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BSc, MSc (ANU) Landscape susceptibility to severe fire

Coronial Inquiry into Gospers Mountain Fire

and

Grose Valley Fire, Mt Wilson

5 May 2023

Contents

1. INTRODUCTION

This report addresses Stage 2 Hearings Issues List, Backburning – Grose Valley, Mt Wilson Fire, points 12, 13 and 14. The report relies on empirical field evidence and other factual data generated at the time of the fires and from the fire ground/s. References to source material is footnoted throughout the document.

This report is DRAFT ONLY as I have requested further RFS data which is currently being sought by my clients via the Court and includes images taken on 14 and 15 December 2019. When this data is made available, I will complete my analysis, results, and conclusions. In the alternative when it is confirmed that the data is not available, I will complete my analysis results and conclusions.

Analysis of this data has been undertaken using standard scientific methodology and so results can be reliably repeated if required.

1.1. Personal Background

I rely on my academic qualifications, both my undergraduate Science degree and Master of Landscape susceptibility to fire, qualifications; 35 years of field experience of fire management in field operations and fire research. I was for 12 years the Fire Management Officer for Blue Mountains District between 1983 and 1995 responsible for planning and management of bushfires in the Wollemi, Blue Mountains, and Kanangra-Boyd National Parks, which became part of the Greater Blue Mountains World Heritage Area (GBMWHA). This is the area in which the fires in this study occurred.

I am also well experienced in developing tried and tested on-ground fire strategies and tactics that are compatible with protection of the GBMWHA values. Because of my field knowledge and predictive capability in fire behaviour, I learnt how to manage fires using a combination of direct and indirect methods to contain a bushfire in the GBMWHA including:

- Remote area operation using ground crews and aerial water bombing.
- Indirect remote attack using strategic fire advantages and careful use of aerial ignition to bring the fire into sheltered places in the fire landscape or into low fuel areas, out of the influence of westerly fire winds, before a blow-up day.
- Short tactical backburns usually under high fuel moistures, dewpoint temperatures, low winds, and mild weather conditions to minimize risk of escape from burning trees or smoldering logs.
- Mop-up of inactive fire edges in strategic breakaway points using remote area crews.

I have walked, driven and flown over most of the National Parks in the GBMWHA. I helped initiate a decision support system for fire management commencing in 1984 for what was to become the GMBWHA (1.3 million ha) using innovative fire landscape features such as:

- Terrain (digital elevation model)
- Vegetation and fuel types
- Fire history of the area back to the 1957-58 fire season

- Fire advantages mapping (Rainforests, moist eucalypt forests, rocky outcrops, and water features
- Sources of Water (Ground and Aviation), and
- Assets at Risk (human, natural & cultural)

I also initiated community fire planning programs at Mount Wilson-Mount Irvine[1] , Mount Tomah, Berambing and Bilpin with the local bushfire brigades back in the late 1980s. After the devastating 2009 Victorian Black Saturday bushfires I was contracted by a local residents' group in Strathewen where 28 people died to develop a community fire safety plan based on these much earlier ideas

I became personally motivated to understand what happened in the wildfires that occurred in the 2019-2020 fire season as I am still very much interested in the GMBWHA, its vegetation, fire history, and fire management. During my time as Fire Management Officer at NPWS Blue Mountains District I developed a keen sense on how to limit the worst excesses of uncontrolled bushfires. To that end I have reconstructed and interpreted the spread and behaviour of over one hundred bushfires including the eight most significant bushfires on Black Saturday between 7 and 8 February 2009 in Victoria. I have also published conference papers on my findings into extreme fire processes including pyroconvection, crown fires, and fire spotting; fire reconstruction methods; and effectiveness of prescribed burning in mitigating the risk and consequent impact of bushfires. My research has always been based on field evidence and grounded in the theory of fire behaviour, and therefore ways to reduce the overall fire size and impact of a wildfire or an uncontained backburn operation.

1.2. Report Overview

A reference map is presented showing the overall extent of the wildfire complex (shaded blue) within the national park system in the GBMWHA, and includes the following fires (Figure 1):

- Gospers Mountain
- Oaky Creek
- Kerry Ridge
- North Putty Complex
- Little L Complex
- Thomsons Creek; and
- Three Mile

The fire origins of both the Gospers Mountain and the Mount Wilson backburn escape are shown as red asterisks, the former starting at about 11:00 on 26 October from a lightning strike and the latter from an escaped backburn lit in the area to the north-west of the junction of the Bells Line of Road and Mt Wilson road sometime after 14:50 on 14 December 2019. The core extent of the Gospers Mountain is overlain in a hatched red colour which shows the core area burnt by the fire and excludes the areas of backburns and backburn escapes along its eastern, south-eastern, and south-western flanks. The Mount Wilson backburn escape is shown in orange shaded colour below the final southern flank of the main wildfire along the Bungleboori and the middle reaches of the

[1] Gellie (1987) Mount Wilson-Mount Irvine Community Fire Plan. NPWS internal report, Blue Mountains District, NPWS of NSW, Blackheath.

Wollangambe. Estimated areas for the two extents are 305,000 ha and 54,000 ha respectively. The total area of the Gospers Mountain complex is estimated to have been 782,200 ha.

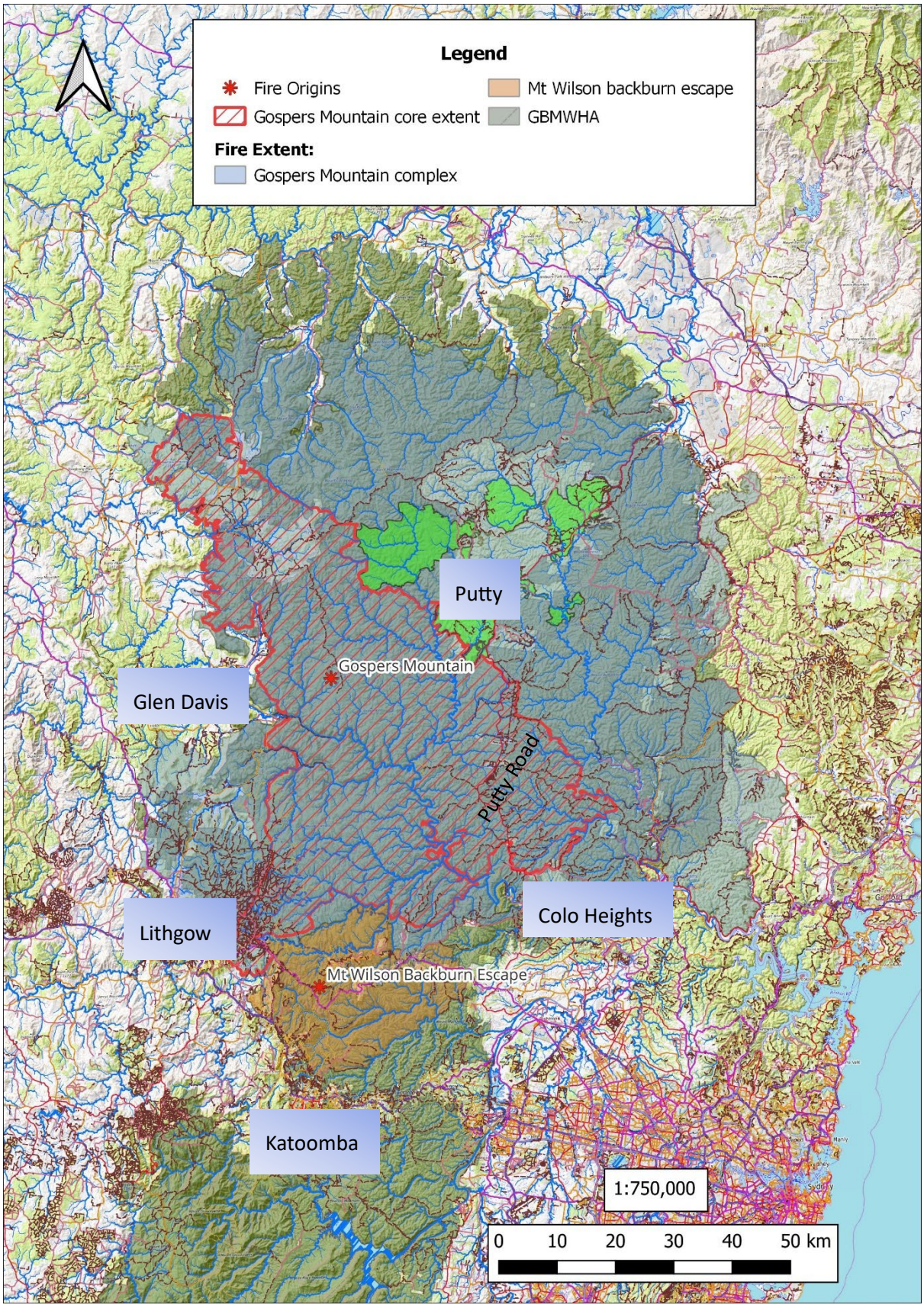

Figure 1: Reference map is presented showing the extent of the Gospers Mountain bushfire (red hatching) without the effect of backburns, and the separate Mount Wilson escaped backburn to its south.

The basic hypothesis in this report is that the core area of this Gospers Mountain bushfire extent could have been reduced significantly had more priority been given to attacking the fire at every opportunity instead on an over-reliance on large scale backburning to enlarge it and make it more difficult to suppress because of uncontrollable fire runs within containment lines further backburn and containment escapes. The inevitable resultant increase in the perimeter makes for even more difficult suppression. The length of the perimeter of the Gospers Mountain complex ended up being over 1,100 km long.

The scope of this report is limited to studying the effect of the various backburns and containment escapes on the eventual size and severity of the Gospers Mountain wildfire and not the other fires starting one month after the lightning ignition in the Gospers Mountain fire complex. In particular, the Mount Wilson backburn escape on 14 December was a significant factor in further enlarging this fire when it was not posing a direct and immediate threat to Mount Wilson and Mount Irvine some distance away to the south-east of a fire front burning in rocky open ground and burnt severely 6 years before in the 2013 State Mine Gully wildfire. I will also show that alternative containment options existed that would avoid the high risk, high consequent impact of that backburn on the communities off Mount Tomah, Berambing and Mount Wilson subsequently. Similar options existed on other sections of the fire in the month leading up to 14 December where backburning was implemented. In many cases the backburns escaped and ended up threatening the very communities they were intended to protect.

The aim of this report is to prepare, in detail, case studies of significant backburn and containment escapes between 13 November and 21 December which resulted in a significant increase in the extent and impact of the Gospers Mountain bushfire on private property, the natural and cultural heritage values of the GBMWHA, and the loss of ecosystem function and biota in forests burnt severely in the course of these escapes.

The report is broken up into eight sections:

Introduction

Methodology

Results – Backburn and Containment Case Studies

Results – Backburn Case Studies

Discussion

Conclusions

Recommendations

Annexures to the Main Report

The seven backburn and containment escape case studies in the report demonstrate that the Mount Wilson backburn and containment escape in this report was not an isolated event. In order to understand what happened during the backburn operation at that location on 14 December, one needs to know the series of decisions and cascading events after a Section 44 emergency was declared on 11 November 2019. The issues in these case studies examine the following questions:

- what was the containment intention;
- what were the fire weather and fireground conditions and backburn lighting tactics, the resultant fire behaviour, and consequent impact of that backburn operation in terms of additional area burnt and fire severity; and
- was it a reasonable decision to implement the backburn given that there might have been other options available?

These fall in the scope set by the coroner in wanting some answers to these important questions so that in the future fire managers and fire agencies are not bound to a single option in containing and finally suppressing a bushfire and can consider other alternatives including using natural fire advantages even during drought conditions, partial containment of major bushfire threats, and inserting remote area crews to mop up inactive fire edges after rainfall events.

I adopted a case study method to analyse the backburn and containment escapes, as well as evaluating containment options during key planning periods for the fire. The case studies follow a method I have developed over the years examining the field fire intelligence made available after a wildfire. It is a drawn-out and sometime tedious process requiring much attention to detail and integrating fire behaviour such as fire spread, fire intensity, and spotting with field fireground conditions, recent wildfire and prescribed burning history, and significantly drought, fuel availability, combustibility and flammability, along with sub-hourly fire weather.

In the results section the results are presented in terms of maps produced from a Geographic Information System (GIS). This is the best way to present a complex series of events. As these maps are based on a fire reconstruction, not all the information is necessarily available. Considerable effort was made to obtain all field fire information, as well as the general details of an operation where applicable. It is not possible to examine in detail resource allocation in any of the case studies. The containment escapes are included in the report since many times these small events could have precluded the necessity for high-risk, severe consequence backburn operations.

In the discussion section I summarize the impact of the backburn and containment escapes ; and draw together the common themes arising out of the seven case studies including: alternatives to backburning by sometimes simply observing and acting when conditions were more favorable to contain or suppress a fire; the causes of severe fire behaviour including light-up patterns in relation to dead fine fuel moisture (DFMC), the critical interval needed to secure a backburn, and the general standards of business practice in backburn operations.

For the purposes of this report, I have included these following definitions and principles for standards of practice in backburn operations. One could also treat containment escapes in the same way so that the risk of escapes from containment lines, whether they are natural fire advantages, fire operations along roads and fire trails, or aerial water or fire-retardant bombing on either inactive or actively spreading fires.

1.3. Definitions Used in this Report

Prescribed Burns and Backburning In this report I treat a backburn the same way as a prescribed burn for these reasons:

Backburning needs to be confined to a particular area and the fire behaviour managed within a specific time period outside of expected very high-extreme fire weather.

Present minimal fire risk and threat to adjoining local villages, townships and local communities.

Backburning needs to be carefully planned and implemented to produce a low-moderate intensity burn rather than an uncontrollable bushfire within the containment lines or from wildfires resulting from spot-overs of containment lines.

Backburn Escapes

A backburn escape can occur when weather and fuel conditions are not conducive to controlling a prescribed burn; or when lighting/ignition techniques are not implemented properly. Or a combination of both.

Containment Escapes

A containment escape is considered a missed opportunity to suppress a fire earlier using a closer fire containment option. This is usually done when the fire weather conditions are mild and the activity of the fire perimeters are either of low-moderate intensity, usually during the day or night on an inactive edge or sporadic fire edges after rain allowing safe remote fire-fighting operations and aerial water bucketing of hotspots. Missed opportunities using natural or weather advantages (such as fire stopping rain events and terrain features) can place further pressure on firefighting strategies and resources leading to further large scale backburning as the only option (other than a Defensive strategy) to contain a wildfire.

Finally, I present a series of conclusions and recommendations which are intended to improve standards of practice in strategic and tactical planning of fire operations to minimize the consequences of backburn and containment escapes and include a range of options including using natural fire advantages and partial containment. Ultimately rain puts out most fires. We just need to aid the process of natural extinguishment.

I hope that by doing so we can incorporate more flexible thinking either during or outside offire emergencies. To that end I would reverse the top-down approach to fire containment and instead apply a more personal, community-based approach to managing bushfires. It is something that my one-time mentors, Jim Hickman, Tony Mount, and Evan Rolley imparted to me in my time as fire research officer with the Forestry Commission of Tasmania. What I learnt there I carry with me to this day and is reflected in this report.

2. METHODOLOGY

The methodology used was interpretation of fire spread and fire intensity, by manual delineation of fire isochrones within QGIS, an open-source Geographic Information System (GIS) on the computer screens

2.1. Data Collation

The following data were collated for the case studies using the information below:

RFS fireline scans

Sentinel-2 satellite imagery

Fire advantage maps based on vegetation mapping

Watercourse data

10-m interval elevation contours

Roads and tracks from on-line Open Source Map (OSM) mapping

Google Earth imagery and OSM-Topo maps

Critical to the interpretation of the fire isochrones were:

Bureau of Meteorology (BOM) weather data from key weather stations at Nullo Mountain, Richmond RAAF, Mt Boyce and Marrangaroo

BOM 128-km Sydney Radar Data,

Field fire weather observations and field reports of fire behaviour during fire operations extracted from the RFS ICON recording system for field fire operations

In addition, fire intelligence for the various firegrounds was gathered including:

- RFS fire spread data
- ICON Intelligence log for the Gospers Mountain Fire supplied by the RFS
- detailed fire behaviour intelligence (where available) from the fire ground such as photographs, RFS radio calls detailing fire observation, RFS situation reports, Incident Action Plans IAP), RFS burn plans, and RFS aerial ignition plans.

Incident weather forecasts, (where available). This is a spot location where BOM provides a forecast for specific location related to fireground activities.

RFS Facebook imagery for the Gospers Mountain Fire.

Photos and videos supplied by individuals taken at the time of backburns and fires near the containment line for the Gospers Mountain fire.

2.2. Interpretation of Data

A core part of the case study method involved digitising fire isochrones as polygon lines, as well as identifying backburn and containment escape points as GIS line and point layers. The key attributes for these layers were added to fields created for each of these layers including:

- Date
- Time (hours format)
- Date and Time
- Data Source
- Fire Category (wildfire, backburn, escaped backburn)
- General fire behaviour patterns around the fire perimeters

Additional fire intelligence information from various sources including the Brief of Evidence, Facebook were notated in Google Earth as KML files. These were later added into QGIS as a separate set of point, line and polygon layers.

This manual delineation of fire isochrones on screen was set against contextual features set up as additional layers in the layers panel .

- Google Earth or OSM-Open Topo maps
- terrain features, including elevation contours, slope, and aspect.
- watercourses
- vegetation classified as general fuel types (see later section **Error! Reference source not found.** for a further description of the classification methods from detailed vegetation maps0
- history of wildfires and prescribed burns
- roads and trails

For estimation of dead fine fuel moisture content (DFMC) and components of fire danger, 10-min fire weather data for BOM Nullo Mountain, Marrangaroo, Mt Boyce and Richmond stations were extracted from the Weather Zone archives and estimations of DFMC and FFDI made for each 10-min period. Although these weather stations lie some distance of 40-70 km from the progressive perimeters of the Gospers Mountain bushfire, they approximate pretty well the fireground weather conditions given they encircle the fireground geographically.

The fire isochrones and other fire point layers were constantly related back to the 10-minute weather data from four key weather stations at Nullo Mountain, Richmond RAAF, Mt Boyce and Marrangaroo as well as Incident Weather Forecasts and ground observations.

2.3. Identification of case studies

Along with the Mount Wilson backburn escape, a summary list of backburn or containment escape incidents were identified from field fire intelligence in the brief of evidence, and from the delineation of fire isochrones in the desktop analysis (**Table 1**). The key attributes for this table include:

- Type of incident - Backburn Escape (BE) or Containment Escape (CE)
- Incident name
- Start date and time of incident
- Finish date and time of incident
- Number of days
- Consequent Area Burnt for each incident.

A chronology of the incidents is also set out in Annexure A in section 8.1 at the end of this report.

Table 1: Summary list of significant backburn or containment escapes for the Gospers Mountain bushfire

INCIDENT NUMBER	TYPE OF INCIDENT	INCIDENT NAME	LOCATION	Start Date / Time	Finish Date / Time
1	BE	North Mellong Swamp	Staircase Hill Trail, Wallaby Swamp Trail	13-Nov-19 09:00	07-Dec-19 23:59
2	BE	Colo Heights	Grassy Hill Firetrail, Putty Road	13-Nov-19 09:00	15-Nov-19 23:59
3	BE	Colo Heights	Putty Road, Wheelbarrow Ridge Road	19-Nov-19 09:00	
4	CE	Cooroongooba River Catchment	Upper Nile	23-Nov-19 14:00	1-Dec-19 TBD
5	CE	Pipeline Track-Wolgan River Anchor Point	Wolgan Valley	23-Nov-19 14:00	11-Dec-19 16:30
6	BE	South West Colo Heights Backburn Escape	Cerones Track, Upper Colo Road	3-Dec-19 11:00	5-Dec-19 23:59
7	BE	Mountain Lagoon	Gospers Ridge Trail	4-Dec-19 00:01	10-Dec-19 13:39
8	BE	Glow Worm Tunnel Road Backburn Escape	Newnes Plateau: West and Central	7-Dec-19 22:30	10-Jan-20 16:30

Table 1 continued

INCIDENT NUMBER	TYPE OF INCIDENT	INCIDENT NAME	LOCATION	Start Date / Time	Finish Date / Time	Number of Days
9	CE	Upper Bungleboori Catchment	Newnes: Plateau East	9-Dec-19 09:00	13-Dec-1917:28	4
10	BE	Mt Wilson Backburn Escape	Mt Wilson Road, Bells Line of Road	14-Dec-19 14:50	26-Dec-19 23:59	12
11	CE	Lithgow Valley	Chiefly Road	7-Dec-19 22:30	21-Dec-19 23:59	14
12	BE	Blackheath	Evans Lookout Road	31-Dec-19	31-Dec-19	1

NC = Not considered in this report; BE= Backburn Escape; CE = Fire Containment Escape

2.3.1. Backburn Escapes Case Studies

For the purposes of this report, four escaped backburn incidents were identified which caused severe impact to human assets[2][3] or the environment. These were:

- Nothern Mellong Swamps on the Putty Road
- Upper Colo
- Glowworm Tunnel
- Mount Wilsom

2.3.2. Containment Escapes Case Studies

In addition, three other containment escapes (CE) were identified that either caused the Gospers Mountain Fire to burn outside of identified natural and cultural fire advantages into much larger areas or broke critical anchors on the western and south-western side of this fire into areas including.

- Cooroongooba River Catchment and the Pipeline Track - Wolgan River Anchor Point on or after 27 November
- Upper Bungleboori Creek between 09 and 13 December
- Lithgow Valley / Chifley Road on 21 December.

These seven critical case studies are listed in **Table 2** below. The spread of each of the fires originating from these escapes was then tracked day by day to determine the final perimeter of each incident.

[2] Tab 46 - Affected Properties, Master Spreadsheet prepared by Jeff Sinton, Detective Senior Constable, NSW Police

[3] Tab 51 - Affected Properties, Master Spreadsheet

Table 2: Case Studies - Critical Backburn and Containment Escapes

INCIDENT NUMBER	TYPE OF INCIDENT	INCIDENT NAME	LOCATION	Start Date / Time	Finish Date / Time
1	BE	North Mellong Swamp	Staircase Hill Trail, Wallaby Swamp Trail	13-Nov-19 09:00	07-Dec-19 23:59
2a	CE	Cooroongooba River Catchment	Central western section of Wollemi NP	23-Nov-19 14:00	1-Dec-19 TBD
2b	CE	Pipeline Track-Wolgan River Anchor Point	Southern Glen Davis	23-Nov-19 14:00	11-Dec-19 16:30
3	BE	South West Colo Heights	Cerones Track & Upper Colo Road, Upper Colo Road	3-Dec-19 11:00 AM	5-Dec-19 23:59
4	BE	Glow Worm Tunnel Road	North of the derelict Newnes pine plantation	7-Dec-19 22:30	10-Jan-20 16:30
5	CE	Upper Reaches of the Bungleboori catchment	East-south-east of the derelict Newnes pine plantation	09-12-19 10:00	13-Dec-19 17:28
6	BE	Mt Wilson Backburn Escape	Mt Wilson Road, Bells Line of Road	14-Dec-19 14:50	26-Dec-19 23:59
7	CE	Lithgow/Clarence/Dargan	Chiefly Road	7-Dec-19 22:30	21-Dec-1923:59

NB: Table 2 contains the final list of critical backburn and containment escapes which are the focus of this report. Incident numbers listed in Table 2 above correspond to the Map Series covered in Section 3 and 4 - Results in this report.

2.4. Closer Containment Options Analysis Method

To understand further the context of the decision-making to implement a high-risk high impact consequence decision to implement a backburn at between north of the Bells Line of Road north and to the west of the Mount Wilson Road to the west, we need to understand the successive strategic containment oversights that occurred between 3 November and 14 December. Alternative containment options did exist at every stage during this period for the western and southern flanks of the Gospers Mountain wildfire. These were not adequately considered in the options analysis and the probability of success of the various feasible alternatives.

Identification of these closer containment option falls within the coroner's terms of reference to investigate whether there were other containment options other than backburning to contain the Gospers Mountain Fire to a much smaller area.

This analysis drew on similar data in the case studies for the backburn and containment escapes and included:

10-min fire weather data

Detailed high-resolution vegetation maps

Fire History

Watercourses

For fire weather and components of fire danger, 10-min fire weather data for BOM Nullo Mountain, Marrangaroo, Mt Boyce and Richmond stations were extracted from the WeatherZone archives and estimations of DFMC and FFDI made for each 10-min period. Although these weather stations lie some distance of 40-70 km from the progressive perimeters of the Gospers Mountain bushfire, they approximate pretty well the fireground weather conditions given they encircle the fireground geographically.

In addition, all detailed vegetation maps for the GBMWHA were extracted from SEED website (http://environment.gov.au/seed). Unfortunately, not all the vegetation has been mapped to a recent high standard of mapping across the GBMWHA. I have been aware of this for some time and have alerted NPWS of NSW for some time because to have a complete coverage of vegetation mapping completed to a high standard is essential for containment options analysis (see Figure 21)

I recently completed a draft vegetation map for the Grose Valley within the Blue Mountains National Park on a contract with the GMBWHA institute last year. There are also gaps in northern Blue Mountains National Park, central and northern Wollemi. One critical gap is in the Wollangambe, Dumbano, and Bungleboori River Catchments to the north-west of Mount Wilson. For this project I digitised most of the rocky outcrops and woodlands on rocky outcrops in this area so that I could show that there were significant barriers to the southerly and easterly spread of the Gospers Mountain between the 1 and 26 December 2019.

For each vegetation map, vegetation types mapped were classified into fire advantage classes based on flammability of the overstorey, the understorey, and the fuel continuity at the surface. The general fire advantage classes were:

Good:

(a) Mesic forest – Rainforest and Wet Sclerophyll Forest in main drainage systems and basalt lithology and

(b) Rocky Outcrops

(c) Secondary grasslands with low fuel loads

Moderate:

(a) Sheltered semi-mesic forest in sheltered easterly and southerly gullies and lower slopes: e.g. Turpentine – Smooth-Barked Apple forest at lower elevations; Monkey Gum – Sydney Peppermint at higher elevations

(b) Exposed woodland on rock outcrops: Scribbly Gum open woodland; Yertchuk Low Woodland, Arid Ironbark exposed woodland in northern Wollemi National Park

(c) Heathland on rock outcrops

(d) Box- Gum woodland on various lithologies

Low:

(a) Exposed ridge and slopes dry sclerophyll forest throughout the GBMWHA
(b) Heath-Mallee

In general terms, the moister vegetation types categorised as a **good** fire advantage are generally more resistant to drought stress, less flammable and combustible and are located in places sheltered from the fire winds. Given the drought conditions these were considered as the only real fire advantage as the drier sheltered forests became more available and combustible, particularly the live fine fuel components in the understorey.

NPWS fire history was also extracted from the SEED website to determine areas recently burnt within the GBMWHA. Recent wild and prescribed fires up to 6 years before July 2019 were classified into decimal years since the last fire, and further classified into two categories: wildfire and prescribed burn. Any fire record older than 6 years was discarded as a possible **good** fire advantage.

Lastly the watercourses were added. Significantly there was state-wide watercourse layer on SEED in 2022. This has now disappeared from the SEED catalogue. Instead, I collated the necessary SRTM 20-m DEM tiles covering the GBMWHA and derived the watercourses directly from it using a series of tools in the processing toolbox within QGIS. These watercourses were then categorised into Strahler stream orders to produce a hierarchy of streams from small permanent creeks to major rivers.

The above data layers were then added to a QGIS project and overlain with the fire isochrones and significant fire hotspots identified on the fireline scan images used to prepare them.

I then graphed the fire weather data into two separate graphs over the full period between 1 November and 31 December:

(a) DFMC and 10-min average and gust wind speed
(b) FFDI and wind direction

Upon inspection of the fire weather and fire danger parameters I then narrowed down the planning periods of the fire when the ranges in DFMC and FFDI provided opportunities for closer containment or for monitoring. These were: the fire-stopping rain events on 3 and 23 November during which 10-15 mm and 4-10 mm of rain consecutively fell on the fireground and the 10-13 December when moist easterly fire weather prevailed over the Gospers Mountain fireground.

The alternative containment options were confined to four planning periods to illustrate limiting the risk of fire outbreak and subsequent severe fire runs on either side of these significant fire-stopping events which lasted 3-4 days on average:

1. The inactive fire period between 03 and 06 November in the initial stages of the Gospers Mountain fire
2. The active fire period after the fire broke containment lines early on the morning of 7 November between then and late evening of 11 November
3. The active fire period between mid-day on 12 and the morning of 16 November in which there was an intense fire run from the two breaches across Wollemi Creek at mid-day on 12 November in which the fire crossed the Putty Road and triggered a spot fire to the east of Colo Heights that afternoon
4. The inactive fire period between 23 and 27 November during which time there were mainly hotspots on the fire edge
5. The active period when the Gospers Mountain fire broke out sometime after 29 November from hot spots around its north-west, north-east, and southern perimeter. The containment options in the planning period between then and 5 December is 23 November to 1 December 2019 respectively.

Using in combination the fire advantages from the recent fire history, the vegetation and watercourses, as well as the trends in DFMC< 10-m wind speeds, the strengths and weaknesses of the fire advantages, the opportunities and threats posed by the Gospers Mountain wildfire were then examined in detail using my detailed knowledge of the fire landscape and my experience in managing bushfires under drought conditions in the GBMWHA. I then broke up the alternative fire perimeters into sections based on the following classification:

- Anchor point
- Dead fire edge
- Potential fallback – in case of containment escapes
- Fuel break: fire trail
- Fuel break: road
- Inactive edge - hotspots
- Natural fire advantages
- RAFT – remote area crews operations
- Recently burnt areas
- Uncontained edge

These are essential firefighting tactics confined to a particular geographic feature: for instance natural fire advantages would comprise rainforest lined creeks in the case of a riparian-based natural fire advantage; or a rocky outcrop with little if any discontinuous surface or elevated fuels;

These closer containment options are essential in comprehending alternative strategies that may have been overlooked because of the IMT's preference for hard containment lines along major roads[4], which historically are relative weak strategic fire advantages to backburn from.

[4] Factual Investigation Gospers Mountain Fire – Impact on Mt Wilson & Bilpin – 14 December 2019 p. 24

2.5.Additional Background Material Used

In addition to my experience and research into fire management and behaviour, I have also made use of information contained in the NSW Rural Fire Service Wildfire Behaviour Manual (2021); the Australasian Fire Authorities Council (2017) National Guidelines for prescribed burning, strategic and program planning and the NSW Rural Fire Service S.O.P.s # 17 Backburning Activities (1999).

The following extract from the RFS's Wildfire Behaviour Manual is based on McArthur's original fire behaviour back in the 1960s (Luke & McArthur (1974) Bushfires in Australia, Australian Government Publishing Service).

Fine fuel moisture content (DFMC) is a critical tool for understanding forecast fire conditions and has been used throughout this report to determine the risk of backburn escapes and fire severity for each case study (

Table 2). In this report we use the algorithm developed by Stuart Matthews et al. (2016)[5].

Table 2: Fuel Moisture Content and Fuel Flammability. [6]

FMC (%ODW)	FUEL FLAMMABILITY
>28%	Eucalypt fuel will not burn
22–28%	Fuel is very difficult to ignite, burning difficult to sustain. Pine litter may continue to burn more readily
16–22%	Eucalypt fuel difficult to ignite. Pine fuels burn readily
13–16%	Pine fuel easy to ignite, eucalypt fuel moderately easy to ignite, burning sustained
10–13%	Burning readily sustained, fire behaviour is predictable, spot fires readily ignite from large firebrands
5–10%	Severe fire behaviour, crowning likely at lower values
<5%	Extreme and difficult to predict fire behaviour

[5] Matthews, S., et al. (2010). "Simple models for predicting dead fuel moisture in eucalyptus forests." International Journal of Wildland Fire **19**(4): 459-467.

[6] NSW Rural Fire Service Wildfire Behaviour Manual, 4 Fuel Moisture Content p.65

3. RESULTS: Backburn Case Studies

From my analysis of the data, I have created a series of maps showing the identified critical escaped backburn & containment escape studies which are presented below. This shows an overview of a series of seven RFS escaped backburns or containment escapes, or a combination of both. An overview map of the entire Gospers Mountain Fire is presented for reference in Figure 1. Figure 2 map showing identified containment breaches has been produced to provide the context in which the following fire case studies are included:

1. Northern Mellong Swamps (BE): 13 - 15 November
2. Cooroongooba River Catchment and Pipeline Track-Wolgan River (CE) : 29-30 November
3. South-west Colo Heights BE: 3 and 5 December
4. Glowworm Tunnel Road series of backburns on the Newnes Plateau (BE & CE): 7 - 13 December
5. The Upper Bungleboori catchment escape (CE): 9 - 13 December
6. The Mount Wilson Backburn escape (BE): 14 - 21 December
7. Lithgow Valley Containment Escape (CE): 20 - 21 December

Each case study includes a series of annotated maps, images and figures that demonstrate:

The intention of the backburning operation extracted from the daily Incident Action Plan map.

Respective geographical locations of the backburning operations or containment escapes in relation to the Gospers Mountain Fire.

The extent of the backburn of containment perimeter under consideration.

The sequence of events leading to the backburn or containment escapes, and

The consequent impact of the backburn or the containment escape in terms of extent and severity, as well as loss of possible options for furthermore confined containment of the Gospers Mountain Fire.

Images and figures showing lighting patterns and fire behaviour (where available).

These seven case studies indicate a repeated pattern of response by the RFS to the Gospers Mountain Fire and will be discussed in the results and conclusion sections of this report.

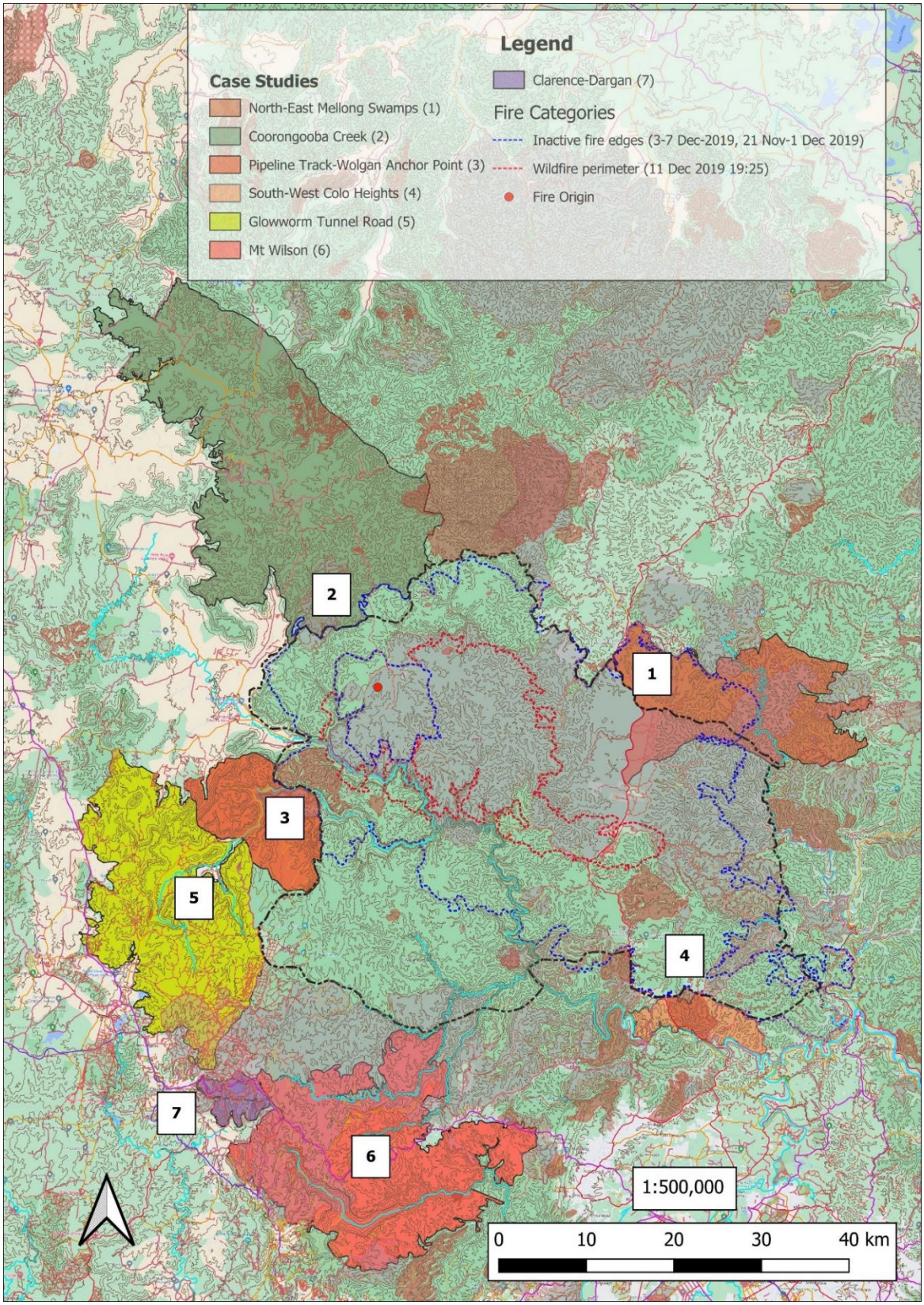

Figure 2: Reference map is presented identifying closer containment options and each Backburn and Containment Escape Study.

