INTRODUCTION

Preface

The Director of Operations/Chief Officer of the Country Fire Authority (CFA), Victoria, has commissioned this report.

The report's scope is defined by the terms of reference supplied by the Chief Officer, which were as follows:-

"To investigate and report on fire behaviour related to fuel loads and weather in the Timbercorp Blue Gum Plantation burnt by fire on Saturday 9th April 2005".

The information presented in the report is based on accounts provided by firefighters who were in attendance at the time and an examination of the burn and char patterns both within and immediately adjacent to the blue-gum plantations.

CHRONOLOGY

On Saturday 9 April 2005 a total fire ban day had been declared for the South-Western Total Fire Ban District of Victoria. The predicted weather indicated that the fire danger would be very high to extreme.

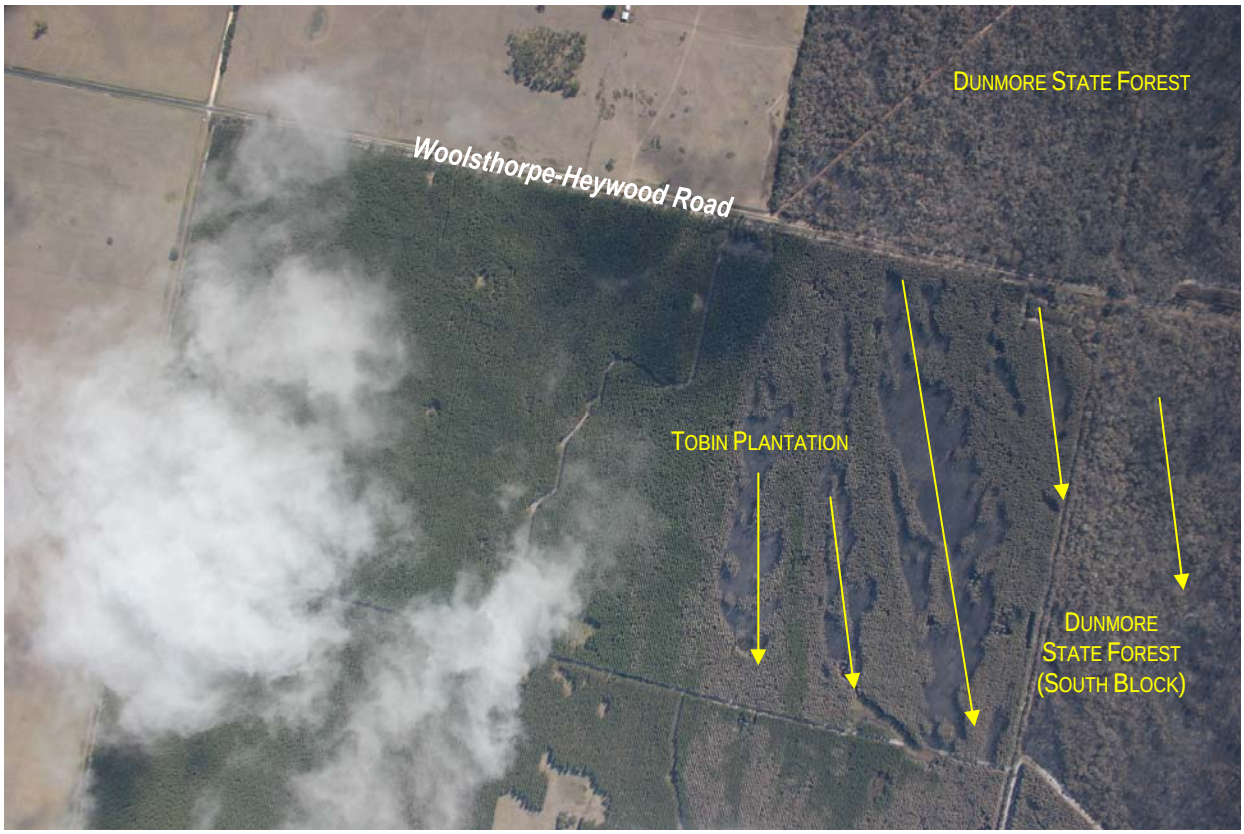
On that day, firefighters were engaged in the suppression of a wildfire in the Dunmore State Forest, north of the Woolsthorpe-Heywood Road.

