

Use of Spatial Data During and After the Blue Mountains Bushfires in October 2013

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ABSTRACT

This paper addresses aspects of the devastating bushfires in the Blue Mountains in October 2013, which resulted in the destruction of 197 homes across the Council area. In total, 186 homes were destroyed in Winmalee, nine in Mt Victoria and two in Mt Irvine. Many other homes were damaged. The houses in Winmalee and Mt Victoria were destroyed in the first couple of hours on the first day. The initial fires were devastating in intensity and speed, which greatly impacted the community in a short period of time before the fire services could adequately react. This paper outlines the behaviour and extent of the actual fires (showing the mapping of the fire over its stages), the extent of the damage caused by the fires with homes lost and utilities services destroyed, and the immediate response by Council and the State Government in the aftermath of the fires. The Survey and Design Section of Blue Mountains City Council was involved in ground-truthing of conflicting damage data being received from various agencies. Initial data was received from NSW Fire and Rescue who were on the scene during the fires. Some of this data was conflicting with other reports and Council needed to rapidly know the true situation. Council staff drove around the areas affected by fire, mapping damage onto a tablet with Council cadastral data on MapInfo. This was cross-checked against the many damage reports and the information corrected as required. The data was downloaded into the Council systems each day. Photographs were taken of each damaged or destroyed house and aerial photographs were obtained and utilised in this process. The immediate response included many other sections of Council, State Government and the Army. Works included assessment of damage to Council parks/reserves (including structures, trees and catchment impacts), issues with asbestos and other contaminants and assessment of damage to all service utilities. Immediate works were undertaken to protect stream catchments from impact of erosion and contamination from run-off in the event of rain. The paper also addresses the responses that were needed under the State Recovery Plan and its implementation through the Local Council.

KEYWORDS: *Bushfires, impact, disaster response, mapping.*

1 INTRODUCTION

The Blue Mountains have always had a close relationship with bushfire. Over the last 20 years, fires have increased in both frequency and intensity as the summers are discernibly more conducive to intense fire activity. Between 16 and 29 October 2013, the Blue Mountains were devastated by three major wildfires. Such fire activity with three major fires burning simultaneously was unprecedented and required a major response by all fire services, under overall control of the NSW Rural Fire Service (RFS), many State Government departments and agencies, Blue Mountains City Council (BMCC), Lithgow Council and the community of the Blue Mountains.

These fires triggered a declaration under Section 44 of the Rural Fires Act 1997. A Section 44 declaration is used when the RFS Commissioner declares that a fire cannot be managed without drawing in extensive resources from other areas. This declaration was in place between 17 October and 29 October 2013. The Prime Minister (Hon. Tony Abbott) and the NSW Premier (Hon. Barry O'Farrell) announced a Natural Disaster Declaration for the Blue Mountains City and Lithgow Local Government Areas on 19 October. A State of Emergency, under Section 33 of the State Emergency and Rescue Management Act 1989, was declared by the Premier on 20 October 2013. This declaration provided emergency services with additional powers to undertake additional safety measures as required and was lifted on 30 October (BMCC, 2014).

This paper provides an overview of the extent of the fires and describes the damage caused by the fires in both housing losses and infrastructure. It then outlines aspects of the response required within the Blue Mountains City Council in ground-truthing reports of property damage and investigation of other damage within their area of responsibility. Finally, the paper provides an overview of the recovery process, which was developed in the aftermath.

2 THE FIRES

2.1 Extent of the Fires

Rarely have the Blue Mountains seen such a large proportion of its area under such a state of intense fire, with three separate fires burning at the same time. This meant that the total fire area had many different fire fronts to be contained and there were variable intensities and fire conditions across the mountains to be taken into account in the planning to fight and contain these fires. All the fires were driven by high temperatures, strong winds and low humidity, generating high intensities and a high rate of spread, which made their containment extremely difficult. Figure 1 illustrates the extent of all fires in October 2103.

This was a tremendous challenge to the firefighting effort and an unprecedented situation for the Blue Mountains community. Most of the fire damage occurred in the first few hours after the start of the Linksvew Fire and the Mount York Fire, respectively. In this initial period, all firefighting responses were focused on protection of life as first priority and protection of property as secondary priority. As the situation became apparent and more resources in personnel and equipment were deployed, the focus was able to be moved fully onto property protection and the containment of the fires.

2.2 State Mine Fire

The State Mine Fire ignited on 16 October 2013 following live ammunition firing on a military range just to the north of Lithgow. It could not be brought under control initially, while in the military firing range, because of the high possibility of live ammunition. It could also not be contained when it spread outside the firing range.

This fire was the largest of the fires and spread to the east. The main threats to townships were at Lithgow, Clarence, Dargan, Bell, Mt Wilson and Mt Irvine. The fire burnt approximately 56,000 ha, destroying two homes (Mt Irvine and Mt Wilson), significantly damaging two others and destroying three outbuildings.