3.1. Case Study 1: Escaped backburns in the Northern Mellong Swamps area

This first case study shows the progression of RFS backburning operations along the Putty Road and Wallaby Swamp Trail from 13 to 15 November 2019 under Severe FFDI and DFMC under 5%. On 15 November 2019 these backburns spotted outside containment lines causing intense fire runs eastward into Yengo National Park. These backburn escapes ultimately spread 28 km to the east and burnt an area of 29,500 ha.

3.1.1. Setting the initial context for the backburn escape (19:43 13 November)

Figure 3 shows the status of backburns on the Putty Road at 19:43 on 13 November in relation to eastern flank of Gospers Mountain wildfire in Wollemi National Park.

Backburning operations on both sides of the Putty Road spread 8.5 km north. This operation caused the fire edge to extend 28km eastwards into the Yengo National Park. The exposed uncontained eastern flank would later on 15 November 2019 be subject to severe fire weather which caused extensive fire runs to the east under dry and gusty strong westerly or south-westerly fire winds.

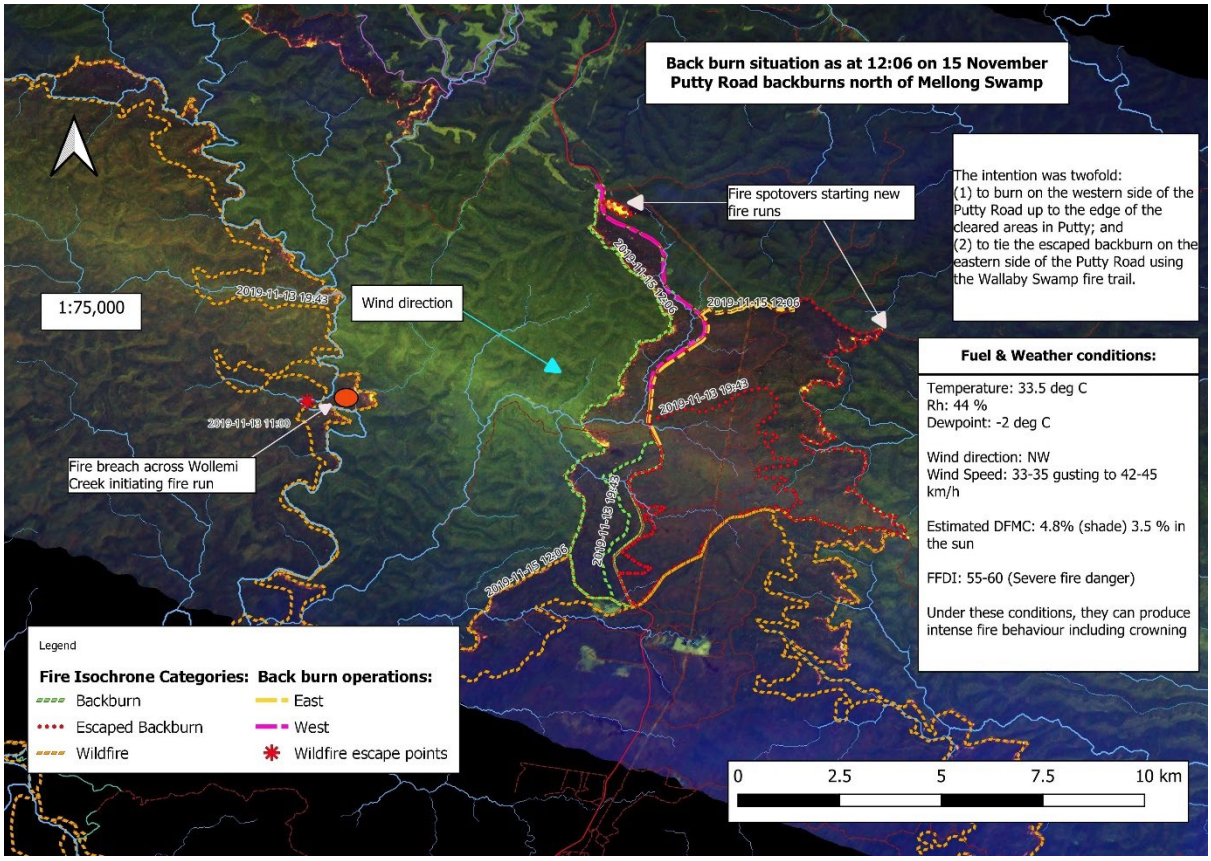

Figure 3: North Mellong Swamp backburn escape as 19:43 13 November 2019

The following sequence of images (Figure 4 &Figure 5) taken on the 13 November 2019 show the type of lighting pattern used to ignite both sides of the Putty Road. This style of lighting pattern using continuous drip-torch lines is conducive to intense backburns that will later be difficult to mop and patrol and cause potential spot-overs from fibrous-barked eucalypt trees. In addition, lighting both sides of the Putty Road were not an effective containment strategy given the potential for

further severe fire runs to start from the eastern side of the Putty Road being lit.

Figure 4: Backburning both sides of the Putty Road on 13 November 2019 at 9:22.[7]

Figure 5: Crowning in eucalypt forest beside the Putty Road on 13 November 2019 at 9:26.[8] *This shows the consequence of the pattern of lighting-up a backburn under deteriorating fire weather conditions using the light-up pattern shown in Figure 3. The DFMC was likely to have been 3-5% which is conducive to intense sub-canopy fires and fire crowning.*

[7] Newton, J. (2019) Putty Road [Photograph] 13 November 2019 at 9:22 a.m.

[8] Ibid, 13 November 2019 at 9:26 a.m.

3.1.2. Situation as at 12:06 15 September 2019

Figure 6 shows the starting points for escaped backburns on the eastern side of the Putty Road at 12:06 on 15 November and:

The progressions of the back burning operation to Staircase Hill trail and Wallaby Swamp trail.

The commencement of new fire runs from spot overs from backburning operations to the east and outside of RFS containment lines as the fire weather deteriorated at mid-day on 15 December.

The main fire in Wollemi Creek is also showing the initial stages of a fire run east to the Putty Road.

The DFMC at 4.8% has reached critical levels of moisture for fire to spread intensely in eucalypt forests and woodlands.

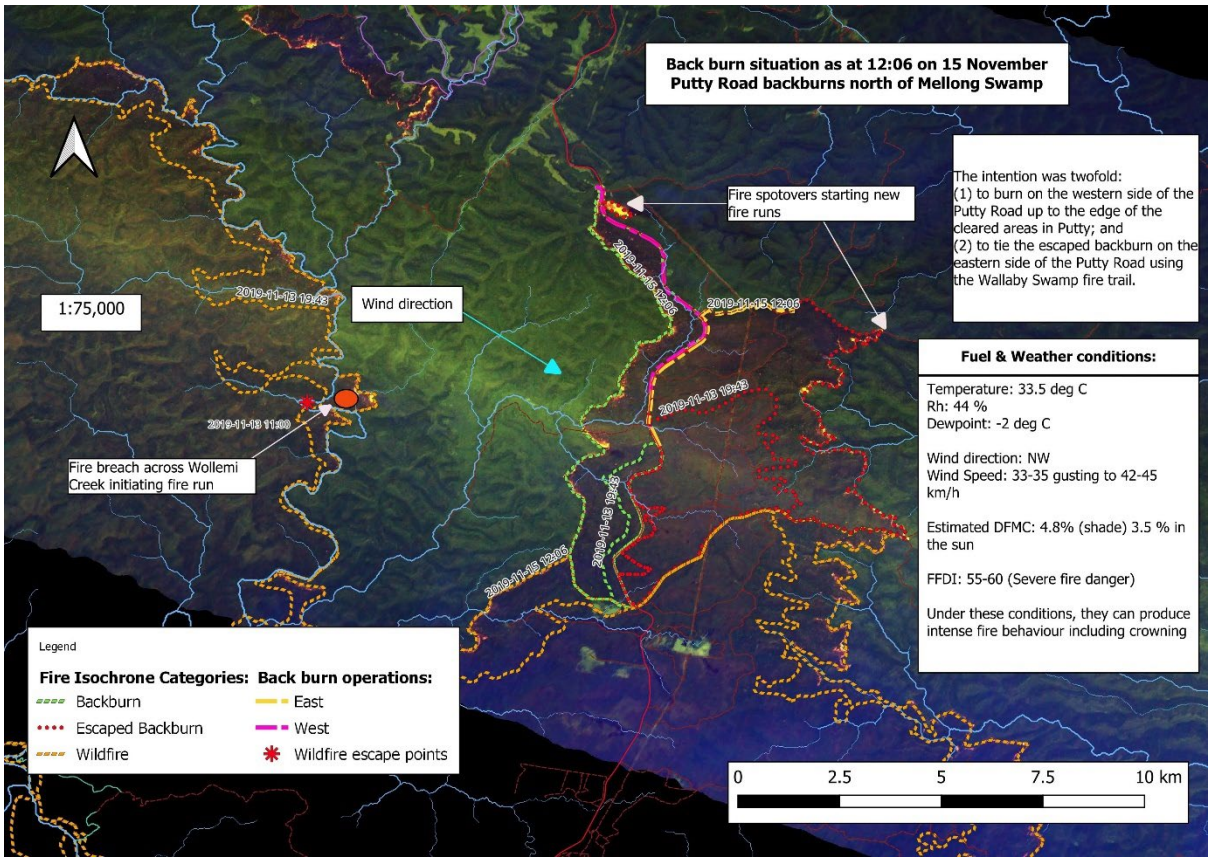

Figure 6: North Mellong Swamp backburn escape as at 12:06 15 Nov 2019

Figure 7 shows the status of the RFS backburn operations along Putty Road on 15 November 2019 as at 16:42 and:

The two fire runs created by the RFS back burns outside identified containment lines which are burning intensely according to the yellow zones highlighted on the RFS fireline scan images.

A missed opportunity to contain the wildfire to the east of Wollemi Creek using targeted water bucketing and perhaps some targeted aerial ignition two to three days earlier.

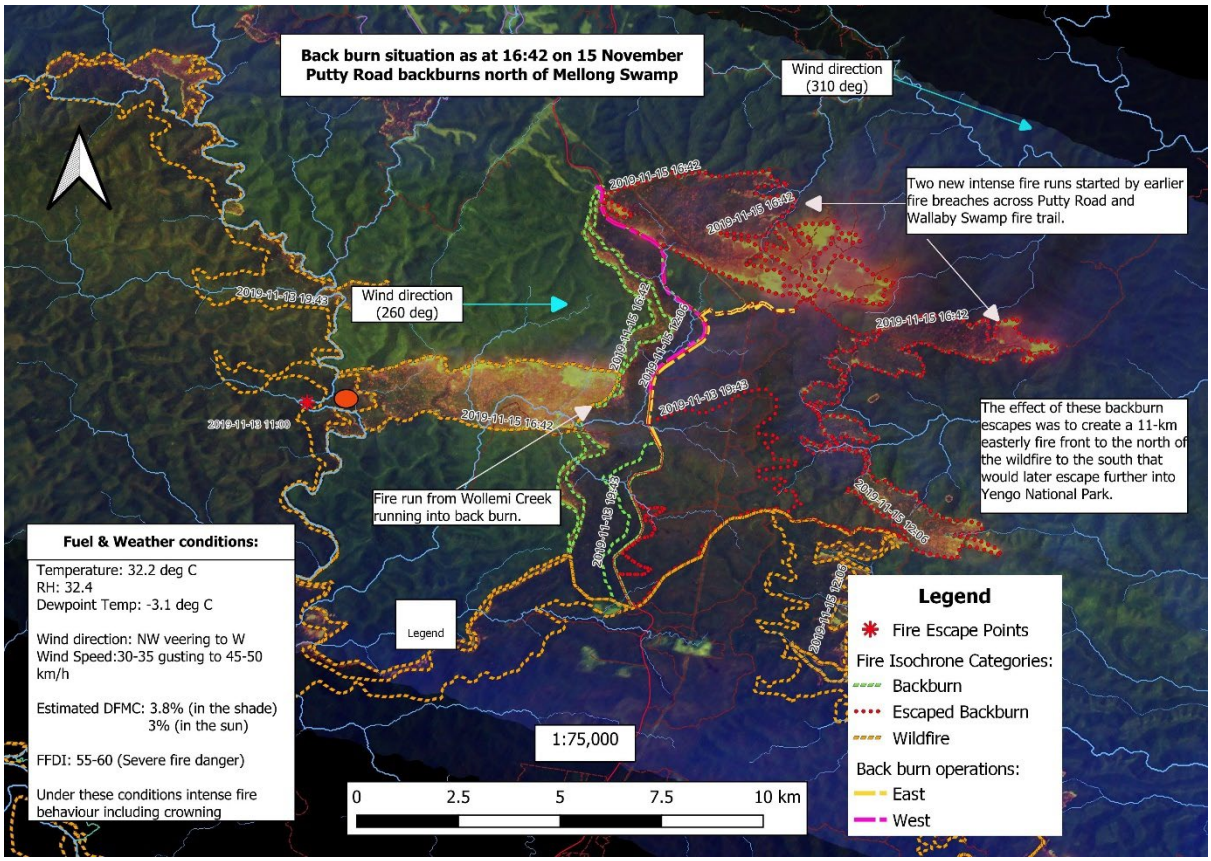

Figure 7: North Mellong Swamp backburn escape as at as at ~16:42 15 Nov 2019

3.1.3. Consequent Impact on North Yengo National Park

Figure 8 shows the consequent area burnt and severity of the RFS backburn fires outside containment lines at north Mellong Swamps. The backburn escapes created a fire run that extended 28km to the east and burnt a total area of 29,500 ha. On 7 December 2019 this backburn escape finally burnt linked up with the Little L complex to the North and the Thompsons Creek fires to the South in central Yengo National Park. It spread on a 11-km front 28 km into the Yengo National Park.

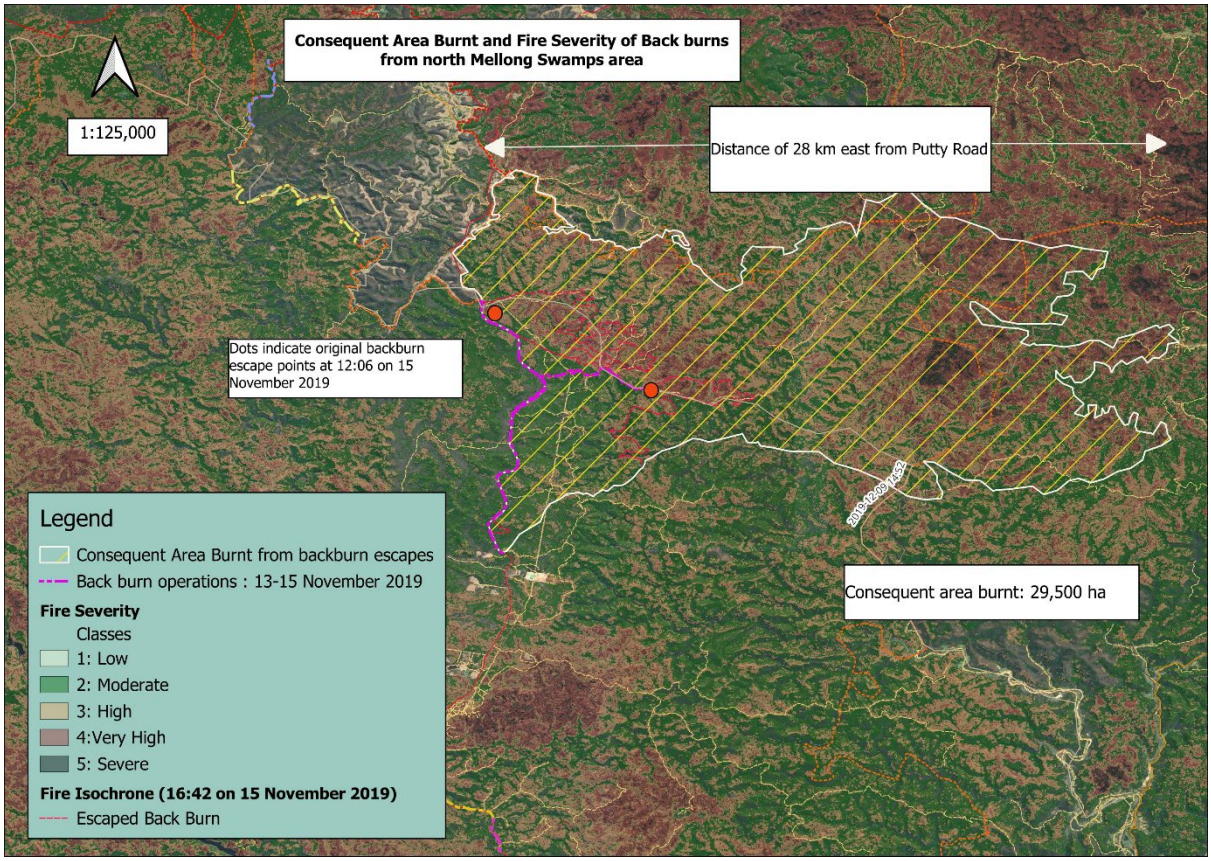

Figure 8: North Mellong Swamp: consequent area burnt 29,500 ha into .

3.2. Case Study 2: Cooroongooba River Catchment and southern Glen Davis-Wolgan River containment escapes

Between 22 and 26 November Nov 2019, the fire edges of the Gospers Mountain bushfire became largely inactive with some occasional hotspots around its fire perimeters in the Coorongooba and southern Glen Davis-Wolgan River sections of Wollemi National Park. On 23 November 4-10 mm of rain fell on the fireground which resulted in the fire to become inactive for several days until 26-27 November 2019.

There was a significant opportunity to suppress the fire hotspots along the length of the Cooroongooba River sector and the Glen Davis-Wolgan River section while there was mild fire weather conducive to water bombing and remote area crew operations (Figure 9).

The net result of these containment escapes resulted in the additional area burnt as shown in Figure 2 overview Map for critical case studies. These meant that the IMT lost a key anchor point in two critical places resulting in the following:

- An additional 75,000 ha to the North-West which caused significant damage to the vegetation in Wollemi National Park and created significantly larger perimeter to contain the fire (Figure 10)
- Significant private property boundary along a convoluted fire perimeter with the Wollemi National Park.
- The opportunity loss in the Wolgan River-Rocky Creek section of the anchor point in the park resulted in pressure being put on the IMT to commit to the Glow Worm Tunnel backburn on 7 December 2019. When this backburn and other containment escapes between 8 and 12 December 2019 failed, the cascading series of tactical and strategic errors resulted in an unfortunate decision to put in the Mt Wilson back burn on 14 December 2019.
- A further area burnt out in the Gardens of Stone National Park (Figure 10).

The consequent area burnt for the two combined containment escapes ended up being 89,500 ha and convoluted fire perimeters amounting 336 km in total. This would have placed a further significant extra toll on resources and firefighters associated with the Mudgee IMT.

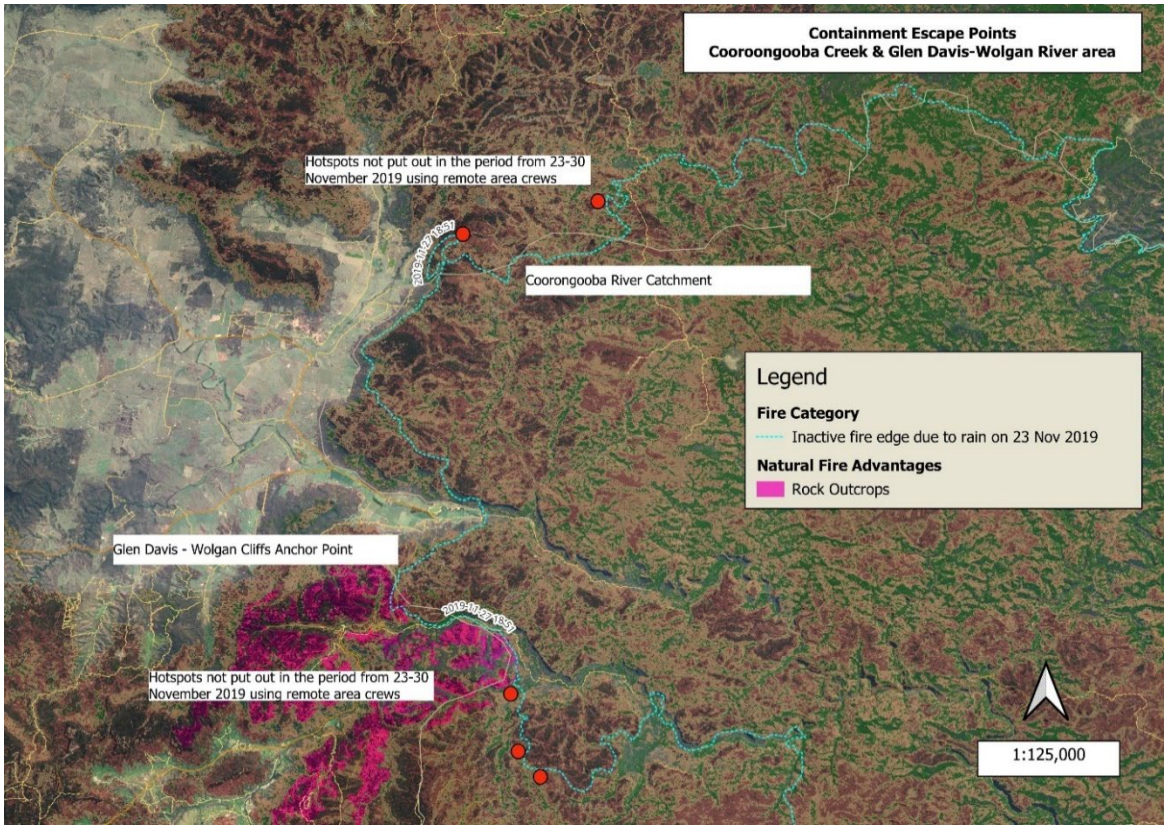

Figure 9: Containment escape points at the Cooroongooba River Catchment and Pipeline Track Anchor Point

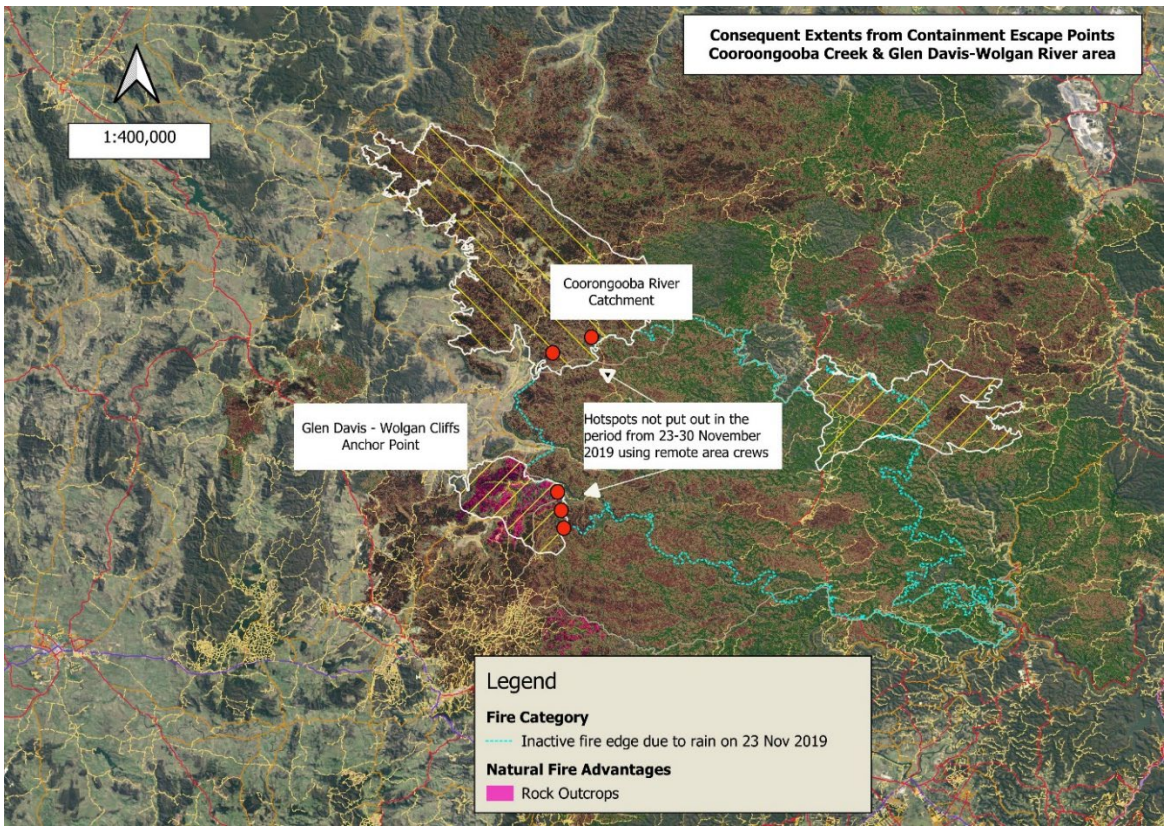

Figure 10: Consequent impact of containment escapes in the Coorongooba Catchment and Pipeline Track-Wolgan RIver anchor point areas

3.3. Case Study 3: Escaped backburn in the South-west Colo Heights area

This is a series of 3 maps showing the status of the RFS backburn operations to the southeast of the Gospers Mountain fire edge along Cerones Track and Upper Colo Road south of Colo Heights and the Putty Road. These backburns were implemented in the lead up to and during Severe FFDI on 4 and 5 December 2019. These maps cover a period from 11:00 on 3 December to 14:48 on 5 December 2019. The total area burnt by the backburn escapes was 5,650 ha.

3.3.1. Situational Context: backburn light up between 11:00 3 Dec and 15:30 4 Dec 2019

Figure 11 shows the status of backburns on or before 01:09 on 5 December in relation to the southern flank of Gospers Mountain wildfire in Wollemi National Park. The backburn is being conducted to protect the western and south-western parts of Colo Heights from a possible fire run emerging near the junction of the Colo and Wollangambe Rivers.

On 3 December 2019 the southern flank of the Gospers Mountain Fire along and west of Drip Rock firetrail was inactive except for one fire escape point identified on the fireline scan at about 17:00 on 3 December 9.5 km west of Colo Heights. This was burning slowly and with low intensity.

Further west, a breakout along the southern edge of Gospers Mountain Fire near to Colo River had moved further south.

Each of these breakouts were effectively obstructed by topography and recently burnt areas from making a run towards Colo Heights before the escalating fire weather conditions two days later on 5 December 2019.

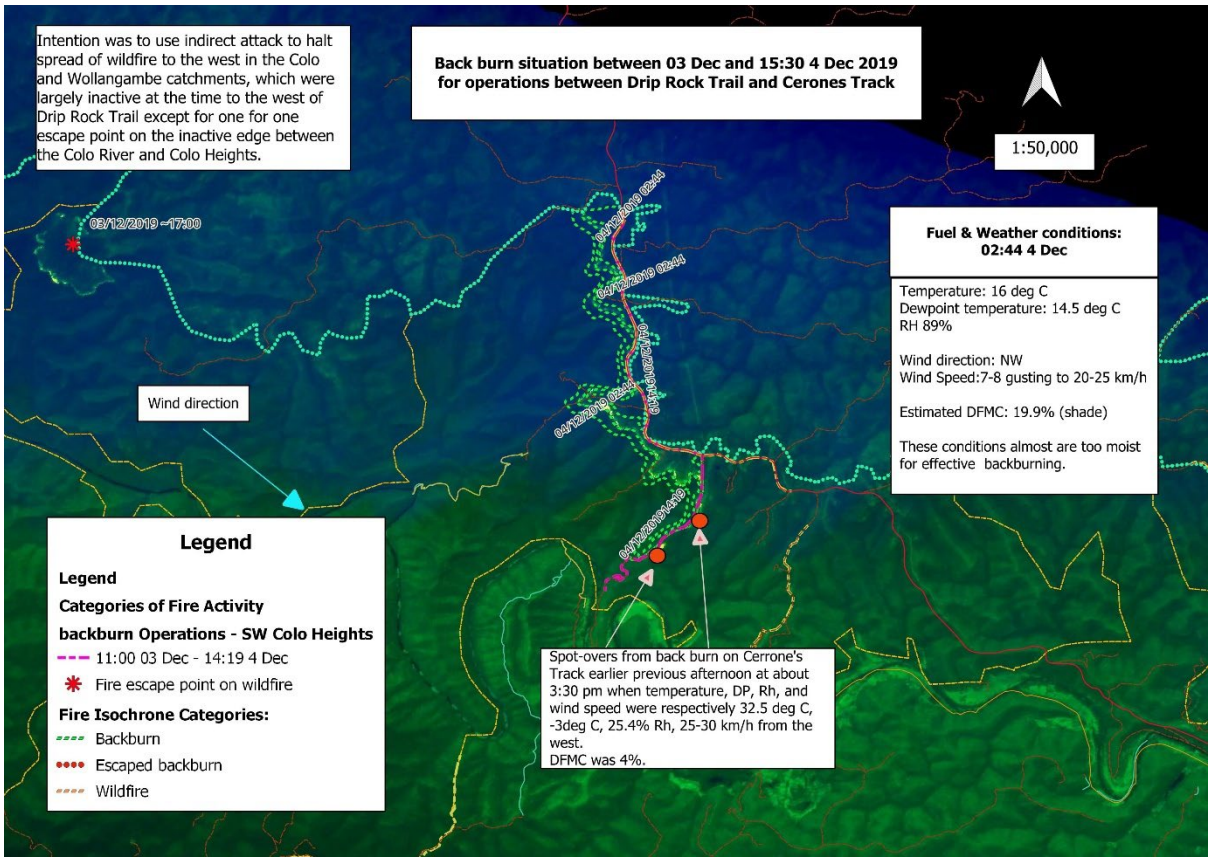

Figure 11: Backburn situation at South-west Colo Heights at 01:09 5 December 2019

3.3.2. Situation as at 12:06 15 September 2019

Figure 12 shows the likely starting points for escaped backburns on or before 14:28 on 5 December 2019 on Cerones Track and Upper Colo Road from Colo Heights down to the Colo River.

The map shows:

- The backburn along Cerones Track did not contain the spread of the original backburn as the map indicates fire to the east and south of the trail. The backburn likely spotted over the track sometime on the afternoon of 4 December 2019.

- The southernmost red dot indicates a point where aerial ignition stirred up the fire to the west of the Upper Colo Road and caused spot fires on the eastern side of the Road to start a new fire run at about 13:30 on 5 December 2019.

- A new set of intense fire runs under the sever fire weather conditions (FFDI=65 at 14:28 5 December 2019) then commenced sometime after that although the precise time is not detailed in the brief of evidence. I suspect sometime later after the spot-over from the aerial ignition operation further to the south-west closer to the Colo River.

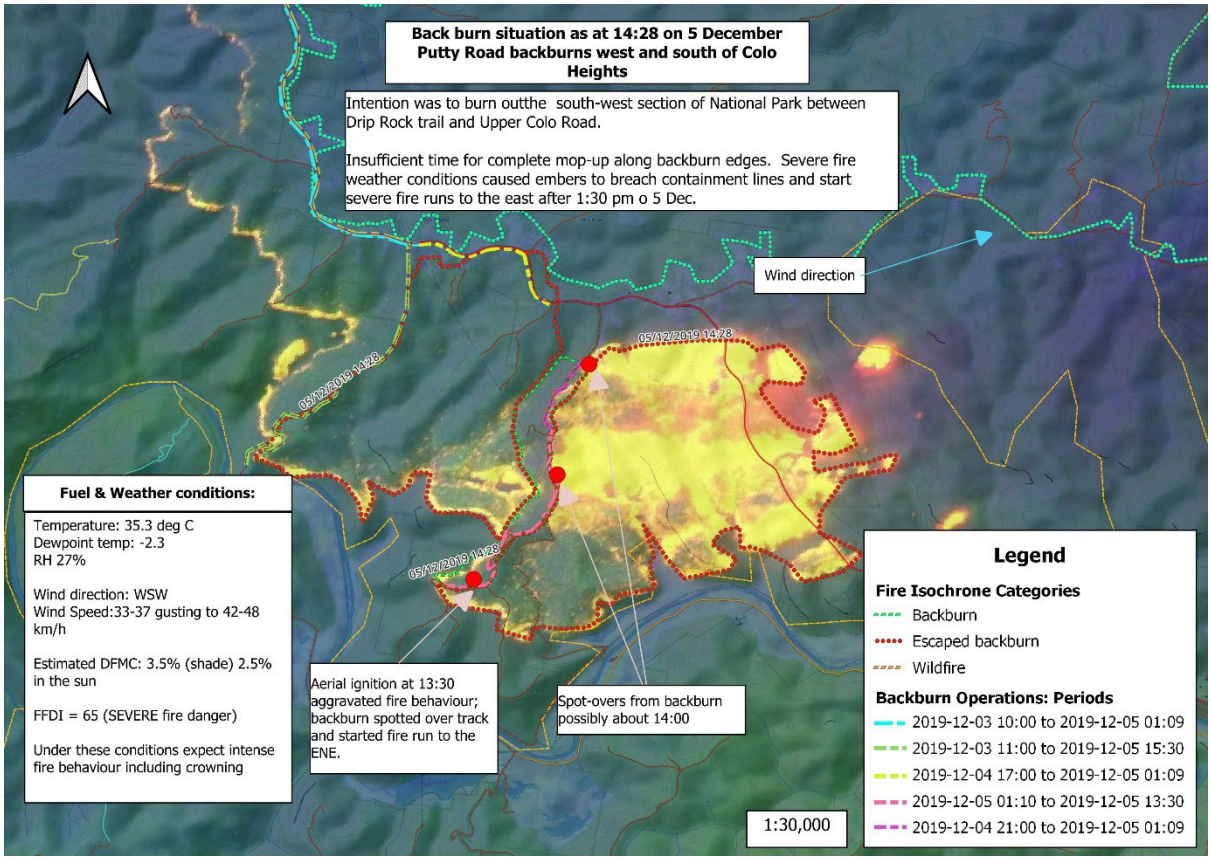

Figure 12: Backburn situation at South-west Colo Heights between 13:30 and 14:28 5 December 2019

3.3.3. Consequent further impact of the South-West Colo Heights backburn

Figure 13 shows the area burnt by the RFS backburn at Colo Heights outside identified containment lines of 5,650 hectares. The escaped backburn required significant further resources to suppress this section of the Gospers Mountain bushfire and resulted in house losses in the Colo Heights and Upper Colo areas.

