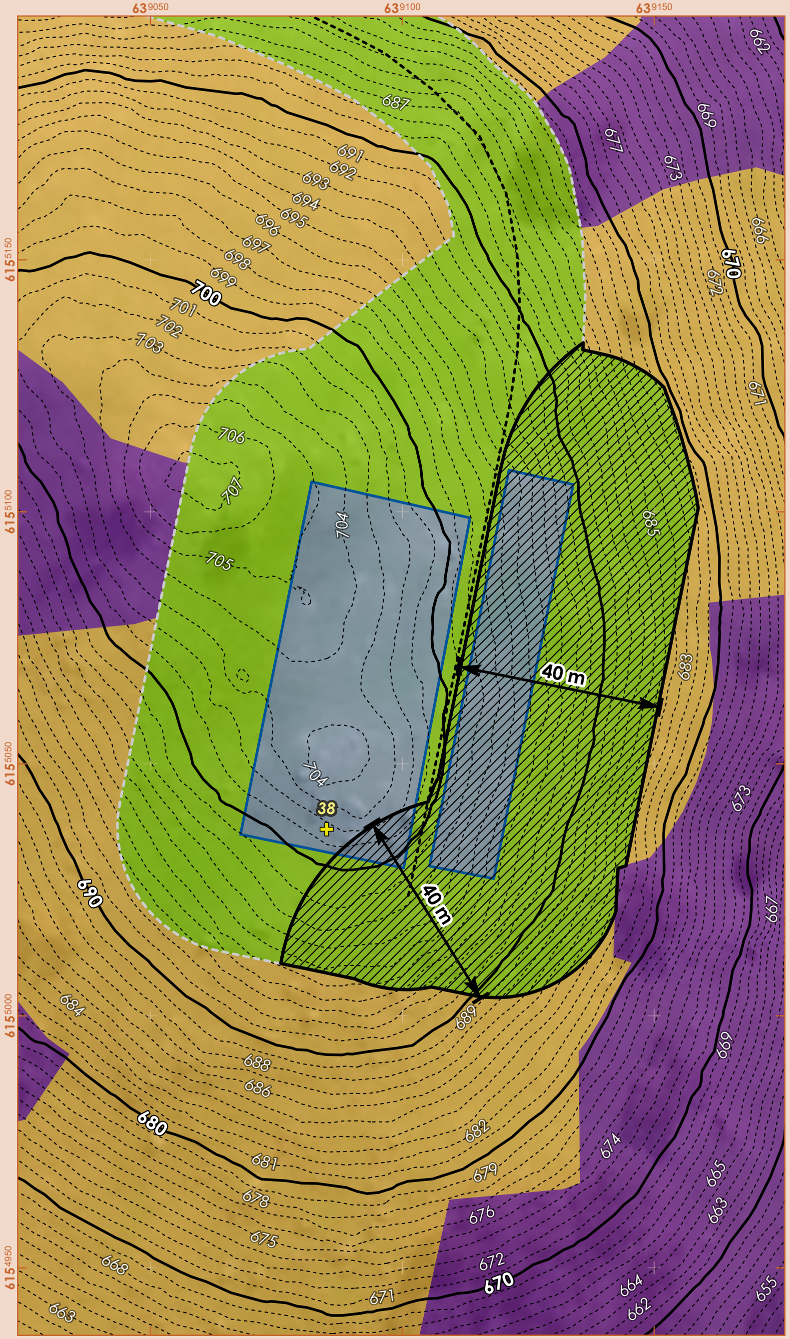
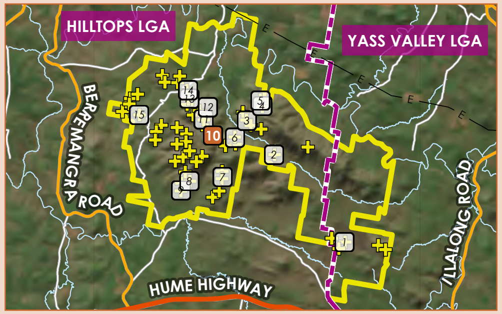
FIGURE 4.4 – BUSH FIRE ASSESSMENT & MITIGATION MEASURES (MAP 10 OF 15)

SLOPE ASSESSMENT



ASSET PROTECTION ZONE





LEGEND

- 🟨 Site boundary
- ✚ Wind turbine generator (WTG)
- - - - Access road
- 🟦 Hardstand
- ▭ Construction footprint
- ▭ Slope buffer (100 m)
- 🟩 Asset protection zone (construction footprint)
- ▨ Minimum setback to avoid Flame Zone (FZ) contact

Existing environment

- —E— Electricity transmission line
- — Major road
- — Minor road
- — Local road
- ------ Topographic contour (1 m)
- — Topographic contour (10 m)
- — Watercourse/drainage line
- ▭ Lot boundary
- ▭ Local government area

Slope class

- 🟩 0–5°
- 🟩 5–10°
- 🟩 10–15°
- 🟨 15–20°
- 🟨 20–25°
- 🟧 25–30°
- 🟥 >30°

Vegetation formation

- 🟨 Grassland
- 🟪 Western Slopes Grassy Woodland

Coppabella Wind Farm

23/09/2025 (v2) 1:5,000 (left) 1:1,500 (right) @A4 GDA2020 MGA Zone 55

50 0 20 m
Left Right

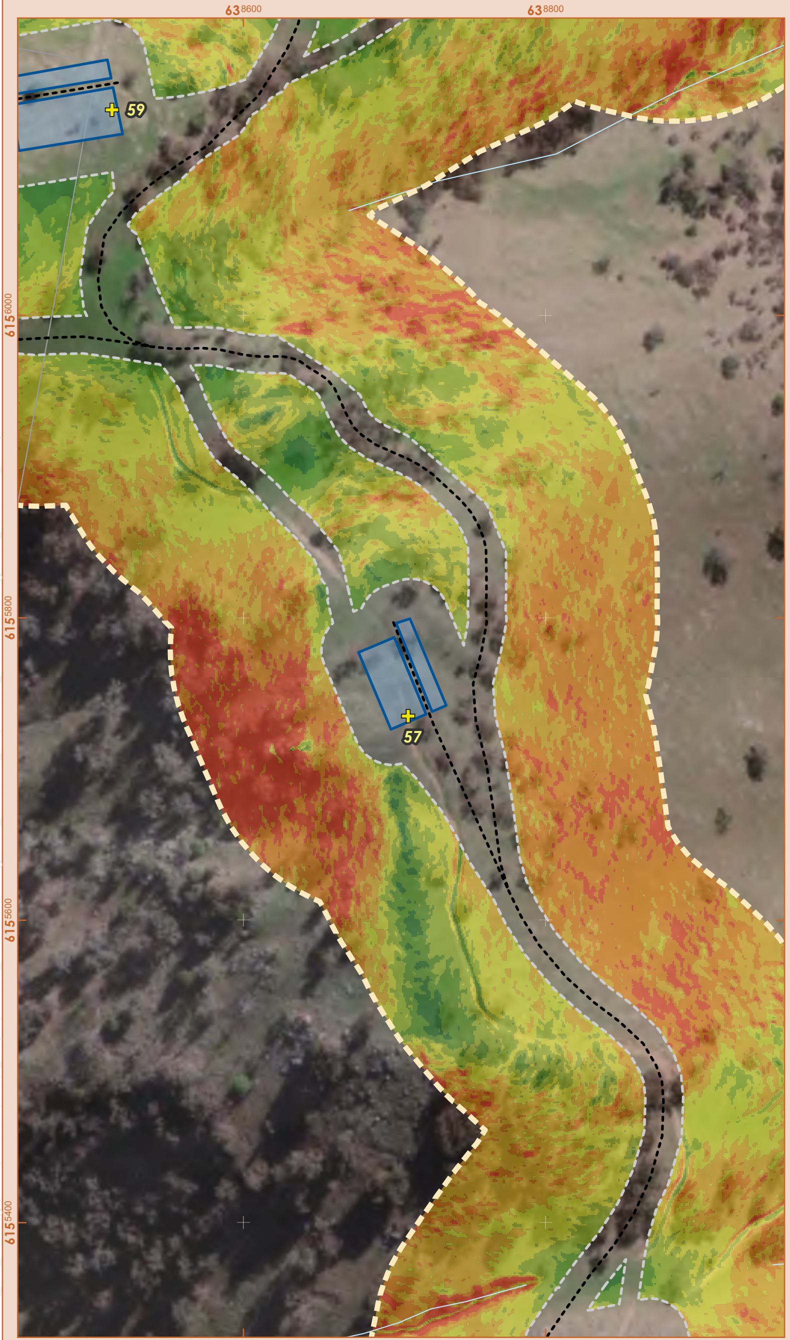
WARATAH BUSHFIRE
PLANNING | GIS | ASSESSMENT

Data source: WBP (2025); DCSSS (2025); DCCEEW (2020); ESRI (2025); ICSM (2014 & 2017); RFS (2025)

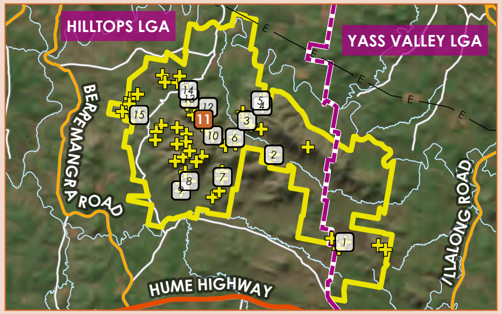
Path: D:_GIS_Working\WBP\W25058\GIS\B_Maps\BAR005_AssessmentMitigation_20250923_02\BAR005_AssessmentMitigation_20250923_02.aprx

FIGURE 4.4 – BUSH FIRE ASSESSMENT & MITIGATION MEASURES (MAP 11 OF 15)

SLOPE ASSESSMENT



ASSET PROTECTION ZONE



LEGEND

- 🟨 Site boundary
- ✚ Wind turbine generator (WTG)
- ┄ Access road
- 🟦 Hardstand
- ▭ Construction footprint
- ▭ Slope buffer (100 m)
- 🟩 Asset protection zone (construction footprint)
- ▨ Minimum setback to avoid Flame Zone (FZ) contact

Existing environment

- —E— Electricity transmission line
- — Major road
- — Minor road
- — Local road
- ┄ Topographic contour (1 m)
- — Topographic contour (10 m)
- — Watercourse/drainage line
- ▭ Lot boundary
- ▭ Local government area

Slope class

- 🟩 0–5°
- 🟩 5–10°
- 🟩 10–15°
- 🟨 15–20°
- 🟨 20–25°
- 🟧 25–30°
- 🟥 >30°

Vegetation formation

- 🟨 Grassland
- 🟪 Western Slopes Grassy Woodland

Coppabella Wind Farm

23/09/2025 (v2) 1:5,000 (left) 1:1,500 (right) @A4 GDA2020 MGA Zone 55

50 0 20 m

Left Right

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PLANNING | GIS | ASSESSMENT

Data source: WBP (2025); DCSSS (2025); DCCEEW (2020); ESRI (2025); ICSM (2014 & 2017); RFS (2025)

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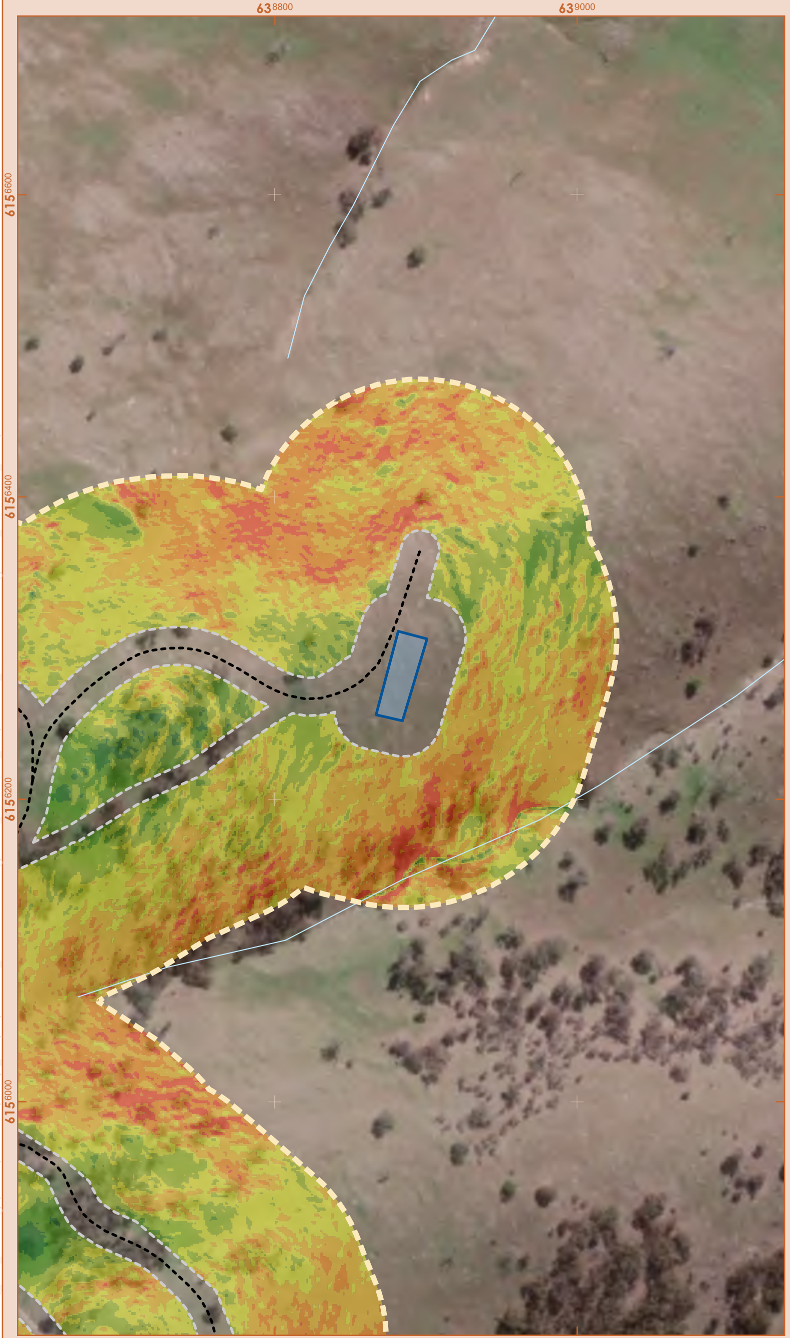
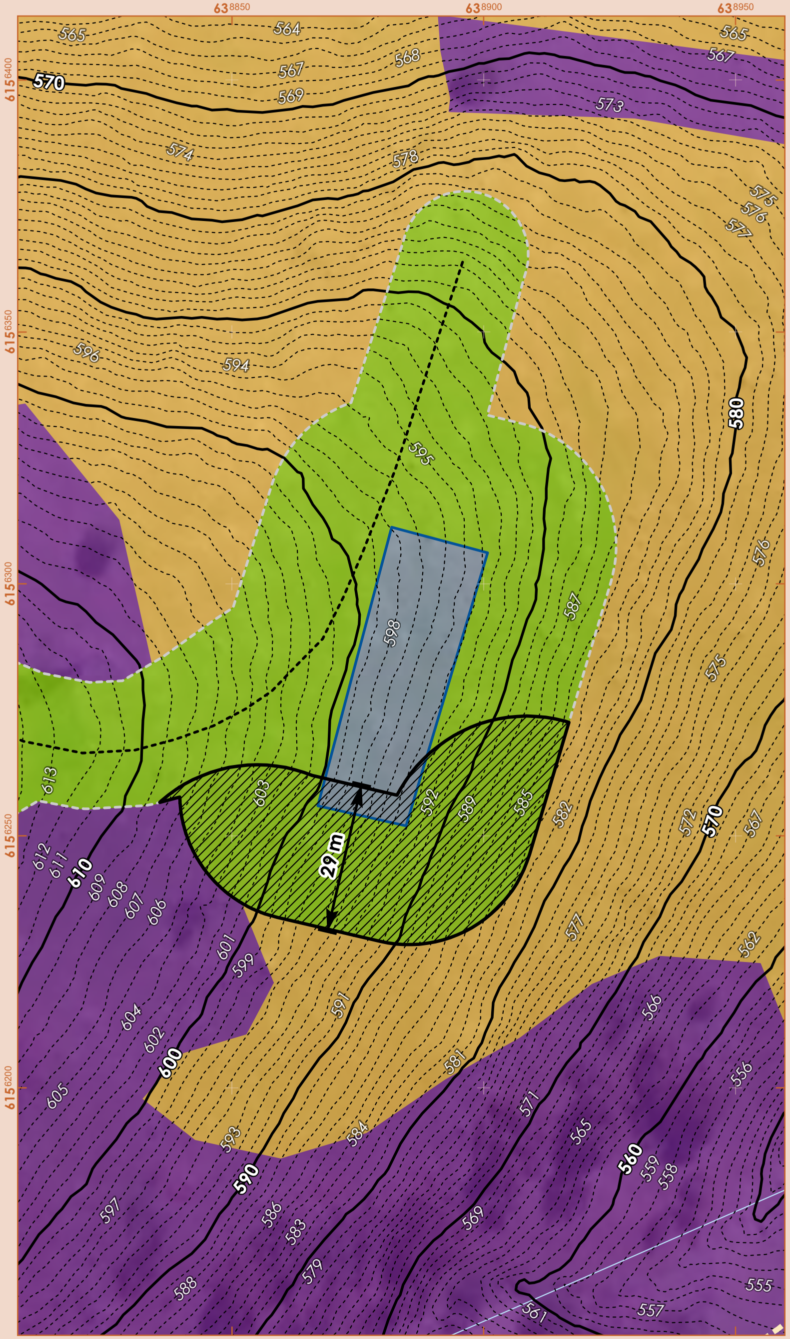
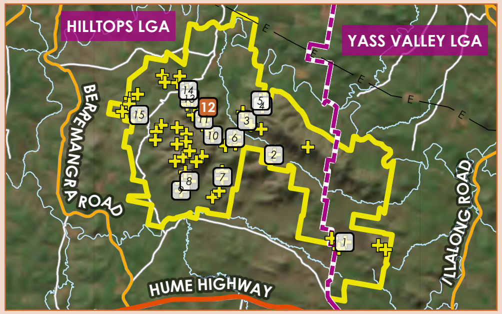
FIGURE 4.4 – BUSH FIRE ASSESSMENT & MITIGATION MEASURES (MAP 12 OF 15)