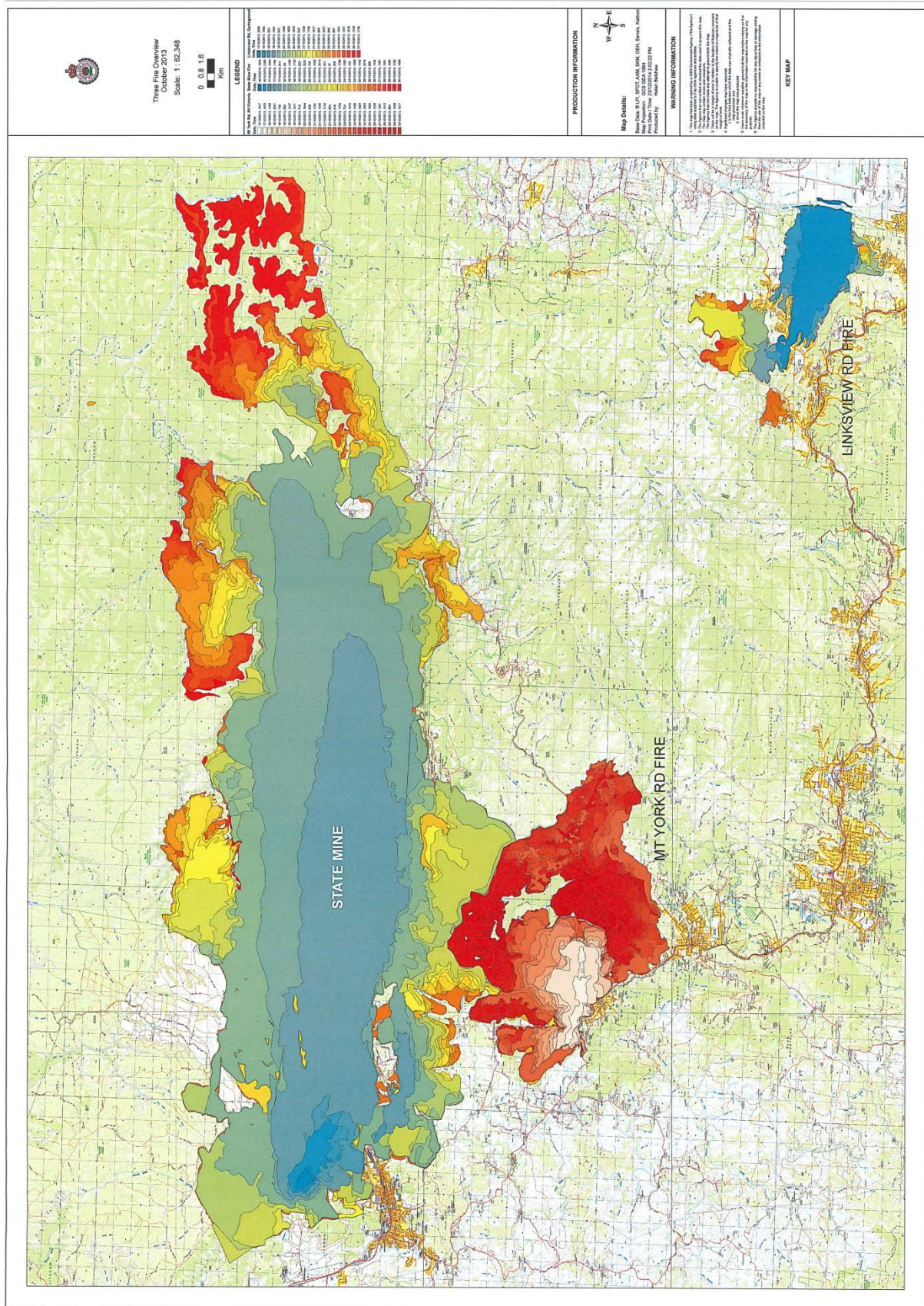


Figure 1: Map of Blue Mountains showing the extent of all fires in October 2013.

3 THE NEED FOR GROUND-TRUTHING OF FIRE DAMAGE DATA

3.1 Initial data

Council was the central data receiving organisation for all issues of damage to housing and emergency recovery works in the immediate aftermath of the bushfires. An Initial Impact Assessment of the Linksvue Fire was compiled by the Environment Protection Authority (EPA) and provided to Council. This consisted of a series of maps of the Linksvue Fire using aerial photography, showing the initial assessment of homes destroyed (Figure 3).

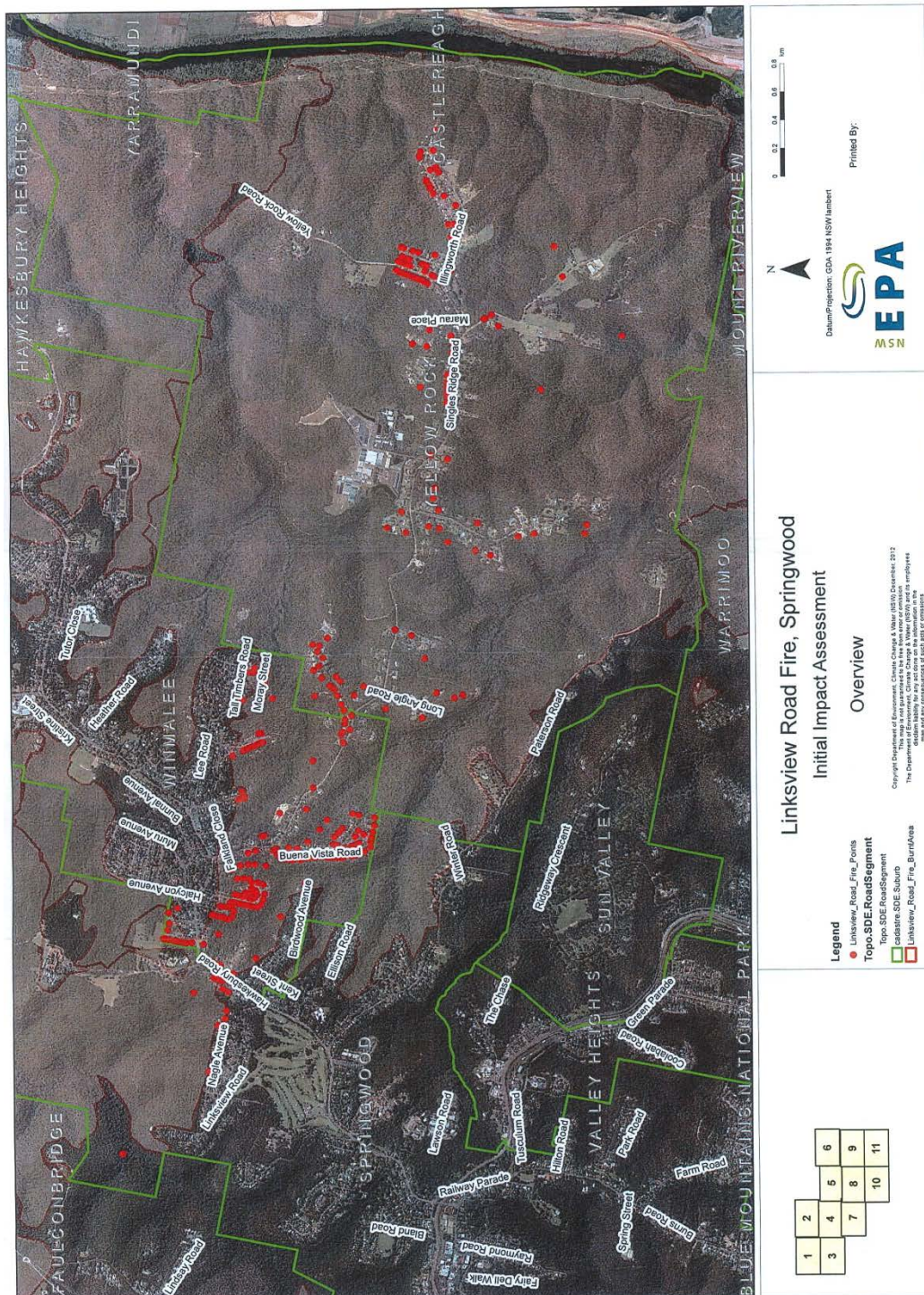


Figure 3: EPA aerial map of initial assessment of damage.

Initial damage reports were compiled by NSW Fire and Rescue and the Department of Public Works. These reports were quite detailed and in their standard formats. They formed the basis of the initial Bushfire Damage Register developed by the Development and Customer Services Group in Council, and particularly by the Building and Compliance Services Section and the Development and Planning Services Section (Figure 4). These sections were primarily involved in the collation of the information on fire damage to buildings and associated structures, so as to adequately respond to a flood of enquiries in relation to a myriad of community concerns and issues.

Subsequent to these initial assessments, there was a constant flow of information over the coming days into Council from affected residents and from Council staff, State Government (primarily Public Works) and the Defence Forces and other service authorities and agencies who were involved in the immediate recovery works. At times, there was difficulty in reconciling the initial data with the subsequent reporting and information flow. Council had concerns as to the overall accuracy of the Damage Register being developed, so it was decided to undertake a process of ground-truthing of the data in the Register, and add and develop the Register as required.