Significant to this also was the main Gospers Mountain bushfire to the west of Colo Heights had hardly spread even despite the maximum FFDI being severe that day.

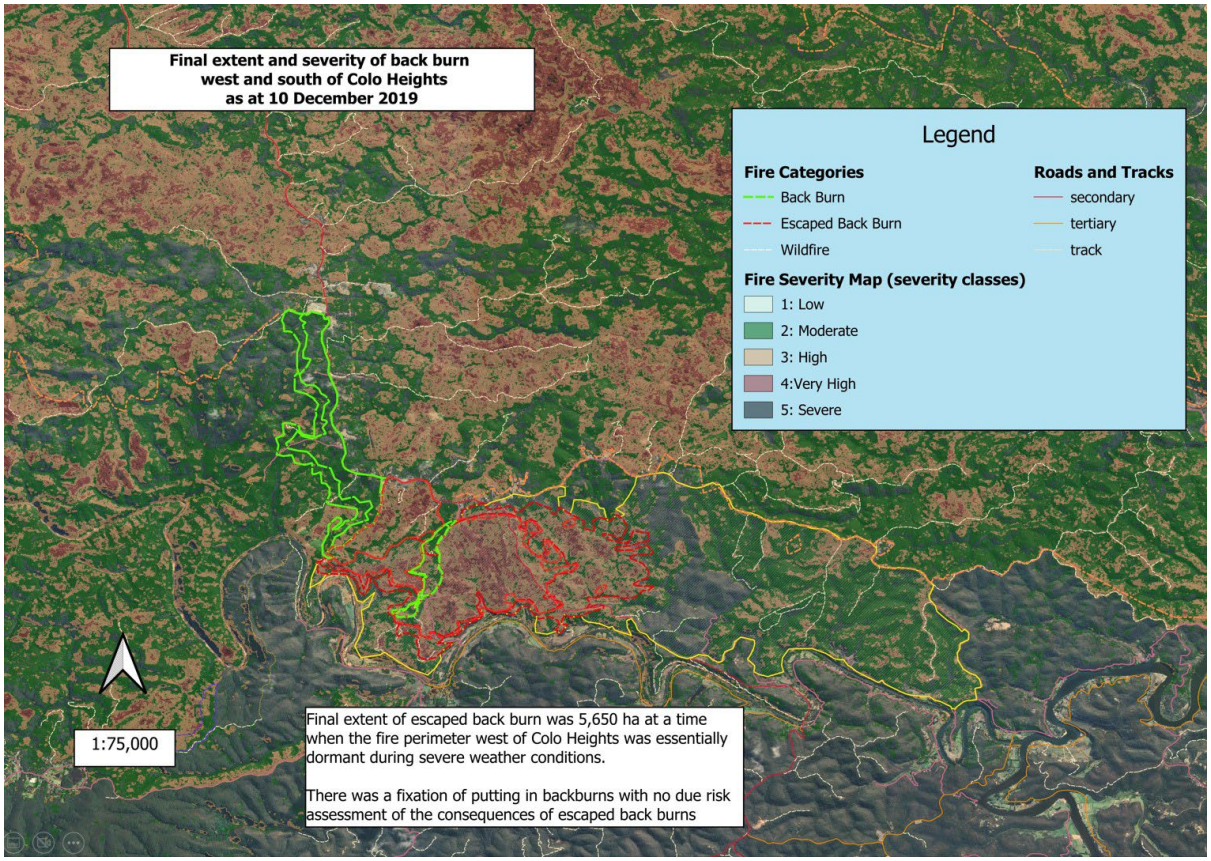

Figure 13: Final extent of the South-west Colo Heights Backburn escape on 10 December

3.4. Case Study 4: Glowworm Tunnel Backburn Escape (19:00 07 December – 11:00 26 December 2019)

This is a series of four maps showing the status of the RFS backburn operations on Newnes Plateau between 19:09 on 7 December and 13:59 on 8 December 2019. Following the backburn escape at around 22:30 on 7 December 2019 the fire spread westward across the Newnes Plateau and burnt 44,650 ha. On 13 December 2019 this fire was burning intensely north of Lithgow causing significant implications for later fire threats and impacts to the communities of Lithgow, Clarence & Dargan.

3.4.1. Situation at commencement of backburn operations (on or about 19:00 7 December 2019)

Map 5 shows the ignitions on the eastern side of the Glow Worm Tunnel Road and the approaching slow spreading south-western flank of the Gospers Mountain Fire at the start of backburning operations:

The linescan images show the Glow Worm Tunnel Road Backburn being lit in three sections 3.0 – 3.5 km apart along the Glowworm Tunnel Road. At 19:06 PM these backburns are already intense as indicated by the yellow colour on the map.

The main Gospers Mountain bushfire was 3-4 km away to the east of the Glowworm Tunnel Road

The conditions were conducive to intense sub-canopy fires with a DFMC of ~5% and winds from the south-west at 15-20 km/h ((Figure 15)[9].

The high atmospheric instability was also conducive to pyro-convection detected on the 128 km Sydney radar between 20:00 and 23:00 that evening (Figure 16)[10]

The likely spread of these backburns under these prevailing conditions was about 1.5 – 2.5 km/h to the north-east.

The fire spread of this section of the Gospers Mountain bushfire was about 0.015-0.025 km/h to the west before an easterly change came through at ~22:30.

I could not locate a detailed burning plan for this operation which entailed burning 13-14 km along the Glow worm Tunnel Road. A broad indicative one was prepared earlier on 23 November 2019 by the Lithgow sub-IMT.[11]

[9] Hartley Rural Fire Brigade, Facebook, 7-8 December 2019
https://www.facebook.com/permalink.php?story_fbid=pfbid02wyjt9iuSVQkhoJMSXtG6vZA1G51xm4h5vJDWBvKV6FKEkPMxkWAbCJad6GDnGAJEl&id=619095948141234

[10] Clarence / Dargan Rural Fire Brigade, Facebook, 7-8 December 2019
https://www.facebook.com/clarencedarganrfb/posts/pfbid0wi88SjEjKp3DmX2QQg5bQVyZod5XiEkgxMaPWNMfPCvdpUdQsu5wSroKMc5VkE41l

[11] Gospers Mountain Fire Strategic Burn Plan, Burn Block O, Old Coach Road Fire Trail, Newnes, 23 November 2019

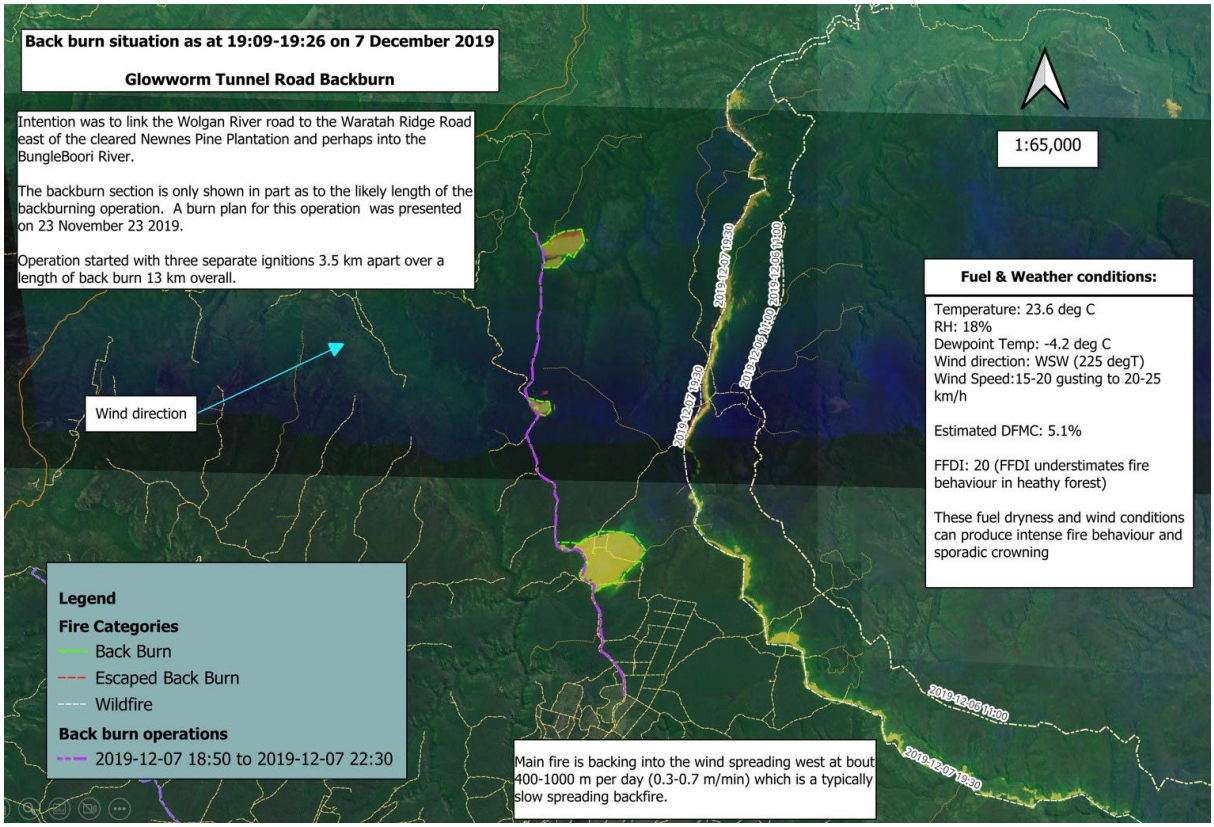

Figure 14: Glow Worm Tunnel Road Backburn escape

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Figure 15: Photograph taken by a firefighter at the Glow Worm Tunnel Road backburning operation shows intense sub-canopy fire somewhere along Glow Worm Tunnel Road (possibly within 15-20 minutes after light-up)

Figure 16: Another image at the Glow Worm Tunnel Road Backburn shows intense fire activity associated with the backburning including crowning fire which is consistent with the very dry fuel moisture conditions Road (again possibly within 15-20 minutes after light-up)

3.4.2. The effective results of a failed backburn operation the next day (08 December)

Figure 17 shows the result of the easterly wind change causing the backburn lit on the eastern side of the Glow Worm Tunnel Road to spot over at 22:30 on 7 December as a result of an easterly cool change. The line scan image at 13:59 on 8 November 2019 shows the extent of the breaches to the west of the Glow Worm Tunnel Road containment line.

~2.6 km of fire existed in the western side of the Glowworm Tunnel Road after the operation and had spread west into in accessible areas on the Newnes Plateau and was too much length to be controlled in a RAFT operation.

As a result, there was next to no likelihood of extinguishing the escaped backburn given the moderate intensity fire behaviour.

The interaction between the backburn and the main fire after the easterly change caused a southerly blow-out of the Gospers Mountain bushfire into the northern sections of the cleared pine plantation which further limited options for tying the fire into the Bungleboori Creek, a known natural fire advantage. This is discussed in the upper Bungleboori catchment case study

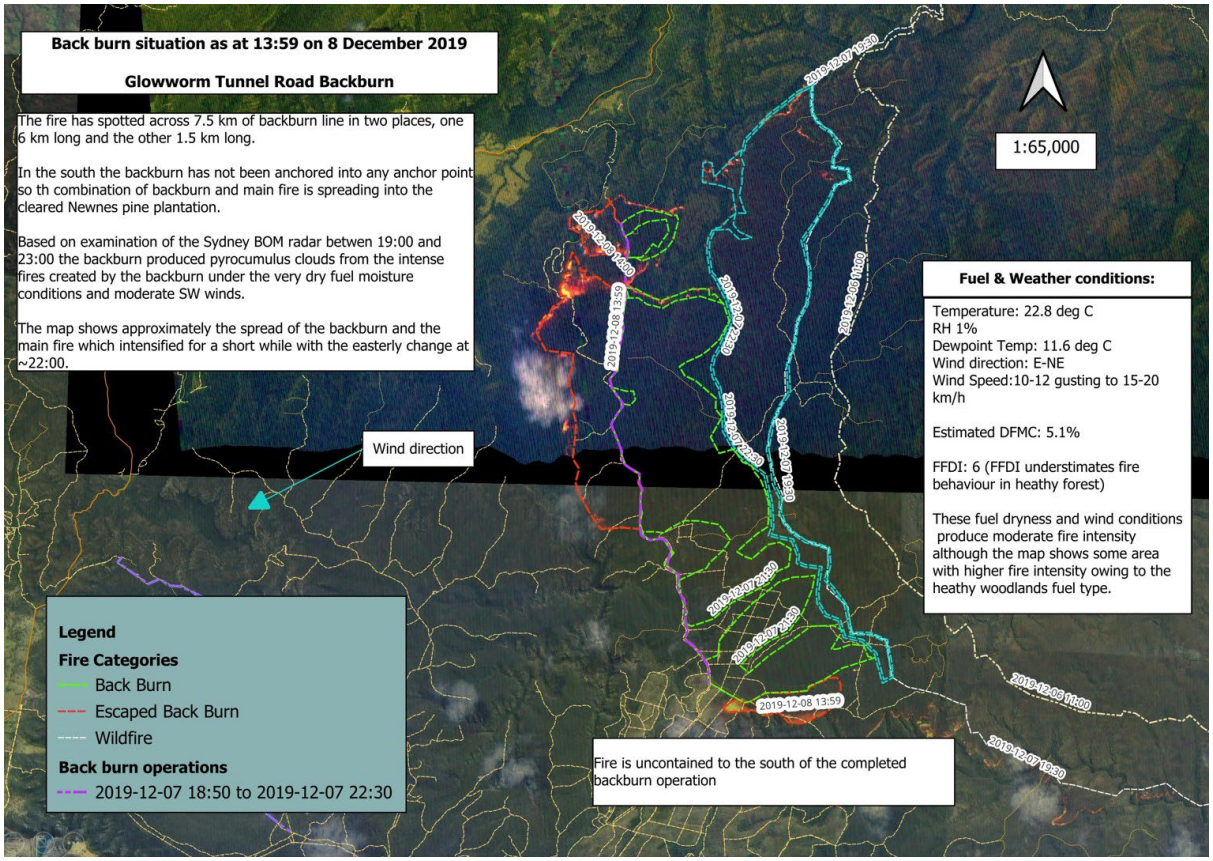

Figure 17: Glow Worm Tunnel Road backburn escape as at 13:59 on 8 December 2019

3.4.3. Consequent impacts of the Glowworm Tunnel backburn on the Newnes Plateau and other forested areas further to the west

Figure 18 shows the extent and severity of the area burnt by RFS backburns to the west well beyond the Glow Worm Tunnel Road containment line of 7 December. The extent of this backburn failure resulted in 44,650 hectares being burnt.

Following the escape and spread of the Glow Worm Tunnel Road Backburn on 7 December 2019 the escaped backburn continued to spread to the west, south, and north over the next 34 days across the Newnes Plateau region until rain on 10 January 2020 that finally extinguished this backburn and other backburn and containment escapes. During this period there were ongoing failed attempts to contain the fire at Sunnyside and Black Fellows Hand Trail with backburns, and a significant containment escape below Wolgan Gap on the early morning of 16 December.

On the western flank, this fire impacted Marrangaroo, Wallerawang, through to the Wolgan Valley, up onto the Cullen Bullen State Forest, and then finally burning through the rest of the Garden of Stone National Park on 21 December with intense fire runs on a day of extreme FFDI. This resulted in further extensive damage to the vegetation in the National Park and damage to property in the

Wolgan Valley.[12]

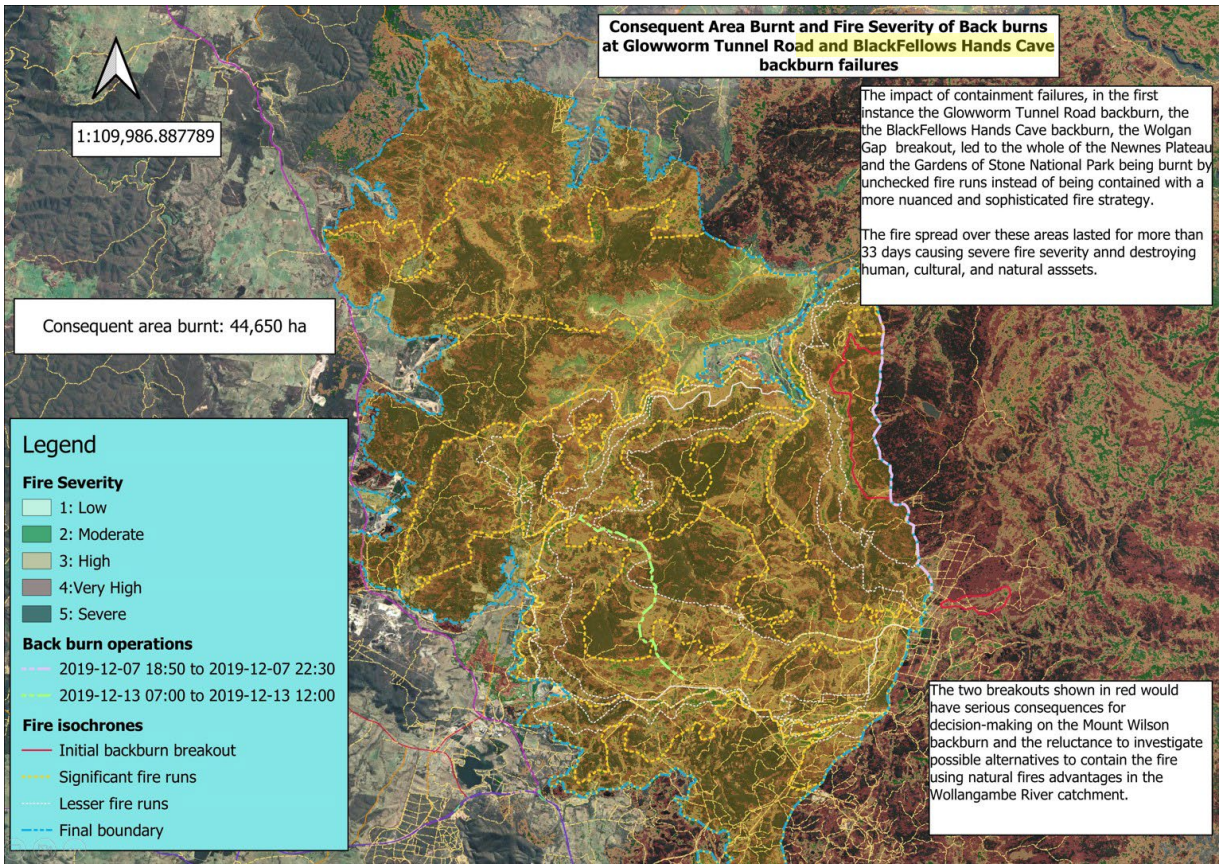

Figure 18: Consequent impact of the Glowworm Tunnel and other containment escapes on the Newnes Plateau, the Cullen Bullen State Forest, and th Gardens of Stone National Park,

Figure 19 shows further containment access across the Black Fellows Hand Cave fire trail on the afternoon of 13 December just one day prior to the Mount Wilson backburn escape when fire danger conditions were much milder than in the Glowworm Tunnel and previous case studies. The consequence of the Glow Worm Tunnel Road and subsequent backburn escapes had significant implications for later fire threats and impacts to the communities of the Clarence-Dargan precinct east of Lithgow and the Cullen Bullen State Forest as well as Gardens of Stone National Park.

[12] These impacts were documented by day-to-day linescans of the fire across this area.

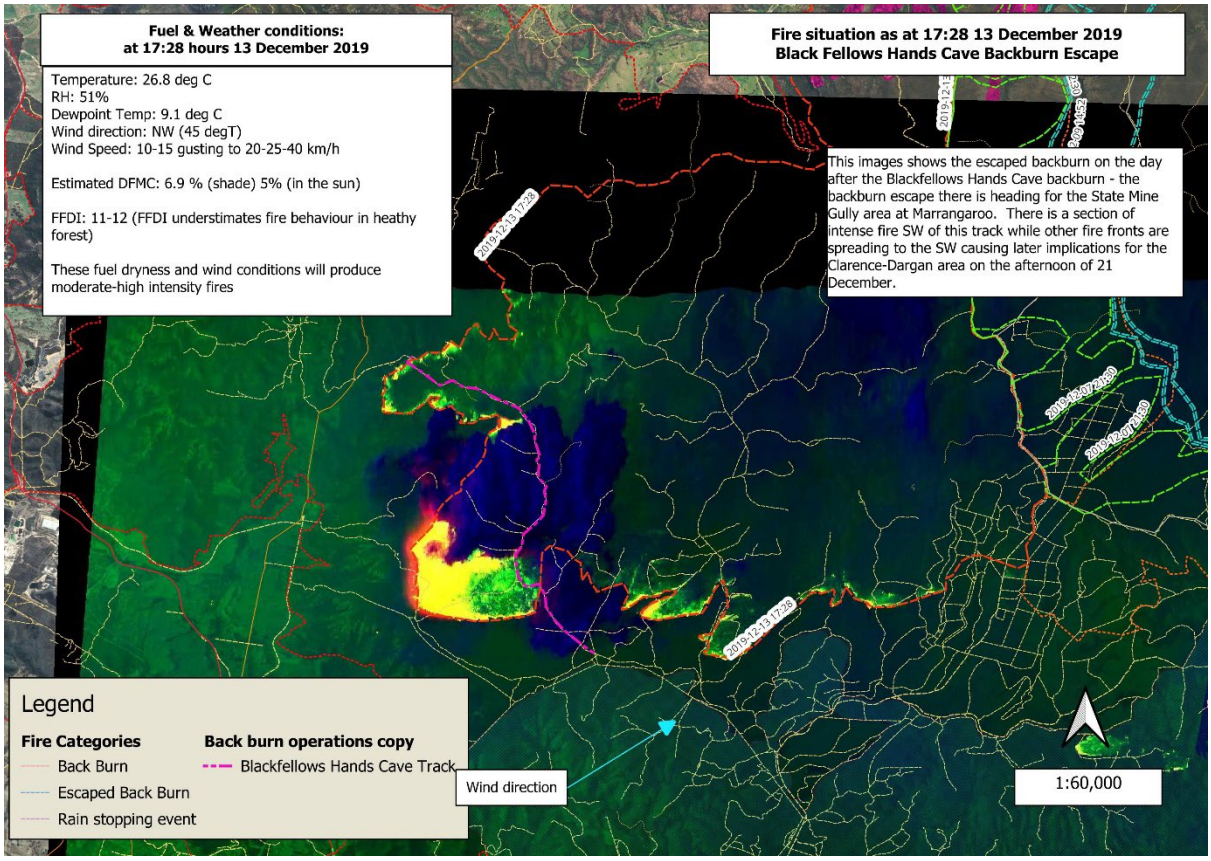

Figure 19: Glow Worm Tunnel Road Backburn escape

Imagery taken from RFS fireline scan on 13 December 2019.[13]

3.5. Case Study 5: Containment escape south of the Newnes Pine plantation area on the afternoon of 13 December

As a result of the failed Glowworm Tunnel backburn operation, the Gospers Mountain wildfire continued to spread south through the recently cleared Newnes Pine plantation towards the north-western corner of the Bungleboori River catchment during a period of relatively benign moist easterly weather conditions. This moist airstream affected most of the fire fireground of the Gospers Mountain wildfire to the extent that backburn operations could not be conducted in the Bilpin – Mount Tootie area in the same period. [14]

On the evening of 10 December DFMCs rose to 20-22%, FFDI between 1 and 2, and winds decreased to less than 5-10 km/h. The typical conditions experienced after that persisted until the early morning of 14 December. Dewpoints were consistently high which meant that at night time there was likely dew condensation on the fine surface fuels.[15]

[13] Rural Fire Service Linescan Imagery: 352934-242976-3131_GOSPERSMOUNTAIN_SWIR_20191213_1728_LR

[14] Factual investigation Gospers Mountain Fire – impact on Mt Wilson and Bilpin 14 December 2019 p.54

[15] Tab 11 - Table 3 - Item 25 - ICON Intelligence Log Gospers Mountain Fire 12 December 2019 9:48:58 p.m. IntelId: 518099

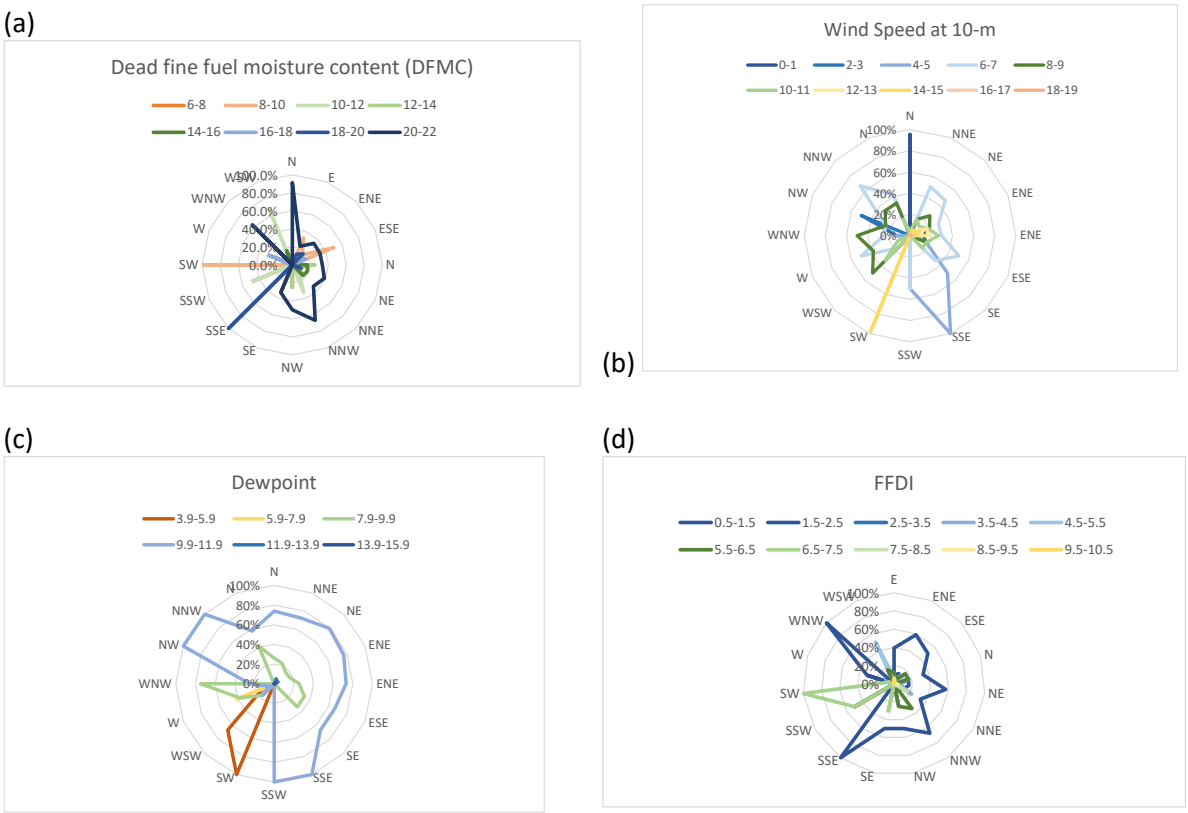

Figure 20: Wind rose diagrams showing relative frequencies of fire weather conditions between 19:00 10 December and 09:00 14 December 2019 for the Upper BungleBoori River catchment based on the closest BOM weather station, Mt Boyce ~20 km away to WSW. (a) Dead fine fuel moisture content (DFMC); (b) Wind speed at 10-m; (c) dewpoint temperature; and (d) Forest Fire Danger Index (FFDI)

The high fuel moisture and wind conditions, as well as most of the are being reasonably close to 4WD access, represented a major opportunity to suppress the fire between the myriad of fire trails to the west on the plateau and to tie the fire back into the upper Bungleboori River. This was also in an area recently burnt in the State Mine Gully bushfires back in October 2013. All this favoured highly tactical operations with minimal resources compared to undertaking a backburn 16 km to the south-east and that did nothing to protect the Mt Wilson and Mt Irvine precincts (Case Study 6)

Because of the ongoing fixation within the RFS to undertake high risk backburns to contain the Gospers Mountains, this and many other small tactical operations were many times overlooked leading to high-impact uncontrolled fire runs through the GBMWHA as the result of escaped backburns and containment escapes which under a NPWS remote area management strategy would have been minimised.

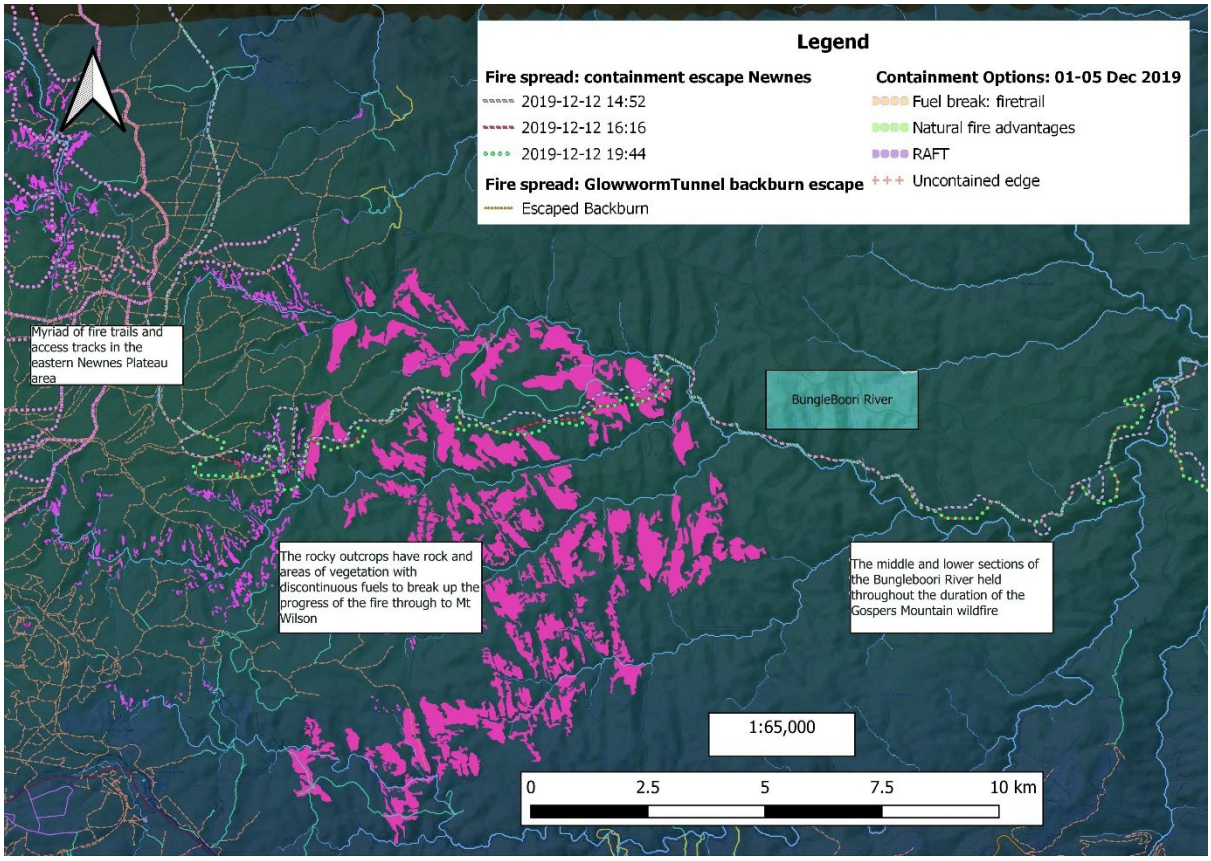

Figure 21: The slow-spreading Gospers Mountain bushfire in the upper Bungleboori River catchment between 19:00 10 September and 19:44 12 September 2019

The net result of this containment escape meant the following impacts:

- A further 14, 230 ha was burnt that burnt the Wollangambe and Dumbano River catchment to the south-east and the Clarence-Dargan area to the south-west (340 ha) (Case Study 7: further containment escape; see Section 3.7)
- Significant private property loss occurred in the Clarence-Dargan areas where around 94 home and buildings were damaged or destroyed. [16]
- Enacting this operation instead of the Mt Wilson backburn would have prevented any loss to house and property in the Mount Wilson, Mount Tomah, Berambing, and Bilpin areas.
- It represented a low risk-high benefit operation that typically NPWS conducts outside of Section 44 emergencies.

[16] Tab 46 - Affected Properties, Master Spreadsheet prepared by Jeff Sinton, Detective Senior Constable, NSW Police

3.6. Case Study 6: Mount Wilson backburn escape (14 – 21 December 2019)

This case study shows the status and spread of the RFS backburn operations at Mt Wilson 2019 from 10am on 14 December 2019 to 11am on 21 December 2019. There are four maps in the map series. The total area burnt by the Mt Wilson Backburn as at 21 December is estimated to have been 53,800 ha.

3.6.1. Overview of fire situation just prior to commencement of backburn operations (07 December 2019)

Figure 22 shows the terrain, weather conditions and the relative location of the Gospers Mountain Fire 12.5 km from Mt Wilson to the north-west. The text box in this map notes that the Gospers Mountain Fire was 16 km from the backburn ignition point on the corner of Bells Line of Road and Mt Wilson Road.

As shown in Case Study 5, the Gospers Mountain wildfire was still in the upper reaches of the Bungleboori River (Figure 21) The map presents the fire linescan captured at 14:52 09 December to illustrate the intense fire through the cleared pine plantations. This would have presented concerns to the Hawkesbury IMT although local suppression should have managed to control the spread of the Gospers Mountains wildfire through the pine plantation area with appropriate on-ground tactics under overnight conditions.

