Gelliondale Wind Farm and Battery Energy Storage System (BESS)

Risk Management Plan (including Fire Safety Study)

June 2023

FIRE RISK
Consultants

Cover photo – View of the typical landscape within and surrounding the proposed Gelliondale Wind Farm and BESS (Fire Risk Consultants).

Document history and date

Revision	Date	Description	By	Review	Approved
V1 - DRAFT	5/6/2023	Initial draft following assessment of available information and site visit.	M Potter & FRC Project Team	FRC Peer Review Team	G Taylor Managing Director
V2	7/6/2023	Updated following client feedback.	M Potter & FRC Project Team	FRC Peer Review Team	G Taylor Managing Director

Fire Risk Consultants
PO Box 12, Glengarry VIC 3854
0487 790 287
www.fireriskconsultants.com.au

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Any fire safety work, including but not limited to planned burning, back burning and/or fire suppression, on any property or building is specifically excluded from this report.

*Where the term **"Bushfire prevention and mitigation related activities"** (or words to that effect) are used, this is to be defined as the clearance of vegetation in accordance with the Victorian State Government guidelines, including clearing and maintenance of existing fire breaks and/or fire access for fire fighters under electricity pylons and properties that have been constructed to Australian Standard AS3959 and/or the National Construction Code.*

Contents

1 Executive Summary

The Gelliondale Wind Farm and BESS project proposes to develop 13 wind turbine generators (WTG), a Battery Energy Storage System (BESS) and associated infrastructure approximately 7 kilometres south west of Yarram. The Wind Farm is proposed to have a total capacity of up to 80 MW.

Gelliondale Wind Farm will be constructed across 1500 hectares of cleared agricultural land and ancillary infrastructure including an energy storage system and a substation adjacent to an existing 66 kilovolt transmission line that passes through the site.

To assess the risk of fire in relation to the development, this Risk Management Plan (RMP) has been developed to consider fire risk associated with bushfire and a fire starting within the proposed infrastructure. The RMP follows the guidance provided by CFA in their *Design Guidelines and Model Requirements: Renewable Energy Facilities 2022* (CFA Guideline). It also includes the assessment of bushfire risk in accordance with Clause 13.02-1S of the Wellington Planning Scheme.

The assessment of bushfire risk has identified a landscape that has experienced large bushfires in the past. Whilst the direct area of the proposed wind farm has not been impacted by large bushfires, there is no doubt that bushfires can occur under elevated fire danger conditions in this landscape. The assessment of bushfire risk in this report has resulted in the recommendations for a range of mitigation treatments that align with the CFA Guideline.

This report contains an assessment of fire risk within the Wind Energy Facility (WEF) including the wind turbine nacelle, substation and the BESS, and identifies the low risk associated with these types of development. This low risk in addition to the mitigation treatments outlined within the CFA Guideline, ensures a high level of fire safety in a WEF and BESS.

The outcome of the risk assessment has recommended a range of mitigations to manage fire risk including:

- Installation of static water supply tanks spread across the WEF and the BESS area that complies with the CFA Guidelines and *AS2419.1:2005 Fire hydrant installations* (AS2419.1).
- Provision of fire breaks around the base of the wind turbines, BESS, Substation and the operations and maintenance area.
- Installation of smoke detection and fire suppression systems within the nacelle.
- Installation of fire safety systems within the BESS enclosures that is based on the manufacturer specifications and results of the UL9540A test.
- Provision of access tracks including overtaking bays.
- Ongoing maintenance programs for the life of the project in accordance with the relevant Standards or manufacturer specifications.

The outcome of the risk assessment has indicated that the development can occur in this landscape and not increase the risk of fire to surrounding communities, farming assets and other infrastructure.

2 Introduction

Fire Risk Consultants have been engaged by Synergy Wind Pty Ltd to develop an RMP for the proposed Gelliondale Wind Farm located between the townships of Yarram, Alberton and Welshpool in south east Victoria. The Wind Energy Facility (WEF) development consists of 13 wind turbines generators, a BESS and associated infrastructure including a substation and access tracks.

The proposed Gelliondale WEF and BESS is in the Wellington Shire in south-eastern Victoria, approximately 7 kilometres south west of Yarram. The WEF will generate approximately 300,000 megawatt hours of renewable energy each year.

This RMP is required to achieve compliance with the CFA Guideline - *Design Guidelines and Model Requirements: Renewable Energy Facilities 2022* (CFA Guideline). The CFA Guideline outlines the purpose and need for a Risk Management Plan (RMP). The RMP has been developed to provide sufficient information for CFA to make an informed decision on fire risk related matters. It is expected that the Planning Permit will require a Fire Management Plan (FMP) and Emergency Management Plan (EMP) in accordance with the requirements of the CFA Guidelines.

The RMP has been prepared following an assessment of the site and analysis of supplied information from the client in relation to the design, commissioning and operation of a Wind Energy Facility. As per the CFA Guideline, this report also aligns with NSW Planning's *Hazardous Industry Planning Advisory Paper 2: Fire Safety Study Guidelines (2011)*. The various requirements outlined within the Advisory Paper have been included within this report where it relates to the proposal.

Table 1 - Response to NSW Fire Safety Study Guideline

Section 2 summary	Response
Identification of fire hazards and the consequences of possible fire incidents	The CFA Guideline provides an outline of the types of fire hazards associated with renewable energy developments. This report also analyses previous fire history (Section 5.3) and includes the assessment of risk resulting from these fire events and other information that is supplied by the developer.
Fire prevention strategies and measures	The outcome of the assessment of risk and the assessment of the design against the CFA Guideline has resulted in a range of fire prevention strategies and measures. These strategies and measures will be included within the Fire Management Plan and include their design and maintenance standards.
Analysis of the requirements for fire detection and protection and identification of the specific measures to be implemented	The CFA Guideline provides specific fire detection and protection requirements including the installation of a fire hydrant system, detection and suppression systems and bushfire protection measures.

Calculation of firefighting water supply and demand	The CFA Guideline provides clear requirements to design and install the fire hydrant system to AS2419 – open yard protection requirements. This includes the development of a firefighting water supply and demand requirement for the BESS area.
Containment of contaminated firefighting water	The CFA Guideline provides the requirement to contain firefighting water at the BESS to enable testing to occur before it is allowed to either entre the stormwater drainage system or needs to be sent to a disposal location.
First aid fire protection requirements.	The CFA Guideline imposes certain requirements along with the obligation on the operator to meet the occupational health and safety requirements imposed by various legislation. This includes the provision of fire extinguishers, warning signs, road access minimum requirements, staff training, induction programs and emergency management planning.

3 Project Overview

The proposed Gelliondale Wind Farm (the project) comprises 13 wind turbines and associated permanent and temporary infrastructure, including:

- Hardstand areas at the base of each WTG.
- Wind turbine height (to tip of blade at highest point) up to 210m, rotor diameter up to 164m and hub height up to 129m. The minimum ground clearance (height from ground to tip of blade at lowest point) is 40m.
- To support the construction of the Wind Farm, there will be approximatley 50 (FTE) positions created with the ongoing operational/maintenance jobs approximatley 10 (FTE).
- Creation or improvement of up to 13 access points from public roads.
- An on-site substation that facilitates connection to the existing 66kV transmission line.
- Battery Energy Storage System (BESS).
- Temporary infrastructure including construction compounds and wind turbine component laydown areas.

4 Existing conditions assessment

4.1 Site description and location

The Wind Energy Facility is spread over approximately 1,500 hectares and is within the Wellington Shire Council area in south eastern Victoria. The project is approximately 7 kilometres to the south west of Yarram. The project involves the construction, commissioning and operation of 13 wind turbine generators (see Figure 1), BESS and associated infrastructure.

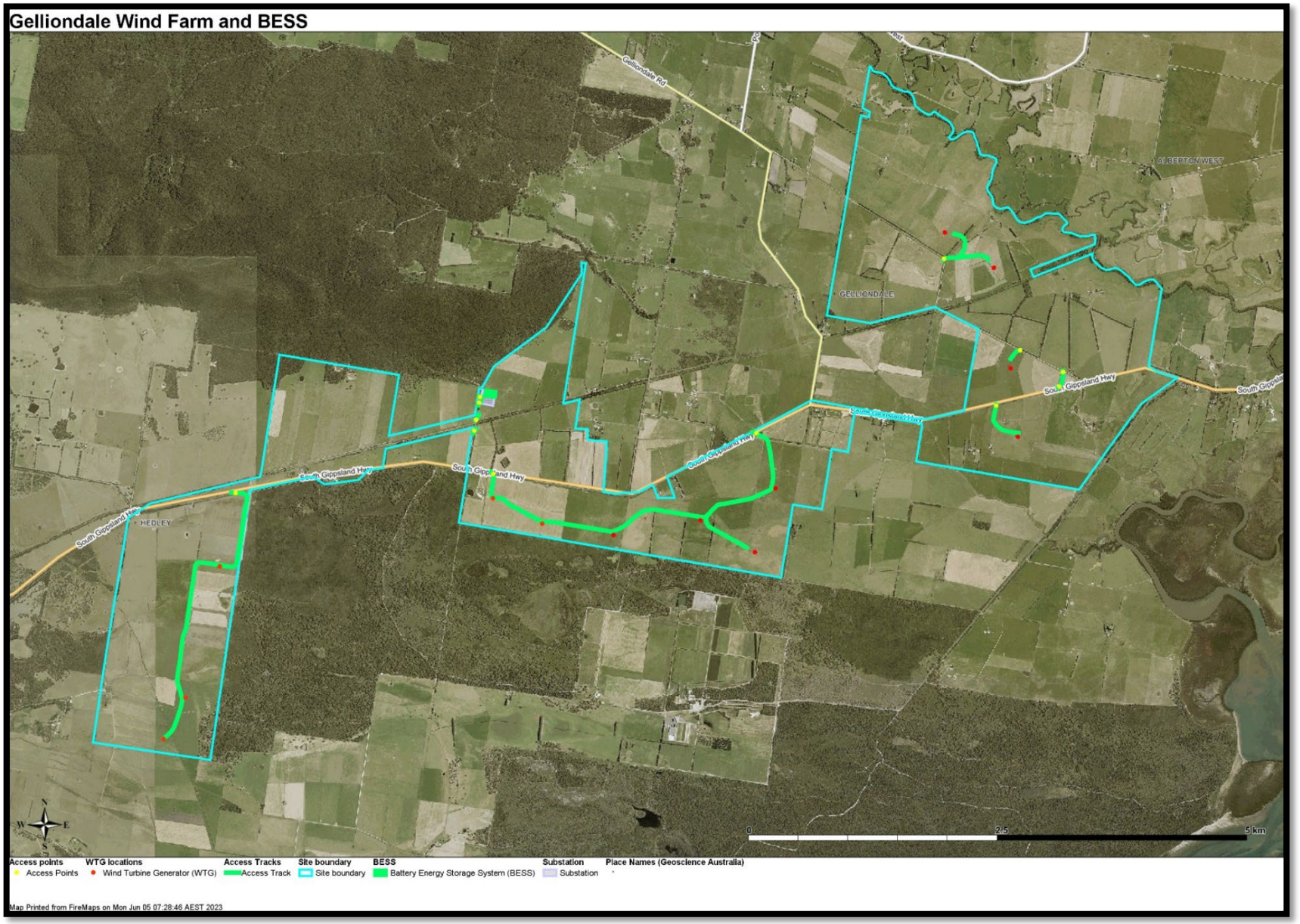

Figure 1 - Overview of the Gelliondale Wind Farm

4.2 Risk indicators

The following information has been obtained and provides relevant information that informs the analysis of risk. This information is primarily related to the bushfire risk that exists in the surrounding area and the analysis of fire risk within the proposed infrastructure.

4.2.1 Bushfire Management Overlay

The Bushfire Management Overlay (BMO) is a Planning Scheme Overlay provided within the Wellington Planning Scheme. It is reliant on areas of a municipality being identified as at risk from bushfire.

The criteria[1] to determine if a BMO should be implemented includes the identification of vegetation including forest, woodland, scrub, shrubland, mallee and rainforest vegetation that is 4 hectares or more in size. Once this is confirmed, a 150 metre buffer is applied from the edge of vegetation. Fire authorities also have the ability to advise locations that may be subject to extreme landscape bushfires.

Figure 2 outlines the location of the BMO in relation to this development. The proposed development has ensured that the substation or the BESS are not located within the BMO. It is proposed for some of the WTGs to be just inside the BMO to the south of South Gippsland Highway. The location of the WTGs has been assessed through this report.

The BMO identifies the areas that are vegetated in the surrounding landscape. The forested areas are primarily associated with the Alberton West State Forest and the Gelliondale State Forest.

