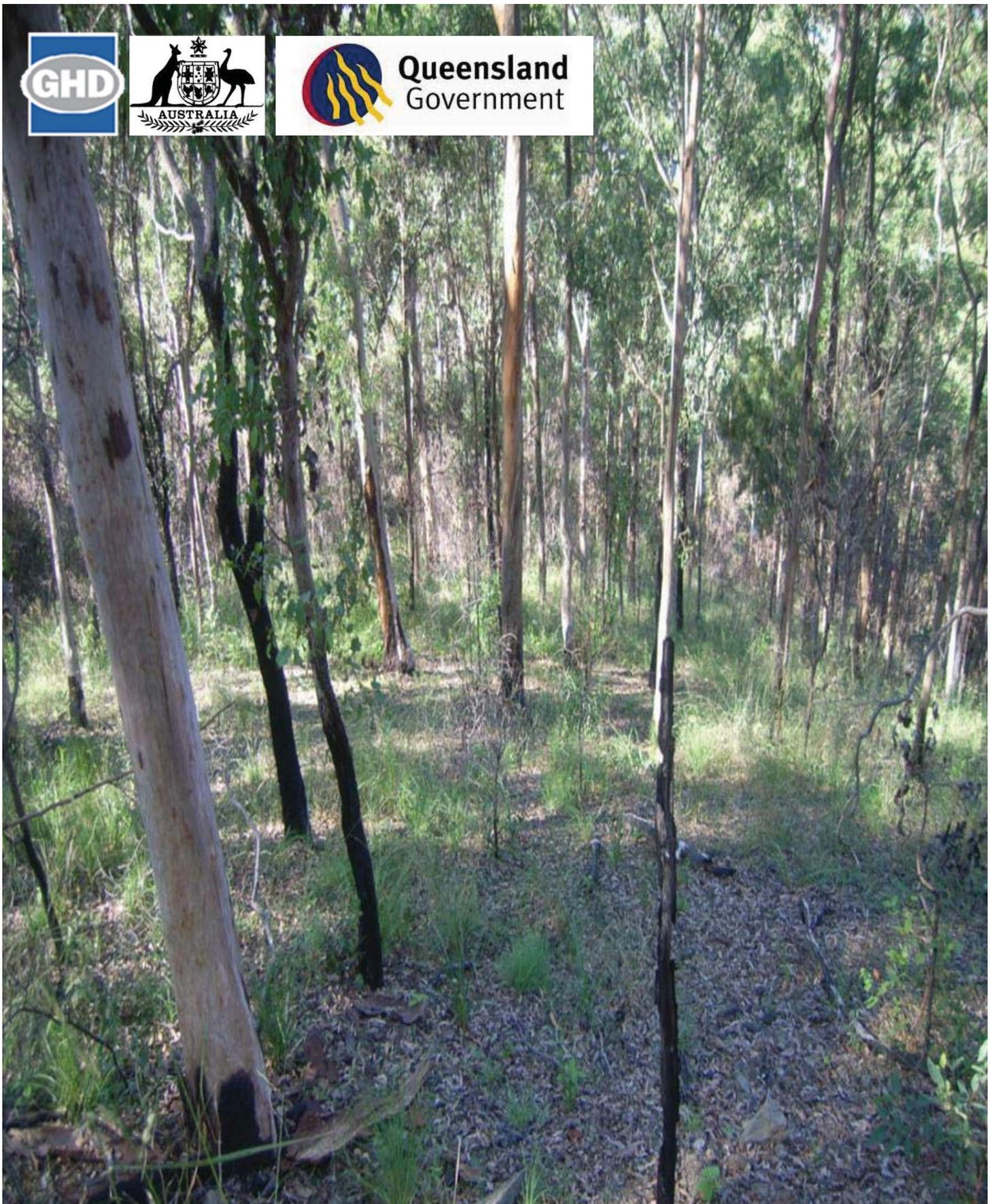




Queensland
Government



Moreton Bay Regional Council

Bushfire Hazard Management Strategy

20 December 2011



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- A Mt Nebo Community Protection Plan
- B Bushfire Mitigation Plan Template



Glossary of Terms/List of Abbreviations

The following terms are generally sourced from the Australasian Fire and Emergency Service Authorities Council (AFAC) Wildfire Glossary¹:

AFAC	Australasian Fire and Emergency Service Authorities Council
APZ	Asset protection zone. An area between an asset and a bushfire hazard where bushfire fuel has been reduced significantly to protect the asset
AS 3959-2009	The Australian Standard for construction of buildings in bushfire prone areas
BKDI	Byram-Keetch Drought Index – see KBDI
BoM	Bureau of Meteorology
Bushfire	An uncontrolled fire burning in forest scrub or grassland vegetation, also referred to as a wildfire
Bush Fire Alert	A formal notification issued by an Emergency Services agency to provide information to affected communities by radio, television, internet or telephone, and consisting of three levels: <ul style="list-style-type: none"> ▶ Advice – A fire has started – there is no immediate danger ▶ Watch and Act – There is a heightened level of threat ▶ Emergency Warning – This is the highest level of Bush Fire Alert. You may be in danger and need to take action immediately
Bushfire attack	Attack by burning debris, radiant heat or flame generated by a bushfire which might result in ignition and subsequent destruction of a building
Bushfire attack level (BAL)	A means of measuring the severity of a building's potential exposure to ember attack, radiant heat and direct flame contact, using increments of radiant heat expressed in kilowatts per metre squared, and the basis for establishing the requirements for construction to improve protection of building elements from attack by bushfire (source: AS3959-2009)
Bushfire hazard	The potential severity of a fire, usually measured in terms of intensity (kW/m)
Bushfire-prone area	An area that can support a bushfire or is likely to be subject to bushfire attack
Crown fire	A fire that advances from top to top of trees or shrubs
Crown scorch	Browning of the needles or leaves in the crown of a tree or shrub caused by heat from a fire
Direct Flame Zone	<i>See Flame Zone</i>