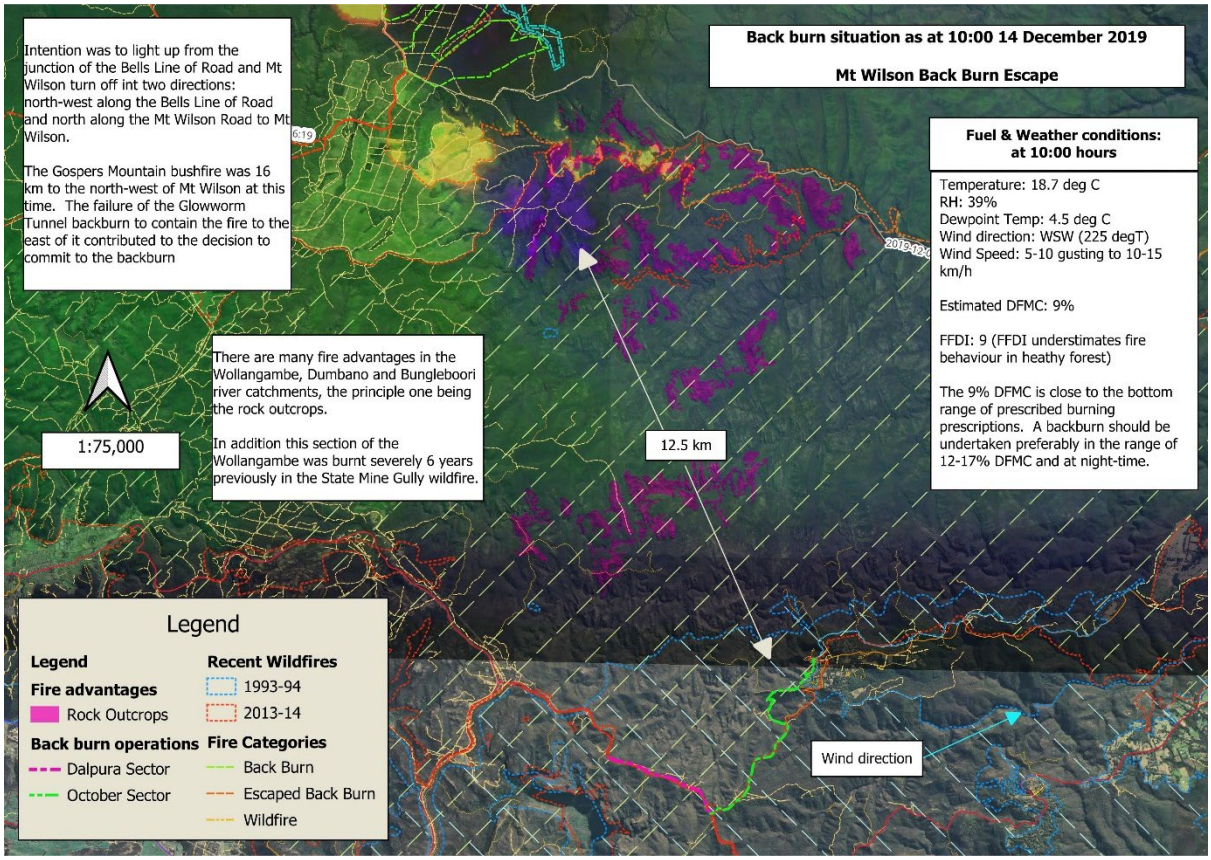

Figure 22: Mount Wilson Backburn

The DFMC and wind conditions represented the early morning conditions before any mixing with the drier and more turbulent westerly airstream flowing over the retreating easterly airflow from overnight. The forecast weather condition from the Gospers Mountains west Incident Fire Weather forecast indicated that fuel moistures would dry out to 5% DFMC and th3 10-m wind speeds would increase to 10-15 km-h. This area is part of the western Blue Mountains that has a very different regional fire climate to that of the lower eastern Blue Mountains. Incursions of moist easterly air flow during summer often reach Mount Tootie and Berambing during early summer and penetrate deeper towards the Newnes Plateau to the west and Coorongooba Creek to the north in late summer. The Sentinel-2 satellite image shows this situation clearly three days earlier (see Figure 23).

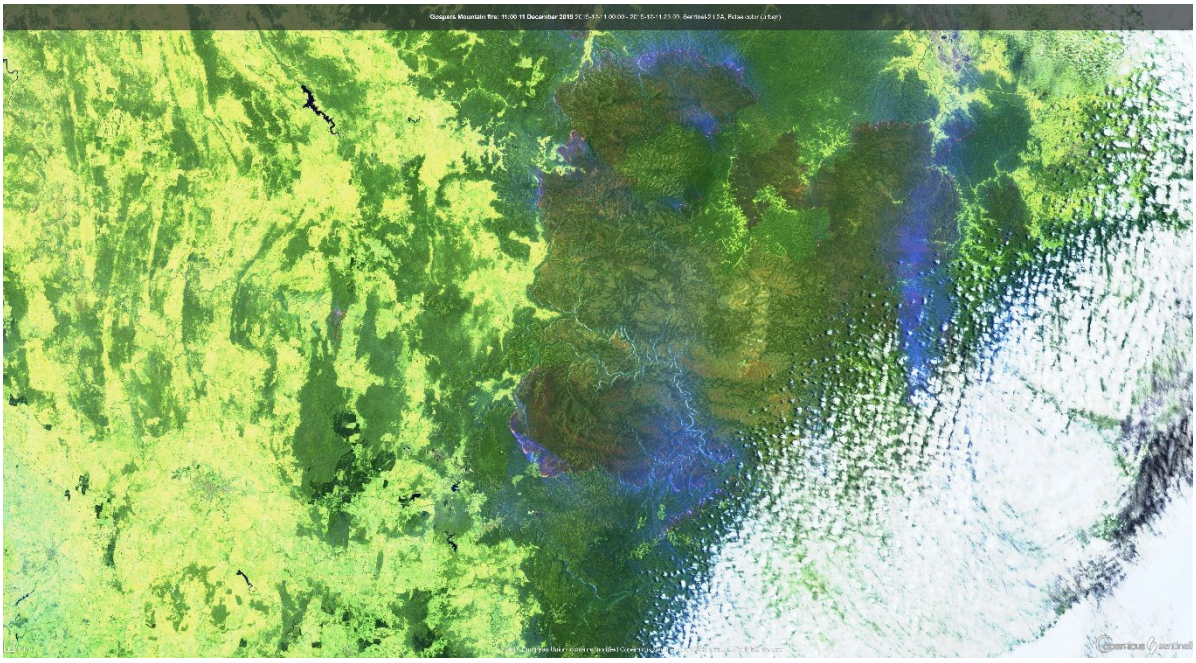

Figure 23: Cloud formation in the lower Blue Mountains and Yengo National Park and clear over the rest of the western and north-western parts of the fire landscape at 11 am on 11 December 2019 and clear

3.6.2. Fire situation analysis of Mt Wilson backburn escape on the afternoon into the early evening on 14 December

The following sequence of photos and map images illustrate the unfolding sequence of events on the afternoon of 14 December 2019.

At 14:08 the photo taken from Mount Tomah shows two distinct plumes of intensifying fire behaviour (Figure 24). The angled plume in the centre of the image illustrates an increasing wind strength from the backburn on the Mount Wilson Road.

Figure 24: The smoke column on the lower left is that of the backburn lit along the Dalpura sector and that in the lower centre is that lit along the October sector on the Mt Wilson Road while the burns were still within containment lines. Image is taken from 44 Skyline Drive, Mt Tomah at 14:08 on 14 December 2019.[17]

The on-ground weather recorded on the fire ground at ~14:30 and reported at 14:51 were Temperature 29 deg C; RH 15%; and Winds from SW gusting up to 15km18
Based on the BOM Mt Boyce weather station, DFMC had decreased from 9% at 10:00 to 4.8% at 14:50, which is a critical level of fuel moisture conducive to rapid spread and intense sub-canopy fires in eucalypt forest. The local fireground DFMC was closer to 4% in the shade and possibly even 3% in the sun, both of which according to the RFS fuel moisture table results in '*extreme and difficult to predict fire behaviour*'[19].

The fire spotted across the October Sector (Mt Wilson road in this case study) at 14:50 and fire activity picked up to the north-east of the Dalpura sector at or about the same time as the winds increased from the south-west (Figure 25). Figure 25 also shows the spread of the two fire runs from the Dalpura sector on the Bells Line of Road to the north of the Mount Wilson and the southern run from the spot-over at 14:50 and the spread from the northern end of the October sector when operations ceased at 14:30.

[17] Parsonson, W. (2019) Mt Tomah [Photograph] 19 December 2019 at 14:08 p.m.

[18] Recording of radio transmission T14-51-24.

[19] NSW Rural Fire Service Wildfire Behaviour Manual, 4 Fuel Moisture Content p.65

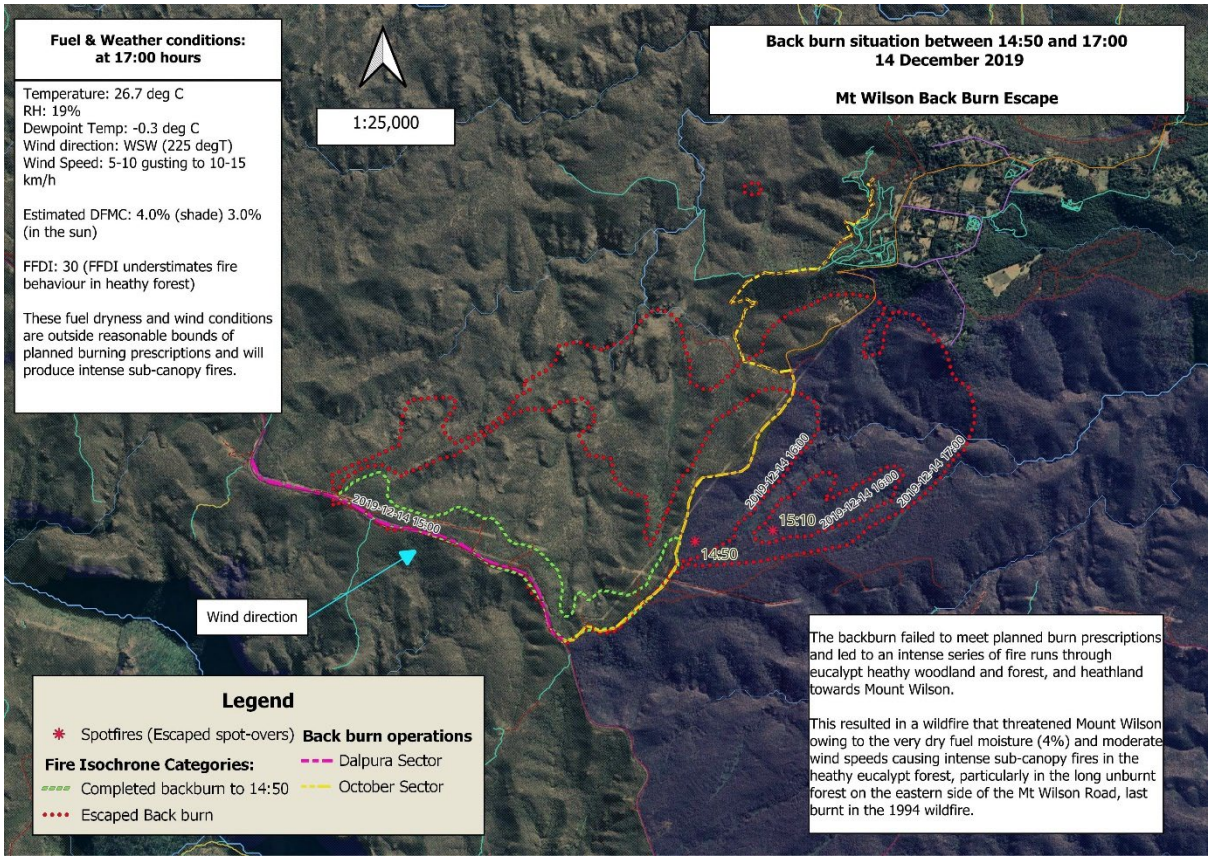

Figure 25: Mount Wilson Backburn between 14:50 14 December and 14:35 15 December 2019

The following sequence of an analysis of photos taken from Bald Trig to the east of Clarence illustrates the fire activity on or about 15:00.

There appears to be two fire runs south of Mt Wilson presented in Figure 27 marked as A and B on the image:

A. The emanating from the Dalpura Sector backburn (marked A) and
B. the darker column (marked B) is the spot fire taking off in the fuels on the east of Mt Wilson Road on the October Sector which had not been burnt since 1994. (Photo inserted in Facebook by the Clarence-Dargan Bushfire Brigade, exact time unknown although likely shortly after the Mt Wilson Road spot-over at 14:50).

Figure 26 shows the line of sights towards the smoked columns in Figures 25-27 respectively identified in the photos taken by a member of the Clarence Dargan Bushfire Brigade and determined in Google Earth.

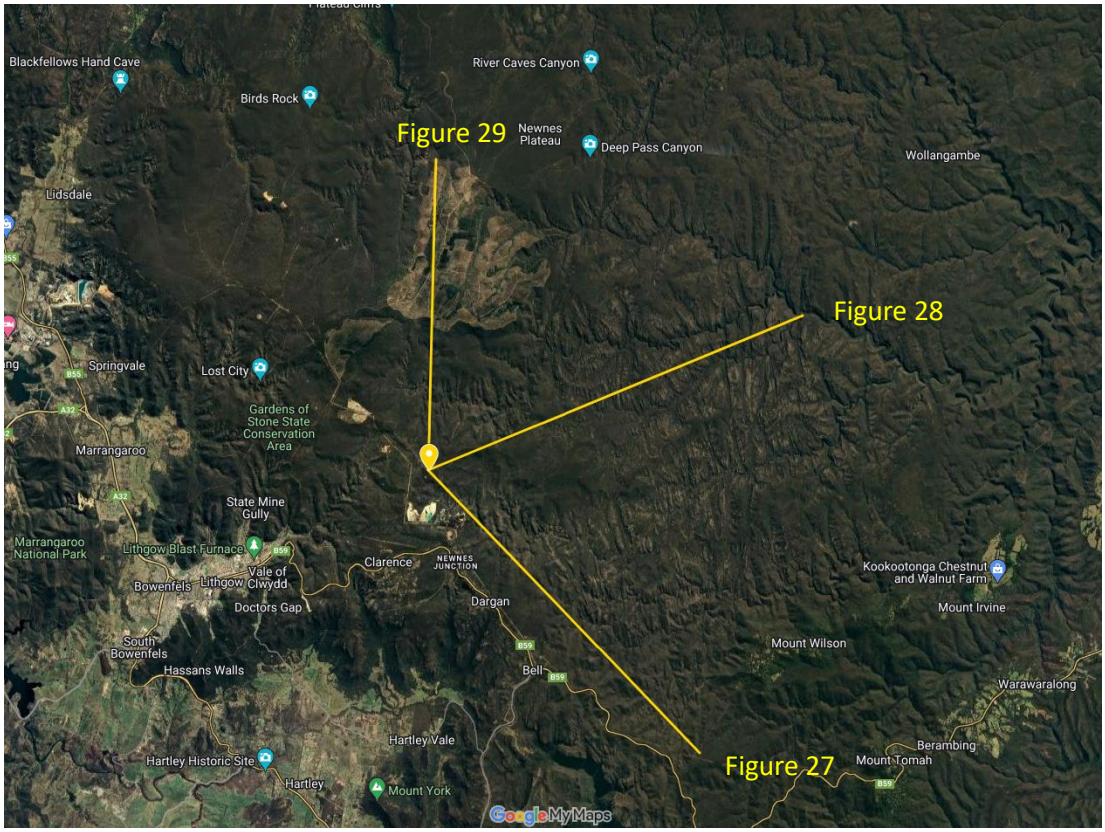

Figure 26: Mt Wilson Backburn - approximate line of sight from Bald Trigg relating to Figure 25, 26 and 27

The following figures illustrate the fire activity in the anticlockwise sequence shown in Figure 26

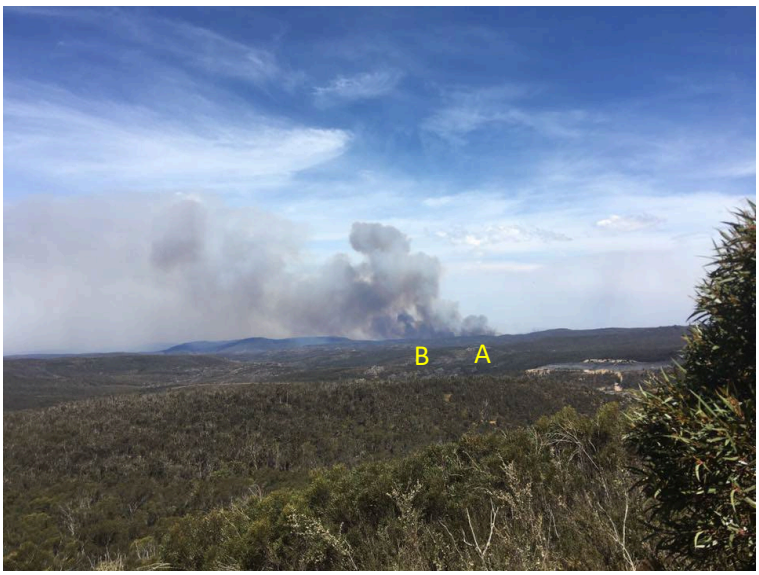

Figure 27: An image taken from Bald Trigg on the Newnes Plateau on the afternoon of 14 December 2019[20] shows the smoke column of the Mt Wilson Backburn located to the south east of Bald Trigg.

[20] Clarence / Dargan Rural Fire Brigade, Facebook, 14 December 2019

https://www.facebook.com/clarencedarganrfb/posts/pfbid0njCACwiAMq8krDNTTtbvqruaMHG9HXuztnVWsqfUqKJJAbUbaANB6xoK6uAUbNQ4l

In Figure 28 the arrow points to the much less activity of the fires spreading down on the northern side of Bungleboori Creek and in the distance is the other part of the fire spreading onto the ridge systems to the east of Wollangambe Creek.

Figure 28: The second images taken at the location[21] is looking north-east at the relatively benign fire activity in the upper reaches of the Bungleboori River at the same time as the photo in Figure 25. The location of the Gospers Mountain Fire has been marked with an orange arrow in this image.

In Figure 29, the orange arrow points to the increased fire activity on the Newnes Plateau as a result of consecutive escaped backburns and consequent escapes which should been dealt with more appropriate on-ground fire tactics.

[21] Ibid

Figure 29: An image taken from Bald Trigg on the Newnes Plateau on the afternoon of 14 December 2019.[22] The image shows the view of the smoke columns of the uncontained fire spread of fire edges resulting from the escaped Glow Worm Tunnel Road Backburn.

- At 16:00, under the increasing SW winds the line of fire from the Dalpura sector backburn spread within containment lines to the northeast and threatened Mt Wilson (Figure 25).

Pyro-convection is now evident in the photo taken from Mt Tomah at 16:30 (Figure 30). The escaped backburn is very much out of control and not suppressible by ground crews even supported by aircraft.

Figure 30: Pyro-convection evident in upper centre of the image. In the middle part of the image the convection column of the Mt Wilson backburn escape. Image was taken from the same location as the above image.[23]

Figure 31 clearly shows black smoke emanating from the easterly fire run of the escaped backburn on the right-hand side of the photo on the eastern side of the Mount Wilson Road. On the left-hand side of the photo the fire run from the Bells Line Road on the Dalpura sector is slightly more advanced and burning with less fire intensity as it burning in more open eucalypt woodland and heathland fuels.

[22] Ibid

[23] Parsonson, W. (2019) Mt Tomah [Photograph] 19 December 2019 16:30 p.m.

Figure 31: Image of the smoke column taken from the intersection of Bells Line of Road and Mt Wilson Road posted to Facebook at 4:06 on 14 December 2019 by Terry Hills Rural Fire Brigade.[24] The fire run on the right-hand side of the photo is from the 14:50 spot fire east of Mt Wilson Road.

- By about 17:00 the escaped backburn had reached Wynnes Rock Lookout and the southern foot slopes of Mount Wilson (Figure 25).

- In summary, the Dalpura sector backburn lit as a line of fire would accelerate very quickly over exposed sandstone plateau ridges towards Mt Wilson behaving like a wildfire once the winds increased from 14:00 onwards. Spotting over the Mt Wilson Road is virtually guaranteed at a DFMC of 4% and in the long-unburnt fuels (1994 wildfire) would spread intensely towards Wynnes Rocks Road where local residents' houses are located at the top of steep forested slope on the edge of the basalt lithology.

- A new bushfire, created by the eastern spot-over on Mt Wilson Road from the RFS backburn, spread eastward impacted Berambing, Mt Tomah, and Bilpin on 15 and 21 December.

The ignition plan documents available (which are undated) describe the plan for the backburn to burn both east and west concurrently from the Mt Wilson Road and Bells Line of Road Intersection.[25]

Any IMT plan that is prepared is signed off by the authorized person, usually the planning officer, and then signed off by the incident controller. There is also telephone or conference call hook-ups with RFS head-office) to discuss the merits of the operation and to seek approval if it is a high-risk, high-consequence fire operation. In my opinion the latter communication would have occurred and RFS head office would have known about the operation and its details.

The concurrent lighting of backburns with anticipated increase in wind strength of the SW winds that afternoon would cause major fire runs as an uncontrollable wildfire to spread towards Mt Wilson once the fire weather deteriorated to a DFMC close to 4% and winds of 15-20 km/h gusting to 30 km/h (FFDI ~30)

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[24] Terry Hills Rural Fire Brigade, Facebook, 14 December 2019 https://www.facebook.com/THRuralFireBrigade/posts/pfbid02CdwgVeyUduN4A1B8m4cagjzt7bBgUrtTA1gGuNBnx142kTbvoo39eMJFU9NxzG1hl

[25] Ignition Plan Bilpin to Bell (undated), Grose Valley Fire, Mt Wilson Brief of Evidence p. 527

3.6.3. Escape Backburn Situation the following two days (15-16 Dec 2019)

Figure 32 shows the status of the escaped backburn on 15 and 16 December 2019.

From 15:00 on 15 December to the early hours of 16 December[26], the fire from the escaped Mt Wilson Backburn had spread into Berambing and Mt Tomah under high- very high FFDI producing crown fires that resulted in patches of severely burnt forest in the upper reaches of Bowen Creek.

By mid-afternoon 15 December 2019 the escaped Mt Wilson backburn had crossed into the Grose Valley catchment to the south-west of Mt Tomah[27] creating further threats to the Blue Mountains towns and villages along the Great Western Highway. By 19 December the fire from the escaped Mt Wilson Backburn had crossed Bells Line of Road south of the Mt Wilson Road.[28] This fire run entered the Grose Valley and spread south of the Grose River causing the RFS to declare the Grose Valley Fire on 20 December 2019.[29]

The middle and lower sections of the Bungleboori Creek had held since 9 December[30] while the escaped Glow Worm Tunnel backburn continued to spread across the central, northern and southern sections of the Newnes Plateau.[31]

The escaped Mt Wilson backburn continued to spread through the Blue Mountains National Park south of Bilpin from spot fires into the headwaters of Wilderness Brook which is a significant fire advantage supporting rainforest throughout most its length to the Grose River.

[26] Tab 11 - Table 3 - Item 25 - ICON Intelligence Log Gospers Mountain Fire 15 December 2019 5:10:24 p.m. IntelId: 520317

[27] Rural Fire Service Linescan Imagery: 352934-244363-3160_GOSPERSMOUNTAIN_TIR_20191216_0338

[28] Rural Fire Service Linescan Imagery: 352934-247076-3393_GOSPERSMOUNTAIN_SWIR_20191219_1356

[29] NSW Rural Fire Service, Bushfire Information Community Newsletter, Information on the Grose Valley Fire, 20 December 2019, https://www.facebook.com/RFSBlueMountainsDistrict/photos/a.184069278305254/2862313447147477/

[30] Rural Fire Service Linescan Imagery: 352934-240702-3018_GOSPERSMOUNTAINSW_SWIR_20191209_1642

[31] Rural Fire Service Linescan Imagery: 352934-242498-3123_GOSPERSMOUNTAIN_SWIR_20191212_1619

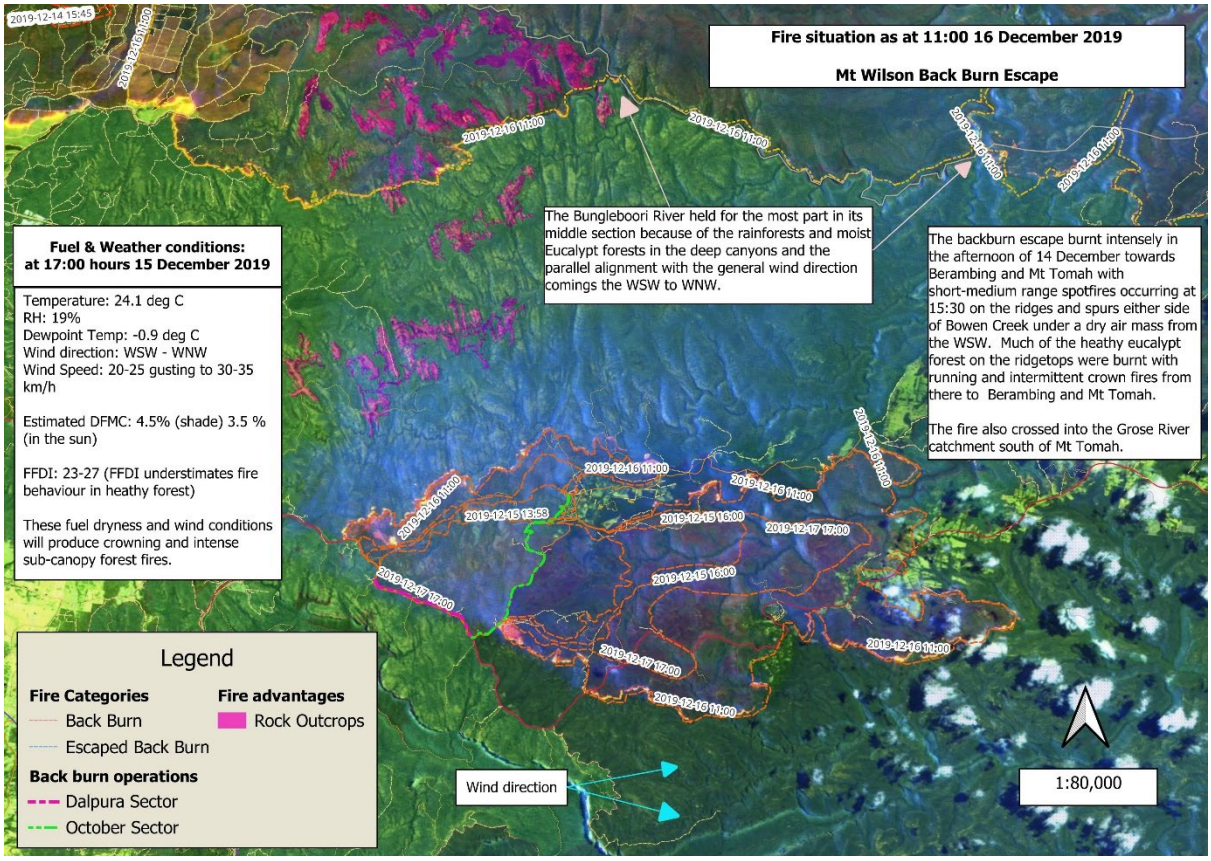

Figure 32: Mount Wilson situational analysis at 11:00 16 December 2019 including fire spread for the previous two days

3.6.4. Consequent later impacts of the escaped Mt Wilson Backburn

Figure 33 shows the consequent area burnt by the Mt Wilson escaped backburn in the World Heritage Area and the Grose River catchment amounting to an area of 51,000 hectares. It also shows uncontrollable and intense fire runs in the Grose River catchment east of Mt Hay, south of the Bells Line of Road in Bilpin, and in the Wollangambe and Dumbano River catchments north of Mt Wilson on 21 December.

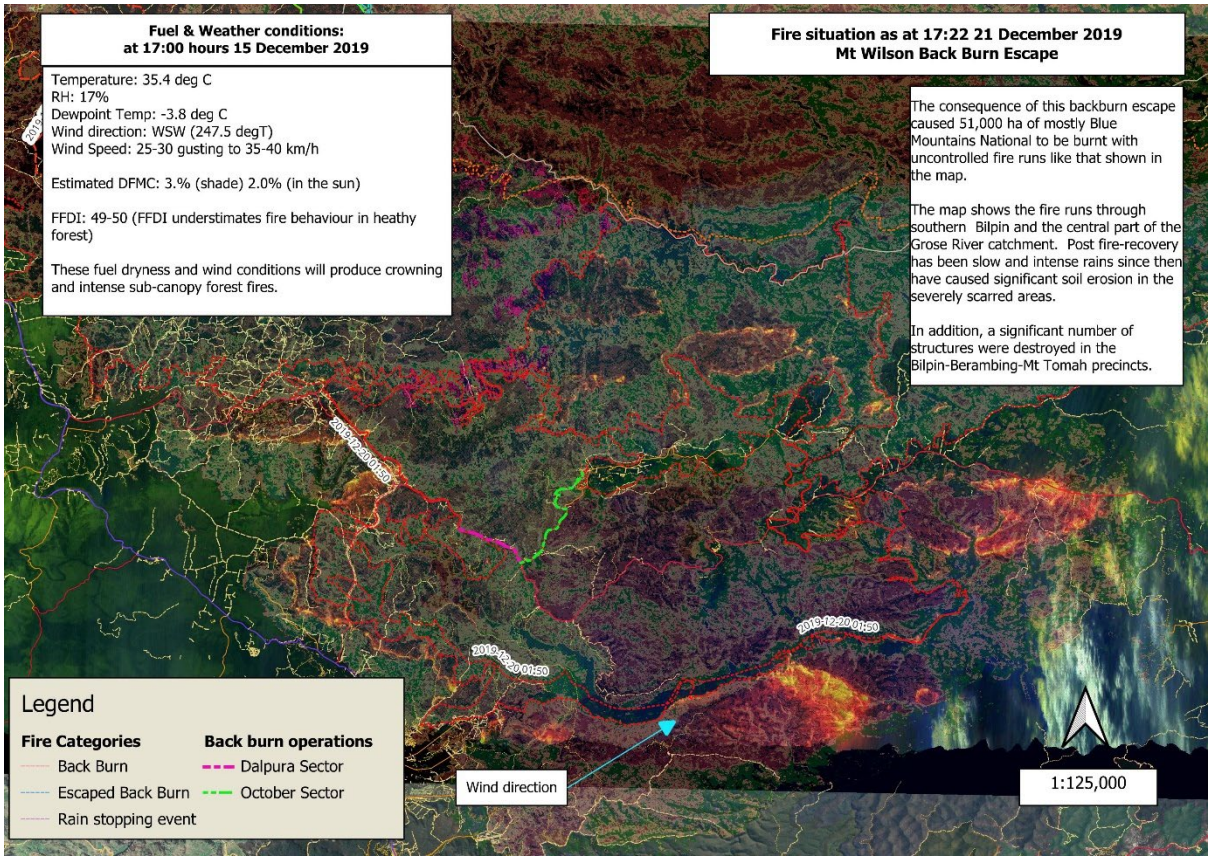

Figure 33: Uncontrolled fire runs burning within and adjoining Blue Mountains National Park on 21 December based on an RFS fireline scan image taken at 17:22 on that day

3.7. Case Study 7: Containment Escape relating to the Clarence-Dargan area

This case study shows the status and spread of a containment escape across the Bells Line of Road below the Zig Zag section on the eastern side of Lithgow. This went on to burn through the Clarence-Dargan area on the afternoon of 21 December 2019

3.7.1. Overview of fire situation between the containment escape and the intense fire run through the Clarence-Dargan area on 12 December 2019

An intense fire spread through Clarence and Dargan on the afternoon of 21 December 2019. The source of this fire came from a spot-over at about 14:15 on 20 December to the south of Chifely Road on the eastern side of Chiefly Lithgow (Figure 34). This containment escape originally came from the containment escape documented in Case Study 5 that spread unchecked south across the Newnes Plateau for 11 days before finally reaching a point on the northern side of Chifley Road that afternoon.

Note: the full IAP for this incident could not be located.

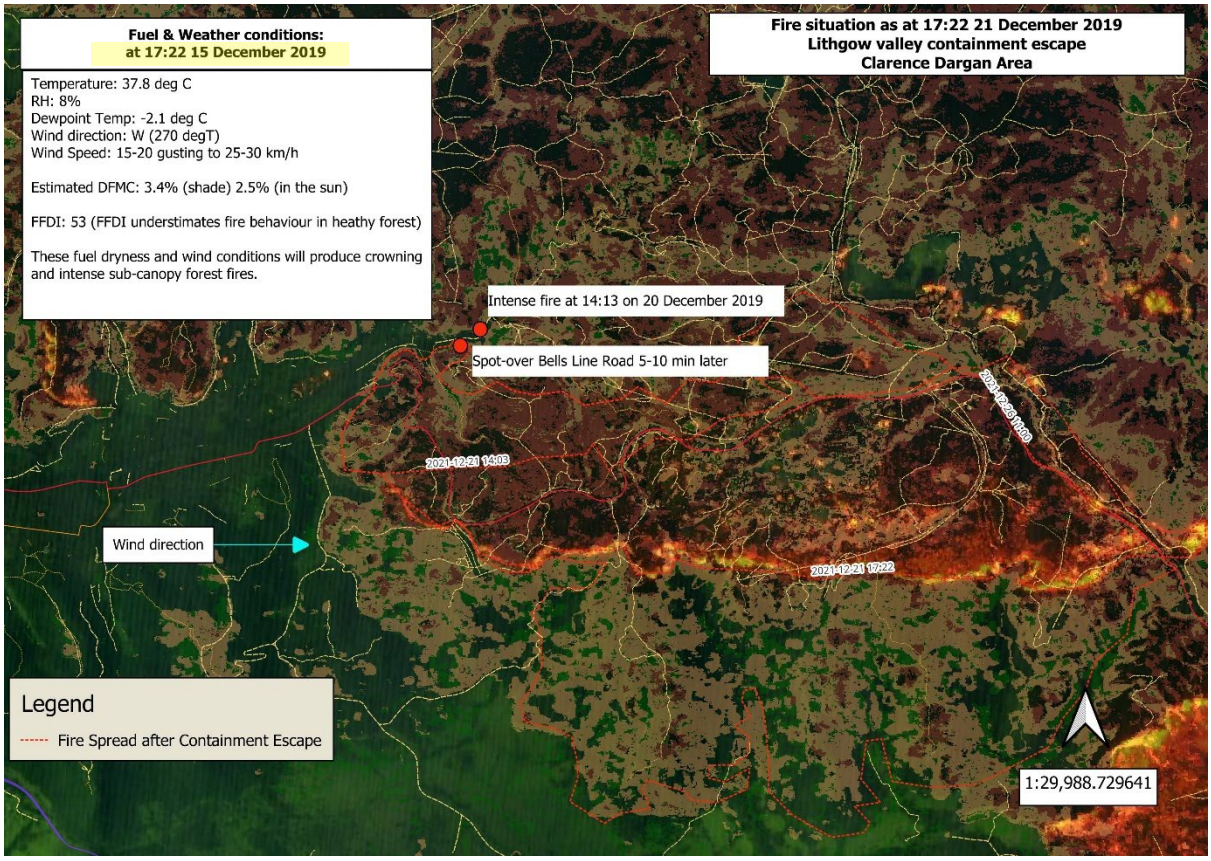

Figure 34: The intense fire run through the Clarence-Dargan area Lithgow Valley on 21 December 2019 originally from the Chifley Road Containment Escape at 14:15 pm 20 December 2019.

4. RESULTS- Containment Options Case Studies

During my investigation of the case study backburns I identified missed opportunities for the RFS to plan viable containment alternatives to the simple strategy of backburning from main road and trails around the National Park system comprising the GBMWHA. This plan was hatched on or around 11 November as part of the declaration of the Section 44 emergency. Subsequent to this, there were very few fire containment strategies devised that took advantage of rainfall events and periods of relatively benign fire weather that could incorporate 'fall forward' options, which would have limited the necessity for further strategic backburning operations.

I have conceived alternative containment strategies based on my considerable detailed knowledge of the fire landscapes within the Blue Mountains a mixture of field-based missed opportunities is set out in the series of 5 maps below.

This section presents the results of four containment analyses relevant to the cascading strategic and tactical errors made by the Hawkesbury IMT between 11 November and 21 December 2019. These are divided into four case studies covering the following periods.

1. The escape of the Gospers Mountain bushfire (05:00 7 November – 07:00 12 November from the inactive fire edge created after the 10-15 mm rainfall event on 3 November 2019
2. The further escape of the Gospers Mountain bushfire across Wollemi Creek to the east and the Colo River to the south and subsequent 13-15 November backburns north of Colo Heights and Mellong Swamps (12:00 12 November – 11:00 16 November 2019)
3. The further opportunity loss to prevent further outbreak of the Gospers Mountains fire after the 4-10 mm rainfall on the afternoon of 23 November across the whole fireground (17:00 23 November to on or about 27 November 2019)
4. The further opportunities lost to limit the progress of the south-western and eastern flanks during the mild fire weather period between 19:00 10 December and 15:00 13 December 2019 to the north of the Bungleboori River and west of the Wollangambe River.