The problems in the original data were probably due to:

- The initial information being collected under emergency conditions where much of the 'normal' physical features have just disappeared, particularly with the normal property identifiers (e.g. letter boxes, identifiable house numbers, fences) being destroyed in many areas. This occurred particularly where there was a mix of vacant land and destroyed housing with no visible boundaries between them apparent in the burnt landscape.
- Inconsistency with house numbering in some streets, particularly near intersections or houses with double frontages, or 'battle-axe blocks' with accesses through rights of way.

In some cases, this resulted in particular homes being reported destroyed when they were not, and others being reported as okay when they were not.

BushFire 2013 Register																															
Register				Property Address				Rapid Damage Assessment				Structural				Tree Hazards				Asbestos				Pool				Owner			
Key	House	House	House	House End	Street	Suburb	Status	Damage	Posting Status	Date	by	ID	Note	Present	Rectified	Present	Rectified	Present	Rectified	Present	Rectified	Present	Rectified	Present	Rectified	Present	Rectified	Comment			
131	4			0	Heather Glen Road	YELLOW ROCK	Completed	75-100%	Unsafe	10/22/2013		RDAG-14	Totally Destroyed	Yes						No								We were unable to attend the meeting, our son attended on our behalf (& in his own right) and collected information for us.			
132	6			0	Heather Glen Road	YELLOW ROCK	Completed	0-25%	Inspected fit	10/23/2013		RDAG-15	Solar power damaged and isolated by owners	No		Yes				No											
134	8			0	Heather Glen Road	YELLOW ROCK	Completed	0-25%	Inspected fit	10/23/2013		RDAG-16	1. Structurally sound. Minor damage to lattice. 2. 6000 litre water tank at rear intact.	No						No											
324	9			0	Heather Glen Road	YELLOW ROCK	Completed	75-100%	Inspected fit	10/24/2013		RDAG-19		Yes						No								Garbage bin replacement, Green waste, dangerous quantities CSR 185426			
136	10			12	Heather Glen Road	YELLOW ROCK	Completed	0-25%	Inspected fit	10/23/2013		RDAG-17	1. Minor fire damage to roof area and bedroom. 2. pool intact but fencing TDBE.	No						No											
325	11			0	Heather Glen Road	YELLOW ROCK	Completed	75-100%	Inspected fit	10/24/2013		RDAG-20	UPG IN SECTOR C	Yes		Unconfirmed				No								Building is a total loss. Please leave the retaining wall on the site. Did not feel there was asbestos on site. Not giving consent at this stage, but will call asap if need be. Army there on Sunday removing trees. Verbal consent given at the time. 5/11/20			
138	14			16	Heather Glen Road	YELLOW ROCK	Completed	75-100%	Unsafe	10/23/2013		RDAG-18	Structure including vehicle and two sheds TDBE	Yes						No									If rebuild what is process - will fees and charges be waived. Land enquiries		
326	15			0	Heather Glen Road	YELLOW ROCK	Completed		Inspected fit	10/24/2013		RDAG-21	SECTOR A POOL CHLORINE AND DEAD TREES PARTIALLY BURNED THROUGH.	Yes		Yes				No											
183	18			0	Heather Glen Road	YELLOW ROCK	Completed	75-100%	Inspected fit	10/24/2013		RDAG-29		Yes						No									Would like ADF to help clear the fire damaged trees not covered by insurance. The trees have been knocked over as were in imminent danger of falling. Told customer this may not be possible under the guidelines ADF are working to.		
185	20			0	Heather Glen Road	YELLOW ROCK	Completed	75-100%	Inspected fit	10/24/2013		RDAG-30		Yes						No									House destroyed		
186	22			24	Heather Glen Road	YELLOW ROCK	Completed	75-100%	Inspected fit	10/24/2013		RDAG-31		Yes						No									Fully destroyed. Septic tank on site		
188	26			0	Heather Glen Road	YELLOW ROCK	Completed		Inspected fit	10/24/2013 .PW		RDAG-32 - PW-26	compressed fibro cement board of outbuilding. Probably asbestos. Friable bc its broken up. Requires bonding with pva and removal.	Yes						Yes											
327	27			29	Heather Glen Road	YELLOW ROCK	Completed	75-100%	Inspected fit	10/24/2013		RDAG-22	PW Comment: House SECTOR C POOL FENCE DAMAGED DUE TO SUBSIDENCE.	Yes		Unconfirmed				No									Structural damage to dwelling and trees		
330	28			0	Heather Glen Road	YELLOW ROCK	Completed	75-100%	Inspected fit	10/24/2013		RDAG-24	SECTOR A 1 X LARGE GUM TREE ACETYLENE/ARGON AND OXYGEN CYLINDERS.	Yes		Yes				No											
190	30			0	Heather Glen Road	YELLOW ROCK	Completed	None	Inspected fit	10/24/2013		RDAG-33		No						No									sheds, garden 2 x grow houses destroyed.		
329	31			33	Heather Glen Road	YELLOW ROCK	Completed	None	Inspected fit	10/24/2013		RDAG-23		No						No											
191	34			0	Heather Glen Road	YELLOW ROCK	Completed	75-100%	Inspected fit	10/24/2013		RDAG-34	gate or barricade as a matter of urgency due to children next door.	Yes						No									Please do not contact regarding the bushfires. Please contact husband.		
102	35			37	Heather Glen Road	YELLOW ROCK	Completed		Unsafe	10/23/2013		RDAG-28		Yes						No											
																				http://hacc-info.nsw.gov.au/General/Organisational-Reporting-and-Response-Reports/Bushfire-2013-Register											

Figure 4: Example of initial collation of data by Council to form the Damage Register.

3.2 Procedures Adopted

3.2.1 Responsibilities

A co-ordinated whole of Council approach was required to respond to the information and data requirements to allow an adequate response to the many and varied needs for disaster planning and the following recovery process. By late October, it was apparent that the Council needed to resolve the issues with the various flows of information coming into Council – to verify the accuracy of the Damage Register and to establish accurate mapping layers on the corporate database and mapping systems. The mapping needed to show fire impacted properties, areas of public safety concerns, areas of environmental concerns and other relevant and essential information.

The Building and Compliance Services Section and the Development and Planning Services Section within the Development and Customer Services Group co-ordinated the data collection and mapping as they were the focus for information on a wide variety of issues, such as:

- Issues of public safety in the fire damaged areas on both public and private lands. Immediate issues were the presence, and possible impacts, of asbestos in damaged and destroyed houses, the safety of many swimming pools which remained after fencing and houses were destroyed, and damage to on-site septic systems with melting of tank lids.
- Development and building enquiries in relation to the repair and reconstruction of damaged and destroyed houses. These were being asked at an early stage by landowners and insurance companies.
- Presentation at a series of public meetings, which were held regularly in the fire damaged areas to keep residents and affected people up to date with the situation.