¹ Source: http://knowledgeweb.afac.com.au/data/bushfire_glossary



EEC	Endangered Ecological Community
Ember Attack	Attack by smouldering or flaming windborne debris that is capable of entering or accumulating around a building, and may ignite the building and other combustible materials and debris. (AS3959-2009)
EPBC	Environment Protection Biodiversity Conservation Act 1999
FDI	Fire Danger Index: A relative number denoting an evaluation of rate of spread, or suppression difficulty for specific combinations of temperature, relative humidity, drought effects and wind speed. The numbers range from 1 to 100 and form classes that equate to FDR (see FDR)
FDR	Fire Danger Rating: A relative class denoting an evaluation of rate of spread, or suppression difficulty for specific combinations of temperature, relative humidity, drought effects and wind speed. Rated as low-moderate (FDI 0-11), high (FDI 12-24), very high (25-49), severe (50-74), extreme (75-100) or catastrophic (100+), indicating the relative evaluation of fire danger
FEZ	Fire Exclusion Zone
Fine fuel	Fuel such as grass, leaves, bark and twigs less than 6mm in diameter that ignite readily and are burnt rapidly when dry
Fireline or Fire Control Advantage	A natural (such as a creekline) or constructed barrier (such as a trail or mineral earth break), or treated fire edge, used in fire suppression and prescribed burning to limit the spread of fire
Flame Zone	The highest level of bushfire attack as a consequence of direct exposure to flames from the fire front in addition to heat flux and ember attack (AS 3959-2009)
FMP	Fire Mitigation Plan
Fuel	Any material such as grass, leaf litter and live vegetation which can be ignited and sustains a fire. Fuel is usually measured in tonnes per hectare. Related Terms: Available fuel, Coarse fuel, Dead fuel, Elevated dead fuel, Fine fuel Ladder fuels, Surface fuels, Total fine fuel, Overall fuel hazard
Fuel layer	Fuel layers within dry eucalypt forests that can be linked to fire behaviour. The four main fuel layers consist of Surface fuel (including fine fuel), Near surface fuel, Elevated fuel and Bark fuel
GIS	Geographic Information System
HI	Haines Index
IC	Incident Controller. Related Term: Emergency Control Officer (ECO)
ICS	Incident Control System
Ignition	The beginning of flame production or smouldering combustion; the starting of a fire.
Ignition pattern	The manner in which a prescribed burn, backburn, or burnout is set, determined by weather, fuel, ignition system, topographic and other factors



	having an influence on fire behaviour and the objective of the burn
iZone	<i>See urban rural interface</i>
Keetch-Byram Drought Index (KBDI)	A numerical value reflecting the dryness of soils, deep forest litter, logs and living vegetation, and expressed as a scale from 0 – 200 where the number represents the amounts of rainfall (mm) to return the soil to saturation. Related Term: BKDI
Lifeline infrastructure	Facilities and structures that provide critical community services such as communication, electricity, water, wastewater, gas and access (roads, rail, airports). Such infrastructure is of high priority in planning emergency response and recovery operations after a natural disaster.
Lighting pattern	<i>See ignition pattern</i>
LMZ	Land Management Zone
MBRC	Moreton Bay Regional Council
Mop up	Cooling of the burn area including wetting-down of heavy fuels; conducted after fire suppression and often involving patrol for embers and flare-ups
NSF	Near Surface Fuels
Peri-urban	Rural urban fringe areas where suburban and rural land uses may intermix. Related term: Urban rural interface
Prescribed burning	The controlled application of fire under specified environmental conditions to a predetermined area and at the time, intensity, and rate of spread required to attain planned resource management objectives. It is undertaken in specified environmental conditions
QFRS	Queensland Fire and Rescue Service
Radiant Heat	The measure of heat energy from a fire impacting on a surface (measured in kilowatts per metre (kW/m ²))
Regional Ecosystem (RE)	Vegetation communities that occur within a similar combination of site factors (geology, land form and soil) within in a bioregion, and originally mapped using satellite imagery, aerial photography and on-ground studies. Each RE is assigned a conservation status based on current remnant extent within a specific bioregion.
SF	Surface Fuels
SFAZ	Strategic Fire Advantage Zone
TOBAN	Total Fire Ban
Urban rural Interface	The line, area, or zone where structures and other human development adjoin or overlaps with undeveloped bushland
Water point	Any natural or constructed supply of water that is readily available for fire control operations



1. Introduction

The Moreton Bay Region is bounded by the Sunshine Coast Region in the north, the Coral Sea and Moreton Bay in the east, Brisbane City in the south, and the Somerset Region in the west. The Region encompasses a total land area of over 2,000 square kilometres, including mountain ranges, water supply catchments, coastal wetlands, national parks, state forests, rural townships and urban centres. The Region is a growing area, with substantial rural, rural-residential, commercial and industrial areas. Rural land is used mainly for dairy farming, timber production, beef cattle farming, mixed farming and tropical fruit growing.

Development patterns in the Moreton Bay Region are among the most diverse in Queensland. Developed areas include waterfront residential areas, highly urbanised suburban areas forming a continuum with inner Brisbane suburbs, urbanised regional townships with significant commuter populations, their own central business districts and light industrial areas, semi-rural townships and numerous rural and mountain localities.

The Region has extensive areas of retained forest cover, particularly in the western parts, with connectivity into urbanised areas through a complex mosaic of timbered and cleared grassy country in semi-rural areas and bushland reserves in urbanised areas. Pine plantations are extensive in the north connecting the D'Aguilar range through the Glasshouse Mountains area and on to Bribie Island. Accordingly, there is the potential for large bushfires to develop in the western part of the region, and under adverse westerly fire weather make runs through semi-rural parts, penetrating into urbanised areas through bushland reserves. Smaller scale fires can develop in bushland areas in the eastern parts of the region, but due to their close proximity to urban populations, such fires have the potential to result in significant consequences for public safety and damage.



LEGEND

-  State Controlled Roads
-  Local Government Boundaries
-  Waterbodies

1:350,000 (at A4)

0 2.5 5 7.5 10
Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56



Moreton Bay Regional Council
Moreton Bay Bushfire Management Plan

Job Number	41-23979
Revision	0
Date	03 NOV 2011

Locality Map **Figure 1**

N:\AU\Toowoomba\Projects\41\23979\GIS\Maps\4123979_13.mxd 201 Charlotte Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com.au
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 Data source: Geoscience Australia - Place Names, LGA Boundaries, Imagery (2009). Navteq - Major Roads, Waterbodies (2008). GHD - Oceans (2011). Created by: CM



1.1 Bushfire History

The last 100 years or so of bushfire history in the Region provides evidence of the significant regional bushfire potential and risk. There is a strong correlation between drought years and high consequence bushfire events. Severe hydrological droughts, which can be characterised as extended periods (several years) of well below average rainfall (e.g. 1927-1936, 1951/4, 1964/6, 1969/70, 1979/83, 1990/96 and 2002/09), have occurred approximately every 10-20 years. During fire seasons occurring in severe drought years, the potential for higher intensity fires in South-East Queensland is elevated.

