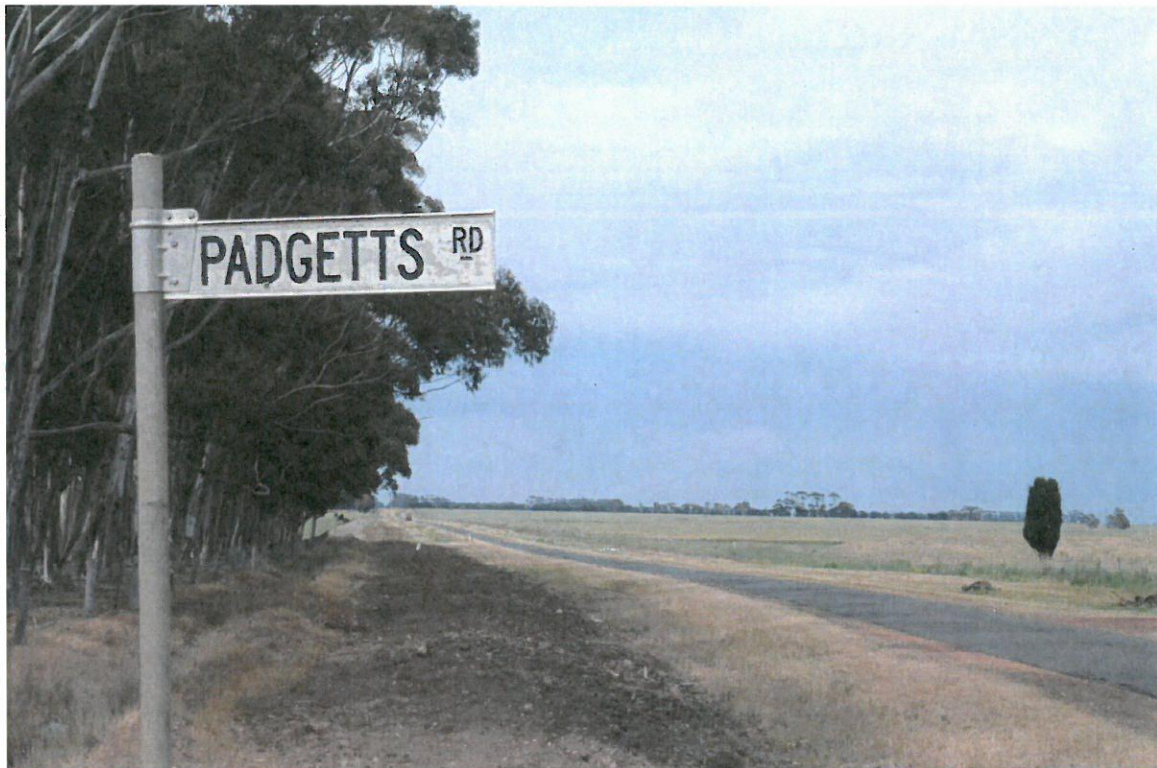


PLANNING AND ENVIRONMENT ACT 1987
PLANNING SCHEME Golden Plains
PERMIT NO. PA1700309
ENDORSED PLAN
SHEET 1 OF 14
SIGNED _____ FOR _____
MINISTER FOR PLANNING
DATE: 28/6/19

ENDORSED TO COMPLY
WITH CONDITION
10
OF PLANNING PERMIT
PA1700309

Bushfire Management Plan Berrybank Wind Farm External Power Line and Substation



Date: 30 May 2019

prepared by:

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Table of Contents

1 Overview.....	4
1.1 Consultation with authorities.....	4
1.2 The Operation of this Document.....	4
2 Location.....	4
2.1 The Site.....	4
2.2 Vegetation profile and topography.....	5
2.3 Road network.....	5
2.4 Water dams.....	5
2.5 Bushfire Management Overlay (BMO) and Bushfire Prone Area (BPA).....	5
2.6 Fire Brigade classifications and response times.....	6
3 Worst-case scenarios.....	6
3.1 Scenario No 1.....	6
3.2 Scenario No 2.....	7
3.3 CFA Response.....	7
4 CFA Emergency Management Guidelines for Wind Energy Facilities – August 2017’ (CFA Guidelines).....	7
4.1 Siting (CFA Guidelines – section 1).....	7
4.2 Access (CFA Guidelines - section.....	7
4.3 Water supply (CFA Guidelines – section 4).....	8
4.4 Fire risks during construction – (CFA Guidelines - section 7 and 8).....	8
4.5 Awareness and training for emergency services (CFA Guidelines – section 9).....	9
4.6 Fuel / Vegetation Management (CFA Guidelines – section 10).....	9
Appendix A – Required safety features during the fire danger period.....	11
Appendix B – Grass fire research into the performance of fire breaks.....	13

