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DELBURN WINDFARM

Bushfire Risk Assessment & Mitigation Plan

February 2020

DOCUMENT CONTROL

Document	Delburn Wind Farm Bushfire Risk Assessment & Mitigation Plan
Client	Peter Marriot, Director & Project Development Manager Delburn Wind Farm Pty Ltd (an OSMI Australia company)
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Synopsis	An analysis of the current and future bushfire risk associated with the proposed Delburn Wind Farm development and site

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DISCLAIMER AND INFORMATION STATEMENT

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ABBREVIATIONS, ACRONYMS AND DEFINITIONS

Abbreviation	Full Title
APZ	Asset Protection Zone - also known as Defendable Space, Asset Protection Zones (APZs) are managed in a way to reduce the impact of bushfire, as vegetation is kept trimmed and controlled. The aim of these areas is to protect human life and reduce the impact of bushfire to surrounding properties and highly valued assets.
AFAC	Australasian Fire and Emergency Services Authorities Council
Bushfire	A general term used to describe fire in vegetation, includes grass fire.
Hazard (Bushfire)	The potential severity of a bushfire, which is determined by fuel load, fuel arrangement and topography under a given climatic condition.
Bushfire risk	The chance of a bushfire igniting, spreading and causing damage to the community or the assets they value.
CFA	Country Fire Authority (Victoria)
CFS	Country Fire Service (South Australia)
Consequence	An outcome or impact of a bushfire event.
DELWP	Department of Environment, Land, Water and Planning
DWF Pty Ltd	Delburn Wind Farm Pty Ltd
EMV	Emergency Management Victoria
FRC	Fire Risk Consultants Pty Ltd
FFMVIC	Forest Fire Management Victoria
FFDI	Forest Fire Danger Index
FIB	Forest Industry Brigade
Fuel Hazard	The arrangement of bushfire fuel available for bushfire
Fuel Load	The amount of bushfire fuel available, expressed in t/ha
GRP	Grand Ridge Plantations Pty Ltd
HVP	Hancock Victorian Plantations
Likelihood	The probability of a fire igniting and spreading, and how often this may occur.
MFB	Metropolitan Fire Brigade
Preparedness	All activities undertaken in advance of the occurrence of an incident to decrease the impact, extent and severity of the incident and to ensure more effective response activities.
Prevention	The elimination or reduction of the incidence or severity of emergencies and the mitigation of their effects.
Recovery	The co-ordinated process of supporting emergency affected communities in reconstruction of the physical infrastructure and restoration of emotional, social, economic and physical wellbeing.
Response	Actions taken in anticipation of, during, and immediately after an incident to ensure that its effects are minimised, and that people affected are given immediate relief and support.
Risk	The exposure to the possibility of such things as economic or financial loss or gain, physical damage, injury or delay, as a consequence of pursuing a particular course of action. The concept of risk has two elements, i.e. the likelihood of something happening and the consequences if it happens.
VFRR	Victorian Fire Risk Register

1 EXECUTIVE SUMMARY

The objective of all bushfire management activities in Victoria is to reduce the impact and consequences of bushfire on people, property and the environment, with the protection of human life the highest priority.

Our analysis has indicated that the Delburn Wind Farm proposed development does not increase the bushfire risk in the landscape if recommendations during the distinct phases of development, construction and operation are implemented.

The introduction of the windfarm will not have an overall negative impact on the ability to fight fire in the development area.

There are positive impacts identified from a bushfire risk perspective with the proposed development on the plantations generally and with future plantation management. These benefits include an enhanced road and track network for fire access, increased surveillance and detection through remote cameras installed on the infrastructure and improved planning and annual exercising for bushfire response. A key part of the development planning and operation will be Delburn Wind Farm Pty Ltd working with Hancock Victorian Plantations to build enhanced fire suppression options into the landscape.

The *Delburn Wind Farm Bushfire Risk Assessment & Mitigation Plan* provides an assessment of the bushfire risk aspects associated with the construction and operation of the proposed Delburn Wind Farm. This includes an analysis of issues relating to bushfire risk within the proposed development site and across the neighbouring land including land used for agricultural purposes.

The report excludes a full evaluation of all environmental, social and economic considerations associated with the construction and operation of wind farms. Its core focus is to provide an expert assessment of bushfire risk concerned with the planning, development and operation of the proposed wind farm.

Fire Risk Consultants has made 41 recommendations to enhance the bushfire management of the proposed development across the areas of construction, operation and during bushfire suppression operations. These recommendations align fully with industry best practice and guidance provide by CFA in the *Guidelines for Renewable Energy Installations (February 2019)*.

Recommendations made by Fire Risk Consultants in this assessment and mitigation plan currently exceed the guidance provided by CFA and Australasian Fire and Emergency Services Authorities Council (AFAC) for wind farm developments.

It is intended that this document remains “live” and becomes subject to an annual review as the proposed project progresses through the stages of design & development, construction and operation.

Bushfire risk to the Delburn Wind Farm and surrounds has been dealt with holistically in the report through an emphasis on bush fire prevention. We have however included actions and recommendations to reduce the spread, severity and intensity of a bushfire if or when one occurs.

South eastern Australia is one of the most bushfire prone areas in the world. Bushfires do not respect land management boundaries or lines on a map. They burn freely across all landscapes if available fuel is present and the weather conditions are conducive to fire spread. Therefore, we have not only assessed the proposed development site but have assessed the bushfire risk at a landscape level. This includes the risk of fire entering the Delburn Wind Farm from neighbouring land.

In Victoria, bushfire safety is considered a shared responsibility between the fire services, the Victorian Government and local government, communities and individuals. All parties are responsible for preparing prior to the fire season in order to protect themselves and their interests from the impact and effect of bushfires.

2 INTRODUCTION

2.1 Purpose

Delburn Wind Farm Pty Ltd (DWF) has engaged the services of Fire Risk Consultants Pty Ltd (FRC) to assess the bushfire risk of the proposed Delburn Wind Farm development, which will see the construction of up to 33 wind turbines on land owned by Grand Ridge Plantations, a subsidiary of Hancock Victorian Plantations (HVP).

A new initiative, planned by DWF Pty Ltd, is to construct this wind farm within a pine plantation managed and owned by HVP. In the northern hemisphere wind farms in pine forests are becoming quite common and we have included some of the learnings from these type of developments in this report.

Fire Risk Consultants is a Gippsland based company that works across Australia and offers a range of operational and strategic services in the fire, emergency management, risk and community sectors. FRC has extensive experience in assessing fire risk, identifying and implementing risk management treatments that are both effective and sensitive to the needs and values of local communities and the environment.

The recommendations and treatments proposed will holistically address fire risks within the turbines and surrounding landscape, the impact of bushfires on the turbines, emergency vehicle access / egress and firefighting suppression including the use of fire-bombing aircraft and water supplies.

2.2 Project overview

OSMI Australia brings over 25 years of wind farm development experience in Victoria and is actively investigating the feasibility of forestry based wind farms throughout Victoria.

Wind farms have been a part of the Victorian landscape for approximately 20 years. However, the development of wind farms in plantations areas in Australia is a relatively new initiative, although they are fairly common in Europe and parts of northern America.

The proposed Delburn Wind Farm site is generally bounded by Hernes Oak to the north, Thorpdale, Narracan and Coalville to the west, Darlimurla to the south, and Boolarra, Yinnar and Driffield to the east.

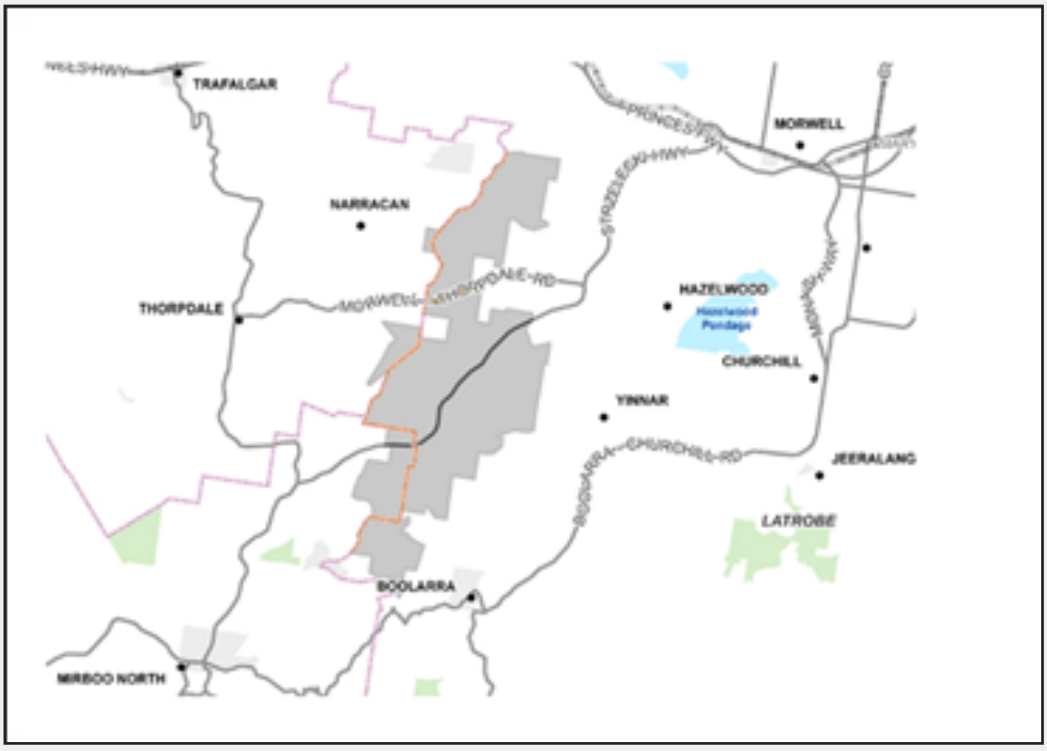

Figure 1 – Site of the proposed Delburn Wind Farm

The revised plan for the Delburn Wind Farm is below and shows the proposed location of the 33 wind

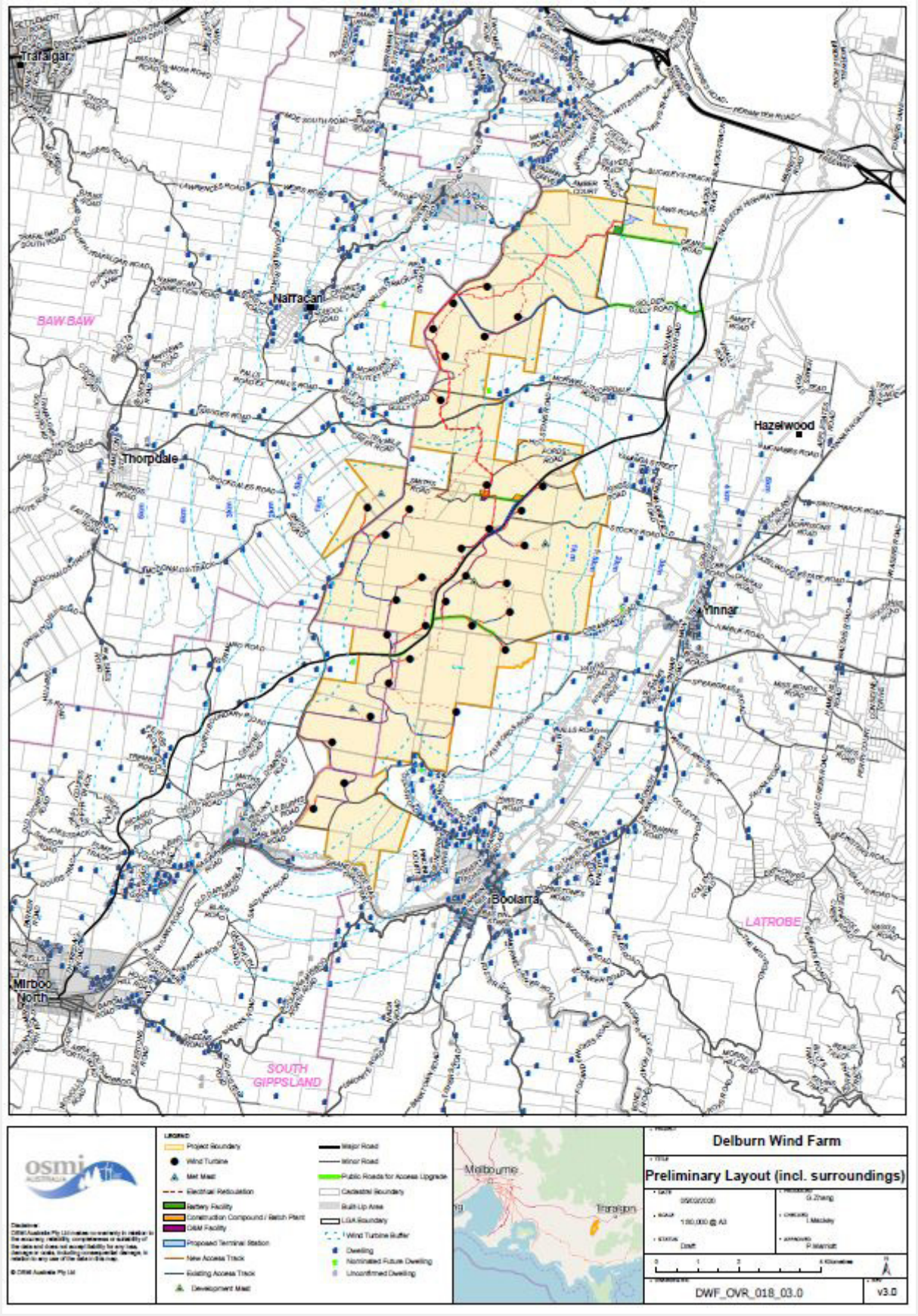

Figure 2 – Revised plan for the Delburn Wind Farm

3 BUSHFIRE CONTEXT

3.1 Overview

Victoria is one of the most fire-prone areas in the world, with a history of catastrophic bushfires such as Black Friday (1939), Ash Wednesday (1983) 2003 Alpine Fire (2003), Great Divide Fire (2006) and Black Saturday (2009).

Victoria's high bushfire risk is the result of factors that increase the likelihood and consequences of fire. These factors include large areas of the state comprising highly flammable dry eucalypt forest, protracted droughts and an increasing population density in bushfire-prone areas.

While bushfire is a significant risk facing Victoria, it is also a natural part of the environment and many plant species rely on fire to regenerate.

A variety of causes can ignite a bushfire: some bushfires result from events that are natural, such as lightning, while others result from human activity. Following ignition, the direction and speed of the fire's travel, and the height and intensity of the flames are determined by climatic and weather conditions, topography and fuel in the area.

Victoria has two main vegetation types affecting the spread of bushfires: grass and forest. Grass fires are predominantly wind driven and spread rapidly under the influence of strong winds. Grass fires burn at a lower intensity and flame height than forest fires and burn out quickly. Grass fires can often be quickly extinguished with water.

In contrast, forests have more fuel (leaf and bark litter on the ground, shrubs, grasses, trees etc.) available for a fire to burn. Wind speeds are lower in the forest and forest fires take some time to reach their full potential: however, once fully developed, forest fires usually have a greater flame height and intensity than grass fires, especially where the flames are burning the tree canopy. Forest fires can be difficult to extinguish, especially when they burn at higher intensities.

While the weather and topography in an area cannot be modified to reduce the fire hazard, a reduction in the flammable fuels in an area can reduce the flame height and intensity of a forest fire. Reduced flame height and intensity makes it safer and easier for firefighters to suppress a forest fire.

Infrastructure such as roads can also increase the speed of a fire response, allowing firefighters to safely and effectively suppress a fire before it reaches maximum intensity and flame height.

3.2 Plantation fires

Although plantations are a type of forest, fire behaviour in both hardwood and softwood plantations can vary greatly according to the stage of growth and the level of silvicultural treatment undertaken by the plantation manager.

Newly planted plantations are exposed to the wind and fires will behave like grass fires. During the growth stages, a plantation can have very dense vegetation, with continuous fuels reaching from the ground to the tree crowns. Fires at this time can behave like an intense forest fire.

However, during the 20 years or so that it takes a plantation to mature, plantation managers can greatly reduce the fire risk by pruning the lower branches, removing alternate rows (thinning) and actively managing weed and shrub infestations. As well as benefitting the quality of the timber, these treatments also reduce both the horizontal and vertical continuity of the fuels and subsequently the intensity of any fire.

The fire risk in mature plantations is much lower, as the tall trees and heightened crowns reduce the likelihood of a crown fire. Pruning, thinning and weed management at an earlier stage also reduce the risk in older plantations.

A second and third rotation plantation is a plantation established on ground which has previously supported a plantation operation from establishment to harvest. This could be a period of up to 25 years. Where possible vegetation (slash) and bushfire fuel is treated prior to the establishment of a new plantation. Options to treat this fuel include burning, rough heaping, mechanical raking and removal from site. Where this does not occur second and third rotation plantations may have a higher fire risk than first rotation plantations, due to residual timber left on the ground from previous harvesting operations. This additional fuel loading can increase fire behaviour in the first few years of a new plantation until the timber decomposes and becomes less available for fire. Softwood offcuts generally decompose more quickly than hardwood offcuts.

Plantation managers can reduce the fire risk by installing and maintaining track networks for greater tanker access for firefighters, contracting firefighting aircraft during the fire season, and limiting public access to reduce ignitions. Many fires in well-maintained plantations can subsequently be extinguished using water.

3.2 Plantation fires continued

In Victoria, the objective of all bushfire management activities is to reduce the impact and consequences of bushfire on people, property and the environment, with the protection of human life the highest priority. This hierarchy of priorities applies equally to HVP and DWF Pty Ltd firefighting resources. Bushfire safety is considered a shared responsibility between the fire services, the Victorian Government and local government, communities and individuals. All parties are responsible for preparing prior to the fire season in order to protect themselves and their interests from the impact and effect of bushfires.

3.3 Fire management responsibility

Victoria has three fire services:

- MFB is responsible for the suppression of fire in the metropolitan fire district. MFB specialises in urban fire.
- CFA is responsible for the suppression of fire in the country area of Victoria (private property outside the metropolitan fire district). CFA specialises in grass fires and township fires.
- DELWP is responsible for the prevention and suppression of fire on public land in Victoria outside the metropolitan fire district. DELWP specialises in forest fire. DELWP delivers its responsibilities through FFMVic, which includes staff from DELWP, Parks Victoria, VicForests and Melbourne Water.