The first of numerous spot fires developed in the native vegetation south of the Woolsthorpe-Heywood Road at approximately 1415 hours. Between 1415 hours and 1430 hours, these fires developed and ran in a generally southerly direction through the Dunmore State Forest – South Block (native vegetation) and the Down Plantation Block into a power-line easement that runs generally east/west.

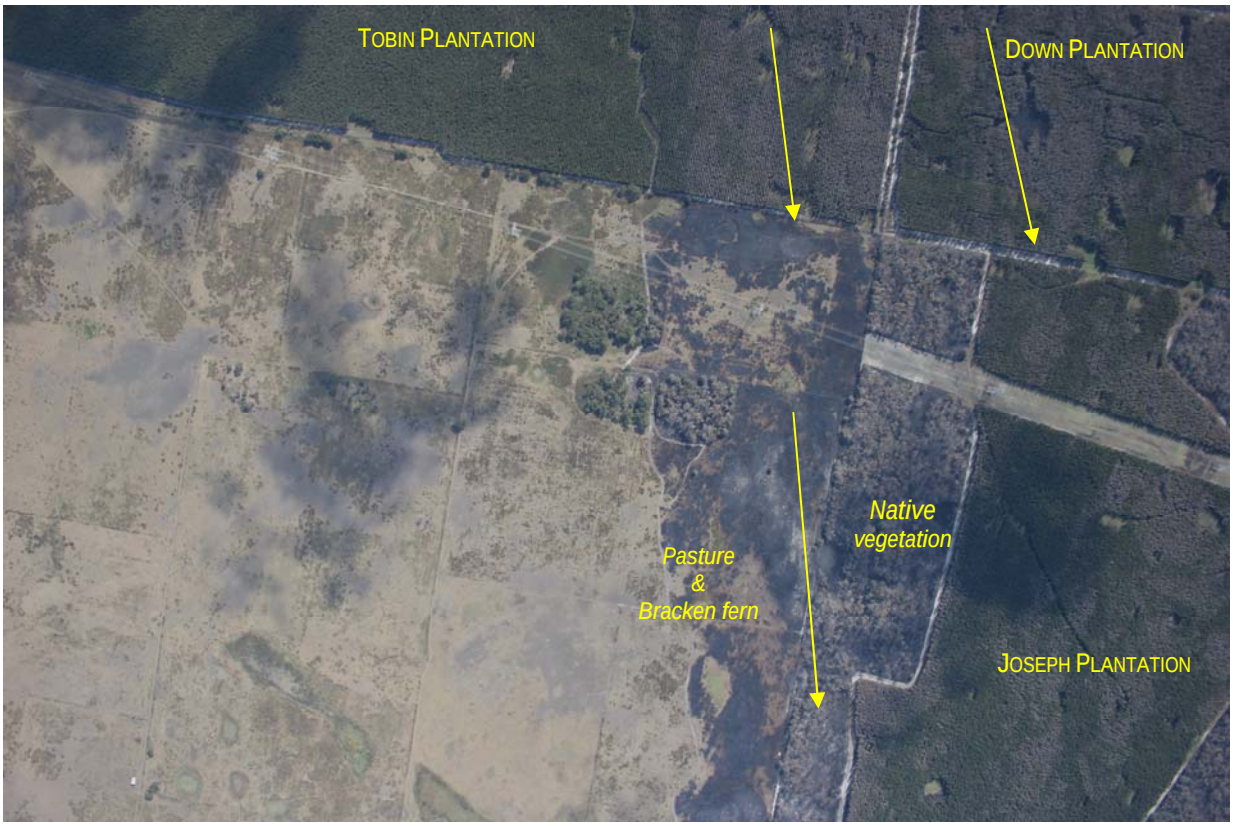
Between 1430 hours and 1450 hours, the fire crossed the power-line easement and continued to run south until it was halted by fire suppression efforts on the southern boundary of the Joseph Plantation Block at Old Mill Road. *(See Photographs #2 and #3)*. This run from the Woolsthorpe/Heywood Road to Old Mill Road travelled approximately 3.5 kilometres in less than one hour.