1 Overview

This Bushfire Management Plan (BMP) has been prepared by My Emergency Management Pty Ltd (MyEM) and commissioned by Berrybank Development Pty Ltd for the Berrybank Wind Farm external powerline / substation connection and surrounding landscape (**Site**). The utility installations associated with Berrybank Wind Farm was approved by the Minister for Planning on the 5 March 2018 under Planning Permit PA1700309. The permit allows the use and development of a utility installation, removal of native vegetation, and creation of access to a Road Zone Category 1.

This BMP has been prepared to satisfy the requirements of Condition 10 of Planning Permit PA1700309, which reads as follows:

‘Before development starts, a bushfire management plan is to be developed in consultation with the Corangamite Catchment Authority, to the satisfaction of and to be endorsed by the responsible authority. When endorsed the plan will form part of this permit. The bushfire management plan is to reflect the requirements of the CFA Emergency Management Guidelines for Wind Energy Facilities – August 2017’.

1.1 Consultation with authorities

As required by the planning permit requirements, the following relevant authorities were consulted to inform the preparation of this plan:

- Corangamite Catchment Management Authority
- Country Fire Authority

1.2 The Operation of this Document

This document is a ‘live’ document, which will be periodically reviewed and updated as required. Updated versions will be circulated to:

- Corangamite Catchment Management Authority
- CFA (South West Region District 6 Headquarters, and any local brigades as specified by the CFA);
- Corangamite Shire Council’s Municipal Emergency Management Committee;
- Available online on the windfarm website.

2 Location

The Berrybank Wind Farm is located in south-western Victoria, approximately 14km east and 16km west of Cressy. The Site is within the Golden Plains Council area.

Berrybank and surrounding district including the Site is a rural settlement with isolated buildings and zoned farming under the Golden Plains Municipal Planning Scheme. The Hamilton Highway is approximately 10.4km from and south of the Site.

2.1 The Site

The Site land use is currently agricultural land with a substation and switchyard proposed to be located approximately 1.3km north of Lismore-Scarsdale Road and will be connected to an overhead 220KV transmission line from the Berrybank wind farm. There is currently an existing Ballarat-Terang 220KV overhead transmission line running from north-east to south-west through the Site.

The Site is bounded by the following roads:

- Crambs Road - North of Site,
- Calverts Road - West of Site,
- Carrolls West Lane – South to South East of Site
- Lismore-Scarsdale Road – South of Site, and
- Willowvale Road – East of Site.

2.2 Vegetation profile and topography

The adjoining land to the north and west, which is where an external grass and/or crop fire is most likely to threaten the Site is a mixture of agriculture including cropping of canola, wheat, other cereals and grazing pastures for sheep and cattle.

The grazing pastures are mainly native perennial grasses with some isolated native trees located sparsely across the landscape. The grazed pastures (i.e. Phalaris) has a heat yield of between 13,700 and 13,900 kJ/kg based on a moisture content of 10 with a fuel load of between 2 and 5 tonnes per hectare (t/ha) depending on the time of year.

The Site is currently used as agriculture land, is predominantly flat with some undulating landscape and will be served by a single gravel access road from Lismore-Scarsdale and Padgetts Road.