[1] https://www.planning.vic.gov.au/__data/assets/pdf_file/0027/447921/Fact-sheet-Bushfire-mapping-methodology-and-criteria.pdf

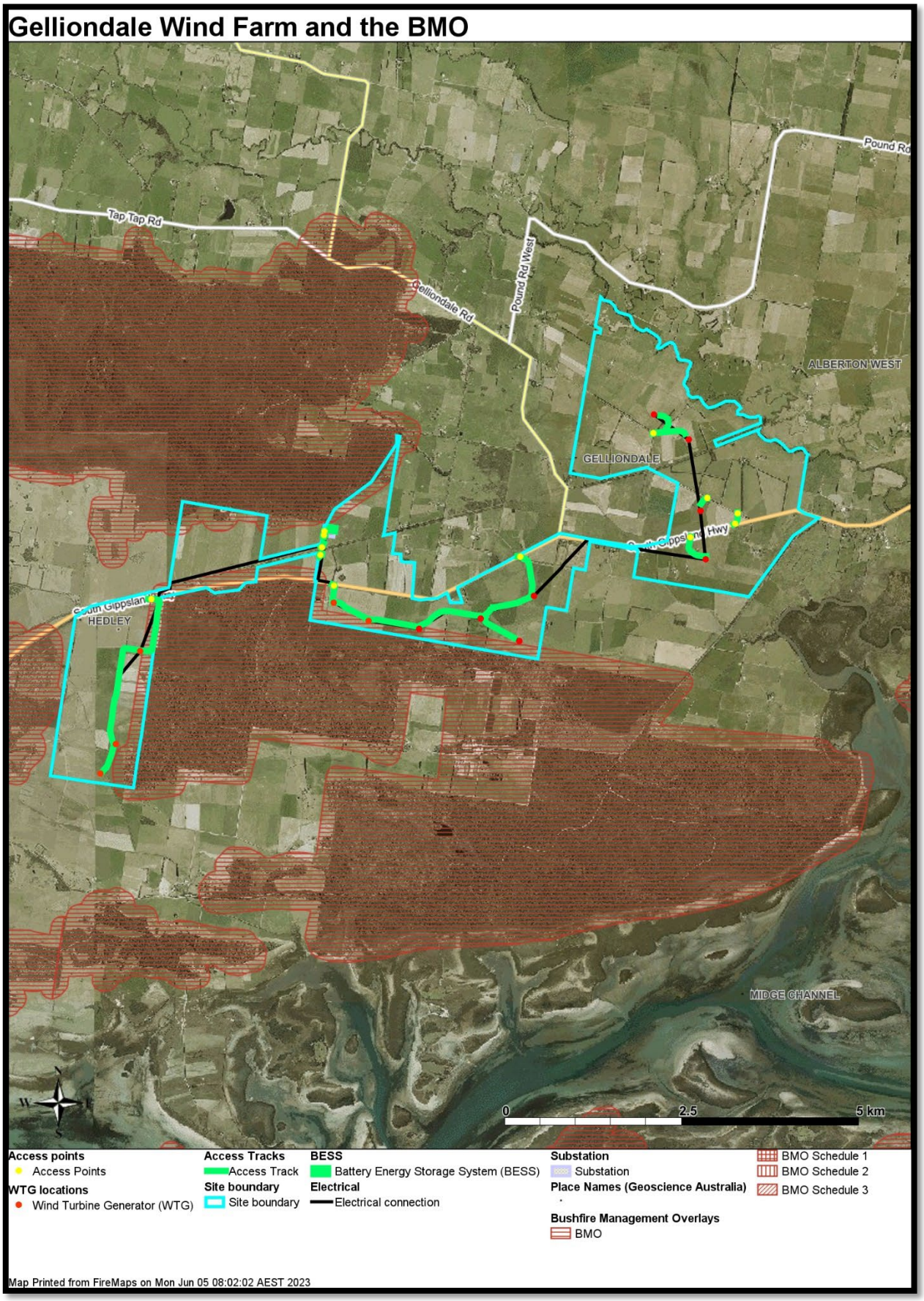

Figure 2 - Location of Bushfire Management Overlay in relation to the Proposed WEF

4.2.2 Bushfire Prone Area

Bushfire Prone Areas (BPA) are areas that are subject to, or likely to be subject to, bushfires. The Minister for Planning has determined that specific areas are designated BPAs for the purposes of the building control system. Specific bushfire construction standards apply in designated bushfire prone areas in Victoria. The entire development is located within a Bushfire Prone Area.

These bushfire construction requirements are aimed at improving bushfire protection for residential buildings. The creation of the BPA map fulfils one of the 67 recommendations made by the Victorian Bushfires Royal Commission that occurred following the 2009 Black Saturday bushfires.

The existence of the BPA will trigger the need to respond to Clause 13.02 of the Planning Scheme. Refer to Section 5.1.

4.2.3 Municipal Fire Management Plan

The Wellington Municipal Fire Management Plan (MFMP) 2015[2] outlines the risk of fires within the municipality and outlines the treatments required to offset these risks. The MFMP was last updated and released in 2015.

The MFMP outlines that the bushfire season generally runs from December to March. The prevailing weather conditions are north westerly winds accompanied by high daytime temperatures and low relative humidity.

The MFMP indicates a level of risk for communities surrounding the proposed WEF. This includes:

Location	Risk rating	Residual risk
Alberton	Very High	Low
Port Albert	Extreme	Very High
Yarram	Very High	High

The Gelliondale locality is not included within the MFMP other than the mention of the HVP Nursery which is located to the south of the development. The bushfire risk to the Nursery is listed as Extreme with no residual risk rating provided.

The MFMP also outlines treatments for the localities, and this includes community education, roadside vegetation management, development and maintenance of strategic fire breaks and fuel hazard management. It has been assumed that the monitoring of the implementation of the treatments is also occurring through the committee established to develop the MFMP.

[2] https://global-uploads.webflow.com/6021ed7c89cc1c1c01fccf29/6021ed7c89cc1c18ccfcd884_Municipal-Fire-Management-Plan.pdf

The MFMP outlines several roads within the surrounding landscape that have been identified as Strategic Fire Breaks. The listed roads have been allocated a treatment being either grazing, burning or slashing.

The MFMP also outlines several treatments that are provided to address bushfire risk across the municipality. The treatments include:

- Community education programs
- Fire Danger Period advisory signs
- Neighbourhood Safer Places (Hawkesdale)
- Private property planning
- Municipal Fire Prevention Notices
- Fuel hazard reduction

4.2.4 Safer Together assessment[3]

The Safer Together project delivered by the Victorian State Government has developed strategies for the various Regions of Victoria. The Gippsland Bushfire Management Strategy was developed to reflect the region's unique environments and communities and includes the location for the Gelliondale Wind Farm and BESS. The strategy was developed through a regional planning process that was guided by the knowledge and priorities of experts, stakeholders and community members from the Region.

The Gippsland Bushfire Management Strategy 2020 is the result of an analysis of bushfire risk across the Region. The Strategy indicates the threat of grassfires, however it does not provide any additional strategies to reduce the risk other than those already undertaken.

4.2.5 Bushfire history

An analysis of bushfire history in the area surrounding the proposed Wind Farm indicates some bushfire activity. According to the data provided by DEECA (Figure 3), there has been no impact on the project footprint because of large bushfires. Smaller bushfires have occurred however it appears that rapid intervention has kept the fires to a small size.

Figure 3 also outlines the fuel reduction burns that have occurred in the surrounding landscape. Most of the fire activity in the Alberton West State Forest and the Gelliondale State Forest is associated with fuel reduction burning.

Larger bushfires have occurred further to the north during 2009 and 2014. These bushfires occurred under elevated fire danger conditions and travelled extensive distances through mainly forested areas.

[3] Gippsland Bushfire Management Strategy 2020 - https://www.safertogether.vic.gov.au/__data/assets/pdf_file/0028/493534/DELWP_BushfireManagementStrategies_2020_Gippsland_rr.pdf

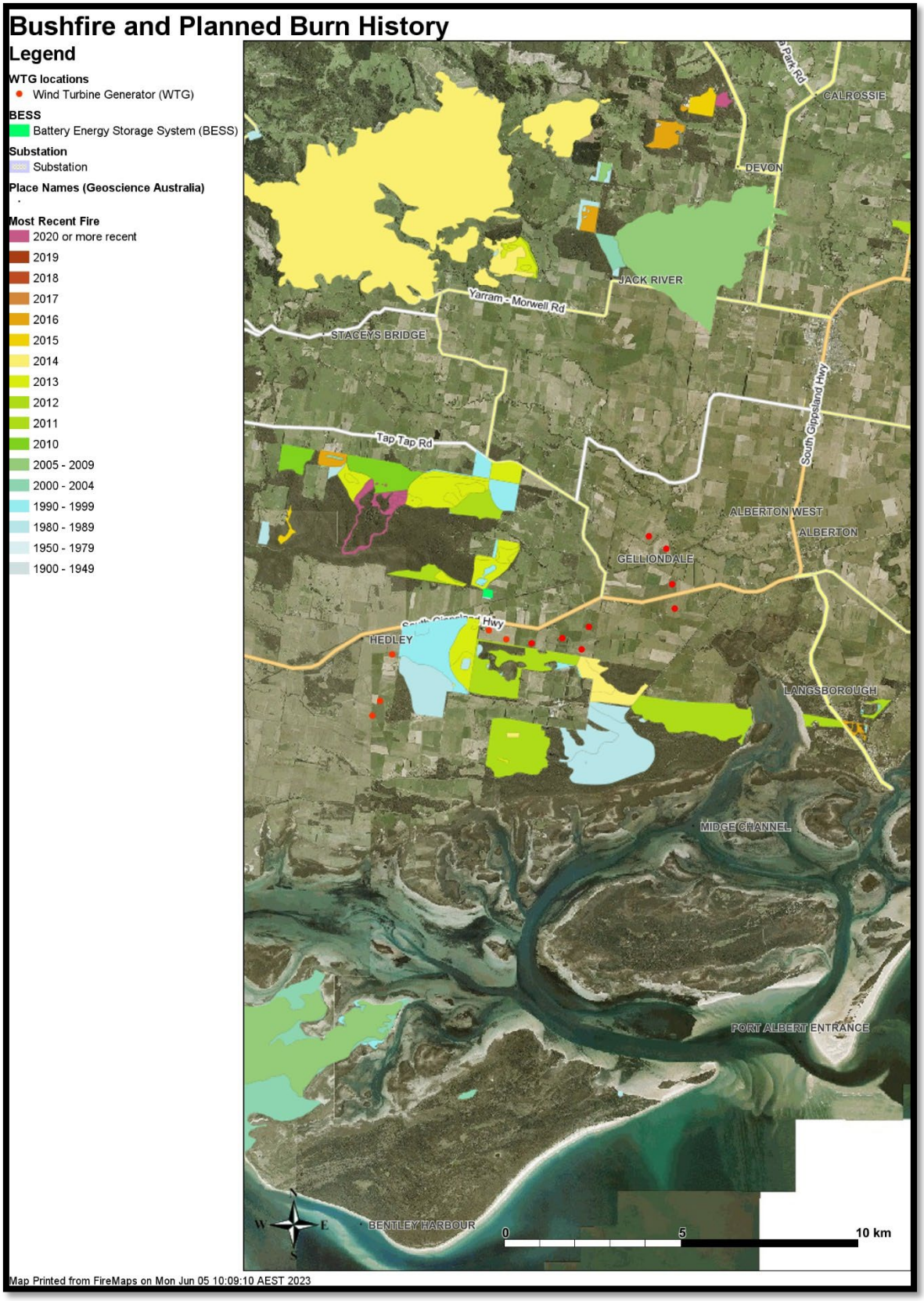

Figure 3 – Bushfire and Planned Burn history surrounding the Gelliondale WEF and BESS

4.2.6 Surrounding landscape and project site assessment

Surrounding area

The surrounding area is a mix of Plantations, Public Land and farming properties. The development is located to the south of the Strzelecki Ranges with the WTGs all located in grassland areas. The landscape is separated into north and south by the South Gippsland Highway which runs east to west through the development.

Figure 4 –Typical landscape surrounding the Gelliondale WEF site.

Due to the farming activities within the surrounding landscape, there is a high level of vegetation fragmentation. The fragmentation is also caused by the extensive road network within the local area that provides several fuel breaks that will likely influence bushfire behaviour in lower fire danger conditions.

In the surrounding landscape are Public Land reserves including the Alberton West State Forest and the Gelliondale State Forest. The fire agencies have identified a number of fuel reduction activities within these areas to manage the bushfire risk. These are outlined within Figure 5 with the darker lines indicating fuel breaks that are installed around the Public Land Reserves and the proposed Fuel reduction burns that are scheduled to occur in the next two years.