The Environmental Sustainability Group were heavily involved in public safety of dangerous trees still standing, particularly near private land or along walking tracks, and in the assessing of damage to facilities in parks and reserves. They were also heavily involved in immediate environmental concerns in the fire areas and clearing of fallen trees on roads and access ways.

The IT section established the IT protocols and systems to collate the information. The Geographic Information System (GIS) staff developed the mapping workspaces on MapInfo and validated the information and surveyed data as it arrived. This was a continuous process and data was being regularly updated on the corporate systems. Blue Mountains City Services required the mapping so as to respond in their many areas of operation in the immediate recovery works, such as clearing trees, cleaning up and waste removal.

3.2.2 Equipment Used in Survey

Most of the data was collected with a motion tablet. This tablet ran with MapInfo v11.5 software, which was loaded with a custom workspace for data capture and logging, and included the Council aerial photography layer, cadastral overlays, street numbering and other relevant data layers. This is enabled through an editable layer and data was captured through Mapbasic scripts and forms writing to a customised table. The tablet had an inbuilt GPS receiver, which interfaced with the MapInfo software through a tool, Blue Marble Geographic Tracker, which logged the geo-coordinates from the GPS and then mapped them spatially in MapInfo.

The survey for ground-truthing of the housing damage register was done mainly by car, using the inbuilt GPS receiver in the tablet. The inbuilt GPS was generally accurate to 2.5 m in good conditions, which was fine for this purpose. As we drove around the streets, our position was tracking on the MapInfo layers and aerial photography in the tablet. Hence there was no confusion over the identification of the individual residential properties, no matter what the ground conditions were.

The surveys for the trees and vegetation mapping were carried out with these same tablets. However, the positional accuracy was enhanced with a Trimble external Pro6H antenna, which had Bluetooth connectivity to the tablet (Figure 5). This delivered sub-metre accuracy to the survey, which was more than sufficient for the purpose.



Figure 5: Survey equipment (left) and survey with external antenna (right).

3.2.3 Protocols and Field Procedure

The data-truthing survey was conducted by car due to the extent of the work and travel involved. Every property in the fire affected areas was visited and visually assessed from the road or driveway. This meant inspecting and identifying every property in the Springwood-Winnalee fire area, Yellow Rock, Mt Victoria fire area, Mt York, Bell, Mt Wilson and Mt Irvine (west and north side areas). No buildings were entered or closely inspected because of safety concerns and time constraints. A database of property damage related to property identification was required as soon as possible.

All buildings were assessed in four categories:

- Zero – no damage.
- Partial – damage present but habitable.
- Substantial – damage present but not habitable.
- Total – destroyed.

At every property, we:

- Identified the property on the tablet GIS. Our position on the MapInfo aerial photography and cadastral overlay was shown at all times with an icon.
- Gave a visual assessment of the property and entered the assessment directly against the property ID in the MapInfo workspace. Some notes could be made here as well.

- Photographed the property, without being invasive to any residents.
- Checked our assessment against a printout of the existing register of damaged properties and either verified or noted amendments.
- Made note of properties that suffered damage or were destroyed but were not noted on the property register. By this cross-checking of the register, it soon became apparent which properties were wrongly identified by address.
- Took note of any other information, such as resident's concerns, their well-being, or noting further information that was relevant.

The tablet was downloaded onto the Council network at convenient intervals during the survey, generally every second day. This time period was adopted so that the data could be assessed by relevant council staff for consistency and adequacy of the results. If any changes were required, or more data collected, this could be done in a timely fashion while we were still in that immediate area. Council's GIS staff then edited the data and merged it into the corporate database and mapping system. They also added other verified information to the database that was reported by other sources.

The photographs (Figure 6) were downloaded at the same time and identified by property address. These were then linked to the MapInfo workspace and to the Damage Register by property ID (Figure 7).

During this work there was a lot of contact with the community in the fire damaged areas. There were a surprising number of people who remained living in these areas, even though there were very limited services. Water was generally available but little or no power, gas or telecommunication services. Many had stayed in their homes and fought the fires, and some others had moved back when their homes were found to be safe.



Figure 6: One of many houses destroyed.



Figure 7: Survey working map.

Access to these areas was restricted to residents only and recovery workers, with road blocks at main entry points off Hawkesbury Road. These residents were very effective in keeping anti-social behaviour out of the area. People without a purpose for being there, who had talked their way past the road blocks were generally questioned and discouraged from being there. This included opportunistic tourists and photographers. The police also had a continual roving presence and contact was maintained with them.

A considerable amount of time was taken talking to residents about what we were doing and why. The response was always positive, and we often learned extra information about problems and issues that they faced which we were able to report back to the relevant people.

3.3 Aerial Photographs to allow Checking of Data

In order to assist in the data verification process, Council needed to access aerial photography post fires to get an overview of the fire areas. To this end, aerial photography from a private company, Skyview Aerial Photography, was commissioned. The photography was not ortho-rectified but was of high resolution and covered all fire areas and environs. The photography was of a panoramic nature and not of individual houses, but was more than capable for our purposes, particularly in being used for data verification purposes. Council later received post-fire high-resolution, autho-rectified imagery from the Emergency Information Co-ordination Unit of Land and Property Information (LPI) as well. Both these sets of photography were invaluable to us in the data validation process (Figures 8-10).



Figure 8: Linksview Fire.



Figure 9: Mount York Fire.

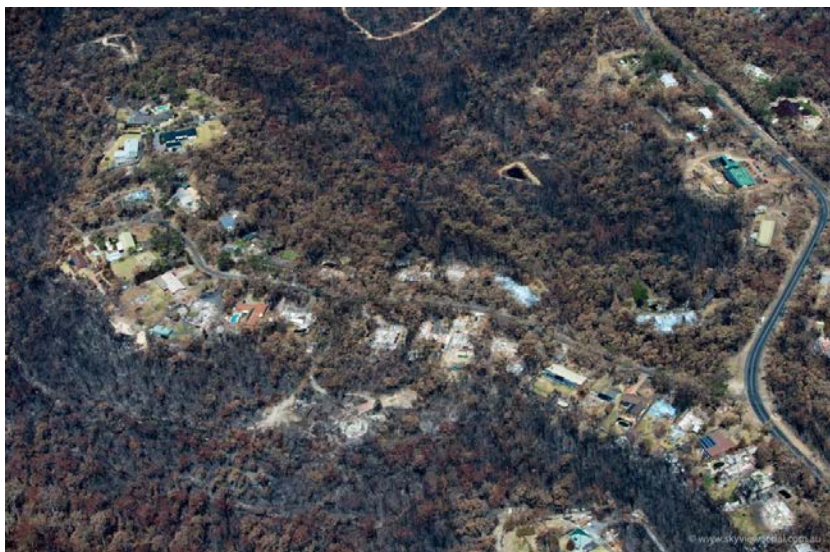


Figure 10: Pattern of damage.