2.3 Surrounding road network

The following lists the roads surrounding the Site, their dimensions and road reserve fuel type and load to assist with determining their suitability for use as fire breaks:

- Crambs Road – 4m bitumen rd plus 15m road reserve extending to 7m bitumen and 14m road reserve. Vegetation to the north is mainly grazed pasture (sheep),
- Calverts Road – 8m gravel rd plus 11.5m road reserve. Vegetation to the west is grazed pasture (sheep), to the east is wheat cropping,
- Carrolls West Lane – 4m gravel road plus 14m road reserve with individual isolated clumps of gum and pine trees. Vegetation immediately to the south is grazed pasture (by sheep transitioning to cropping after 430m to 550m
- Lismore-Scarsdale Road – 6.5m bitumen rd plus 31.5m road reserve. Vegetation is mainly cropping to the south, and
- Willaway Road – 4m bitumen rd plus 30m road reserve. Vegetation is cropping to the west and grazed pasture to the east

All road reserves are predominantly native grasses which had been slashed to varying width (minimum 2m) at the time of my inspection which reduces the grass fuel load to less than 2t/ha and fire line intensity. There are isolated trees along some parts of the road reserve but are the exception and not rule.

2.4 Water dams

Based on an analysis of Google Earth photo dated December 2016 and my own ground observations, there were approximately 21 dams within the land detailed above which would be suitable to supply water for firefighting operations. All dams were around 70% full at the time of inspection.

2.5 Bushfire Management Overlay (BMO) and Bushfire Prone Area (BPA)

The Site is not within a BMO or BPA and therefore no bushfire planning provisions or bushfire building construction standards apply.

2.6 Fire Brigade classifications and response times

The nearest fire brigades are rural volunteer brigades with a likely response time of between 20 to 50 minutes plus travel time, are from the Lismore Group of brigades and include:

- Berrybank located at 3565 Foxhow Berrybank Road, Berrybank and is approximately 11.6km from the Site,
- Derrinallum located at Hamilton Highway, Derrinallum and is approximately 15.6km from the Site,
- Lismore located at 15 West Street Lismore and is approximately 19km from the Site, and
- Mingay & district fire brigade located at 18 Barrs Road Mingay and is approximately 66km from the Site.

It is important to note that rural volunteer brigades may not be able to respond to all fire calls throughout the year, particularly if there are other fires burning within the area.

3 Worst-case scenarios

To understand the level of fire risk and determine what bushfire prevention and preparedness measures would be required to mitigate the risk to an *'acceptable level'*, we must first understand the contributing risk factors which will affect fire behaviour at the surrounding landscape. This will help determine potential impact and consequences to the substation, switchyard and neighbouring properties.

To assist with this and to put into context the potential level of fire risk, the following two (2) worst-case scenarios are provided to set the scene using weather conditions similar to Ash Wednesday fires of 1983 and **with no fire risk controls in place**.

A grassfire starting and burning under the influence of north or north west wind burning in a south or south easterly direction with a temperature of 41C°, relative humidity of 5%, wind speed @ 45+kph, 100% cured grass and drought factor of 10 resulting in a Forest Fire Danger Index (FFDI) of "Catastrophic" (that is an FFDI greater than 100).

3.1 Scenario No 1

- Internal Site fire involving the substation and/or switchyard in mid-February, is noticed when a large amount of black smoke is seen by a nearby resident, by this stage, burning matter has started a grass / stubble fire within the surrounding landscape. Based on the above weather conditions, the rate of fire spread would be in a south / south easterly direction at just over 14km/h¹ and would easily cross a fire break of 3m or less, i.e. Lismore-Scarsdale Road. It is worth noting that fires involving crops under similar weather conditions would result in slower rates of spread.
- If we take the time the grass / stubble fire has been burning as 15 minutes when noticed and reported to 000, the time the call is received and nearest fire brigade responds is 30 minutes, plus 10 minutes travel time to the fire, the overall time from the fire occurring to the first brigade arriving on scene, would be around 55 minutes, during that time, the fire would have spread a distance of approximately 13km from the point of origin if the forward rate of spread was not stopped by a suitable fire break or fire brigade intervention.

¹ CSIRO Grassland Fire Spread Meter.

3.2 Scenario No 2

- External grass / stubble fire burning from the North West under similar conditions described above would easily cross a fire break 3m or less, i.e. Crambs Road which will impact the substation and switchyard.
- If the fire enters the Site and impacts the substation and switchyard directly (without any vegetation clearances), it would be exposed to direct flame immersion and radiant heat damaging or igniting internal combustible electronic equipment and wiring and/or smoke ingress could interfere with sensitive electronic equipment resulting in equipment failure and damage.