In my considerable experience managing and containing remote areas I have drawn up a set of principles in managing remote area fires (see Section 8.4: Annexure D: Personal submission to the NSW Fire Inquiry). For accurate and timely formulation of appropriate and ecologically-based containment fire strategies, the following principles should be adhered to:

1. **A complete set of vegetation maps is needed to cover the full extent of the GBMWHA that can be classified into natural fire advantages.**
2. **A detailed set of fire advantages mapping is prepared and updated before the start of any fire season based on past successful fire containment actions.**
3. Ongoing dead and live fuel moisture assessments across the range of vegetation types to determine fuel connectivity, flammability, and combustibility and the likelihood of moist fire advantages such as rainforests and eucalypt mesic forests containing a fire.
4. Once a fire has started:
    (a) Assess the fire weather patterns to determine likely timing and length of exposure to severe fire runs
    (b) Monitor the fire activity in the field on an ongoing basis, continually assessing potential fire advantages in the likely fire paths and potential growth of fire perimeters

(c) Minimise the active fire perimeters size of a fire and the width of severe front fronts before a run of severe fire weather

(d) Take advantage of lulls in fire weather to suppress inactive fire edges and hotspots using remote area crew; and

(e) Treat the campaign like guerrilla warfare where every opportunity is taken to delay or retard the fire spread using RAFT and water bombing tactics in areas identified as breakout points for large fire runs

In relation to principle 3(b), fires can be herded into places out of the wind by using small targeted areas of aerial ignition or small tactical backburns on protected flanks of a bushfire.

I will use the 1997 Lithgow Tip bushfire as my principal example before outlining the alternative fire strategies and tactics involved in the four case study examples involving the successive failures in the lead-up to the Mt Wilson backburn. The fire reconstruction is based on my memory of the spread of the fire and the containment strategy I devised to contain this wildfire. All of this remains vivid in my memory. I include this example as it exemplifies an alternative approach to remote area fire management in the Wollangambe River catchment in a fire that threatened Mount Wilson and Mount Irvine. I could have devised a variation of this fire strategy in 2019-2020 had I been consulted and involved developing alternative fire containment strategies. [32]

The Lithgow Tip fire started on a western lower slope of the first ridge to the north of western Lithgow in the early afternoon of 2 December 1997. I happened to be working as CRA Unit manager in Queanbeyan that afternoon. I was called in about 4 pm to support fire operations because of my previous work experience as a fire management officer in the Blue Mountains. After a four-hour drive from Queanbeyan via Oberon I drove up the Bells Line of Road to view the spread of the fire on the main ridge system to the north of the Wollangambe River. I noted its location and then went to NPWS office in Blackheath where I set about setting up my planning systems that I had devised ten years earlier. I was advised that backburns had commenced at Clarence and were headed to Bell.

Figure 35 illustrates the approximate fire strategy I devised for this bushfire that evening. In it one can see a number of different containment sections of the fire. My first concern was to secure a dozer line north into the Wollangambe River from a point mid-way between Clarence and Bell to divert the fire away from assets at Bell and obviate the need for a large-scale backburn down the Bells Line of Road to Mount Wilson Road and then north to Mount Wilson. I knew of a ridge I had walked in the late 1980s while surveying the vegetation in that area. The rest of the southern flank of this fire was to be secured from this point all away west along the Wollangambe River around the bases of Mount Wilson and Mount Irvine to its junction with the Bungleboori River. This would form the northern boundary back to the pine plantation where I knew that we could connect with the road and fire trail system back to the fire origin.

The following day I met with Blue Mountains City Council and Lithgow representatives of the RFS at the Lithgow Fire Control Centre and presented my containment fire strategy. As with all such alternative fire strategies this was met with opposition. However, in the end I managed to convince

[32] In 2016 I made contact with the Executive Director, Fire at NPWS of NSW in September 2016 after I presented a seminar at Blue Mountains Region to offer my fire planning services. Again in 2018, I offered my services to Simon Heemstra, the Planning team leader at the RFS, at the International Forest Fire Conference in Coimbra in November 2018, a year before the 2019-2020 bushfire season. In both cases, I received no follow-up reply. I determined then that they perceived my services as not useful.

them and we went ahead as a separate NPWS division between Bell all the way around the eastern end of the fire back to the Newnes pine plantation with all the necessary NPWS bulldozer and operator who I trusted, and the NPWS firefighting team. That afternoon we put in the bulldozer line into the Wollangambe River. Overnight we backburnt along to its junction with the Wollangambe River. Given the favourable conditions for the next few days, that afternoon I instructed a NPWS aerial ignition team with a briefing to undertake aerial ignition along the ridge system.

This they did that afternoon of 4 December and the burn operation the following day had put the fire off the plateau ridges into the gullies and lower slopes of the Wollangambe River. We did have a containment escape 1 km east of the dozer line at its junction with the Wollangambe River. The next day on 5 December. I had a water bombing helicopter on standby for this very purpose. It went out and suppressed the outbreak. We then followed up with remote area crews under the command of a very experienced NPWS local fire fighter Neville Brogan whom I trusted and he trusted me in my field firefighting decisions. The outbreak was suppressed successfully that evening.

The following day on the 6 December we had another containment escape from the Wollangambe River just north of Mount Irvine. I had been briefed of the fire perimeter in this area and predicted that we could get a containment escape. We launched another successful operation and this containment escape was contained like the previous one.

Later the following week a strong dry southerly change caused the fire to jump the BungleBoori River and spread northwards towards Mount Cameron. I was called back from Queanbeyan to devise a further containment strategy in which we used a combination of retardant bombing aircraft from Victoria to contain the western flank and north-western corner of the containment escape. This we did successfully after NPWS and DSE RAFT teams then put in a rakehoe line that tied the western flank into a tributary of Rocky Creek. The rest of the containment escape was put out by rain.

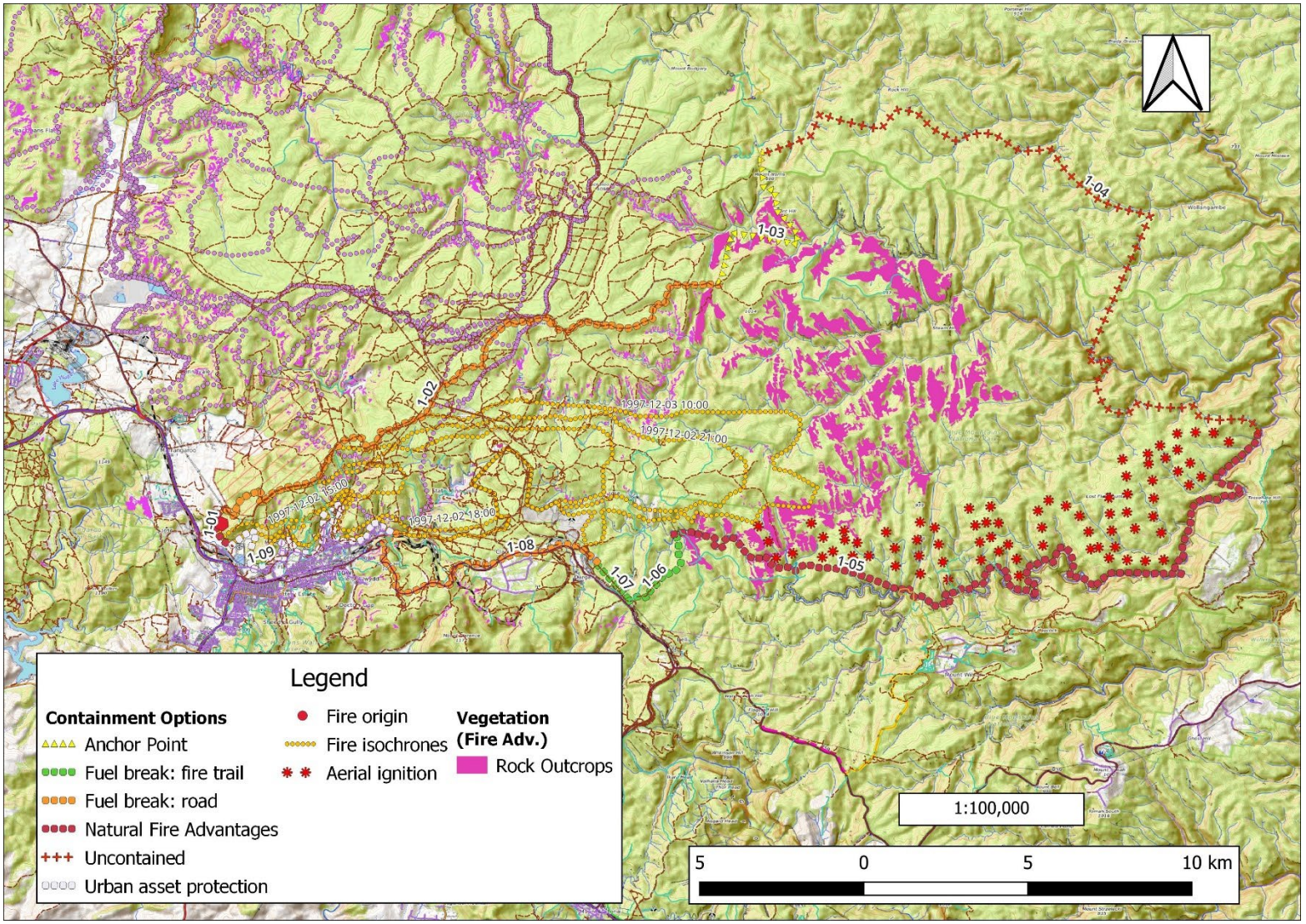

Figure 35: The Aerial Ignition containment strategy used in the 1997 Lithgow Tip bushfire based on the natural fire advantage of the Wollangambe River as a natural fire advantage

4.1. Case Study 8: Alternative containment option strategy: containment escapes after the inactive fire edge (07 – 11 Nov 2019)

On the afternoon of 3rd November 10-15 mm of rainfall fell over the fireground from a wet thunderstorm that extinguished the fire fronts around the fire perimeters of the Gospers Mountain bushfire. For a period of four days after this rainfall event NPWS undertook a remote area operation to contain the fire to the inactive fire perimeters. I have insufficient evidence provided in the Brief of Evidence that details what ground and aerial resources NPWS of NSW had to contain this fire of 10750 ha with a perimeter of over 60 km.

The 14 km-long eastern flank of the Gospers Mountain did have some significant fire advantages along it including rainforest in its lower part and wet sclerophyll forest in the middle section. To mop it thoroughly before the containment escapes would have required some significant NPWS remote area resources. The lower part of the fire advantage held along the rainforest lined creek for a distance of 3 km. The upper 11-km section of the eastern flank could have been held had there been some RFS aerial resources devoted to other fires up the North Coast of NSW.

My containment fire strategies are based on what NPWS was considering using although I have made a request to NPWS to supply the incident action plan including the IAP maps and resource allocation in the period from 3 to 7 November. These mainly comprise natural fire advantages around most of the fire perimeter (sectors 1-01, 1-03, 1-04, 1-05, and 1-06) with a small section of RAFT work to tie in the two creek catchments of Coorongooba Creek to the west and Koondah Creek to the east (sector 1-02). The containment escapes on the eastern flank (sector 1-04) occurred too early for aerial water bombing to be successful although the northernmost containment escape could have been extinguished leaving just one fire run to occur later in the day.

The natural fire advantage on the western flank of this fire (sector 1-01 in Figure 36) was used before in the Running Stream wildfire in February 1992, in which I as fire management officer at that time devised a containment fire strategy employing Running Stream to the East and Cooroongooba Creek to the west and using NPWS RAFT teams to tie the two creeks together in the upper parts of their tributary catchments. We used aerial ignition to burn between the two tributaries. Both creeks held and there were no breakouts. This was much later in the fire season and had similar vegetation and fuel dryness conditions similar to that at this stage of the Gospers Mountains fire.

On the early morning of 7 November there were five significant containment escape points identified on the fireline scan taken at 06:07 on 07 November on its eastern fire flank. These latter breaches produced two significant fire runs towards the Wollemi Creek. There were other containment escape points later that day on the southern and western flanks overlooking the Colo Heights and Cooroogooba Creek which meant that the only fire advantage holding was on the northern flank of the fire north of Gospers Mountain (sector 1-02 in Figure 36). This containment escape produced two fire runs. The one in the north burnt 1,200 ha by the evening and the other to the south 4,500 ha by midnight on 7 November. These escapes and those on the western and southern flanks were within the natural fire advantages identified in my fire containment strategy. The most important one was the Coorongoba sector (Sector 1-01) to consolidate as an anchor point to the west. All of my fire strategies on past fires involved establishing anchor points and working from there.

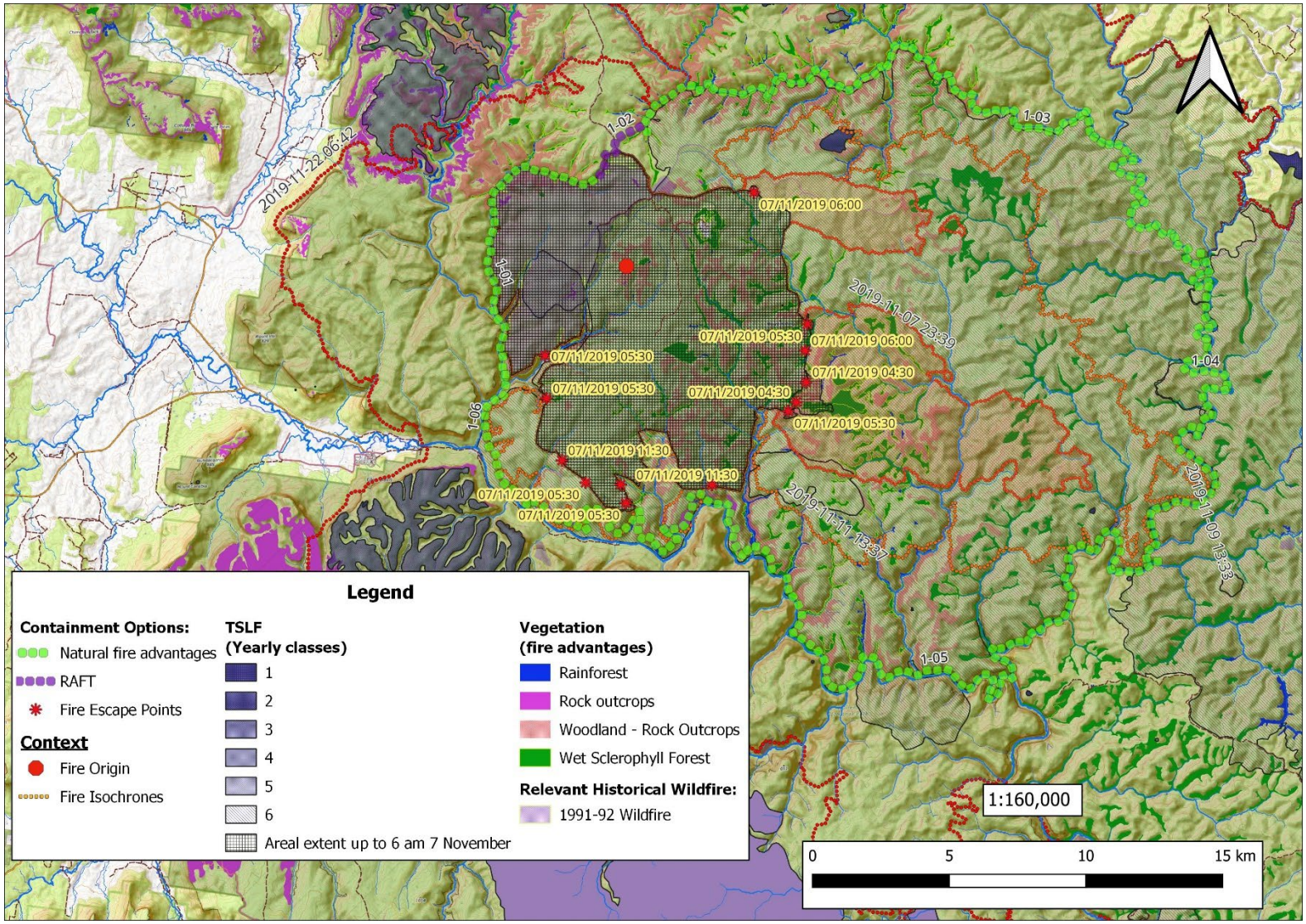

Figure 36: Strategic containment option for the planning period 07-11 November 2019 showing the use of natural fire advantages around most of the Gosper Mountain wildfire

After the fire runs of 7 November, I would have considered undertaking similar small tactical aerial ignitions to bring the fire off the ridgetops much earlier to the edges of Wollemi Creek (Sector 1-04 in Figure 36) so that the potential for any spot-overs from intense fire runs to the west of Wollemi Creek would have been avoided. This tactical approach necessitated adequate aerial resources to follow up water bombing of hotspots. Of course, RFS held these additional aerial firefighting resources.

4.2. Case Study 9: Alternative containment option strategy: containment escapes after the blow-up conditions on 12 December 2019

This case study follows on the previous case study 7 in the previous section 4.1.

On the morning of 12 November, the Gospers Mountain bushfire had increased to 39,000 ha in size and over 200 km in perimeter.

It then broke out on the south-eastern flank across the Wollemi Creek at about 12:00 at two locations identified from the fire linescan taken at ~12:00 on 12 November 2019 in two locations: one near the Wollemi Creek; and the other from a spot-fire emanating from an intense fire run along the ridge top to the west of it (Figure 37).

An intense fire run ensued that crossed the Putty Road and burnt into the Yengo National Park. This fire run was 19 km long from its starting point on Wollemi Creek and had burnt 8,600 ha at 19:25 by early evening on 12 November.

The alternative containment strategy was based on the NPWS expressed desire to contain the Gospers Mountain to the footprint of the previous footprint in the October 2013.[33] I have drawn up 18 fire containment sectors principally using natural fire advantages, roads and fire trails, as well recently burnt areas. In any strategy there is always a fallback strategy depending on how the fires behaves in relation to the current one. This has not been added to the map for the purposes of clarity as the map is quite complicated as it is.

The Hawkesbury IMT then committed itself to undertake backburns 12 km along the Putty Road to the north of the northern flank of the wildfire (Case Study 1; Section 3.1) and up to 4 km south of the southern flank towards Colo Heights between 13 and 15 November. While these were being conducted, a containment escape occurred at about 11:00 on 13 November on the Wollemi Creek which could have been suppressed with aerial water bombing. This subsequently led to an intense fire run up to the western-most northern backburn along the Putty Road on the afternoon of 15 December (Case study 1; Section 3.1).

All these backburns then escaped in an east-south-east direction at midday on 15 November (highlighted in red in Figure 37) and considerably expanded the width of the fire in a North-South direction and burnt an area of over 9,200 ha while the wildfire burnt while the wildfire burnt about 8,700 ha the same afternoon. Had there been a watch and wait tactic to see what the fire might do on the blow-up day of 15 November and the breakout along the Wollemi Creek been suppressed on the morning of 13 November, the only sectors under pressure were sector 2-14 and 2-15. In the

[33] National Parks and Wildlife Service, Incident Action Plan, 2 November 2019, 352934-215180-IAP Running Stream 2 Nov 2019

north, the Wallaby Swamp fire trail to the east of the Putty Road could have used to contain the fire under milder fire weather conditions (Sector 2-09).

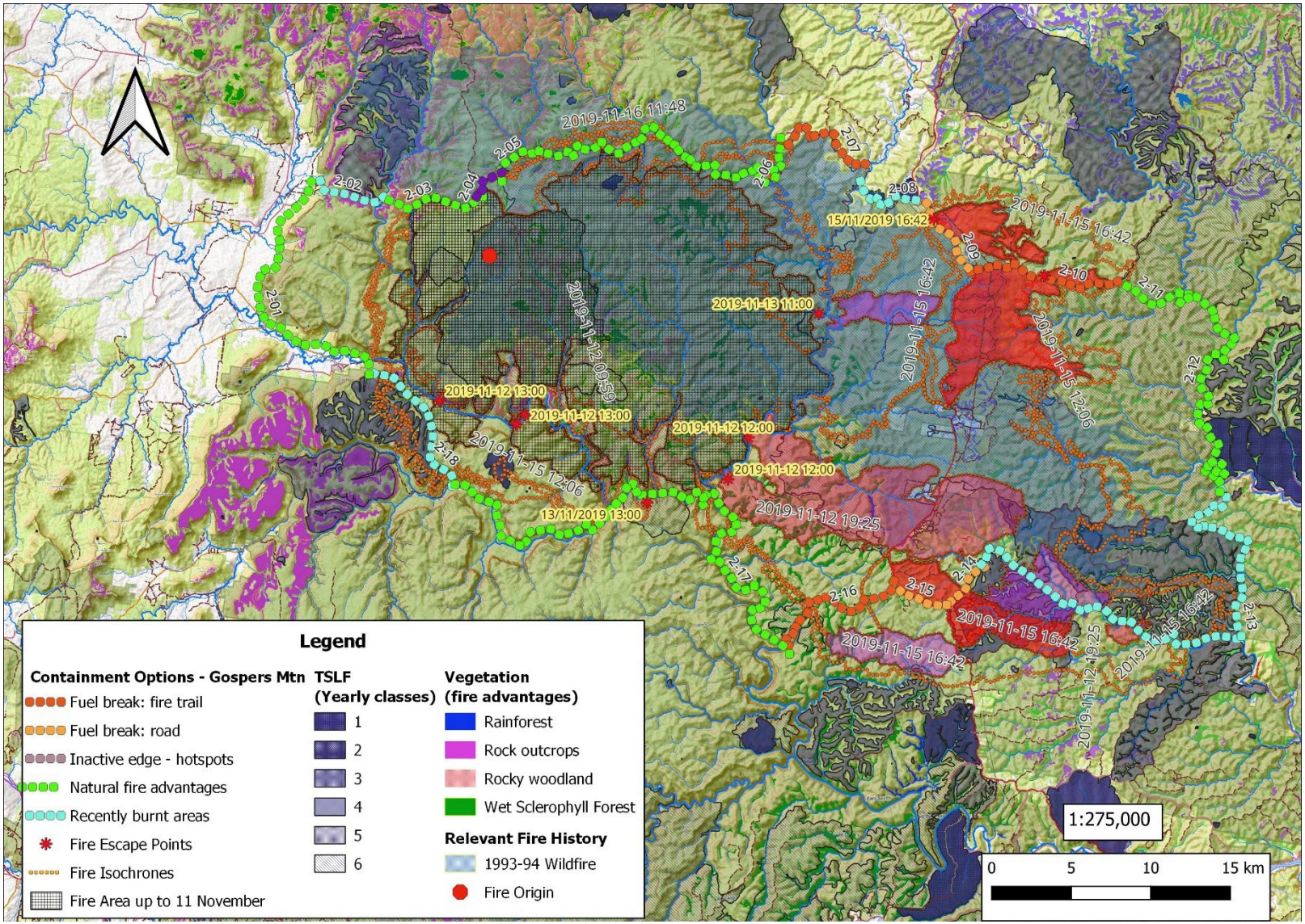

Figure 37: Alternative fire containment strategy for the planning period 01-05 December planning period using the BungleBoori and Wollangambe River fire advantages

Along the leading southern flank above sectors 2-14 and 2-15, the considerable amount of recent prescribed burns could have been used to contain the fire. In this part of the fire, I developed a fire strategy for a wildfire on December 26, 1990, in which NPWS Blue Mountains District largely unaided by RFS brigades contained the wildfire north of Colo Heights. Back then, we had no recent fuel-reduced areas to take advantage as in this fire scenario. This is not highlighted on the map as the recent prescribed burns there in the last four years would obscure that fire.

In addition, had there been more attention to the possible hotspots above sectors 2-17 and 2-18 north of the Colo River, the expansion of the fire on its southern flank could have been delayed and the fire size reduced to take advantage of milder fire weather conditions to secure the southern flank.

Finally, I have underlain the extent of the 1994 Coorongooba wildfire which burnt from the Coorongooba Creek over the Wollemi Creek and Putty Road in two days from the 6-7 January 1994. The fire went out naturally in the more exposed woodland between the Mellong Swamps and the McDonald River as well in the north-west sector in the middle and upper Cooroongooba River catchment. In the next week after these fire runs, I focussed on the southern flank where after some tactical aerial ignition above the cliffs with aerial water bombing using a helicopter working out of farm east of Glen Alice, courtesy of a local farmer. There was just a helicopter pilot and myself and a bambi bucket. We worked along the northern bank of the Colo River first identifying the hotspots and then he set me down on a river bank while he put out the hotspots with his Hughes 500 equipped with a 1,000 litre water bucket. We repeated that every day for a week until we had all the hot spots out and kept the fire to the northern side of the Colo River.

4.3. Case Study 10: Alternative containment option strategy: containment escapes after the rainfall event of 23 November 201

This containment strategy alternative is based on the fire-extinguishing rainfall event on 23 November during which 4-10 mm of rainfall fell on the fireground and there was subsequently milder easterly fire weather until 29 November. The simple part of this fire containment strategy is that the Gospers Mountain bushfire with a fire extent of 185,000 ha and 516 km of fire perimeter has hardly any active along this length of perimeter. Based on my assessment of the limited number of fire scans captured between 23 and 30 November I identified about 2 km of low-intensity fire below the cliffs north of Glen Davis.

This is an example of a fall-forward fire strategy in which every possible hotspot along the inactive fire edge is extinguished based on potential large fire runs to the east or south-east along the length of its perimeter. This was a period when the inactive edge could have been flown with Forward Looking Infra-Red (FLIR camera to detect and then follow-up RAFT team and water-bombing helicopter extinguish hotspots. The fire weather was subsequently comparatively benign for these operations until the fire weather conditions started to deteriorate from about 29 November based on my interpretation of fire weather data from both Nullo Mountain and Marrangaroo BOM weather stations.

I have identified hotspots from the fire linescan images or Sentinel-2 satellite imagery on 1 December which later broke out and started new fire runs to the north-west and south of the inactive edge. The southernmost ones are dealt with in the next case study. The north-west and north-east containment escapes were dealt with previously in case study numbers 1 and 2 (sections 3.1 and 3.2 of this report)

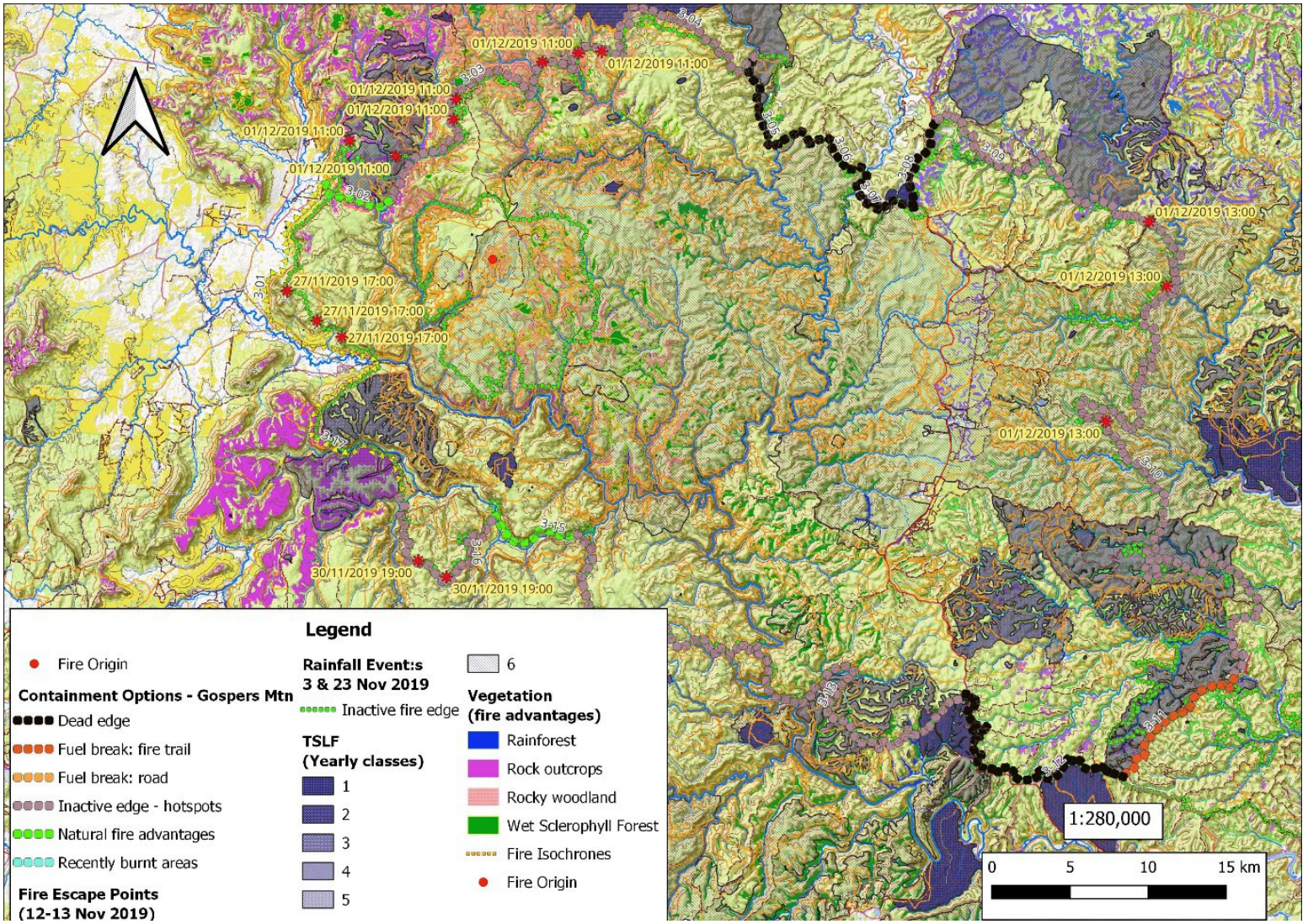

Figure 38: Alternative fire containment strategy for the planning period 23-27 November utilising the inactive fire edge created by the 23 November rainfall event and to partially contain the Gospers Mountains southern flank from Glen David to Colo Heights

4.4. Case Study 11: Alternative containment strategy for the southern containment line (01 – 06 December 2019)

The containment escapes on the southern part of the inactive edge from the rainfall event on 22 November re-activated after 09:00 on 29 November in about four locations (Figure 39). I do not have the exact details to hand as these containment escapes are not documented in the brief of evidence (footnote needed here). The western fire runs from the cliffs on the eastern side of Rocky Creek spread 11 km to the south-east until 11:00 on 6 December; the central fire run below Tambo Creek 3.5 km; and the easterly run 2.5 km.

The Hawkesbury IMT did nothing to prevent these outbreaks from occurring base on the brief of evidence (reference needed here). The longer south-east fire run to the west from Rocky Creek 29 November and morning of 1 December exemplifies what happens when potential outbreaks are not dealt with in a timely manner using RAFT and aerial water bombing combined during the inactive period of the principle. This violates the principles 3a, 3b, and 3c of remote area fire management presented earlier in the introduction to Section 4.

As the result of these earlier containment escapes, I have formulated an alternative containment strategy that utilizes the natural fire advantages in the west, the Bungleboori Creek, to the south, and the Wollangambe River to the east. The river containment line then links back to the inactive fire edge on the northern side of the Colo River, which then links back to the start of the Drip Rock track on the Putty Road.

This alternative containment strategy employs rocky outcrops in the north-west corner of the map (sector 4.15), the fire trail system from the southern end of that to the upper reaches of the Bungleboori Creek (sector 4.14), a small RAFT section between there and the Bungleboori Creek (sector 4.13), the length of the Bungleboori Creek with its slot canyons, rainforests, and mesic forests to its junction with the Colo River (sector 4.111), and from there north along the western side of the Wollangambe River (a continuation of sector 4.11), and then finally from the Colo River back along the inactive edge to the Putty Road.