Historically most significant fires of the Region were associated with droughts, or as a consequence of dry periods following flood events 1-2 years before. The Regions fire history includes the following significant events:

Table 1 Previous Significant Bushfire Events

Fire Season	Details	Previous Wet Period
1936	The 1936 fire occurred after an extended dry period that followed significant flooding in the previous two years (floods around Brisbane in 1934 and 1935). This fire burnt along the D'Aguilar Range from Mt Glorious area in a South-Easterly path to The Gap. Fires were reported to have burnt on a five mile wide front over the Samford range and spreading through the Bunya district. Rich dairying country and grazing lands were reported 'fire ravaged' and large numbers of cattle killed.	1934 & 1935
1952	The 1952 fire season had the highest incidence of consecutive higher fire danger days, resulting in fire losses across the state. The 1952 season was also preceded by major flooding across the region in 1951.	1951
1964-5	The 1964-65 fires, that burnt a total of 92,000 hectares in south east Queensland, occurred in a severe drought affected fire season which followed the 1963 floods.	1963
1976	Significant fires occurred in 1976, following the benchmark floods in 1974. Fires the following year resulted in the loss of 300 hectares of pine plantation at Petrie.	1974
1991	In the drought affected 1991 season, large fires occurred throughout South-East Queensland. The previous year parts of Brisbane and the Sunshine Coast experienced flooding.	1990
1994	In January 1994 a 4000 hectare fire burnt at Mount Glorious and around Mt Nebo. In late 1994 severe fires occurred across the region and included the Beerburrum fire that burnt through large areas, and resulted in significant injuries, loss of assets and 5,000 hectares of plantation. These 1994 fires occurred during a long El Niño, though major flooding of the upper reaches of the Brisbane River occurred in early 1992.	1992
2000	In August 2000 hundreds of fires were recorded across South-East Queensland resulting in property losses and injuries. The year before, heavy rain in February 1999 resulted in flooding in SE Queensland.	1999



When compared to the rest of Australia, Queensland has a very low number of house losses associated with bushfire. Based on historical analysis, the majority of house losses in Queensland have occurred within the last 15 years (Blanchi et al 2010²).

1.2 Moreton Bay Regional Council Strategy Development

Moreton Bay Regional Council (MBRC) engaged GHD Pty Ltd (GHD) to prepare this *Moreton Bay Regional Council Bushfire Hazard Management Strategy* (Strategy). The purpose of the strategy is to:

- ▶ Reduce community vulnerability to bushfire hazards throughout the Moreton Bay Region;
- ▶ Create a Bushfire Management Strategy to support appropriate planning and environmental management processes cognisant of the potential impacts of climate change;
- ▶ Develop a set of comprehensive guidelines for bushfire management planning regarding the protection of council managed properties and assets;
- ▶ Appropriately identify and avoid high risk bushfire areas and establish effective adaptation strategies to minimise vulnerability to bushfire hazards throughout the region;
- ▶ Provide tools, mechanisms and provisions to better the design of developments and infrastructure and improve community preparedness; and
- ▶ Implement a strategy for a community education campaign to align with the final suggested Planning Scheme Provisions and Strategy.

1.3 Structure of This Strategy

This Strategy has been structured as follows:

- Section 2 Bushfire risk factors** – Analysis of the key bushfire risk factors across the Moreton Bay Region. Analysis includes scenario analysis of how fires could be expected to spread under adverse fire weather conditions, and categorisation of localities within MBRC into different risk levels. This includes a consideration of the potential impacts of climate change on these risk factors.
- Section 3 Shared responsibility** – Establishes the concept of ‘shared responsibility’ as a key management principle, and provides a framework as to how bushfire risk management responsibility is shared between State government agencies, MBRC, other land managers, the community, and lifeline infrastructure managers.
- Section 4 Bushfire management planning** – Identifies the key issues to be addressed in Local Government level bushfire management planning and establishes a framework and standards for the development of MBRC reserve specific bushfire mitigation plans.
- Section 5 Community awareness and preparedness** – Emphasises the critical importance of community awareness and understanding of their local risks, and knowledge of how to prepare and respond for the bushfire season and fire events when they occur. Establishes a requirement and framework for the preparation of community bushfire preparedness guides for the purpose of providing accurate information to residents who prepare and

² Blanchi, R., Lucas, C., Leonard, J. and Finkele, K (2010) *Meteorological conditions and wildfire-related house loss in Australia*. International Journal of Wildland Fire 2010, 19, 914-926



maintain personal/family bushfire survival plans, and provide a basic level of locally tailored Prepare, Act, Survive information to those that don't.

- Section 6** **Planning provisions and controls** – Outlines the approach applied by MBRC through Planning Scheme Provisions to reducing levels of bushfire risk to future developments.
- Section 7** **Partnership and liaison requirements for fire response** – Affirms that MBRC is not a fire fighting authority, but does maintain appropriate capacity to undertake its land and fire management responsibilities and support fire and emergency services in their response to fires. Identifies the partnership and liaison requirements to maintain successful partnership arrangements.
- Section 8** **Recovery** – Identifies the key issues for MBRC to address in post-fire recovery operations.
- Section 9** **Recommendations** – Compiles the key recommendations identified throughout the MBRC Bushfire Risk Management Strategy.



2. Bushfire Risk Factors in MBRC Area

Bushfire is a significant and established natural hazard in the Moreton Bay Regional Council (MBRC) area. Evidence for this includes:

- ▶ A high proportion of the native vegetation (and significant areas of exotic vegetation) in MBRC is fire prone – it becomes combustible on a seasonal basis (eg. grasslands/open grazing country, grassy woodlands, dry open forests, sclerophyllous shrublands, swamp/floodplain woodlands, pine plantations);
- ▶ Whilst the above fire prone vegetation types are evidence of short to moderate interval fires in the past, the tall moist sclerophyll forest types on sheltered aspects in the D’Aguilar Range are evidence of longer interval very high intensity bushfires in those locations. The fires from which these forests last regenerated would have been very high intensity, and such fires are typically part of much larger landscape scale fire events;
- ▶ Adverse fire weather can and does coincide with dry seasonal periods when vegetation is fire prone. Although days of ‘extreme’ Forest Fire Danger Index are not common in MBRC, they do occur and when they do, serious life-threatening fires can and do result;
- ▶ Bushfires running under adverse weather conditions can reach intensity levels, rates of spread and proportions that they are beyond the capacity of fire and emergency services to control, and therefore they will result in widespread damage and threats to human life; and
- ▶ Large, intense bushfires that have burnt extensive areas, caused high property and economic losses, and threatened human life have occurred previously in the MBRC area (see *section 1.1* for a MBRC fire history overview).