At some stage during or after this run of fire, several other fires developed further to the west at the northern end of the Tobin Plantation Block *(See Photograph #1).* These developed into several significant runs through that plantation. One of these runs entered the pasture immediately to the south of the Tobin Plantation Block then through the native vegetation area on the western boundary of the Joseph Plantation Block and into the plantation. *(See Photograph # 3)*

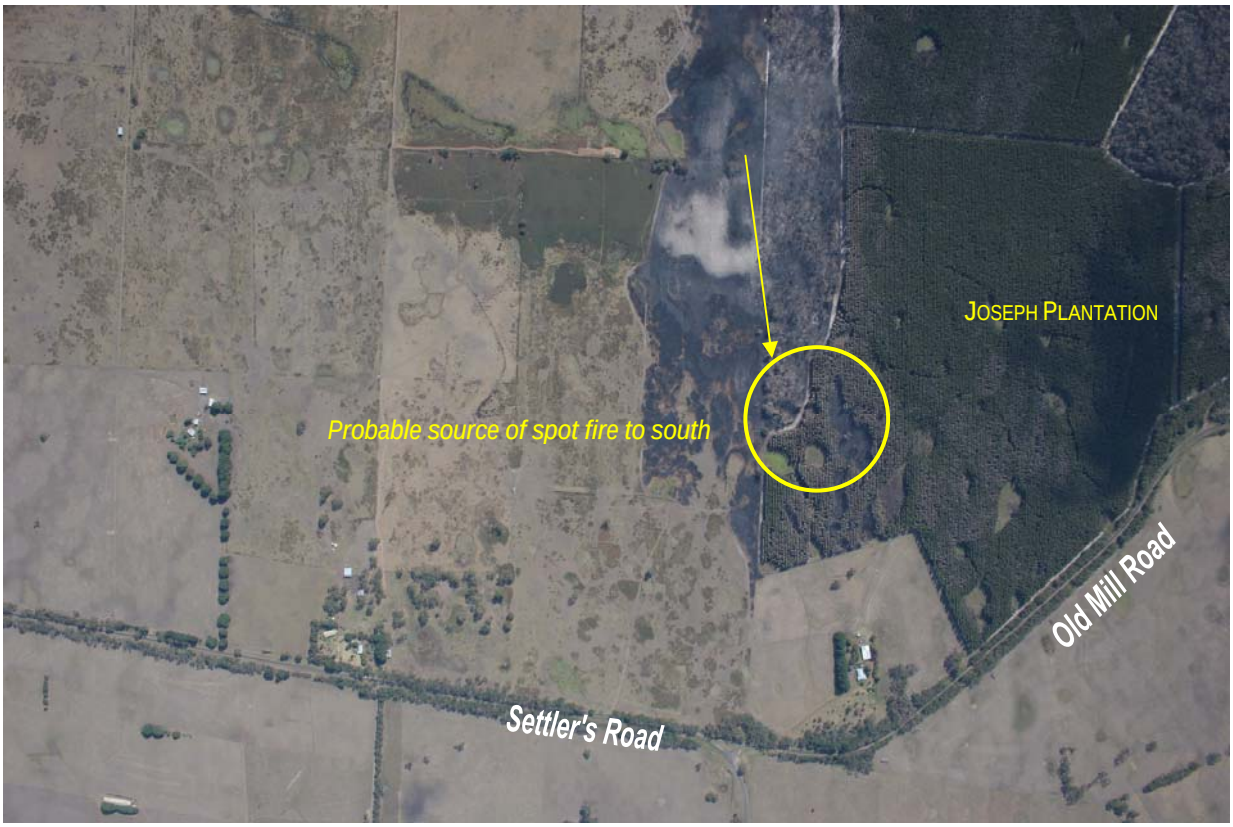
At approximately 1600 hours, a new fire developed in native forest adjacent to Settlers Road, approximately 3 kilometres south of Old Mill Road. *(See Photograph # 4)*



Photograph # 1 – Run of fire from Dunmore State Forest – over Woolsthorpe-Heywood Road – through Tobin plantation. Arrow represents direction of running fire.