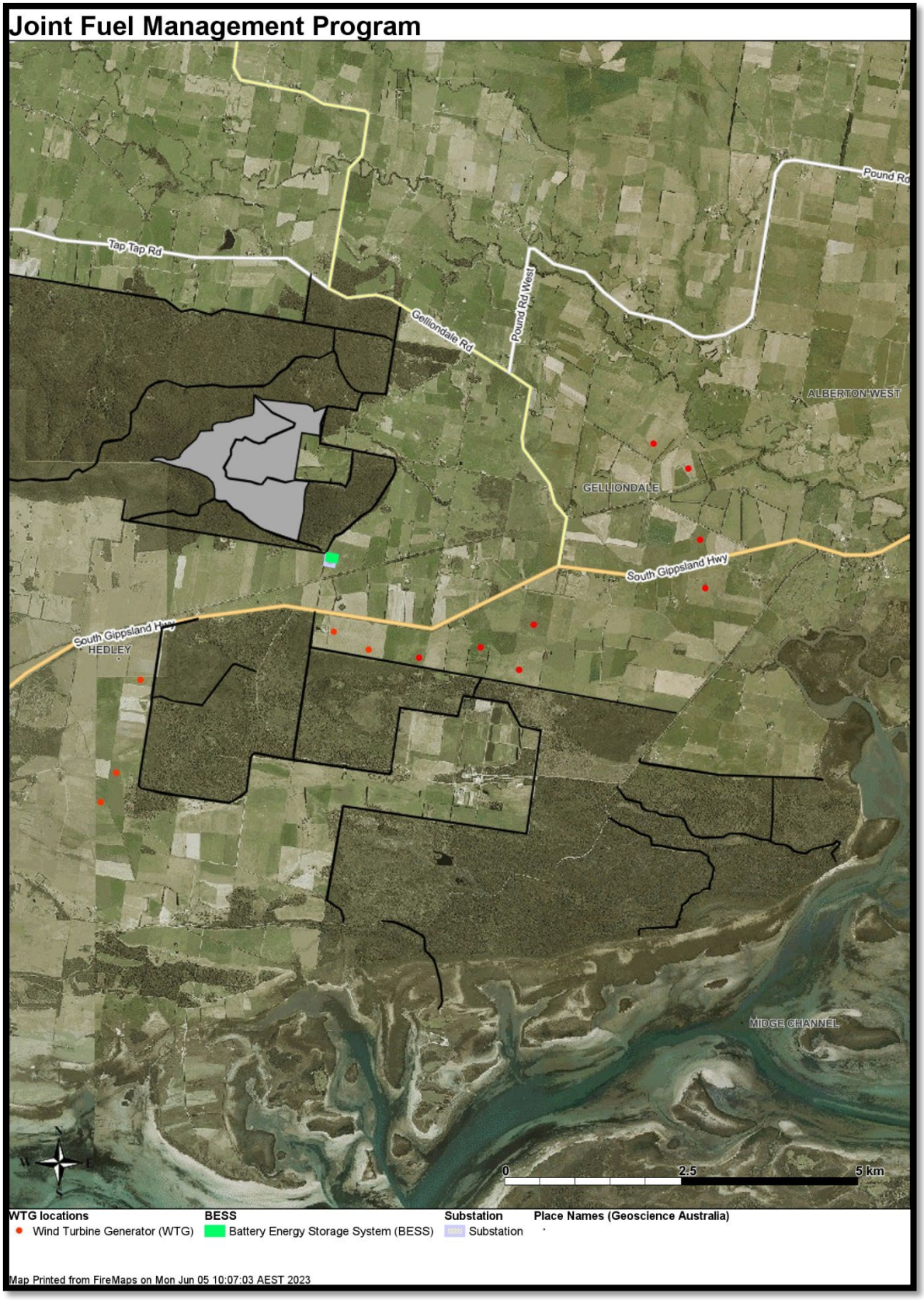

Figure 5 - Joint Fuel Management Program

Project site

The project site is located along the South Gippsland Highway. The WTG's, BESS and Substation are all located within farming properties. The farming activities vary from stock grazing, cropping including irrigated areas. The landscape within the site boundary is highly fragmented and varies considerably depending on the use of the land. This is likely to continue for the life of the WEF development.

There is very little treed vegetation on the properties apart from small, isolated clumps for stock protection and linear strips of trees (wind breaks). The dominant vegetation is grassland when assessed against AS3959.

The development site consists of road access through a network of private, municipal and public roads.

5 Risk assessment process

To effectively assess the fire risk associated with the proposal, this report is structured to assess risk using the following frameworks:

- Clause 13.02 – Bushfire Planning –Wellington Planning Scheme[4]
- Assessment against the requirements of the CFA Guideline *Design Guidelines and Model Requirements: Renewable Energy Facilities 2022*
- Risk assessment that meets section 5 of the CFA Guidelines.

The risk assessment provides the opportunity to bring the information gained from the above processes or information together and if required, make any additional recommendations. All recommendations are aimed at reducing the risk to an acceptable level.

5.1 Clause 13.02 – Bushfire planning assessment

Clause 13.02[5] of the Wellington Planning Scheme plans to strengthen the resilience of settlements and communities and prioritise protection of human life through several objectives. However, it should be noted that the proposed WEF does not introduce new settlements into the landscape. The assessment has been undertaken within the context of a WEF and BESS.

5.1.1 Bushfire hazard assessment

Elevated bushfire behaviour in south east Australia is often dominated by strong and gusty north westerly winds followed by a south westerly change that normally occurs in the afternoon or early evening. These conditions have historically caused the loss of life and property and are usually associated with elevated fire danger warnings issued by the fire agencies.

Table 2 below outlines the hazard assessment relating to the proposed development. Figures 6 and 7 provide an overview of the likely bushfire scenarios within the surrounding area. The assessment has identified the presence of the north west and south west likely bushfire impacts. This is supported by the MFMP.

It is acknowledged that bushfires may approach from other directions, however the treatment of the risk from these aspects will be sufficient to offset bushfire approach from any directions. The presence of large Plantations to the north and the surrounding Public Land Reserves is acknowledged and whilst they may generate elevated bushfire intensities and behaviour, it is unlikely for this to occur under an easterly wind influence. The conditions required to generate elevated bushfire behaviour would require a north westerly or south westerly wind influence.

[5] https://planning-schemes.app.planning.vic.gov.au/Wellington/ordinance/13.02

Table 2 - Assessment against Clause 13.02

Bushfire hazard type	Conditions	Likely Scenario	Considerations
The site for the development	Once completed, the WEF, Substation and BESS will be required to comply with conditions as specified within the CFA Guideline that includes the management of vegetation around the base of the turbine towers and surrounding the BESS and other infrastructure during the fire danger period. During construction, there is a risk of a fire igniting and spreading through unmanaged vegetation. During the construction phase, the properties surrounding the construction area will continue to be used for farming activities including stock grazing.	A bushfire starting on the property is a possibility in particular during the construction phase due to the increased number of people working on the project and the operating machinery. Bushfires that are started by lightning, arson or other human caused events could burn through the WEF and threaten the surrounding properties and the BESS. The access track network and vegetation management requirements around the turbine towers, BESS and other infrastructure will limit bushfire spread under elevated fire danger conditions. During construction, any work that is occurring near unmanaged grassland has the potential to start a bushfire and leave the property.	During the construction phase of the WEF and BESS, where possible, all vegetation within 100 metres of works areas is to be managed during the fire danger period with all grassland less than 100mm in height. When the fire danger conditions are elevated (Catastrophic), the Emergency Management Plan will outline procedures to close the site during the construction phase and limit maintenance operations unless critical. The CFA Guideline requires the provision of vegetation management surrounding the base of the turbine towers, the BESS area and other infrastructure. The access roads will be established during the construction phase and maintained for the life of the project. These access roads will likely assist with bushfire containment under lower fire danger conditions.
Neighbourhood (400 metres) and local conditions (one kilometre)	Within one kilometre of the development, the surrounding landscape is a mix of grassland that is used for agricultural purposes and native vegetation contained within the Alberton West State Forest and	Under strong wind conditions a bushfire can travel quickly across the landscape. Bushfires are heavily influenced by the quantity of fuels and the wind strength. Roadsides will contribute to bushfire spread due to the unmanaged fuels and the presence of trees that will	The provision of access roads throughout the WEF will assist with containing bushfires and providing increased accessibility to the landscape. The managed areas will also significantly limit the chances

	the Gelliondale State Forest. The surrounding road network provides access and egress opportunities for emergency services and in some cases, these are maintained as fire breaks.	likely generate short distance ember attack. The nature of the farming properties results in a highly fragmented landscape where some areas are considered as containing reduced fuel or other areas have elevated fuels due to cropping. The likely worst-case scenario is a bushfire burning within the Alberton West State Forest under a north westerly wind influence. The forested areas to the north west of the substation and BESS area are likely to generate spotting that will start new fires where combustibles exist.	of a bushfire starting at the towers and BESS. The substation and BESS will be provided with fuel breaks around the perimeter and be designed to offset the impact of embers.
Landscape conditions (10 kilometres)	The landscape surrounding the development site consists of large areas of forested vegetation along with grassland vegetation associated with farming activities.	The likely bushfire behaviour will involve fires within the forested areas surrounding the development. To the north west, bushfires have the ability to travel long distances due to the vegetated areas within and surrounding the Strzelecki Ranges. Historically, bushfires have not progressed into the farming properties from the north west.	The protection of the WEF and BESS infrastructure from bushfire impact is required by the CFA Guideline. The provision of access roads will increase the ability for firefighters to access the areas surrounding the WEF. The WTGs in the central area will be located to the south of the access track thereby providing additional fuel breaks from a bushfire approaching from the north.

5.1.2 Bushfire Hazard Landscape Assessment

Figures 6 and 7 outline the outcome of the bushfire hazard landscape assessment. The assessment identifies the two likely scenarios that may occur in relation to the Wind Energy Facility. Both scenarios are consistent in that the likely bushfire impact on the development is from either the north west or south west. Table 2 provides a description of each of the scenarios contained within Figure 8 and 9.

Table 3 - Bushfire scenarios

Scenario	Description
A	Depending on the location of the ignition, bushfires can burn through either forested areas or farming properties. Elements of the development are at a higher risk than others due to their proximity to the forested areas. The WTGs located at either end of the development are likely to be impacted by a bushfire burning through grassland with the WTGs in the middle section likely to be impacted by embers from a bushfire burning through the public land reserves. Most of the WTGs, the BESS and substation area are all located outside the BMO and located in areas that will not be exposed to elevated levels of radiant heat. There is the potential for a bushfire to be burning within the Strzelecki Ranges and travel long distances under a north westerly wind influence to then impact on the development site. The presence of setbacks from the forested areas and the existing landscape features along with those established as part of the development will assist with reducing bushfire behaviour.
B	A bushfire that approaches under a south westerly wind influence usually occurs after a north westerly wind has been influencing the weather conditions. The wind change can occur after a bushfire has been burning for some time under the north westerly influence. Depending on the location of the bushfire, the western and southern side of the WEF can come under threat at the same time. The potential maximum fire run under a south westerly is approximately seven kilometres. This will be primarily through grassland vegetation that is associated with farming properties. The fragmented vegetation that is associated with farming activities will influence bushfire behaviour. The road network will also contribute to slowing or stopping the bushfire spreading.