Note: For the purpose of this bushfire management plan, ‘acceptable level of risk’ is defined as; ‘the level of human and/or material injury or loss from an industrial process that is considered tolerable by a community or authorities in view of social, regulation, economic and environmental cost benefit analysis’.

3.3 CFA Response

- CFA response is predetermined using the level of hazards and risks of the day and CFA protocols. In terms of a grass fire response, CFA response tables are based on the fire danger ratings, i.e. on days of severe and above, 3 x brigade response is common.
- Notwithstanding the above, in the event of a fire involving substation and switchyard, the same CFA response tables should apply and the incident controller, once arriving on scene and after undertaking a dynamic risk assessment, would call for additional resources if required. This is standard response protocols for fires.
- To assist the local fire brigade officer / incident controller to effectively respond to fires, it is proposed CFA use this bushfire management plan to prepare Brigade and Group response plans to the Site supported by training provided by the Site occupiers.

4 CFA Emergency Management Guidelines for Wind Energy Facilities – August 2017’ (CFA Guidelines)

The following fire risk controls are designed to minimise the of bushfire to an ‘*acceptable level of risk*’ and respond to the relevant sections of the CFA Emergency Management Guidelines for Wind Energy Facilities – August 2017’ in relation to bushfire management planning.

4.1 Siting (CFA Guidelines – section 1)

Section 3 will be satisfied by the following:

- The Site will be in an open grass / crop area and will be grazed by cattle and/or sheep where possible,
- The area surrounding the substation and switchyard will have no scrub and trees planted to a minimum distance of 30m.

4.2 Access (CFA Guidelines - section 3)

Section 3 will be satisfied and enhanced by the following:

- To allow the roads bounding the Site to be used as effective fire breaks, (prevent fire entering or leaving the Site), they will be maintained to a minimum of 5m width (including gravel verges) and slashed roadside vegetation prior to the declared fire danger period. Refer Appendix B for CSIRO research into fire break performance,

- The internal access road will be constructed to a minimum of 3.5m in trafficable width with a 4m metre vertical clearance, accessible in all weather conditions and capable of accommodating a vehicle of 15 tonnes;
- As the landscape is predominantly flat, the average grade requirements will not be an issue, particularly as responding fire brigades will be rural tankers designed for off roads firefighting.
- A minimum 10-metre mineral fire break (i.e. crushed rock or stones etc) around the substation and switchyard to prevent direct flame contact and minimise radiant heat impact.
- Familiarisation of the Site will be offered to the local fire brigades who will respond to a fire within or external the Site.
- CFA should use the familiarisation visit and this bushfire management plan to develop Brigade, Group and District response plans.

4.3 Water supply (CFA Guidelines – section 4)

Section 4 will be satisfied by the following:

- 1 x static non-combustible water tank complying to AS 2419.1 of no less than 22,500L effective capacity be located within 30m but no closer than 10m of the substation and switchyard. The water is only intended for use to protect the substation and switchyard from a grass or stubble fire.
- A hard-suction point will be provided with a water tank suction point compatible with the local fire brigade and be positioned within 4m to a hard-standing area capable of accommodating a vehicle of 15 tonnes and accessible during all-weather conditions,
- The static storage tank will be manually filled and if the tank is used, will be refilled within 24hours of use, otherwise it will be full at all times of the year including outside the declared fire danger period,
- An external water level indicator will be installed and visible from the hard-standing area, and a directional signage to CFA standard will be fitted at the entry gate to assist with locating the water tank.

4.4 Fire risks during construction – (CFA Guidelines - section 7 and 8)

The highest risk identified at the Site is a grass / stubble fire during the installation and construction phase and the declared fire danger period which generally occurs between December and May each year. Potential hazards and ignition sources include:

- Flammable and combustible fuels stored on-Site and vehicle / machinery re-fuelling;
- Welding, cutting and grinding creating sparks;
- Sparks from faulty vehicle and machinery exhaust systems etc;
- Discarded cigarettes and matches by construction workers.