SLOPE ASSESSMENT



ASSET PROTECTION ZONE





LEGEND

▭ Site boundary
✚ Wind turbine generator (WTG)
- - - Access road
▭ Hardstand
▭ Construction footprint
▭ Slope buffer (100 m)
🟩 Asset protection zone (construction footprint)
▨ Minimum setback to avoid Flame Zone (FZ) contact

Existing environment
—E— Electricity transmission line
— Major road
— Minor road
— Local road
······ Topographic contour (1 m)
— Topographic contour (10 m)
— Watercourse/drainage line
▭ Lot boundary
▭ Local government area

Slope class
🟩 0–5°
🟩 5–10°
🟩 10–15°
🟨 15–20°
🟨 20–25°
🟧 25–30°
🟥 >30°

Vegetation formation
🟨 Grassland
🟪 Western Slopes Grassy Woodland

Coppabella Wind Farm

23/09/2025 (v2) 1:5,000 (left) 1:1,500 (right) @A4 GDA2020 MGA Zone 55

50 0 20 m
Left Right

Disclaimer: mapping is indicative only and the data shown has an inherent level of inaccuracy that is dependent on the data source. The location of all mapped features and boundaries should be confirmed by a registered surveyor.

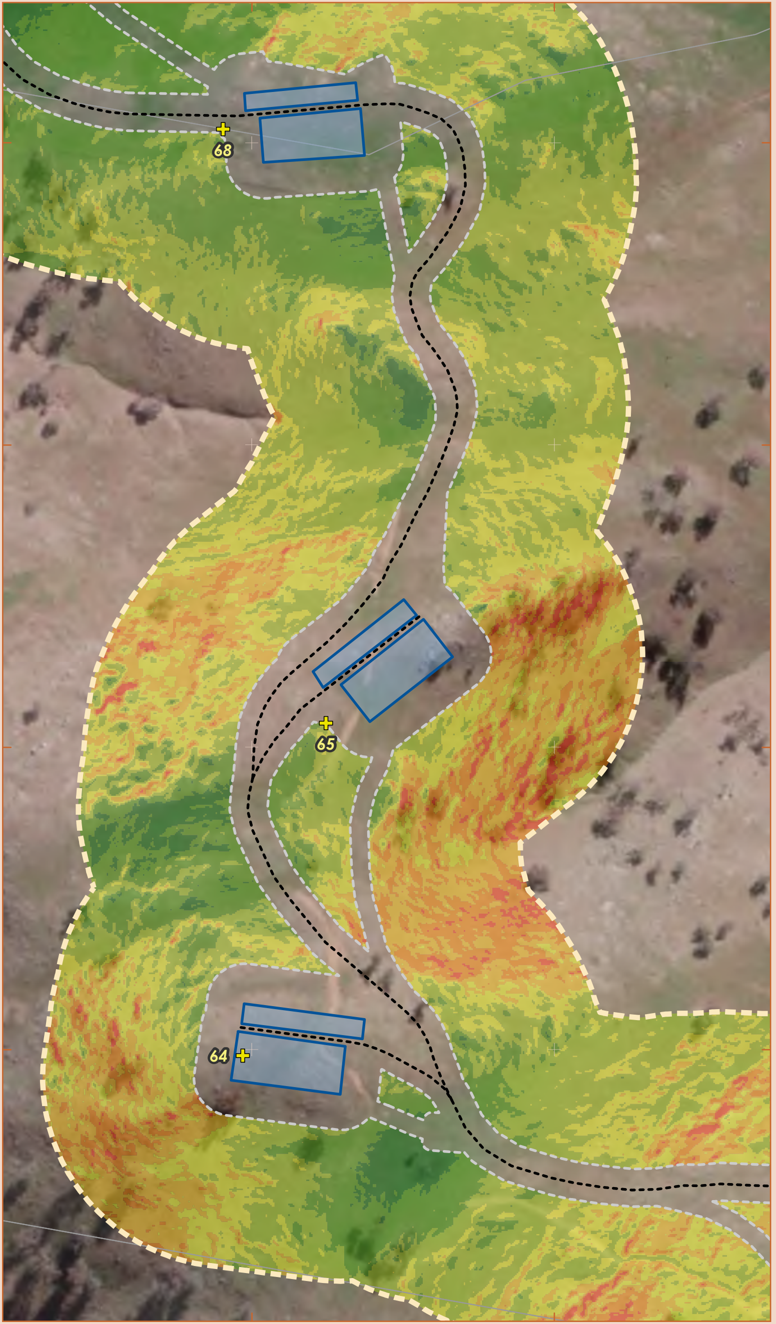
WARATAH BUSHFIRE
PLANNING | GIS | ASSESSMENT

Data source: WBP (2025); DCSSS (2025); DCCEEW (2020); ESRI (2025); ICSM (2014 & 2017); RFS (2025)

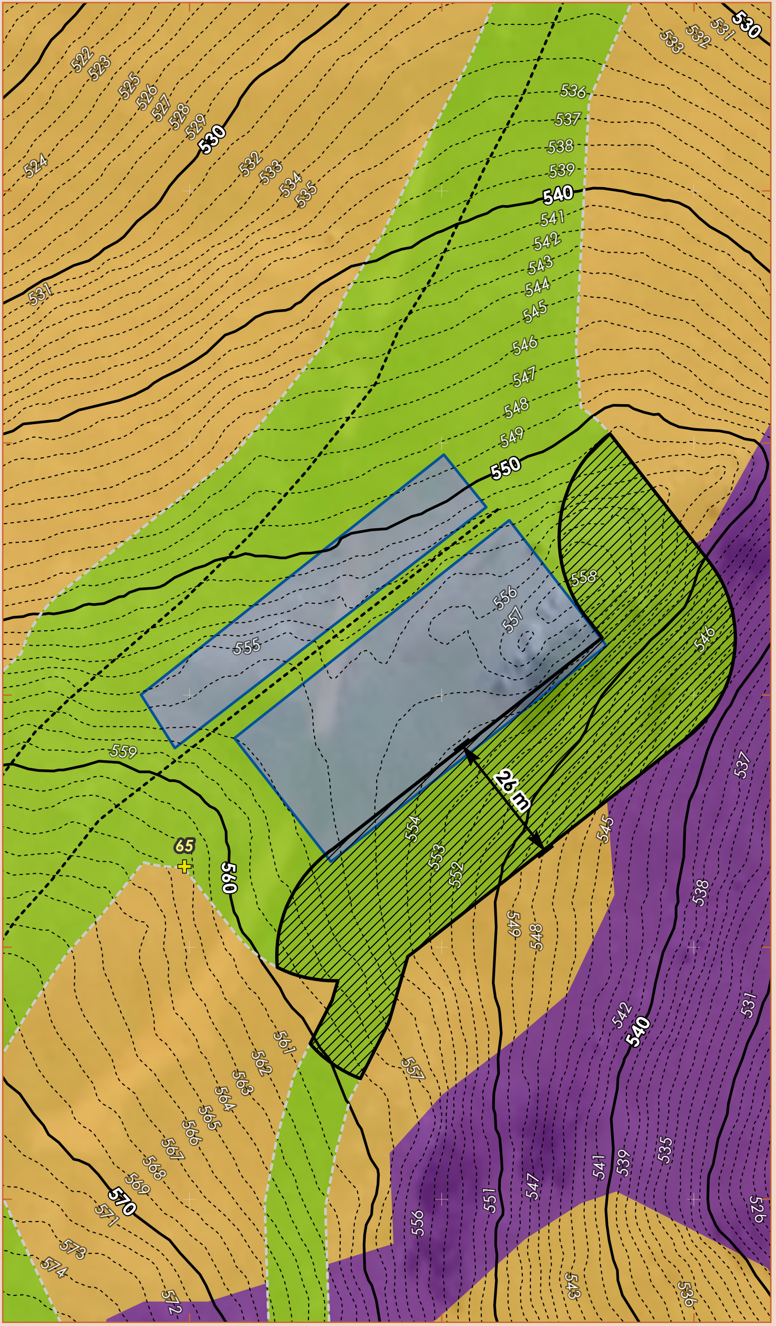
Path: D:_GIS_Working\WBP\W25058\GIS\B_Maps\BAR005_AssessmentMitigation_20250923_02\BAR005_AssessmentMitigation_20250923_02.aprx

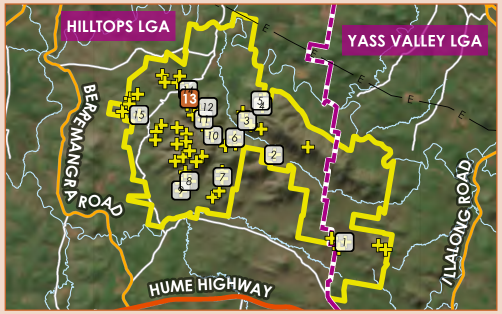
FIGURE 4.4 – BUSH FIRE ASSESSMENT & MITIGATION MEASURES (MAP 13 OF 15)

SLOPE ASSESSMENT



ASSET PROTECTION ZONE





LEGEND

🟨 Site boundary
✚ Wind turbine generator (WTG)
- - - Access road
▭ Hardstand
▭ Construction footprint
▭ Slope buffer (100 m)
🟩 Asset protection zone (construction footprint)
▨ Minimum setback to avoid Flame Zone (FZ) contact

Existing environment
—E— Electricity transmission line
— Major road
— Minor road
— Local road
- - - Topographic contour (1 m)
— Topographic contour (10 m)
— Watercourse/drainage line
▭ Lot boundary
▭ Local government area

Slope class
🟩 0–5°
🟩 5–10°
🟩 10–15°
🟨 15–20°
🟨 20–25°
🟧 25–30°
🟥 >30°

Vegetation formation
🟨 Grassland
🟪 Western Slopes Grassy Woodland

Coppabella Wind Farm

23/09/2025 (v2) 1:5,000 (left) 1:1,500 (right) @A4 GDA2020 MGA Zone 55

50 0 20 m
Left Right

Disclaimer: mapping is indicative only and the data shown has an inherent level of inaccuracy that is dependent on the data source. The location of all mapped features and boundaries should be confirmed by a registered surveyor.

WARATAH BUSHFIRE
PLANNING | GIS | ASSESSMENT

Data source: WBP (2025); DCSSS (2025); DCCEEW (2020); ESRI (2025); ICSM (2014 & 2017); RFS (2025)

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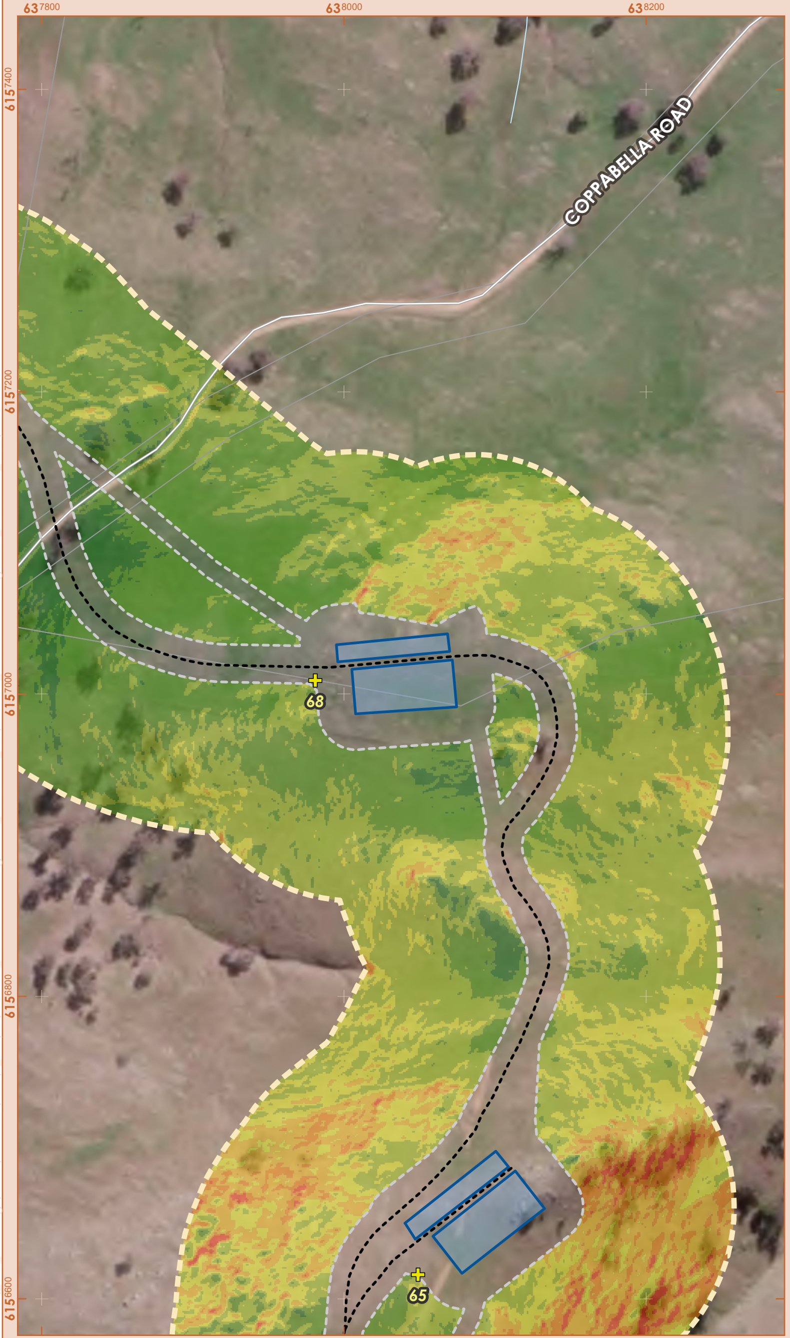
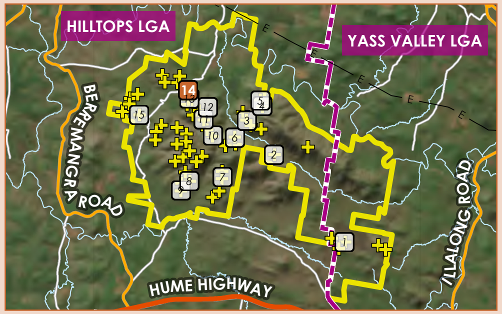
FIGURE 4.4 – BUSH FIRE ASSESSMENT & MITIGATION MEASURES (MAP 14 OF 15)