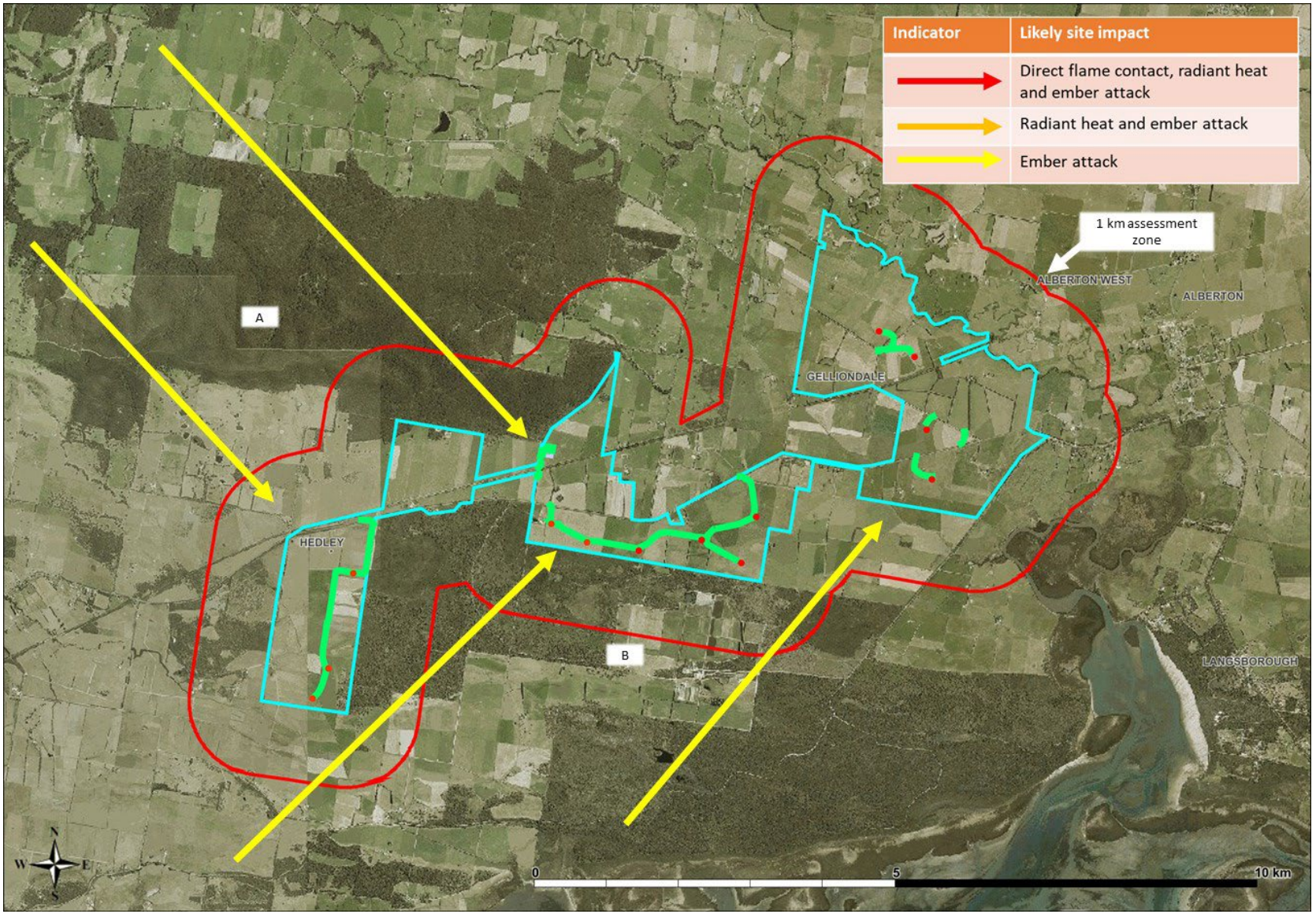

Figure 6 – One kilometre landscape assessment

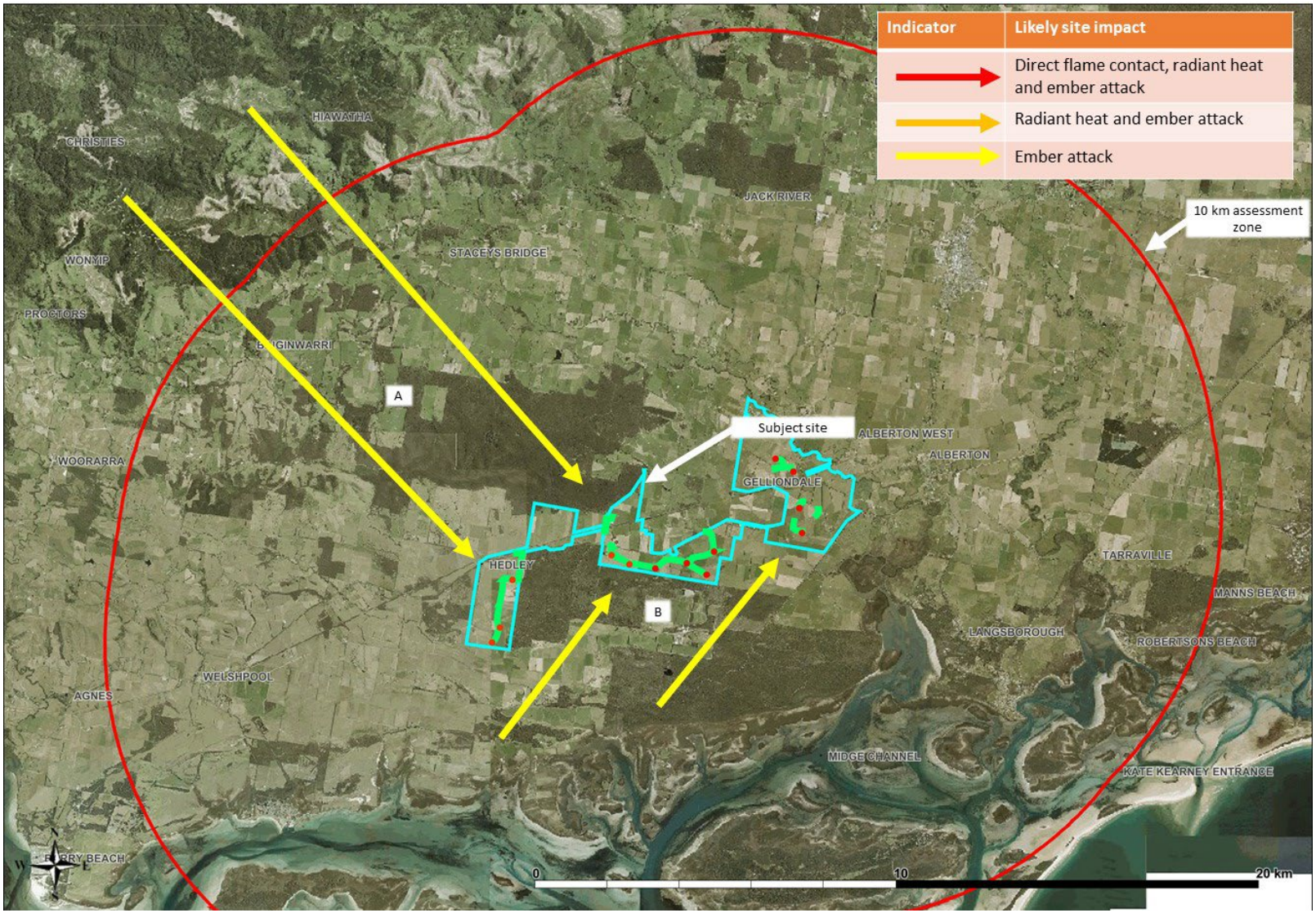

Figure 7 - 10 kilometre landscape assessment

Clause 13.02 Settlement Objectives are primarily related to settlement development of which it could be argued that a Wind Energy Facility and BESS does not meet these definitions. Regardless, an assessment of the project has been undertaken against the Settlement Objectives to allow for a detailed consideration of the project against the Clause 13.02 Policy.

Table 4 - Response to Clause 13.02 - Settlement Objectives

Settlement planning objectives	Project response	Achieved (✓ or ×)
Directing population growth and development to low risk locations, being those locations assessed as having a radiant heat flux of less than 12.5 kilowatts/square metre under AS 3959-2009 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2009).	This project does not promote population growth and will only have people onsite during the construction phase and when undertaking maintenance during the operations phase. It is proposed for 50 people to be involved in the construction stage, which will enable an increased fire monitoring capability. The design has ensured that there will not be any part of the BESS or Substation within the Bushfire Management Overlay.	✓
Ensuring the availability of, and safe access to, areas assessed as a BAL-LOW rating under AS 3959-2009 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2009) where human life can be better protected from the effects of bushfire.	The development will result in areas that will achieve a Bushfire Attack Level (BAL) Low rating when assessed against AS3959. This will include the BESS, Substation and the base of the WTGs. Depending on the location of a bushfire in the surrounding landscape, there are several travel routes available to leave the area and travel to an area deemed to be BAL LOW. These locations would include Yarram, Port Welshpool and other areas. The identification and travel routes to the various locations that meet the BAL LOW requirements will be addressed within the Emergency Management Plan that is developed for the WEF and BESS.	✓
Ensuring the bushfire risk to existing and future residents, property and community infrastructure will not increase as a result of future land use and development.	The WEF and BESS will be provided with a range of protection measures that will ensure the bushfire risk to existing and future surrounding properties will not increase. These measures include: • Asset Protection Zone surrounding the base of each Turbine Tower, the BESS area, Substation and other works areas. • A fire detection (smoke/heat) and suppression (gas) system will be installed within the high risk electrical cabinets in the wind turbine nacelle, with the details/design of this system to be determined in consultation with CFA.	✓

	• BESS design considerate of fire risk and provided with suitable monitoring systems with the aim of preventing fires. • Access road network to be developed and maintained to allow for access to each of the towers including the provision of overtaking bays. • Provision of static water supplies to support firefighting operations at the BESS and throughout the WEF.	
Achieving no net increase in risk to existing and future residents, property and community infrastructure, through the implementation of bushfire protection measures and where possible reducing bushfire risk overall.	The fire protection measures required by the CFA Guideline ensures that there is no net increase in risk to existing and future residents. The site for the WEF and BESS has been chosen to ensure separation from existing dwellings is achieved.	✓
Assessing and addressing the bushfire hazard posed to the settlement and the likely bushfire behaviour it will produce at a landscape, settlement, local, neighbourhood and site scale, including the potential for neighbourhood-scale destruction.	The bushfire risk has been assessed at the landscape level. This has identified the potential for long bushfire runs to occur from the north west and south west aspects. This development will not change the current expected bushfire behaviour in the landscape, it will likely reduce the risk in the surrounding areas due to the addition of an access track network and management around the base of the turbines, BESS and other areas.	✓
Assessing alternative low risk locations for settlement growth on a regional, municipal, settlement, local and neighbourhood basis.	The development of the WEF and BESS is required to occur in remote locations. This area has been chosen due to the low number of dwellings in the surrounding landscape. The CFA Guideline requirements ensures the management of risk is occurring that reflects the landscape bushfire risk.	✓
Not approving any strategic planning document, local planning policy, or planning scheme amendment that will result in the introduction or intensification of development in an area that has, or will on completion have, more than a BAL-12.5 rating under AS 3959-2009 Construction of Buildings in Bushfire-Prone Areas (Standards Australia, 2009).	The development will achieve a less than BAL 12.5 rating when assessed against AS3959 through the provision of Asset Protection Zones around the infrastructure.	✓

5.1.3 Assessment against Clause 13.02 summary

The assessment against Clause 13.02 has identified that the development is within an area where the landscape bushfire risk is influenced by the potential for bushfires in the surrounding landscape. These bushfires have the potential to travel long distances depending on the weather conditions being experienced. However, the proposal has been designed to limit both the potential impact on the WEF and the BESS and the potential for fires to leave the property and enter the surrounding landscape. As the development is required to achieve the requirements outlined within the CFA Guidelines as a minimum, this will ensure that the settlement planning objectives are achieved.

5.2 Analysis against CFA Guideline

CFA has produced Guidelines that outline their requirements to address fire risk within renewable energy installations. Section 5 of the Guideline outlines the process to analyse risk to enable the identification of hazards that may or can cause fires.

The CFA Guideline also specifies model requirements for renewable energy installations. Prior to the risk assessment being undertaken, it is important to assess the Wind Energy Facility and BESS project against these requirements. This will increase the effectiveness of the risk assessment.

The following table provides the model requirements from CFA's Guideline and how this project addresses the specific areas.