3.4 Results

The staff at Council continually developed its own Register of Fire Damage to properties, in which it was fully confident of the accuracy of the data. This Register was the hub for all information relating to the fire damage with links to all pertinent information locations and its sources (e.g. NSW Fire and Rescue, Public Works, Council, residents, Defence Forces), relevant photographs and the MapInfo workspace. It was a live document, and information was updated as recovery works proceeded.

A MapInfo workspace was developed with a great deal of information attached graphically to each property in the fire areas. For each property, various attributes were linked and presented by symbols on each property in the workspace.

Graphical information shown for each property was (Figure 11):

Damage to the homes (see section 3.2.3):

- Zero – home not damaged.
- Partial – home damaged but habitable.
- Substantial – home damaged but not habitable.
- Total – home destroyed.

Other considerations in the damage risk of the property:

- Inspected fit for habitation.
- Structural issues.
- Unknown, to be checked.
- Presence of asbestos.
- Restricted, e.g. pools and septic.
- Whether the property had been made safe.

The access of the data (both Damage Register and graphic workspace) was available corporately to all staff working on the fire recovery process, i.e. the Recovery Team and associated agencies, which had been established in Springwood offices to deal with the recovery process. In addition, the information was made available to the many agencies that were working to reconstruct infrastructure in the area. Figure 12 shows part of the updated Property Damage Register.



Figure 11: Part of MapInfo workspace with graphical information (aerial underlay turned off).

Reference Number	Property	ID No.	Structural Hazards	% Building Damage	Asbestos present	Posting status	F&R NSW comment	Swimming Pool Present	Inspected by	Tree Hazards	Swimming Pool Damage	O/S Damage
2	46C Birdwood Avenue, WINMALEE NSW 2777	RDA1-1	Y Yes	L5 75-100%	N No	U Unsafe			FR			
3	46A Birdwood Avenue, WINMALEE NSW 2777	RDA1-2	Y Yes	L5 75-100%	N No	U Unsafe			FR			
4	49 Birdwood Avenue, WINMALEE NSW 2777	RDA1-3	Y Yes	L4 50-75%	Y Yes	U Unsafe			FR			
5	156 Hawkesbury Road, SPRINGWOOD NSW 2777	RDA1-4	Y Yes	L5 75-100%	Y Yes	U Unsafe		Y Yes	FR			
6	158 Hawkesbury Road, SPRINGWOOD NSW 2777	RDA1-5	N No	L5 75-100%	N No	U Unsafe			FR			
8	425-443 Singles Ridge Road, YELLOW ROCK NSW 2777	RDA4-22	N No	L1 None	N No	F Inspected fit		N No	FR			
9	160 Hawkesbury Road, SPRINGWOOD NSW 2777	RDA1-6	Y Yes	L5 75-100%	N No	U Unsafe		N No	FR			
10	295-299 Singles Ridge Road, YELLOW ROCK NSW 2777	RDA4-23, RDA4-46, RDA6-55	Y Yes	L5 75-100%	N No	U Unsafe		N No	FR			
11	173 Hawkesbury Road, WINMALEE NSW 2777	RDA1-7	Y Yes	L3 25-50%	Y Yes	R Restricted		Y Yes	FR			
12	411-413 Singles Ridge Road, YELLOW ROCK NSW 2777	RDA4-24	N No	L1 None	N No	F Inspected fit		N No	FR			
13	407-409 Singles Ridge Road, YELLOW ROCK NSW 2777	RDA4-25 -PW-03	Y Yes	L1 None	Y Yes	F Inspected fit		N No	FR, PW			
14	32 Emma Parade, WINMALEE NSW 2777	RDA3-7	Y Yes	L5 75-100%	Y Yes	U Unsafe	Structure completely destroyed by fire. External walls still standing. No floor or roof remains.	N No	FR			
15	399-405 Singles Ridge Road, YELLOW ROCK NSW 2777	RDA4-26, RDA4-23	Y Yes	L5 75-100%	Y Yes	U Unsafe			FR			
16	40 Emma Parade, WINMALEE NSW 2777	RDA3-8	Y Yes	L5 75-100%	Y Yes	U Unsafe	Structure completely destroyed by fire. 1. external wall remaining. Large amount of friable asbestos over entire debris pile.	N No	FR			
17	340-360 Singles Ridge Road, YELLOW ROCK NSW 2777	RDA4-27 -PW-04	Y Yes	L1 None	Y Yes	F Inspected fit			FR, PW			
18	171A Hawkesbury Road, WINMALEE NSW 2777	RDA1-8	N No	L2 0-25%	N No	F Inspected fit	window damaged and partial ceiling due to fire and water.	N No	FR			
19	393-397 Singles Ridge Road, YELLOW ROCK NSW 2777	RDA4-28 -PW-05	Y Yes	L5 75-100%	Y Yes	U Unsafe		Y Yes	FR, PW			
20	3 Colville Road, YELLOW ROCK NSW 2777	RDA1-10	N No	L1 None	N No	F Inspected fit	Fence and Shed damaged in rear yard. Loose sheets may be a hazard in high wind	N No	FR			
21	379-383 Singles Ridge Road, YELLOW ROCK NSW 2777	RDA4-29	N No	L1 None	N No	F Inspected fit	damage to rear boundary fence and lns fence	N No	FR			
22	5 Colville Road, YELLOW ROCK NSW 2777	RDA1-11	N No	L1 None	N No	F Inspected fit			FR			
23	87 Buena Vista Road, WINMALEE NSW 2777	RDA5-1	N No	L2 0-25%	N No	F Inspected fit	damage to retaining walls and front pergola. Loose timbers from damaged pergola needs to be pulled down.	N No	FR			
24	7 Colville Road, YELLOW ROCK NSW 2777	RDA1-12	N No	L1 None	Y Yes	U Unsafe	Dangerous trees and limb will need to be removed before asbestos is dealt with as they overhang work area		FR	Y Yes		
25	83 Buena Vista Road, WINMALEE NSW 2777	RDA5-2	Y Yes	L5 75-100%	N No	U Unsafe	TOTAL DESTRUCTION OF ALL PROPERTY PRESENT AS PER IMAGE. HOUSE AND VEHICLE		FR			
26	57 Emma Parade, WINMALEE NSW 2777	RDA3-9	Y Yes	L5 75-100%	Y Yes	U Unsafe		N No	FR			
27	79 Buena Vista Road, WINMALEE NSW 2777	RDA5-3	N No	L2 0-25%	N No	F Inspected fit	DAMAGE TO FRONT DECKING, GARDEN SHED, REAR VERANDAH	N No	FR			
28	4 Illingworth Road, YELLOW ROCK NSW 2777	RDA3-10	N No	L1 None	N No	F Inspected fit		N No	FR			
29	64 Buena Vista Road, WINMALEE NSW 2777	RDA5-4	Y Yes	L5 75-100%	Y Yes	U Unsafe	TOTAL DAMAGE. ASBESTOS PRESENT	N No	FR			
30	9 Colville Road, YELLOW ROCK NSW 2777	RDA1-13	N No	L1 None	N No	F Inspected fit	1. pre-existing minor hazard from trees 2. minor damage to lns fence	N No	FR	Y Yes		
31	6 Illingworth Road, YELLOW ROCK NSW 2777	RDA3-11	N No	L1 None	N No	F Inspected fit		N No	FR			
32	5 Sunny Ridge Road, WINMALEE NSW 2777	RDA2-1	N No	L1 None	N No	F Inspected fit	lopping of large gum trees at rear of residence	N No	FR	Y Yes		

Figure 12: Part of updated Property Damage Register.