Therefore it is not a matter of **if** MBRC experiences a large, intense life-threatening bushfire, but **when**, and **where**. There are numerous ‘candidate’ areas that can support large high intensity fires within the MBRC area, and it is only a matter of time before the three key ingredients come together – abundant seasonally dry fuels, adverse fire weather, and an ignition source.

2.1 Bushfire Risk Factors

Bushfire is a real and established threat to life, property, community infrastructure and livelihoods in the MBRC area where:

- ▶ Settlements and residential areas are situated within or adjacent to significant tracts of bushfire prone vegetation – some residential developments have retained areas of native vegetation that can carry fire into built-up areas;
- ▶ Semi-rural communities and businesses are interspersed with agricultural lands, forestry plantations and bushland reserves/remnants;
- ▶ Commercial plantations are located in or near areas that are vulnerable to the onset and propagation of bushfire;
- ▶ Native vegetation regeneration is occurring on currently cleared or previously farmed areas;



- ▶ Assisted regeneration / planting of areas for offsetting purposes particularly if located adjacent to areas where the evacuation of people may be difficult (such as hospitals, nursing homes and childcare centres); and
- ▶ Roads, overhead powerlines, telecommunications equipment and other key community infrastructure are situated in positions where they can be cut or damaged by bushfires.

The level of risk to an asset, or group of assets in a locality, from bushfire depends on a number of factors that can vary spatially and/or temporally (e.g. terrain, slope and aspect, ignition patterns, fuel characteristics and frequency of weather conditions that promote fire spread, etc.).

Risk is defined in the new (2009) AS/NZS ISO 31000 *Risk Management – Principles and Guidelines* as “the effect of uncertainty on objectives” noting that it is often expressed by “a combination of the consequences of an event... and the associated likelihood”, or:

$$\text{Risk} = f(\text{likelihood}, \text{consequence})... (1)$$

A framework and methods for the consideration of bushfire in the context of the above definition of risk has been developing over about the past decade (e.g. Bradstock and Gill, 2001³; Shields and Tolhurst, 2003⁴; Preisler *et al.*, 2004⁵, Tolhurst *et al.*, 2008⁶; Atkinson *et al.* 2010⁷, de Mar and Adshead, 2011⁸). These prior works can allow us to conceptualise that the level of risk to an asset or community can be considered as outlined in **Figure 2**. Some principles reflected in **Figure 2** are that:

- ▶ *Likelihood* refers to the potential that a bushfire might impact an asset by considering that a sequence of steps (namely: ignition, spread and penetration) would need to occur to arrive at this outcome. The overall likelihood is the product of the likelihoods of those steps occurring, and depends on local environmental factors, fuel availability and management and intervention capability *etc.* that can all vary spatially; and
- ▶ *Consequence* refers to the potential adverse outcomes associated with a bushfire’s impact. The obvious direct impact would be fatalities or severe injuries and loss or damage to assets. Indirect impacts might occur on the local economy through, say, loss of work or investments. The level of consequence can vary depending on the value of the resource and the resilience of the local economy, *etc.*

This section identifies the key factors that influence fire risk in MBRC. A range of factors are described, and the way in which they influence fire risk is discussed. In the following section, issues relating to how fire risk is managed by MBRC are discussed.

³ Bradstock, R and Gill, A (2001) ‘Living with fire and biodiversity at the urban edge: in search of a solution to the human protection problem in southern Australia’, *Journal of Mediterranean Ecology*, 2, 179-185

⁴ Shields, B and Tolhurst, K (2003) ‘A theoretical framework for wildfire risk assessment’, in *Proceedings of the 3rd International Wildland Fire Conference and 10th Annual AFAC Conference*, 3-6 October, Sydney, Australia

⁵ Preisler, H, Brillinger, D, Burga, R and Benoit, J (2004) ‘Probability-based models for estimation of wildfire risk’, in *International Journal of Wildland Fire*, 13, 133-142

⁶ Tolhurst, K, Shields, B and Chong, D (2008) ‘Phoenix: development and application of a bushfire risk management tool’, *The Australian Journal of Emergency Management*, 23(4), 47-54

⁷ Atkinson, D, Chladil, M, Janssen, V and Lucieer, A (2010) ‘Implementation of quantitative bushfire risk analysis in a GIS environment’, *International Journal of Wildland Fire*, 19, 649-658

⁸ de Mar, P. and Adshead, D. (2011) *Climate Change Amplified Plantation Fire Risk Study*. Report prepared for the Department of Agriculture, Fisheries and Forests, Canberra

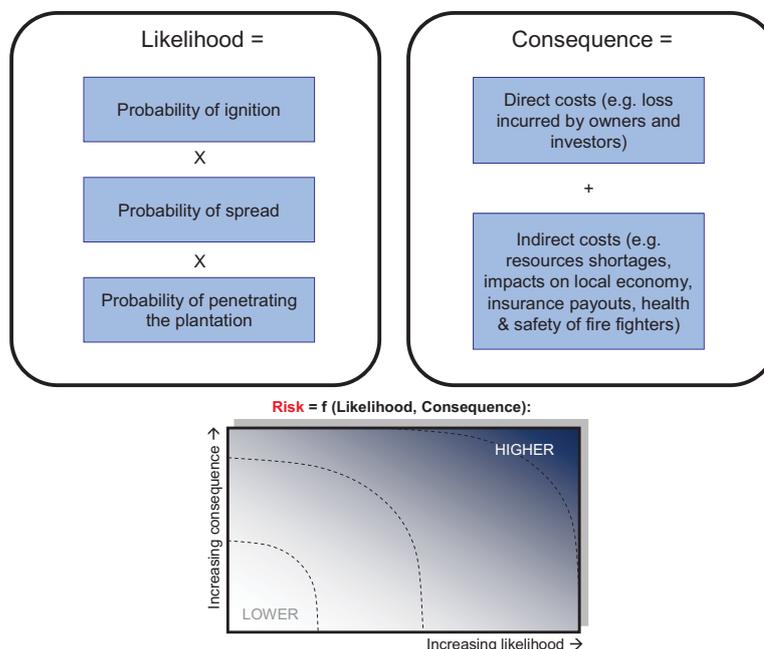


Figure 2 Conceptual Framework for Considering Bushfire Risk to Assets

2.1.1 Vegetation/Fuels and Fire Characteristics

Forests, woodlands and shrublands accumulate dead fine fuel during their growth, typically in the form of leaf and twig litter, shed bark and dead components of understorey vegetation. Fuel characteristics vary between vegetation types, and are influenced by other factors, including local climate conditions, aspect and soils. The fuel characteristics typical of major vegetation groups in the MBRC area are summarised in **Table 2**. Vegetation type and characteristics are used to quantify the level of hazard in both the Australian Building standard (AS3959:2009) and SPP1/03.