Legislation passed by the Victorian Parliament in 2019 will see permanent firefighters from CFA and MFB come together under a single fire service known as Fire Rescue Victoria. The CFA will remain a significant firefighting entity with approximately 65,000 volunteers located in regional Victoria.

For fire management purposes, HVP is considered a private landholder.

The *Country Fire Authority Act 1958* enables CFA to form Forest Industry Brigades (FIB), where forest industry companies are required to provide and maintain specified levels of equipment, officers and firefighters. These brigades are under the operational direction of CFA during incidents and are afforded the legal protections of CFA. HVP has formed seven FIB, including HVP Gippsland Plantations FIB which comprises employees and contractors of Grand Ridge Plantations Pty Ltd.

4 STATUTORY PLANNING FRAMEWORK

This section reviews relevant legislation, planning policy and strategic bushfire management planning frameworks for bushfire prevention and response in the Delburn Wind Farm area.

4.1 Legislation

The project site is on land owned by Grand Ridge Plantations in the country area of Victoria (private property outside the metropolitan fire district).

The *Country Fire Authority Act 1958* relates to fire prevention and suppression in the county area of Victoria, with CFA responsible for the suppression of fire in this area. Although not explicit, the onus is on individual owners and occupiers of land to ensure their properties are free of fire hazards that may put the lives and property of other people at risk.

The Act provides for the CFA to declare the Fire Danger Period (FDP) in individual municipalities and Total Fire Ban by weather districts. These declarations impose restrictions on the lighting of fire and activities that may cause a fire, during the period where fire is a risk. The Act also authorises municipalities to issue fire protection notices to landholders for fire hazard removal.

Section 43 of the *Country Fire Authority Act 1958* states *'it is the duty of every municipal council and public authority to take all practical steps (including burning) to prevent the occurrence of fires on, and minimise the danger of the spread of fires on and from – any land vested in it or under its control or management: and any road under its care and management'*.

Each municipality that has a bushfire risk appoints a Municipal Fire Prevention Officer. The Act authorises Municipal Fire Prevention Officers to issue Fire Prevention Notices on owners or occupiers of private properties to complete fire management works. A Municipal Fire Prevention Officer may enter private land to remove fire hazards if they are not treated within the time frame or manner stipulated on the Fire Prevention Notice.

The Municipal Fire Prevention Officers also acts as the executive officer of the Municipal Fire Management Planning Committees, responsible for producing a Municipal Fire Management Plan.

The *Forests Act 1958* identifies the Secretary of the Department of Environment, Land, Water and Planning (DELWP) as responsible for the prevention and suppression of fire across all National parks, State forests and protected public land. This Act imposes fire regulations all year on public land.

Victoria Police prosecute offences relating to fire pursuant to the *Country Fire Authority Act 1958*, the *Crimes Act 1958* and the *Summary Offences Act 1966*.

4.2 Policy

The Victorian Government Safer Together program involves local communities working in partnership with land, fire and emergency management agencies, such as CFA and DELWP, to reduce the risk of bushfire to people, property and the environment. The Safer Together approach involves identifying bushfire risk reduction targets, values to be protected from bushfire, the risk of bushfire impacting on these values and strategies to manage this risk.

A key component of the Safer Together program is the development of Priority Fuel Management Areas (PFMAs). PFMAs highlight where bushfire fuel treatments will most effectively reduce long term bushfire risk to communities. These areas cross both public and private land tenure and form part of bushfire management strategies. Figure 3 details the current PFMAs in Gippsland as published on the Engage Victoria platform.

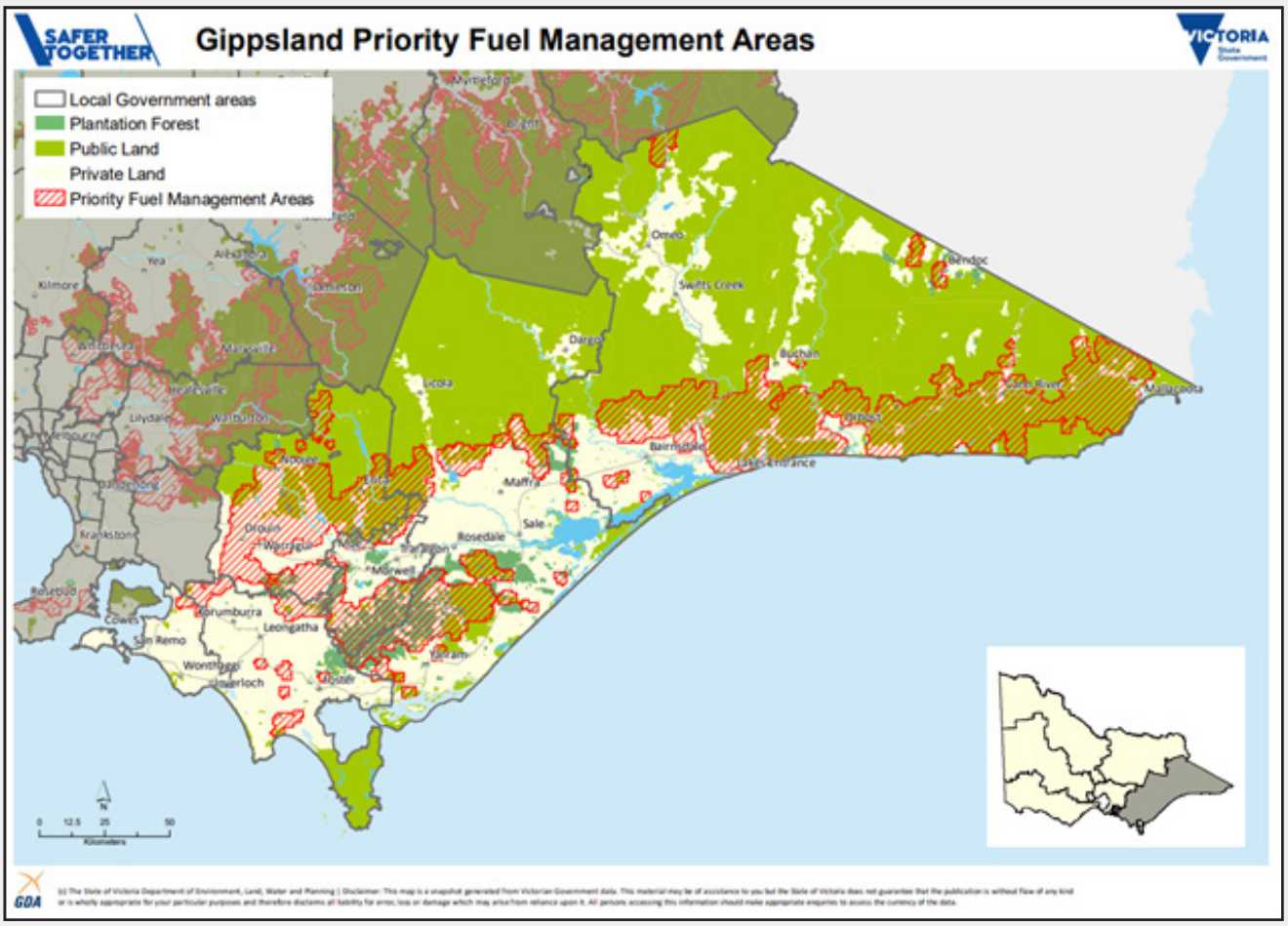

Figure 3 – Gippsland Priority Fuel Management Areas

The general area where the DWF will be located is covered by a PFMA. This will result in the agencies focussing on further risk reduction efforts through the management of fuel to reduce the risk to the community.

4.3 Planning

The *Emergency Management Act 1986* and *Emergency Management Act 2013* provide the emergency management framework for Victoria and the Emergency Management Manual[1] Victoria contains emergency-related policy and planning documents for Victoria, including the arrangements for State, regional (Victorian State Government regions) and municipal fire management planning.

The structures for fire management planning are defined in the Emergency Management Manual Victoria Part 6 Municipal Emergency Management Planning Arrangements - Guidelines for Committees. The diagram below indicates these structures.

[1] Emergency Management Manual Victoria can be found at: https://www.emv.vic.gov.au/policies/emmv

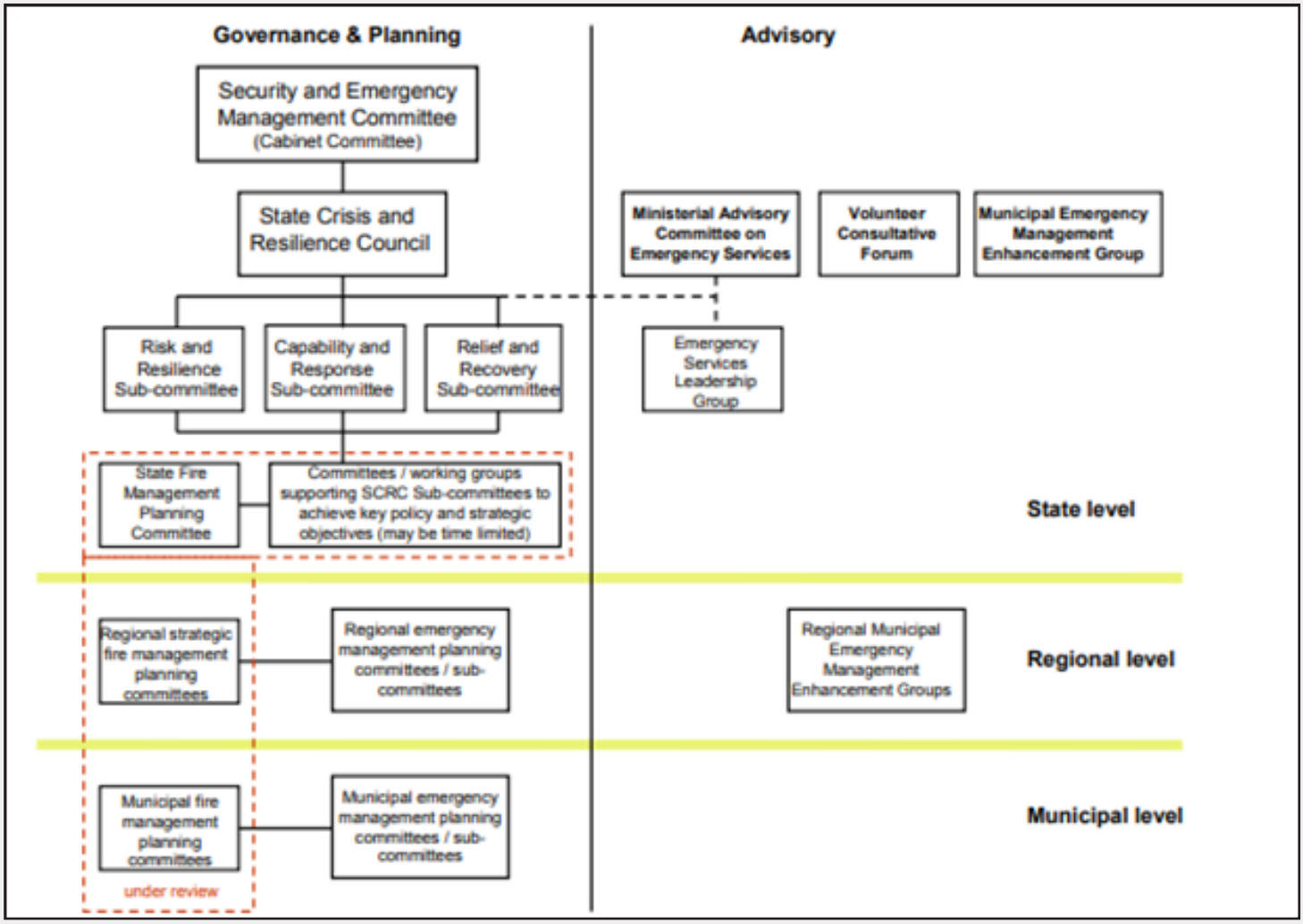

Figure 4 – An overview of the State's emergency management and planning committee structure

Currently, Regional Emergency Management Planning Committees prepare Regional Emergency Management Plans and Municipal Emergency Management Planning Committees) prepare Municipal Emergency Management Plans. These cover all emergencies.

Where fire is a risk in the area, these committees establish Regional Strategic Fire Management Planning Committees and Municipal Fire Management Planning Committees as subcommittees to prepare integrated Regional Strategic Fire Management Plans and Municipal Fire Management Plans respectively. These plans engage all agencies with a role in fire management and outline responsibilities.

The Delburn Wind Farm site is located in Gippsland and most of the proposed turbines are located in the Latrobe City Shire, with several in South Gippsland Shire and one in Baw Baw Shire.

The following regional and municipal plans[2] apply:

- *Gippsland Regional Strategic Fire Management Plan*
- *Latrobe City Municipal Fire Management Plan*
- *Baw Baw Municipal Fire Management Plan*
- *South Gippsland Fire Management Plan.*

FRC has engaged with CFA in the development of this risk assessment and mitigation plan.

[2] These plans can be downloaded from: https://www.emv.vic.gov.au/responsibilities/fire-management-planning

4.4 Victorian Fire Risk Register

A detailed bushfire risk assessment for each municipality in Victoria has occurred via use of the Victorian Fire Risk Register – Bushfire (VFRR-B), facilitated by the CFA. This tool identifies risks to human settlements, economic assets, environmental and cultural assets across the municipality. The data captured also models likelihood and consequence information and effects.

The Latrobe Valley bushfire catchment contains almost 3% of the risk to life and property in the State of Victoria. High risk towns in this area include Tyers, Jeeralang Junction, Moe South, and Boolarra. Key infrastructure includes power stations, coal mines and the Australian Paper Mill (APM).

Included within the VFRR-B data capture is treatment options across the municipality based on risk mitigation options. This includes use of the multi-agency annual works program to reduce bushfire risk, community education, targeted compliance activities, collaboration with other agencies, planned burning to reduce fuel hazard and local community action plans.

The current VFRR data does not capture the proposed development of the Delburn Wind Farm. This is not unusual as projects in the development phase are not normally included in this process as they are not yet listed as an asset.

The Latrobe, South Gippsland and Baw Baw Municipal Fire Management Planning Committees have completed an analysis of the risk in the general area that the DWF will be constructed. The Latrobe Municipal Fire Management Plan provides a copy of the economic and human settlement maps. Unfortunately, these are not provided with the Baw Baw and South Gippsland MFMPs.

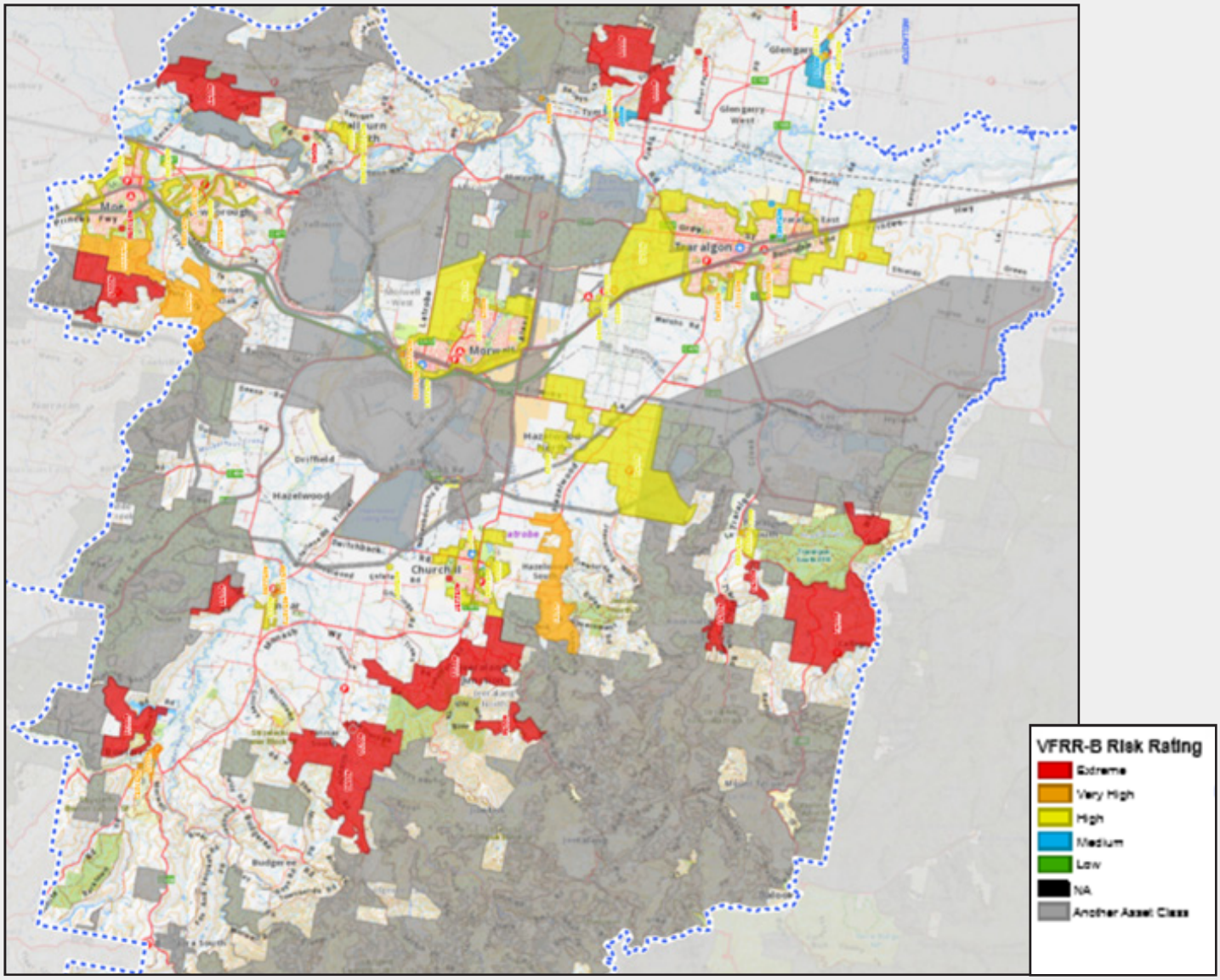

Figure 5 – VFRR human settlement map for Latrobe

The results of the analysis has identified human settlements at extreme risk that surround the proposed site for the DWF. These include the Darlimurla settlement, Boolarra and Yinnar (Creamery Road area).

5 KEY POLICY DOCUMENTS

This section outlines key policy documents relating to bushfire risk assessment and mitigation for wind farm planning.