4 OTHER IMMEDIATE RESPONSE WORKS BY COUNCIL

4.1 Survey of Dangerous Trees on Public Property

Due to issues of public safety, it was necessary to inspect and make safe all public areas, parks and reserves, walking tracks, camping areas and the interface between urban and bushland areas, which were managed by Council. This was a huge task in the Blue Mountains, with large areas of bush and urban interface. Council only mapped the areas under the care and control of Council.

All these areas were walked, and qualified staff inspected and assessed every tree that could have an impact on public safety. If a tree required attention, it was numbered, photographed, surveyed by backpack-mounted GPS and mapped onto the MapInfo workspace in the tablet (Figure 13). Trees were assessed as high or medium priority for works.

High priority works included trees that:

- Had fallen and were blocking roads and accesses.
- Were standing but damaged and had potential to fall.
- Had limbs that could fall.
- Had potential for causing injury to people or further damage to nearby property.

Medium priority works included trees that had not fallen but were not in immediate danger of doing so, and trees that had already fallen and needed to be cleared or made safe. Areas of rapid weed regrowth were also becoming apparent, so these were mapped as well for further treatment.

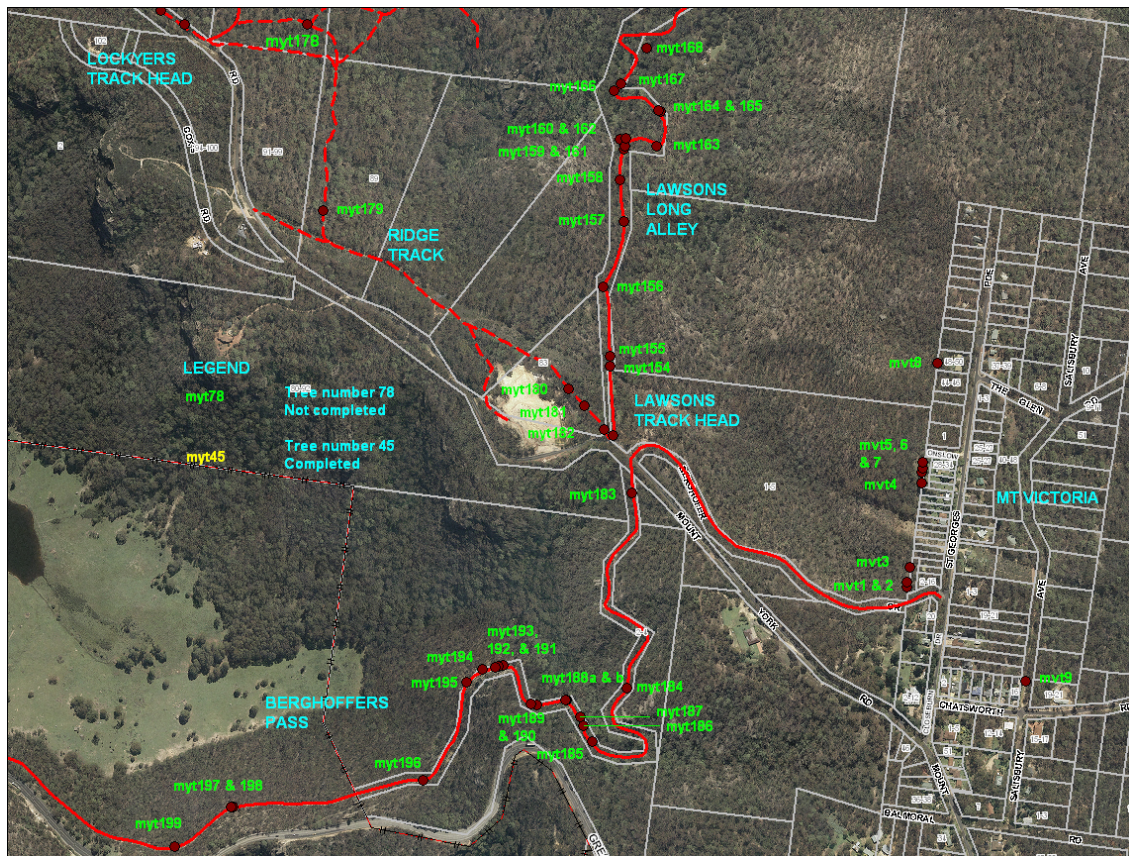


Figure 13: Plan of dangerous trees at Berghoffers Pass and Mt Victoria.

After the mapping was completed, contractors were engaged to clear the trees. In areas that had reasonable access, the trees were cut, logged and chipped. These chips were then used in other parks and reserves where needed. In areas of no access, the trees were generally logged up and then moved further into the bush. This was a practical measure that needed to be undertaken, although the volumes of timber in this situation were not large.

4.2 Environmental Concerns from Drainage

A high level of concern emerged with the stability of the soil after the fires burnt all the ground cover. These burnt areas had exposed top soil, which was very fine and friable. There was high potential for erosion and contamination issues in the event of rain. Erosion was possible as sheet erosion across slopes and concentrated erosion in drainage channels and watercourses (Figure 14). Contamination of the bush soils was possible from contaminants being washed from properties that were damaged or destroyed.

A range of sediment and run-off control devices were put in place immediately by Council staff and the Defence Forces. Such devices included (Figure 15):

- Sandbags and filter geofabric over all drainage pits. This was aimed at preventing contaminants and silt from washing into the bush.
- Utilising kerbing as detention basins in low points. This was quite effective in one cul-de-sac, where the drainage pits were blocked and the kerb levels were raised with coir logs.
- Installing sedimentation fencing and sand bag reinforcement at drainage outlets.
- Installing coir logs along drainage channels to form small retardation dams to reduce the velocities of run-off. These were located between 10 and 20 m intervals along watercourses depending on the gradients of the drainage channels.
- Installing coir logs at areas of possible contaminant flow from damaged properties, such as across driveways and hardstand areas.

There were periods of rain following the fires, but no high-intensity storms. After each day of rain, all the structures were inspected and strengthened or adjusted if necessary. Street sweeping trucks were also continuously circulating, vacuuming the roads of sediments and contaminants. This was a key to the effectiveness of the measures that were put in place.



Figure 14: Typical drainage channel (left) and typical drainage line (right).



Figure 15: Typical treatment drainage pits (left) and typical treatment hardstand areas (right).