SLOPE ASSESSMENT



ASSET PROTECTION ZONE



LEGEND

▭	Site boundary
✚	Wind turbine generator (WTG)
-----	Access road
▭	Hardstand
▭	Construction footprint
▭	Slope buffer (100 m)
🟩	Asset protection zone (construction footprint)
▨	Minimum setback to avoid Flame Zone (FZ) contact

Existing environment

—E—	Electricity transmission line
—	Major road
—	Minor road
—	Local road
-------	Topographic contour (1 m)
—	Topographic contour (10 m)
—	Watercourse/drainage line
▭	Lot boundary
▭	Local government area

Slope class

🟩	0–5°
🟩	5–10°
🟩	10–15°
🟨	15–20°
🟨	20–25°
🟧	25–30°
🟥	>30°

Vegetation formation

🟨	Grassland
🟪	Western Slopes Grassy Woodland

Coppabella Wind Farm

23/09/2025 (v2) 1:5,000 (left) 1:1,500 (right) @A4 GDA2020 MGA Zone 55

50 0 20 m
Left Right

WARATAH BUSHFIRE
PLANNING | GIS | ASSESSMENT

Data source: WBP (2025); DCSSS (2025); DCCEEW (2020); ESRI (2025); ICSM (2014 & 2017); RFS (2025)

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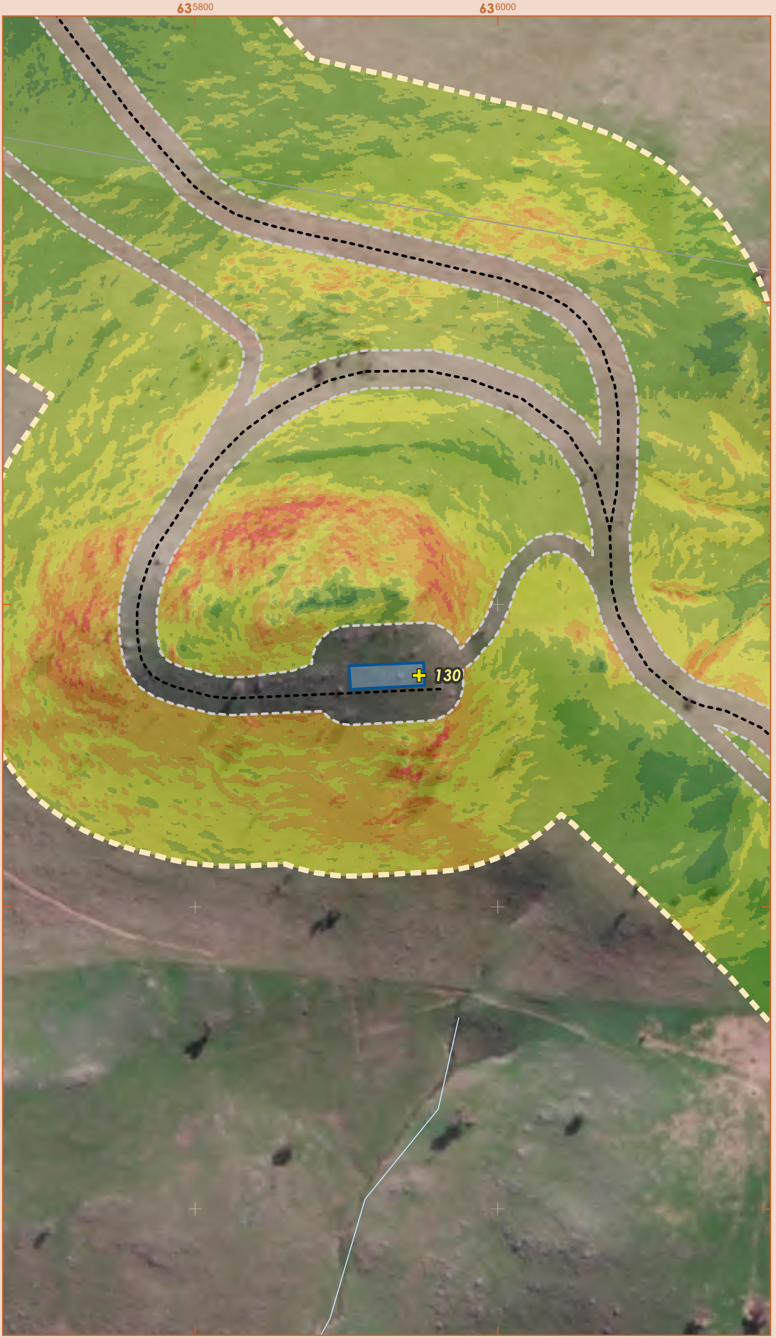
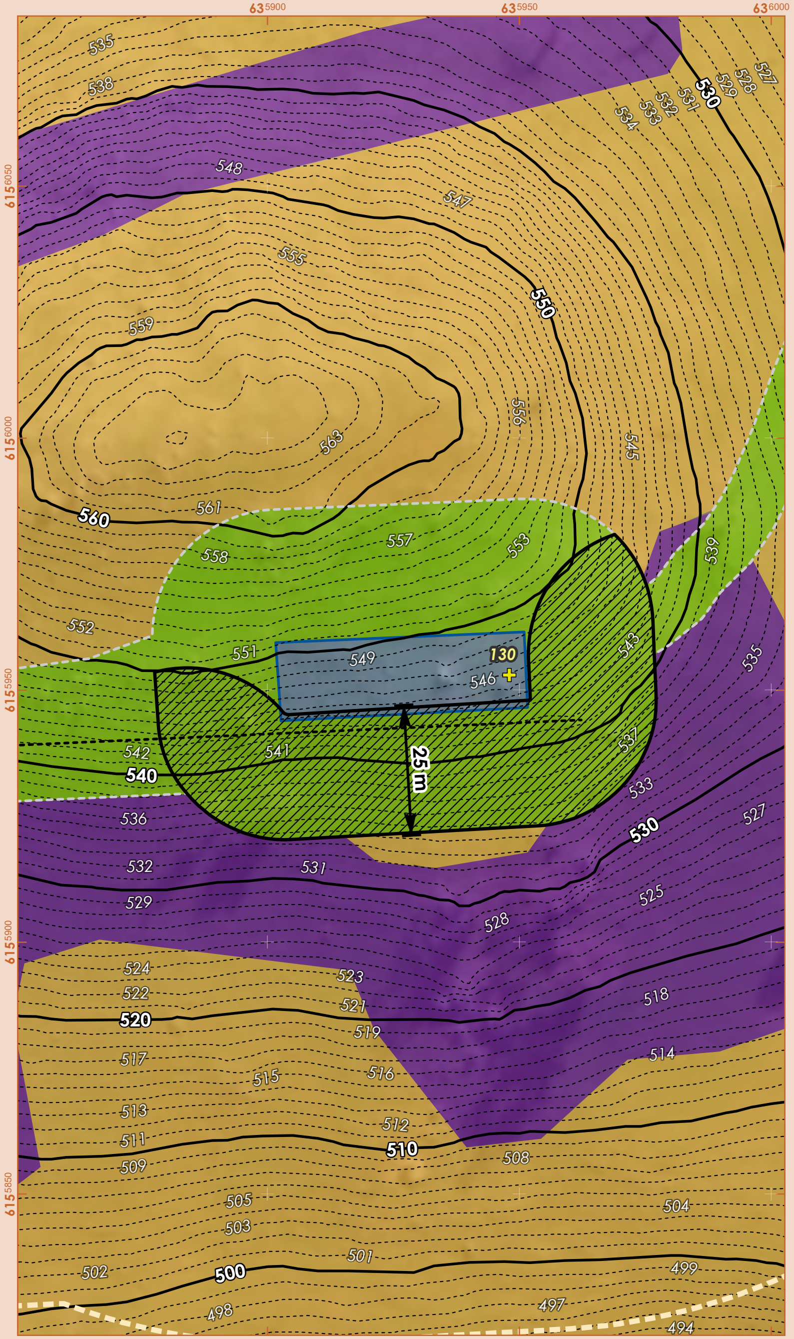
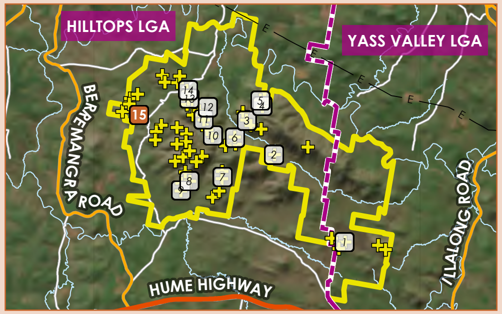
FIGURE 4.4 – BUSH FIRE ASSESSMENT & MITIGATION MEASURES (MAP 15 OF 15)

SLOPE ASSESSMENT



ASSET PROTECTION ZONE





LEGEND

- 🟨 Site boundary
- ✚ Wind turbine generator (WTG)
- ┈ Access road
- 🟦 Hardstand
- ▢ Construction footprint
- ▢ Slope buffer (100 m)
- 🟩 Asset protection zone (construction footprint)
- ▨ Minimum setback to avoid Flame Zone (FZ) contact

Existing environment

- —E— Electricity transmission line
- — Major road
- — Minor road
- — Local road
- ┈ Topographic contour (1 m)
- — Topographic contour (10 m)
- — Watercourse/drainage line
- ▢ Lot boundary
- ▢ Local government area

Slope class

- 🟩 0–5°
- 🟩 5–10°
- 🟩 10–15°
- 🟨 15–20°
- 🟨 20–25°
- 🟧 25–30°
- 🟥 >30°

Vegetation formation

- 🟨 Grassland
- 🟪 Western Slopes Grassy Woodland

Coppabella Wind Farm

23/09/2025 (v2) 1:5,000 (left) 1:1,500 (right) @A4 GDA2020 MGA Zone 55

50 0 20 m
Left Right

WARATAH BUSHFIRE
PLANNING | GIS | ASSESSMENT

Data source: WBP (2025); DCSSS (2025); DCCEEW (2020); ESRI (2025); ICSM (2014 & 2017); RFS (2025)

Path: D:_GIS_Working\WBP\W25058\GIS\B_Maps\BAR005_AssessmentMitigation_20250923_02\BAR005_AssessmentMitigation_20250923_02.aprx

4.8 Bush fire risk created by the project

Fire risks have been identified and must be effectively managed during the construction and commissioning of the project.

4.8.1 Assessment of bush fire risk during construction and decommissioning

The potential sources of ignition of bush fires resulting from the construction of the project and decommissioning include:

- Construction equipment including bulldozers, excavators and vegetation removal machinery using slashers and mulching machines. These activities can produce sparks when steel blades encounter rock, with the potential to ignite surrounding vegetation.
- Motor vehicle exhaust systems and diesel-powered trucks with pollution control devices have the potential to emit burning diesel particles and ignite grassland and woodland ground fuels.
- Hot works such as welding and grinding can produce sparks resulting in an extreme level of risk of ignition for cured vegetation.
- Electrical equipment faults create a high level of risk of ignition of vegetation.
- Inappropriate storage of chemicals has the potential to cause a chemical fire or explosion. Failure to clean up a spill can also lead to fire.

Mitigation measures required to manage and minimise these risks are outlined in Section 5.

4.8.2 Assessment of bush fire risk during operation

The potential sources of ignition of bush fires resulting from the operation of the project, including those identified within the PHA are:

- Landscape hazards, such as ignition of site infrastructure from embers, radiant heat and flame contact from a bush fire external to the project area
- Potential fire spread due to proximity of batteries to each other and on-site infrastructure.
- Production and accumulation of flammable gases in battery enclosures with ignition resulting in fire or explosion and thermal runaway.
- Faulty equipment.

- Mechanical damage or failure of battery case (e.g short circuit, overheating, overcharge.
- Chemical hazards, such as the inherent hazards of the stored dangerous goods; spills and leaks of transformer oil/diesel spills/leaks, refrigerant gas/coolant; chemical reactions from ignition.
- Mechanical damage to battery containers/enclosures due to vehicular impact.

The potential consequences of fire within and external to the site include:

- Damage to BESS and associated infrastructure.
- Disruption to power supply.
- Injury and/or fatality to onsite personnel or firefighters.
- Bush fire and damage to the surrounding environment, including the surrounding rural areas.
- Heat radiation to transformer. The transformer overheats and fails.
- Ember attack ignites exposed cables.
- Contaminated fire water (potential runoff of contaminated fire water into the environment)
- Emergency responders are unable to reach BESS as space between battery banks is insufficient for to allow for safe vehicle movement.

Section 5 outlines the mitigation measures required to manage and minimise these risks, and Section 5.2.5 provides a summary of the controls outlined in the PHA.

5. BUSH FIRE MITIGATION MEASURES

Bush fire mitigation measures have been developed for the construction, operational and decommissioning phases of the project based on guidance from NSW RFS guidelines, *PBP 2019,* electrical network industry sources and best practice design guidelines prepared by the CFA (2023 & 2025). Adopting these measures is expected to reduce, to an acceptable level, both the risk of bush fire ignition by construction and/or operation of the assets and the risk that bush fires in the landscape pose to the assets.

5.1 During construction and decommissioning

Construction and decommissioning activities may pose a potential for on-site ignitions, resulting in a fire escaping to the surrounding private land. These mainly arise from hot work, fire risk work, vegetation clearing and management and the use of vehicles on site. It is recommended that contractors incorporate the following bush fire mitigation measures to ensure the risk is appropriately managed.

- The use of construction equipment, slashers and mulching machines in areas where rock is known to occur shall be accompanied by a fire-fighting appliance such as a 4-wheel drive (4WD) Striker with 'slip-on' fire-fighting unit or tanker trailers, equipped with diesel pump and hose. This work should not occur during periods of Total Fire Ban and Catastrophic Fire Weather Days.
- Precautions should be used during all external hot works with shielding and a water supply (i.e., nine kilogram water fire extinguisher) provided. No external hot works should be undertaken during periods of Total Fire Ban and Catastrophic Fire Weather Days. Contractors must be aware of prohibited activities or exemptions that are notified by the Commissioner of the NSW RFS under the RF Act s99.
- Emergency external hot works undertaken during periods of Total Fire Ban and Catastrophic Fire Weather Days are to have a NSW Rural Fire Service fire-fighting appliance on stand-by at the works.
- Motor vehicles should not be driven across long cured (dry) vegetation (grass & crops) and should be equipped with a nine kilogram water fire extinguisher.