5.1 Clause 13.02 - Victorian Planning Scheme

The State Government has introduced into all Planning Schemes Clause 13.02 which is aimed at strengthening the resilience of settlements and communities to bushfire through risk-based planning that prioritises the protection of human life.

When considering bushfire matters in context of planning, it is Clause 13.02, sitting within the Victorian Planning Provisions, that directs municipalities to consider 'bushfire' irrespective as to whether the land is currently affected by a Bushfire Management Overlay. Further, it directs a considered approach to bushfire hazard identification and assessment.

To demonstrate that clause 13.02 has been considered, a bushfire hazard assessment has been undertaken and the 'Settlement Planning' objectives have been addressed in this report. It should be noted that the likely bushfire scenarios are also included in the sections relating to the Phoenix Rapidfire analysis.

5.1.1 Bushfire hazard assessment

The Bushfire Hazard Assessment is a key component of assessing risk as outlined within Clause 13.02 of the Latrobe Planning Scheme. The requirements outline the need to consider and assess the bushfire hazard on the basis of:

- Landscape conditions (20 kilometres)
- Local conditions (1 kilometre)
- Neighbourhood conditions (400 metres)
- The site for the development

As the development is in an existing pine plantation, the hazard assessment, following a detailed analysis has resulted in a similar outcome for the local conditions, neighbourhood conditions and the site for the development. Due to the nature of the landscape surrounding the proposed DWF and based on past fire history, the likely scenarios include fires travelling through the plantations. The age of the plantation will influence the intensity of the bushfire.

Table 1 outlines the hazard assessment relating to the proposed DWF.

Bushfire hazard type	Description	Likely scenario/s	Considerations
Landscape conditions	The landscape hazard up to 20 kilometres from the DWF indicates significant areas of plantation. There are tracts of grassland that is primarily farmland. The farmland to the west of the development is irrigated. Refer to Figure 7 for further detail.	The likely scenario when assessing the hazard up to 20 kilometres from the DWF sites, is fires burning through grassland. There are some areas to the south of the development where the plantation vegetation connects to forest on private and public land. This could see a bushfire burning under a south westerly influence entering the plantation landscape.	• Maintenance of perimeter fuel breaks. • Early identification of fire ignitions • Engagement with MFMPCs to ensure fuel management treatments on surrounding land including roadsides are implemented and maintained.
Local conditions	The conditions within 1 kilometre of the site is primarily plantations. Refer to Figure 6 for further detail.	The likely scenario is a bushfire starting in the plantation estate and travelling towards the turbine towers.	• Establish effective road access that also serve as fuel breaks. • Early identification of fire ignitions • Eliminate unnecessary activity on high risk days including hot work.

Table 1 – Landscape Hazard Assessment

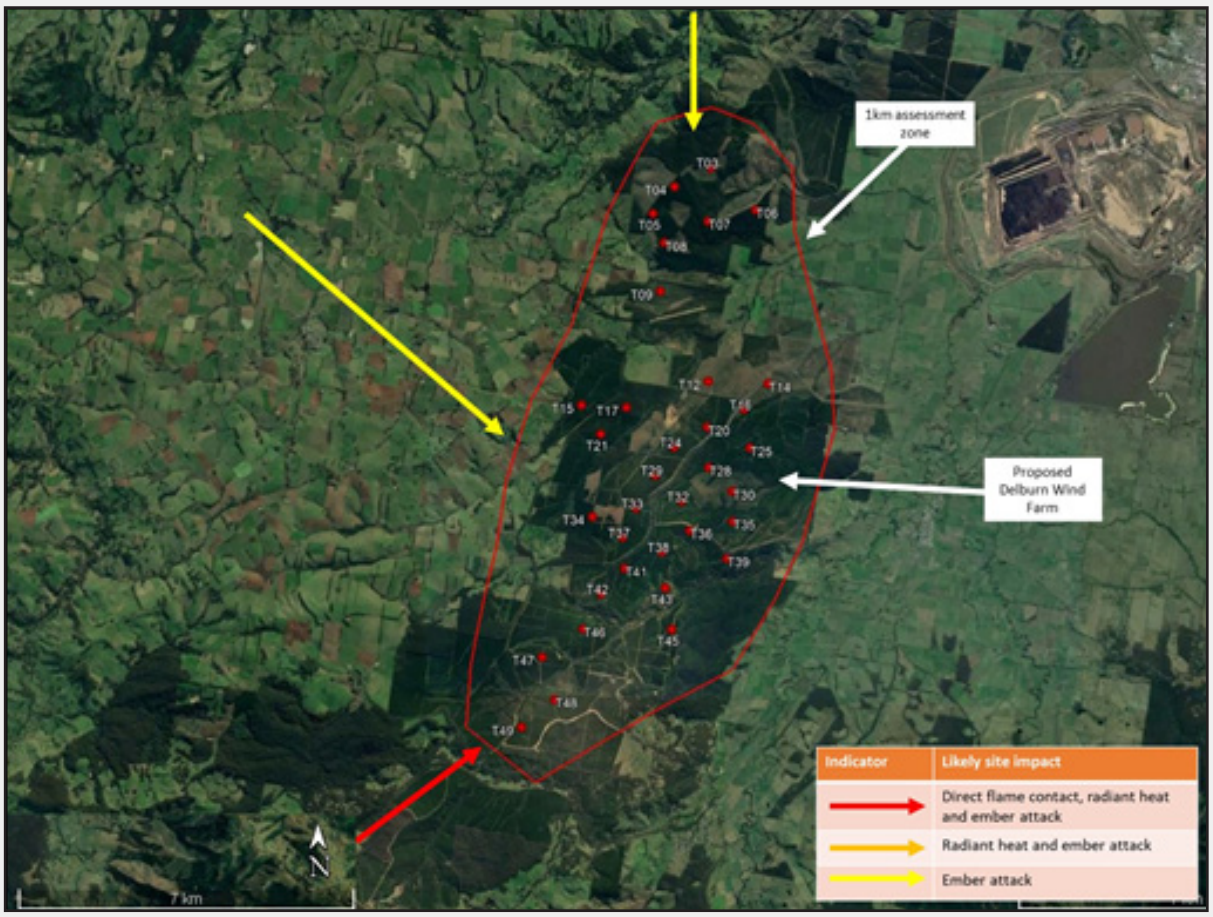

Figure 6 – 1 kilometre landscape assessment

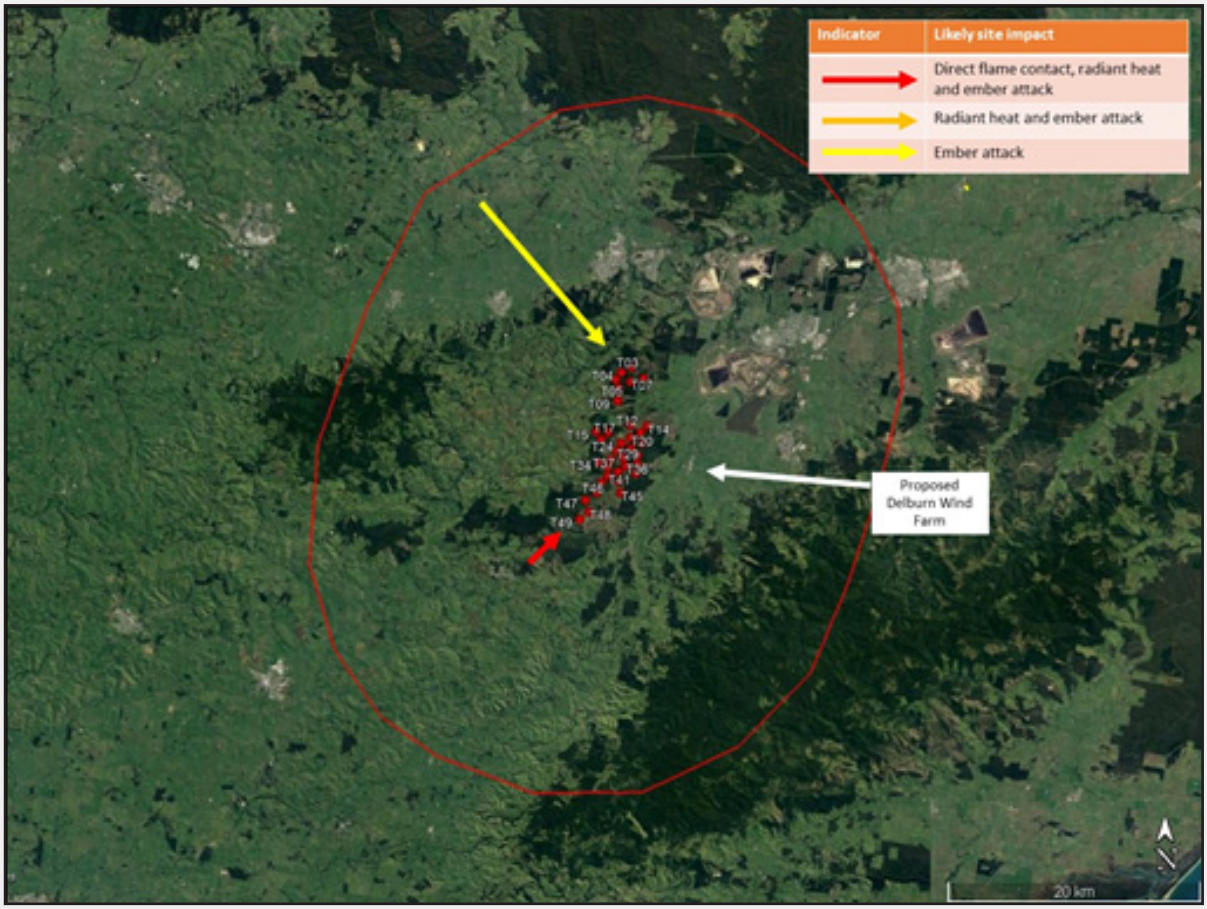

Figure 7 – 20 kilometre landscape assessment

5.1.2 Settlement Planning - Clause 13.02

Clause 13.02 of the Latrobe Planning Scheme identifies the objectives that are required to be achieved to strengthen the resilience of settlements and communities and prioritise protection of human life.

This policy must be applied to all planning and decision making under the *Planning & Environment Act 1987* relating to land that is:

- Within a designated Bushfire Prone Area
- Subject to a Bushfire Management Overlay
- Proposed to be used or developed in a way that may create a bushfire hazard

The DWF proposed development clearly must comply with this planning clause.

The DWF proposed development does not introduce new settlements into the landscape. This report assesses the bushfire hazard as it relates to existing settlements including Driffield, Yinnar, Boolarra, Thorpdale and Darlimurla.

Table 2 outlines how this development meets the objectives of Clause 13.02 based on the bushfire hazard assessment and the adoption of the proposed treatments.

Settlement Planning objective	Project Response	Achieved
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 3959-2018 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2009)	The wind turbines will be provided with defendable space that is more than the 48 metres required to achieve BAL 12.5 of AS 3959.	✓
Ensuring the availability of, and safe access to, areas assessed as a BAL-LOW rating under AS 3959-2018 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2009) where human life can be better protected from the effects of bushfire.	The DWF development is providing increased access roads and defendable space surrounding the turbines. This will provide workers with the ability to travel safely to locations that would achieve a BAL LOW rating.	✓
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 DWF development will result in reduced plantation vegetation through the creation of cleared areas for the wind turbines along with additional access roads. The access roads will also be developed wider than what is currently there to facilitate construction, and these will be maintained.	✓
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 DWF development will reduce bushfire risk within the Plantation. Bushfire protection measures will be implemented including: • Vegetation clearance • Additional response capability • Vegetation thinning • Restricted operations during high fire danger periods	✓

Table 2 – Clause 13.02 Assessment Framework

- continued on next page

5.1.2 Settlement Planning - Clause 13.02 continued

Settlement Planning objective	Project Response	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.	As per section 5.1.1 of this report the hazard has been assessed. Based on the detailed assessment contained in this report and the additional information contained with the Phoenix analysis this development does not increase the hazard compared to the current situation. It has been concluded that the development reduces the amount of vegetation available for bushfire present in the landscape.	✓
Assessing alternative low risk locations for settlement growth on a regional, municipal, settlement, local and neighbourhood basis.	As the development does not increase risk across the landscape, identification of low risk areas has not been completed.	✓
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 3959-2018 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2009).	The wind turbines are not required to comply with AS 3959 due to the development type. With the provision of defendable space, they will not be exposed to radiant heat in excess of BAL 12.5.	✓

Table 2 – Clause 13.02 Assessment Framework

5.2 Australasian Fire Authorities Council

Australasian Fire and Emergency Services Authorities Council (AFAC) has produced a position paper *Wind farms and Bushfire Operations (2014)*[3]. The paper states the position of AFAC member agencies towards wind farms and their development. The scope of the paper is limited to the issues relating to planning for bushfire prevention, preparedness, response and to recovery operations in and around existing and planned wind farms.

This document has been referenced in later sections of this report.

5.3 CFA Guidelines for Renewable Energy Installation

CFA has recently updated its publication *Guidelines for Renewable Energy Installations (February 2019)*[4] to provide details about standard measures and processes in relation to fire safety, risk and emergency management that should be considered when designing, constructing and operating new renewable energy facilities, and upgrading existing facilities.

Renewable energy facilities that support the generation of electricity in Victoria include wind farms, solar farms, and battery storage facilities. The principles described may also apply to upcoming renewable technologies such as geothermal plants and landfill gas/biogas.

The Guidelines acknowledge that the majority of the windfarm developments to date have been located in agricultural areas containing grassland.

This document surpasses CFA's *Emergency Management Guidelines for Wind Farms*[5] which, although containing relevant information regarding wind farms, was written in 2009 and is now outdated regarding wind farm technology.

[3]AFAC's Wind Farms and Bushfire Operations position paper can be found here: http://w-wind.com.au/wp-content/ploads/2016/11/AFAC_sub78a_TFS.pdf

[4]CFA Guidelines for Renewable Energy Installations 2019 can be found here: https://www.cfa.vic.gov.au/documents/3554830/3558078/CFAGuidelinesforRenewableEnergyInstallations.pdf/eb29e41a-18a4-998e-97a7-9a4c9350574e

[5]CFA Emergency Management Guidelines for Wind Farms 2009 can be found here: http://www.aph.gov.au/DocumentStore.ashx?id=c3c32571-561a-45fb-9042-f07efca41c67

5.4 SA CFS Guidelines for Wind Farms

South Australia Country Fire Service (CFS) *Guidelines for Wind Farms (March 2016)*[6] outline the steps that can be taken to minimise the possibility of bushfire being caused by a wind turbine or critical infrastructure being affected by bushfire entering the site, including:

- Development control processes which guide the siting of installations, the provision of fire vehicle access, water supply for firefighting, and vegetation management
- Development of risk and response plans to define how fire services will respond to fire in wind farm developments.
- Development of emergency risk management plans by wind farm operators.
- Compliance with hazard reduction responsibilities defined under legislation.

The guidelines support the use of fire bombing, subject to a risk assessment, and as part of an integrated plan to support ground resources.

5.5 OSMI - HVP Operational Protocols

DWF Pty Ltd has prepared operational protocols for the proposed Delburn Wind Farm development in conjunction with HVP. The document outlines a set of clear and practical management protocols, procedures, and actions applicable to the various phases of the project development, construction and operation.

The protocols include specifications for:

- CFA bushfire risk mitigation for forest operations:

Forest Operations Restricted Period

  - Required OSMI fire equipment
  - Use of vehicles, mobile plant and stationary plant
  - Forest operations restrictions
- Fire risk mitigation controls for installed infrastructure:
  - Active controls
  - Firefighting equipment and training
- Emergency procedures.

The protocols remain a working document between HVP & DWF Pty Ltd.

5.6 Climate change and bushfire

The Victorian Government's Climate Change Framework has identified the future impact on the emergency management sector. It states that in relation to emergency management the following scenarios will be realised:

- More complex emergency response situations as a result of increases in the frequency, intensity and severity of extreme weather events
- Response to emergency events will become increasingly more complex, especially for community preparedness and emergency responders
- Overlapping fire seasons in the northern and southern hemispheres increases the cost of bushfire response as equipment and emergency management staff may not be able to be shared.

The Framework also identifies the changing vegetation type as our forests become drier due to reduced annual rainfall. These changes combined will mean larger and more complex emergency response situations into the future. It is also anticipated that the number of high risk days will increase which directly correlates to a reduced opportunity for Land Managers to manage the risk from their land through fuel reduction burning.

These issues strongly support the need to continually improve the way fire management planning is assessed and plans delivered into the future.

[6] SA CFS Guidelines for Wind Farms can be found here: https://www.nwfc.gov.au/sites/default/files/cfs-guidelines-wind-farms.pdf?v=1484179504

5.7 Fire Danger ratings

The State Bushfire Plan[7] outlines the importance of fire danger ratings and how they are used to inform the community and emergency management personnel about the level of fire danger at a given time.

Fire Danger Ratings give an indication of how a fire would behave under forecast weather conditions and how difficult it would be for the fire services agencies to control a fire in these conditions. During the warmer months, weather forecasts, radio and television broadcasts, some newspapers and the emergency smartphone application feature the daily Fire Danger Rating.

Fire Danger Rating categories	Grassland Fire Danger Index (GFDI)	Forest Fire Danger Index (FFDI)
Low – Moderate	0 – 11	0 – 11
High	12 – 24	12 – 24
Very High	25 – 49	25 – 49
Severe	50 – 99	50 – 74
Extreme	100 – 149	75 – 99
Code Red	150 +	100 +

Figure 8 – Fire Danger Rating categories

The Fire Danger Rating table is utilised by emergency management agencies and other industries to inform the actions that are required to be taken during preparedness and response planning activities. Industries who undertake planning against the Fire Danger Ratings benefit from this as it allows them to align their preparedness and response planning with the fire agencies.

[7] https://files-em.em.vic.gov.au/public/EMV-web/State-Bush-Fire-Plan-2014.pdf

6 BUSHFIRE AND ENVIRONMENT ANALYSIS - EXISTING CONDITIONS

The following provides a summary of the current bushfire context within which the proposed Delburn Wind Farm development is to be located.

6.1 HVP Fire Management

HVP has developed fire protection guidelines for its operations. The guidelines have been developed over many years and aim to reduce the incidence and severity of fires. They include a series of operational restrictions based on the FFDI for any particular day at each specific plantation location. As a manager of more than 240,000 hectares of land across rural Victoria, every Summer the organisation plays a significant part in the State's firefighting operations.