To mitigate these risks, the following controls will be put in place:

- Standard construction management measures and restrictions will be applied on high fire risk activities (welding, cutting and grinding) during days the grassfire danger rating of severe or above;

- A 'hot work' policy will be adopted requiring a Hot Work Permit e.g. open flame work such as welding, cutting and grinding will not commence unless authority has been given by the Site manager or delegate. A "Hot Work Permit" will be completed prior to commencement of any work and remain current for 24 hours only'.
- Introduce a work practice of no welding, cutting and grinding or undertaking other hot work that emits a spark or flame during a day of total fire ban or during days when the grassfire danger rating is severe or above.
- Have a minimum two (2) x 9 litre stored pressure water extinguishers or firefighting capability (i.e. water tanker) available and ready to operate always when welding, cutting and grinding.
- Smoking only be allowed in designated area;
- All flammable and combustible liquids be stored and handled in accordance with the relevant sections of AS 1940 – 2017, The storage and handling of flammable and combustible liquids including fire protection equipment;
- Each vehicles and machinery working on Site be:
 - free from faults and mechanical defects which could cause an outbreak of fire;
 - fitted with a spark arrester; and
 - carry a minimum one (1) 9L pressurised water extinguisher.
 - Refer Appendix A for CFA regulatory safety features of motor vehicles driven during fire danger period near vegetation,
- If there is a potential risk of fire along transmission line corridors, a cleared vegetation easement be established and maintained during the declared fire danger period.
- The Site construction manager and supervisors install the Vic Emergency App and program in a watch zone of the surrounding area, so they are notified of a potential threat from a grass fire burning in the area.

4.5 Awareness and training for emergency services (CFA Guidelines – section 9)

Section 9 will be satisfied by the following:

- A familiarisation visit to the Site will be offered to CFA and other relevant emergency services and training offered to CFA on how to safely respond to a fire involving the substation, switchyard and overhead 220KV transmission line. It is recommended this familiarisation and training be used to assist CFA develop local emergency response plans.

4.6 Fuel / Vegetation Management (CFA Guidelines – section 10)

The main fire risk after the Site is commissioned is during the declared fire danger period from an external grass or crop fire which could be started from one of the following ignition sources:

- External grass or crop fire entering the Site from a burn-off getting away, grinding, welding, or slashing, i.e. blade hits a rock,
- Discarded cigarette from motor vehicles,
- Faulty vehicle / machinery exhaust system,
- Lightning strike to ground.

To mitigate these risks, and satisfy section 10, the following risk controls will be put in place:

- To allow the roads bounding the Site to be used as effective fire breaks, (prevent fire entering or leaving the Site), they will be maintained to a minimum of 5m width (including gravel verges) and slashed roadside vegetation prior to the declared fire danger period. Refer Appendix B for CSIRO research into fire break performance,
- Grass within the Site will be kept well maintained and at a low height through slashing or grazing,

- A minimum 10-metre mineral fire break (i.e. crushed rock or stones etc) around the substation and switchyard to prevent direct flame contact and minimise radiant heat impact and to prevent a fire spreading from the substation and/or switchyard.
- The area surrounding the substation and switchyard will be kept cleared of scrub and trees to a minimum distance of 30m.
- There will be no long grass in areas where plant and heavy equipment will be working.
Note: there are currently no trees or shrubs on the Site and therefore leaf litter is not a fire risk,
- Each vehicles and machinery working on Site be:
 - free from faults and mechanical defects which could cause an outbreak of fire;
 - fitted with a spark arrester; and
 - carry a minimum one (1) 9L pressurised water extinguisher.

Appendix A – Required safety features during the fire danger period

50 Required safety features of motor vehicles driven during fire danger period near crops

(1) In the country area of Victoria, a person shall not drive or operate a vehicle propelled by internal combustion (other than a vehicle referred to in subsection (2)) so that the vehicle is in contact with any crop, grass, stubble, weeds, undergrowth or other vegetation unless the vehicle is fitted with an efficient silencing device so constructed that all the exhaust from the engine of the vehicle passes through the silencing device.

Penalty: 10 penalty units.