- Operators of diesel-powered trucks should be made aware of the risk of ignition of vegetation posed by the exhaust emission system. These trucks should be equipped with a nine-kilogram water fire extinguisher.
- Electrical equipment should be checked weekly for potential faults.
- All chemicals should be managed and stored in accordance with safety data sheet requirements.
- Fire detection and suppression systems should be installed at the earliest stage of construction for BESS infrastructure.
- Provide first-aid equipment, such as fire extinguishers.
- Prepare an updated Emergency Response Plan (inclusive of the bush fire risk management) to include the BESS component (refer to Section 5.2.7)

5.2 During operation (permanent mitigation measures)

5.2.1 Asset protection zones & vegetation screening

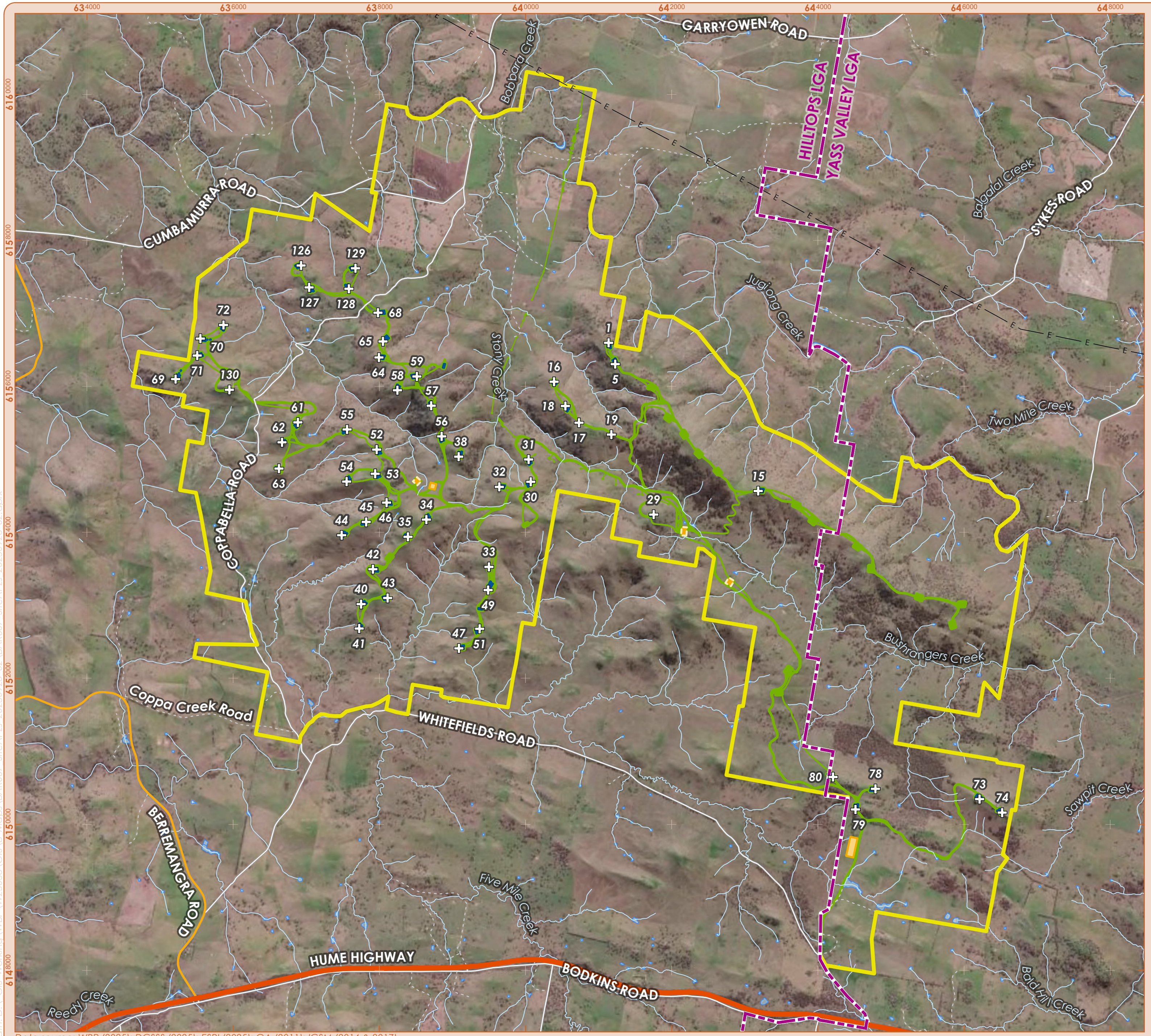
APZs have been defined around the batteries, as shown in Figure 4-4, to minimise radiant heat impact and avoid flame zone (FZ) contact.

The APZ must be effectively managed for the duration of the project's operational life.

The effective management of vegetation and fuel can reduce the risk of fire entering the development footprint, and the consequences of fire. The following measures are recommended:

- Long grass and deep leaf litter must not be present in areas where heavy equipment will be working.
- Maintenance of grassland within the asset protection zone (refer Figure 4-5) during the Fire Danger Period.
- Remove any accumulation of combustible materials (including leaf litter) in or within the minimum setbacks identified for BESS and related infrastructure; and
- Landscape screening (if required) should occur outside of the APZ and consider the potential increase in fire risk due to the type (species), density, height, location and overall width of the vegetation screening.

FIGURE 4.5 – SITE ASSET PROTECTION ZONES



LEGEND

🟨 Site boundary

✣ Wind turbine generator (WTG)

🟧 Temporary Construction Compound

🟨 Permanent Construction Compound and O&M

🟦 Hardstand

🟩 Asset protection zone (construction footprint)

Existing environment

—E— Electricity transmission line

— Major road

— Minor road

— Local road

- - - Vehicular track

— Watercourse/drainage line

▭ Waterbody

▭ Local government area

Coppabella Wind Farm

23/09/2025 (v2) 1:75,000 @A4 GDA2020 MGA Zone 55

0 1 2 km

Disclaimer: mapping is indicative only and the data shown has an inherent level of inaccuracy that is dependent on the data source. The location of all mapped features and boundaries should be confirmed by a registered surveyor.

WARATAH BUSHFIRE

PLANNING | GIS | ASSESSMENT

Data source: WBP (2025); DCSSS (2025); ESRI (2025); GA (2011); ICSM (2014 & 2017)

Path: D:_GIS_Working\WBP\W25058\GIS\B_Maps\BAR007_SiteAPZs_20250923_02\BAR007_SiteAPZs_20250923_02.aprx

5.2.2 Building construction

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.

Each BESS must be regularly serviced to manufacturers' specifications and regularly inspected for signs of mechanical damage to external containers/enclosures. It is recommended that BESS infrastructure is:

- Installed on a non-combustible surface such as concrete.
- Fencing and retaining are constructed from fire-resistant materials.
- All buildings are designed for adequate fire protection.
- Insulation around the battery module to limit heat effects.
- The vent covers of the BESS shall be constructed of non-combustible material
- Adoption of the recommendations outlined in the Preliminary Hazard Analysis prepared by Riskcon Engineering (2025).

5.2.3 Access for firefighting operations

Access to the project will extend from the Hume Highway in the south and link to Coppabella Road, which traverses the property in the west. The access will be sealed and 5.5 m wide.

The existing internal network of access tracks has been established to enable responding emergency services to access all facility areas, including fire service infrastructure (water tanks), substations, BESS and related infrastructure.

The internal access tracks will include:

- Connecting 5.5m wide (minimum) access tracks to facilitate access to all wind turbines and BESS infrastructure.

- Access must allow for safe and effective firefighting operations around the perimeter of each BESS (where slopes allow). Alternatively, access must be provided within 70m of the most distant BESS container.

Access to the development footprint complies with the acceptable solutions outlined in Table 5-2 below. This criterion does not necessarily relate to BESS infrastructure in all circumstances, and therefore, additional comments have been incorporated where applicable.

Table 5-1 – Performance criteria for access (PBP 2019)

Performance criteria	*Acceptable solution*	*Compliance with acceptable solutions*	*Comment*
Firefighting vehicles are provided with safe, all weather access to structures and hazard vegetation	Property access roads are two-wheel drive, all-weather roads	☑	Can comply
The capacity of access roads is adequate for firefighting vehicles	The capacity of road surfaces and any bridges/causeways is sufficient to carry fully loaded firefighting vehicles (up to 23 tonnes); bridges/causeways are to clearly indicate load rating.	☑	Can comply
There is appropriate access to water supply	Hydrants are provided in accordance with AS 2419.1:2021	☐	Static water supply is to be provided
	There is suitable access for a Category 1 fire appliance to within 4m of the static water supply where no reticulated supply is available	☑	
Fire fighting vehicles can access the dwelling and exit the property safely	At least one alternative property access road is provided for individual dwellings or groups of dwellings that are located more than 200m from a public road	☑	Alternative property access is achieved with access provided to the north, south and west.
The capacity of access roads is adequate for firefighting vehicles.	The capacity of perimeter and non-perimeter road surfaces and any bridges/causeways is sufficient to carry fully loaded firefighting vehicles (up to 23 tonnes); bridges/ causeways are to clearly indicate load rating.	☑	Can comply

Performance criteria	***Acceptable solution***	***Compliance with acceptable solutions***	***Comment***
Firefighting vehicles can access the development footprint and exit the property safely.	Minimum 4m carriageway width;	☑	Complies
	In forest, woodland and heath situations, rural property access roads have passing bays every 200m that are 20m long by 2m wide, making a minimum trafficable width of 6m at the passing bay;	N/A	The proposed 5.5m sealed roads provide an opportunity for passing
	A minimum vertical clearance of 4m to any overhanging obstructions, including tree branches;	☑	Can comply
	Provide a suitable turning area in accordance with Appendix 3 of PBP 2018	☑	Can comply
	Curves have a minimum inner radius of 6m and are minimal in number to allow for rapid access and egress;	☑	Can comply
	The minimum distance between inner and outer curves is 6m;	☑	Can comply
	The crossfall is not more than 10 degrees;	☑	Complies
	Maximum grades for sealed roads do not exceed 15 degrees and not more than 10 degrees for unsealed roads; and	☑	Complies
Note: Some short constrictions in the access may be accepted where they are not less than 3.5m wide, extend for no more than 30m and where the obstruction cannot be reasonably avoided or removed.			

5.2.4 Water supply

In the event of a fire (structure, grass fire or bush fire), sufficient water must be available and safely accessible to emergency services to ensure fire suppression activities are safe and effective. The water supply must be provided to cover the BESS infrastructure.

Additional fire protection systems or equipment required under any Australian Standards for dangerous goods must be provided as prescribed.

The following outlines the performance criteria for water supply. This criterion does not necessarily relate to BESS infrastructure in all circumstances, and therefore additional comments in relation to CFA (2025) guidelines have been incorporated where applicable.

It is recommended that the water supply for firefighting purposes is located at the primary vehicle access point to the project (as a minimum) and located at least 10m away from the BESS infrastructure. Dedicated firefighting supply tanks – with volume (and siting) to be determined through the Fire Safety Study.

Table 5-2 – Performance criteria for water supplies (PBP 2019)

Performance criteria	*Acceptable solutions*	*Achievable for the project*	*Comment*
An adequate water supply is provided for firefighting purposes.	Reticulated water is to be provided, where available.	..	Can comply. Additional static water is to be provided
	A static water supply is to be provided where no reticulated water is available	☑	
The integrity of the water supply is maintained.	All above-ground water service pipes are metal, including and up to any taps.	☑	Can comply
A static water supply is provided for firefighting purposes in areas where reticulated	Where no reticulated water supply is available, water for firefighting purposes is provided in accordance with Table 5.3d of PBP 2019. These requirements are designed for residential development.	☑	Water requirements are to be determined in consultation with the district RFS, Fire Rescue NSW & as determined through the Fire Safety Study

Performance criteria	*Acceptable solutions*	*Achievable for the project*	*Comment*
water is not available.	A connection for firefighting purposes is located within the IPA or non-hazard side and away from the structure; 65mm Storz outlet with a ball valve is fitted to the outlet	☑	CFA (2022) recommends tanks be located at vehicle access points to the facility and must be positioned at least 10m from any infrastructure (i.e. BESS, etc).
	Ball valve and pipes are adequate for water flow and are metal	☑	Can comply
	Supply pipes from tank to ball valve have the same bore size to ensure flow volume	☑	Can comply
	Underground tanks have an access hole of 200mm to allow tankers to refill direct from the tank	☑	Can comply
	A hardened ground surface for truck access is supplied within 4m	☑	Can comply
	Above-ground tanks are manufactured from concrete or metal	☑	Can comply
	Raised tanks have their stands constructed from non-combustible material or bush fire-resisting timber (see Appendix F of AS 3959(2018);	☑	Can comply
	Unobstructed access can be provided at all times;	☑	Can comply
	Underground tanks are clearly marked	☑	Can comply

Performance criteria	***Acceptable solutions***	***Achievable for the project***	***Comment***
	Tanks on the hazard side of a building are provided with adequate shielding for the protection of firefighters	☑	Can comply
	All exposed water pipes external to the building are metal, including any fittings	☑	Can comply
	Where pumps are provided, they are a minimum 5hp or 3kW petrol or diesel-powered pump, and are shielded against bush fire attack; any hose and reel for firefighting connected to the pump shall be 19mm internal diameter	☑	Pumps are not mandatory. If provided they are to comply with the acceptable solutions Fire hose reels are not mandatory and are not proposed.
	Fire hose reels are constructed in accordance with AS/NZS 1221:1997, and installed in accordance with the relevant clauses of AS 2441:2005	☑	

5.2.5 Other mitigation measures

In addition to the measures outlined above, other considerations apply to the operation of renewable energy assets to effectively manage bush fire risk. This is generally outside of the scope of this document, but can be summarised as:

- The requirements of the dangerous goods legislative framework, and all relevant Australian Standards.
- Procedure/controls for correct storage of chemicals and combustible materials on-site (away from BESS units).
- Procedures to shut down BESS during conditions where fire can spread externally into the development footprint and when temperature exceeds high temperature threshold as outlined in the PHA.

- Appropriate monitoring for project infrastructure, to ensure that any shorts, faults or equipment failures with the potential to ignite or propagate fire are rapidly identified and controlled, and any fire is notified to 000 immediately.
- The provision for direct alarm monitoring to the fire brigade for BESS automatic detection systems should be considered.
- Provision of a dry retention basin with the capacity to store contaminated fire water (as a safeguard to prevent potential runoff of contaminated fire water into the environment)

In addition to the above, the BESS will be equipped with the following as outlined in the PHA:

- The flammable DG cabinets shall be subject to hazardous area classification in accordance with AS/NZS 60079.10.1:2022.
- Any electrical equipment to be installed within the defined hazardous areas shall be installed in accordance with AS/NZS 60079.14:2022.
- BESS must be tested in accordance with UL9540A.
- Testing to demonstrate clearances required to prevent propagation of fires between separated BESS units.
- BESS to be installed in accordance with manufacturer and UL9540A report recommended clearances based on testing.
- BESS to be installed with fire protection systems specified by the manufacturer and UL9540A report.
- Before construction, detailed design to validate the BESS can be installed in the project area whilst meeting the recommended clearances.
- UL testing information shall be made available to the certifying authority. It is noted that a confidentiality agreement may be required.
- The vent covers of the BESS shall be constructed of non-combustible material.
- The vents shall not be located above battery packs within the BESS container.

5.2.6 Potential environmental impact of bush fire mitigation measures

The direct impacts have been assessed as part of the Modification report (September 2025), including all bush fire mitigation measures, as these are wholly contained within the project area. There are no significant environmental constraints associated with the project.

5.2.7 Emergency Response Plan & Environmental Management Plan

The Emergency Response Plan (inclusive of Section 4.11 - Bush Fire Risk Management) for the Coppabella Wind Farm must be updated for the project to incorporate the BESS. The Plan will inform operational and emergency management practices at the facility and will effectively describe all fire hazards and provide clear actions and accountabilities for their management.

6. CONCLUSION & RECOMMENDATIONS

6.1 Conclusion

This bush fire assessment report has been undertaken for the installation of new BESS units at each wind turbine associated with the approved Coppabella Wind Farm.

This assessment has found that bush fire can potentially affect the project from the surrounding grassland and woodland vegetation.

The potential impact of bush fire both within and outside the Project area will be mitigated with the adoption of the bush fire protection measures outlined in this document (as required by PBP 2019) and the controls outlined in the PHA. The project is categorised by the NSW RFS as 'other development' and complies with the following aims and objectives of PBP 2019.

Table 6-1 – Aims and objective of PBP 2019

Aims and objectives	Statement of compliance
Afford buildings and their occupants protection from the exposure to bush fire	A defendable space of at least 24-40m will be provided around the footprint of each BESS to avoid flame zone (FZ) contact. The mitigation measures outlined in the PHA (Riskcon, 2025) will be implemented including the installation of non-combustible vent covers to prevent the entry of embers.
Provide for a defendable space to be located around buildings	
Provide appropriate separation between a hazard and buildings which in combination with other measures, prevent the likely fire spread to buildings	
Ensure that appropriate operational access and egress for emergency personnel and occupants is available	Access to each BESS will extend from the existing internal network of access tracks to enable responding emergency services to access all areas of the facility, including fire service infrastructure (water tanks), BESS and related infrastructure. Internal access tracks include:

Aims and objectives	Statement of compliance
	Internal access tracks (minimum 5.5m) to provide access to each WTB & BESS. Access must allow for safe and effective firefighting operations around the perimeter of each BESS (where slopes allow). Alternatively, access must be provided within 70m of the most distant BESS container.
Provide for ongoing management and maintenance of bush fire mitigation measures.	All bush fire mitigation measures are confined to the construction footprint. The Environmental Management Strategy (inclusive of the Emergency Response Plan and associated Bush Fire Risk Management section) are to be updated to ensure ongoing management and maintenance. The preparation of a fire management plan is also recommended.
Ensure that utility services are adequate to meet the needs of firefighters	All utility services will comply with PBP 2019. It is recommended that water supply for firefighting purposes is located at the primary vehicle access point to the facility and elsewhere in consultation with the NSW RFS District Office for the Southern Tablelands and Southern Tablelands, Fire and Rescue NSW and as detailed within any future Fire Safety Study.