These containment escapes had three major consequences for the southern line containment strategy. First, the failed backburn on the evening of 7 December breached the identified western containment line (sector 4.14) and caused the 46,000 ha blow-out of the fire to the west into Gardens of Stone National Park, Cullen Bullen State Forest, property loss in the Wolgan Valley, the western side of the Newnes Plateau threatening private property at Marangaroo and the city of Lithgow (refer back to case study 4; Section 3.6). Second, the southern flank of the fire between Rocky Creek and the Colo River (a major part of Sector 4.11) to become active along its length and with further inattention this crossed the Wollangambe River on or about 13:00 on 5 December. This then caused the Hawkesbury IMT to implement the failed Mt Wilson backburn escape (Case Study 6; Section 3.6), which then spread in all directions (Figure 40):

5. to burn out the Wollangambe, Dumbano and Bungleboori River catchments with uncontrollable and uncontained backburns

to damage property and infrastructure, people's lives and destroy the fabric of local communities adjoining Blue National Park

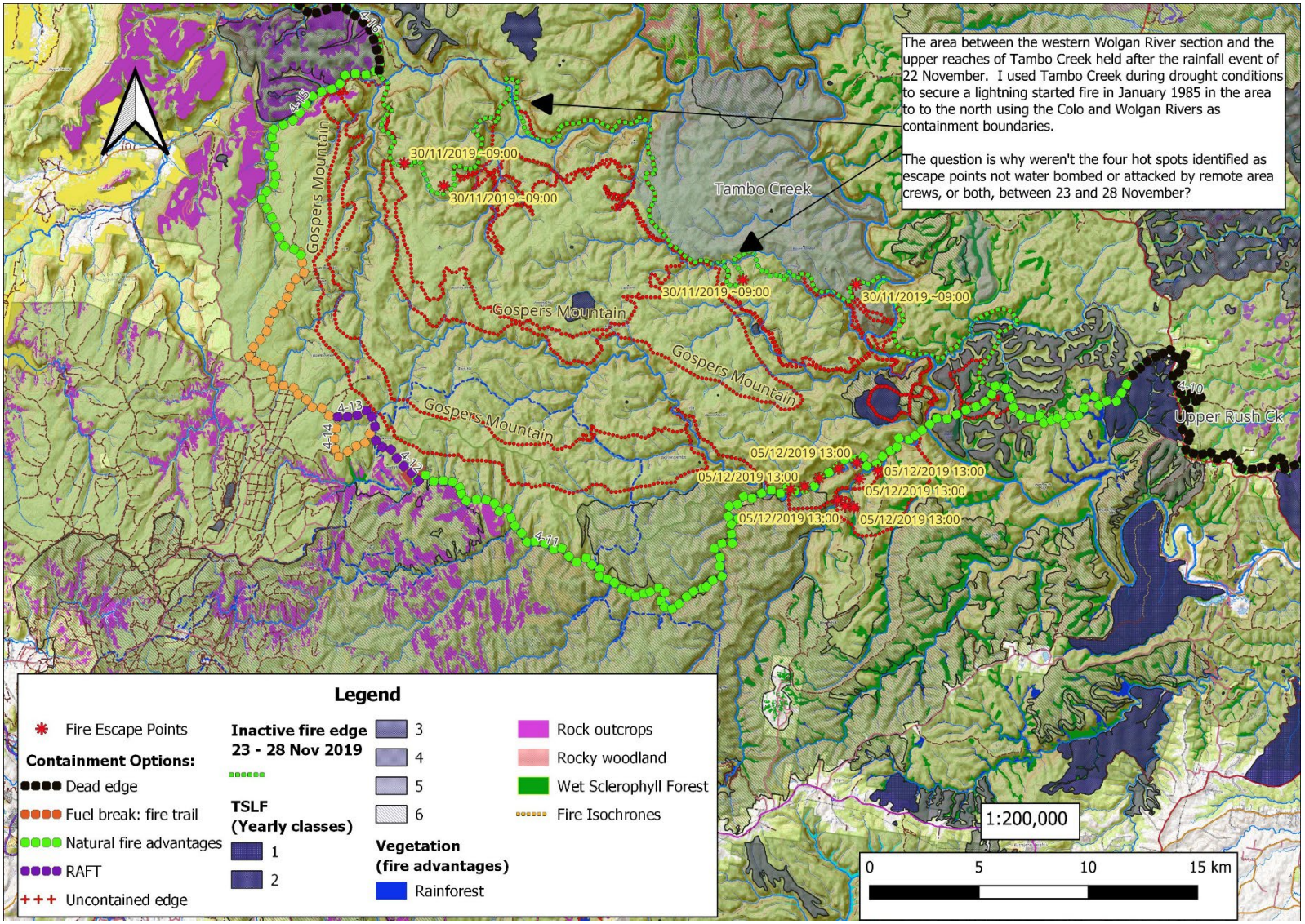

Figure 39: Alternative fire containment strategy for the planning period 01-05 December planning period using the BungleBoori and Wollangambe River fire advantages

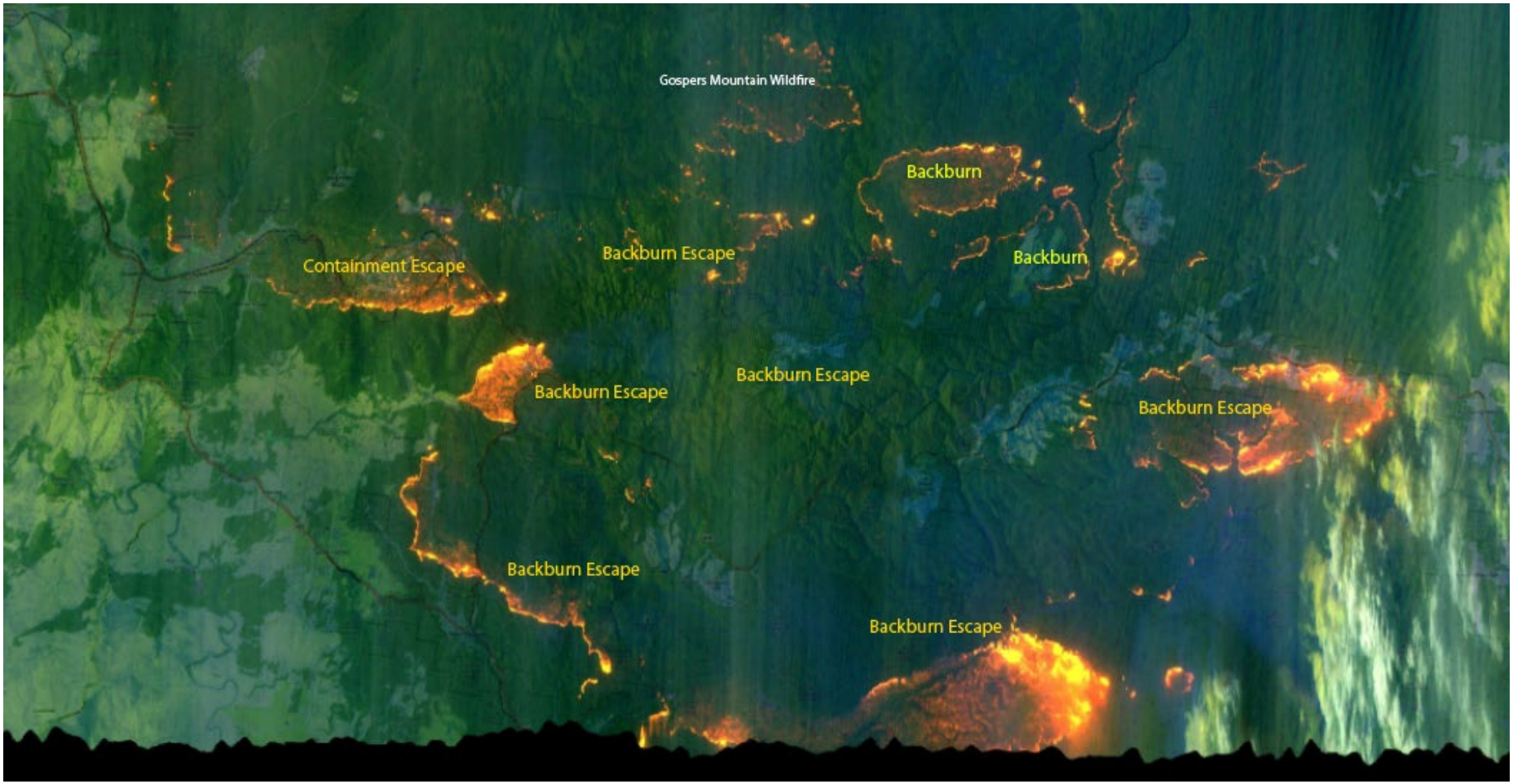

Figure 40: The resultant devastating impact of the failure to contain the inactive fire edge created after a rainfall event on 22 November 2019 to vegetation in the Wollangambe and the Grose Valley catchments within and adjoining Blue Mountain NP in the GBMWHA, and to adjoining local communities in Lithgow, Clarence-Dargan, Mount Wilson- Irvine-Tomah, Berambing, and Bilpin.

Furthermore, there was a further containment escape on the sector 4.11 on the northern side of the Colo River midway between the Colo River and the Putty Road on the afternoon of 3 December while the backburn to the south-west of Colo Heights backburn was being implemented from Drip Rock Track down to Cerones track (Figure 39). This backburn (Case Study 3; Section 3.3) proceeded to escape on the next two days: (1) on the afternoon of 4 December, and (2) after 13:30 on 5 December to cause more unnecessary devastation and grief and anguish to local residents (Annexure B). The commentary and observations made by the Styles makes for gripping reading and epitomizes the chaos and disruption to people in rural communities caused by a lack of a clear, cohesive, comprehensive fire strategy that takes into account:

1. a realistic fire assessment and implementation of remote fire area fire strategies using the fire containment principles outlined at the start of this section.
2. conserves and protects a range of natural and cultural values in a National Park reserves system;
3. utilises a range of natural and man-made fire advantages at times when the fire weather patterns are more benign and anchor points created by antecedent rainfall events; and
4. involves local communities and utilises their local experience and knowledge.

The consequences of doing the opposite is chaos and devastation to people living in rural communities, and long-term fire impacts to the biota, natural vegetation ecosystems, and the water catchments. The National Park System in the GBMWHA should be honoured and cherished and not decimated in an 782,000 ha fire complex. Something is deeply remiss here.

5. DISCUSSION

5.1. Summary of backburn and Containment Escape Studies

The core area burnt by the Gospers Mountain fire is presented with the surrounding areas of backburn and containment escapes in Figure 41. The critical periods in the course of this fire are depicted inside the core based on those identified as the basis for the case studies, comprising the two inactive fire periods: (a) between the afternoon of 3 November and the early hours of 7 November and (b) the afternoon of 22 to the early hours on 29 November; as well as the intense fire run from 12:00 on 12 November running into the early hours of 16 November.

Based on the consequent area burnt in the backburn and containment escapes, estimates of the additional area burnt is presented in Table 3, along with the likely minimal core extent of the Gospers Mountain bushfire had it been contained to a much small area using the fire containment analyses presented in Section 4.

Table 3: Summary Table of Consequent Area Burnt by the Back and Containment Escapes

INCIDENT NUMBER	TYPE OF INCIDENT	INCIDENT NAME	NUMBER OF DAYS	CONSEQUENT AREA BURNT (ha)
1	BE	North Mellong Swamp	24	34,600
2a	CE	Cooroongooba River Catchment (NW Wollemi)	8	74,900
2b	CE	Pipeline Track-Wolgan Cliffs	18	14,600
3	BE	South West Colo Heights	2	5,650
4	BE	Glow Worm Tunnel Road	34	44,600
5	CE	Upper Reaches of the Bungleboori catchment	4	54,000
6	BE	Mt Wilson Backburn Escape	12	14,300
7	CE	Lithgow/Clarence/Dargan	14	340
			TOTAL	**242,990**
		Minimal core extent burnt by Gospers Mountain wildfire		305,000
		Total Area		**547,990**

The final extent of the Gospers Mountain bushfire is estimated to have been 547,990 ha including the minimal core area and the consequent area burnt by all the backburn and containment escapes. If there had greater attention paid to the opportunities to limit the extent and severity of this bushfire, I have estimated based on the analyses presented in Sections 3 and 4 the likely area could have been somewhere between 185,000 ha (inactive edge created by November 22 rainfall event) and 250,000 ha. If earlier remote area fire operations were successful it could have limited to even less than 185,000 ha and therefore limiting impact on private property around the edge of the GBMWHA.

If these closer containment options had been implemented successfully, well away from human assets, there would have been no need for large-scale backburns from 13 November all the way through to 14 December, culminating in the Mount Wilson backburn escape.

The summary results presented are in sharp contrast to the statements made by RFS Commissioner Rob Rogers on 2 September 2022 when he stated that "There was a very small number, but there was some back-burns that went wrong. More than a thousand back-burns that we had put in during that fire season—I think there was a record of four that caused problems".[34]

In the Answers to Supplementary Questions on Notice, from the same Budget Estimates hearing, RFS Commissioner Rob Rogers provided evidence stating that zero backburns had been conducted in the Lithgow LGA.[35]

(No. 25 in Section 8.1: the Chronology of Backburn Escapes on the Gospers Mountain Wildfire).

[34] NSW Budget Estimates Emergency Services and Resilience, Flood Recovery, 2 September 2022 Transcript p. 15. Available at: https://www.parliament.nsw.gov.au/lcdocs/transcripts/2984/Transcript%20-%20PC%205%20-%20Emergency%20Services%20and%20Resilience,%20Flood%20Recovery%20-%202%20September%202022%20-%20CORRECTED.pdf

[35] NSW Budget Estimates Emergency Services and Resilience, Flood Recovery, 2 September 2022, SQ89. Available at: https://www.parliament.nsw.gov.au/lcdocs/other/17821/ASQON%20-%20Hon%20Steph%20Cooke%20MP%20-%20Emergency%20Services%20and%20Resilience,%20Flood%20Recovery.pdf

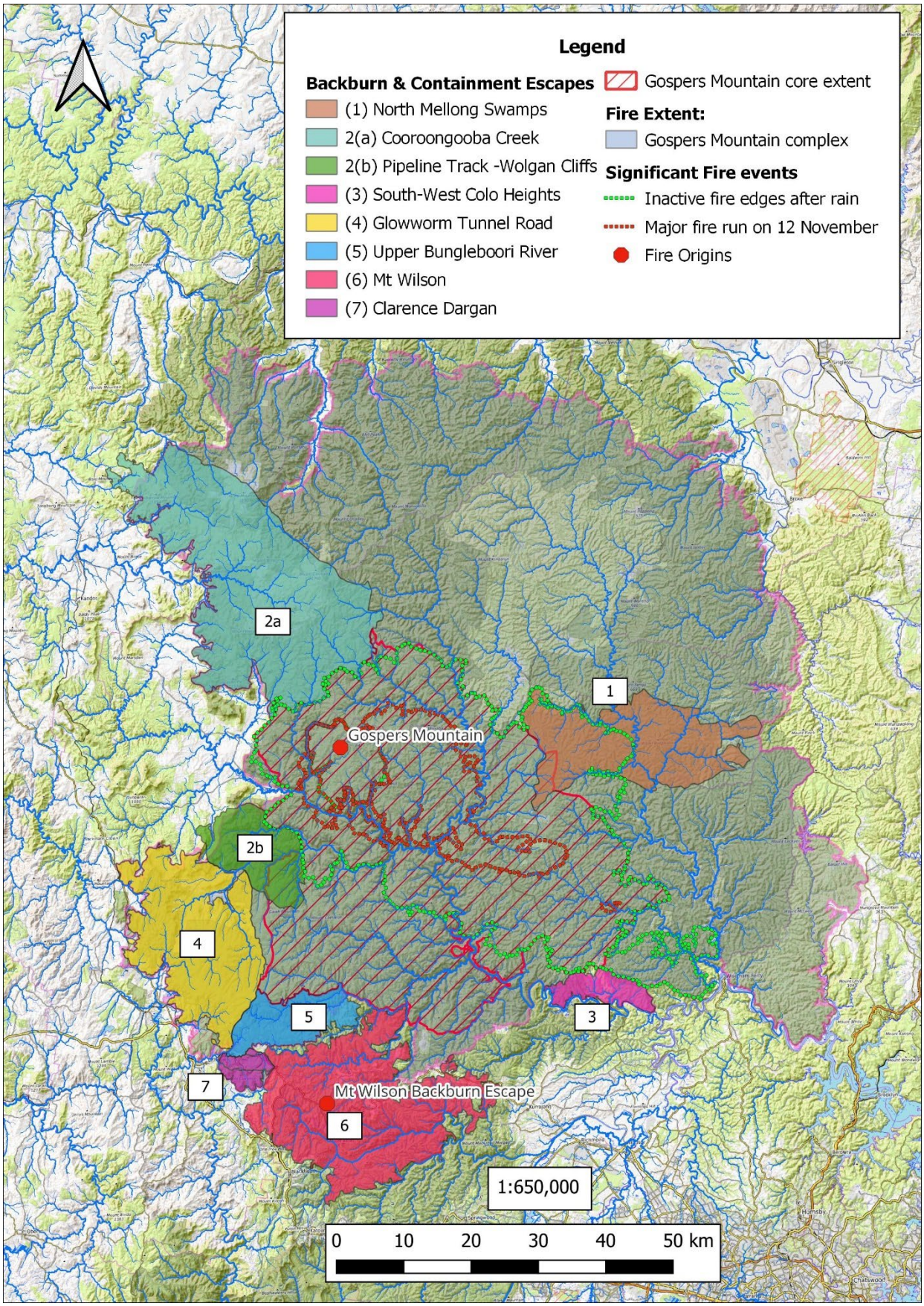

Figure 41: Final summary consequent impact of backburn and containment escapes on the Gospers Mountain section of the Gospers Mountain complex.

5.2. Discussion Topics relating to backburn escapes.

The most important discussion topics arising from the Results sections 3 and 4 are:

1. RFS non-compliance with RFS Operational Protocol for Backburning

2. The lack of overall success of the broad strategic plan made by the RFS in the Section 44 declaration on or about 11 November 2019 to supress the Gospers Mountain wildfire to a much smaller area between 200,000 and 300,000 ha or less by not assessing alternative strategic containment options

3. The missed opportunities to implement the “fall forward” option of IMT Plan when opportunities arose from changes in westerly dry weather patterns to more benign easterly weather which occurred at opportune times during the run of the Gospers Mountain bushfires.

4. Whether the RFS actions are congruent with the Rural Fires Act (1997) Part 1 Preliminary, 3 Objectives of the Act (a) (c) (c1) (d)

(a) for the prevention, mitigation, and suppression of bush and other fires in local government areas (or parts of areas) and other parts of the State constituted as rural fire districts, and

(c) for the protection of persons from injury or death, and property from damage, arising from fires, and

(c1) for the protection of infrastructure and environmental, economic, cultural, agricultural and community assets from damage arising from fires, and

(d) for the protection of the environment by requiring certain activities referred to in paragraphs (a)–(c1) to be carried out having regard to the principles of ecologically sustainable development described in section 6 (2) of the *Protection of the Environment Administration Act 1991*.

1. RFS NON-COMPLIANCE WITH RFS OPERATIONAL PROTOCOL FOR BACKBURNING

RFS OPERATIONAL PROTOCOL

RFS Operational Protocol for backburning that was in practice during the 2019/2020 Fire Season, S.O.P #17 Backburn Activities (1999)[36] states in part that:

The Key Factors

All backburning must be strictly supervised. Officers in charge must ensure:

- Weather and fuel conditions are suitable for a controllable backburn.
- Adequate time and resources are available for the backburning operation (eg: tankers, firefighters, look-outs, communications etc).
- Spot overs can be quickly extinguished.

AND

Backburning is not to be conducted when:

- The fire is running in extreme conditions, or the weather is forecast to create extreme conditions before the backburn is likely to be secured.
- There is insufficient time or resources to conduct the backburn.

The key factors of consideration are weather and fuel conditions, and how a backburn is implemented (including burn pattern and management). These factors determine the likelihood of being able to control the backburn once lit, by containing the burn and black out the fire when the containment area perimeter is reached.

[36] NSW Rural Fire Service S.O.P #17 Backburning Activities (1999)

WEATHER AND FUEL MOISTURE CONDITIONS ARE SUITABLE FOR A CONTROLLABLE BURN

All RFS backburn operations identified as case studies in this report were implemented during periods of Severe Fire Danger Rating (FFDI); or were implemented under High-Very High FFDI in the lead up to periods of Severe FFDI.

The interpretation of FFDI into fire danger classes (Low, Moderate, High, Very High, Severe, Catastrophic) is promoted in roadside signage informing the public of the risk of fire outbreak and potential risk of fire to natural, cultural, and human assets of all kinds.

Fuel moisture content must be carefully considered to understand the potential flammability of fuel in the fire ground and therefore the likelihood of a backburn escaping by spotting outside containment lines. Fuel moisture content is measured as Dead Fuel Moisture Content (DFMC). Even at lower FFDI ratings the DFMC can still be extreme and conducive to unpredictable fire behaviour that can lead to spot fires and backburn escapes.

The Australasian Fire Authorities Council (AFAC) identifies[37] that a "fuel appraisal is required to gather all relevant fuel information in the burn area, or adjacent to it".

- A burn prescription should prescribe maximum and minimum values for fuel moisture content, weather, and fire behaviour.
- Planning must anticipate escapes.
- Resources are devoted to securing public welfare in the event of escapes.

Incident Action Plans or burn/ignition plans available in the Gospers Mountain Fire or Grose Valley Fire, Mt Wilson Brief of Evidence, do not describe maximum or minimum values for DFMC, weather or fire behaviour for backburning activities.

It is unclear if fuel moisture content measurements were conducted prior to the backburn operations identified in this report. There is no information available in the Brief of Evidence or Registry to demonstrate Fuel Moisture Content readings took place.

It is unlikely that Fuel Moisture Readings were conducted as this requires specific equipment (Speedy Moisture Meter, Wiltronix moisture meter, or a Lignomat or Proster moisture meter for small twig and coarse woody debris.)

Each backburn case studies were implemented when weather and fuel conditions were forecast to create DFMC of <5% (except for the Glow Worm Tunnel Road Backburn which was marginally outside this range at 5.1%). DMFC of <5% is conducive to "extreme and difficult to predict fire behaviour"[38].

Fuel Moisture Readings, if they had been undertaken prior and during backburn operations would have only confirmed that conditions were not suitable for backburning.

The DFMC and FFDI values for each backburn case study have been provided in Table 4.

[37] Australasian Fire Authorities Council (AFAC)

[38] NSW Rural Fire Service Wildfire Behaviour Manual, 4 Fuel Moisture Content p.65

Table 4: Key DFMC and FFDI values extracted from backburn studies.

Backburn case study	FFDI	DFMC (%)
Northern Mellong Swamp	Severe	3.5 - 4.8
South Western Colo Heights	Severe	4
Glow Worm Tunnel Road	Very High	5.1
Mt Wilson	Very High	-4

ADEQUATE TIME AND RESOURCES ARE AVAILABLE.

Planning of the backburns

Detailed RFS information on backburn lighting and ignition plans is not evident in the Brief of Evidence or Registry. Where it can be found it is not complete. For this report, date and time-stamped geo-located images of the fire ground supplied by RFS volunteer fire fighters and residents have been used to calculate the pattern and timing of ignition in the case studies presented in this report.

On the information available, there is no source documentation outlining detailed planning of any of the case study backburning operations listed in this report.

Given the high risk and high consequences of each backburn listed in this report, it is concerning that these basic planning documents are unavailable as they would provide significant insight into the decision-making process of the IMT and RFS before each backburn was implemented. For a list of documents that could not be found in the Registry or Brief of Evidence see Annexure

Drip-torch Lighting Patterns

Lighting up under these weather and fuel conditions, using a continuous line of fire ignition can create intense sub-canopy fires in sandstone heathy woodland and heathy forest that results in pyro-cumulous clouds driven by intense convection from rapidly spreading intense fire fronts and short-range spotting.

Figure 42 - Backburning both sides of the Putty Road on 13 November 2019 at 9:22[39]

[39] Newton, J. (2019) Putty Road [Photograph] 13 November 2019 at 9:22 a.m.

Figure 43 - This photo taken at the Glow Worm Tunnel Road Backburn shows convection clouds forming after the ignition of a section of the backburn.[40]

A consequence of this ignition pattern is severe fire behaviour and defoliated of intensely burnt eucalypt forest that takes many years to recover its forest canopy. This leaves the bare ground exposed to the ravages of intense rain from follow-up thunderstorms which occurred in February 2020 after the fires were extinguished.

Figure 44 - Intensely defoliated burnt eucalypt forest at Mt Bell following the Mt Wilson Backburn escape.

Management of Backburn Light-up Teams

Skill levels and experience of RFS volunteers conducting a backburning operation can vary substantially. RFS volunteers receive basic training in how to fill their fire truck with water and point their hoses at the fire. There is no training in use of a drip torch or the varying lighting patterns for backburning operations for volunteers with Basic Firefighter qualification.

The officer in charge must ensure the ignition plan directions are followed. Likewise, it is critical for the IMT to recognise the potential limitations of knowledge, skills and experience, especially when resources are stretched and adjust their strategy and implementation accordingly.

[40] Hartley Rural Fire Brigade, Facebook, 7-8 December 2019
https://www.facebook.com/permalink.php?story_fbid=pfbid02wyjt9iuSVQkhoJMSXtG6vZA1G51xm4h5vJDWBvKV6FKEkPMxkWAbCJad6GDnGAJEl&id=619095948141234

Figure 45 – Example of Strip lighting technique used in the Dalpura Sector during the Mt Wilson backburn on 14 December 2019.[41]

For example, the ignition plan for the Mt Wilson Backburn on the 14 December 2019 states that "spot ignition" [42] was to be used as the technique for lighting the backburn. However, imagery taken along Bells Line of Road in the Dalpura Sector of the backburn on 14 December 2019, shows a strip lighting pattern being implemented by firefighters. This could be one explanation as to why the Dalpura Sector backburn line had progressed 2.4km west along Bells Line of Road at 13:30 where the October Sector had only progressed 1.8km.[43]

Resources available

The Rural Fire Service is primarily a road-based firefighting service. It relies on four-wheel drive fire trucks staffed by volunteers who receive basic training in how to fill the truck with water and point water hoses at the fire. Volunteer staff can also be deployed to make hand tool lines, fire breaks and black out fire grounds usually in close proximity to their fire trucks.

The Service also has aircraft such as helicopters, Large Air Tankers (LAT) and Very Large Air Tankers (VLAT) capable of bucketing or "dropping" water or fire retardant onto active fire fronts in inaccessible locations which can be useful in firefighting in remote areas. These are less useful in forested areas at the tree canopy disperses the retardant so that the final surface layer does not penetrate the surface fuels. Both types of aviation equipment are even less effective at fuel moisture contents (my expert opinion based on preliminary analysis of aircraft effectiveness during the 2019-2020 bushfires).

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[41] Rural Fire Service – Chifley/Lithgow Team Facebook, 14 December 2019, 10:44 a.m., https://www.facebook.com/ChifleyLithgowRFS/videos/firefighters-supported-by-water-bombing-aircraft-have-commenced-back-burning-ope/586447662107951

[42] Ignition Plan Bilpin to Bell (undated), Grose Valley Fire, Mt Wilson Brief of Evidence p. 527

[43] Annexure C, FINAL supplementary Statement James Carter 14 April 2023.

The resource allocation was insufficient in each of the case studies as the backburns escaped containment lines and were unable to be contained and blacked out before causing significant damage to public and or private property.

Adequate time for mop up, blacking out and patrolling.

In each case study there was no time to mop up, black out and patrol of backburning operations before forecast of deteriorating weather conditions occurred. Normally, around 3 days is required to carry out these tasks to ensure burnt areas do not reignite and create spot overs or breaches of containment.

SPOT OVERS CAN BE QUICKLY EXTINGUISHED

In each case study spot overs could not be quickly extinguished because of the weather conditions, fuel moisture content and lack of resources.

2. LACK OF SUCCESS OF THE PLAN MADE BY THE IMT ON OR ABOUT 11 NOVEMBER 2019 TO CONTAIN THE GOSPERS MOUNTAIN WILDFIRE

The "hard line" (road based) plan identified by the IMT[44] required the introduction of new fire into the landscape often many kilometres from the Gospers Mountain wildfire. In each of the case studies, backburns were implemented in breach of RFS Operational Protocol for Backburning resulting in the fire escaping.

Each escaped backburn brought fire closer to communities and consequently led to the destruction and or damage of homes and properties in the Hawkesbury, Lithgow and Blue Mountains Local Government Areas (LGA).

All structures reportedly destroyed by the Gospers Mountain Grose Valley Fires, were as a result of the escaped RFS backburns and the result of failed follow-up containment escapes. Below is discussion of each of the case study backburns.

Table 5 below lists the backburn fire location/case study, the area burnt by the escaped backburn and number of structures damaged or destroyed by the backburn escape.

[44] Gospers Mountain Section 44 Incident Controllers Report p. 8

Table 5: Consequent Impact of Escaped Backburns

Backburn case study	Area burnt (ha)	No. Structures destroyed
Northern Mellong Swamp	29,500	Unknown
South Western Colo Heights	5,650	No BIA available[45]
Glow Worm Tunnel Road (and subsequent Lithgow Valley containment escape)	44,650	146[46]
Mt Wilson	51,000	67[47]
Total	130,800	213

RFS escaped strategic backburns caused emergency warning to be issued which disrupted and displaced residents and caused the destruction of structures (homes and buildings). The final tally of structures destroyed or damaged by escaped backburns (and subsequent containment escapes) was around 213, however some structures at Colo Heights haven't been included in the final count. Likewise the recovery of residents affected by escaped backburns is difficult. Residents describe ongoing trauma and struggle to comprehend how and why decisions were made that caused such devastation on their communities. This can be seen in a personal statement by Kristyne Smith from Mt Tomah in Annexure B 8.2.2.

[45] In addition, statements made to the Royal Commission into Natural Disaster Arrangements, as well as online photos of destroyed structures at Colo Heights suggest that multiple buildings were lost.

[46] Tab 46 - Affected Properties, Master Spreadsheet prepared by Jeff Sinton, Detective Senior Constable, NSW Police, Gospers Mountain Fire Brief of Evidence

[47] Tab 51 - Affected Properties, Master Spreadsheet, Grose Valley Fire, Mt Wilson Brief of Evidence

Figure 46 – "25 yrs worth of blood sweat and tears also lost up here at Colo Height's from a planned backburn gone terribly wrong".[48] See Annexure B 8.2.1

RFS escaped strategic backburns caused destruction of major public infrastructure (such as the Mt Victoria to Lithgow Railway Line)[49], had a substantial later economic impact on industries like tourism. These impacts have been documented in other government reports.

RFS escaped strategic backburns caused an increased risk to volunteers, professional firefighters as well as residents across the Gospers Mountain fire ground and similarly on other firegrounds in NSW well before and after 14 December at Mt Wilson.

RFS escaped strategic backburns caused situations where firefighters were trapped by escaped backburns (for example Colo Heights, Cerones Track 4 December 2019 [50], Blackfellows Hands Trail (12 December 2019) [51]

[48] Annexure B Submission of Craig and Deborah Styles to the Royal Commission into Natural Disaster Arrangements.

[49] Sydney Morning Herald, Fire damage shuts Blue Mountains line to electric trains for months, 6 January 2020, https://www.smh.com.au/national/nsw/fire-damage-shuts-blue-mountains-line-to-electric-trains-for-months-20200103-p53oik.html

[50] Tab 11 - Table 3 - Item 25 - ICON Intelligence Log Gospers Mountain Fire 4 December 2019 3:21:24 p.m. IntelId: 507266

[51] Tab 11 - Table 3 - Item 25 - ICON Intelligence Log Gospers Mountain Fire 12 December 2019 5:44:10 p.m. IntelId: 517947

How the opportunity was missed to fall forward

The expert knowledge and skills needed to identify and act on these missed opportunities lies within the National Parks and Wildlife Service Rangers and local RFS Brigades in communities located in and around the perimeter of the Greater Blue Mountains, Wollemi and Yengo National Parks.

Unfortunately, as stated previously no information is available on the makeup of the team that made the plan implemented on or about 11 November 2019. Information is available in the Brief of Evidence from volunteer RFS members and RFS Superintendent Karen Hodges who were tasked with implementing the plan.

The photo below of the Deputy RFS Commissioner Rog Rogers and several Assistant Commissioner planning "large scale backburns today in the Blue Mountains to contain the Grose Valley Fire."[52]. This demonstrates the involvement at the highest level in trying to contain the escaped RFS strategic backburns that were at this time blanketing the Sydney basin with smoke and threatening tens of thousands of homes in Greater Western Sydney.

Figure 47 - Photo from Assistant Commissioner Rebel Talbert showing Deputy Commissioner Rob Rogers receiving a briefing this morning, 22 December 2019

While all these participants involved in the planning and implementation of containment strategies have expert knowledge in the operation of the RFS, none have the depth of local knowledge and skills

[52] NSW Rural Fire Service, 22 December 2019. Available at: https://www.rfs.nsw.gov.au/about-us/our-districts/blue-mountains/photo-and-video-gallery/2015-photo-and-video-gallery/grose-valley-back-burn-planning-22-12-2019

brought by local National Parkes and Wildlife Rangers and local RFS brigades in management of fire in their local area.

I have read the account of local RFS Brigade members concern about the implementation of the containment strategies regarding the Mt Wilson strategic backburn operation; and I have held discussions with others and listened to their worry about the centralization of decision-making regarding fire planning and implementation with Head Office causing the devaluing of their knowledge and skills about management of fire in their backyard because they are not present to have input into the process; and the removal of fire incident management from local fire sheds closest to the fire ground to a distant and more RFS District Office.

Their worry is legitimate because they effectively no longer have a seat at the table as the table is too far from the fire ground for them to leave their homes and community's and return safely in periods when fire is active in their landscape.

3. WHETHER THE RFS ACTIONS ARE CONGRUENT WITH THE RURAL FIRES ACT (1997) PART 1 PRELIMINARY, 3 OBJECTIVES OF THE ACT (A) (C) (C1) (D)

I do not have the necessary qualifications to comment on this.

I only say that the plan made by the RFS on 11 November 2019 failed within the first 48 hours of implementation and despite this the RFS continued with its implementation until the of December 2019, causing economic and psycho-social devastation to the communities and continued destruction of world heritage values, ecosystem disruption, and possible significant biota losses within the Greater Blue Mountain World Heritage Area.

6. CONCLUSIONS

6.1. General conclusion

The ten case studies presented in this report demonstrate conclusively that the Gospers Mountain containment plan identified on or about 11 November 2019 led to continuous backburn failures and containment escapes across the Gospers Mountain fireground starting from the 13 November 2019 leading up to the 14 December at Mt Wilson, and beyond.

The implementation and outcomes of each strategic backburning operation became progressively more destructive, at first to the Greater Blue Mountain World Heritage Area, and then to public and private infrastructure within and surround the Blue Mountains and Wollemi National Parks.

This culminated on 21 December 2019 when fire from the escaped Glow Worm Tunnel Road / Black Fellows Hands Trail series of backburns, along with the escaped Mt Wilson Backburn inflicted major property losses in Lithgow, Clarence, Dargan, Mt Victoria, Bell, Bilpin and Kurrajong Heights.
The containment of the Gospers Mountain wildfire by surrounding it with “hard line” strategic backburns along main roads and access roads was an ineffective strategy and planned increase in the fire ground from 56,000 to 450,000 hectares was unnecessarily destructive; and as it required a breach of Operational protocols for backburning, always likely to fail. Other containment options existed, but there is no evidence they were recognised so a plan could not be made to exploit them.

This failed plan urgently requires review and systemic reform to ensure this destruction of our built and natural environment happens again.

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6.2. Detailed conclusions

The southern containment strategy

A combination of very high to severe FFDI, extremely low fine fuel moisture content (DFMC), implementation of backburns a long way from the wildfire front, usually during the day just prior to anticipated major fire weather blow-up events; resulted in the inevitable escape of RFS backburns.

This introduced significantly higher intensity fire into the landscape which resulted in a larger and more convoluted fire perimeter for the RFS to control, leading to increased pressure on resources as further assets had to be dispatched to try to control the escaped backburns. (Northern Mellong Swamps 14-15 November, South Colo Heights 6-11 December) and Newnes Plateau 8-16 December 2019)
The strategy increased risk of harm to volunteers, professional firefighters as well as residents across the Gospers Mountain fire ground before and after the 14 – 15 December 2019 burn over event resulting from the Mt Wilson escaped back burn. Situations where firefighters were trapped by escaped

RFS backburns are documented at Colo Heights, Cerones Track 4 December 2019[53], and Blackfellows Hands Trail 12 December 2019[54] as well as Mt Wilson on 15 December 2019.

This failed containment strategy had significant impact on human assets resulting in the damage or destruction of over 200 buildings[55] [56]; significant damage to public infrastructure for example closure of the train line between Mt Victoria and Lithgow due to damage to rail line caused by fire; significant economic damage to key industries such as tourism in the Greater Blue Mountains all caused by escaped RFS backburns lit because of implementation of the Southern Containment Strategy. The total cost of these losses is not publicly available.

Similarly, This flawed containment strategy has done significant and perhaps irreparable damage to the Wollemi, Yengo and Blue Mountains National Parks fauna, flora and biodiversity habitats devaluing the UNCESCO World Heritage status of this region; and First Nation cultural heritage which is yet to be given and economic value.

This failed strategy has caused significant and perhaps irreparable damage to communities impacted by the fire it unleashed into the environment as evidenced in Dr Terrence Kirkpatrick in his report which I have read along with the personal testimonies in the NSW Bushfire Inquiry and the Royal Commission into Natural Disaster Arrangements.

The Mt Wilson strategic backburn

The planning of this strategic backburn on 13 December 2019 and its implementation on 14 December breached RFS Operational Protocol for back burning causing a large bushfire that continued for 53 days burning out 51,000 hectares, damaging or destroying about 70 structures and threatening the homes of tens of thousands of people.

7. RECOMMENDATIONS

1. BIASED AND INACCURATE STRATEGIC FIRE ASSESSMENT OF FEASIBLE REMOTE AREA ALTERNATIVES

The containment plan for the Gospers Mountain wild fire was bias toward road base firefighting strategy and tactics. There is a lack of knowledge and skills by those with overall decision-making authority to identify other ways to manage fire in the landscape. The RFS has expert knowledge and

[53] Tab 11 - Table 3 - Item 25 - ICON Intelligence Log Gospers Mountain Fire 4 December 2019 3:21:24 p.m. IntelId: 507266

[54] Tab 11 - Table 3 - Item 25 - ICON Intelligence Log Gospers Mountain Fire 12 December 2019 5:44:10 p.m. IntelId: 517947

[55] Tab 46 - Affected Properties, Master Spreadsheet prepared by Jeff Sinton, Detective Senior Constable, NSW Police

[56] Tab 51 - Affected Properties, Master Spreadsheet

skills in staffing and deploying government equipment (fire trucks, planes and helicopters and volunteer fire fighters).

The RFS does not have expert knowledge or skills in management of fire in remote fire landscape, particularly managing remote wildfires in National Parks. This knowledge and skills require a combination of years of academic scientific study and skills development from emersion in specific natural environments and through discussion and working with residents with expert local knowledge of their local environs. This allows for the identification of likely fire pathways and nuancing of fire containment plans to include this information increase the likelihood of success.