4.3 Public Safety Concerns

4.3.1 Asbestos

One of the critical safety aspects to be dealt with in the fire areas was the presence of asbestos in many of the homes that had been destroyed or damaged. It presented a safety issue for windborne particles, for people accessing the properties and for run-off during rain into the surrounding properties or bushland. Consequently, all houses were inspected by Public Works and those found to have asbestos were sprayed with a binding agent until they could be safely removed. The blue binding agent was quite noticeable throughout the fire area (Figure 16).



Figure 16: Houses with asbestos.

4.3.2 Backyard Swimming Pools and Other Hazards

Another major issue for public safety was the many swimming pools that were constructed at houses which were badly damaged or destroyed. This resulted in easy access to many of these pools after the fencing was badly damaged or destroyed. Some pools were full of water, though very dirty, and some had very little water. All houses in the fire area with pools were inspected for safety compliance and cross-checked with Council's existing pool records.

In addition, the general property damage inspections highlighted other hazards presenting a possible danger to people in the area. On some properties with on-site septic systems, the plastic tanks were compromised with their lids melting in the fire. This presented a safety and public health issue as the tanks were sometimes difficult to identify being covered by debris

and ash, and the sewage in the tank was exposed, so was dealt with as a matter of priority. In all cases of safety, particularly with swimming pools, temporary mesh fencing was erected around the hazard until the hazard was made safe.

4.4 Plans of Consolidation: Heather Glen Road

A planning issue arose in Heather Glen Road, which had many destroyed homes. There was a Council planning requirement for Heather Glen Road that imposed a minimum lot size with property development. In general, the minimum lot size was the equivalent of two of the existing lots in the original subdivision and so two lots had to be consolidated with any development. Over time, the street was almost fully developed but several of the properties were never consolidated and the houses were constructed across existing boundaries.

It was decided to ensure that the property consolidations were done with the reconstruction of houses. However, there were concerns that this would be an undue imposition on people at this time. Accordingly, Council approached LPI and obtained a blanket exemption number for compiled plans for the seven affected properties to be consolidated. The offer was also made that Council prepare the Plans of Consolidation for the property owner if they so desired.

4.5 Base Plans Utilised for Other Purposes

Base plans of all the fire areas that Council printed for its own ground-truthing survey were also in demand, both in the immediate fire aftermath and during the recovery process. They were used for a range of information gathering and planning purposes. These base plans were simply cadastral maps with house numbers and street names in either A1 or A3 size.

Two examples of the need for these base plans were:

- Immediately after the fire, they were used by other agencies and contractors, particularly Public Works, to assist in mapping damage that was inspected (such as the asbestos issue) and to locate properties needing particular work. By using these maps, the data was sure to be linked to the correct property ID. Sets of maps were also placed on walls in planning rooms to control the work at properties and mark off when they had been made safe.
- The Red Cross used a wider set of plans incorporating villages and residential areas close to the fire areas. They visited every household in the fire areas (periodically) and the wider area to talk to everyone on their well-being and arranging counselling and other assistance as required. They used the maps for planning the teams of people undertaking this work and to identify those addresses of people requiring more regular assistance.

5 IMPACTS OF THE FIRES ON THE BLUE MOUNTAINS

5.1 Loss of Life and Personal Injury

The Blue Mountains community was extremely fortunate as, despite the large loss of property and the intensity of the fires, particularly on the first day, there was no loss of life. There were some injuries sustained, mainly respiratory issues with smoke inhalation and minor injuries such as lacerations, minor burns and minor orthopaedic injuries. A total of 69 people presented to hospital in the period and 22 people required admission. 12 people were Emergency Services personnel (BMCC, 2014).

5.2 Private Property Damage

As detailed in section 2, the fires were devastating across the Blue Mountains and particularly severe in the Linksvue Fire area, affecting parts of Springwood and Winmalee and the whole of Yellow Rock. In the Linksvue Fire, 186 homes were destroyed, 132 significantly damaged, and 93 other outbuildings (e.g. sheds) were destroyed and damaged. In the Mount York Fire, which affected the north part of Mt Victoria, nine homes were destroyed, one significantly damaged and several outbuildings were destroyed. In the State Mine Fire, which affected Mt Wilson and Mt Irvine, two homes were destroyed, two significantly damaged and three outbuildings destroyed (BMCC, 2014).

5.3 Essential Services Damage

5.3.1 Water

Approximately \$1 million damage was caused to the water infrastructure. Power was lost to quite a number of sewage pumping stations, which necessitated the deployment of generators until power was restored. On-property pressure sewer systems were damaged on 93 properties and 60% needed to be rebuilt, as the tanks and control boxes were melted. It was required to replace over 110 water metres, which had components melt (BMCC, 2014).

5.3.2 Electricity

On 17 October 2013, approximately 5,000 homes were without power services. Within four days, all houses were reconnected to power services except for those homes destroyed or significantly damaged. Approximately \$1 million damage was caused to infrastructure, including cables, poles and five power transformers (BMCC, 2014).

5.3.3 Gas

During the emergency, Jemena disconnected gas supply to 766 customers for safety reasons. Supply was restored in less than two days. However, 182 gas meters were damaged or affected and needed repairs. Gas supplies were disconnected to 98 homes that had been destroyed or significantly damaged (BMCC, 2014).

5.4 Impacts to Council

Council was directly involved with the initial response and recovery phase while trying to maintain its core services. Over 125 frontline staff were involved in the initial response phase and support was required from Penrith and Oberon Councils.

Examples of activities (not previously mentioned in this paper) included:

- Resourcing for the Incident Operations Centre (12-hour rolling shifts).
- Plant and resources in active bushfire response tasks.
- Additional waste collection, cleaning and temporary amenities.
- Additional green waste collection in significantly affected areas and provision of fee-free waste at the tip.
- Traffic control and controlling traffic into/out of the worst affected areas for several weeks.
- Involvement in activities of the Evacuation Centre.

- Supporting the State-led recovery with 15-20 staff assisting with the recovery process before State funding was provided for the establishment of a local recovery team.
- Reduced fees for all rebuilding Development Applications (DAs) and associated costs at both Council and the State Government. This has totalled over \$500,000 to date.

By December 2013, Council's contribution translated to more than 16,000 hours of staff time and \$680,000 in cost. It should be noted that damage to public property (e.g. signage, seats, bus shelters, guide posts and fencing) caused by the fires was minimal (BMCC, 2014).

5.5 Business Impacts

The business impacts to the Blue Mountains community were substantial, particularly within the tourism and ancillary services sector. The Blue Mountains Economic Enterprise investigated the economic impacts over the Blue Mountains Local Government Area (LGA). They estimated that the total Blue Mountains economic output declined by \$71.37 million. The tourism sector in the region (including Blue Mountains, Lithgow and Oberon LGAs) estimated a decline in tourism spending of \$66.16 million, a figure which included both day visitors and visitors staying in the area.

These dramatic declines in economic activity affected local employment, direct income to a wide range of businesses and caused flow-on effects in other economic activity throughout the region. Substantial advertising campaigns were required to help address this issue and to get the message out that the Blue Mountains were a safe place to visit and the normal attractions were still in operation (BMCC, 2014).