6.2 Recommended mitigation measures

The following recommendations are provided to ensure that the project has adequate clearances to combustible vegetation, firefighting access and water supplies in accordance with the requirements of *PBP 2019*.

Table 6-2 – Mitigation measures

Ref. no.	Mitigation measure	Timing
1	The entire construction footprint surrounding each BESS is maintained to the standard of an inner protection area (IPA) in accordance with the requirements of Appendix 4 of *Planning for Bush Fire Protection 2019*. The BESS must be located to avoid flame zone (FZ) contact.	Pre-construction/ construction & operation
2	Access roads are to comply with the property access road requirements as outlined in Table 7.4a of *Planning for Bush Fire Protection 2019*, with additional considerations as outlined in Section 5.2.3 of this document.	Pre-construction/ construction
3	Water supply for firefighting purposes must be located at the primary vehicle access point to the facility and elsewhere in consultation with the NSW RFS District Office for the NSW Rural Fire Service, Fire and Rescue NSW and the fire Safety Study. Further: • a SWS must be provided on site located within the IPA or non-hazard side and away from structures; • unobstructed access is to be provided within 4m of the SWS at all times; • a 65mm Storz connection with a ball valve is fitted to the outlet of the SWS; • ball valve and pipes are adequate for water flow and are metal; • supply pipes from tank to ball valve have the same bore size to ensure flow volume; • underground tanks have an access hole of 200mm to allow tankers to refill direct from the tank and a hardened ground surface for truck access is supplied within 4m; • underground tanks are clearly marked; • above-ground tanks are manufactured from concrete or metal;	Construction & operation

Ref. no.	Mitigation measure	Timing
	• raised tanks have their stands constructed from non-combustible material or bush fire-resisting timber (see Appendix F of AS 3959); • tanks on the hazard side of a building are provided with adequate shielding for the protection of firefighters; • all exposed water pipes external to the building are metal, including any fittings; • where pumps are provided, they are a minimum 5hp or 3kW petrol or diesel-powered pump, and are shielded against bush fire attack; • any hose and reel for firefighting connected to the pump must be 19mm internal diameter; and • any fire hose reels are constructed in accordance with AS/NZS 1221:1997 and installed in accordance with the relevant clauses of AS 2441:2005.	
4	The Emergency Response Plan (inclusive of Section 4.11 Bushfire Risk Management) in the existing Coppabella Wind Farm Environmental Management Strategy must be updated for the project to incorporate the BESS.	Construction & operation

7. REFERENCES

Cheney N.P., Gould J.S. Catchpole W.R. (2008) – *Grassfires: Fuel weather and fire behaviour*. CSIRO Publishing 2nd Edition, Collingwood, Vic.

Councils of Standards Australia AS3959 (2018) – *Australian Standard Construction of buildings in bush fire-prone areas.*

Country Fire Authority (CFA) (2023) - *Design Guidelines and Model Requirements Renewable Energy Facilities,*

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Goldwind (2024) – Coppabella Wind Farm Environmental Management Strategy

Keith, David (2004) – *Ocean Shores to Desert Dunes – The Native Vegetation of New South Wales and the ACT*. The Department of Environment and Climate Change.

Riskcon (2025) – *Preliminary Hazard Analysis Coppabella Wind Farm BESS*. Riskcon Engineering Pty Ltd.

Rural Fire Service (2019) - *Planning for bush fire protection – a guide for councils, planners, fire authorities and developers*. NSW Rural Fire Service.

Southern Tablelands Bush Fire Risk Management Committee (2019) – *Bush Fire Risk Management Plan*

South West Slopes Bush Fire Risk Management Committee (2023) – *Bush Fire Risk Management Plan*

Appendix 1: Bushfire attack assessor results

NBC Bushfire Attack Assessment Report V4.1

AS3959 (2018) Appendix B - Detailed Method 2

Print Date: 23/09/2025 **Assessment Date:** 23/09/2025

Site Street Address: Coppabella Wind Farm, Yass

Assessor: Nicole van Dorst; Waratah Bushfire Planning

Local Government Area: Yass **Alpine Area:** No

Equations Used

Transmissivity: Fuss and Hammins, 2002
Flame Length: RFS PBP, 2001/Vesta/Catchpole
Rate of Fire Spread: Noble et al., 1980
Radiant Heat: Drysdale, 1985; Sullivan et al., 2003; Tan et al., 2005
Peak Elevation of Receiver: Tan et al., 2005
Peak Flame Angle: Tan et al., 2005

Run Description: WTB 1

Vegetation Information

Vegetation Type: Grassy and Semi-Arid Woodland (including Mallee)

Vegetation Group: Forest and Woodland

Vegetation Slope:	24 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	10.5	**Overall Fuel Load(t/ha):**	20.2
Vegetation Height(m):	2	Only Applicable to Shrub/Scrub and Vesta	

Site Information

Site Slope:	0 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m):	2.5	**APZ/Separation(m):**	29

Fire Inputs

Veg./Flame Width(m):	100	**Flame Temp(K):**	1090

Calculation Parameters

Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg)	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	100

Program Outputs

Level of Construction:	BAL FZ	**Peak Elevation of Receiver(m):**	13.64
Radiant Heat(kW/m2):	38.79	**Flame Angle (degrees):**	23
Flame Length(m):	45.33	**Maximum View Factor:**	0.586
Rate Of Spread (km/h):	6.6	**Inner Protection Area(m):**	29
Transmissivity:	0.871	**Outer Protection Area(m):**	0
Fire Intensity(kW/m):	68885		

Run Description: WTB 130

Vegetation Information

Vegetation Type: Grassy and Semi-Arid Woodland (including Mallee)

Vegetation Group: Forest and Woodland

Vegetation Slope: 21 Degrees

Vegetation Slope Type: Downslope

Surface Fuel Load(t/ha): 10.5

Overall Fuel Load(t/ha): 20.2

Vegetation Height(m): 2

Only Applicable to Shrub/Scrub and Vesta

Site Information

Site Slope: 0 Degrees

Site Slope Type: Downslope

Elevation of Receiver(m): 2.5

APZ/Separation(m): 25

Fire Inputs

Veg./Flame Width(m): 100

Flame Temp(K): 1090

Calculation Parameters

Flame Emissivity: 95

Relative Humidity(%): 25

Heat of Combustion(kJ/kg) 18600

Ambient Temp(K): 308

Moisture Factor: 5

FDI: 100

Program Outputs

Level of Construction: BAL FZ

Peak Elevation of Receiver(m): 12.24

Radiant Heat(kW/m2): 37.93

Flame Angle (degrees): 27

Flame Length(m): 37.3

Maximum View Factor: 0.573

Rate Of Spread (km/h): 5.37

Inner Protection Area(m): 25

Transmissivity: 0.87

Outer Protection Area(m): 0

Fire Intensity(kW/m): 56005

Run Description: WTB 15

Vegetation Information

Vegetation Type: Grassland

Vegetation Group: Grassland

Vegetation Slope: 24 Degrees

Vegetation Slope Type: Downslope

Surface Fuel Load(t/ha): 6

Overall Fuel Load(t/ha): 6

Vegetation Height(m): 0

Only Applicable to Shrub/Scrub and Vesta

Site Information

Site Slope: 0 Degrees

Site Slope Type: Downslope

Elevation of Receiver(m): 2.5

APZ/Separation(m): 15

Fire Inputs

Veg./Flame Width(m): 100

Flame Temp(K): 1090

Calculation Parameters

Flame Emissivity: 95

Relative Humidity(%): 25

Heat of Combustion(kJ/kg) 18600

Ambient Temp(K): 308

Moisture Factor: 5

FDI: 130

Program Outputs

Level of Construction: BAL FZ

Peak Elevation of Receiver(m): 7.34

Radiant Heat(kW/m2): 37.47

Flame Angle (degrees): 37

Flame Length(m): 19.75

Maximum View Factor: 0.563

Rate Of Spread (km/h): 88.53

Inner Protection Area(m): 15

Transmissivity: 0.875

Outer Protection Area(m): 0

Fire Intensity(kW/m): 274435

Run Description: WTB 16, 43 & 54

Vegetation Information

Vegetation Type: Grassland

Vegetation Group: Grassland

Vegetation Slope: 25 Degrees **Vegetation Slope Type:** Downslope

Surface Fuel Load(t/ha): 6 **Overall Fuel Load(t/ha):** 6

Vegetation Height(m): 0 Only Applicable to Shrub/Scrub and Vesta

Site Information

Site Slope: 0 Degrees **Site Slope Type:** Downslope

Elevation of Receiver(m): 2.5 **APZ/Separation(m):** 15

Fire Inputs

Veg./Flame Width(m): 100 **Flame Temp(K):** 1090

Calculation Parameters

Flame Emissivity: 95 **Relative Humidity(%):** 25

Heat of Combustion(kJ/kg) 18600 **Ambient Temp(K):** 308

Moisture Factor: 5 **FDI:** 130

Program Outputs

Level of Construction: BAL FZ **Peak Elevation of Receiver(m):** 7.47

Radiant Heat(kW/m2): 38.8 **Flame Angle (degrees):** 34

Flame Length(m): 20.44 **Maximum View Factor:** 0.582

Rate Of Spread (km/h): 94.85 **Inner Protection Area(m):** 15

Transmissivity: 0.877 **Outer Protection Area(m):** 0

Fire Intensity(kW/m): 294040

Run Description: WTB 38 & 37

Vegetation Information

Vegetation Type: Western Slopes Grassy Woodland

Vegetation Group: Woodlands

Vegetation Slope: 30 Degrees **Vegetation Slope Type:** Downslope

Surface Fuel Load(t/ha): 10.5 **Overall Fuel Load(t/ha):** 18.3

Vegetation Height(m): 0.9 Only Applicable to Shrub/Scrub and Vesta

Site Information

Site Slope: 0 Degrees **Site Slope Type:** Downslope

Elevation of Receiver(m): 2.5 **APZ/Separation(m):** 40

Fire Inputs

Veg./Flame Width(m): 100 **Flame Temp(K):** 1090

Calculation Parameters

Flame Emissivity: 95 **Relative Humidity(%):** 25

Heat of Combustion(kJ/kg) 18600 **Ambient Temp(K):** 308

Moisture Factor: 5 **FDI:** 100

Program Outputs

Level of Construction: BAL FZ **Peak Elevation of Receiver(m):** 17.28

Radiant Heat(kW/m2): 39.9 **Flame Angle (degrees):** 18

Flame Length(m): 67.1 **Maximum View Factor:** 0.602

Rate Of Spread (km/h): 9.99 **Inner Protection Area(m):** 40

Transmissivity: 0.871 **Outer Protection Area(m):** 0

Fire Intensity(kW/m): 94411

Run Description: WTB 42

Vegetation Information

Vegetation Type: Grassland

Vegetation Group: Grassland

Vegetation Slope: 29 Degrees

Vegetation Slope Type: Downslope

Surface Fuel Load(t/ha): 6

Overall Fuel Load(t/ha): 6

Vegetation Height(m): 0

Only Applicable to Shrub/Scrub and Vesta

Site Information

Site Slope: 0 Degrees

Site Slope Type: Downslope

Elevation of Receiver(m): 2.5

APZ/Separation(m): 17

Fire Inputs

Veg./Flame Width(m): 100

Flame Temp(K): 1090

Calculation Parameters

Flame Emissivity: 95

Relative Humidity(%): 25

Heat of Combustion(kJ/kg) 18600

Ambient Temp(K): 308

Moisture Factor: 5

FDI: 130

Program Outputs

Level of Construction: BAL FZ

Peak Elevation of Receiver(m): 8.44

Radiant Heat(kW/m2): 38.18

Flame Angle (degrees): 33

Flame Length(m): 23.46

Maximum View Factor: 0.574

Rate Of Spread (km/h): 125

Inner Protection Area(m): 17

Transmissivity: 0.875

Outer Protection Area(m): 0

Fire Intensity(kW/m): 387500

Run Description: WTB 44, 45, 73

Vegetation Information

Vegetation Type: Grassland

Vegetation Group: Grassland

Vegetation Slope: 21 Degrees

Vegetation Slope Type: Downslope

Surface Fuel Load(t/ha): 6

Overall Fuel Load(t/ha): 6

Vegetation Height(m): 0

Only Applicable to Shrub/Scrub and Vesta

Site Information

Site Slope: 0 Degrees

Site Slope Type: Downslope

Elevation of Receiver(m): 2.5

APZ/Separation(m): 14

Fire Inputs

Veg./Flame Width(m): 100

Flame Temp(K): 1090

Calculation Parameters

Flame Emissivity: 95

Relative Humidity(%): 25

Heat of Combustion(kJ/kg) 18600

Ambient Temp(K): 308

Moisture Factor: 5

FDI: 130

Program Outputs

Level of Construction: BAL FZ

Peak Elevation of Receiver(m): 6.82

Radiant Heat(kW/m2): 36.82

Flame Angle (degrees): 39

Flame Length(m): 17.81

Maximum View Factor: 0.553

Rate Of Spread (km/h): 71.97

Inner Protection Area(m): 14

Transmissivity: 0.875

Outer Protection Area(m): 0

Fire Intensity(kW/m): 223121

Run Description: WTB 5 & 59

Vegetation Information

Vegetation Type: Grassy and Semi-Arid Woodland (including Mallee)
Vegetation Group: Forest and Woodland

Vegetation Slope: 22 Degrees
Vegetation Slope Type: Downslope
Surface Fuel Load(t/ha): 10.5
Overall Fuel Load(t/ha): 20.2
Vegetation Height(m): 2
Only Applicable to Shrub/Scrub and Vesta

Site Information

Site Slope: 0 Degrees
Site Slope Type: Downslope
Elevation of Receiver(m): 2.5
APZ/Separation(m): 26

Fire Inputs

Veg./Flame Width(m): 100
Flame Temp(K): 1090

Calculation Parameters

Flame Emissivity: 95
Relative Humidity(%): 25
Heat of Combustion(kJ/kg) 18600
Ambient Temp(K): 308
Moisture Factor: 5
FDI: 100

Program Outputs

Level of Construction: BAL FZ
Peak Elevation of Receiver(m): 12.52
Radiant Heat(kW/m2): 38.76
Flame Angle (degrees): 25
Flame Length(m): 39.8
Maximum View Factor: 0.585
Rate Of Spread (km/h): 5.75
Inner Protection Area(m): 26
Transmissivity: 0.872
Outer Protection Area(m): 0
Fire Intensity(kW/m): 60006

Run Description: WTB 56

Vegetation Information

Vegetation Type: Grassland
Vegetation Group: Grassland

Vegetation Slope: 23 Degrees
Vegetation Slope Type: Downslope
Surface Fuel Load(t/ha): 6
Overall Fuel Load(t/ha): 6
Vegetation Height(m): 0
Only Applicable to Shrub/Scrub and Vesta

Site Information

Site Slope: 0 Degrees
Site Slope Type: Downslope
Elevation of Receiver(m): 2.5
APZ/Separation(m): 14

Fire Inputs

Veg./Flame Width(m): 100
Flame Temp(K): 1090

Calculation Parameters

Flame Emissivity: 95
Relative Humidity(%): 25
Heat of Combustion(kJ/kg) 18600
Ambient Temp(K): 308
Moisture Factor: 5
FDI: 130

Program Outputs

Level of Construction: BAL FZ
Peak Elevation of Receiver(m): 6.98
Radiant Heat(kW/m2): 39.43
Flame Angle (degrees): 34
Flame Length(m): 19.08
Maximum View Factor: 0.59
Rate Of Spread (km/h): 82.63
Inner Protection Area(m): 14
Transmissivity: 0.879
Outer Protection Area(m): 0
Fire Intensity(kW/m): 256138

Run Description: WTB 57

Vegetation Information

Vegetation Type:	Grassland		
Vegetation Group:	Grassland		
Vegetation Slope:	26 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	6	**Overall Fuel Load(t/ha):**	6
Vegetation Height(m):	0	Only Applicable to Shrub/Scrub and Vesta	

Site Information

Site Slope:	0 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m):	2.5	**APZ/Separation(m):**	16

Fire Inputs

Veg./Flame Width(m):	100	**Flame Temp(K):**	1090

Calculation Parameters

Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg)	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	130