Under certain conditions, fuels can be ignited and sustain combustion. Fuel accumulations can ignite and will sustain combustion when their fuel moisture content falls below threshold values. For the dominant vegetation types in MBRC, typically fuel will ignite and carry fire with the assistance of wind at fuel moisture content below about 20%. In Eucalypt fuel, combustion will not normally be sustained above a fuel moisture content of around 16% (Tolhurst and Cheney, 1999⁹).

In MBRC, conditions in which forest, woodland and plantation fuels become combustible occur annually (in late winter and spring, and in prolonged seasons extending into early summer) and therefore these are exposed to some level of fire risk every year. In years with significant rainfall deficiencies (particularly spring and summer rainfall deficiencies), the length of fire risk exposure and severity of exposure are amplified because a higher proportion of forest fuels is available to burn for a longer period. In MBRC, elevated risk seasons can occur when fuels across a high proportion of the area become dryer than normal (eg. during drought) which typically happens one or more times per decade.

⁹ Tolhurst, K and Cheney, N P (1999) A Synopsis of the knowledge used in prescribed burning in Victoria, Department of Natural Resources and the Environment, Victoria



Table 2 Fuel Characteristics of Major Vegetation Formations

Formation Class	Fuel (Hazard) Characteristics	General Fire Behaviour Characteristics
<p>Grasslands; low sedgy heaths</p> <p>Native and exotic grassland areas, and low sedgy heaths less than 0.5 m high.</p> <p>Grassland in MBRC mainly present as cleared agricultural land, or non-agricultural amenity blocks where tree cover has been removed.</p> <p>Very young recently established pine plantations (0 – 3 years old) which are dominated by grass will have similar fuel and fire characteristics to grassland.</p>	<p>Fuels predominantly very fine, standing cured/dead grass. The fuel characteristics which most influence fire behaviour are degree of curing (proportion of dead to live biomass) and the average height of the grass (influenced by species and intensity of grazing or slashing or mowing).</p> <p>Grassland less than 60% cured unlikely to carry fire except in some specific types such as blady grass.</p> <p>Due to the very fine nature of grass fuels, they are highly flammable when cured and dry. With very fine fuels being exposed to the wind, fuels respond rapidly to drying trends and are highly sensitive to wind speed and direction changes.</p> <p>Sedgy heaths, which typically occur in lowland areas, have a high proportion of very fine fuels. Live/green components of some heath components are highly flammable due to the fineness of their fuel and high oil content.</p>	<p>Warning: Do not rely on generalised fire behaviour characterisation during fire management operations. Predict grass fire behaviour using the Grassland Fire Spread Meter (CSIRO, 1997).</p> <p>General fire characteristics:</p> <ul style="list-style-type: none"> At High to Very High FDR fast moving fires in windy conditions; At moderate FDR, slow, low intensity fires can spread in the grassy fuels when wind speeds are sufficient; and At low FDR, with light and variable wind, fire has difficulty sustaining itself in grassy fuels, being restricted to heavier fuel pockets.
<p>Open Woodland (grassy)</p> <p>An overstorey dominated by an open to sparse layer of eucalypts with crowns rarely touching, and typically 15 – 35 m high.</p> <p>Understorey cover has grassland characteristics.</p> <p>In MBRC grassy woodland mostly</p>	<p>Note: Grassy understorey less than 50 - 60% cured does not constitute a hazard except under extreme conditions.</p> <p>Fuels predominantly surface fuel (with taller ungrazed grass extending into the near-surface fuel layer) being dominated by grasses and with some litter fuels also present under trees.</p> <p>Bark fuels of rough barked Eucalypts can be</p>	<p>Warning: Do not rely on generalised fire behaviour characterisation during fire management operations. Predict grassy woodland fire behaviour using the Grassland Fire Spread Meter (CSIRO, 1997). Note: fire spread may be over-predicted as wind penetration to the fire may be impeded to some degree by the woodland overstorey.</p> <p>General fire characteristics:</p> <ul style="list-style-type: none"> At High to Extreme Fire Danger Rating (FDR) fast



Formation Class	Fuel (Hazard) Characteristics	General Fire Behaviour Characteristics
<p>occurs where grassy understorey is maintained by grazing, slashing or low intensity burning (thus inhibiting shrub invasion).</p> <p>Note: some areas mapped as grassy woodland may increasingly develop a shrubby understorey in the prolonged absence of fire and without grazing or slashing. Shrub (native and exotic) layers can become dense. Fuel and fire behaviour in thickening, shrub invaded grassy woodlands will be similar to shrubby dry sclerophyll forest.</p>	<p>significant in long-unburnt areas.</p>	<p>moving fires in windy conditions, with extended burn-out times where downed timber is present. Crown fires cannot develop due to discontinuity of the canopy in grassy woodland;</p> <ul style="list-style-type: none"> ▶ High to extreme bark fuels in long-unburnt areas generate prolific short distance spotting potential; ▶ At moderate FDR, slow, low intensity fires can spread in the grassy understorey when wind speeds are sufficient; and ▶ At low FDR, with light and variable wind, fire has difficulty sustaining itself in grassy fuels, being restricted to heavier and continuous fuel pockets and downed timber.
<p>Dry sclerophyll forest (grassy understorey)</p> <p>Timbered land dominated by eucalypts with crowns rarely touching, and typically 15 – 35m tall.</p> <p>Understorey is dominated by long-lived perennial grasses and herbs.</p>	<p>Note: Grassy understorey less than 50 - 60% cured does not constitute a hazard except under extreme conditions. However, long-lived, clump forming grasses in long-unburnt forest areas may appear green on the outside but may contain a high proportion of dead fine fuel inside the clump and can burn freely.</p> <p>Fuels dominated by surface fuel; being a combination of grass and litter fuels. Grassy fuel components recover quickly after fire.</p> <p>In long-unburnt areas, grass fuels can extend from the surface into the near-surface fuel layer, which in some cases may be added to by an increase in shrub components as time since fire increases.</p>	<p>Warning: Do not rely on generalised fire behaviour characterisation during fire management operations. Predict dry sclerophyll forest fire behaviour using the Fuel Assessment and Fire Behaviour Prediction in Dry Eucalypt Forest Field Guide – Interim Edition (Gould et al 2007b).</p> <p>General fire characteristics:</p> <ul style="list-style-type: none"> ▶ At High to Extreme FDR fast moving fires in windy conditions, with extended burn-out times where downed timber is present. Crown fires may develop, particularly in long unburnt and/or ungrazed fuels, and/or on upslope areas; ▶ High to extreme bark fuels in long-unburnt areas generate prolific short distance spotting potential; ▶ At moderate FDR, low intensity fires can spread in the