RECOMMENDATION: The RFS recognize the role of NPWS to manage fire in the National Park system in accordance with their plans of management and strategic fire plans. In accordance with this principle, skilled and experienced NPWS staff should be appointed to key positions in the Incident Management Teams. At the same time NPWS needs to improve its capability to manage difficult and complex fires in remote areas and along its boundary with private landholders using decision-support systems and natural, cultural, and fire-based GIS data.

2. PRINCIPLES IN STRATEGIC AND TACTICAL FIRE FORMULATION

RECOMMENDATION: For accurate and timely formulation of appropriate and ecologically-based containment fire
strategies, the following principles should be adhered to (as detailed in Section 4 of this report):

1. **A detailed set of fire advantages mapping is prepared and updated before the start of any fire season based on past successful fire containment actions.**
2. **Ongoing dead and live fuel moisture assessments across the range of vegetation types to determine fuel connectivity, flammability, and combustibility and the likelihood** of moist fire advantages such as rainforests and eucalypt mesic forests containing a fire.
3. Once a fire has started:
   (f) Assess the fire weather patterns to determine likely timing and length of exposure to severe fire runs.
   (g) Monitor the fire activity in the field on an ongoing basis, continually assessing potential fire advantages in the likely fire paths and potential growth of fire perimeters.
   (h) Minimise the active fire perimeters size of a fire and the width of severe front fronts before a run of severe fire weather.
   (i) Take advantage of lulls in fire weather to suppress inactive fire edges and hotspots using remote area crew; and
   (j) Treat the campaign like guerrilla warfare where every opportunity is taken to delay or retard the fire spread using RAFT and water bombing tactics in areas identified as breakout points for large fire runs.

3. DEVELOPMENT OF COMMUNITY-BASED FIRE PLANS

The National Parks and Wildlife Services also developed a methodology for community fire plans such as the one for Mt Wilson attached which was presented to me by members of the local RFS while I was writing this report. This was done for many community locations in the Blue Mountains National Park during the 1980's and 90's. It gave the community a clear plan of how fire approaching from any direction would be managed. This helps manage community anxiety in protracted fire seasons, enabling people to be able to better manage ambiguity – the need to wait for things to unfold, and manage the fire if it approaches. This would likely have resulted in a much better outcome than implementation of the RFS IMT Plan for the containment of the Gosper Mountain wildfire.

RECOMMENDATION: National Parks and Wildlife Service Rangers, local RFS Brigades and or Fire Rescue and interested community groups develop fire plans with each community located inside and on the boundaries with the Blue Mountains, Wollemi and Yengo National Parks.

The purpose of these plans is to develop local consensus using expert environmental and local knowledge on how the community will respond to fire approaching from any direction. These plans are to be held by local RFS Brigades, the RFS District and State Headquarters for use by Incident Management Teams determining fire management strategies.

4. RFS NON-COMPLIANCE WITH OPERATIONAL PROTOCOLS FOR BACK BURNING

Non-compliance with RFS Operational Protocols for Backburning will result in the backburn escaping as evidenced in the case studies in this report.

Introducing fire into the landscape when dead fine fuel moisture (DFMC) and fire weather conditions as determined by the FFDI are very high to severe, will make the fire very difficult to impossible to control and extinguish.

Introducing fire into the landscape when fuel conditions are highly combustible and combustible as determined by the dead fine fuel moisture content (DFMC) and the FFDI is very high to severe, will make a fire almost impossible to control and extinguish.

Introducing fire into the landscape when there are insufficient available resources will make the fire very difficult to impossible to control and extinguish.

When all these factors align you will have a 100% failure rate with a guarantee of spot overs of containment lines and a failure to control this to stop the uncontrolled spread of more fire in the landscape.

The RFS has Operational Protocols for Backburning which if complied with, would likely prevent this happening.

The extent of destruction to the built and natural environment, to communities and our fauna and flora and the cost of recovery require that breaches of RFS Operational Protocols for so called "strategic backburning" be banned and any breach of this ban attract the same penalties an ordinary citizen would be exposed to if they lit the backburn fire.

RECOMMENDATION: The RFS Operational Protocols for backburning be strengthen so that any breach of it for so called strategic backburning purposes be banned and attract the same penalties an ordinary citizen would be exposed to if they lit the backburn fire.

5. STRATEGIC and TACTICAL PRESCRIBED BURNING WITHIN AND OUTSIDE NATIONAL PARKS REMOVE HASARD REDI

There is an urgent need for National Parks and Wildlife service to have the capacity to fulfil its requirement for ongoing prescribed burning, so a repetition of the Gosper Mountain fire RFS containment strategy doesn't happen again.

Prescribed burning has been successfully undertaken in winter months by local bush fire brigades working in collaboration with National Parks over many decades. This practice has all but ceased in recent times and as the Report by Kurrajong Heights RFS Brigade Captain and Volunteer Firefighter Brian Williams states, it is extremely difficult to plan and undertake prescribed burns with the current RFS stringent requirements.

RECOMMENDATION: National Parks and Wildlife Service Rangers in collaboration with Local RFS Brigades and District Offices implement prescribed burning in accordance with local community plans.

That a report be made to the community through recognized media outlets on the progress of prescribed at the commencement and termination of each fire off fire season, that is at the commencement of May and end of September each year. And where prescribed burning has not occurred a plan be made of when it will happen, and the community be informed.

6. FIRE CONTROL AND RFS INCIDENT MANAGEMENT TEAMS

Little information is available on the composition of the Incident Management Team for containment of the Gospers Mountain fire and escaped RFS backburns, other than that provided in the photograph of the Deputy Commissioner now Commissioner for the RFS (see Figure 47). This photograph is part of an RFS article requesting greater National Parks involvement in the planning and management of the Grose Valley fire, which was in fact the escaped Mt Wilson backburn renamed by the RFS when it crossed into the Blue Mountains LGA. The lead roles in the IMT such as Incident controller, planning officer and divisional commander should be experience NPWS officers.

RECOMMENDATION: There is an urgent need for multiagency Incident Management Teams to be to lead by a high level of knowledge, skills, and experience in fire in the landscape in which the incident is located. This requires a team of professionals with expert environmental knowledge as is held by National parks officers and independent with environmental, ecological, science based qualifications combined with local community members with expert knowledge of local topography and vegetation, and historical fire behavior.

To ensure this, the qualifications, knowledge and skills of the IMT members needs to be prescribed, and Fire Control and IMT need to be located as close as possible to the fire ground to allow for the input of expert local knowledge.

To enhance transparency the name and field of expertise of each member of the Incident Management Team should be published through identified community media outlets (same as used for community fire plan publicity) so residents can identify any shortcoming in knowledge in the team and offer solutions to this.

7. INCREASED TRANSPARENCY AND ACCOUNTABILITY

The cost of the containment strategy implemented on 11 November 2019 for the Gospers Mountain Fire is extraordinary and ongoing.

The devastation of our natural environment and world heritage area, public, business and household economic resources, psychosocial infrastructure of communities and individuals impacted; and anger at the RFS use of so called 'strategic' backburning during the 2019 -20 fire season in rural communities in other parts of the State needs to be considered going forward.

This report is the only independent review of the RFS Incident Management Team actions in containing the Gospers Mountain wildfire. It is being done because of the determination of a very small rural community to protect itself against this happening.

The Mt Wilson Backburn Survivors Group or ON FIRE for better bushfire management, as they now call themselves, is a community with the skills, knowledge, resources, and determination to make representation for improvement of the system. Many communities who have suffered just don't have this necessary combination of factors to be able to put their case for improving outcomes.

The NSW Bushfire Inquiry 2020 recommendations which the government saw fit to include in legislation, with quarterly reporting to parliament has not caused the RFS to implement these recommendations as evidenced by some of these recommendations being considered by the Coroner in the Issues List of Stage 2 Hearings.

I am familiar with the Victorian model for increasing transparency and accountability implemented because of the 2009 Royal Commission into the Black Saturday bushfires which is an Inspector General for Emergency Management (IGEM). This is an independent statutory role providing assurance to government and the community in respect of Victoria's emergency management arrangements and fostering their continuous improvement.

IGEM undertakes objective reviews, evaluations and assessments of Victoria's emergency management arrangements and the sector's performance, capacity, and capability.

Through reliable, evidence-based information, IGEM identifies what is working well and where improvements can be made in the state's emergency management arrangements. This includes monitoring the implementation of recommendations and actions identified through reviews to ensure they are effective and sustainable in the long-term. IGEM strives to give Victorians confidence that the emergency management arrangements are effective and are actively helping to keep communities safe.

NSW RFS and communities would benefit from the introduction of any independent body that recommends and then oversights the necessary improvements to fire management and fire suppression in accord with a range of local community concerns, expectations, and involvement.

RECOMMENDATION: That NSW implement a Victorian Style Inspector General of Emergency Services to improve accountability and transparency within emergency services agencies.

8. ANNEXURES

8.1. Annexure A: Chronology of Backburn Escapes on the Gospers Mountain Wildfire

1. On 26 October 2019 the Gospers Mountain fire was ignited by a lightning strike.[57]
   On 11 November 2019, during a severe fire danger rating period, the fire grew by approximately 26,000 hectares to 56,000 hectares with a perimeter of around 170kms.[58]
2. On 11 November 2019 the fire was declared under section 44 of the Rural Fires Act 1997 (NSW) and commenced being managed by a multi-agency Incident Management Team (IMT) operating from the NSW RFS Hawkesbury Fire Control Centre.[59]
3. On 12 November 2019 the IMT identified a containment strategy to encircle the fire with backburns ignited from control lines which was calculated to result in a fire area of approximately 450,000 hectares[60] which would create "a planned protected zone around assets and allow firefighting to be undertaken on firefighters' terms with sufficient resources under suitable conditions."[61]
4. On 13 and 14 November, with a severe fire danger rating prediction[62], the IMT began implementation of this strategy conducting backburning from the northern active fire edge "near junction Kings and Tari Sector", moving north to Wallaby Swamp Trail burning both the east and west sides of the Putty Road. Backburning was also conducted southward along the western side of the Putty Road from Grassy Hill Fire Trail (communication tower) toward Drip Rock Trail.[63] Linescans taken on these dates confirm this strategy was implemented.[64] [65]
   On 15 November, with a severe fire danger rating prediction[66], the IMT continued implementation of this strategy with the next back burn on the Putty Road, Wallaby Swamp Trail, Staircase Spur Trail. The backburn escaped containment lines burning in the wrong direction away from the Gospers Mountain fire front causing an Emergency Warning to be

[57] Letter sent by Lyncoln Chee Director, Inquests, Inquiries and Representation to Mr Geoff Conway dated 3 June 2022 p.1

[58] Ibid p.2

[59] Ibid

[60] Gospers Mountain Section 44 Incident Controllers Report p. 8

[61] Factual Investigation Gospers Mountain Fire – Impact on Mt Wilson & Bilpin – 14 December 2019

[62] NSW Rural Fire Service, Facebook, 12 November 2019, 9:57 p.m., https://www.facebook.com/nswrfs/photos/a.10150499693320552/10157418388195552/

[63] NSW Rural Fire Service Gospers Mountain Incident Action Plan 15 November 2019 p. 1

[64] Rural Fire Service Linescan Imagery: 352934-222715-1951_GOSPERSMOUNTAIN_SWIR_20191113_1151

[65] Rural Fire Service Linescan Imagery: 352934-223684-2017_GOSPERSMOUNTAIN_SWIR_20191114_0753

[66] NSW Rural Fire Service, Facebook, 14 November 2019, 3:10 p.m., https://www.facebook.com/nswrfs/photos/a.10150499693320552/10157423719550552/

issued for properties at Yengo Drive.[67] [68]

5. On 19 November with a severe fire danger rating prediction[69], the IMT continued implementation of this strategy with the next backburn at Colo Heights, Drip Rock Sector, Putty Road, Barina Drive[70] [71] and Wheelbarrow Ridge Road. This backburn fire escaped containment lines burning in the wrong direction away from the Gospers Mountain fire front threatening property and structures and causing an Emergency Warning to be issued for the Colo Heights area. The RFS named this escaped backburn the Gospers Mountain fire.
6. On 23 November there was a 4-10 mm rainfall event[72] that put out the fire perimeters across the whole fire for several days until reignition occurred on or about 1 December 2019.

7. On 3, 4 and 5 December 2019, with a very high and or severe fire danger rating prediction[73] [74], the IMT continued implementation of this strategy with the next back burn at Colo Heights, Cerones Track.[75] This backburn fire escaped containment lines burning in the wrong direction away from the Gospers Mountain fire front destroying property and structures[76]. Four separate Emergency Warnings were issued for the Colo Heights area.[77] The RFS named this escaped backburn the Gospers Mountain fire.

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[67] Tab 11 - Table 3 - Item 25 - ICON Intelligence Log Gospers Mountain Fire 15 November 2019 1:35:24 p.m. IntelId: 488496

[68] Tab 11 - Table 3 - Item 25 - ICON Intelligence Log Gospers Mountain Fire 15 November 2019 1:39:00 p.m. IntelId: 488518

[69] NSW Rural Fire Service, Facebook, 18 November 2019, 3:50 p.m., https://www.facebook.com/nswrfs/posts/pfbid0szRmKAgS3MgDuGGesq3JEjvV59U6MSnb1iHymMNJwCA7KH2TLah7v8Ni8QzfQ1EyI

[70] NSW Rural Fire Service Gospers Mountain Incident Action Plan - East Div 18 November 2019 p. 6

[71] Tab 11 - Table 3 - Item 25 - ICON Intelligence Log Gospers Mountain Fire 19 November 2019 10:10:31 a.m. IntelId: 492316

[72] Bureau of Meteorology 10 minute weather data from Marrangaroo, Mt Boyce, Nullo Mountain and Richmond RAAF base.

[73] NSW Rural Fire Service, Facebook, 4 December 2019, 6:06 a.m., https://www.facebook.com/nswrfs/posts/pfbid02UjaApo3rKKmyxMJakQtarRbLDZXUgvqFLfUAtMZFy32SibiAxKkcRLcXZTfAFXsDl

[74] NSW Rural Fire Service. Facebook, 5 December 2019, 6:00:00 a.m., https://www.facebook.com/nswrfs/photos/a.10150499693320552/10157485643795552/

[75] NSW Rural Fire Service Gospers Mountain Incident Action Plan Overview 4 December 2019 p. 1 & p. 9

[76] Tab 11 - Table 3 - Item 25 - ICON Intelligence Log Gospers Mountain Fire 6 December 2019 12:13:14 a.m. IntelId: 509462

[77] Tab 11 - Table 3 - Item 25 - ICON Intelligence Log Gospers Mountain Fire, 4 December 2019 4:34:43 p.m. IntelId: 507413, 5 December 2019 12:17:20 p.m. IntelId: 508335, 5 December 2019 3:27:49 p.m. IntelId: 508734, 6 December 2019 12:03:12 p.m. IntelId: 509462

8. On 5 and 6 December 2019, with a severe fire danger rating prediction[78], the IMT continued implementation of this strategy with the next backburn at Mountain Lagoon between the Colo River and Bilpin[79]. This backburn fire escaped containment lines[80] burning in the wrong direction away from the Gospers Mountain fire front threatening property and structures. The RFS named this escaped backburn the Gospers Mountain fire.
9. On 7 December 2019, with a very high fire danger rating prediction[81], the IMT continued implementation of this strategy with the next back burn along the Glow Worm Tunnel Road on the Newnes Plateau. The backburn fire escaped containment lines[82], creating "a major breach of containment" where "approximately 5km has breached the line from 428113 to 4426177".[83] The escaped backburn burnt in the wrong direction away from the Gospers Mountain fire front. destroying property and structures[84]. The RFS named this escaped backburn the Gospers Mountain fire.
10. On 12 December with a very high fire danger rating prediction[85], the IMT continued implementation of this strategy with the next back burn along the Blackfellows Hands Trail at Newnes Plateau. The backburn fire escaped containment lines[86] burning in the wrong direction away from the Gospers Mountain fire front destroying property and structures[87]. The RFS named this escaped backburn the Gospers Mountain fire.
11. On 14 December 2019, with a very high fire danger rating prediction, the IMT continued implementation of this strategy with the next back burn at the intersection of Mt Wilson Road and Bells Line of Road[88]. The fire escaped containment lines burning in the wrong direction

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[78] NSW Rural Fire Service, Facebook, 6 December 2019, 5:52 a.m., https://www.facebook.com/nswrfs/posts/pfbid02GhcMtJu7GXXSbsctRK4t6ox6Wy8b2DPcS2iVxm8vuBh7z45Cp88SUAmhPeZYHQKDl

[79] NSW Rural Fire Service, Bells and Bilpin Division Sub Plan, 4 December 2019 p. 1 & p. 5

[80] NSW Rural Fire Service, Bells and Bilpin Division Sub Plan, 7 December 2019 p. 1 & p. 6

[81] NSW Rural Fire Service. Facebook, 7 December 2019, 8:01 a.m., https://www.facebook.com/nswrfs/photos/a.10150499693320552/10157492792750552/

[82] Tab 11 - Table 3 - Item 25 - ICON Intelligence Log Gospers Mountain Fire 8 December 2019 9:24:20 a.m. IntelId: 512771

[83] Ibid

[84] Tab 46 - Affected Properties, Master Spreadsheet prepared by Jeff Sinton, Detective Senior Constable, NSW Police

[85] NSW Rural Fire Service. Facebook, 11 December 2019, 4:09 p.m., https://www.facebook.com/nswrfs/photos/a.10150499693320552/10157506469685552/

[86] Tab 11 - Table 3 - Item 25 - ICON Intelligence Log Gospers Mountain Fire 12 December 2019 5:44:10 p.m. IntelId: 517832

[87] Tab 46 - Affected Properties, Master Spreadsheet prepared by Jeff Sinton, Detective Senior Constable, NSW Police

[88] Letter sent by Lyncoln Chee Director, Inquests, Inquiries and Representation to Mr Geoff Conway dated 3 June 2022 p.1

away from the Gospers Mountain fire front destroying property and structures[89]. The RFS named this escaped backburn the Gospers Mountain fire.

12. On 16 December the Glow Worm Tunnel backburn escape, together with subsequent backburn and containment escapes spread west into the Cullen Bullen State Forest, and then later into the Gardens of Stone National Park, and the remainder of the Wolgan Valley, which was heavily impacted by fire runs on the 21 December under severe fire forest fire danger.

13. On 18, 19 & 20 December 2019 fire spread from the Newnes Plateau into the Lithgow-Clarence precinct impacting Angus Place, Oaky Park, Morts Estate, Vale of Clwydd and the eastern extent of the Lithgow township.[90] This fire was identified by the RFS as the Gospers Mountain fire.
14. On 20 December 2019 the southern section of the escaped Mt Wilson Backburn located south of Grose River was annexed by the RFS and named the Grose Valley Fire.
15. On 21 December a spot-over at the bottom of the Zig Zag railway caused fire to spread from the Newnes Plateau. Lithgow, Clarence and Dargan were impacted causing Emergency Warnings to be issued[91] and destroying buildings and structures.[92] The RFS identified this fire as the Gospers Mountain fire.
16. On 21 December fire from the escaped backburn from 14 December at the intersection of Mt Wilson Road and Bells Line of Road impacted Bell, Mt Victoria, Blackheath, Bilpin, Kurrajong Heights causing Emergency Warnings to be issued and destroying buildings and structures[93]. The RFS identified this as the Gospers Mountain fire and Grose Valley Fires.
17. On 31 December 2019, the Blue Mountains IMT implemented another back burn near Evans Lookout Road at Blackheath. The backburn fire escaped containment lines destroying property and structures. [94] The RFS named this escaped backburn the Grose Valley Fire.
18. On 2 September 2022 the RFS Commissioner Rob Rogers stated in NSW Budget Estimates that "There was a very small number, but there was some back-burns that went wrong. More than a thousand

[89] Ibid p.12

[90] Tab 11 - Table 3 - Item 25 - ICON Intelligence Log Gospers Mountain Fire 18 December 2019 4:35:45 p.m. IntelId: 523496, 19 December 2019 9:14:50 p.m. Intel Id: 525116, 20 December 2019 3:49:49 p.m. IntelId: 525814, 20 December 2019 3:21:47 p.m. IntelId: 525774

[91] Tab 11 - Table 3 - Item 25 - ICON Intelligence Log Gospers Mountain Fire, 21 December 2019 7:53:25 a.m. IntelId: 526261

[92] Tab 46 - Affected Properties, Master Spreadsheet prepared by Jeff Sinton, Detective Senior Constable, NSW Police

[93] Tab 51 - Affected Properties, Master Spreadsheet

[94] Factual Investigation Grose Valley Fire – Blackheath to Lawson Backburn – December 2019 p. 29

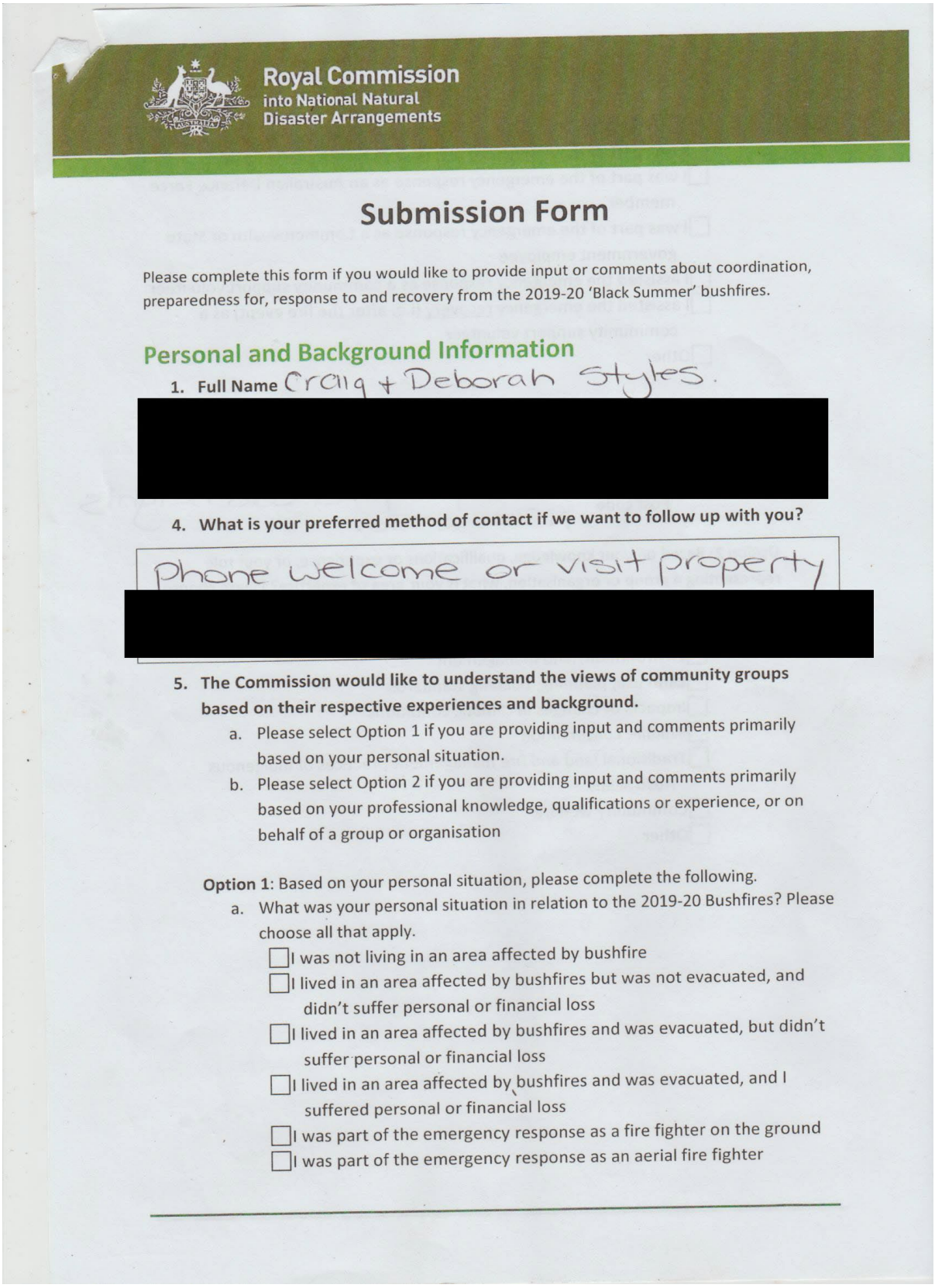
19. back-burns that we had put in during that fire season—I think there was a record of four that caused problems"[95]. In a supplementary answer on notice Commissioner Rogers provided evidence stating that there were no RFS backburns conducted in the Lithgow LGA"[96]

[95] NSW Budget Estimates Emergency Services and Resilience, Flood Recovery, 2 September 2022 Transcript p. 15. Available at: https://www.parliament.nsw.gov.au/lcdocs/transcripts/2984/Transcript%20-%20PC%205%20-%20Emergency%20Services%20and%20Resilience,%20Flood%20Recovery%20-%202%20September%202022%20-%20CORRECTED.pdf

[96] NSW Budget Estimates Emergency Services and Resilience, Flood Recovery, 2 September 2022, SQ89. Available at: https://www.parliament.nsw.gov.au/lcdocs/other/17821/ASQON%20-%20Hon%20Steph%20Cooke%20MP%20-%20Emergency%20Services%20and%20Resilience,%20Flood%20Recovery.pdf

8.2. Annexure B

8.2.1. Submission to the Royal Commission into Natural Disaster Arrangements from Craig and Deborah Styles



Royal Commission into National Natural Disaster Arrangements

Submission Form

Please complete this form if you would like to provide input or comments about coordination, preparedness for, response to and recovery from the 2019-20 'Black Summer' bushfires.

Personal and Background Information

1. **Full Name** Craig + Deborah Styles.

[redacted]

4. **What is your preferred method of contact if we want to follow up with you?**

phone welcome or visit property

[redacted]

5. **The Commission would like to understand the views of community groups based on their respective experiences and background.**
   a. Please select Option 1 if you are providing input and comments primarily based on your personal situation.
   b. Please select Option 2 if you are providing input and comments primarily based on your professional knowledge, qualifications or experience, or on behalf of a group or organisation

Option 1: Based on your personal situation, please complete the following.

a. What was your personal situation in relation to the 2019-20 Bushfires? Please choose all that apply.
   - ☐ I was not living in an area affected by bushfire
   - ☐ I lived in an area affected by bushfires but was not evacuated, and didn't suffer personal or financial loss
   - ☐ I lived in an area affected by bushfires and was evacuated, but didn't suffer personal or financial loss
   - ☐ I lived in an area affected by bushfires and was evacuated, and I suffered personal or financial loss
   - ☐ I was part of the emergency response as a fire fighter on the ground
   - ☐ I was part of the emergency response as an aerial fire fighter

☐ I was part of the emergency response as health professional
☐ I was part of the emergency response as an Australian Defence Force member
☐ I was part of the emergency response as a Commonwealth or State government employee
☐ I assisted the emergency response as a community support volunteer
☐ I assisted the emergency recovery (i.e. after the fire event) as a community support volunteer
☐ Other

b. Where do you live? Please provide your Local Government Area, town name and post code.

Local Government Area Choose an item.
Town name
Post code [redacted]

Option 2: Based on your knowledge, qualifications or experience, or your role representing a group or organisation, what is your area of expertise? Please choose all that apply.

☐ Emergency/disaster response and/or management
☐ Environment/land management
☐ Land use, planning, building standards
☐ Impacts of changes in climatic conditions
☐ Wildlife conservation
☐ Traditional land and fire management practices of Indigenous Australians
☐ Community welfare
☐ Other

Input / Comments

6. **In your experience, what areas of the bushfire emergency response worked well?**

None in my case!! We had no warnings, calls or attendance to our property until it was too late, as to what was actually unfolding and the severity of it. In our opinion local RFS could and should have called for backup Eg: Air attack, plane retardant etc as there was nothing on the 4th Dec. This backburn was lit in a 35-50K an hr north westerly winds which blows directly to us in an upward direction, my knowledge was the backburn was originally spose to be conducted between Bob Turners + Cerone's track in an inwards direction. The wind conditions were so fierce my husband was standing watching each puff of smoke appear with his hat flying off his head as we have a very clear view of where it took place Local RFS at the site and being locals should have known better and in fact were warned by ex RFS not to do it as the same thing happened in 1994, but were told we have better resources to cope now. LOL What an absolute joke, they were undecc but did it anyway with catastrophic consequences. Meetings held at the local hal were nothing short of a joke always ending in RFS arguing amongst themselves in front of locals for the right of superior + hierach in which none of them had any clue themsel

Cont page (6).

When the calvery were here eg. Melbourne trucks and other RFS etc we all felt a lot safer with the impending Gospers mountain fire that we awaited for 3 weeks. It was made very clear by our local volunteer RFS that they were unhappy their territory was taken over and they didn't like being told what to do, I know this information first hand as im the chef at the local Rd house service station. Clearly the local volunteers waited till they all left the area then decided to conduct the backburn on their own. The upper Colo brigade Captain [redacted] was actually asleep in bed at the time whilst his crew along with Colo heights were lighting up Cerone's track obviously not aware of the forthcoming disaster they were about to cause, Unacceptable actions by RFS volunteers who in mine and my families opinion should be held accountable, I mean lets face it if one of us had of done the same im pretty sure we'd be sitting in a jail cell right now?? Local RFS were more scared of the situation than my family who saved a shed we are living in and they proved it by sitting on a milkcrate and filming, whilst the others watched my untrained family members doing their best to save whats left

7. **In your experience, what areas of the bushfire emergency response didn't work well?**

We had no official written letters to say a backburn was being undertaken behind our property to warn us what so ever!! hence the major wind factors on that day brought it to us and not even a call to warn us it was coming with such severity. One RFS truck responded Upper Colo to our property when it was all too late. Their attitude was utmost disappointing in our view and their actions as previously stated were none the better. One hosed a small amount of water onto an awning and was then heard to say don't waste all the water in our truck, these were their exact words and I'm still to this day bewildered at what was said and what went on with all of them. Upper Colo told my husband they managed to put it out twice, the third time it got away from them, we came straight here sorry your place is now undefendable. Not very professional in my view and we truly believe they could have done a hell of a lot more than they did. My husband, 25, 22 yr old sons ran around with wet tea towels motorbike goggles shorts and thongs with 1000 tanks, pumps, hoses saving what we have left on our 60 acres which is next to nothing. Other buildings were damaged beyond repair. RFS actions were nothing short of ignorance as no one has been to see us and explain why this happened.

8. **In your experience, what needs to change to improve arrangements for preparation, mitigation, response and recovery coordination for national natural disaster arrangements in Australia?**

We feel governments should be more involved in the compensation for major losses, but we are just left to our own devices to make the calls We didn't deserve what has happened to us, let alone all the native wildlife and some of our animals as well because of a desicion of department, who pays then,? who's responsible? Our animals died a horrific death as there was no time to save them. Piss poor effort from schafields RFS crew who could have helped us but were too busy filming at our gate for their social fb site. Take a look at Bellbird gully property going up in flames. We actually had more trucks parked out on the Rd than on our property helping to save it. We feel the whole day and efforts by all RFS at Colo heights that day are deemed deporable from speaking to other community members. We are disgusted at their actions on 4th Dec and for going ahead with it in such conditions. Why not wait till later at night when there's no wind? I mean they all whinged day in day out how tired they all were from working long hrs. Property owners who know their land should be able to have burn reductions when seasons are right, and not be ruled by agreens party who like in the city I hope they are happy with themselves with whats happened, with the amount of fuel on the ground which caused such catastrophic results, could

cont page (8)

have been avoided in all aspects of the situation. Road blocks were conducted in such a manner that is unacceptable. Police officers had several complaints made about their dispicable attitudes in this event. Water trucks delivering were denied access and were an essential commodity at the time. People were forced to go without food and water north of Cobb heights service station as they weren't aloud through. My husband, whose diabetic and needed insulin was denied access through a Rd block and we were told to ring 000 and he would be airlifted out if he went into a coma. Ludicrous on all behalfs the times then allocated to go town with 15 minute timeframes when it actually takes roughly 35/40 mins to actually drive to town with a space of 15 mins to find a park, go shopping and drive back to the Rd block??? Never have I heard such stupidity planned Kaos in my entire life. The whole sordid performance was the shittest show I've ever seen and to be quite frank the all that were involved should be utterly ashamed of themselves

9. Is there anything else you would like to tell the Royal Commission?

The backburn conducted on 4th Dec has totally ruined our lives 40 yrs worth of memories + memrobila gone in an afternoon. Sentimental + irreplaceable Wedding photo's, video's pics of first walks/talks of my adult children, family airlooms handed down through generations all gone. My 25yr old son who'd not long before moved back home from Melbourne after 4 yrs to start his own business, lugged everything, a whole housefull of possesions tools, cars, stored in 2 shipping containers also gone, not insured, my childrens lost motor bikes, buggy's, go carts, gear everything they owned too, My husband lost his 25yr old business, not insured which was here for 8 yrs with every yr threatning a bushfire but nothing and it takes a planned backburn to take his income away from us that is not retreivable. To say Im angry beyond belief is and understatement, we did not need this backburn to save Colo heights village AT ALL, infact the main gospers fire didn't and wasn't coming anywhere near us what so ever, so whoever made this decision to backburn should be held fully accountable for us to be compensated, My family were untrain in this catastrophic situation but their actions far outweighed the actions of Local volunteers. We are now left to try and get on with our lives and it's all swept under the rug. We are utterly gutted with the whole senario which shouldn't have happened. Just writing this 4 months after the fact is gut wrenching to say the least, having to live it all over AGAIN

Do you intend to provide supporting material?

☑ Yes
☐ No

If you are providing any supporting material, please include it with your Submission if possible. If you need to send it separately (e.g. if you make a Submission over the phone), please ensure supporting material can be clearly identified as relating to your Submission by including your name or other identifier so that it can be considered with your Submission.

10. Do you agree to your submission being published? (Mandatory)

☑ Yes, I agree to my submission being published in my name
☐ Yes I agree to my submission being published anonymously
☐ No I don't agree to my submission being published

Once you have completed this form, email it to rcnda.submissions@royalcommission.gov.au or print the form and post it to the Royal Commission at:

National Natural Disaster Royal Commission
Locked Bag 2000
Manuka ACT 2603

NOTE: If required I have several photo's/video's of the 4th Dec 2019. Also I have evidence of RFS lighting the track/times video footage etc. Commencement and end result.

8.2.2. Personal statement from Mt Tomah resident affected by the Mt Wilson Backburn.

25/10/2022

Kristyne and Aaron Ballard-Smith

27-31 Skyline Rd, Mount Tomah, 2758

350 Molybdonite Rd, Locksley, 2795

0414677410

To Mr Barry Calvert,

I am writing to you as you know who I am, and I know you will share our story with those who need or should know. I have been watching in the Facebook groups the meetings regarding the Mount Wilson back burn and 19/20 bushfires and feel I need to share our truth. Whilst brief because its difficult, its important to share. Also of note, we have received no information about a community meeting for Mount Tomah.

It has taken me almost three years to acknowledge the trauma my husband, my children, and my community experienced, and continue to experience because of the Mount Wilson back burn.

We had listed our Skyline Rd property for sale in Spring, 2019, a few weeks before Gosper Mountains fire began. We were in the process of relocating to Bathurst to provide our children with other school opportunities. At the time there was interest in our property, and we had received an offer to purchase.

As long-term residents of Skyline Rd, purchasing in the year 2000 as 20/ 21 years old, we had experienced bushfires, knew the terrain and unique climate, and were well prepared.