Program Outputs

Level of Construction:	BAL FZ	**Peak Elevation of Receiver(m):**	7.86
Radiant Heat(kW/m2):	37.09	**Flame Angle (degrees):**	36
Flame Length(m):	21.16	**Maximum View Factor:**	0.558
Rate Of Spread (km/h):	101.63	**Inner Protection Area(m):**	16
Transmissivity:	0.874	**Outer Protection Area(m):**	0
Fire Intensity(kW/m):	315045		

Run Description: WTB 58

Vegetation Information

Vegetation Type:	Grassland		
Vegetation Group:	Grassland		
Vegetation Slope:	27 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	6	**Overall Fuel Load(t/ha):**	6
Vegetation Height(m):	0	Only Applicable to Shrub/Scrub and Vesta	

Site Information

Site Slope:	0 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m):	2.5	**APZ/Separation(m):**	16

Fire Inputs

Veg./Flame Width(m):	100	**Flame Temp(K):**	1090

Calculation Parameters

Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg)	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	130

Program Outputs

Level of Construction:	BAL FZ	**Peak Elevation of Receiver(m):**	7.88
Radiant Heat(kW/m2):	38.39	**Flame Angle (degrees):**	34
Flame Length(m):	21.9	**Maximum View Factor:**	0.577
Rate Of Spread (km/h):	108.89	**Inner Protection Area(m):**	16
Transmissivity:	0.876	**Outer Protection Area(m):**	0
Fire Intensity(kW/m):	337551		

Run Description: WTB 58

Vegetation Information

Vegetation Type: Grassland

Vegetation Group: Grassland

Vegetation Slope: 22 Degrees
Vegetation Slope Type: Downslope

Surface Fuel Load(t/ha): 6
Overall Fuel Load(t/ha): 6

Vegetation Height(m): 0
Only Applicable to Shrub/Scrub and Vesta

Site Information

Site Slope: 0 Degrees
Site Slope Type: Downslope

Elevation of Receiver(m): 2.5
APZ/Separation(m): 14

Fire Inputs

Veg./Flame Width(m): 100
Flame Temp(K): 1090

Calculation Parameters

Flame Emissivity: 95
Relative Humidity(%): 25

Heat of Combustion(kJ/kg) 18600
Ambient Temp(K): 308

Moisture Factor: 5
FDI: 130

Program Outputs

Level of Construction: BAL FZ
Peak Elevation of Receiver(m): 6.95

Radiant Heat(kW/m2): 38.06
Flame Angle (degrees): 37

Flame Length(m): 18.43
Maximum View Factor: 0.571

Rate Of Spread (km/h): 77.12
Inner Protection Area(m): 14

Transmissivity: 0.877
Outer Protection Area(m): 0

Fire Intensity(kW/m): 239060

Run Description: WTB 65

Vegetation Information

Vegetation Type: Western Slopes Grassy Woodland

Vegetation Group: Woodlands

Vegetation Slope: 22 Degrees
Vegetation Slope Type: Downslope

Surface Fuel Load(t/ha): 10.5
Overall Fuel Load(t/ha): 18.3

Vegetation Height(m): 0.9
Only Applicable to Shrub/Scrub and Vesta

Site Information

Site Slope: 0 Degrees
Site Slope Type: Downslope

Elevation of Receiver(m): 2.5
APZ/Separation(m): 26

Fire Inputs

Veg./Flame Width(m): 100
Flame Temp(K): 1090

Calculation Parameters

Flame Emissivity: 95
Relative Humidity(%): 25

Heat of Combustion(kJ/kg) 18600
Ambient Temp(K): 308

Moisture Factor: 5
FDI: 100

Program Outputs

Level of Construction: BAL FZ
Peak Elevation of Receiver(m): 12.45

Radiant Heat(kW/m2): 38.49
Flame Angle (degrees): 25

Flame Length(m): 39.57
Maximum View Factor: 0.581

Rate Of Spread (km/h): 5.75
Inner Protection Area(m): 26

Transmissivity: 0.871
Outer Protection Area(m): 0

Fire Intensity(kW/m): 54361

Run Description: WTB 66

Vegetation Information

Vegetation Type: Western Slopes Grassy Woodland

Vegetation Group: Woodlands

Vegetation Slope: 24 Degrees

Vegetation Slope Type: Downslope

Surface Fuel Load(t/ha): 10.5

Overall Fuel Load(t/ha): 18.3

Vegetation Height(m): 0.9

Only Applicable to Shrub/Scrub and Vesta

Site Information

Site Slope: 0 Degrees

Site Slope Type: Downslope

Elevation of Receiver(m): 2.5

APZ/Separation(m): 29

Fire Inputs

Veg./Flame Width(m): 100

Flame Temp(K): 1090

Calculation Parameters

Flame Emissivity: 95

Relative Humidity(%): 25

Heat of Combustion(kJ/kg) 18600

Ambient Temp(K): 308

Moisture Factor: 5

FDI: 100

Program Outputs

Level of Construction: BAL FZ

Peak Elevation of Receiver(m): 13.88

Radiant Heat(kW/m2): 38.52

Flame Angle (degrees): 24

Flame Length(m): 45.1

Maximum View Factor: 0.582

Rate Of Spread (km/h): 6.6

Inner Protection Area(m): 29

Transmissivity: 0.87

Outer Protection Area(m): 0

Fire Intensity(kW/m): 62406

APPENDIX H: ENVIRONMENTAL NOISE ASSESSMENT

Goldwind Australia Pty Ltd
Level 25, Tower 1, International Towers Sydney
100 Barangaroo Avenue
Barangaroo NSW 2000

S8585C2

Attention: Renae Gifford

31 August 2025

Dear Renae,

COPPABELLA BESS
ENVIRONMENTAL NOISE ASSESSMENT

Sonus has been engaged to conduct an environmental noise assessment for the Coppabella battery energy storage system (**BESS**) proposed to be installed on the same land as the Coppabella Wind Farm, in the Southern Tablelands Region of New South Wales.

The proposal is to install a small BESS near the base of each of the 69 wind turbine generators (**WTG**) comprising the wind farm. Each BESS will comprise 24 battery containers and 6 DC-DC converters.

The noise from the proposed BESS has been assessed in accordance with the NSW *Noise Policy for Industry*.

An overview of the project layout, including nearby receivers, is shown in Figure 1.

The assessment has been based on:

- Noise data for the battery containers contained in "NOISE TEST REPORT GoldBlock L700Pro", dated January 2025 (sound power level of 77 dB(A) per unit).
- A sound power level of 80 dB(A) for the DC-DC converters provided by email correspondence on 14 May 2025.

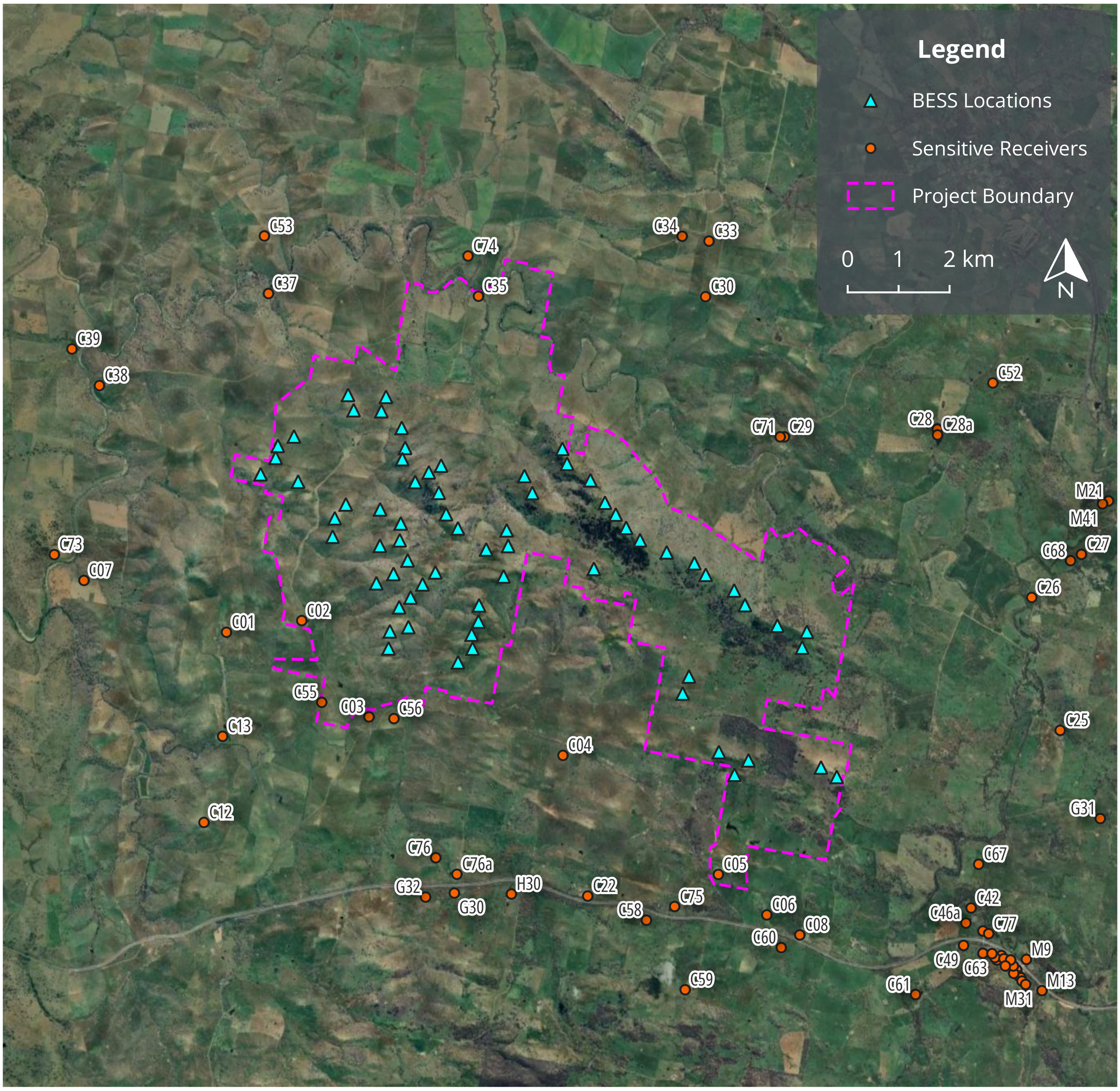


Figure 1: Overview of project layout and surrounding receivers

CRITERIA

The NSW *Noise Policy for Industry* (the **Policy**) establishes noise trigger levels based on the existing background noise environment (intrusiveness noise levels) and the amenity for particular land uses (amenity noise levels). The noise trigger levels are the lower values provided by the two methods.

The most onerous criteria are assigned to locations with low background noise levels in a rural area. In these circumstances night time project intrusiveness noise level is 35 dB(A) and the project amenity noise level is 38 dB(A).

Based on the above, the preliminary assessment has assumed a Policy noise trigger level of 35 dB(A) for the operation of the BESS at all locations.

METHODOLOGY

Environmental noise predictions have been made using the CONCAWE noise propagation model as implemented in the *SoundPLAN* noise modelling software. The CONCAWE noise propagation model accounts for the following influences:

- Sound power levels and locations of noise sources (including the height of sources)
- Separation distances between noise sources and receivers
- Shielding provided by the ground topography
- Influence of the ground and air absorption
- Meteorological conditions

Unless an analysis of historical meteorological; conditions is conducted, the Policy requires the use of noise-enhancing meteorological conditions to be included in the noise model.

This predictions of noise at receivers have therefore considered worst-case (Category 6) meteorological conditions (i.e. those that are most conducive to noise propagation).

RESULTS

The highest noise level predicted at any receiver from the proposed BESS is 20 dB(A) at receiver ID “C56”, which easily achieves the 35 dB(A) noise trigger level.

An additional assessment, which also includes the wind farm substations, has been performed. With the wind farm substations included in the noise model, the highest noise level predicted at any sensitive receiver is 21 dB(A) at associated receiver “C35”. The highest noise level predicted at any non-associated receiver is 20 dB(A) at receiver ID “C56”.

In some instances, the noise from BESS facilities and transformers in particular, can attract a character penalty for tonality. However, due to the very low predicted noise levels, it is considered that no penalty is warranted.

If you have any questions or require clarification, please let me know.

Yours faithfully
Sonus Pty Ltd

CTurnbull

Chris Turnbull
Principal

+61 417 845 720
ct@sonus.com.au

APPENDIX I: UPDATED TRAFFIC ASSESSMENT

Amber Organisation
www.amberorg.com.au
1800 022 363

Amber

Renae Gifford
Senior Environmental Planner
Goldwind Australia Pty Ltd.
Level 25, Tower 1, International Towers Sydney
100 Barangaroo Ave
Barangaroo NSW 2000

Ref: 1240
16 September 2025

Issued via email: **renaegifford@goldwindaustralia.com**

Dear Renae

Coppabella Wind Farm – Traffic Assessment

Amber Organisation has been engaged to provide a traffic assessment to support the Traffic Management Plan (TMP) and proposed modification for the Coppabella Wind Farm to allow the provision of four-hour duration BESS units on-site.

The Coppabella Wind Farm is an approved project allowing for up to 75 turbines to be constructed approximately 16km west of Yass, on the northern side of Hume Highway. It is proposed to provide up to six BESS units for 53 turbines which would result in up to 318 units across the project.

The primary site access to the Project Area, including all oversize/overmass (OSOM) vehicles and heavy vehicles, is via the Hume Highway / Whitefields Road intersection.

1. Background

It is understood comments have been received from Transport for New South Wales (TfNSW) on the approved TMP which require turn warrant assessments and potential updates to the proposed designs for the intersection of Hume Highway and Whitefields Road.

The Project also proposes to apply for a modification to the consent which would allow the provision of up to 318 BESS units on-site, resulting in up to 636 additional heavy vehicle trips (two-way total) throughout the construction period. The traffic impacts associated with the proposed increase in heavy vehicle trips have been included within this assessment.

Reference is made to the following documents which provide further details regarding the Project background and traffic impacts:

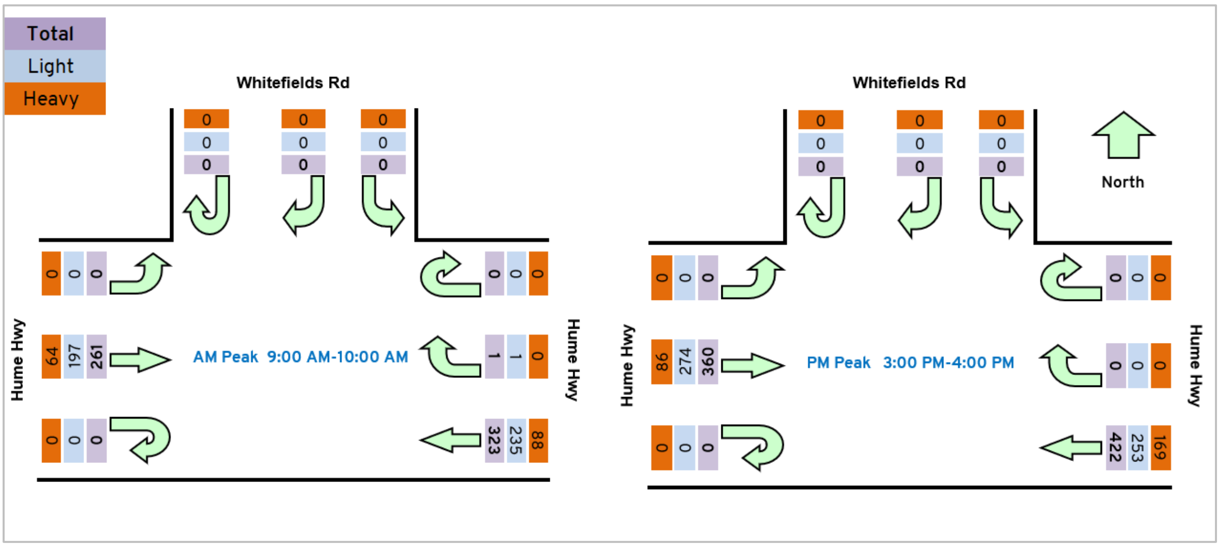
- Traffic Impact Study (TIS) prepared by Bega Duo Designs dated December 2008.
- Supplementary TIS prepared by Bega Duo Designs dated November 2013 and April 2014.
- TMP prepared by Goldwind dated 7 August 2024.