HVP fire crews are part of the CFA being registered as Forest Industry Brigades (FIB). As active members of the CFA, their fire crews are trained in bushfire control and work alongside other CFA volunteers on the fire frontline.

HVP undertakes a range of prevention measures to protect its assets from fire including a network of firebreaks and fire access tracks.

6.2 Location

The proposed Delburn Wind Farm development is located in the Gippsland region of Victoria, about 150 kilometres south-east of Melbourne. The area is bounded by Baw Baw Shire in the north and north-west, Latrobe City and Baw Baw Shires centrally, Wellington Shire in the east and south-east, and South Gippsland Shire in the south-west.

The site is located on a ridge top in the Strzelecki Ranges to the south of the Latrobe Valley, overlooking the Hazelwood Power Station. The ridge forms the boundary between three municipalities: most of the proposed turbines are located in the Latrobe City Council, with several in South Gippsland Shire and one in Baw Baw Shire.

The town of Morwell is approximately 5 km to the north-east of the development site and of Moe is approximately 5 km to the north. Other townships in the vicinity of the proposed development include Thorpdale, Yinnar and Boolarra.

Latrobe City is Victoria's only eastern regional city council, home to 73,929 residents and 5,019 businesses and is the residential and commercial hub of a larger catchment of 262,000 people stretching across the Latrobe Valley and Gippsland region.

6.3 Topography

The natural environment of the Latrobe City, South Gippsland and Baw Baw municipalities is diverse, containing varying topography ranging from steep, almost inaccessible hills of the Jeeralang and Strzelecki Ranges to flat plains of the Latrobe Valley, some of which is noted flood plain.

The proposed Delburn Wind Farm development is located along the ridge line of the Strzelecki Ranges.

6.4 Vegetation

The area has extensive blue-gum and pine plantations.

AS 3959:2018 Construction of buildings in bushfire prone areas allows for all bushfire fuel present in Australia to classified into one of 7 fuel types. Bushfire fuel is classified based on the type, structure, height and the dominant species present.

These are:

- Type A Forest
- Type B Woodland
- Type C Shrubland
- Type D Scrub
- Type E Mallee / Mulga
- Type F Rainforest
- Type G Grassland

Bushfire fuel present within the proposed development site can be classified as Class A Forest. It is surrounded by farmland that could be classified as Type G Grassland.

6.4 Vegetation continued

Hancock Victorian Plantations is transitioning away from hardwood to softwood plantation, such that all new planting is softwood (Pinus radiata). Older eucalypt plantations have a greater spotting potential (up to 30km on code red days) than pine plantations which have a maximum of around 1km. The transition of the plantations to pine will reduce this spotting potential. This is due to the nature of the bark – pine has heavy well attached bark, whereas eucalypt has ribbony loosely attached bark which can lead to long, medium and short distance spotting.

Native eucalypt forest is present within the plantations along gullies. This fuel is often not treatable by planned burning but burns readily under bushfire conditions. Fires in native eucalypt forest can spread the fire into adjoining areas by spotting.

Fire threat changes as the plantation type is altered, silvicultural operations occur (planting, thinning, harvesting), or as the forest grows and matures.

Young eucalypt fuels vary depending on if there is a scrub or grassy understorey. Sites that were previously farmland tend to have less fuels, whereas areas that were native forest have much higher fuel loads. After about 6 years of age the eucalypt plantation develop high levels of ribbony bark which leads to greater spotting potential.

Pine is generally most flammable from the ages 4 – 20 with crown fires being common at Forest Fire Danger Indexes (FFDIs) greater than around 30. After this, with ages reaching around 20 the ladder (or connecting) fuels are not present and ground fires are more common at lower FFDI. Crown fires can occur above FFDI 50-60 and become increasingly likely as FFDIs increase. Young plantation or chopper rolled plantation has generally lower fire intensities and is readily accessible by direct attack dozers constructing fire lines or aerial attack.

All forest fuels are capable of extraordinary fire behaviour when there are conducive weather conditions and fuel arrangement. Pine plantations are no exception. In 1983 in south eastern Australia flame heights of nearly 200m metres were observed (Sutton, 1984) in 15 year old P. radiata plantation. These were calculated by the RAAF using the oblique photograph in Figure 9.

Large tornado like fire storms have also occurred in plantations (Pierces Creek/Uriarra ACT in 2003 and at Mt Muirhead South Australia 1983). The coalescing of spot fires has resulted in large areas igniting simultaneously and generating tornado strength winds which have snapped mature pine trees. Researchers in the ACT suggest that the tornado moved at 30km/h and was 0.5km wide.

Similar fire tornados have also been observed in native forest in the 2003 Pierces Creek/Uriarra fire. For our analysis plantation fuels are mapped as of June 2018. Much of the area is replanted pine following the 2009 fires and native forest is assumed to be at the levels pre 2009. This is slightly higher than current levels, but regrowth levels are approaching those of pre 2009. Much of the native forest fuels are located on private land.

Fires under catastrophic conditions burn freely but only occur rarely. These examples illustrate that although this type of fire behaviour is possible within plantations the occurrence is fortunately infrequent. A fire burning under catastrophic conditions would have a detrimental effect on the wind farm infrastructure and operation.

Figure 9 – Column of flame 200m high observed in the 1983 Ash Wednesday fire near Furner, South Australia. Note: that this was an intermittent burst of energy and not the norm of that fire.

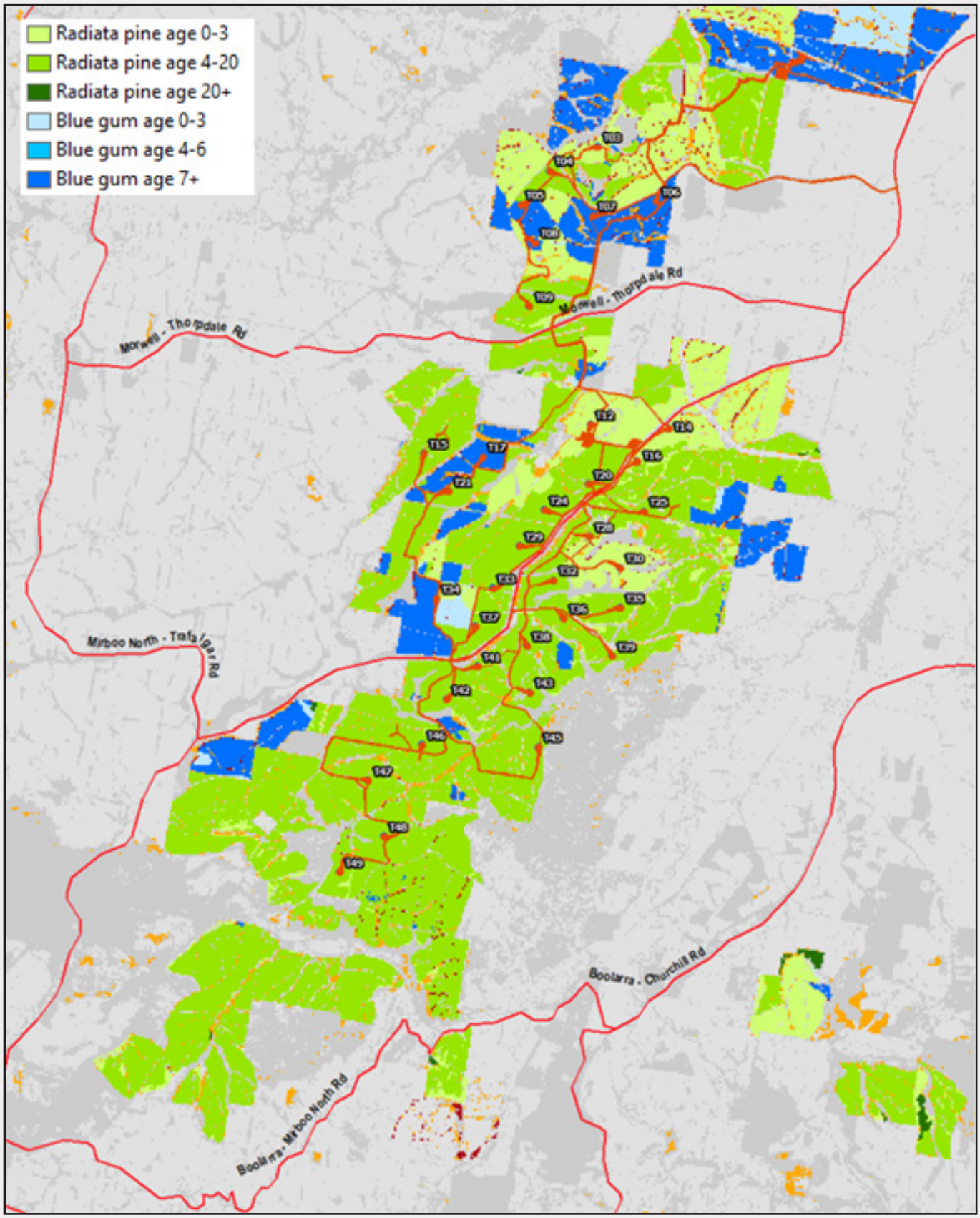

Figure 10 – Plantation age class as of June 2018, incorporating softwood and hardwood plantations.

6.5 Land use

Gippsland holds some 16 per cent of the world's brown coal reserves the majority located in the Latrobe Valley. Latrobe City has the largest amount of power generation infrastructure in Victoria. Coal ignites easily and is hard to suppress, as seen in February 2014 with the Hazelwood Mine Fire.

Latrobe has the second highest area of plantations in the Gippsland region. Public forest currently supplies significant quantities of native hardwood timber supporting a significant pulp and paper manufacturing sector that is a mainstay of Latrobe's manufacturing sector as well as a range of timber processing operations. A transition away from the use of timber from native forests is currently underway. Information provided by HVP to the consultants indicates that approximately 60% of the wood fibre supplied to Australian Paper Maryvale is from HVP managed plantations. This will likely increase as the move away from native timber continues.

The land proposed for the Delburn Wind Farm is used for both hardwood and softwood plantation. The majority of plantation resources in the area are managed as large-scale industrial plantations. It is surrounded in some areas of native forest and rolling farmland. Rural land is used mainly for dairy, beef, potatoes and general farming.

In many areas of Victoria, the highest fire risk is from the north-west, and south-west. Figure 11 highlights that the intensive irrigated agricultural area centred around Thorpdale remains largely non-flammable even in dry years. This provides a large buffer to the possible external fire threat. Ignitions likely to threaten the plantation and development are thus more likely to come from within the plantation or immediately adjacent (for example Mirboo North, Coalville, Hernes Oak and Darlimurla).

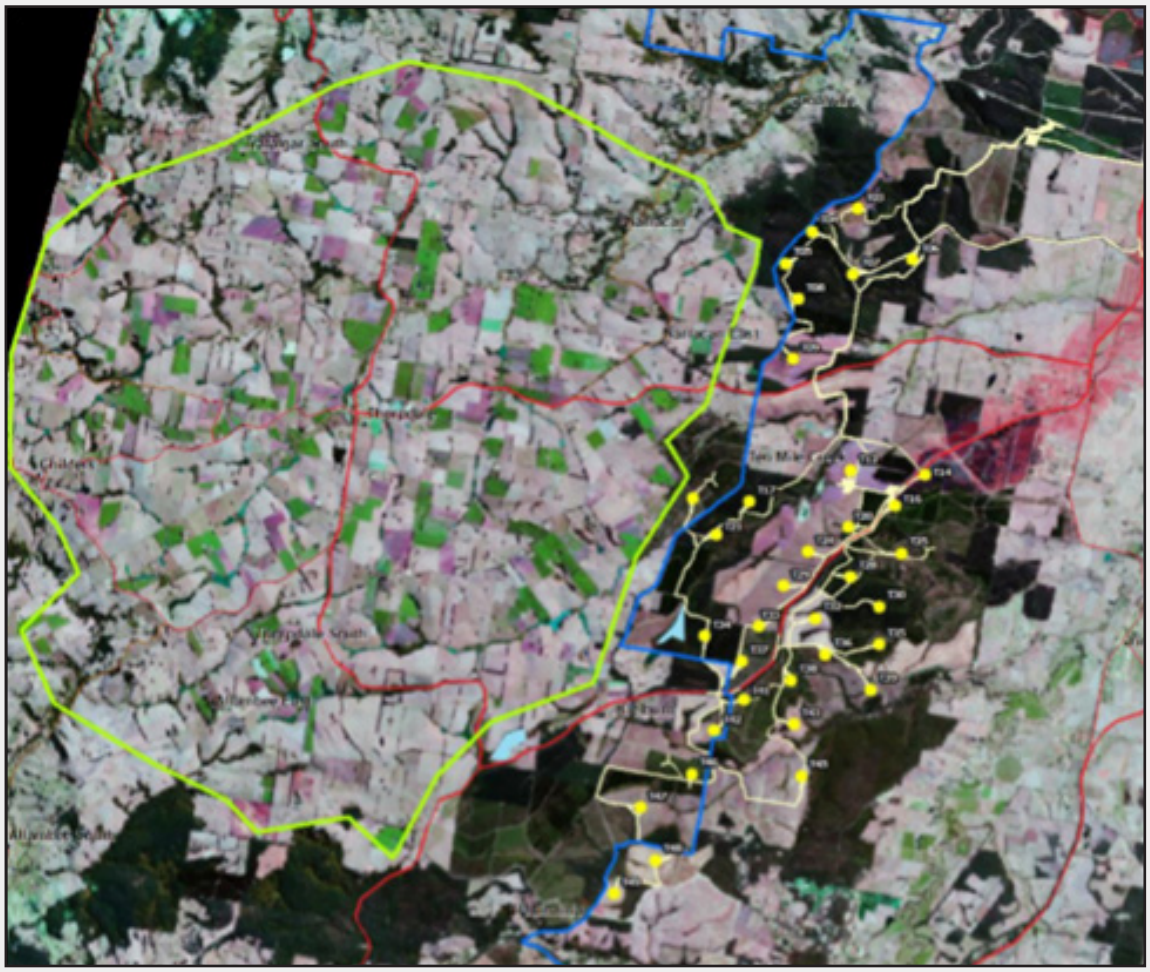

Figure 11 – Landsat false colour image from 22nd February 2014

The area circled in yellow shows areas of intensive irrigated agriculture around Thorpdale. Green areas are non-flammable crops and purple areas mineral earth. The footprint of the February 2014 Latrobe Valley fires is shown as a light red scar. Irrigated areas can also be seen south west of Yinnar in the river valley.

6.6 Access and egress

Infrastructure such as roads and tracks increase the speed of a fire response, allowing firefighters to safely and effectively suppress a fire before it reaches maximum intensity and flame height.

A road and track network can also act as boundaries for planned burns and to create a defendable space near assets, from which firefighters can work to protect these assets.

A good road and track network can:

- improve bushfire response times, which increase the likelihood of bushfires being suppressed in minimal time and to a minimal area
- improve firefighter safety, by providing a safer platform from which firefighters can prepare for and fight bushfires
- provide greater protection for assets
- improve the speed of evacuation of the area, if required.

An important factor in assessing locations, in particular in the context of their potential for future development, is the ability for the community to leave an area safely but also for emergency service agencies to access a site safely.

Considerations for access and egress in relation to a location includes the following:

- Is more than one option available for access/egress from a community or location available
- Are the access/egress corridors free from vegetation that may generate fire activity along these corridors
- Are there large trees present along the roadsides that in the event of high winds or fire activity fall onto the roadway and impede access/egress
- Is the road listed as a strategic firebreak within the MFMP in either the primary or secondary category.

A number of roads across the proposed development footprint have been identified as strategic fire breaks within HVP, local government and agency plans and these have the ability to influence the effectiveness of access and egress across the development. Providing these are maintained in accordance with firebreak specifications, they can be considered as supporting access and egress from a location.

6.7 CFA firefighting resources

CFA have a number of fire brigades located in the Latrobe Valley. Figure 12 shows the location of the fire stations in relation to the general outline of the DWF. In a number of these locations, there are multiple firefighting vehicles available. In every fire station there would be at least one appliance that has been designed to respond to bushfires.

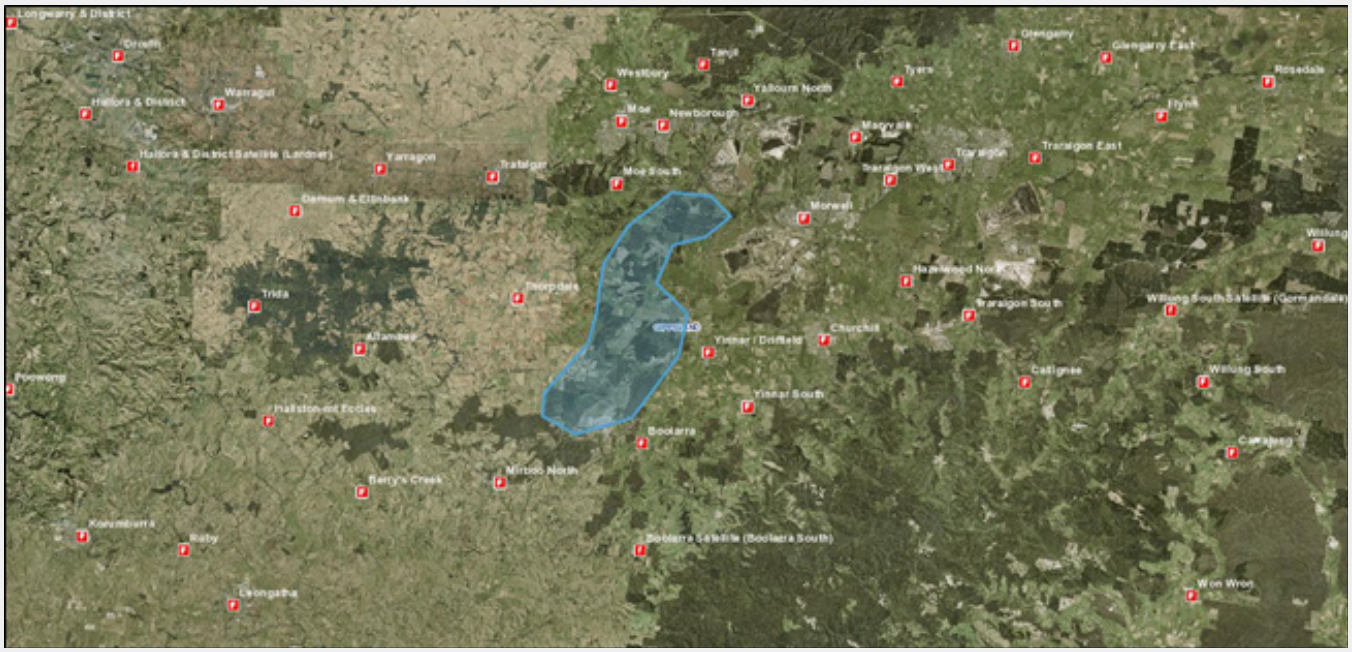

Figure 12 – CFA fire brigades within the general area of the DWF outlined in blue

6.7 CFA firefighting resources continued

HVP Gippsland Plantations Forest Industry Brigade comprises over 100 employees and contractors. The CFA and HVP resources will enable quick response to reports of bushfires in the Latrobe Valley. The majority of bushfires that start on low fire hazard days are suppressed easily. On high risk days, if first attack is not possible by firefighting resources then it is likely for a bushfire to escalate to being uncontrollable in a short period of time.