(2) In the country area of Victoria, a person must not drive or operate a tractor or a self-propelled farm machine or a traction engine or an earth-moving, excavating or road-making machine propelled by or incorporating a heat engine within nine metres of or in contact with any crop, grass, stubble, weeds, undergrowth or vegetation unless the tractor, traction engine or machine—

(a) is free from faults and mechanical defects which would tend to cause an outbreak of fire; and

(b) is fitted with a spark arrester; and

(c) carries the prescribed fire suppression equipment during a fire danger period.

Penalty: 10 penalty units.

(3) A person operating a tractor, traction engine or machine referred to in subsection (2) must maintain the spark arrester in proper working order so as to prevent the discharge of exhaust particles which may tend to cause an outbreak of fire.

Penalty: 10 penalty units.

(4) A person must not fit a spark arrester to a tractor, traction engine or machine referred to in subsection (2) unless the spark arrester complies with the standard prescribed under subsection (5).

Penalty: 10 penalty units.

(5) A person must not sell a tractor, traction engine or machine unless it is fitted with a spark arrester which complies with the relevant Standards Association of Australia standard prescribed for the purposes of this subsection.

Penalty: 10 penalty units.

(6) The Chief Officer may exempt a person from compliance with subsection (2)(c) where in the opinion of the Chief Officer the circumstances surrounding the operation of the tractor, traction engine or machine warrant it.

(7) Nothing in this section requires a tractor, engine or machine referred to in subsection (2) which is fitted with a turbocharger or an exhaust aspirated air-cleaner to be fitted with a spark arrester.

COUNTRY FIRE AUTHORITY REGULATIONS 2014 - REG 113

Vehicular heat engines

- (1) For the purposes of section 50(2)(c) of the Act, the prescribed fire suppression equipment is—
- (a) at least one water spray pump of the knapsack pattern that—
 - (i) is in proper working order; and
 - (ii) is fully charged with water; and
 - (iii) has a tank capacity of not less than 9 litres; and
 - (iv) complies with AS 1687; or
 - (b) at least one water (stored pressure) fire extinguisher that—
 - (i) is in proper working order; and
 - (ii) is fully charged with water and maintained at the correct pressure; and
 - (iii) has a tank capacity of not less than 9 litres; and
 - (iv) complies with AS/NZS 1841.1.
- (2) For the purposes of section 50(5) of the Act, a spark arrester must comply with AS 1019.

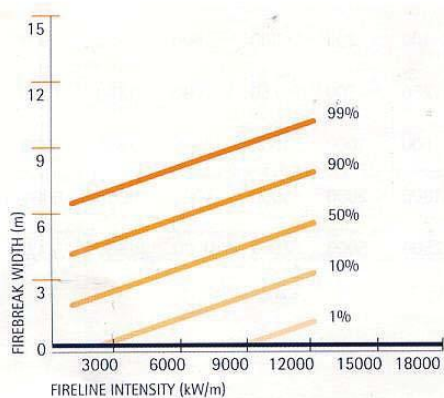
Appendix B – Grass fire research into the performance of fire breaks

1. Relevant research to the site regarding fire break performance was conducted by scientists from the CSIRO National Bush Fire Research Unit in 1988 including an investigation into grass fire behaviour.
2. The aim of the research was to develop a relation between the probability of fuel break failure and variables such as fuel break width and fire line intensity, (that is the quantity of heat released per metre of fire front).
3. The aim was achieved by lighting experimental fires over large uninhabited areas during periods of very high fire danger.
4. Fuel types involved mostly kerosene grass, kangaroo grass and sorghum, which are similar to many found in the open grasslands of southern Australia including Victoria. These grasses were almost fully cured and low eucalyptus and paperbarks and occurred sparsely on the test site, (average 10 trees per hectare).
5. Systematic measurements of fuel characteristics found most fuel fell between 2 and 5 tonnes per hectare and grass height was usually between 0.15 and 0.55 m.
6. During the experiment, wind speed varied from 3 to 30 km per hour, relative humidity from 13 to 55% and air temperature from 19 to 36 degrees Celsius. Using the Macarthur meter, this equates to Grassland Fire Danger Index of 'Extreme' using CSIRO – modified McArthur Mk 4 Grassland Fire Danger Meter.
7. The test site was divided into 170 blocks, (200 x 200m or 100 x 100m in size). Fuel breaks were constructed 5, 10, or 15m wide by grading or burning strips of grass so that no flammable material remained.
8. To test the effectiveness of fuel breaks, 113 fires, either at a single point or in a line 60 to 200m in length were lit. The head fires burned 20 to 200m before reaching a fuel break. Their speed ranged from 0.4 to 8.0 km per hour. No trees stood within 20m of the fuel break for 58% of fires lit, for the remainder, the number of trees present was generally less than four, and almost always less than eight.