Photograph # 2 – West flank of main fire. Run of fire from Tobin Plantation block – through pasture and bracken fern – into native vegetation – and then Joseph plantation. Arrows represent direction of running fire.



Photograph # 3 – Southwest corner of main fire. Run of fire from pasture and bracken fern – into native vegetation – and then Joseph Plantation. Arrows represent direction of running fire.

Photograph # 4 – Spot fire – approx 2.5 km south of main fire. Arrow represents direction of running fire. The area of origin is almost due south of the area of native vegetation highlighted in photograph #3. Arrows represent direction of running fire.

TOPOGRAPHIC FACTORS AND LANDSCAPE FEATURES

The terrain south of the Woolsthorpe-Heywood Road is generally flat with isolated depressions or low-lying areas. Slope, aspect and elevation, therefore, were not factors that influenced the behaviour of this fire to any significant extent.

Throughout this report reference is made to key features and locations in the landscape. To assist orientation, these features and locations are named and described as follows:

Woolsthorpe-Heywood Road: – This road runs generally east/west and separates the main Dunmore State Forest in the north, from the Tobin Plantation Block and Dunmore State Forest - South in the south.

Tobin Plantation Block: – A Blue-gum plantation of approximately 260 hectares situated immediately south of the Woolsthorpe-Heywood Road. This block is at the western extremity of the wildfire that occurred on 9 April 2005. The plantation is divided into two compartments by a linear break that runs east/west across the block. This break is approximately 10 metres wide. The plantation is approximately 7 years old and the plantation rows run generally north/south.

Dunmore State Forest - South: – An area of mixed species eucalypt forest of approximately 150 hectares situated immediately south of the Woolsthorpe-Heywood Road and north of the Down Plantation Block. The dominant tree type is stringy-bark with isolated areas of gum.

Down Plantation Block: - A Blue-gum plantation of approximately 90 hectares situated south of the Dunmore State Forest – South. This plantation is approximately 6 years old and the plantation rows run generally east/west.

Joseph Plantation Block: - A Blue-gum plantation of approximately 250 hectares situated immediately south of the Down Plantation Block. This block is at the southern extremity of the main wildfire that occurred on 9 April 2005. The plantation is approximately 7 years old and the plantation rows run generally north/south. There are three large areas of mixed species eucalypt vegetation within this block - one along the western boundary of the block; a second on the northern boundary between the Down Plantation Block and the power-line easement; and the third in the centre of the block.

Power-line Easement: - A high-voltage power-line easement of approximately 60 metres width that runs generally in a west-north-westerly direction. The easement runs through the northern section of the Joseph Plantation Block. This portion of the easement is ploughed. However there was enough fuel within the ploughed areas to carry a fire. The easement then runs through pasture south of the Tobin Plantation Block.