The fire agencies also operate aircraft across Gippsland including the Latrobe Valley. The aircraft based at Latrobe Valley operate under a predetermined dispatch arrangement where they are automatically dispatched to reports of fires when certain protocols are met.

6.8 Prescribed burning

The potential for fuel reduction burning to assist with protection has been examined. There are only small remnant areas of native forest within the development area with the majority outside it under private ownership. The native forest fuels present little threat (potentially some small localised threat) to the windfarm assets and plantations. They do however present a threat to local communities. Many residents have built houses in amongst the native forest and do not manage the fuel loads on their land.

There may be opportunities to identify areas for the CFA/DELWP Joint Fuel Management Program (JFMP) where both organisations conduct planned burning operations on Victoria's public and private land over the next three years. The JFMP is a live, 3-year rotating document that can be added to at any time. Some areas of public land in the Boolarra area already appear on the plan.

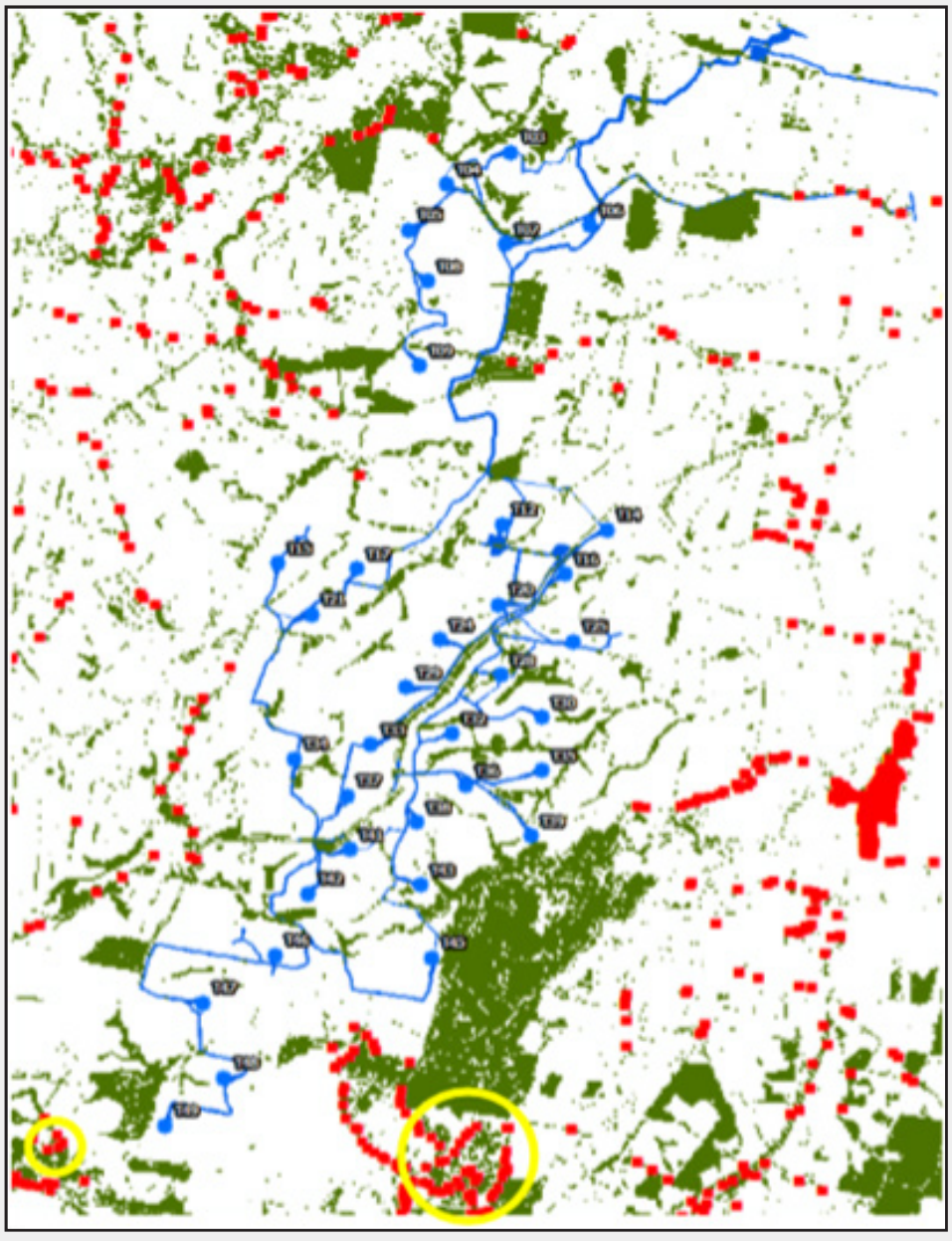

Figure 13 – Native forest fuels (green) are predominantly in private hands and often contain many dwellings (red squares). The yellow circles highlight the areas where many houses were impacted in 2009.

6.9 Fire history

There are reports of fires in the area in 1898, in the 1920s and in 1944, but the recent fire in 2009 just prior to Black Saturday is still remembered by the local community. In January 2009 the Delburn fire burnt 6534 hectares and destroyed 44 houses primarily in and around Boolarra. Sixty percent of the area burnt was commercial tree plantations managed by HVP.

The fire impacted on the site of part of the proposed development area causing significant plantation damage. The fires burned mainly between 28th of January and 3rd of February, being at their most destructive on 30th of January. Of note is the fact that the peak FFDI was only 63 at 1630hrs on the 30th of January (Source: BOM records for Latrobe Valley) which was significantly less than on Black Saturday. Worse fires are theoretically possible and this is reflected in the Phoenix modelling.

Figures 13 and 14 show the February 2009 imagery, house and structure loss locations, the proposed tower locations, plantation area and public land.

An examination has been made of the location of house and structure loss following the bushfire. This fire resulted from multiple arson ignitions from arson and destroyed 44 houses.

Most house losses occurred when the fire moved to the east on the afternoon of the 30th of January. At Latrobe Valley Airport the temperature was 44c, RH 10% and the wind speed 20 gusting to 30km/h. There were many spot fires ahead of the main fire.

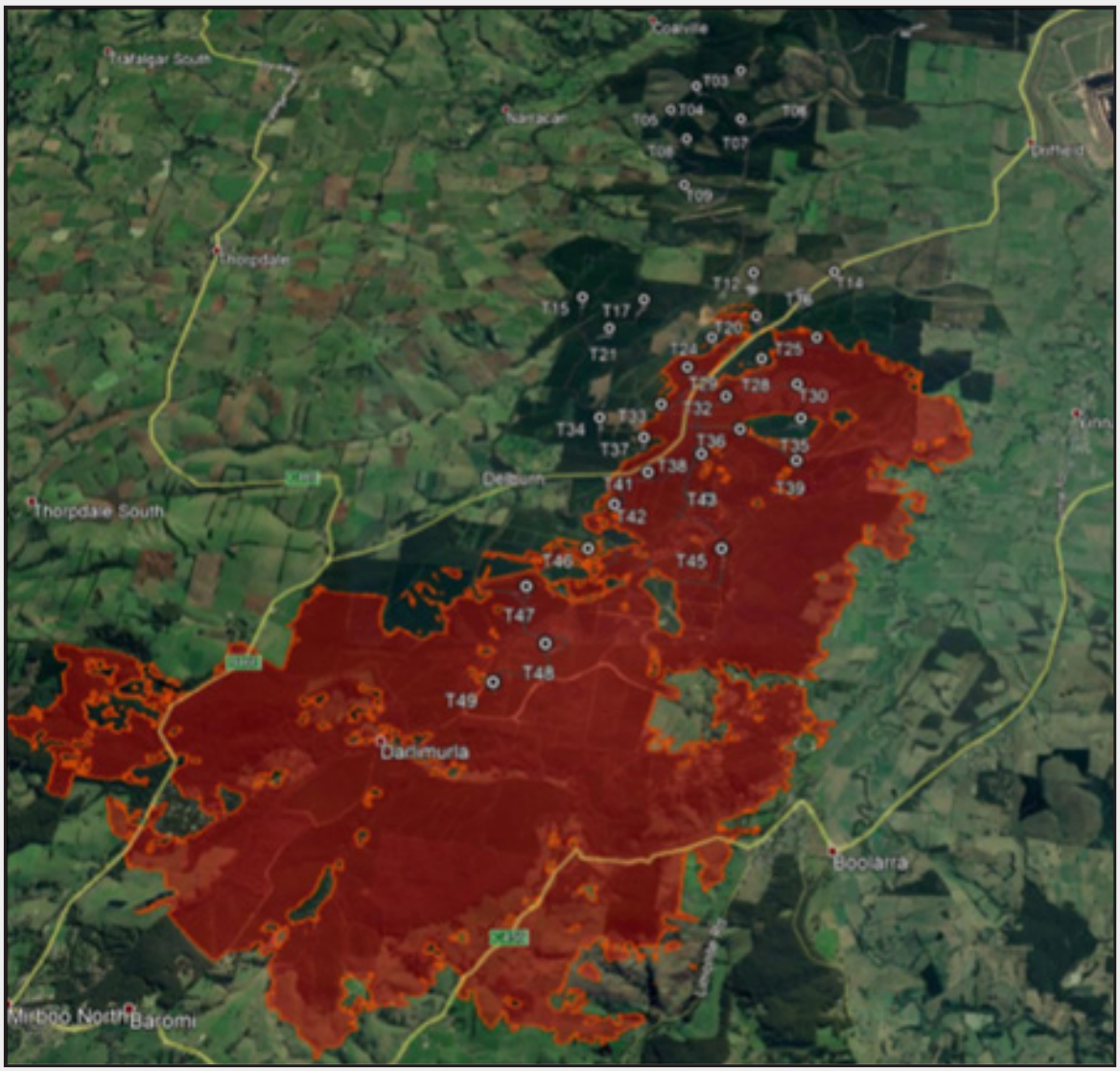

Figure 14 – Location and area burnt in Delburn fire and proposed development tower locations

6.10 Fire ignitions

Within the Latrobe Valley, fire ignitions are a regular occurrence, Figure 15 shows the fire ignitions that have been reported to CFA between 2010 – 2017. The map demonstrates that more fire ignitions occur in areas with increased populations. These are largely based around the townships of Traralgon, Morwell, Moe and Churchill. However, a number of fire ignitions occur along roadsides and in isolated areas.

In relation to fire ignition data, the Latrobe Municipal Fire Management Plan (MFMP) states the following:

The threat of bushfire exists annually throughout Latrobe. Based on an historical analysis major bushfires have occurred over the past 11 years at least every 3-4 yrs.

The vast majority of bushfires in Latrobe, around 96%, occur in scrub or bush and grass type vegetation with some 51% of all bushfires are contained to less than one hectare in size. The ignition factor of many fires is unknown, around 22%, however of the known causes of ignition the top ignition factors for bushfires are:

- *Deliberately lit or suspicious fires 32.7%*
- *Unattended or inadequately controlled fires in the open 9.4%*
- *Fuel reduction burns private 6.7%*

74.3 % of the Latrobe footprint is made up of "freehold" land e.g. farming, business, and residential. Plantations make up 16.5 % and 9 % is Public Land (National Parks, State Forests, Conservation Reserves, etc.). While forest fires represent only 3.8% of all bushfires; when they do occur, they can have devastating consequences as occurred in the Black Saturday fires of 2009.

The threat of fire is always present in the Latrobe Valley. Continued focus on fire ignition reduction strategies should continue to be supported. These strategies should be focused on human caused fires such as arson, escaped burn offs and roadside fires.

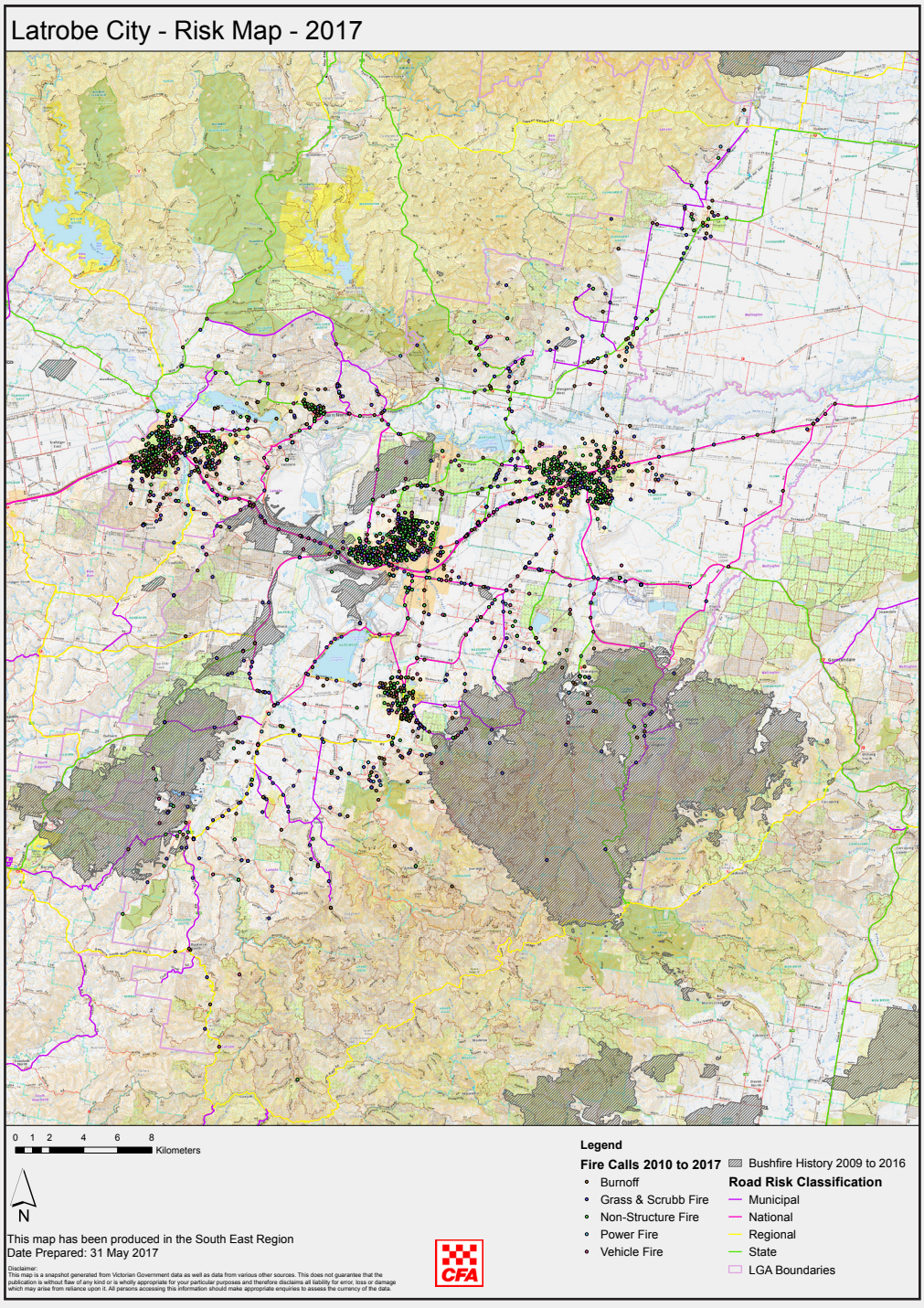

Figure 15 - Fire ignitions in Latrobe City 2010 - 2017

6.11 Phoenix RapidFire computer model

The State of Victoria uses Phoenix RapidFire to model fire scenarios before and after fire risk reduction works, such as fuel management activities, to calculate residual risk. At maximum fuel levels, bushfire risk is at 100%. Through fuel management, the State aims to reduce fuel levels to 70% (the residual risk). This means, if a major bushfire were to occur, the impact of bushfires will be reduced by about a third.

However, Phoenix RapidFire simulations have limitations including the use of input data of varying quality. Phoenix RapidFire is one of several bushfire models currently available, each with its own strengths and weaknesses. Like all models, Phoenix RapidFire gives only an approximation of reality. Some of the factors[8] that may limit the accuracy of Phoenix RapidFire results are:

- The quality of its inputs. Phoenix RapidFire uses a range of data inputs to model bushfire behaviour, including fuel types, ignition locations, weather variables, topography and previous fire history. These data sets vary in accuracy.
- All bushfires have been simulated using the same weather scenario, which has been designed to represent a typical 'worst case' fire day in Victoria.
- A full understanding of bushfire risk requires consideration of both the likelihood and consequence of bushfire impacts on human life, property and other values. Phoenix RapidFire mainly considers the consequence element of bushfire risk and the likelihood of particular ignitions is explicitly ignored.

The results of Phoenix RapidFire model simulations need to be validated against the information collected from on-site data collection, as this provides a more accurate overview of the fire risk and residual risk from fire hazard mitigation works.

6.12 Phoenix RapidFire predictive scenarios

Two days of simulations were conducted using weather from Latrobe Valley Aerodrome on the 29th and 30th of January 2009.

These days were both severe (tending extreme) fire danger ratings days and experienced different wind changes.

These days were chosen as they have occurred on site. There may be worse days and similarly many fire days that are not as severe.