Formation Class	Fuel (Hazard) Characteristics	General Fire Behaviour Characteristics
<p>Dry Sclerophyll forest (shrubby understorey)</p> <p>Timbered land dominated by eucalypts with crowns rarely touching, and typically 15 – 35m tall.</p> <p>Understorey is dominated by shrubs with a typically sparse ground cover of mainly hard leaved sedges.</p>	<p>Bark fuels of rough barked Eucalypts can be significant in long-unburnt areas.</p> <p>Note: Drought index and fuel moisture content are very important as they determine the proportion of the fuel (hazard) that is available to burn.</p> <p>Fuels dominated by surface and near-surface fuel being a combination of litter fuels (surface) and shrubs with suspended litter (near surface fuels). Some grassy components may also be present.</p> <p>Shrub regeneration may be prolific after fire, particularly if the previous fire interval was long allowing heavy seed bank accumulation. In such cases, surface and near-surface fuels may recover to around 80% or more of pre-fire levels within 5 to 7 years.</p> <p>Bark fuels of rough and smooth barked Eucalypts can be significant in long-unburnt areas. Bark fuel reduction effects after fire persist for considerably longer than surface and near-surface fuel reductions.</p>	<p>grassy understorey when wind speeds are sufficient; and</p> <ul style="list-style-type: none"> ▶ At low FDR, with light and variable wind, fire has difficulty sustaining itself in grassy fuels, being restricted to heavier and continuous fuel pockets and downed timber.
		<p>Warning: Do not rely on generalised fire behaviour characterisation during fire management operations. Predict dry sclerophyll forest fire behaviour using the Fuel Assessment and Fire Behaviour Prediction in Dry Eucalypt Forest Field Guide – Interim Edition (Gould et al 2007b).</p> <p>General fire characteristics:</p> <ul style="list-style-type: none"> ▶ At High to Extreme FDR fast moving fires in windy conditions, with extended burn-out times where downed timber is present. Crown fires can propagate in areas with a well-developed shrub layer and are likely in such areas at high to extreme FDR, particularly on upslope sections; ▶ High to extreme bark fuels in long-unburnt areas generate prolific short distance spotting potential, and less prolific long distance spotting potential where smooth bark ribbons or loose fibrous bark is present; ▶ At moderate FDR, low to moderate intensity fires can spread when wind speeds are sufficient. Higher intensity fire can occur in dry, heavy fuels and on upslope areas; ▶ At low FDR fire can sustain itself when fuel moisture is low (<12%), and can burn for extended periods in heavier fuel pockets and downed timber when drought



Formation Class	Fuel (Hazard) Characteristics	General Fire Behaviour Characteristics
<p>Tall heathland/shrubland</p> <p>Dense coastal banksia heaths, paperbark thickets and other dense timbered wetland communities have fuel characteristics resembling tall heathland/shrubland .</p> <p>Other vegetation types with tall heath/shrubland fuel characteristics include dense young shrubby regrowth following bushfires.</p>	<p>Young shrubby regrowth fuels are dominated by near surface and elevated fuels.</p> <p>In dense shrubby regeneration, fine fuel quantity (live fuels < 3mm diameter and dead fuels < 6mm) in the near surface and elevated fuel layers can reach overall fuel hazard levels around 25 t/ha, and reach heights exceeding 3 metres. Fuel arrangement can be near continuous.</p> <p>A high proportion of the fuels will be live, and therefore may have moisture contents not conducive to fire spread, but may carry fire when drought stressed, or when mature/over-mature with increasing dead fine fuels, and/or during very high/extreme fire weather.</p>	<p>indices are elevated; and</p> <ul style="list-style-type: none"> ▶ Fire behaviour may be increased from usual levels in drought affected periods. <p>Warning: Do not rely on generalised fire behaviour characterisation during fire management operations.</p> <p>No nationally used heath fire behaviour guide is currently available. In the absence of locally validated heath fire behaviour models, Predict fire behaviour using the Fuel Assessment and Fire Behaviour Prediction in Dry Eucalypt Forest Field Guide – Interim Edition (Gould et al 2007b). This should be used with caution and by persons experienced in fire behaviour analysis.</p> <p>General fire characteristics:</p> <ul style="list-style-type: none"> ▶ Heath fires are wind driven, with rates of spread usually faster than in dry forest but slower than in grass under the same conditions; ▶ At Moderate to Extreme FDR fast moving fires in windy conditions, with extended burn-out times where dead individual plants and downed timber are present. Sustained crown fire can be expected at High to Extreme FDR, particularly when the wind is above 8 – 10 km/hr; and ▶ When winds are light and variable, fires can have difficulty spreading in many (but not all) heath types due to surface fuel discontinuity typical of heath vegetation. <p>Warning: Do not rely on generalised fire behaviour characterisation during fire management operations.</p>
<p>Wet/moist sclerophyll forest (grassy understorey)</p>	<p>Note: Grassy understorey less than 50 - 60% cured does not constitute a hazard</p>	