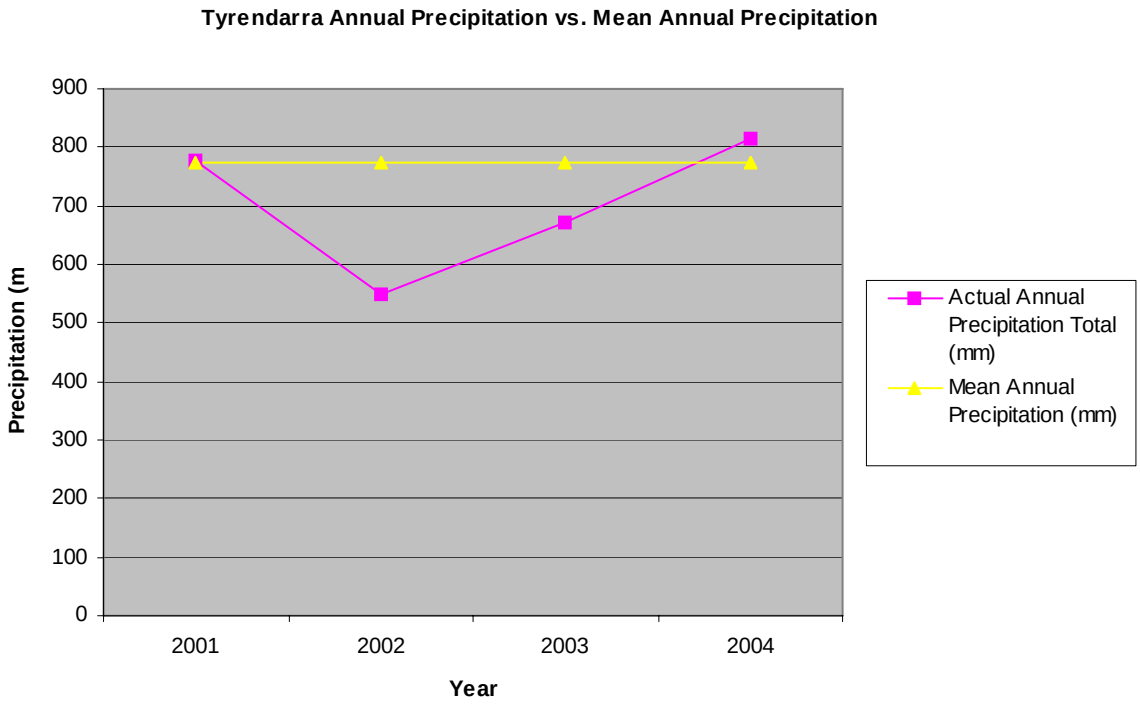
Old Mill Road: - This road runs generally northeast/south west along the southern boundary of the Joseph Plantation Block and was the southern boundary of the main fire.

Settlers Road: - This road runs generally east/west and intersects with Old Mill Road near the southern boundary of the main fire. It then runs generally south towards the Princes Highway.

WEATHER FACTORS

Long-term rainfall:

Rainfall deficiencies had existed in the fire area, with a deficit over an extended period of time. Figures supplied by the Bureau of Meteorology indicated that for the four previous years below average rainfall was recorded.



Actual Conditions:

The following weather information was recorded at Portland and Hamilton Airports for the period 1200 hours to 1700 hours. The Portland Airport is approximately 35 kilometres southwest of the fire and the Hamilton Airport is approximately 60 kilometres northeast of the fire.

Time Location	Temp	RH	Wind Dir/Speed/Gusts	Fire Events
1200 hrs Portland Hamilton	 30.4 30.6	 27 24	 N @ 31 - 50 km/hr N @ 46 - 61 km/hr	Wildfire burning in native vegetation north of Woolsthorpe/Heywood Road.
1300 hrs Portland Hamilton	 32.3 32	 18 19	 N @ 39 - 63 km/hr N @ 48 - 61 km/hr	
1400 hrs Portland Hamilton	 33.3 32.9	 16 17	 N @ 37 - 59 km/hr N @ 46 - 63 km/hr	Fire entered plantation south of Woolsthorpe/Heywood Road.
1500 hrs Portland Hamilton	 34.1 32.8	 16 17	 N @ 31 - 48 km/hr N @ 48 - 61 km/hr	
1600 hrs Portland Hamilton	 33 32.3	 16 17	 N @ 30 - 43 km/hr N @ 44 - 57 km/hr	Spot fire reported near Settlers Road – approx 3 km south of Old Mill Road
1700 hrs Portland Hamilton	 32.5 31.3	 17 19	 N @ 26 - 37 km/hr N @ 37 - 52 km/hr	

By applying the peak conditions recorded at these locations and a fuel load of 25 tonnes/hectare, the McArthur Fire Danger Meter suggests that a fire in a dry sclerophyll forest should crown with a forward rate of spread of approximately 2.7 km/hr. The potential spotting distance would be approximately 8.6 km.

Wind up to 60km/hr was reported from the fireground.

FUEL FACTORS

Plantations

Examination of the unburnt areas adjacent to the fire suggests that the fuel structure within the plantations was relatively typical of 6 and 7 year old plantations. The height of the trees was between 10 and 14 metres and the canopy had not yet completely closed. Within each plantation, the surface and elevated fuel hazard was generally moderate with some accumulation of leaf litter and dead twigs in the depressions between rows *(See Photograph #5).*

However there were locations within each plantation where it was evident that the trees were exhibiting signs of drought stress. In these areas, both the surface and elevated fuel hazard was very high due to the presence of accumulated leaf litter, twigs and bark on the ground and suspended on the trunks of the trees (*See Photograph #6).* In these locations the bark hazard was very high and such accumulations of fuel would cause a significant increase in fire intensity. The overall fuel hazard rating therefore would be rated as very high and the equivalent of approximately 13 tonnes/hectare.