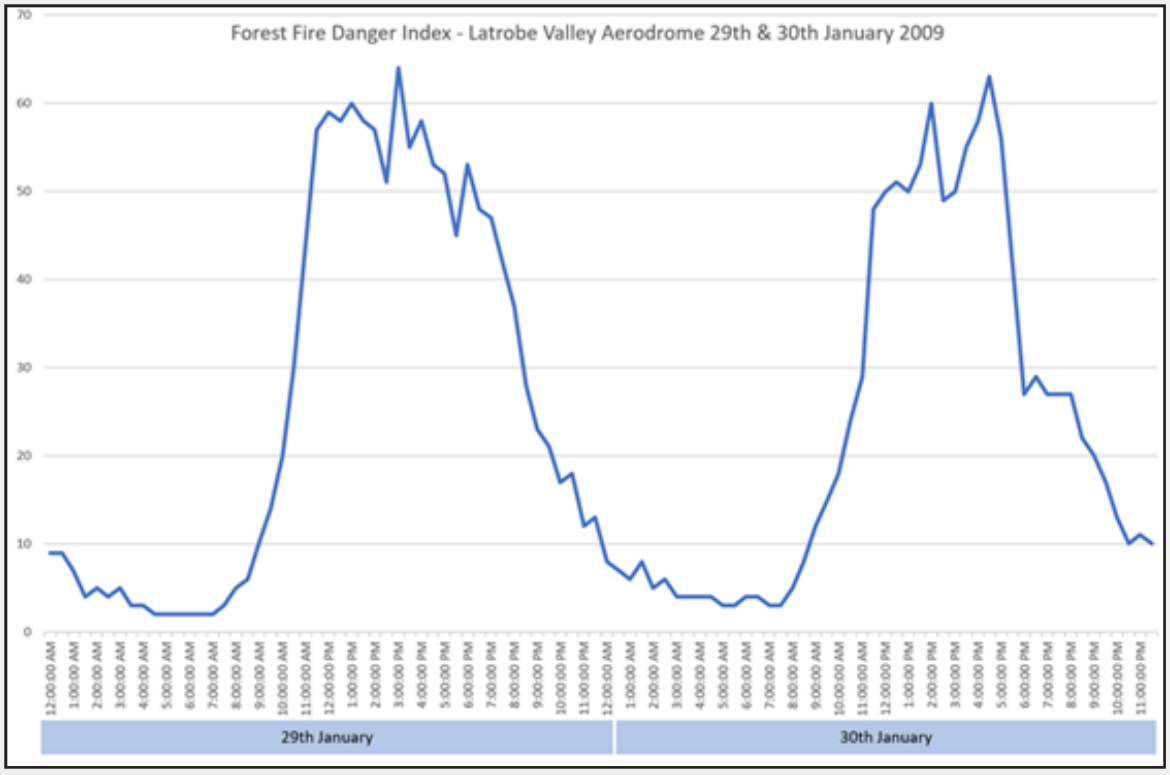

Figure 16 - Forest Fire Danger Index, Latrobe Valley Aerodrome 29th & 30th January 2009

[8] DELWP Measuring Bushfire Risk in Victoria http://www.delwp.vic.gov.au/__data/assets/pdf_file/0009/318879/DELWP0017_BushfireRiskProfiles_rebrand_v5.pdf

6.12 Phoenix RapidFire predictive scenarios continued

Three fires were ignited for the Phoenix analysis. There locations were:

1. Creamery Rd – 1300hrs
2. Ashfords Rd – 1300hrs
3. Lyrebird Walk – 1530hrs

This is approximately the ignitions at Lyrebird Walk and Creamery Road and the escape from Ashfords Road during the 29th & 30th January 2009.

Each fire is assigned resources comprising 2 4x4 slip on units, 4 tankers and a medium helicopter.

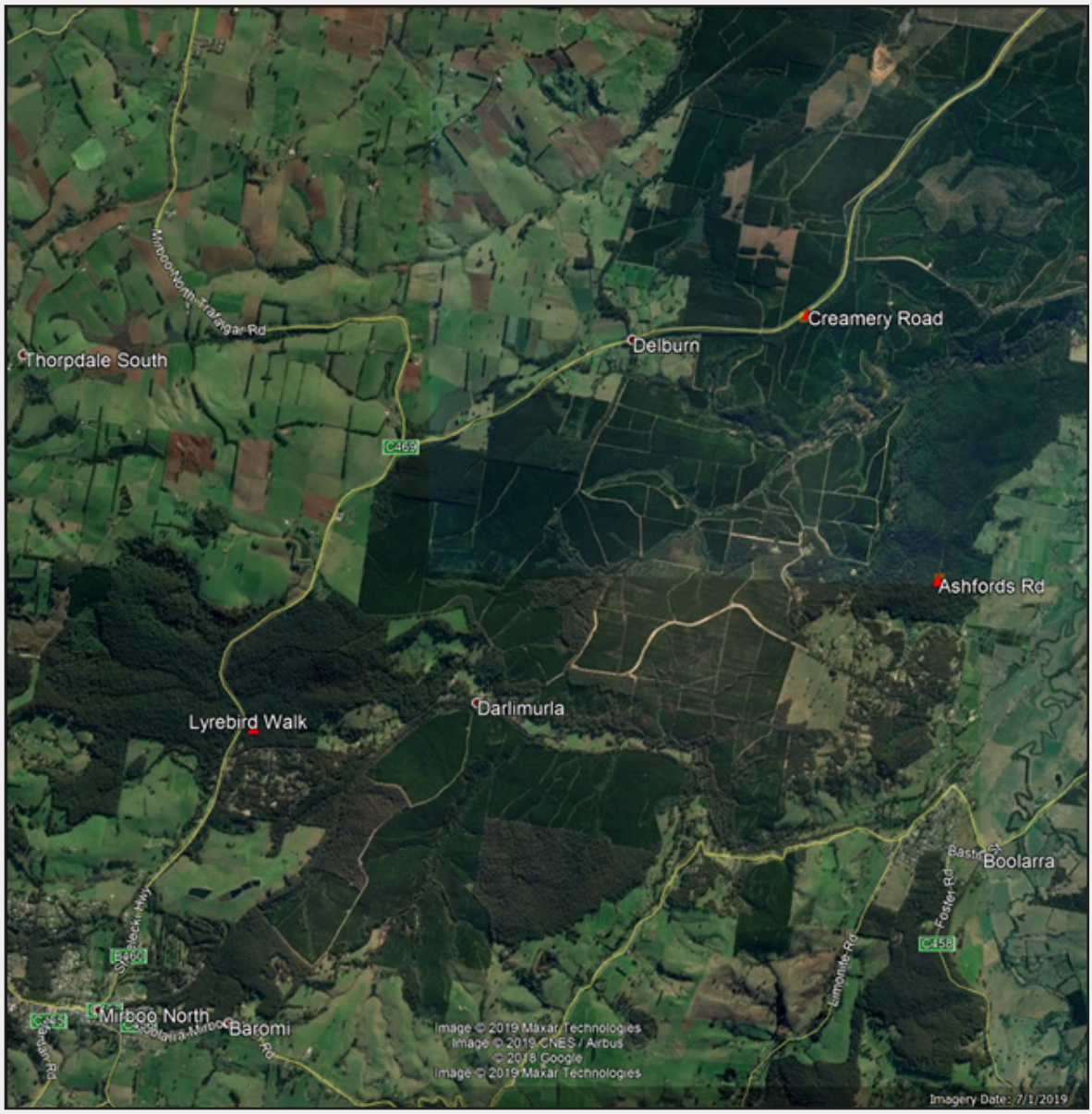

Figure 17- Point of origin map for fire ignition modelling

Type	Start (hrs)	Duration (hrs)	Turn Around (min)	Quantity
Hand Trail / Slip-ons	0.50	24		2
Tanker (4000 litres)	0.75	24		4
Medium Helicopter (1400 litres)	1.00	8	30	1

Figure 18 - Resource allocation for individual fire ignitions, including turnaround time

Two changes were made to the Phoenix data for post DWF modelling. The disruption layer was modified to change widths of roads, breaks and clearings. The fuel layer was also modified to show the footprint layer of the turbines as mineral earth/non-flammable. The operational protocols require an area of high pruning adjacent to the cleared areas at the base of each turbine tower. The Phoenix modelling is unable to measure this additional fuel modification treatment.

These changes mean that at low intensities and at low wind these and other barriers may stop the fire. Conversely at higher intensities and higher winds the fire and spotting will breach these non-fuel areas.

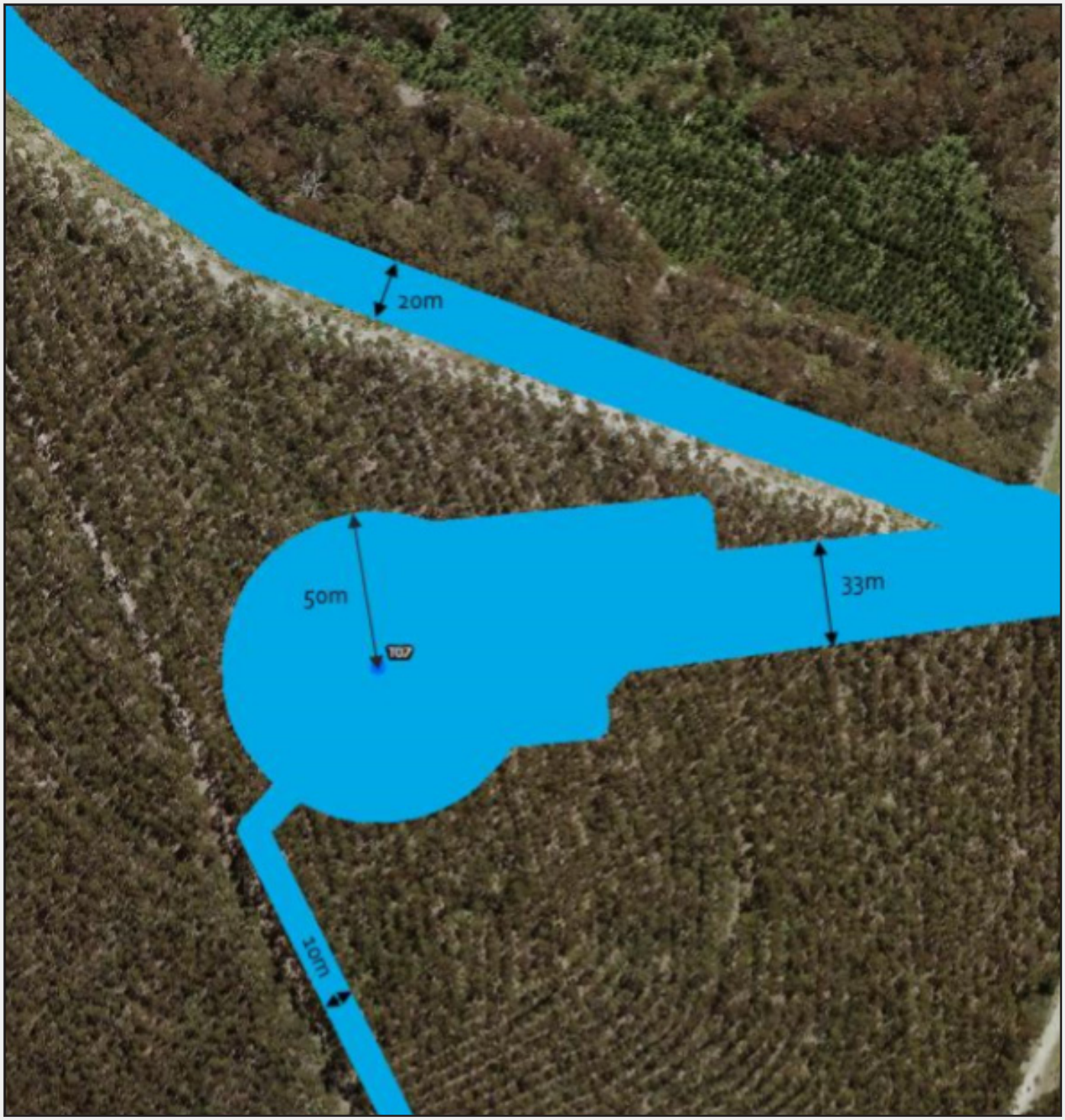

Figure 19 - Example of plantation fuel modifications (cleared area) for proposed tower 07

6.12 Phoenix RapidFire predictive scenarios continued

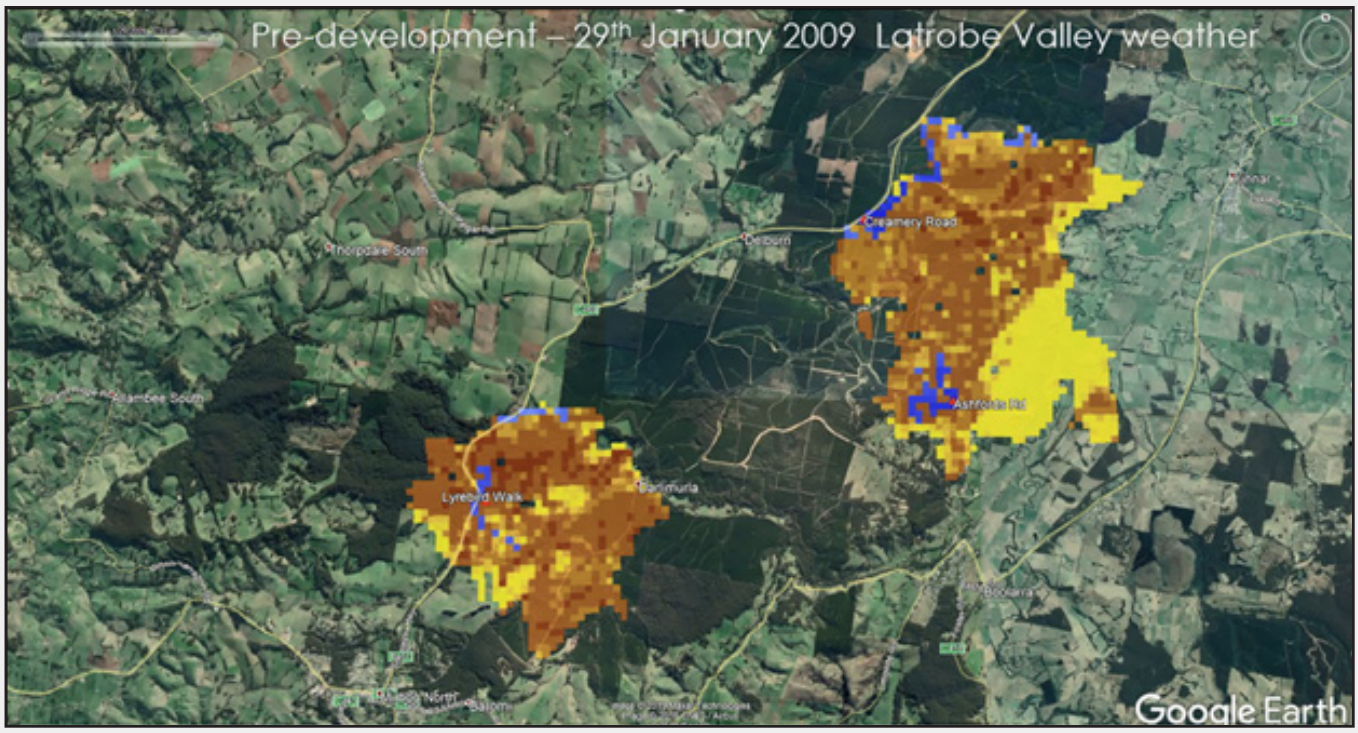

Figure 20 - Example of computer modelled fire run, 29th January 2009 (pre development)

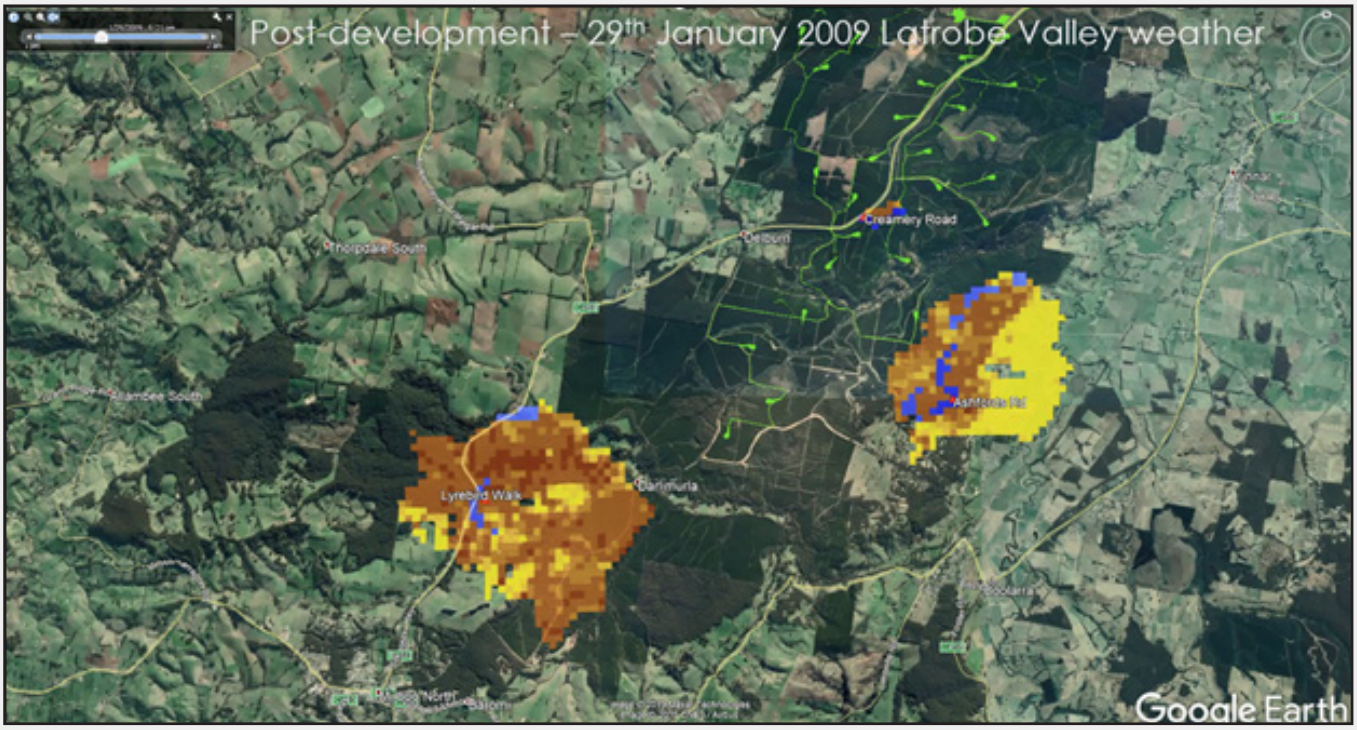

Figure 21 - Example of computer modelled fire run, 29th January 2009 (post development)

In the 29th January post development scenario, the Creamery Road fire is halted by the clearings and suppression.