Table 5 - Response to CFA Guideline

Model requirement	Compliance	Comments
Section 3 – consulting with CFA		
Early consultation, prior to the development of the planning permit application, ensures that CFA can effectively consider emergency response implications.	✓	CFA has been consulted on the project and ongoing consultation will continue to occur through the development of the Fire Management Plan and Emergency Management Plan once the Planning Permit has been issued. This Risk Management Plan has been developed to support the consultation with CFA to demonstrate how the fire risk is proposed to be managed.
Section 4 – Planning Applications		
Planning applications must address all relevant aspects of fire safety, including landscape and bushfire	✓	This RMP has been developed to enable the developer to demonstrate how they propose to manage the risk of fire in relation to the development.

hazards, and hazards to and from the proposed technologies.		
Section 6- Facility Location and Design		
Section 6.1 – Facility Location		
Planning applications for all renewable energy facilities proposed in high-risk environments must address the following, in addition to providing an assessment against policy at Clause 13.02-1S (Bushfire Planning):	✓	This RMP includes an assessment against Clause 13.02 within Section 4.1. The assessment has identified the potential for bushfires to approach the development from either the north west or south west.
a) The impact of any ignitions arising from the infrastructure (solar panels, wind turbines, battery energy storage systems, electrical infrastructure) on nearby communities, infrastructure and assets.	✓	This report considers the impact and the likelihood of fires that leave the property. The Clause 13.02 assessment has considered this and has also been addressed within the risk assessment in Section 6.
b) The impact of bushfire on the infrastructure (e.g. ember attack, radiant heat impact, flame contact).	✓	This report considers the impact of bushfire on the infrastructure. The Clause 13.02 assessment considered this and has also been addressed within Section 6.
c) Assessment of whether the proposal will lead to an increase in risk to adjacent land and how the proposal will reduce risks at the site to an acceptable level.	✓	The Clause 13.02 assessment has considered this and determined that there will be no increase in bushfire risk because of the development. The requirements including managing vegetation around the base of the turbine towers and BESS area, detection and suppression systems installed within the wind turbine nacelle and provision of access roads supports the management of bushfire risk.
Section 6.2 – Facility Design		
Section 6.2.1 – Emergency vehicle access		
All facilities		

a) Construction of a four (4) metre perimeter road within the perimeter fire break.	✓	As outlined within the CFA Guideline, this is not required due to the nature of Wind Energy Facilities.
b) Roads must be of all-weather construction and capable of accommodating a vehicle of fifteen (15) tonnes.	✓	The Access Roads constructed for this development will be designed, constructed and maintained to ensure they can support the movement of vehicles up to 15 tonnes.
c) Constructed roads should be a minimum of four (4) metres in trafficable width with a four (4) metre vertical clearance for the width of the formed road surface.	✓	All Access Roads will be a minimum of four metres wide.
d) The average grade should be no more than 1 in 7 (14.4% or 8.1°) with a maximum of no more than 1 in 5 (20% or 11.3°) for no more than fifty (50) metres.	✓	The site is mainly flat with only small slopes present. There are no roads that will require assessment of the grade.
e) Dips in the road should have no more than a 1 in 8 (12.5% or 7.1°) entry and exit angle.	✓	The site is mainly flat with only small slopes present. There are no roads that will require assessment of dips.
f) Roads must incorporate passing bays at least every 600 metres, which must be at least twenty (20) metres long and have a minimum trafficable width of six (6) metres. Where roads are less than 600 metres long, at least one passing bay must be incorporated.	✓	Passing bays have been included within the design of the Access Tracks for the site. The tracks will be 9 metres wide inclusive of drainage. Therefore, no overtaking lanes are required.
g) Road networks must enable responding emergency services to access all areas of the facility, including fire service infrastructure, buildings, and battery energy storage systems and related infrastructure.	✓	The proposed access roads will provide direct access to the base of all wind turbines, BESS area and other works areas. Other infrastructure is located adjacent to Public Roads and accessible by emergency service vehicles.
h) The provision of at least two (2) but preferably more access points to the facility, to ensure safe and efficient access to and egress from areas that may be impacted or	✓	As the development is a Wind Energy Facility, there are numerous access points located throughout the development.

involved in fire. The number of access points must be informed through a risk management process.		The BESS will be provided with dual access/egress points.
Wind Energy Facilities		
Constructed roads developed during the construction phase of facilities must be maintained post-commissioning and throughout the operational life of the facility, to allow access to each turbine for maintenance and emergency management purposes.	✓	The access roads developed for the construction phase will be retained throughout the life of the project. This will provide access for maintenance activities along with emergency vehicle access if required.
Section 6.2.2 Firefighting Water Supply		
All Facilities		
a) Water access points must be clearly identifiable and unobstructed to ensure efficient access.	✓	Static water supplies for the Wind Energy Facility and BESS will be located where possible at the property entrances or at other strategic locations around the site. The final location of static water supplies will be determined in consultation with CFA.
b) Static water storage tank installations must comply with AS 2419.1-2005: Fire hydrant installations – System design, installation and commissioning.	✓	The static water supply will be located within tanks that comply with AS2419.1:2015.
c) The static water storage tank(s) must be an above-ground water tank constructed of concrete or steel.	✓	The static water tanks will be above ground.
d) The static water storage tank(s) must be capable of being completely refilled automatically or manually within 24 hours.	✓	Site management will have an arrangement with a local water carrier to ensure static water supplies are refilled within 24 hours. This will be addressed within the Emergency Management Plan.
e) The static water storage tanks must be located at vehicle access points to the facility and must be positioned at least ten (10) metres from any infrastructure (solar	✓	Static water tanks will be located at the entrances to the access roads constructed for the wind turbine development. They will be located at least 10 metres from all infrastructure.

panels, wind turbines, battery energy storage systems, etc.).		
f) The hard-suction point must be provided, with a 150mm full bore isolation valve (Figure 1) equipped with a Storz connection, sized to comply with the required suction hydraulic performance. Adapters that may be required to match the connection are: 125mm, 100mm, 90mm, 75mm, 65mm Storz tree adapters (Figure 2) with a matching blank end cap to be provided.	✓	The static water tanks will be provided with a hard suction point and adapters that will allow for the typical firefighting appliances to access the water supplies.
g) The hard-suction point must be positioned within four (4) metres to a hardstand area and provide a clear access for emergency services personnel.	✓	The hard suction points will be accessible by firefighting appliances.
h) An all-weather road access and hardstand must be provided to the hard-suction point. The hardstand must be maintained to a minimum of 15 tonne GVM, eight (8) metres long and six (6) metres wide or to the satisfaction of the CFA.	✓	The tanks will be provided with access to allow firefighting appliances to access the hard suction point.
i) The road access and hardstand must be kept clear at all times.	✓	This requirement will be specified within site procedures and the Emergency Management Plan.
j) The hard-suction point must be protected from mechanical damage (eg. bollards) where necessary.	✓	Bollards will be provided to protect the static water tanks outlets from mechanical damage.
k) Where the access road has one entrance, a ten (10) metre radius turning circle must be provided at the tank.	✓	Turning provisions will be provided at the base of each wind turbine that will enable firefighting appliances to safely turn around.
l) An external water level indicator must be provided to the tank and be visible from the hardstand area.	✓	This has been included within the design.

m) Signage (Figure 3) indicating 'FIRE WATER' and the tank capacity must be fixed to each tank.	✓	This has been included within the design.
n) Signage (Figure 4) must be provided at the front entrance to the facility, indicating the direction to the static water tank.	✓	Signage will be provided at all property entrances that shows the location of the closest static water supply to that location.
Wind Energy Facilities		
a) The fire protection system for wind energy facilities must incorporate at least one static fire water storage tank of at least 45,000L effective capacity at each site entrance.	✓	Following an assessment of the development, 12 x 45,000 litre static water tanks are required as a minimum at the points where the access roads meet the Public Roads.
b) Additional static fire water storage tanks of at least 45,000L effective capacity must also be incorporated in facility design. The number and location of tanks is to be determined through a comprehensive risk management process (Risk Management Plan), in consultation with CFA.	✓	There have been no additional static water tanks identified for the WEF area. Additional water supplies will be provided for the Substation and BESS area, and these are outlined in further sections.
c) Fire water must be provided to cover buildings, control rooms, substations and grid connections, in consultation with CFA.	✓	Static water supplies will be provided at key infrastructure locations. The final decision will be determined in consultation with CFA.
d) Nacelles must be equipped with automatic fire detection, alarm and fire suppression systems.	✓	A fire detection (smoke/heat) and suppression (gas) system will be installed within the high risk electrical cabinets in the nacelle, with the details/design of this system to be determined during consultation with CFA. The systems will be monitored 24/7 by the onsite monitoring system and if activated, an alert will be sent to the site operator. The Emergency Management Plan will include procedures for alerting the CFA to a fire.
e) Additional fire protection systems or equipment required under any	✓	There is no infrastructure proposed within the Wind Energy Facility that will

Australian Standards for dangerous goods must be provided as prescribed.		include dangerous goods. If the Substation, workshop areas or other parts of the development proposes to utilise equipment that includes a product that is deemed to be a dangerous good, an assessment will be undertaken in accordance with the Dangerous Goods (Storage and Handling) Regulations. The BESS area will trigger the need to seek the fire brigades input into the fire system design due to the presence of Lithium Ion (Class 9). This will be undertaken at a future date and will rely on this assessment as background.
Battery Energy Storage Systems		
1) For facilities with battery energy storage systems, the fire protection system must include as a minimum:		
b) Where no reticulated water is available, a fire water supply in static storage tanks, where:	✓	Static water supplies in storage tanks will be provided.
i. The fire water supply must be of a quantity no less than 288,000L or as per the provisions for Open Yard Protection of AS 2419.1-2005 flowing for a period of no less than four hours at 20L/s, whichever is the greater.	✓	The BESS layout is being determined and the provision of water supplies will be in accordance with the provisions of AS2419.1.
ii. The quantity of static fire water storage is to be calculated from the number of hydrants required to flow from AS 2419.1-2005, Table 3.3. *(E.g., For battery installations with an aggregate area of over 27,000m2, 4 hydrant outlets are required to operate at 10L/s for four hours, which equates to a minimum static water supply of 576kL.)*	✓	The BESS area will be provided with water supplies that conforms with AS2419.1.
iii. Fire hydrants must be provided and located so that every part of the battery energy storage system is within reach of a 10m hose stream issuing from a nozzle at the end of a	✓	Fire hydrants will be located around the site to enable coverage to be achieved.

60m length of hose connected to a fire hydrant outlet.		
iv. The fire water supply must be located at vehicle entrances to the facility, at least 10m from any infrastructure (electrical substations, inverters, battery energy storage systems, buildings).	✓	The water supply will be at least 10 metres from any infrastructure.
v. The fire water supply must be reasonably adjacent to the battery energy storage system and shall be accessible without undue danger in an emergency. (Eg., Fire water tanks are to be located closer to the site entrance that the battery energy storage system).	✓	The static water supply and booster assembly will be located adjacent to the main entrance to the BESS area.
vi. The fire water supply must comply with AS 2419.1-2005: Fire hydrant installations - Section 5: Water storage.	✓	The water supply will comply with the requirements outlined within Section 5. This will as a minimum include: • Appropriate overflows and air gaps • Large and small bore connections • Tank contents indicator • Appropriate signage • Access opening and ladders
Substations		
Fire water must be available to substations.	✓	A 45,000 litre static water supply will be located at the Substation. This may be in conjunction with the BESS area water supply.
Section 6.2.4 – Fire Breaks		
A fire break must be established and maintained around:		
b) The perimeter of control rooms, electricity compounds, substations and all other buildings onsite. The width of fire breaks must be a minimum of 10m, and at least the distance where radiant heat flux	✓	The substation will be provided with a 10 metre wide fire break.

(output) from the vegetation does not create the potential for ignition of on-site infrastructure.		
Wind Energy Facilities		
A fire break must be established and maintained around the base of wind turbines.	✓	All wind turbines will be provided with a fire break of 10 metres around the base of the turbine tower to ensure they will not exceed a radiant heat exposure where the infrastructure is likely to ignite. It is also acknowledged that the site operators through their regular inspection program will engage with landowners if the surrounding landscape becomes unmanaged through the life of the project.
Battery Energy Storage Systems		
A fire break must be established and maintained around battery energy storage systems and related infrastructure.	✓	A fire break will be provided surrounding the BESS compound. The fire break will extend from the edge of the perimeter driveway to the BESS area fence.
Section 6.2.5 – Design Specific to Facility Type		
Wind Energy Facilities		
a) Wind turbines must be located no less than 300 metres apart.	✓	This has been included within the design.
b) Wind turbines must be provided with automatic shut-down, and the ability to be completely disconnected from the power supply in the event of fire.	✓	This requirement has been included within the project specifications. The SCADA system will be designed to enable either onsite operators or remotely operating to shut down a single or multiple wind turbines.
c) Installed weather monitoring stations must be notified to the Civil Aviation Safety Authority (CASA) as per CASA Advisory Circular AC 139-08, v2.0, March 2018 (as for all structures 110m or more above the ground).	✓	Any permanent weather masts being installed as part of the project will be marked as per the CASA requirements.