There were also a number of openings within each plantation where the quantity of fully cured grasses increased the surface fuel hazard to extreme *(See Photograph #7).* These openings are exposed to the influence of the prevailing winds and more solar radiation. The combination of these factors – particularly under the conditions on 9 April 2005 - did cause an increase in fire intensity in the plantations around these openings.

Native Vegetation Areas

There are several large areas of mixed species eucalypt forest within and adjacent to each of the plantation blocks. The dominant tree type in each of these areas is stringy-bark with isolated areas of gum. The overall fuel hazard in each of these areas was extreme at the time of the fire (Bark - Very High; Elevated - Very high; Surface - Extreme). There was no evidence to suggest that any of these areas had been treated to reduce the fuel hazard prior to 9 April 2005.

The presence of long-unburnt string-bark contributed to short distance spotting into adjacent plantation areas and into the power-line easement south of the Down Plantation Block. Evidence of significant quantities of charred stringy bark was found in burnt areas of the easement immediately south of the native vegetation.

The presence of gum-bark species had the potential to cause long distance spotting. Charred pieces of gum bark were found on the beach at Tyrendarra East, approximately 8 kilometres south of Old Mill Road. A sample of these were examined by Kevin Tolhurst (CFTT), and based on the cellular composition, he determined that about 80% of the embers were from Messmate Stringy-bark and about 20% from Rough-barked Manna Gum. It is probable that the embers came from the Settlers Road Block to the south, due to the presence of the Manna Gum at this site. However it must be noted that charred bark on the beach does not mean that these fragments were alight and capable of starting a spotfire when they landed.

The elevated fuel hazard contributed to crown fire in some locations *(See Photograph #8).*

Photograph # 5.

Example of typical fuel characteristics within the plantations.

Location: Tobin Plantation Block.

South of Woolsthorpe-Heywood Road.

Direction Facing: South.

Observations:

- *Surface fuel – Moderate*
- *Elevated fuel – Moderate*

Photograph # 6.

Example of isolated pockets of surface and elevated fuel.

Location: Tobin Plantation Block.

South of Woolsthorpe-Heywood Road and west of western fire control line.

Direction Facing: South-east

Observations:

- *Surface fuel hazard – Very High*
- *Elevated fuel hazard – Very High*

Photograph # 7

Example of fuel characteristics in and adjacent to openings in plantation.

Location: Tobin Plantation Block.

South of Woolsthorpe-Heywood Road.

(Grid Ref: 725 768)

Direction Facing: South.

Observations:

- *Surface fuel hazard – Extreme*
- *Elevated fuel hazard – High*

Photograph #8

Example of fire intensity in native vegetation areas.

Location: Western Boundary of Dunmore State Forest (South Block) – adjacent to Tobin Plantation Block.

Direction facing: South east

Observations:

- *Crown fire*
- *Tree height approximately 12 metres*
- *Elevated fuel hazard – Very High.*

FIRE BEHAVIOUR

There were multiple points of ignition on the northern boundary of the Tobin Plantation Block. The burn and char patterns in this area suggest that the maximum flame height during the initial stages of each of these fires was less than 2 metres. However as each of these fires developed, they merged with others – increasing the winds under the tree canopy and the flame height to more than 10 metres. The fires also developed in intensity in areas where it was evident that there had been 'jackpots' of near-surface and elevated fine fuel *(See Photograph # 6).*

Once the crown fire developed in the plantations, there were sufficient embers being produced from within the plantation itself to maintain the process, sustaining continued crown fire development. The denser canopy of Blue Gum plantations restricts winds at ground level, but mass spot fires will help create in-draught winds below the canopy. *(See Photograph # 10)*

In isolation, the width of each of these runs of fire was relatively narrow. However, given that there were several fires from multiple ignition points, the width of the fire expanded rapidly as each fire merged and as the runs of each fire developed.