Formation Class	Fuel (Hazard) Characteristics	General Fire Behaviour Characteristics
<p>Eucalypt dominated forest with a tall (>30m) open canopy, generally occurring in high rainfall areas (>900mm/yr).</p> <p>The forest floor typically is covered with grasses and herbs, with sparse shrub presence.</p>	<p>except under extreme conditions. However, long-lived, clump forming grasses in long-unburnt forest areas may appear green on the outside but may contain a high proportion of dead fine fuel inside the clump and can burn freely.</p> <p>Fuels dominated by surface fuel; being a combination of grass and litter fuels. Grass fuel components recover quickly after fire.</p> <p>In long-unburnt areas, grass fuels can extend from the surface into the near-surface fuel layer, which in some cases may be added to by an increase in shrub components as time since fire increases.</p> <p>Bark fuels of rough and smooth barked Eucalypts can be significant in long-unburnt areas.</p>	<p>There is no national fire behaviour guide specific to wet sclerophyll forests. Predict wet sclerophyll forest fire behaviour using the Fuel Assessment and Fire Behaviour Prediction in Dry Eucalypt Forest Field Guide – Interim Edition (CSIRO, 2007).</p> <p>General fire characteristics:</p> <ul style="list-style-type: none"> ▶ At High to Extreme FDR fast moving fires in windy conditions, with extended burn-out times where downed timber is present. Crown fires may develop, particularly in long unburnt and/or ungrazed fuels, and/or on upslope areas; ▶ High to extreme bark fuels in long-unburnt areas generate prolific short distance spotting potential; ▶ An moderate FDR, low intensity fires can spread in the grassy understorey when wind speeds are sufficient; and ▶ At low FDR fire has difficulty sustaining itself in grassy fuels, being restricted to heavier fuel pockets and downed timber.
<p>Wet/moist sclerophyll forest (mesic understorey)</p> <p>Eucalypt dominated forest with a tall (>30m) open canopy, generally occurring in high rainfall areas (>900mm/yr).</p> <p>The forest floor typically is covered with deep litter beds and mesic vegetation including ferns, vines and rainforest species.</p>	<p>Fuels dominated by surface fuel, which under most conditions is too moist to sustain combustion. Typically elevated fuels in the form of Eucalypt bark and litter suspended in understorey vegetation is also present.</p> <p>These fuels are typically only dry out sufficiently to burn during hot dry conditions during significant droughts.</p> <p>Bark fuels of rough and smooth barked Eucalypts can be significant in long-unburnt areas.</p>	<p>Warning: Do not rely on generalised fire behaviour characterisation during fire management operations.</p> <p>There is no national fire behaviour guide specific to wet sclerophyll forests. Predict wet sclerophyll forest fire behaviour using the Fuel Assessment and Fire Behaviour Prediction in Dry Eucalypt Forest Field Guide – Interim Edition (CSIRO, 2007).</p> <p>General fire characteristics:</p> <ul style="list-style-type: none"> ▶ At Very High to Extreme FDR in drought years, very high intensity fires in windy conditions, with extended burn-



Formation Class	Fuel (Hazard) Characteristics	General Fire Behaviour Characteristics
		<p>out times. Crown fires may develop, particularly on upslope areas. Fire spread unlikely in average to above average rainfall years, however, in adverse weather fire may carry significant distance into wet forest from dry forest areas burning through elevated/suspended fuels;</p> <ul style="list-style-type: none"> ▶ High to extreme bark fuels in long-unburnt areas generate prolific short distance spotting potential, with long distance spotting also possible; ▶ An moderate FDR, low intensity fires can spread in the grassy understorey when wind speeds are sufficient; ▶ At low FDR fire has difficulty sustaining itself in grassy fuels, being restricted to heavier fuel pockets and downed timber; and ▶ Safe prescribed burning is difficult to impossible due to fuel moisture levels.
		Source GHD 2011



2.1.2 Landscape Position: Adjacent Landscape Vegetation Cover and Condition

The landscape location where vulnerable assets are situated will have a most significant impact on bushfire risk. The land cover and condition on lands adjacent to assets, particularly in the direction from which adverse weather comes, is particularly influential on fire risk.

Fires in forests are in general much more difficult to contain and keep contained than are fires in open country dominated by pasture and crops. This is because forest fires are much more intense, burn for longer periods, generate short to long distance spotting, have more obscured visibility of the active fire edge, greater access difficulty and require greater effort and resources per metre of fire line/containment line to suppress and mop-up. Therefore, fire vulnerable assets with extensive forest cover in the adverse prevailing up-wind direction will be at significantly higher fire risk than assets adjacent to grassland, particularly if the grasslands are well grazed prior to onset of fire-conducive conditions. If the upwind forests are extensive, have heavy fuels, poor or limited access, or are remote from resources for successful initial attack of small fires, then bushfire risk is further amplified. Cumulatively, these forest fire risk factors all make it more unlikely that fires in the adverse prevailing up-wind direction will be contained before the onset of bad weather, the arrival of which is likely to generate a forest fire of uncontrollable proportions which can directly spread into, or spot into the down-wind asset locations.

Conceptually, the bigger a fire prone forest area is, the larger the bushfire it can support. The larger a running bushfire is, the more difficult it is to contain (increasing numbers of firefighting resources required and the complexity of suppression planning and operational management and coordination increases). Historically, the majority of high-consequence fires in Australia have been from fires starting in forests (or grasslands and then burning into forests) where they build up in size and intensity and then burn through, or into, vulnerable communities or assets as uncontrollable fires in adverse conditions (COAG, 2004). Therefore in assessing local bushfire risk it is important to consider the landscape position of a locality, particularly in relation to the amount of fire prone forest in the area, and the direction from the fire-vulnerable assets that such forests are situated. During the MBRC fire strategy workshop, GHD facilitated a bushfire risk assessment exercise. Landscape position risk was one of the key factors identified and assessed.

GHD has considered landscape position risk from two different directions – from the most adverse fire weather side (in MBRC this is from north anti-clockwise through west to south) and the least adverse fire weather side (from north clockwise to south). A four point scale can be used to assess the landscape position risk factor (**Table 3**):



Table 3 Surrounding Landscape Vegetation Cover Risk

Surrounding Landscape Vegetation Cover	Very High	High	Moderate	Low
	Land cover dominated by extensive, mature fire prone forest or plantation. During drought the local landscape has previously supported large fires. Clearings within the extent of forest are relatively small and easily crossed by short distance spotting (<500m).	Roughly equal mix of cleared agricultural lands (or peri-urban residential lands) and remnant forest or plantation areas - forested areas are large enough to support running high intensity fire and spread to other forest areas through short distance spotting (< 500m)	Mostly cleared or urbanised landscape with small and/or regularly grazed or burnt forest remnants. Forest areas/linear features not sufficiently large enough or contiguous to support large high intensity fires	Extensively cleared agricultural or urbanised landscape with only isolated clumps or linear features with trees, or a more extensive forest area which has highly modified understorey (mown grass, low flammability, reticulated gardens etc)

The western proportion of MBRC and Bribie Island contain the largest areas of contiguous vegetation, primarily within catchment, State Forest or National Parks lands of the D’Aguilar and Conondale Ranges. The vegetation of these western ranges is primarily dry sclerophyll forest with a shrubby understorey and with a grass dominated understorey, and wet sclerophyll forest with some patches of rainforest. This vegetation would fall into the Very High Category.