d) All guy wires and monitoring towers must be clearly marked, even where marking is not required by CASA.	✓	This will be undertaken during the project.
Battery Energy Storage Systems		
1) The design of the facility must incorporate:		
a) A separation distance that prevents fire spread between battery containers/enclosures and: • Other battery containers/enclosures. • On-site buildings. • Substations. • The site boundary. • Any other site buildings. • Vegetation. *Separation must be at least the distance where the radiant heat flux (output) from a battery energy storage system container/enclosure fully involved in fire does not create the potential for ignition of these site elements.*	✓	The site design will be in accordance with the manufacturer's specifications. The manufacturer design specifications have been tested against international standards. Appropriate separation will be provided to enable effective firefighting operations to occur and to limit the potential for fire spread between battery packs.
b) A fire break around the battery energy storage system and related infrastructure, of a width of no less than 10m, or greater where determined in the Risk Management Plan. Fire breaks must be non-combustible, constructed of concrete, mineral earth or non-combustible mulch such as crushed rock. *The width must be calculated based on the ignition source being radiant heat of surrounding vegetation, including landscaping.*	✓	Surrounding the BESS area will be a perimeter access road that is within a 10m fire break. The remainder of the vegetated areas within the BESS compound will be maintained during the fire danger period.
c) A layout of site infrastructure that: i. Considers the safety of emergency responders.	✓	The site layout has been designed to ensure safe and effective access for

ii. Minimises the potential for grassfire and/or bushfire to impact the battery energy storage system. iii. iii. Minimises the potential for fires in battery containers/enclosures to impact on-site and offsite infrastructure.		firefighters and minimises the potential for bushfires to impact on the area.
2) Battery energy storage systems must be:		
a) Located so as to be reasonably adjacent to a site vehicle entrance (suitable for emergency vehicles).	✓	Emergency vehicle access is available to the site.
b) Located so that the site entrance and any fire water tanks are not aligned to the prevailing wind direction (therefore least likely to be impacted by smoke in the event of fire at the battery energy storage system.)	✓	The static water supply will be located adjacent to the main entrance. This provides effective access for firefighters.
c) Provided with in-built detection and suppression systems. Where these systems are not provided, measures to effectively detect and/or suppress fires within containers must be detailed within the Risk Management Plan.	✓	The BESS packs will be installed as per the manufacturer's specifications. Where detection and suppression systems are recommended, these will be installed. All BESS technologies are provided with multiple sensors and alerts that will detect if a fault is occurring. Procedures will ensure that upon detection of faults, the battery will be shut down immediately until it has been checked by an operator.
d) Provided with suitable ember protection to prevent embers from penetrating battery containers/enclosures.	✓	The BESS packs will be designed to prevent embers from penetrating into the packs. The design will also consider the potential for leaf litter accumulation and to ensure any ignitions within these areas will impact on the BESS.
e) Provided with suitable access roads for emergency services vehicles, to and within the site, including to battery energy storage	✓	Access is provided to the BESS area and the fire hydrant systems.

system(s) and fire service infrastructure.		
f) Installed on a non-combustible surface such as concrete.	✓	The BESS packs will be installed on a non-combustible surface.
g) Provided with adequate ventilation.	✓	The battery packs are provided with ventilation systems that meet the manufacturers specifications.
h) Provided with impact protection to at least the equivalent of a W guardrail-type barrier, to prevent mechanical damage to battery containers/enclosures.	✓	Impact protection will be provided around the BESS area.
i) Provided with enclosed wiring and buried cabling, except where required to be above-ground for grid connection.	✓	This will be included within the design.
j) Provided with spill containment that includes provision for management of fire water runoff.	✓	Suitable spill containment will be provided around the equipment that holds dangerous goods. In most cases the equipment itself is manufactured with its own bunding. A fire water runoff basin will be provided within the BESS property. This area will enable fire water to be captured and if required, to be disposed of.
Section 7 – Facility Construction and Commissioning		
Section 7.1.4 – Emergency Management		
An Emergency Management Plan must be developed for the construction and commissioning phase of the facility.	✓	An Emergency Management Plan will be developed for both the construction and operations phase.
Section 8 – Facility Operation		
Section 8.1 – Vegetation and Fuel Management		
Facility operators must undertake the following measures during the Fire Danger Period:		
a) Grass must be maintained at or below 100mm in height during the declared Fire Danger Period.	✓	This requirement will be included within the Fire Management Plan for the areas

		surrounding the Substation, BESS and the operations and maintenance area.
b) Long grass and/or deep leaf litter must not be present in areas where heavy equipment will be working, during construction or operation.	✓	This requirement will be included within the Fire Management Plan.
c) Restrictions and guidance must be adhered to during the Fire Danger Period, days of high (and above) fire danger and Total Fire Ban days (refer to www.cfa.vic.gov.au).	✓	This requirement will be included within the Fire Management Plan.
d) All vehicles and heavy equipment must carry at least a nine (9)-litre water stored-pressure fire extinguisher with a minimum rating of 3A, or firefighting equipment as a minimum when on-site during the Fire Danger Period.	✓	This requirement will be included within the Fire Management Plan.
Section 8.2 – Maintenance		
All Facilities		
Inspection, maintenance and any required repair activities must be conducted for all infrastructure, equipment and vehicles at the facility. Maintenance must be in line with any relevant Australian Standards and the manufacturer's requirements.	✓	This requirement will be included within the Fire Management Plan.
Section 8.4 Facility and System Monitoring		
All Facilities		
Appropriate monitoring for facility infrastructure must be provided, 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.	✓	In addition to the detection and suppression systems, the site will be provided with a SCADA system that will monitor the day to day operations of the Wind Energy Facility and BESS. The system includes a range of sensors that will detect faults and report them to the monitoring centre. The system is preprogramed to send alert messages and includes: • Over temperature

		• Under temperature • Under voltage warning • Power off fault • Voltage and current changes. These alerts are automatically transmitted to a monitoring centre. There are appropriate levels of back up communication systems installed in the event of power failures or other events that may interrupt the communications connections.
Section 9 – Fire Management Planning		
All Facilities		
A Fire Management Plan must be developed for the facility, in conjunction with CFA, before commissioning of the facility.	✓	A Fire Management Plan will be developed prior to the commissioning of the Wind Energy Facility and BESS. This Plan will be provided to CFA for their consideration and feedback.
Section 10 – Emergency Management Planning		
All Facilities		
An Emergency Management Plan must be developed specific to the facility, in conjunction with CFA, prior to commissioning of the facility.	✓	An Emergency Management Plan will be developed prior to the commissioning of the Wind Energy Facility and BESS. This Plan will be provided to CFA for their consideration and feedback.
Section 10.2.1 – Developing an Emergency Information Book		
All Facilities		
An Emergency Information Book must be developed and available to emergency responders. Emergency Information Books must be located in Emergency Information Containers, provided at each vehicle entrance the facility.	✓	An Emergency Information Book will be housed within an Emergency Information Container and located at strategic sites across the development. The final location and number of Emergency Information Containers will be determined in conjunction with CFA.

6 Risk Assessment

6.1 Introduction

The risk assessment process involves identifying, analysing, evaluating and treating the identified risks. The overall risk assessment process requires a consistent approach and follows *AS ISO 31000:2018 Risk management – Guideline*s as incorporated into the National Emergency Risk Assessment Guidelines (NERAG). Figure 1 provides an overview of the risk assessment process as outlined within *AS ISO 31000:2018 Risk management – Guidelines*.

Risk management is the process of recognising risk and developing methods to both minimise and manage the risk. This requires the development of a method to identify, prioritise, treat (deal with), control and monitor risk exposures.

A risk assessment is a function of the likelihood of an adverse event occurring and the consequence of the event. A comprehensive risk assessment will identify potential risks and consequences and therefore assist with the development of mitigation actions.

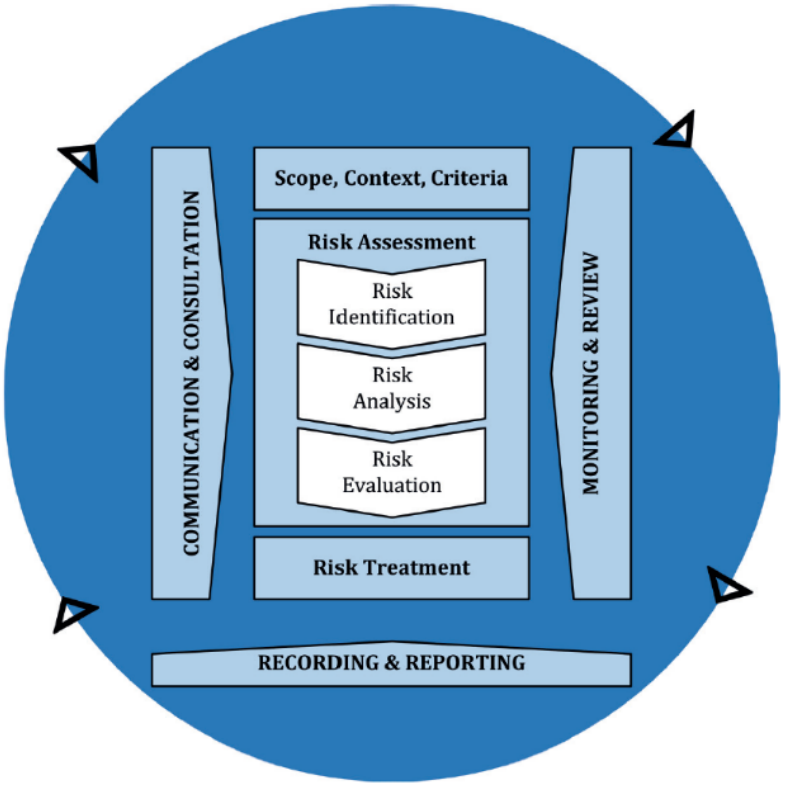

Figure 8 - Overview of AS/NZS ISO 31000-2018 risk management process

This report seeks to follow the steps outlined within the risk management guideline along with the process outlined within NERAG. The outcome of this assessment is a detailed understanding of hazards, the likelihood and consequence of a hazard becoming an emergency, and the treatments identified to manage this risk.

6.2 Context

The assessment of fire risk is a key requirement imposed on the development by CFA through their Guidelines. The CFA Guideline outlines the types of hazards that may need to be considered in relation to Wind Energy Facilities and BESS systems at the design, construction and operations phases.

6.3 Analysis of fire risk

Wind Energy Facility and BESS infrastructure is largely acknowledged as having limited potential to cause fires. There have however been fires previously and these have been considered during the assessment of risk outlined within this report.

It is important the assessment of risk considers the various stages of the project including construction and the operations phase.

6.3.1 Assessment of fire risk during construction

The construction phase includes various stages including site works, construction of footings and the installation of the turbine towers. This stage also includes the commissioning of the technology and other systems including fire protection systems. This ensures the relevant connectivity is installed to ensure that all alerts and system messages are transmitted to an appropriate monitoring location.

The location of the development could mean that construction is occurring on elevated fire danger days. There is a risk of both causing a fire or being impacted by a fire.

6.3.2 Assessment of fire risk during operations

The operations phase follows the commissioning stage of the project, and the role of maintenance becomes critical to ensure that the system operates as it was designed, for the life of the development. The ongoing maintenance of the infrastructure and development is critical to ensure the ongoing management of fire risk.

All the system components are to be considered as critical as they all are contributing to the ongoing safe operations. The system components include monitoring connectivity, fire protection systems, vegetation management and other safety systems.

6.4 Risk identification

Through discussions with the client, review of various documentation and the consideration of previous fire history that involved wind energy facilities, the following hazards have been identified:

Table 6 -Risk assessment consequence table

Hazard	Description
Electrical hazards causing a fire	Electrical faults and/or hazards can be a key cause of fire in the Wind Energy Facility and BESS infrastructure. BESS hazards including battery faults, overcharging, rapid discharge, loss of remote monitoring systems, internal short circuits and overheating. Hazards include faulty wiring and connections. An outcome of these faults can include 'thermal runaway'.
Fire causing spread to adjoining infrastructure on the property	A fire that has started in the development may spread to adjoining infrastructure or surrounding areas within the facility. Rapid escalation of the fire size and complexity can create issues for on site staff and contractors, firefighters and the community.
Fire causing off-Site impacts	Any fire on the property that can spread to adjoining properties most likely through vegetation connectivity, on bushfire risk days can start fires in the surrounding landscape that can threaten the community.
Off-Site fire impacting on the Site	A bushfire burning through the surrounding landscape can enter the property and threaten the infrastructure by potentially starting new fires.
Dangerous goods	The dangerous goods that are stored within the BESS, substation and inverters may leak and either ignite or require clean up by either on site staff, contractors or firefighters.
Fire water runoff	In the event of a fire involving the BESS, firefighters will respond and use water to either extinguish or cool the surrounding area until the infrastructure is deemed safe. The fire water may be contaminated and if not contained may create environmental issues.
Staff and firefighters	The response to a fire by staff, contractors or firefighters can be dangerous due to the various safety hazards associated with a fire in this type of infrastructure.

The above list may not be exhaustive however it is believed that it will allow the assessment of most hazards that may be encountered in a development of this type.

6.5 Risk analysis

The analysis of risk requires the consideration of the likelihood and consequence of an event occurring and measuring this against a predetermined matrix to enable the consideration of each risk both individually and collectively.

For this assessment, a risk matrix has been developed that enables the effective consideration of risk and to enable a comparison between the outcome of the hazard assessment.

6.5.1 Likelihood

An assessment of the likelihood of a fire occurring at this development including the potential to impact on people and other infrastructure/property is a key part of the risk assessment. The following will be considered during the assessment of an event occurring:

- Potential for an unplanned fire to occur
- Potential for this ignition to develop and exhibit significant fire behaviour
- Potential for that fire to destroy assets
- Potential for people to be affected or threatened
- The potential for it to develop into a major fire.