2. Traffic Assessment

2.1 Existing Traffic Volumes

Amber commissioned a turning movement survey at the Hume Highway / Whitefields Road intersection in order to determine the existing traffic conditions. The survey was undertaken on Thursday 8 May 2025 from 6:00am-10:00am and 3:00pm-7:00pm. A summary of the peak hour results is presented below with the full survey data provided within Appendix A.

Figure 1: Turning Movement Survey Peak Hour Results – Hume Highway / Whitefield Road



The survey results indicate the intersection currently carries a moderate to high level of traffic in the order of 585 and 782 vehicles in the morning and evening peak hour, respectively. The morning peak hour was recorded from 9:00am to 10:00am and the evening peak hour was recorded from 3:00pm to 4:00pm.

The majority of vehicle trips during the morning and evening peak periods are eastbound and westbound through movements along Hume Highway, with minimal traffic entering or exiting Whitefields Road. Overall, the results indicate both roads are able to accommodate an increase in vehicle trips, noting Hume Highway is a major State Highway which provides a dual carriageway with two travel lanes in each direction.

2.2 Traffic Generation

The peak traffic impacts of the project will occur during construction which is expected to commence by the end of 2025 and take approximately 12-16 months. Construction activities associated with the project will generally be undertaken during the following approved standard hours:

- Monday to Friday: 7am – 6pm
- Saturday: 8am – 1pm
- No work on Sundays or public holidays.

Updated project traffic volumes including the proposed modification to allow the provision of BESS units on site have been provided by Goldwind and are summarised in Table 1. A trip is defined as a one way vehicular movement from one point to another excluding the return journey (i.e. a return journey to and from the site is counted as two trips).

Table 1: Traffic Generation During Construction Period

Vehicle Type	Average		Peak	
	Vehicle Trips per Day (vpd)	Peak Hour Vehicle Trips (vph)	Vehicle Trips per Day (vpd)	Peak Hour Vehicle Trips (vph)
Light Vehicles	50	25	104	52
Heavy Vehicles (excluding OSOM)	74	8	112	11
Total	**124**	**33**	**216**	**63**

During the construction period, the project is expected to generate an average of approximately 50 light vehicle trips per day and 74 heavy vehicle trips per day (two-way totals) excluding any oversize/overmass configurations which would operate under escort and are subject to specific traffic management measures. It is noted that the proposed BESS units are expected to be transported using semi-trailers and are included within the heavy vehicle traffic volumes.

It is estimated that during the peak construction periods, traffic volumes would be up to 104 light vehicle trips and 112 heavy vehicle trips per day.

The peak hour for construction traffic will occur at the start and end of the day when workers are transported to/from the site. Most workers will typically arrive on-site between 6:00am and 7:00am and depart between 5:00pm and 7:00pm. Workers generally have staggered finish times which results in the evening peak hour being less pronounced, however for the purposes of this assessment it is conservatively assumed that the evening peak hour project traffic is the same as the morning peak.

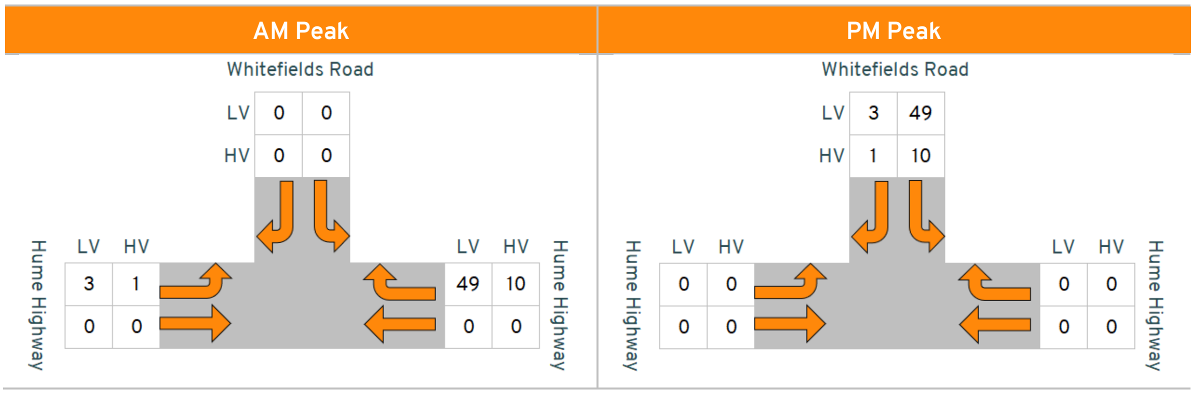
Heavy vehicle trips will generally be distributed throughout the middle of the day, although it is conservatively estimated that some heavy vehicles may travel during the morning and evening peak hours.

2.3 Traffic Distribution

All construction traffic will access the site via Hume Highway and Whitefields Road. The majority of vehicle trips are expected to originate from the east including Port Kembla, Yass and surrounding areas. For the purposes of the assessment, it is estimated that 95% of vehicles would travel to/from the east with the remaining 5% traveling to/from the west.

The resulting project peak hour traffic volumes at the Hume Highway / Whitefields Road intersection are outlined in Figure 2.

Figure 2: Project Traffic



2.4 Traffic Assessment

In order to determine the ability of the road network to accommodate the traffic expected to be generated during the peak construction period, an analysis of the operation of the Hume Highway / Whitefields Road intersection was carried out using the SIDRA computer modelling program.

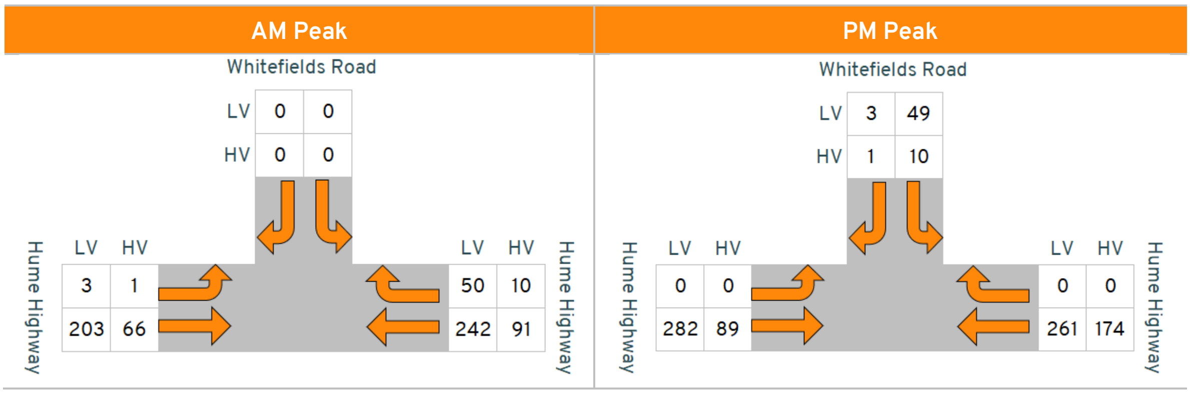
Level of Service (LOS) is a qualitative measure used to describe the operating conditions of a section of road or an intersection. Levels of Service are designated from A to F from best (free flow conditions) to worst (forced flow with stop start operation, long queues and delays) and represent the perception of the road conditions by motorists including speed and travel time, freedom to manoeuvre, traffic interruptions, comfort and convenience, and safety. The LOS for sign-controlled intersections is based on the average delay (seconds/vehicle) of the critical movement.

The total traffic volumes at the site access intersection consist of the sum of the following:

- Existing surveyed peak hour traffic volumes outlined within Figure 1 adjusted by a 1.5% compounded annual growth rate to reflect the end of the construction period in 2027.
- Construction traffic volumes outlined within Figure 2.

The resulting total traffic volumes used for the assessment are provided in Figure 3.

Figure 3: Total Peak Hour Volumes During Peak Construction



The results of the SIDRA analysis for the morning and evening peak hours are provided within Appendix B and summarised in Table 2.

Table 2: SIDRA Analysis Results Summary

Approach	Movement	AM Peak Hour			PM Peak Hour		
		Average Delay (sec)	95% Queue (m)	Level of Service	Average Delay (sec)	95% Queue (m)	Level of Service
Hume Highway (East)	**Through**	0.0	0.0	A	0.0	0.0	A
	Right	12.4	2.7	A	12.0	0.0	A
Whitefields Road (North)	**Left**	7.5	0.1	A	8.4	2.1	A
	Right	10.3	0.1	A	13.7	2.1	A
Hume Highway (West)	**Left**	8.9	0.0	A	8.2	0.0	A
	Through	0.0	0.0	A	0.0	0.0	A

The SIDRA analysis indicates the following:

- The intersection is expected to operate with minimal queue lengths on all legs of the intersection.
- The overall average delay at the intersection is 1.2 and 0.7 seconds in the morning and evening peak hours respectively, which predominantly reflects vehicles slowing to manoeuvre at the intersection (Geometric Delay); and
- The intersection is expected to operate with good level of service. It is noted that the intersection would not change from LOS A.

Accordingly, the Hume Highway / Whitefields Road intersection is expected to be able to readily accommodate the traffic movements generated during peak construction.

2.5 Intersection Design

2.5.1 Turn Treatments

The requirement to provide turn facilities at the Hume Highway / Whitefields Road intersection is primarily generated during the morning peak hour when the workforce accesses the site.

Austroads Guide to Traffic Management Part 6: Intersections, Interchanges, and Crossings specifies the turning treatments required at intersections. Figure 3.25 of the guide specifies the required turn treatments on the major road at unsignalised intersections.

The traffic volumes used for the assessment are provided in Figure 3 and have been plotted against the Austroads Guide in Figure 4. Table 3 identifies the required turn treatments at the intersection.

Figure 4: Austroads Turn Treatment Assessment Plot

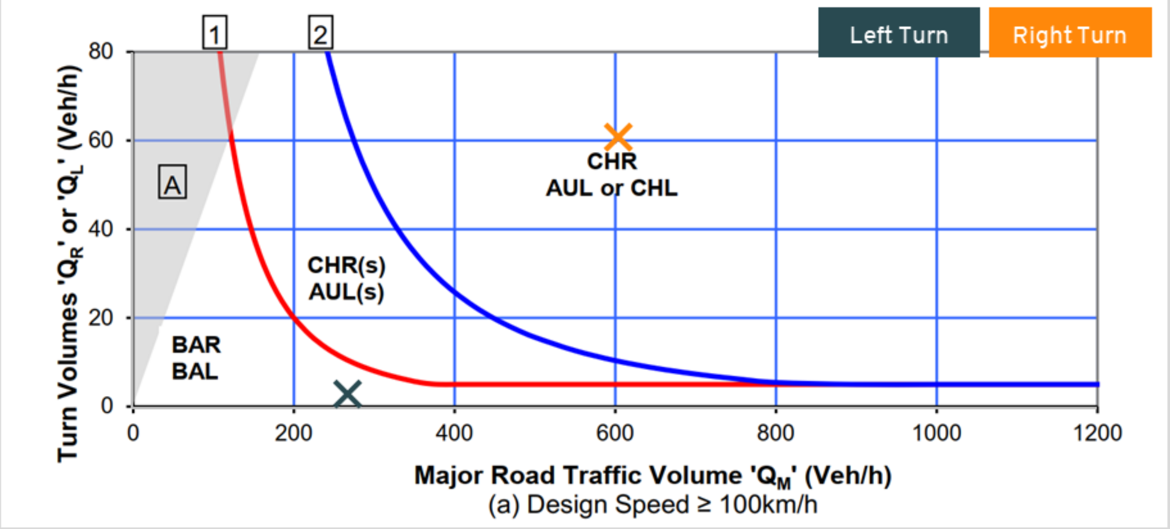


Table 3: Turning Volumes and Turn Treatment Requirements

Turning Treatment	Traffic Volume (vph)		Requirement
	Turn Volume	Major Road	
Right Turn	61	605	CHR
Left Turn	3	269	BAL

Based on the assessment, the intersection would require Basic Left Turn (BAL) and Channelised Right Turn (CHR) treatments.

The intersection is currently provided with a left turn treatment which exceeds the BAL requirement and is therefore considered appropriate particularly given the minimal volume of turning traffic.

The intersection is also currently provided with a short right turn lane which is proposed to be extended to form a Channelised Right Turn treatment. The CHR is the highest order turn treatment for the right turn movement and accordingly, the intersection turning facilities are considered appropriate.

2.5.2 Design Review

The Hume Highway / Whitefields Road intersection provides a wide central median which facilitates two-stage crossing movements for vehicles turning right out of Whitefields Lane onto Hume Highway (westbound). The available storage length between the eastbound and westbound carriageways is limited to approximately 19 metres. Accordingly, all vehicles exiting the site to travel toward the west would be limited to a maximum length of 19 metres (e.g. a 19 metre semi-trailer or truck and dog) which would be included within the TMP.

The Hume Highway has a speed limit of 110km/h which would theoretically require an acceleration lane length of 1,500m to allow a semi-trailer to accelerate from rest to a speed of 90km/h (i.e. no less than 20 km/h below the mean free speed of the through road in accordance with Section 5.4 of the Austroads Guide). However, it is noted that acceleration lanes are not typically provided for wind farm projects given the practicality of providing these treatments for a limited construction timeframe which generates the majority of the traffic impacts associated with the project. The intersection is provided with suitable Safe Intersection Sight Distance exceeding 341 metres based on a design speed of 120km/h along Hume Highway and reaction time of 2.5 seconds.

Accordingly, the design of the intersection is suitable to allow vehicles to safely enter the State Road network, and it is considered that acceleration lanes are not required for the project.

3. Conclusion

Based on the above assessment, it has been determined that:

- The Hume Highway / Whitefields Road intersection currently carries a moderate to high level of traffic however both roads are able to accommodate an increase in vehicle trips, noting Hume Highway is a major State Highway which provides a dual carriageway with two travel lanes in each direction.

- During the construction period, the project is expected to generate an average of approximately 50 light vehicle trips per day and 74 heavy vehicle trips per day (two-way totals) excluding any oversize/overmass configurations which would operate under escort and are subject to specific traffic management measures. It is noted that the proposed BESS units are expected to be transported using semi-trailers and are included within the heavy vehicle traffic volumes.

- It is estimated that during the peak construction periods, traffic volumes would be up to 104 light vehicle trips and 112 heavy vehicle trips per day.

- The Hume Highway / Whitefields Road intersection is expected to be able to readily accommodate the traffic movements generated during peak construction based on the results of the SIDRA modelling assessment.

- The turn treatment assessment indicates the Hume Highway / Whitefields Road intersection would require a BAL and CHR treatments. The intersection is currently provided with a left turn treatment which exceeds the BAL requirement and is therefore considered appropriate particularly given the minimal volume of turning traffic. The intersection is also currently provided with a short right turn lane which is proposed to be extended to form a Channelised Right Turn treatment. The CHR is the highest order turn treatment for the right turn movement and accordingly, the intersection turning facilities are considered appropriate.

- All vehicles exiting the site to travel toward the west would be limited to a maximum length of 19 metres (e.g. a 19 metre semi-trailer or truck and dog) which would be included within the TMP. This limitation is due to the available storage length within the wide central median at the Hume Highway / Whitefields Road intersection.

- Suitable sight distance is provided at the Hume Highway / Whitefields Road intersection to allow vehicles to safely enter the State Road network, and it is considered that acceleration lanes are not required for this project.

If you have any questions, please feel free to contact the undersigned.