With the pre development scenario, suppression fails, and the fire continues to spread.

In the 30th January post development scenario, the Creamery Road fire is not halted by the clearings, but the suppression keeps it on one side of the Strzelecki Highway.

In the 30th January pre-development scenario, the Creamery Road fire is much harder to supress and crosses the Strzelecki Highway.

In the 30th January post development scenario, the Ashfords Road fire is slowed (and occasionally stopped) by the clearings as night approaches and is assisted by topography (downhill fire run).

Figure 22 - Ashfords Road fire scenario, 30th January

Our analysis has indicated fires of low intensity and low spotting potential can be stopped by the larger/wider development clearings. These may be flank fires parallel to the breaks, downhill fire runs, or fires in their early development phase.

Fires of higher intensity are not stopped by the development clearings and breaks. Stronger winds, heavier fuel loads, head fires and uphill runs easily breach these clearings.

The area burnt is generally less with the development changes.

It appears that there are similar numbers of houses within the fire impact area under the pre and post development scenarios.

The Phoenix modelling has indicated that fuel changes undertaken as part of the development will under some circumstances reduce or halt fire spread and will assist with suppression activities.

Impacts on properties appear similar under both scenarios and are most likely influenced by other factors. The scenarios potentially show similar areas of residential housing being impacted as in 2009. Much of the possible house loss is influenced by the adjacent freehold native forest, immediate proximity to forest fuels and construction standard.

The modelling has examined fire conditions similar to those experienced in January 2009 at Delburn. It is recognised that there can be situations where fire conditions will be worse and the fuel modification less effective – and that under less severe conditions fuel modifications will be more effective.

7 POTENTIAL FOR ADDITIONAL BUSHFIRE RISK

The risk of bushfire fires resulting from windfarms could arise from the following scenarios. This section refers to examples of wind farm fires in Australia and overseas, and the key policy documents outlined in chapter 5 of this report.

7.1 Bushfire risk during construction

Due to the presence of ignition sources including hot works, increased vehicle traffic and difficulties with keeping vehicles off vegetated areas the risk of a fire starting during construction is always present. An example of this is the Parry Sound 33 forest fire[9] in Ontario Canada (July 2018) was ignited by wind farm construction during extreme heat and on a fire ban day. The weather was dry, the fuels volatile and workers took unnecessary risks to stay on schedule, despite the fire risk. A number of other fires were also ignited during construction but were controlled.

7.2 Bushfire risk during operation

7.2.1 Power line fires

Power transmission lines, which connect the wind farm to the power grid, can arc or come into contact with falling trees or branches and cause a bushfire. The Victorian Bushfires Royal Commission identified powerline failures during severe weather to have caused several of the Black Saturday fires and their recommendation #27 related to placing power lines underground in bushfire prone areas to mitigate future bushfires. All powerlines with the DWF proposed development will be located underground.

7.2.2 Turbine fires

Research[10] indicates turbine fires can be ignited by lightning strike (such as a Wonthaggi wind turbine in 2012 where lightning struck the blade of a turbine but did not ignite a fire[11]), electrical malfunction (Lake Bonney Wind Farm fire in 2006[12]), mechanical failure and maintenance errors.

The installation of fire protection systems can prevent or minimise turbine fires. Passive systems include lightning protection systems[13], radiant heat barriers, the use of non-combustible insulating materials, replacing 'hot' procedures such as welding with 'cold' procedures such as cold bonding and regular maintenance checks. Active systems include fire detection and alarm systems, smoke management and suppression systems.

Of the approximately 300,000 wind turbines in the world, there are a total of around 50 turbine fires occur each year (a rate of 1:6000)[14]. The research indicates most turbine fires occur in older turbines where fire protection systems are not installed. Of the known number of turbine fires, only a very small number result in fires in the surrounding scrub or grass vegetation.

North American examples of turbine fires causing vegetation fires are:

- Rhodes Ranch 3 Fire[15] in Mulberry Canyon south of Merkel (August 28, 2019), which burnt about 250 acres.
- Washington Turbine fire blaze[16] (July 22, 2019), which was caused by molten sections of the turbine falling to the ground and burnt more than 350 acres.
- Juniper fire in Klickitat County (21 July 2019), which was suspected to be sparked from a wind turbine fire and burnt around 253 acres.

Australian examples are:

- Currandooley Bushfire near Canberra[17] (17 January 2017), burnt around 3,400 hectares. This fire was caused by a crow hitting a windfarm powerline and was not a wind turbine issue.
- Lake Bonney Wind Farm (also known as Canunda Wind Farm) fire[18] at Tantanoola, South Australia (22 January

[9] https://www.cbc.ca/news/canada/parry-sound-wildfire-wind-farm-1.4930354
[10] https://www.iafss.org/publications/fss/11/983/view/fss_11-983.pdf
[11] http://www.windaction.org/posts/33470-lightning-hits-wind-turbine#.XW3r-IVOKM8
[12] https://www.iafss.org/publications/fss/11/983/view/fss_11-983.pdf
[13] https://www.nachi.org/wind-turbines-lightning.htm
[14] https://www.renewableenergymagazine.com/wind/gcube-launches-unique-report-into-wind-turbine-20151117
[15] https://www.wind-watch.org/news/2019/08/28/wind-turbine-blamed-for-rhodes-ranch-3-fire-in-mulberry-canyon-south-of-merkel/?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+NWW-News+%28National+Wind+Watch%3A+News%29
[16] https://www.oregonlive.com/pacific-northwest-news/2019/07/southern-washington-blaze-caused-by-wind-turbine-that-caught-fire-now-30-contained.html
[17] https://stopthesethings.com/2018/02/06/wind-farm-neighbours-burnt-out-by-bushfire-sparked-by-infigen-pursue-millions-in-nsw-supreme-court/

2006) was the result of a turbine fire ignited by an electrical failure during a heat wave. It burnt 80,000 ha of national park and suppression resources included firebombing aircraft.

- Cathedral Rocks Wind Turbine Fire, Port Lincoln South (3 February 2009) ignited due to unknown causes but burnt only a small surrounding area of scrub.

The AFAC guidelines indicate:

- Turbine towers are not expected to start fires by attracting lightning.
- Turbines can malfunction and start fires within the unit. Automatic shutdown and isolation procedures are installed within the system. Although such fires may start a bush fire within the wind farm, planning for access and fire breaks can reduce the likelihood of the fire leaving the property. This risk from such fires is less than that of many other activities expected in these rural environments.
- Extra guidance is provided for windfarms being developed in fuels other than grassland

7.3 Potential impacts on bushfire suppression operations

7.3.1 Risk from an approaching bushfire

Wind farms may be exposed to damage from approaching bushfires. Examples include:

- Starfish Hill (October 2010)
- The Bluff Wind Farm in South Australia (29 December 2011), which was approached by a grass fire started by lightning. However, an access road constructed for the wind farm was used as a fire control line and the fire spread halted (see photo overleaf).
- Waterloo Wind Farm[19] in South Australia's Gilbert Valley region (January 2017) was approached by a grass fire that started about a half a kilometre west. Again, the access track was successfully used as a control line and firebombing aircraft were used.

These examples provide evidence that wind farms can provide access roads to often inaccessible areas and their cleared areas provide staging areas for firefighting.

Figure 23 - The Bluff Wind Farm with fire impacts adjacent to turbines

[18] https://www.iafss.org/publications/fss/11/983/view/fss_11-983.pdf
[19] https://ramblingsdc.net/WindTurbineFires.html#Aerial_fire-fighting_and_wind_turbines

7.3.2 Impact on fire bombing

The AFAC Wind farms and Bushfire Operations document notes the following precautions that need to be taken with firebombing:

- Wind monitoring towers associated with wind farm investigations and planning can be very much taller than the planned turbines and can be less visible. The location and height of monitoring towers should be noted during aerial firefighting operations.
- Aerial firefighting operations will treat the turbine towers similar to other tall obstacles. Pilots and Air Operations Managers will assess these risks as part of routine procedures. Risks due to wake turbulence and the moving blades should also be considered. Wind turbines are not expected to pose unacceptable risks.

The South Australian Country Fire Service (CFS) Guidelines for Wind Farms[20] supports the use of fire bombing, subject to a risk assessment, and as part of an integrated plan to support ground resources.

Waterloo Wind Farm[21] in South Australia's Gilbert Valley region (January 2017) was approached by a grass fire that started about a half a kilometre west and burned to the top of the ridge where the wind turbines are. The turbines were paused by the wind farm operators and the water bombing aircraft flew wherever they were needed, sometimes between the turbines. This may have been the first bushfire in Australia at a wind farm where firebombing aircraft were used.

The wind farm operators made some learnings regarding fire preparedness, including:

- Practicing communications practices advising state air-desk (who control aerial firefighting assets)
- On site asset management/operations centre control procedures to pause, brake and 'lock' individual turbines
- Best practice approaches to support aerial and ground based responses
- Water storage point signage, access track markings and site mapping.

Figure 24 – Air Tractor firebombing around wind turbines, Waterloo South Australia

[20] https://www.nwfc.gov.au/sites/default/files/cfs-guidelines-wind-farms.pdf?v=1484179504
[21] https://www.cleanenergycouncil.org.au/news/in-case-of-fire-a-real-life-experience-at-a-wind-farm-site

A more recent fire at the Waubra Wind Farm in Western Victoria on Friday 19th January 2018 is another example of how integrated firebombing within the wind farm environment worked effectively with ground resources to halt the spread of fire.

Twelve aircraft and 24 firefighting vehicles worked to control the 42 hectare fire over 2 hours.

Figure 25 – Air Tanker firebombing around wind turbines, Waubra Wind Farm, Victoria

7.3.3 Other firefighting considerations

The AFAC guidelines indicate:

- Wind farms are not expected to adversely affect fire behaviour in their vicinity. Local wind speeds and direction are already highly variable across landscapes affected by turbulence from ridge lines, tall trees and buildings.
- Wind farms can interfere with local and regional radio transmissions by physical obstruction and radio frequency electromagnetic radiation. Any interference can be minimised or eliminated though appropriate turbine siting at the planning stage and by moving away from the tower if experiencing local interference during operations.
- Wind farms are an infrastructure development that must be considered in the preparation of Incident Action Plans for the suppression of bushfires in their vicinity. These considerations are routine and wind farms are not expected to present elevated risks to operations compared to other electrical infrastructure.

8 BUSHFIRE RISK ASSESSMENT NATIONAL FRAMEWORK, METHODOLOGY & MATRIX

8.1 NERAG

The *Delburn Wind Farm Bushfire Risk Assessment & Mitigation Plan* has been designed to meet the guidance set out in the National Emergency Risk Assessment Guidelines (NERAG), issued by the Australian Attorney General's Department in 2015.

NERAG is a useful tool for measuring bushfire risk as it provides methodology tailored to the Australian context. This framework is also built around international standards and best practice, being AS/NZS ISO 31000:2009.

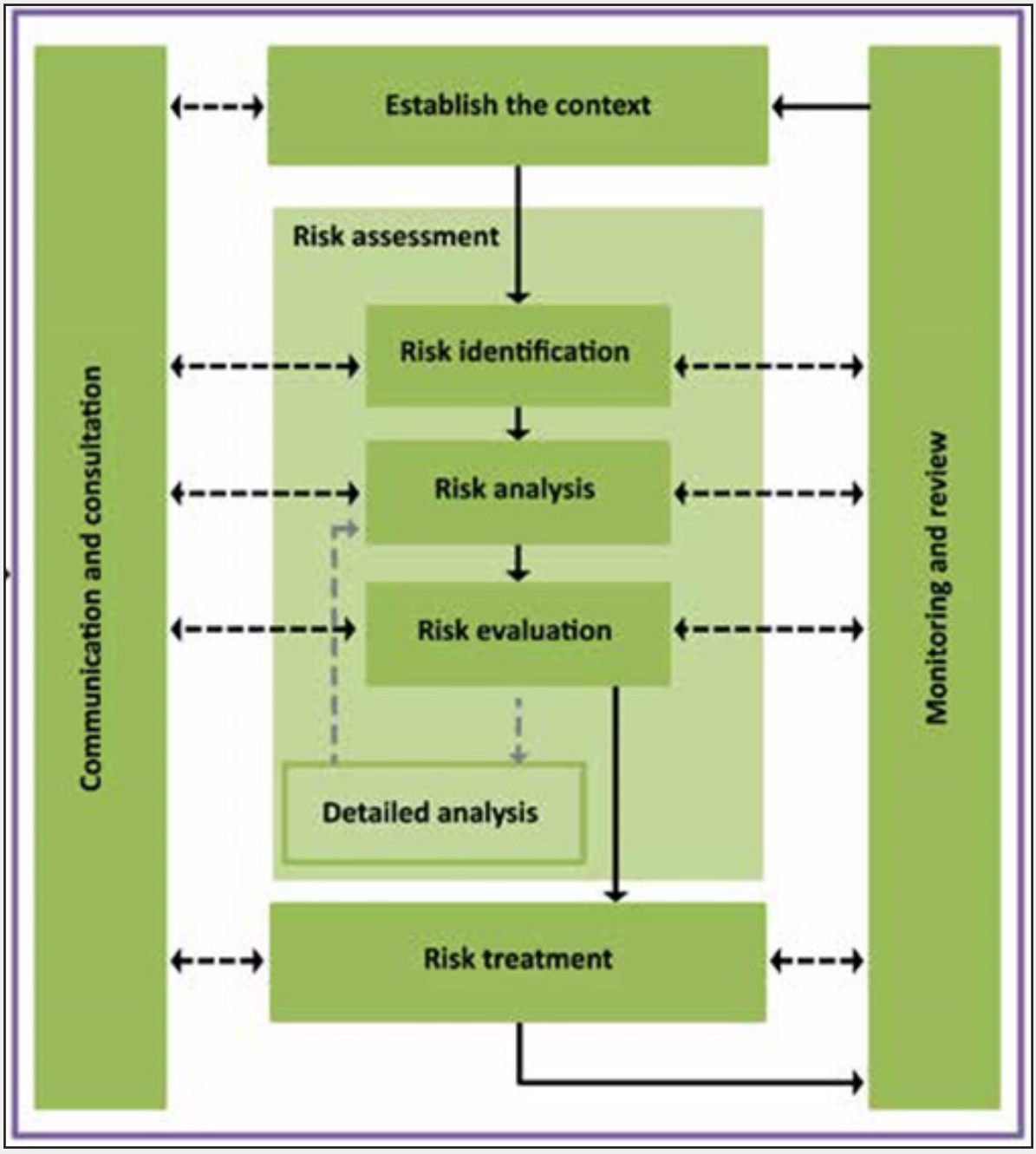

Figure 26 – The emergency related risk management process (NERAG, Attorney General's Department, 2015)

8.2 FRC methodology

The methodology for the bushfire risk assessment included:

- Desktop analysis of relevant existing data and reports associated with the site
- Existing conditions analysis including overall fuel hazard analysis, plantation age and Phoenix predictive modelling to determine base conditions
- Review of legislative framework for the study area including a review of fire agency legislation.
- Consultation with relevant government stakeholders including the Country Fire Authority
- Identification of measures to avoid, mitigate or manage identified impacts. Review of relevant legislation, planning policy, strategic bushfire management planning to understand the regulatory and planning context for bushfire prevention and responses in the study area
- Collation and assessment of relevant data on fire weather conditions, fire history, bushfire prone areas, vegetation, topography and assets at risk from existing sources
- Review of the proposed design for the wind farm, the layout of operations and activities that could pose a risk from a bushfire perspective
- Identification of bushfire hazards for the proposal and those arising from development and operation of the proposed wind farm for communities and the environment in surrounding areas
- Detailed site assessment to understand site conditions influencing bushfire risk and its management. This included bushfire fuel hazard, topography, access and surrounding land uses and vegetation types
- Identify bushfire response capability in the vicinity of the site and potential for adequate response to a bushfire event on the site
- Identify egress routes from the area and the adequacy of these in relation to potential bushfire risk
- Consultation with a regional CFA representative on their requirements for bushfire risk management and potential impacts to this from quarrying activities.
- Review and refinement of bushfire risk controls on the basis of the site assessment and CFA discussions
- Development of a preliminary set of preventative (which seek to avoid bushfire ignitions) and mitigating (which seek to reduce the effects of fire once it has been ignited) bushfire risk controls for the proposal.

8.3 Bushfire Risk Assessment Matrix

The Bushfire Risk Assessment Matrix on the following pages has been conducted utilising all available information. It acknowledges that a level of bushfire risk is present already in the plantations and that the proposed development is analysed from a perspective to define if there is a net increase in the bushfire risk with the development. Some strategies to reduce bushfire risk identified by FRC do not sit under the control of the DWF or HVP.

8.4 Benefits and opportunities

Benefits of the project to reduce bushfire risk generally include:

- An increased awareness of bushfire risk in the development area and to collaboratively work to reduce bushfire risk across a broad landscape, including land managed by the Crown, HVP and other freehold property owners
- Alignment with Stage Government policy through Safer Together of a tenure blind approach to bushfire risk mitigation and initiatives

Identified opportunities to reduce bushfire risk include:

- The creation of an improved and enhanced fire access track network allowing fast and expedient access to the site for first responding firefighters and day to day maintenance of the asset
- Greater surveillance of the area, including the remote monitoring of the landscape through cameras installed across the network
- Increased numbers and presence of OSMI and HVP personnel accessing the wind farm and plantation areas generally.

RISK TO	Cause	Likelihood	Justifcation	Consequence	Justification	Risk	Strategy to Lower Risk
LIFE							
DWF on-site staff & contractors, HVP staff and fire agency firefighters	Loss of life / injury due to entrapment in the wind farm estate in a major fire event	Possible	Fire behaviour could be unpredictable for direct attack suppression and may entrap fire-fighters. An internal track network at some locations which may lead to confusion. Spotting in pine plantations is possible, but less likely to occur than in native vegetation. Some wind farm landscape features include steep slopes and adjoining vegetated areas on private property with native forest In the event of smoky conditions in the wind farm estate, people's sense of direction could be affected	Major	While entrapment may only be possible, if it does occur there is potential for loss of life.	HIGH	Fire fighters from HVP, CFA and FFMVic to be briefed by an experienced person and must be made aware of risks and provided with up to date maps showing track locations. DWF and HVP maintain all tracks to a minimum of CFA & FFMVic standards. Local CFA Brigades undertake annual inspection to become familiar with access and egress to the sites, access difficulties for larger appliances, areas restricted to smaller fire appliances. All fire-fighters shall have a Minimum Skills qualification and maintain situational awareness when undertaking fire suppression operations. CFA & FFMVic reinforces safe work practices SOP's at all briefings. HVP have the ability to close the estate in the event that they deem the risk to life from an emergency event including a bushfire is too high. All DWF employees and contractors must carry firefighting equipment along with communications devices during the FDP. An agreed position will be established between HVP and DWF that determines when operations will cease in relation to the forecast FFDI The vegetation management arrangements for the turbines will allow for some level of sheltering to occur in the event that a crew or person is not able to self-evacuate from the Estate. Site compounds will have available static water supply of 22,000 litres as a minimum.