Recommendations for mitigation actions in the area may be determined by a number of approaches depending on the level of assessed risk. Strategies to lower risk are provided to ensure the risk is managed to an acceptable level.

An assessment of likelihood considers factors such as:

- Sources of ignition
- Use of the property and/or surrounding area
- History of ignitions within similar infrastructure
- Ability to spread from the property.

Table 7 - Likelihood table

Likelihood scale frequency	Description
Almost certain	The event Is expected to occur in most circumstances. (75%-99%). Has occurred frequently at the location.
Likely	The event will probably occur in most circumstance (50% - 75%). Has occurred frequently in the company.
Possible	The event should occur at some time. Likely to occur sometime (25% - 50%). Has occurred many times in the industry, but not in the company.
Unlikely	The event could occur at some time. Unlikely but possible (10% - 25%). Has occurred once or twice in the industry.
Rare	The event may occur only in exceptional circumstances. Assumed it may not be experienced (0% - 10%). Unheard of in the industry.

6.5.2 Consequence

Consequence refers to the potential damage that could result from a fire occurring in relation to people and assets. In assessing the possible consequences, the assessment considers a variety of hazard, exposure and vulnerability factors including:

- The likely number of people at the facility
- The proximity of other assets

- The location of surrounding properties and the type of activities
- Response capability if an event occurred.

The consequence scale refers to the potential impacts which could occur should a fire occur.

Table 8 - Risk assessment consequence table

Consequence scale	Description		
	People	**Environment**	**Plant/Equipment**
Catastrophic	Multiple fatalities	Permanent widespread ecological damage. Toxic release off-site with detrimental effect. Likely EPA prosecution	Massive widespread equipment damage (i.e. plant/equipment write-off) ($1M +).
Major	Single fatality or permanent disability	Heavy ecological damage with costly restoration. Off-site release contained with outside assistance and little detrimental impact.	Multiple equipment replacements ($200 000 - $1M).
Moderate	Major injuries - Incapacitations or requiring time off work	Major but recoverable ecological damage. On-site release contained with outside assistance.	Equipment level replacement /repair ($50 000 - $200 000).
Minor	Significant injuries - Medical treatment, non-permanent injury	Limited but medium term damage. On-site release immediately contained	Component level replacement /repair ($10 000 - $50 000).
Insignificant	Slight injuries- First Aid Treatments (cuts/ bruises)	Short term damage. Low financial loss, negligible environmental impact	Slight Damage (< $10 000).

The risk rating table (Table 8) is used to combine likelihood and consequence to obtain a risk score. The risk score is used to aid decision making by determining which areas are at the greatest risk of a fire starting and spreading through the development. Actions can be prioritised using this method to determine where risk mitigation works will occur.

Table 9 - Risk matrix

				Impact Score				
				1	2	3	4	5
				Insignificant	Minor	Moderate	Major	Catastrophic
Fire Risk Consultants Risk Assessment Matrix			People	Slight Injuries- First Aid Treatments (cuts/bruises)	Significant Injuries - Medical Treatment, non-permanent injury	Major Injuries - Incapacitations or requiring time off work	Single Fatality or Permanent Disability	Multiple Fatalities
			Environment	Short term damage / Low financial loss, negligible environmental impact	Limited but medium term damage / On-site release immediately contained	Major but recoverable ecological damage / On-site release contained with outside assistance	Heavy ecological damage with costly restoration / Off-site release contained with outside assistance and little detrimental impact	Permanent widespread ecological damage / Toxic release off-site with detrimental effect / Likely EPA prosecution
			Plant / Equipment	Slight Damage (< $10 000)	Component level replacement /repair ($10 000 - $50 000)	Equipment level replacement /repair ($50 000 - $200 000)	Multiple equipment replacements ($200 000 - $1M)	Massive widespread equipment damage (ie plant/equipment write-off) ($1M +)
Likelihood	A	Almost Certain	The event Is expected to occur in most circumstances / 75%-99% / Has occurred frequently at the location	Low (5)	Moderate (10)	Very High (18)	Extreme (23)	Extreme (25)
	B	Likely	The event will probably occur in most circumstance / 50% - 75% / Has occurred frequently in the company	Low (4)	Moderate (9)	Very High (17)	Very High (20)	Extreme (24)
	C	Possible	The event should occur at some time. Likely to occur some time / 25% - 50% / Has occurred many time in the industry, but not in the company	Low (3)	Moderate (8)	High (13)	Very High (19)	Very High (22)
	D	Unlikely	The event could occur at some time. Unlikely but possible / 10% - 25% / Has occurred once or twice in the industry	Low (2)	Low (7)	High (12)	High (15)	Very High (21)
	E	Rare	The event may occur only in exceptional circumstances. Assumed it may not be experienced / 0% - 10% / Unheard of in the industry	Low (1)	Low (6)	Moderate (11)	High (14)	High (16)

The outcomes of the risk assessment are used to inform the recommendations. These are aimed at providing guidance to management to reduce the fire risk at the property.

6.5.3 Risk analysis worksheets

The following risk analysis worksheets have assessed the hazards identified in Section 6.4 and results in a risk classification that correspond with strategies to lower risk if it is required.

The initial assessment of risk is based on the information that has been supplied to date. The development of additional strategies to lower risk are made as either there was no information provided that identified the treatment or further clarity is required to be considered.

Table 10 - Risk assessment - Electrical hazards causing a fire

RISK	Electrical hazards causing a fire
CAUSE	Electrical faults and/or hazards can be a cause of fire in Wind Turbines and BESS systems. Hazards may include faults, loss of remote monitoring systems, internal short circuits and overheating. The Substation due to the presence of electrically charged equipment may, due to a fault or other cause catch fire. Within a BESS, faults can lead to thermal runaway which will create suppression difficulties.
LIKELIHOOD	Possible
JUSTIFICATION	There is a history of fires within Wind Energy Facilities including electrical substations. Available data does not indicate that this is widespread. Modern wind turbine nacelles are fitted with smoke detection and suppression systems and other safety systems to either prevent a fault from occurring or to automatically commence shut down procedures if required. They will also send alerts to site operators. Fires usually occur within the Nacelle which is located at the top of the tower and is where the turbine is located. These areas are difficult to access and rely on trained technicians being available. The turbine and associated equipment will be maintained as per the manufacturer's specifications. There are examples of fires within BESS technology that indicates that when faults occur, they can escalate into challenging events including thermal runaway. To offset the likelihood of a fault within the BESS that creates a flammable atmosphere in and around the BESS, escalates to a fire, or a fire that affects adjacent infrastructure, the following mitigation treatments are included: • Cooling systems that maintain the temperature of the battery packs during day-to-day operations. • Safety systems that send alerts to the monitoring centre if a sensor is activated. • Barriers between each of the battery module bays within each BESS designed to reduce the possibility of thermal runaway from spreading to adjoining battery units. • Separation distances between individual battery packs and other infrastructure in accordance with manufacturer installation guidelines. • The BESS will be installed by qualified and competent people in accordance with the manufacturer's specifications to relevant Australian Standards and including compliance with UL9540A – Energy Storage System Requirements.
CONSEQUENCE	Moderate
JUSTIFICATION	A fire is unlikely to occur in more than one turbine due to the separation between the towers. A loss of a single turbine will not significantly impact on business operations. Due to the remoteness of the infrastructure, they will unlikely cause issues that will impact on surrounding people or property.

	If the multiple layers of protection fail or are not able to suppress the fire, then it is highly likely for the entire nacelle to be destroyed in the fire. This is a highly unlikely scenario. The multiple layers include: • Smoke detection and fire suppression system. • Monitoring systems that detect faults. • Electrical system manufactured and installed in accordance with the relevant Standards. The consequence of a fire within a BESS has been assessed as likely only impacting on the pack where the fire originated. It is unlikely for a fire to spread to other packs.
RISK RATING	High (13)

STRATEGY TO LOWER RISK	The requirements outlined within the response to the CFA Guideline will be sufficient to ensure the risk is maintained at a reduced level. Other requirements that will further reduce the risk include:
	• Development of an Emergency Management Plan that includes in addition to that required by CFA and AS3745:
	  ○ A system to communicate effectively between the monitoring centre and the onsite staff and contractors.
	  ○ Provision of 24/7 technical expert contact details for the fire brigade to contact in the event of an emergency or threat of an emergency.
	• Developing a procedure that requires a technician to be deployed to the site when the site monitoring communications are down.
	• The site monitoring system will indicate the early stages of a fault or emergency event and provides the ability to commence shut down procedures remotely from the site.

RESIDUAL RISK	Moderate (8) (possible/unlikely)

Table 11 - Risk assessment - Fire causing spread to adjoining infrastructure on the property

RISK	Fire causing spread to adjoining infrastructure on the property
CAUSE	A fire that starts within Wind Energy Facility may spread to adjoining infrastructure. A fire that has started within a component with the BESS may spread to adjoining infrastructure.
LIKELIHOOD	Unlikely
JUSTIFICATION	A fire that starts within a wind turbine nacelle may drop burning materials to the ground and depending on the weather conditions, may spread to an adjoining turbine tower or other infrastructure. Due to the separation between the infrastructure this is highly unlikely to occur. The risk of fire spreading to adjoining infrastructure within the BESS and to adjoining infrastructure with the Wind Energy Facility is unlikely due to the design of the components within the BESS, and the mitigation features incorporated into the design.
CONSEQUENCE	Major
JUSTIFICATION	The consequence of a fire affecting adjoining areas of the development is likely to be minor due to the provision of fire breaks around the base of the turbine towers, surrounding the BESS, substations and operations and maintenance area. The existing road network along with the proposed access roads will assist with slowing or stopping fire spread between the turbine towers and other infrastructure.
RISK RATING	High (15)
STRATEGY TO LOWER RISK	Due to the low rating, no additional strategies are required to be implemented beyond compliance with the CFA Guideline as outlined in Section 4. These strategies include: • Development of an Emergency Management Plan • Development of a Fire Management Plan that outlines the required performance and maintenance of all fire mitigation and management initiatives. • Provision of access tracks and fire breaks around the Wind Energy Facility and BESS. • 24/7 monitoring of the system that will alert operators to any faults or events that may lead to a fire. This will result in immediate shut down of the system.
RESIDUAL RISK	High (12) (Unlikely/Moderate)

Table 12 - Risk assessment - Fire causing offsite impacts

RISK	Fire causing offsite impacts
CAUSE	Any fire within the WEF and BESS may spread to adjoining properties most likely through vegetation connectivity. These types of fires would occur on elevated fire danger days during the summer months. Fires may also occur within the peat deposits that is present throughout the site.
LIKELIHOOD	Possible
JUSTIFICATION	The compliance with CFA Guidelines requires a range of mitigation strategies implemented including: • Provision of a fire break surrounding the Wind Energy Facility and BESS infrastructure. • Static water supplies for firefighting purposes are scattered through the development and at the BESS. • The monitoring system provides for early notification of a fault and will have the ability to remotely shut down the site if required. • The development of a peat management procedure that ensures that during the construction phase whenever peat is identified the risk is managed.
CONSEQUENCE	Moderate
JUSTIFICATION	The Clause 13.02 assessment has identified the limited risk for a fire to spread from the site into the surrounding landscape. The creation of fire breaks surrounding the wind turbines, BESS, substations and operations and maintenance area will reduce the potential for a fire to leave the infrastructure. Under elevated fire danger conditions there is the potential for a fire that is caused by site operations to leave the site. This fire would have started outside the vegetation managed areas. Depending on the level of vegetation management in the surrounding landscape, the fire could spread and become uncontrollable quickly. This fire will be influenced by the various existing fire management activities including roadside vegetation management, personal property preparation, firefighting appliances and equipment and activities undertaken by agencies responsible for fire management. The consequence of this type of fire would be the same as a fire caused by other practices in the surrounding landscape. The surrounding landscape is well managed due to farming operations. This will assist with reducing the potential for bushfires to leave the site and impact on the surrounding community.
RISK RATING	High (13)

STRATEGY TO LOWER RISK	The site Emergency Management Plan will include a procedure for contacting the Municipal Fire Prevention Officer (MFPO) if the vegetation on adjoining properties is unmanaged and becomes a fire risk. The MFPO may, following an assessment issue a Notice requiring the vegetation to be managed. Any vegetation growth on the property will be managed and removed. During the fire danger period, additional inspections will occur to ensure that all weeds and other vegetation is removed from the fire breaks and other critical areas. The peat management procedures will clearly articulate the following: • If peat is identified and is exposed, a complete ban on hot works will be implemented within 10 metres of the peat deposit. • Wherever possible, peat will not be left exposed and will be covered. • If peat is identified during the Fire Danger Period, a minimum of 500 litres of firefighting water supply and a pump will be available at the location until works have ceased or the peat is covered over.
RESIDUAL RISK	Low (7) (Unlikely/Minor)