On the western extremity of the fire, the burn and char patterns suggest that the flame height in the flanking fire decreased rapidly to less than 0.5 metres. *(See Photograph # 11)*

The evidence available suggests that the time of the development of the spot fire near Settlers Road coincides with the fire burning in and adjacent to the native vegetation area on the western boundary of the Joseph Plantation Block. The trees in this area of native vegetation include gum bark types that are prone to long-distance spotting.

Photograph # 9

Location: Tobin Plantation Block. South of Woolsthorpe-Heywood Road.

Direction Facing: South.

Observations:

- *Flanking fire from east (left) joined with developing running fire from north west (right)*
- *Flame height increasing from approx 2 metres to approx 10 metres as fire progressed in south-south-east direction.*

Photograph # 10

Location: Tobin Plantation Block. South of Woolsthorpe-Heywood Road.

Direction Facing: South-south-west.

Observations:

- *Fire ran generally south-south-east. (Right to left)*
- *Flame height approximately 12 to 15 metres.*
- *Plantation rows run generally north/south.*

Photograph # 11

Location: Tobin Plantation Block.

Western flank. South of Woolsthorpe-Heywood Road.

Direction Facing: North.

Observations:

- *Flanking fire from east (right).*
- *Flame height decreasing to 300 mm as fire progressed laterally in a generally westerly direction.*

Effect of Plantation Rows

The fire intensity in the Tobin Plantation Block, where the rows of trees were planted in a generally north/south direction, was significantly greater than the fire in the Down Plantation Block, where the rows were planted in an east/west direction. This is despite the fact that the Down Plantation Block was in the immediate path of a very intense running fire out of the native vegetation area to the north. It is apparent that this variation in fire intensity is attributable to both the concentration of litter fuels in the depressions between plantation rows and greater exposure to the prevailing winds.

Effect of Linear Breaks

It was evident that the east/west linear breaks within and between the plantations did not halt the progress of any running fire. However these breaks did serve to reduce the intensity of running fire and to limit the spread of most lateral or flanking fire.

The burn and char patterns in the runs of fire in the Tobin Plantation Block, north of the east/west break, indicated that the flame height was between 10 and 15 metres *(See Photograph #9).* To the south of the break, the flame height in the runs rarely exceeded 3 metres. This break is approximately 10 metres in width.

Similarly the east/west linear break between the Down Plantation Block and the Joseph Plantation Block did not halt the progress of the runs of fire. Again, south of this break, in the Joseph Plantation, it was evident that the fire intensity did not develop substantially except in proximity to native vegetation areas or openings in the plantation. The break between the Down and Joseph plantations is approximately 30 metres.