RISK TO	Cause	Likelihood	Justifcation	Consequence	Justification	Risk	Strategy to Lower Risk
LIFE							
Neighbours: Surrounding the HVP & Delburn Windfarm estate, particularly to the south and east of the wind farm.	Loss of life/ injury due to smoke or fire escaping the pine plantation.	Possible	There is a risk that wildfire may move from some of the higher risk areas and threaten surrounding homes. Some houses and properties appear to be not adequately prepared for living in a high bushfire risk environment.	Major	Fatalities possible under elevated FDI's if residents leave too late or if properties are unprepared.	HIGH	CFA Community Safety Department to encourage residents to prepare Bushfire survival plans as per CFA standard practice and prepare themselves for bushfire. CFA to encourage residents to maintain Community Fireguard action groups and schedule pre-season meetings. DWF, HVP & CFA to update surrounding residents on pre-summer fire prevention and preparedness activities. Surrounding properties to adequately prepare for fire. HVP and DWF to continue to understand the relationship between its Estate and the adjoining land in the context of bushfire prevention and suppression. The road layout for the wind farm Estate where possible will be utilised to limit bushfire spread and support suppression activities. HVP and DWF continue to influence fire management planning treatments that are defined within the Latrobe Municipal Fire Management Plan.

RISK TO	Cause	Likelihood	Justifcation	Consequence	Justification	Risk	Strategy to Lower Risk
LIFE & ASSETS							
Adjoining Public Land Recreational Users.	Loss of life / injury due to entrapment on roads and recreational sites in a major fire event.	Possible	Recreational users on adjacent Public Land are not always with their vehicle and may be some time away from a safe mode of transport. Evacuation of visitors from surrounding Public Land in the event of a fire is possible as there are normally multiple access points into the Public Land estate.	Major	Visitors on foot may become disoriented if in the HVP estate during fire due to smoke, fatalities may occur.	HIGH	Land managers continue to enact closure protocols to the recreational facilities on identified high risk days In the event of bushfires in the Estate, HVP close the area to prevent or limit visitors. DWF and HVP develop interpretation displays covering bushfire awareness at wind farm visitor information centre entrance. Public Land managers & HVP continue to use evacuation points for recreational users. Visitors, DWF & HVP staff and contractors should seriously consider the risk of being in the HVP estate during days of significant fire danger. HVP assets do not permit recreational users.
DWF & HVP Assets (excluding softwood & hardwood plantations): Towers, turbines, fencing, signs, roads, car parks, bridges, drainage infrastructure and other built assets.	Loss of/ damage to DWF & HVP infrastructure due to radiant heat and direct flame contact.	Likely	Part of the assets constructed from flammable material. Distance between plantation vegetation and the blades is approximately 60 – 70 metres On high FDI days, the flame length or significant radiant heat could impact on the blade.	Moderate	Assets will need to be re-established at a cost to DWF & HVP.	HIGH	DWF & HVP to maintain database of known assets and maintenance register. DWF & HVP to undertake protection of assets and adopt bushfire asset protection strategies. DWF to consider upgrading assets with less flammable materials. HVP to name all fire access tracks and have clear directional signage as per PV / FFMVic standards. DWF to have a detailed understanding of the likely heat impacts onto the blades and towers. Consideration provided to making the Nacelle ember proof to limit any impact.

RISK TO	Cause	Likelihood	Justifcation	Consequence	Justification	Risk	Strategy to Lower Risk
ASSETS / ECONOMY ENVIRONMENT							
Whole Delburn Wind Farm precinct.	Loss of whole precinct due to major fire event.	Possible	Bushfire fuel is present in plantations. History of arson and malicious fire ignitions. History of bushfire starting from lightning strikes.	Moderate	Environmental impact, particularly in riparian areas, local impact on habitats. Local death & short-term displacement of species. Nature of high value development in forest vegetation.	HIGH	HVP to continue to monitor plantations post bushfire, develop strategies to manage negative environmental response. HVP & DWF consider future revegetation projects that don't contribute to bushfire risk in the future, by increasing setback distances. DWF and HVP maintain all strategic access tracks to CFA and FFMVic standards, particular attention to areas of elevated bushfire risk. DWF, HVP and CFA to meet pre bushfire season to discuss reducing bushfire spread and potential impacts. DWF, HVP to facilitate an annual pre-season familiarisation meeting with local CFA Groups & Brigades DWF & HVP to review the fire management risks in the area annually. The introduction of the new road network is designed with bushfire prevention and suppression strategies in mind. Consider surveillance type systems around the towers that can act as a deterrent for malicious activity.

9 RECOMMENDATIONS

Recommendations made by FRC Pty Ltd is this section currently exceed the guidance provided by CFA and AFAC in the proposed wind farm development.

9.1 Recommendations for the construction phase

FRC has made 21 recommendations to guide DWF Pty Ltd during the construction phase of the DWF development. They are:

1. Ensure all activities undertaken during the Fire Danger Period are appropriate under the *Country Fire Authority Act 1958*, including:
   - compliance with Total Fire Ban Day restrictions
   - obtaining permits for any "hot work" activities
2. Adhere to CFA's *Guideline for Renewable Energy Installations (February 2019)*
3. Ensure all Staff, Contractors and site visitors are informed of fire response procedures that follow identified legislative requirements, policies and procedures
4. Ensure that all works during the declared Fire Danger Period have appropriate permits from Local Government and CFA
5. Ensure that all Construction and operational works follow appropriate Work Health and Safety requirements
6. Develop a "Bushfire Management Plan" to consolidate recommendations
7. Facilitate a high standard of communication with landowners, relevant stakeholders and the community regarding daily activities via a 'steering committee' or the like and an appropriate communication plan
8. Establish a primary contact person for the community to contact with concerns, questions or issues
9. Ensure all contractors:
   - Are appropriately briefed and understand their legal obligations in relation to managing bushfire risks
   - Have appropriate procedures, Safe work practices, contingency plans, MSDS for operation of all equipment, chemicals, flammable materials that may contribute to bushfires.
   - Have appropriate "initial" suppression equipment available on site
10. Considers a policy of "no work" on declared Code Red Fire danger days
11. Provide appropriate bushfire training for contractors and staff
12. Establish an APZ around each turbine and consider other zoning strategies to assist bushfire mitigation
13. Ensure all building construction is in line with all regulations and codes of building in bushfire prone areas and AS 3959
14. Ensure appropriate bunding in areas where there is potential for flammable fuels and oils to leak and create bushfires or other environmental risks
15. Ensure all access roads and tracks are identified and meet CFA & FFMVic Guidelines for emergency vehicle access
16. Consider appropriate signs to assist emergency response crews determine track names, location and turbines etc.
17. Establish emergency assembly areas
18. Consider the option to have all power lines underground
19. Consider security fencing around turbines and substations to prevent public access
20. DWF Pty Ltd provide fire suppression capability, in addition to HVP resources, to enhance response in the development area
21. Current static water supply locations in the HVP estate are assessed for their suitability to be increased in size to support aerial firefighting operations in the future.

9.2 Recommendations for the operational phase

FRC has made 15 recommendations to guide DWF Pty Ltd during the operational phase of the DWF development. They are:

1. Install fire detection systems, in built fire protection and suppression systems, remote alarming and notification systems in turbines to report potential bushfire risks
2. Provide cameras on the turbines to increase situational awareness across the landscape
3. Adhere to CFA's *Guidelines for Renewable Energy Installation (February 2019)*
4. Establish remote shut down procedures for turbine operations during bushfires or reported faults, or at the request of the emergency services.
5. Install lightning conductors to dissipate electricity to ground and reduce turbine damage and bushfire risk
6. Undertake regular inspections and maintain records of all turbines, the substation, and power lines (including easements)
7. Develop bushfire preparedness audits to record all "annual" fire danger season preparedness activities and prevention works
8. Develop a bushfire response plan, including a communications plan
9. Ensure suitable firefighting equipment is available onsite or readily accessible (as per response plan)
10. Ensure staff and contractors are trained in the use of firefighting equipment and have appropriate personal protective clothing
11. Ensure the maintenance of APZs around turbines and buildings
12. Ensure all access roads and tracks are maintained to meet industry standards for emergency vehicle access
13. Ensure DWF management vehicles carry firefighting water and basic fire equipment during the declared Fire Danger Period
14. DWF to develop an induction package for CFA & HVP containing all relevant information on the wind farm operations, including specific bushfire response information
15. Install static water supplies at strategic locations across the DWF proposed development in at least three locations (north site, central site and south site, minimum 100,000 litres at each location).

9.3 Recommendations for assist bushfire operations

FRC has made 5 recommendations to guide DWF Pty Ltd and the fire agencies during fire sppression operations at the DWF development. They are:

1. Develop a response plan and suppression strategies to assist firefighters understand the risks associated with fires in turbines
2. Liaise with the local CFA Brigades and Groups to assist with familiarising them with DWF operations and infrastructure
3. Provide liaison person to support incident management during bushfires
4. Respond to instructions and follow all advice from CFA, HVP and FFMVic during incidents
5. Shut down turbines in vicinity of reported fire

In addition, the CFA, HVP and FFMVic to ensure all responding crews, including aircraft:

- Continue to encourage a safety first culture
- Follow organisational policies and procedures
- Regularly undertake dynamic risk assessments
- Undertake pre-season familiarisation for local crews with new access roads and tracks, infrastructure sites, evacuation points and safe zones, low fuel areas and natural firebreaks

10 REFERENCES

Code of Practice for Bushfire Management on Public Land can be found here: https://www.ffm.vic.gov.au/__data/assets/pdf_file/0006/21300/Code-of-Practice-for-Bushfire-Management-on-Public-Land.pdf

DELWP Measuring Bushfire Risk in Victoria http://www.delwp.vic.gov.au/__data/assets/pdf_file/0009/318879/DELWP0017_BushfireRiskProfiles_rebrand_v5.pdf

DELWP Overall Fire Hazard Assessment Guide (4th edition July 2010) https://www.ffm.vic.gov.au/__data/assets/pdf_file/0005/21110/Report-82-overall-fuel-assess-guide-4th-ed.pdf

Emergency Management Manual Victoria, including Part 6 Municipal Emergency Management Planning Arrangements - Guidelines for Committees be found at: https://www.emv.vic.gov.au/policies/emmv

Fire Danger Rating information can be found on the CFA website at http://www.cfa.vic.gov.au/warnings-restrictions/total-fire-bans-and-ratings/

Information on fire restrictions and Total Fire Bans can be found at: https://www.cfa.vic.gov.au/warnings-restrictions/can/

Information on the responsibilities of public authorities and owners and occupiers of land can be found at http://www.cfa.vic.gov.au/about/who-does-what/

Safer Together information can be found at: https://www.safertogether.vic.gov.au/background

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Cruz M.G., Alexander, M.E., Plucinski, M.P. (2017) The effect of silvicultural treatments on fir behaviour in radiata pine plantations of South Australia. Forest Ecology and Management 397 (2017) pp. 27-38.

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Royal Commission 2009 Delburn Bushfire http://royalcommission.vic.gov.au/Finaldocuments/volume-1/HR/VBRC_Vol1_Chapter03_HR.pdf

CFA (2009) Investigation Report Traralgon East Tanker 1- 30 January 2009-Delburn Fire Complex http://royalcommission.vic.gov.au/getdoc/2cc427e1-ae24-4790-89612fd7686d9f27/WIT.3004.032.0091.pdf

Sutton M. (1984) Extraordinary flame heights observed in pine fires on 16th February 1983 Australian Forestry 1984 Vol47(3) pp199-200

https://www.smh.com.au/environment/researchers-confirm-first-fire-tornado-during-2003-bushfires20121119-29liv.html

APPENDIX A - DWF/HVP OPERATIONAL PROTOCOLS

Relevant extracts from the DWF / HVP Operation Protocols February 2019 Version 1:

4.2 Project Design

To facilitate the movement of aircraft around the site, especially firebombing aircraft, tall structures such as wind monitoring towers and turbines should be spaced no closer than 300 meters apart.

4.4 Aerial spraying, inspection and firefighting

d) In the event of an emergency event involving aerial operations (i.e. aerial firefighting, air ambulance), GRP shall notify OSMI and/or the site operations team as soon as possible and the shutdown procedure shall be implemented as soon as practicable following the notice.

5.1 GRP fire protection guidelines for forest operations

GRP prepare and annually review Fire Protection Guidelines for Forest Operations which apply to land managed by GRP.

Sections of the guidelines that are relevant to the project Works have been summarised in this Section 0 below; however, if there are any inconsistencies with the GRP guidelines, the guidelines are to supersede this summary.

5.1.1 Forest Operations Restriction Period

All contractors on land managed by the GRP are required to provide appropriate fire equipment and follow work practices and fire restriction guidelines at all times during the Forest Operations Restriction Period or whenever there is a likelihood of the spread of fire.

The Forest Operations Restriction Period - commences on 1st December each year or earlier if the fire danger period has been declared by the CFA. The Forest Operations Restriction Period shall continue whilst either the fire danger period or the prohibited period are in force or may be extended if necessary, by GRP.

5.1.2 Fire equipment

a. All OSMI personnel and contractors must provide firefighting equipment as specified in Table 3 at all times during the Forest Operations Restriction Period and outside of this period where the weather conditions in the area are such that there is a reasonable possibility of the spread of a fire.

Table 3: Firefighting equipment requirements

Item	Vehicles	Plant
Extinguisher	1.0 kg AB(E)	9L stored pressure water extinguisher on hand or a 9L knapsack fully charged and in working order on hand plus 4.5 kg AB(E) or inbuilt extinguisher (> 4.5 kg AB(E))
Water supply		
Rake hoe	Rake hoe	Rake hoe
Communications	UHF Radio or mobile telephone	

b. Requirements for fire extinguishers are guided by:

- AS 2444-2001 Portable fire extinguishers and fire blankets – selection and location;
- AS 5062–2006 Fire protection for mobile and transportable equipment;
- AS 1851–2012 Routine servicing of fire protection system and equipment; and
- MFB Fire Safety Guideline GL–16 Selection, installation and maintenance of portable fire extinguishers.

Fire extinguishers must be in a reasonably accessible location and be ready for use by simply removing a pin or similar. Every fire extinguisher must have a current tag or sticker attached that is legible and indicates the date of the most recent test. The test tag must have been punched or signed and dated by an authorised inspector within the last 6 months +/- 1 month. No other system is acceptable.

All persons must know the location of the fire extinguisher, the type fitted and its application and be trained in the use of the fire extinguishers.

c. During the Forest Operations Restriction Period an approved mobile firefighting unit must be located at each work front whilst construction related activity is in progress. A mobile firefighting unit shall:

i. have a minimum capacity of 400 litres;

ii. be fully charged with water;

iii. have a minimum of 30 metre length of 19mm hose connected to a nozzle and minimum 5 H.P. pump;

iv. be capable of delivering a steady stream of water to any point where operations are taking place.

It shall be noted that GRP preference a mobile unit to be vehicle based, such as the units used by HVP staff. These are 300L or 400L units, pump, hose and assoc. equipment on the back of a Landcruiser or Hilux tray ute ("slip-ons").

d. Firefighting equipment must be in good working order

7.1 Emergency Response

a. OSMI must prepare and maintain a Project Emergency Response Plan (ERP) in consultation with GRP. The ERP shall not be inconsistent with the GRP Gippsland Emergency Management Plan and shall be reviewed on an annual basis.

b. To facilitate effective emergency communications between GRP, CFA and OSMI, OSMI site permanent staff vehicles shall have installed at least one (1) radio capable of communicating on all CFA/FFMV fire agency channels along with the HVP trunk radio network, and one (1) 80 channel UHF CB radio.

7.2 Emergency Participation

a. Staff based permanently on-site for the construction and/or operation of the Project will be strongly encouraged to participate with local emergency response groups (i.e. CFA and SES) in order to provide site familiarity, technical expertise and added resource support in the event of an emergency event on or near the Project site.

APPENDIX B - PILOT TESTIMONIAL

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As a helicopter pilot with over 20 years' experience in firefighting aviation, I have spent significant time operating helicopters immediately adjacent to wind farm towers within the Australian landscape.

Wind farms are often perceived as creating additional and unique risks to low level aircraft operations, in my opinion this is simply not the case.

I have flown in and around operating wind towers both on the upwind and downwind side and have experienced no operationally significant effects of the structures through altered wind patterns or turbulence.

Wind towers in my opinion create no additional risk when compared to other large infrastructure, they are simply another obstacle to be avoided in flight. The towers pose no significant threat from a visibility perspective and are easy to see from the air. The surrounding infrastructure such as meteorological masts, powerlines and guy wires in the vicinity of the towers pose no more threat than similar assets found at any other major power generating resource.

The Australasian Fire and Emergency Service Authorities Council released a document in 2018 titled "Wind Farms and Bushfire Operations". The recommendations contained within this document developed following on from the bushfire incident experienced at the Waterloo Wind Farm in South Australia include:

- Turbines to be immediately shut down and locked in the Y position;
- Identification of meteorological masts, powerlines and guy wires (i.e. marker balls)

I consider these tactics to be sufficient to reduce the risks posed by operating in the vicinity of the towers to a completely acceptable level and the towers would cause no limitations to our firefighting capability.

Additional methods that could be considered would be:

- To produce a map of all existing infrastructure within the wind farm that could pose a threat to aviation operations that can easily be provided to pilots operating in the area (ideally both .gpx and .kml format to allow upload into commonly used navigation apps);
- To identify all available water sources in the area to ensure that the location of those that may be used for waterbombing uplifts enable pilots to select one, that regardless of the direction of approach of the fire, does not compel them to traverse back and forth across the line of towers during operations.

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