Table 13 - Risk assessment - Offsite fire impacting on the site

RISK	Offsite fire impacting on the site
CAUSE	A bushfire burning through the surrounding landscape can occur and threaten the infrastructure by potentially starting new fires.
LIKELIHOOD	Unlikely
JUSTIFICATION	The Clause 13.02 assessment has identified the surrounding landscape as having the potential for supporting a bushfire. It identifies major fires that have occurred in the surrounding landscape. The municipal fire management planning process does not identify this area as having a significant impact on property survivability due to the lack of vegetation that would support large scale ember impact. The provision of a firebreak and other managed areas will limit the ability for a bushfire to impact on the property.
CONSEQUENCE	Minor
JUSTIFICATION	Due to the separation between the wind turbines and other infrastructure, the separation surrounding the BESS, the possibility of the development being impacted by a bushfire is reduced. The provision of fire breaks around the base of the towers, BESS area and other infrastructure will ensure a bushfire can't directly impact on the structure.
RISK RATING	Low (7)
STRATEGY TO LOWER RISK	Prior to construction commencing, an Emergency Management Plan will be developed that includes the requirements for vacating the site when the fire danger is elevated during both construction and operations phases of the project. The development is monitored through a SCADA system that will enable remote operation in the event that the site needs to be closed to personnel.
RESIDUAL RISK	Low (6) (Rare/Minor)

Table 14 - Risk assessment – Dangerous goods

RISK	Dangerous Goods
CAUSE	With reference to the Dangerous Goods (Storage and Handling) Regulations 2012, there are quantities of Dangerous Goods at the Site within various components of the Proposal. There is the potential for a leak of Dangerous Goods to occur that may cause a threat to people, the environment or be involved in a fire.
LIKELIHOOD	Unlikely
JUSTIFICATION	There will be dangerous goods associated with the BESS and the associated infrastructure. The quantities of dangerous goods will depend on the chosen supplier of the battery packs and other the types of other equipment including transformers. As a minimum the following dangerous goods will be present:

	• Lithium ion • Refrigerant Both products are contained within the battery packs and have their own bunding, and sensors and alert system that will send a message to the operator if a leak is occurring. The Dangerous Goods are installed within the infrastructure during the manufacturing process. This means that Dangerous Goods are contained and sealed and not readily accessible at the site. Following transportation to the Site, any infrastructure with Dangerous Goods will be inspected to ensure it has not been damaged during transportation. If infrastructure with Dangerous Goods is to be stored at Site prior to installation, it will be stored in line with manufacturer's specifications. Infrastructure will be installed in line with manufacturer's specifications (including inspection and testing). Together, these measures will prevent the likelihood of leaks outside the infrastructure footprint. The manufacturers installation specifications include the protection of the battery pack to ensure that no damage occurs during installation. The design of the BESS including the installation of bollards at high risk locations will prevent vehicles from impacting the infrastructure and potentially causing a leak.
CONSEQUENCE	Moderate
JUSTIFICATION	The assessment of the dangerous goods quantities at the BESS will be confirmed following the selection of the chosen technology and will comply with the requirements of the Dangerous Goods legislation.
RISK RATING	High (12)
STRATEGY TO LOWER RISK	In accordance with the Dangerous Goods (Storage and Handling) Regulations (2012), the fire brigade's views must be sought if the quantities have exceeded the fire protection amounts listed in Schedule 2 as will be likely be the case for the Lithium-Ion and the insulating gas. The Emergency Management Plan will include details of the hazards associated with dangerous goods and appropriate procedures in response to this RMP, including leak management and other response arrangements to Dangerous Goods related emergencies.
RESIDUAL RISK	Moderate (11) (Rare/Moderate)

Table 15 - Risk assessment - Fire water runoff

RISK	Fire water runoff
CAUSE	In the event of a fire involving the BESS, firefighters will respond and use water to either extinguish or cool the surrounding area until the infrastructure is deemed safe. The CFA Guideline outlines the need to provide capacity for the management of fire water runoff for the BESS to ensure this water does not enter the environment.
LIKELIHOOD	Unlikely
JUSTIFICATION	The risk of a fire within the BESS that would result in fire water runoff is unlikely due to the design of its components, particularly the battery packs and the mitigation features incorporated into its design. This includes: • Quality components will be selected for the Proposal. Most of the infrastructure that supports the BESS is non-combustible or has low quantities of combustible materials. • The battery packs are contained within an enclosure and have several features incorporated within the design that limits the potential for fire spread between components. • The separation between the battery packs and supporting infrastructure (transformers) is in accordance with manufacturer specifications. • Battery packs will be installed on a non-combustible area that will prevent fire spreading along the ground. Due to the design features incorporated into the BESS the likelihood of a fire occurring at the BESS is low. As such, the likelihood of requiring fire water to extinguish a fire at the BESS is also low.
CONSEQUENCE	Minor
JUSTIFICATION	The BESS area will be designed to enable the collection of fire water in the event of a fire. A basin will be constructed where water will flow to and enable testing to then determine the most appropriate disposal method. The basin will ensure that the water is flowing away from firefighters and site staff to enable them to continue to monitor and undertake suppression activities if required.
RISK RATING	Low (7)
STRATEGY TO LOWER RISK	The Emergency Management Plan will provide procedures to manage fire water runoff on the site and provide contact details for organisations that can undertake testing and disposal if required.
RESIDUAL RISK	Low (6) (Rare/Minor)

Table 16 - Risk assessment – Staff and responding firefighters

RISK	Staff and responding firefighters
CAUSE	The response to a fire by staff, contractors or firefighters can be dangerous due to the various safety hazards associated with a fire in this type of infrastructure.
LIKELIHOOD	Possible
JUSTIFICATION	There is the potential for firefighters and/or staff and contractors to be present during an emergency event and not being familiar with the site and the infrastructure. The CFA Guideline does impose a variety of controls onto the management of the site through the Emergency Management Plan and how CFA interacts with the site if they are called to a fire.
CONSEQUENCE	Moderate
JUSTIFICATION	The provision of an Emergency Information Container that will include the Emergency Management Plan, site plans and contact details for technical specialists will ensure responding firefighters seek information prior to entering the property. The local CFA brigades will be provided the opportunity to tour the facility regularly.
RISK RATING	High (13)
STRATEGY TO LOWER RISK	In all cases a technician will be dispatched to the site to review any faults or alerts that may if not checked, cause a fire. Any faults that are sent to the monitoring centre will be assessed and a technician deployed to make an initial assessment. The Emergency Management Plan will include a requirement to engage with the responding firefighters early to ensure they are aware that a technician is on their way and that entry to the site can wait until they arrive unless there is a life or property protection emergency. The Emergency Information Container that is required by the CFA Guidelines will provide detailed contact information for responding firefighters to seek specialist advice prior to accessing the property.
RESIDUAL RISK	Moderate (8) (Possible/Minor)

6.6 Cumulative impact assessment

Consideration of the potential cumulative effects of multiple Wind Farms in the surrounding landscape has not identified any issues that require assessment. It is noted that the nearest Wind Farm is approximately 10 kilometres away.

The matters considered included use of firefighting aircraft, firefighting strategies and bushfire ignition risk and spread. It was determined that due to the existing separation it was unlikely for a bushfire to impact on multiple Wind Farms at the same time. If this did occur, the geographical separation would not cause any cumulative effects.

7 Conclusion

The assessment of risk for the proposed Gelliondale Wind Energy Facility and BESS has identified that this development can occur safely providing the requirements outlined within this RMP are implemented.

This report acknowledges the existing bushfire risk in the surrounding landscape, and it has demonstrated how the design will reduce the potential for bushfire to either enter or leave the property.

The assessment of fire history in relation to WEF and BESS infrastructure identifies limited examples of where these renewable energy developments and systems have caused fires. There is no doubt that a wind turbine can present fire risks if not designed, constructed, commissioned and operated effectively. The importance of following design requirements and committing to the ongoing maintenance of the system is critical to reduce fire risk.

The additional requirements imposed on the development by the CFA Guideline and this RMP will strengthen the management of fire risk. In addition to this, following the issue of a Planning Permit, the development of a Fire Management Plan and Emergency Management Plan that meets the requirements of the CFA Guideline will assist with managing the risk of fire.

The results of this assessment should provide confidence that the operator of the wind energy facility and BESS will introduce systems, procedures and maintenance programs to ensure fire risk is managed.

Appendix A – Site photos

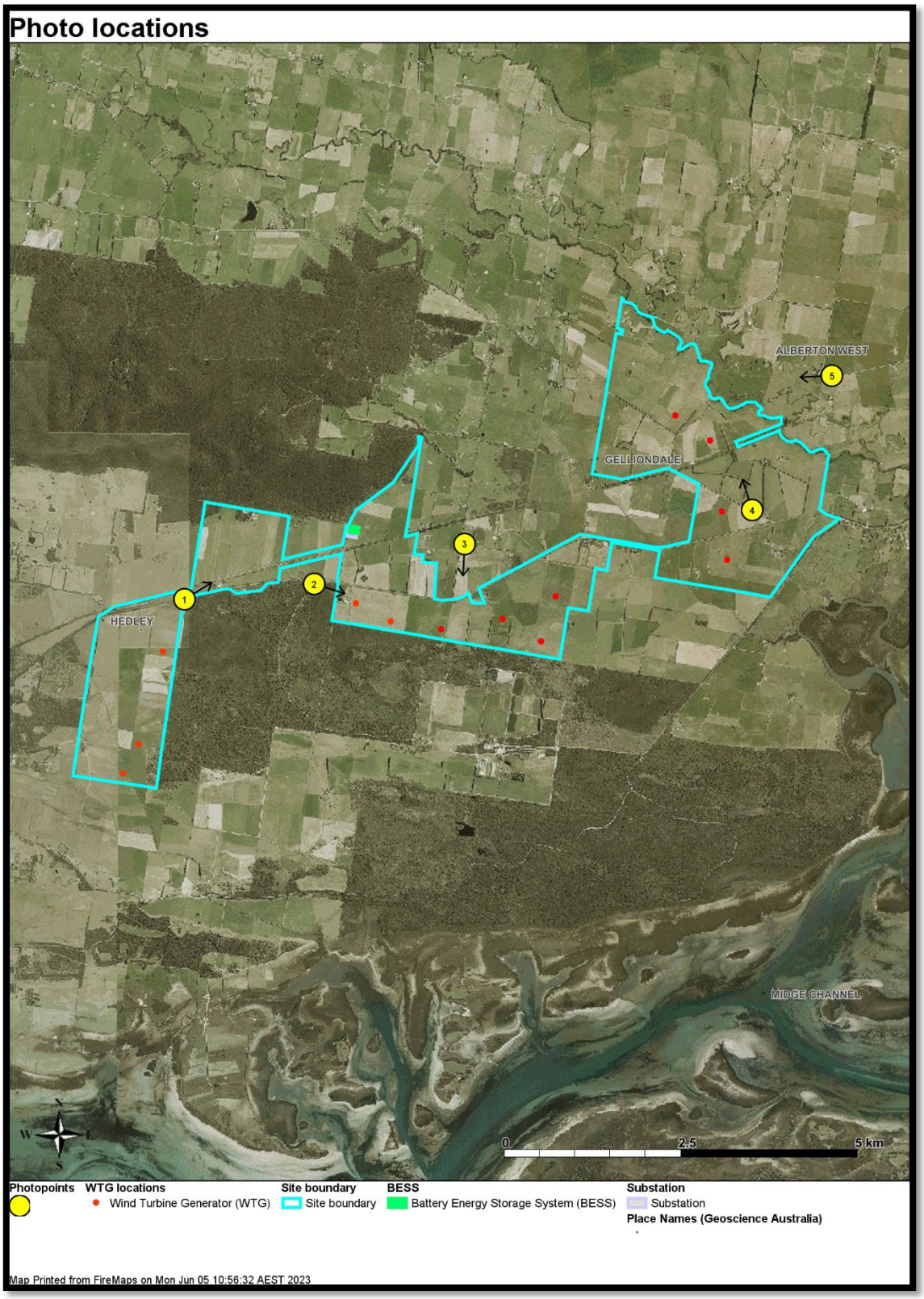

Figure 9 - Drone photos

1 Looking east along South Gippsland Highway with the Gelliondale State Forest to the south.	
2 Typical landscape for the location of the WTGs to the sough of the South Gippsland Highway.	
3 Looking south from near the South Gippsland Highway to the location of the WTGs to the north of the Gelliondale State Forest.	

4 Looking north towards the South Gippsland Highway.	
5 Typical landscape to the east of the development site. Note the riparian areas that are indicative of a lower bushfire risk.