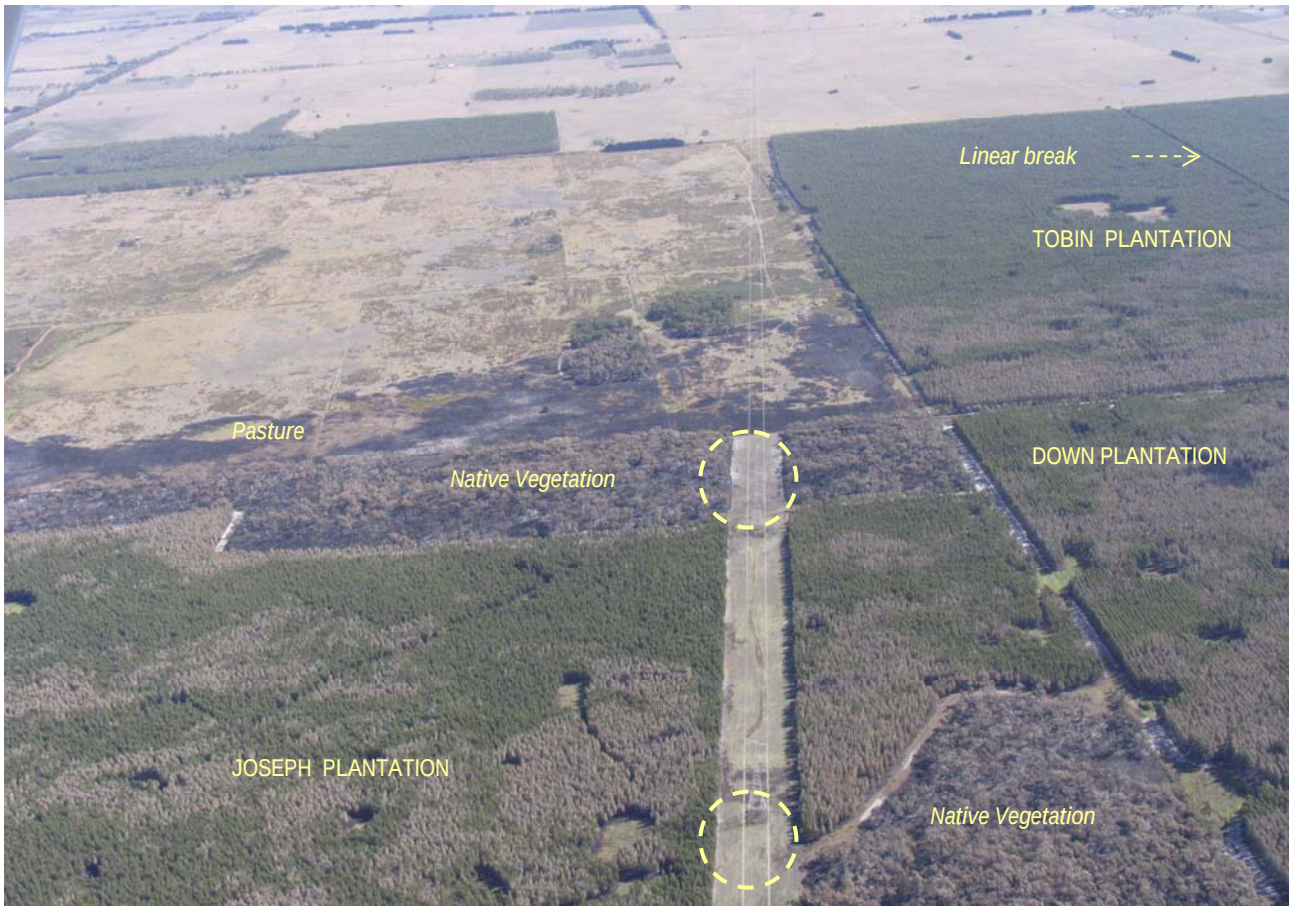
The most significant linear break in the area of this fire was a high voltage power-line easement of approximately 60 metres width. This break runs generally east/west - across the run of the fire. I could not find any evidence to indicate that running fire crossed this break from plantations to the north. However I did find significant quantities of charred stringy-bark in the burnt areas within and south of the easement.

Effect of Native Vegetation Areas

The overall fuel hazard in each of the native vegetation areas within and adjacent to each of the plantations was extreme. (Bark – Extreme; Elevated Fuel – Very High; Surface Fuel – Extreme).

It was evident from the burn and char patterns that the intensity of fire in the native vegetation areas was greater than in the plantations. It was also evident that plantation trees immediately adjacent to native vegetation suffered substantially more fire damage than others. *(See Photograph # 12)*

There is little doubt that the presence of long-unburnt stringy bark trees in the native vegetation contributed to a significant amount of short distance spotting into adjacent areas. When multiple spot fires occur in close proximity, fire develops faster and with more intensity. There were numerous examples of this in localities downwind of the native vegetation areas.



Photograph # 12. Facing generally west to northwest along power-line easement.

- *The extent of damage to plantation trees is significantly greater adjacent to native vegetation areas and adjacent to openings within the plantations.*
- *Fire crossed the power-line easement in areas adjacent to native vegetation areas (Circled). Significant quantities of charred stringy-bark were located in the easement in these areas. There was some lateral movement of fire within the easement.*
- *The easement is approximately 60 metres in width.*

ACKNOWLEDGEMENTS

The CFA acknowledges and thanks the staff at Timbercorp Forestry for their cooperation and assistance with this project. Timbercorp also provided the aerial photographs used in this report.

Thanks also to the staff from the Department of Sustainability and Environment and Parks Victoria.