Yours sincerely
Amber Organisation

Oliver Mihaila
Associate

Appendix A

Turning Movement Survey Data

TRANS TRAFFIC SURVEY

TURNING MOVEMENT SURVEY trafficsurvey.com.au

Intersection of Hume Hwy and Whitefields Ln, Bookham

GPS *-34.806712, 148.581907*

Date:	Thu 08/05/25
Weather:	Overcast
Suburban:	Bookham
Customer:	Amber

North:	Whitefields Ln
East:	Hume Hwy
South:	N/A
West:	Hume Hwy

Survey Period	AM:	6:00 AM-10:00 AM
	PM:	3:00 PM-7:00 PM
Traffic Peak	AM:	9:00 AM-10:00 AM
	PM:	3:00 PM-4:00 PM

All Vehicles

Time		**North Approach Whitefields Ln**			**East Approach Hume Hwy**			**West Approach Hume Hwy**			**Hourly Total**	
Period Start	**Period End**	**U**	**R**	**L**	**U**	**R**	**WB**	**U**	**EB**	**L**	**Hour**	**Peak**
6:00	6:15	0	0	0	0	0	21	0	16	0	234	
6:15	6:30	0	0	0	0	0	37	0	27	0	268	
6:30	6:45	0	0	0	0	0	42	0	23	0	278	
6:45	7:00	0	0	1	0	0	40	0	27	0	316	
7:00	7:15	0	0	0	0	0	46	0	25	0	357	
7:15	7:30	0	0	0	0	0	41	0	33	0	389	
7:30	7:45	0	0	0	0	1	49	0	53	0	449	
7:45	8:00	0	0	0	0	0	48	0	61	0	450	
8:00	8:15	0	0	0	0	0	53	0	50	0	479	
8:15	8:30	0	0	0	0	0	55	0	79	0	516	
8:30	8:45	0	0	0	0	0	50	0	54	0	549	
8:45	9:00	0	0	0	0	0	76	0	62	0	571	
9:00	9:15	0	0	0	0	1	85	0	54	0	585	Peak
9:15	9:30	0	0	0	0	0	90	0	77	0		
9:30	9:45	0	0	0	0	0	71	0	55	0		
9:45	10:00	0	0	0	0	0	77	0	75	0		
15:00	15:15	0	0	0	0	0	121	0	91	0	782	Peak
15:15	15:30	0	0	0	0	0	93	0	90	0	765	
15:30	15:45	0	0	0	0	0	101	0	79	0	766	
15:45	16:00	0	0	0	0	0	107	0	100	0	763	
16:00	16:15	0	0	0	0	0	116	0	79	0	703	
16:15	16:30	0	0	0	0	0	86	0	98	0	661	
16:30	16:45	0	0	0	0	0	97	0	80	0	620	
16:45	17:00	0	0	0	0	0	64	0	83	0	585	
17:00	17:15	0	0	0	0	0	69	0	84	0	567	
17:15	17:30	0	0	0	0	0	64	0	79	0	545	
17:30	17:45	0	0	0	0	0	63	0	79	0	520	
17:45	18:00	0	0	0	0	0	66	0	63	0	499	
18:00	18:15	0	0	0	0	0	63	0	68	0	492	
18:15	18:30	0	0	0	0	0	56	0	62	0		
18:30	18:45	0	0	0	0	1	51	0	69	0		
18:45	19:00	0	0	0	0	0	53	0	69	0		

Peak Time		**North Approach Whitefields Ln**			**East Approach Hume Hwy**			**West Approach Hume Hwy**			**Peak total**
Period Start	**Period End**	U	R	L	U	R	WB	U	EB	L	
9:00	10:00	0	0	0	0	1	323	0	261	0	585
15:00	16:00	0	0	0	0	0	422	0	360	0	782

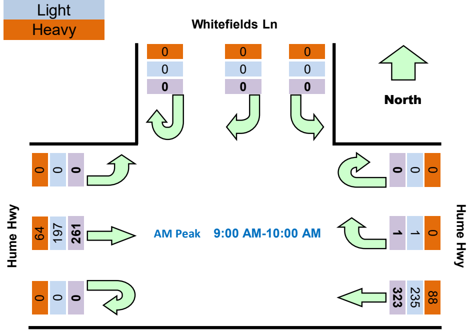
Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

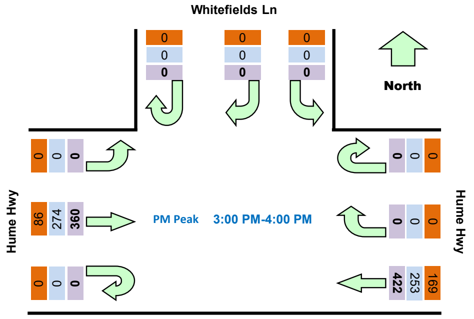
Graphic

Total

Light

Heavy





Light Vehicles

Time		North Approach Whitefields Ln			East Approach Hume Hwy			West Approach Hume Hwy		
Period Start	Period End	U	R	L	U	R	WB	U	EB	L
6:00	6:15	0	0	0	0	0	8	0	4	0
6:15	6:30	0	0	0	0	0	19	0	8	0
6:30	6:45	0	0	0	0	0	25	0	11	0
6:45	7:00	0	0	1	0	0	20	0	15	0
7:00	7:15	0	0	0	0	0	32	0	12	0
7:15	7:30	0	0	0	0	0	23	0	16	0
7:30	7:45	0	0	0	0	1	32	0	29	0
7:45	8:00	0	0	0	0	0	28	0	30	0
8:00	8:15	0	0	0	0	0	33	0	32	0
8:15	8:30	0	0	0	0	0	37	0	52	0
8:30	8:45	0	0	0	0	0	32	0	30	0
8:45	9:00	0	0	0	0	0	52	0	45	0
9:00	9:15	0	0	0	0	1	62	0	43	0
9:15	9:30	0	0	0	0	0	63	0	57	0
9:30	9:45	0	0	0	0	0	52	0	43	0
9:45	10:00	0	0	0	0	0	58	0	54	0
15:00	15:15	0	0	0	0	0	70	0	79	0
15:15	15:30	0	0	0	0	0	56	0	62	0
15:30	15:45	0	0	0	0	0	65	0	56	0
15:45	16:00	0	0	0	0	0	62	0	77	0
16:00	16:15	0	0	0	0	0	73	0	63	0
16:15	16:30	0	0	0	0	0	49	0	74	0
16:30	16:45	0	0	0	0	0	52	0	53	0
16:45	17:00	0	0	0	0	0	40	0	57	0
17:00	17:15	0	0	0	0	0	39	0	63	0
17:15	17:30	0	0	0	0	0	33	0	49	0
17:30	17:45	0	0	0	0	0	31	0	43	0
17:45	18:00	0	0	0	0	0	31	0	39	0
18:00	18:15	0	0	0	0	0	27	0	42	0
18:15	18:30	0	0	0	0	0	30	0	35	0
18:30	18:45	0	0	0	0	1	22	0	33	0
18:45	19:00	0	0	0	0	0	25	0	25	0

Peak Time		North Approach Whitefields Ln			East Approach Hume Hwy			West Approach Hume Hwy			Peak total
Period Start	Period End	U	R	L	U	R	WB	U	EB	L	
9:00	10:00	0	0	0	0	1	235	0	197	0	433
15:00	16:00	0	0	0	0	0	253	0	274	0	527

Heavy Vehicles

Time		North Approach Whitefields Ln			East Approach Hume Hwy			West Approach Hume Hwy		
Period Start	Period End	U	R	L	U	R	WB	U	EB	L
6:00	6:15	0	0	0	0	0	13	0	12	0
6:15	6:30	0	0	0	0	0	18	0	19	0
6:30	6:45	0	0	0	0	0	17	0	12	0
6:45	7:00	0	0	0	0	0	20	0	12	0
7:00	7:15	0	0	0	0	0	14	0	13	0
7:15	7:30	0	0	0	0	0	18	0	17	0
7:30	7:45	0	0	0	0	0	17	0	24	0
7:45	8:00	0	0	0	0	0	20	0	31	0
8:00	8:15	0	0	0	0	0	20	0	18	0
8:15	8:30	0	0	0	0	0	18	0	27	0
8:30	8:45	0	0	0	0	0	18	0	24	0
8:45	9:00	0	0	0	0	0	24	0	17	0
9:00	9:15	0	0	0	0	0	23	0	11	0
9:15	9:30	0	0	0	0	0	27	0	20	0
9:30	9:45	0	0	0	0	0	19	0	12	0
9:45	10:00	0	0	0	0	0	19	0	21	0
15:00	15:15	0	0	0	0	0	51	0	12	0
15:15	15:30	0	0	0	0	0	37	0	28	0
15:30	15:45	0	0	0	0	0	36	0	23	0
15:45	16:00	0	0	0	0	0	45	0	23	0
16:00	16:15	0	0	0	0	0	43	0	16	0
16:15	16:30	0	0	0	0	0	37	0	24	0
16:30	16:45	0	0	0	0	0	45	0	27	0
16:45	17:00	0	0	0	0	0	24	0	26	0
17:00	17:15	0	0	0	0	0	30	0	21	0
17:15	17:30	0	0	0	0	0	31	0	30	0
17:30	17:45	0	0	0	0	0	32	0	36	0
17:45	18:00	0	0	0	0	0	35	0	24	0
18:00	18:15	0	0	0	0	0	36	0	26	0
18:15	18:30	0	0	0	0	0	26	0	27	0
18:30	18:45	0	0	0	0	0	29	0	36	0
18:45	19:00	0	0	0	0	0	28	0	44	0

Peak Time		North Approach Whitefields Ln			East Approach Hume Hwy			West Approach Hume Hwy			Peak total
Period Start	Period End	U	R	L	U	R	WB	U	EB	L	
9:00	10:00	0	0	0	0	0	88	0	64	0	152
15:00	16:00	0	0	0	0	0	169	0	86	0	255

Appendix B

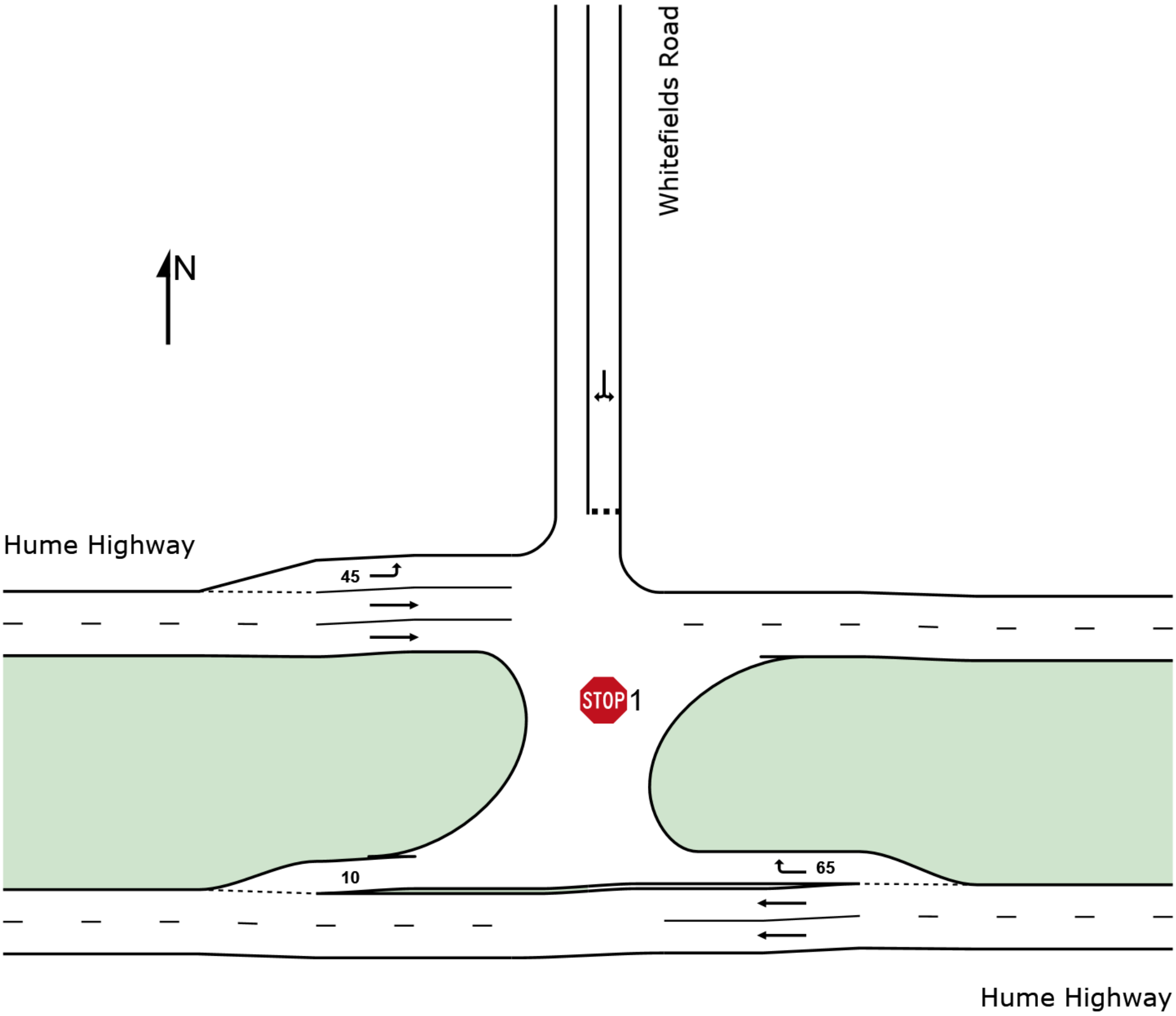
SIDRA Results

SITE LAYOUT

Site: [1] AM (General)

NA
Site Category: (None)
Stop (Two-Way)
Site Scenario: 1 | Local Volumes

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: [1] AM (General)

Output produced by SIDRA INTERSECTION Version: 10.0.5.217

NA
Site Category: (None)
Stop (Two-Way)
Site Scenario: 1 | Local Volumes

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total	HV]	Arrival Flows [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue [Veh.	Dist]	Prop. Qued	Eff. Stop Rate	Number of Cycles to Depart	Aver. Speed
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: Hume Highway															
5	T1	All MCs	351	27.3	351	27.3	0.114	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	110.0
6	R2	All MCs	63	16.7	63	16.7	0.101	12.4	LOS A	0.3	2.7	0.42	0.71	0.42	62.2
Approach			414	25.7	414	25.7	0.114	1.9	NA	0.3	2.7	0.06	0.11	0.06	98.2
North: Whitefields Road															
1	L2	All MCs	1	0.0	1	0.0	0.003	7.5	LOS A	0.0	0.1	0.33	0.56	0.33	68.3
2	R2	All MCs	1	0.0	1	0.0	0.003	10.3	LOS A	0.0	0.1	0.33	0.56	0.33	68.7
Approach			2	0.0	2	0.0	0.003	8.9	LOS A	0.0	0.1	0.33	0.56	0.33	68.5
West: Hume Highway															
3	L2	All MCs	4	25.0	4	25.0	0.003	8.9	LOS A	0.0	0.0	0.00	0.67	0.00	66.5
4	T1	All MCs	283	24.5	283	24.5	0.090	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	110.0
Approach			287	24.5	287	24.5	0.090	0.1	NA	0.0	0.0	0.00	0.01	0.00	108.9
All Vehicles			703	25.1	703	25.1	0.114	1.2	NA	0.3	2.7	0.04	0.07	0.04	102.2

Site Level of Service (LOS) Method: Delay (NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: [2] PM (General)

Output produced by SIDRA INTERSECTION Version: 10.0.5.217

NA
Site Category: (None)
Stop (Two-Way)
Site Scenario: 1 | Local Volumes

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total	HV]	Arrival Flows [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue [Veh.	Dist]	Prop. Qued	Eff. Stop Rate	Number of Cycles to Depart	Aver. Speed
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: Hume Highway															
5	T1	All MCs	458	40.0	458	40.0	0.164	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	109.9
6	R2	All MCs	1	0.0	1	0.0	0.002	12.0	LOS A	0.0	0.0	0.45	0.62	0.45	67.2
Approach			459	39.9	459	39.9	0.164	0.0	NA	0.0	0.0	0.00	0.00	0.00	109.8
North: Whitefields Road															
1	L2	All MCs	62	16.9	62	16.9	0.073	8.4	LOS A	0.3	2.1	0.34	0.63	0.34	60.6
2	R2	All MCs	4	25.0	4	25.0	0.073	13.7	LOS A	0.3	2.1	0.34	0.63	0.34	60.8
Approach			66	17.5	66	17.5	0.073	8.7	LOS A	0.3	2.1	0.34	0.63	0.34	60.6
West: Hume Highway															
3	L2	All MCs	1	0.0	1	0.0	0.001	8.2	LOS A	0.0	0.0	0.00	0.67	0.00	78.8
4	T1	All MCs	391	24.0	391	24.0	0.124	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	110.0
Approach			392	23.9	392	23.9	0.124	0.0	NA	0.0	0.0	0.00	0.00	0.00	109.8
All Vehicles			917	31.5	917	31.5	0.164	0.7	NA	0.3	2.1	0.02	0.05	0.02	103.7

Site Level of Service (LOS) Method: Delay (NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

APPENDIX J: TRUEVISUAL BESS REPRESENTATION

View towards to North East from Whitefields Road (Turbine 74- 80)

View from Whitefields Road towards Turbines 47-33

Whitefields Road view to the north west (turbine 47-49)