We were devastated to hear of the decision to use a control burn at Mount Wilson, and at the time predicated the outcome, knowing history had already demonstrated that this was not a good decision. As well as history, my husband, through his work, knew that two control burns had already been unsuccessful in Lithgow/ Newnes region preceding the decision to try another at Mount Wilson. The conditions were not appropriate, and he was seeing it firsthand. Whilst we have more to say on this, the purpose of this letter is to share our story.

Our trauma began on December 15th, 2019, and continues today. Our home and property were destroyed on that day. Following December 15th we spent 11 months engaged in back-and-forth exchanges with NRMA regarding the value of repair, replacement, and construction of our home and buildings. Whilst this resolved in the end, during this period we were under significant financial stress as we had to two mortgages to fund, as well the expense of travelling back and forth to meet contractors, delivery drivers and time away from employment. Whilst this was happening, I was leading a large school in Bathurst through COVID19 lockdowns, my husband was managing state essential infrastructure and we were supporting our children who were learning from home (often without supervision). I'm sure you can imagine the level of stress this brought upon us.

Following this period, it took us another 12months to reconcile the depts from rates, power bills, cars and school fees that piled up whilst we covered both mortgages. Depts that were created because our home was unable to be sold and NRMA took 11 months arguing about the value of fences, sheds, ect. We're still paying off the BMCC rates bill! Despite the stress we showed up to work, supported our family and began the rebuilding process.

Last month, almost three years on, the final building has been completed (well almost). Whilst the buildings have been repaired and replaced, the gardens and fences remain almost untouched. We

have dedicated as much time as we can spare cutting up dead trees and fallen branches, recovering the garden from noxious weeds and spraying. We work full time in the Bathurst and Lithgow region, we have children in year 11 and year 12 and we have our new farm to manage. Time is not something we have much of.

We would like to move on with our lives and begin the heal, however until the gardens and fences are repaired, we are unable to do so. Perhaps those who made the decision to back burn under those conditions can spend a day or ten in my garden. These are ongoing consequence. I ask how is this fair, how is this reasonable.

Those who know Mount Tomah and its terrain, know that the back burn should not have been lit.

Kind regards

Kristyne Smith

8.3. Annexure C: Sequence of events leading to the containment escape from the 1994 Bell Range bushfire

The sequence of images is based on an analysis of the start of the Bell Range wildfire that started beside the Bells Line of Road 1t 13:30 on 7 December 1994. This was presented to the coroner as part of the NPWS Blue Mountain District's submission to the coroner investigating the case and origin of the 1994 NSW bushfires.

There are striking parallels between the fireground tactics used on this fire and those used on the Mt Wilson backburn. It seems that the RFS has not learnt from the mistakes of the past and that this lessons learnt in this little case study were not incorporated into any training except for the Bilpin Bushfire Brigade which taught this lesson to its brigade members from 1994 onwards.

I prepared this analysis for the NSW coroner for the start of the 1994 Bell Range bushfires so that he could understand the circumstances in which the fire escaped direct attack from an unauthorised backburn which accelerated a separate fire from the one being attacked by NPWS ground crews and NPWS helicopter. The bushfire went on to spread into the Grose Valley having breached further backburns on the Mount Wilson Road and a section of the Bells Line of Road past the turn-off to the Mount Banks firetrail. The further backburns likely exacerbated the fire spread and caused the fire to spot-over the Grose Valley onto the main ridge system to the east of Mount Hay.

There are strong parallels between this and the Mount Wilson escaped burn in that both incidents the backburns were lit under conditions of close to extreme DFMC (4-5% in the shade). . It seems that the RFS has not learnt from the mistakes of the past and that this lessons learnt in this little case study were not incorporated into any training except for the Bilpin Bushfire Brigade which taught this lesson to its brigade members from 1994 onwards.

I then reconstructed in detail the spread and progression of the Bell Range fire in the Grose Valley and in the upper Bowen Creek catchment. A copy of the fire reconstruction map is in my house at Stanley, Victoria. This was also submitted to the NSW fire coroner.

Slide 1: General Context

Historical containment escape example
Bells Line of Road
13:30 – 14:45 07 January 1994

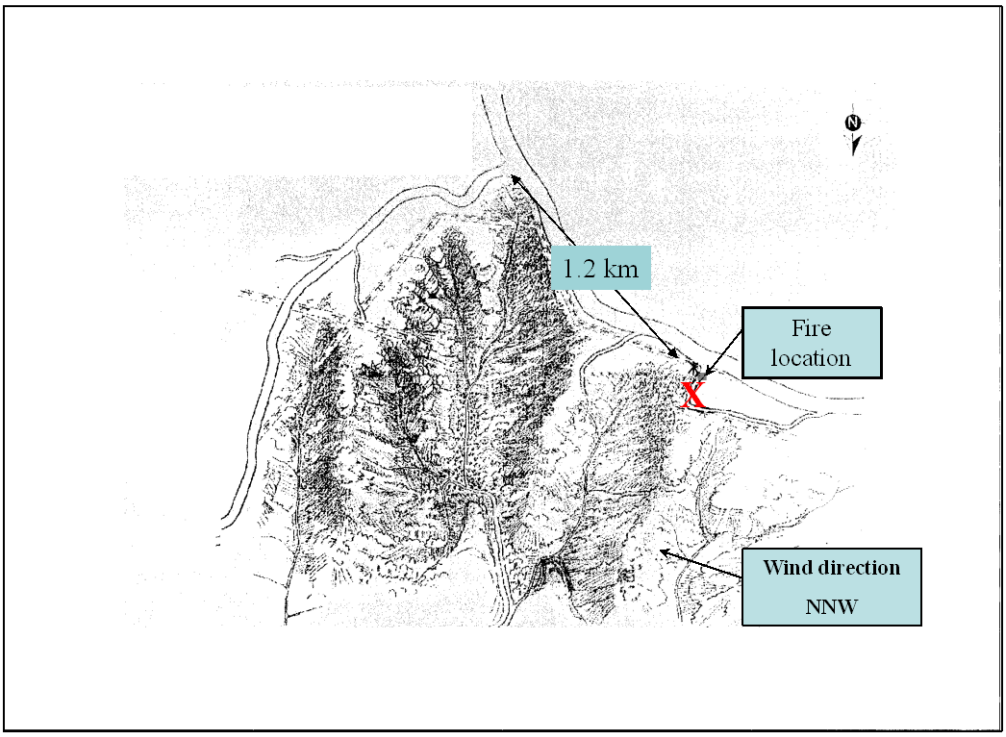
Ignition occurred at 13:30 on the Bells Line Road 3. 4 km NW of the intersection of the junction of the Bells Line of Road and Mt Wilson Road

Fire Weather

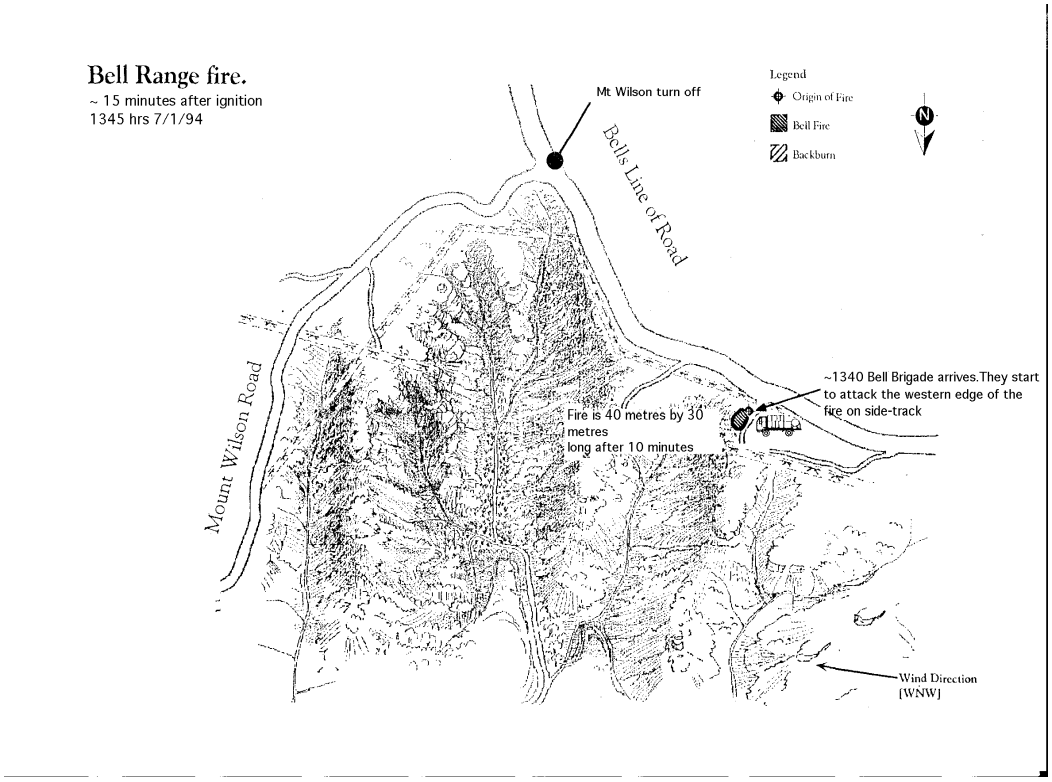
- Temp 34 deg C.
- Humidity < 12%
- Wind gusting 30-45 km/h
- Soil Water Deficit 135 mm
- FFDI 40-45

- Dead fuel moisture content (DFMC) 3-4% in the fuels in the sun

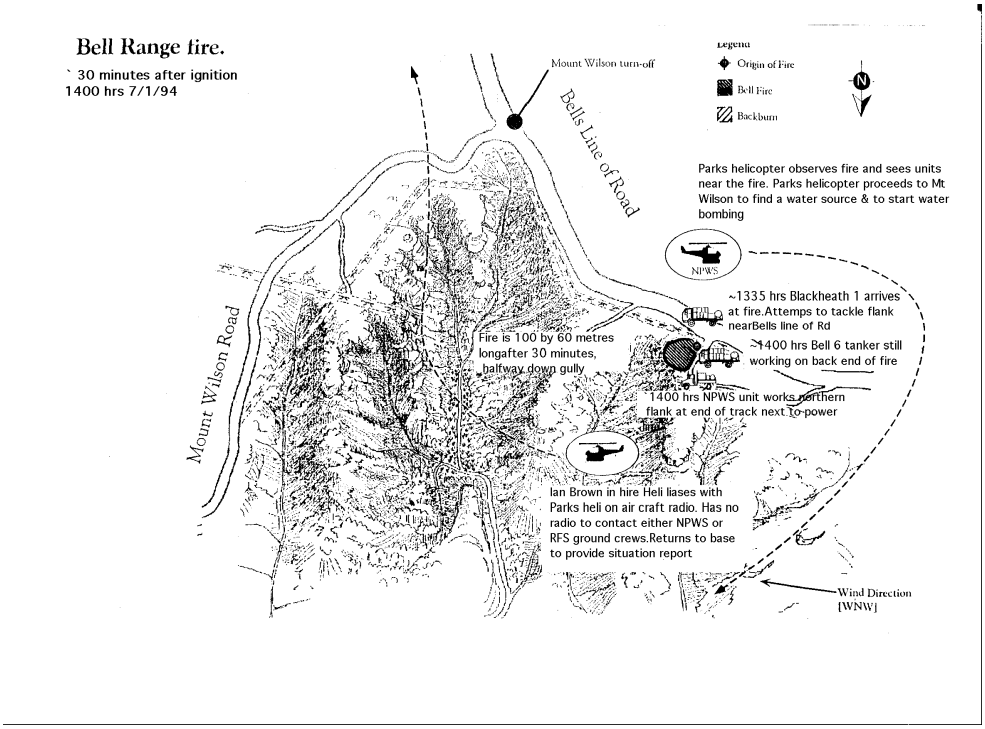
Slide 2: Ignition



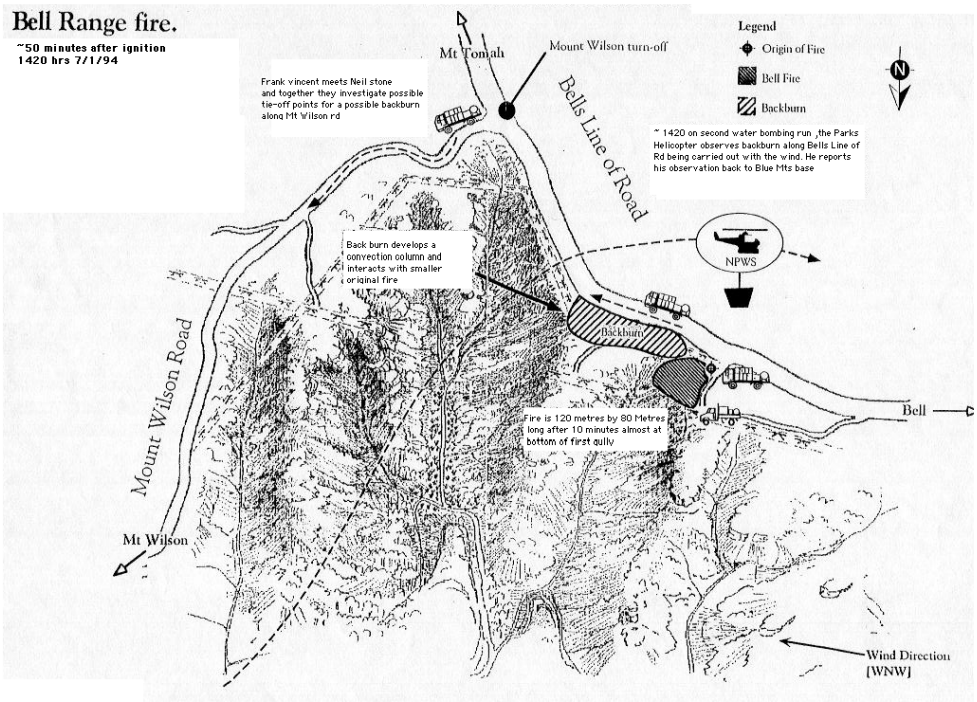
Slide 3: 15 minutes after ignition



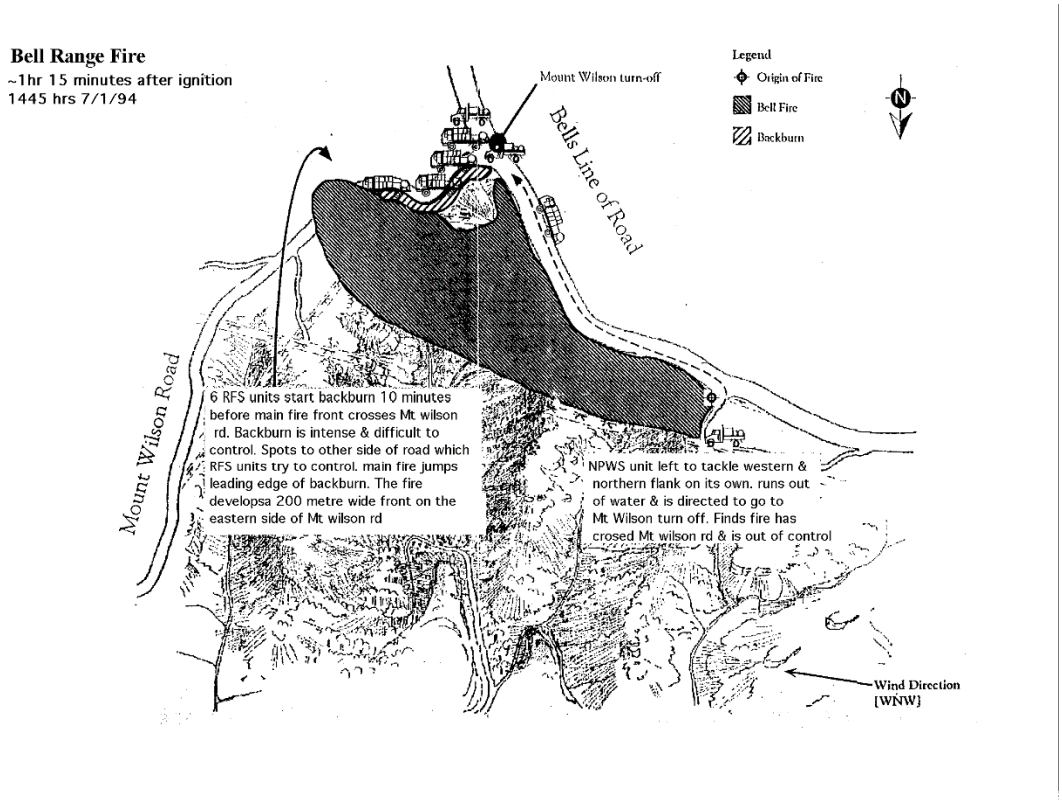
Slide 4: 30 minutes after ignition



Slide 5: 50 minutes after ignition



Slide 6: 75 minutes after Ignition



8.4. Annexure D: Personal Submission to the NSW Fire Inquiry

Submission to the NSW Bushfire Inquiry

Nicholas Gellie

Fire and Vegetation Scientist, and former NPWS fire and project manager (1983 – 2000}

53 Pioneer Road

Stanley, VIC, 3747

Email: ecofuego.au@gmail.com

Background

I monitored the fires as a private individual in New South Wales between 1 December and 31 Jan 2020, focusing on the Blue Mountains and South Coast since 1 December once I became aware of the dire situation in NSW. I did so without any financial support just interested in supporting the bushfire suppression effort. This submission is based on what I wrote to the Commissioner of the Rural Fire Service (RFS} on 28 December 2019 and updated to reflect the recent history of fire and weather events in the Blue Mountains. This submission mainly reflects my observations and analyses of fire events in the Blue Mountains and since I have done further post fire assessment elsewhere in Eastern NSW. I have completed analyses further south on the South Coast and Snowy Mountains. I have pretty much a complete understanding on what happened on most of the fires in central eastern and south-eastern NSW.

I have well-developed fire intelligence and fire strategy skills for over 40 years using a variety of tools, such as Google earth, satellite data such as Sentinel, Landsat TM, and Himawarri data, localised drought and fire weather intelligence, fire spread data from DEA hotspots and available fire linescan data. I can read fire landscapes with a high degree of accuracy and skill developed any many ears of observing, studying, and analysing bushfires.

I have honed these fire analytical skills from over 100 fire reconstructions, including 2002/03 and, 2006/07 Victorian and NSW bushfires, 2009 Black Saturday fires in Victoria and many wildfires elsewhere in SE Australia and the world. I spent five years of my life studying the eight most significant 2009 Black Saturday bushfires in Victoria as well as other significant bushfires before and after then. I have also reconstructed the2003 Canberra bushfires. Some of this I have done voluntarily without any funding or support gaining access where possible to fireline scans some of which in the past came gratis from RFS. I say thank you for trusting in me. I have an independent open approach to analysing bushfires with fear or favour.

In the 2019-2020 fire season, I can report that there were many missed opportunities to contain these fires to minimise their extent and fire severity in national parks, private land, and critical water catchments. I say this because I know many of fire landscapes well and what containment strategies have and haven't worked particular during severe droughts and bushfire conditions

I am also critical about some of the failed backburning strategies and caused new fires well away from the main fire fronts. I would also add that building and containing long lengths of backburn line is fraught with very high risk of failure as was evident from the escaped backburns on the Bees Nest,

Drake-Long Gully, Busbys Flat, Walshpool State Forest, Stockyard Creek, and Torrington fires up the North Coast; the Balmoral, Glowworm Tunnel, Mount Wilson, and Yerranderie Road escaped backburns in the Sydney region; and the many backburns conducted during the Currowan fire on the South Coast.

These are some of my thoughts about extreme and large fire potential, the past and current containment strategies, and weaknesses in the organisational approach to dealing with them, including incident management teams, the need for experienced staff and personnel at all levels, and the way RFS handles emergency warnings and media advice.

First, how can we mitigate severe-extreme fire risk potential on a bushfire?

We need to know in detail the state of landscape dryness, the fuel types and fuel conditions, topography, and fire history, and how a fire will burn under many different sets of conditions, based on what happened before and how it is likely to burn now. We need to measure the state of fuels, their fuel moisture content and fuel connectivity across the connectivity. From my fire reconstruction work and past experience, I can tell what is going to happen having studied extreme fires for almost three decades based on estimation of the different fuel elements, their loading and their dead and live fuel moisture of in the most widespread dry, semi-mesic, and mesic fuel types, and the likely timing and duration of extremely low fuel moistures, strong winds and unstable atmospheric conditions.

The first principle is we must minimise the size of a fire and the width of head fire front before a blow-up day. So, our fire strategies need very much to take this account. We aim to minimise energy release from a fire by thinking where we want the fire to be on a blow-up day. We herd the fire into sheltered spots from the fire wind and put any parts of it out that are going to erupt into a major fire run. We also must identify problem spots and work on them 24 hours before and secure them here and when we can. We do not light up backburns the day or hours before a hot and dry and windy wind change which can escape and do horrific damage to our native vegetation, adjoining private property and public infrastructure

We need to corner large fires and restrict large fire resulting from backburns or spotovers from critical fire advantages, thus limiting pyro-convective potential evident in pyro-cumulus or pyro-cumulonimbus over large intense bushfires, sometimes combining with highly unstable damp atmosphere during the passage of semi-dry continental heat troughs and cool southerly or easterly wind changes which often occur on blow-up days. The Grose Valley fire on the morning of Saturday 21 December represents a classic example of limiting the breakout of the fire until later in the afternoon. We could have limited it further had a large helicopter with a water bucket worked the Grose River and bucketed any spot-overs. The pyro-cumulonimbus cloud that formed over the Tianjara and Currowan bushfires in Morton is an example how not to do it. Active areas of deep flaming combustion were seen on unchecked fire front, consuming bone-dry fuels at near-oven dry moisture contents (2.5-5% as a percentage of ODW}, as well as understorey and canopy foliage along long lengths of active head fires spreading as intense sub-canopy or active crown fires. These contributed to large amounts of convective heat and moisture feeding the convection columns at a time when a pre-frontal trough passed overhead of these bushfires

I happened to observe the back burn on the Glowworm Tunnel Road on the evening of 7 December on the Newnes Plateau using BOM Sydney radar observation. I could not believe my eyes when I saw a pyro-Cu cloud forming on the BOM radar when I knew the western fire sector of the Gospers Mountain fire was relatively inactive burning against the wind at less than 500-700 m per day.

I later learnt that 14 km of backburn up the Glow-worm Tunnel Road had been put in less than three hours. That afternoon the dead fine fuel moisture content fell to 4-5 % associated with a dry south-westerly airmass and average 10-m wind speeds at 25-30 km/h winds that caused crown fires to burn

into a benign wildfire front 4-5 km away to the east of the backburn. The backburn did more damage to the forest and heathy woodland than did the backing fire into the SW wind. A massive energy release occurred which resulted in a near-extreme fire behaviour event. Implementing backburns in as a long line of fire on the western side of a fire with a forecast westerly wind to drive the backburn should be avoided at all costs. I have it on good advice that this same containment strategy did incredible damage to the Pilliga Forest in earlier Pilliga fires. It is probably best to wait for the right conditions or come up with an alternative fire strategy rather implement damaging high-risk backburns.

Third, how should we approach containment strategies in general

We need to use whatever fire advantages are in a fire landscape (dams, rivers, rainforests, rocky areas, low fuel areas that occur naturally from planned burns, areas sheltered from winds. We need to contain a fire to where there are patches of recently burnt areas from wildfires and prescribed burns, tied into rainforests, rocky areas, deep sheltered gorges and cleared country.

We need to avoid backburning well away from the main fire with attendant very high risk of escape when the chance of success of backburning is approaches zero (Mt Wilson, Blue Mountains, Balmoral, Green Wattle Creek, and parts of the Currowan-Tianjara complex) creating new fires where there

was none and exposing more people and assets. We need to consider that any backburn undertaken well away from a going fire is considered a new potential fire outbreak. We need to plan better the length and time of implementation of backburning as to when and how they can be conducted. A drip-torch can be a very dangerous tool if handled by inexperienced firefighters. Multiple teams lighting long lengths of backburns can exacerbate holding a fire line even under milder fire weather conditions during extreme droughts with drought-stressed forests and shrublands.

We also need to secure the back edge of any wildfire and create strong anchor points, and not let it a bushfire burn unchecked for weeks (like the Gospers Mountain and Currowan-Tianjara complex bushfires). We could have avoided new areas being burnt along the western side of the Blue Mountains at Nullo Mountain, Ben Bullen, Lithgow, Clarence and Dargan. It is not just the high-risk impact zones from a fire on the eastern side of any fire that need to be worked on. This is an important lesson for everyone involved in the last fire season.

We need to take advantage of the weather when it and the fires are benign. Sometimes we cannot backburn because of high dead fine fuel moisture contents associated with more stable easterly weather that can produce high relative humidity and patchy light rain which occurs frequently up and down the coast of NSW after cool southerly wind changes. These times can be a godsend if we can make use of containment strategies that aim to break up fire fronts, put hot spots, use naturally occurring low fuel areas. Instead of complaining about the weather and not being able to backburn, we take advantage of the weather and have specialist fire crews and aircraft resources put the fire

out in key areas that will cause large blow-outs if the fire fires in new unwanted directions. It is all about stalling for time. We could have done this on the Newnes Plateau and Wollangambe had the backburns being implemented poco a poco (little by little), at the right time and with a great deal of care for after-burn results on the fireground. I happen to be a backburn and aerial ignition expert having carried out these operations on the ground many times in my past life.

Second, have we got it right with these bushfires from the start?

We need to plan and act faster when a fire starts - know what are our options are and implement them quickly and safely with a moderate to high chance of success. It is about knowing everything about our fire landscapes (the landscape patterns of vegetation and fuels, the state of fuel dryness (inherent moisture in dead and green fuels in a fuel bed, fuel structure fuel connectivity, the terrain, your fire

advantages, the fire weather patterns). If we don't know this detail and we operate remotely without this knowledge in a fire control centre, we will never come up with the right strategies on the ground. Hence the prolonged campaign and being on the back foot for the most part and having huge areas being burnt including our precious water catchments. I have spent most of my life bushwalking, canyoning, cross-country-skiing, and vegetation and fire survey work in many different areas of Tasmania Victoria, New South Wales. I have a geographic brain that can integrate all of the above landscape attributes over time and can retain vivid memories and recall of many prescribed burning and wildfire operations.

We have relied too much on backburning and not enough in hitting a fire where it is weakest with highly trained professional paid and volunteer resources. We also rely too much on fire trucks because they are meant for property protection. We don't have enough other trained specialist crews and resources that can work in remote and difficult terrain. Large-scale backburning takes up huge amounts of resources like when we needed to contain fires elsewhere, such as the western side of the Gospers Mountain fire on the edge of Wollemi National Park.

Whenever a period of 3-5 days of easterly weather settles over the fires, the fires become much less active. Often in the Blue Mountains and the South Coast escarpment, dewy nights with fog drip are frequent, sometimes followed by rain showers. These raise the fuel moistures of surface forest and shrubland fuels to the point of extinction of flaming combustion in lighter more open surface forest fuels, and sometimes even in deeper fuel beds in semi-mesic eucalypt forest

Once thing that needs to change is fighting fires at night in remote terrain. We used to do it safely and it can be done safely now when I worked with NPWS as a fire manager. It is like a covert military operation planned and executed with great skill and diligence always watching the fuel moisture, the fire, everything. It is the sort of thing I do very well.

I also feel that the present fire Incident Management Team (IMT) structure and its processes needs to be rethought from the ground up. Its processes are full of bureaucratic blockages. It can't act quick enough to respond directly and quickly to changing circumstances on the fireground. We are doing no better than we were back in the 1950s or 1960s with much more technological and aircraft resources. So, we need a more flexible and adaptable organisation with skilled and trained strategic thinkers at the fore, like our armed forces. As part of that, we don't apply strategic thinking well enough - we are bogged in human not landscape detail. We just react to what a fire is doing not what we can do to minimise its impact. The planning and operational approach needs to be reviewed thoroughly so that we can implement safely fall forward strategies when the conditions are right. I would say we could have reduced the area by about at least a third or more.

Using people from outside the area in IMTs and fire operations means they usually don't know the country intimately they are working in. We need to build up expertise and resources in each region for them to be able manage fires locally and regionally.

Third, Supporting National Parks as an independent fire management agency

I once overheard a media comment by Bob Rogers that more on-the-ground rangers and field staff are needed to support fire operations. In the last year, NPWS's fire management and suppression capability was dealt a major blow because of staff cuts and voluntary redundancies. I helped build up this capabability back in the 1980s and 1990s advising the NPWS executive through strategic reports and corporate advice. NPWS and possible other fire agencies such as State Forests and RFS have also have lost many skilled field operators and planners for fire planning, mitigation, and fire suppression operations - people who know their patch and care about it. It is a tragedy that politicians who operate in urban landscapes don't understand the need to have rangers and other field staff out there looking

after country in National Parks and are there to help and implement good well- conceived fire strategies.

We need many more highly mobile remote area and bush strike teams - perhaps we could reemploy these staff as part of a NPWS strike team which could go as a professional support to any fire management or suppression operations.

Significantly NWPS is now subsumed into a mega Environment and Planning department. It is a land management agency tasked with a herculean task to manage nature conservation reserves with threadbare resources and now relatively inexperienced staff, the NSW government having shed many experience fire managers and field officers.

The NPWS and Forests NSW need to have an equal say in fire operations with RFS to protect our natural and cultural values, watersheds, wildlife. We also need to change the charter of RFS to protect country, biodiversity, natural and cultural heritage and not just put the fire out during fire emergencies. We have lost a huge tourism resource because we as a society did not care enough about the natural forest environments which support us.

Fourth, train more people in strategy assessment and decision-making

I have been involved in fire strategy assessment and decision-making for over my lifetime. I can say that there are no well-designed educational courses or mentoring processes for this now in Australia. We seem to think that training people by Powerpoint presentations for IMT positions is sufficient basis for people to undertake important fire suppression roles. We also ask people have never worked of experienced a fire landscape to make critical decision about it.

We now live in a highly urbanised society that is highly disconnected from nature. We have a new generation of people not skilled in the old bush ways or have the experience and wisdom to connect deeply with place and its ecological and social history. We think that we have done a great job putting out the recent bushfires yet so much aera was unnecessarily burnt by inappropriate containment strategies based on faulty fire strategy and fire assessments. Are we prepared to do a proper and thorough after-action review (AAR)of each bushfire to assess what could be done better next time taking into account alternatives? Or are we going to repeat the same mistakes because we not are not willing to go that extra mile to protect more than just life and property.

Training skilled practitioners in fire strategy assessment is a major government investment for the future management of bushfires.

This is not something that can be done with a Powerpoint-oriented bushfire training course. We need to invest in field-orientated mentoring and training of fire strategies by collecting, analysing, and interpreting decision-support field-based data at local, precinct, and landscape scales:

- Detailed mapping of vegetation and fuel type mosaics classified appropriately for bushfire planning
- Breakdown of fuel loading and combustion properties of fuel beds into dead and live fine and coarse fuel elements such as: surface litter, near surface-fuels, understorey, tree bark and canopy.
- Survey and mapping of natural and man-made fire advantages and assets at risk (natural and cultural)
- Dead and live fuel moisture monitoring of the above fuel elements in representative fuel types in a fire landscape
- Fuel connectivity patterns related to drought
- Hourly direct measurement or estimation of dead fine fuel moistures, wind direction, and wind speeds
- Field measurements of fire behaviour, such as rate of spread, flame height, depth of flaming combustion, active and passive fire crowning
- Weather synoptic patterns and air masses characteristics over bushfire, and assessment of pyro-convective potential

Sixth, Involve the local rural communities better using a bottom-up approach to fire planning

We need our community to be involved in all sorts of innovative ways to support a new approach to managing fires under this new climate change scenario. It is here and we have to adapt to it. I support what the fire chiefs have been saying to the Premier of NSW and the Prime Minister about the new normal in fire adaptation, fire management, and fire control. What we are dealing with is not normal in my experience and my scientific studies of drought and fire weather patterns.

I pioneered community fire planning in the Blue Mountains to take document everything that affects the potential of fires to do damage, the fire containment advantages, the assets-at-risk, the fuel types in the planning area, the detailed fire history, and likely fire scenarios. I can say that the first one I worked on at Bilpin been used on every bushfire since 1988, including 1993-94, 2000-2001, 2006-07, 2002-13, and could have applied in 2019-20.

Seventh, better more targeted and less emotional media messages about fire conditions and emergency warnings

Unless we have more specific, succinct, strategic and targeted community advice and messages about fire conditions and fire warnings we are going to wear out people emotionally, physically, and mentally, which can create unnecessary panic and confusion.

It is about time to tone down the language used in media briefings and advice to the public large. I would recommend not using the term mega-fire. It is misleading even if there are unchecked large fire fronts. Most of the other parts of a large bushfire are not a threat to anyone except under very

extreme fire conditions. We just differentiate what is a high-risk high fire severity situation from a low risk and low threat. It is all bundled up in a general vague bushfire warning that helps few people at risk or threat to make better informed decision to protect themselves, their families, or their workers

Eighth, change the charter of RFS to protect all aspects of the environment, as well as life and property from fire

I am really concerned that the RFS promotes life and property as the only reason for containing and extinguishing bushfires. Right now, the Blue Mountains landscape is in deep moisture stress because of the lack of rainfall in the last three months. I have first-hand accounts that usually resilient heathland plants are dying, bracken fern in damp eucalypt forests is 90-100% cured and some and some wet sclerophyll understorey species are dying, and rainforest trees are shedding their leaves.

This lack of moisture in the fuel bed is conducive to rapid combustion and high flammability causing very high severity from intense fires under severe fire weather conditions.

The charter of the RFS should be to protect all natural and cultural systems, as well as life and property. That means supporting NPWS park management objectives and water catchment authorities' management and protection plans. Nearly all of the inner catchment of the Burragorang was burnt. Was one of the key objectives to minimise the area burnt in Sydney's principal water catchment in containing the Green Wattle, Kowmung, and Ruined Castle bushfires? I am not sure that the Incident Management Teams factored this as a key consideration into their strategic thinking.

We had intense thunderstorms in the Blue Mountains on 8 and 10 February producing 300-500 mm of rainfall. The bare forest soils in the Burragorang water catchment and elsewhere to the north in the Blue Mountains and Wollemi National Parks were fully exposed to intense rainfall which on the Sydney sandstone derived soils would have created soil erosion and debris flows in exposed high-fire severity areas and adjoining watercourses. This occurred after the 2003 Canberra fires in the Cotter catchment causing the water authority there to install a purification plant to stall the loss in water quality.

This will require a much more strategic focus on protecting our forested landscape from severe-extreme fire along the lines I have already suggested above. Scenario planning for these eventualities need to be of the preparation and planning for severe bushfires in forested catchments anywhere now in NSW.

Conclusions and Recommendations

The culture of fire suppression in NSW needs reshaping with a strong focus to put any remote fire where possible before it gets too large to contain. We need and open and honest assessment of what went wrong and what we can do to improve our effective bushfire management strategies in the future.

My summary recommendations are:

- We need to improve fire suppression capability and fire strategy assessment and revert to a more field-based local approach to managing bushfires rather than operating from centralised fire control centres
- Rapid and effective initial attack within 2-6 hours after detection, and working overnight when fuel moisture and wind speeds can be favourable for safe ground crew operation.
- Applying effective fire containment strategies using a variety of options instead of over- reliance on backburning (in other words indirect attack often many kilometres from the actual fire perimeters).
- Only undertake small tactical backburns under favourable drought fuel conditions, dead fine fuel moisture content and local wind conditions with adequate time for thorough mop-up

and patrol. Cancel backburns if there is a likelihood of escape particularly if the backburn conditions are outside prescribed burning guidelines

- A complete rethink of the current centralised-driven one fire agency approach to managing bushfires in NSW
- Government fire agencies become more open and transparent to work with local communities at risk from bushfires