5.6 Personal Impacts

There were heavy impacts on the immediate community affected by the bushfires, including:

- Fear and trauma for those who lost their homes and had to stay safe during the fires on the first day. The impact of the fires was so rapid that many people could not evacuate the area in time.
- Many people were emotionally exhausted after fighting the fires, either with the RFS or defending their own properties, and being unable to evacuate if they needed.
- Dislocation of the community and services.
- Separation from friends and relatives. Many families had to move out of the area after their homes were destroyed. This meant moving away from their support networks.
- Poor air quality and smoke issues caused many health issues.
- Loss of pets. The RSPCA mapped homes of lost pets to help locate homes of pets that were found and made pets available to those who had lost their own pets.

However, the wider community in the mountains was substantially affected as well:

- Being a close-knit community, everyone knew someone directly affected.
- Most of the community were involved in the bushfires in some way, either through direct action of fighting the fires, indirect help in the firefighting effort or in preparation of their own homes for fire activity.
- Experiencing economic effects and social impacts.

It will take a substantial length of time for many members of the community to recover from this traumatic event (BMCC, 2014).

5.7 Environmental Impacts

With the bushfires being so wide spread, there were substantial impacts on the environment (BMCC, 2014):

- Native fauna suffered greatly in the affected areas. In addition to the more common fauna, it is estimated that 18 threatened species were affected in the Linksview Fire and 21 threatened species in the Mount York and State Mine Fires.
- Native flora suffered greatly although most are fire resilient. Much flora, both trees and understorey, were severely damaged. It is estimated that seven threatened species were affected in the Linksview Fire and 16 threatened species affected in the Mount York and State Mine Fires.
- With much of the flora and understorey burnt, there is a high potential for rapid weed growth, which will threaten natural species.
- Issues of contamination (mentioned previously).
- Issues of erosion and sedimentation of waterways (mentioned previously).

6 DISASTER RECOVERY PLAN

A Recovery Plan was established to drive the recovery process over the next 18 months. It was established to transition from the short-term State-led recovery effort to longer term recovery – consistent with State Government guidelines and resolved by Council. The Recovery Plan is very much a community-based plan, managed by Council with close support from the State Government and including a range of other agencies (Figure 17).

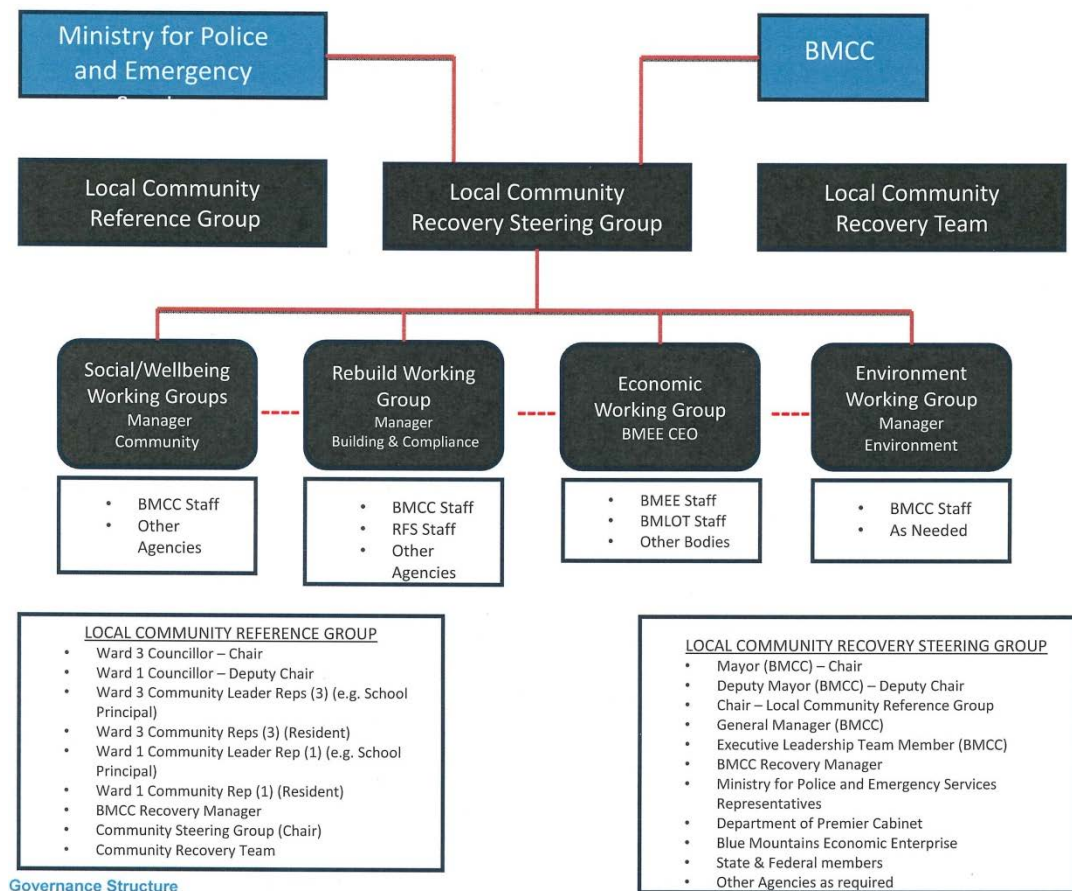


Figure 17: Governance structure, Recovery Team (BMCC, 2014).

The Recovery Plan aims to capture the priority recovery issues and sets out how these will be addressed, why, by whom and by when. This allows for (BMCC, 2014):

- An orderly and systematic way of capturing issues.
- A clear framework for addressing each issue.
- The ability to track the progress and effectiveness of recovery.
- A reporting framework to both the relevant committees and the community.

The objectives of the Recovery Plan are to (BMCC, 2014):

- Provide effective and efficient co-ordination and delivery of programs and services to assist and hasten the recovery of affected communities.
- Co-ordinate programs and services that assist the recovery process.
- Support community involvement and ownership of the recovery process.
- Provide clarity for participating agencies on their responsibilities under the plan.

7 CONCLUDING REMARKS

The major bushfires that occurred in the Blue Mountains in October 2013 were unprecedented in the region and presented a tremendous challenge in fighting the fires and in the recovery process, both in the short and long term. The recovery process is a highly complex process with numerous issues to be resolved and acted upon in a co-ordinated way.

An essential foundation for many recovery activities is an accurate database and associated Damage Register, which is well-constructed, detailed and verified. These are essential to assist in a co-ordinated approach in the recovery process, when there are many separate agencies and contractors involved at the same time.

In this situation, a major effort was required to establish this Damage Register and digital workspaces, detailing as much of the original damage as possible, but also in keeping up to date with the priority recovery works underway by managing information between the responsible agencies.

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BMCC (2014) Blue Mountains Bushfires October 2013 – Local Recovery, Resilience and Preparedness Action Plan, version 3 (June 2014), Blue Mountains City Council, 83pp.