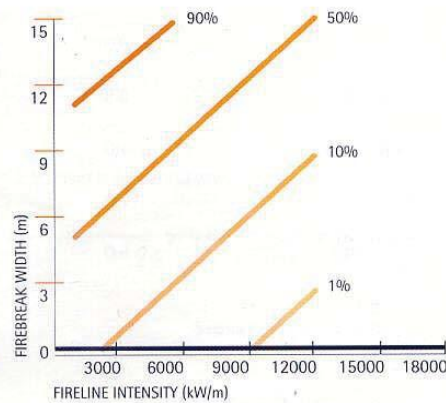
Research results were:

- When trees were absent, none of the 4.5 to 15m wide fuel breaks were breached while 83% of those 1 to 3.5m wide were. Fuel breaks of 1 to 3.5m mainly failed because of direct flame contact, the fire actually 'reaching' across the barrier. All except the least-intense fires easily breached such breaks.
 - When trees were present within 20m of a fuel break, only 45% of the 4.5 to 15m wide fuel breaks managed to stop fires. These fires invariably jumped the fuel breaks directly opposite trees and firebrands (such as burning bark or leaves that are capable of starting spot fires) were the main cause.
 - Fuel breaks performance became less effective as fire line intensity increased. Of the 20 fires approaching breaks 1.0 to 3.5m wide with intensities less than 7,000 kW/m, 6 (30%) stopped; while of the 15 approaching breaks with an intensity of 7,000 kW/m or greater, none stopped.
12. To put these results to practical use, CSIRO researcher Andrew Wilson developed a statistical model that assists in calculating the probability of fuel break breach under given conditions.

13. This model involved taking into account fire line intensity, the presence or absence of trees within 20m, and fuel break width. Generally, the model predicts the fires breaks becomes less effective with increasing fire intensity, closer proximity of trees and / or decreasing fuel break width.
14. More specifically, the model as shown in Figures 1 and 2, predicts the following results:
 - A 3m wide fuel break has only a 50% probability of stopping a grass fire (no trees within 20m) that approaches head-on with an intensity of 5,000 kW/m
 - A 5m fuel break has a 90% probability of stopping the same fire.
 - A 9m wide fuel break has only a 50% probability of stopping a grass fire with trees within 20m of the break that approaches head-on with an intensity of 5,000 kW/m.
 - A 15m wide fuel break has a 90% probability of stopping the same fire.
15. Finally, it is important to remember that Wilson’s work does not include consideration of the effect of slope, but this does not detract from the value of his work because, in the absence of any other similar research data, it provides useful information to help us better understand potential fire behaviour.



No Trees Present Within 20m of the Break



Trees Present Within 20m of the Break

Source: Cheney and Sullivan 1997, P70

Fig 1 Probability of a head fire being controlled with no trees within 20m of the break

Fig 2 Probability of a head fire being controlled with trees present within 20m of the break

16. Deductions from this research relevant to the site:
 - The fuel type and conditions under which CSIRO research was undertaken were:
 - Kerosene grass, kangaroo grass and sorghum which has a Heat yield of between 16,900 and 18,600 kj/kg based on a moisture content (% Oven-dry weight) of 10 and a fuel load of 5 tonnes per hectare.
 - The grass land surrounding the proposed site is grazed pastures (i.e. Phalaris) which has a heat yield of between 13,700 and 13,900 kj/kg based on a moisture content of 10 with a fuel load of 5 tonnes per hectare.
 - **The assessed grass fuel loads within paddocks around the Site and along road reserves will vary between 5 and 2 tonnes per hectare depending on the time of year.**