The vegetation cover within the central part of the MBRC regional council area is more dispersed owing to historical agricultural activities and urbanisation. The historic subdivision of farming and cropping lands within this central zone has resulted in a large number of semi-rural allotments, with less intensive land management and a higher component of shrub and forest fuels than the previous agricultural land use. This vegetation cover would fall into the High or Moderate category.

The eastern part of MBRC, with the exception of Bribie Island, is largely urban, and would fall into the Low category.

In addition to the extent of fire prone forest/scrub cover in a landscape area, two other attributes of the vegetation type/cover are important to take into consideration. These are the proximity of forest/scrub vegetation to areas of fire-vulnerable assets, and the nature of spotting generated by the vegetation. The latter is important because this is the primary vector by which forest fires cross impediments to fire spread such as roads, firebreaks, low/no fuel areas and water bodies. It is also the principal fire attack mechanism responsible for house loss. Planted areas such as offset sites, particularly where local fire prone and shrubby species are used, can also significantly elevate fire risk at a specific locality and this should be taken into account when making an assessment. These factors can also be assessed using a four point scale (**Table 4**):

Table 4 Proximity of Woody Vegetation Risk

Proximity of woody vegetation on adjacent lands	Very High	High	Moderate	Low
	<p>Tracts of fire prone woody vegetation, or timber plantations, adjoin the-at risk area, separated by fire trails or breaks of less than 10m wide. Vigorous surface fires in the adjacent vegetation can spread into at-risk area through flame propagation across the break.</p>	<p>Tracts of fire prone woody vegetation, or timber plantations, adjoin the at-risk area, separated by fire trails or breaks from 10 - 50m wide. Fire can enter the area through short distance spotting.</p>	<p>Tracts of fire prone woody vegetation or timber plantations are well separated from the at-risk areas by cleared lands between 50 and 300m. Fire can cross the cleared land enter the at-risk area through medium to long distance spotting or as a grassfire.</p>	<p>The at-risk area is separated from other fire prone woody vegetation or timber plantations by a distance exceeding 300m.</p>
<p>Vegetation type / spotting features</p>	<p><u>Short-long distance prolific propensity:</u> Very fine, loosely held fibrous bark species (eg. stringybarks, peppermints and other fine fibrous barked species). Long length, high suspended load ribbon barks</p>	<p><u>Short-long distance moderate propensity:</u> Fine fibrous barked species - fibrous bark on the lower trunk with loose flakes of bark at top of bark sock (eg Blackbutt) Ribbon barked species which commonly retain suspended bark ribbons on the trunk, branch forks or shrubs (eg bluegum, white gum)</p>	<p><u>Short-medium distance, moderate propensity:</u> Small tessellated flake-barks (eg bloodwoods) Rough or platy barked species (eg. Pines, platy-barked box) Coarse, short-strand fibrous bark</p>	<p><u>Short distance, low propensity:</u> Smooth barked species with trunk and branches entirely free of loose bark. Smooth slab-barked species (eg spotted gum, non-fibrous barked box). Rough, tightly held hard-barks, (eg Ironbark). Scrub communities with tightly held bark (Banksia, Acacia)</p>

2.1.3 Topography, Access and Fuel Reduction within the Surrounding Landscape

In the previous section the influence on bushfire risk of land cover in the surrounding landscape was discussed. Linking with this are the land management practices on these lands. For example different agricultural practices on adjacent lands will affect fire risk to different degrees. Where grazing is undertaken on adjacent pastures, particularly if grass paddocks are grazed short (<10 cm) before the bushfire danger period commences, fire risk will be significantly lower than in areas where grazing is



absent, intermittent or light (where cured grass has accumulated). Cropping practices can be similarly influential on fire risk, particularly the timing of crop harvesting and the crop residue management practices. On forested lands, the forest fuel loads associated with land management practices can significantly affect prospects for initial attack success of fires starting in those forests.

Of great importance also is the nature of the topography and access in the adjacent landscape area. This has a significant bearing on the likelihood of fire suppression success. Steep areas where fires can develop quickly on uphill runs, and where access for firefighters to engage in initial attack is limited will have a much higher difficulty for early fire control, than areas that have good access, and gentler topography.

During the MBRC workshop, GHD facilitated fire scenario based fire risk assessment exercises. Risk factors dealing with surrounding landscape use and management were considered in identifying varying degrees of risk. A four point scale can be used to assess these aspects of land use and management risk factors in the surrounding landscape (**Table 4**):

Table 5 Surrounding Landscape Risks

	Very High	High	Moderate	Low
Surrounding Landscape – Land Use and Condition	Grass and vegetation cover on non-forested land is not appreciably reduced by land management activities, and usually carries significant quantities of cured grass or fire prone vegetation through the bushfire danger period	Cleared land areas usually carrying cured and lightly grazed grass cover at least into the first half of the bushfire danger period; forested landscape components not frequently burnt or grazed	Cleared land areas are usually grazed short or have had fire prone crops removed by the start of the bushfire danger period	Modified/cleared adjacent land areas support irrigated pasture or crops through summer which will not carry fire, or carry grass cover only in above average rainfall seasons (when forests retain good soil moisture through the fire danger period)
Surrounding Landscape – Topography and Access	Rough topography with relatively limited access making initial attack by ground crews difficult	Rough topography but with reasonable road/trail access such that fires starting on Low to High FDR days are usually contained within 1 -2 days	Undulating/hilly topography with reasonably good access – fires starting on Low to High FDR days are almost always contained by initial attack resources	Gentle topography with good road/trail access and surrounding landscape visibility



2.1.4 Climate and Weather

Climate and weather (weather is the day-to-day state of the atmosphere, whilst climate is weather attributes of a locality averaged over a period of years – usually 30 or more) are key fire risk factors. The climate dictates such things as how often the landscape will be in a fire prone condition – the timing and length of the bushfire season, and exposure to risk-elevating climatic events such as droughts in forested areas. The weather dictates the severity of fire conditions (wind speed and direction, relative humidity and temperature) on any given day, which has a strong influence on fuel combustibility and therefore on how fast fires can spread and how severely they will burn.

In landscape terms, MBRC is not a huge area (2,037 square kilometres land area), incorporating coastal plains, foothills, to the top of the D'Aguilar range, in a 'sub-tropical – warm humid summer' climate zone. However, within the MBRC there is a degree of climatic variation ranging from higher rainfall/ humidity, areas with strong seabreeze influence in the immediate vicinity of the coast grading down to dryer, hotter areas at the foot of the ranges and further inland.

The key climate and weather characteristics of the MBRC are:

- ▶ A tropical warm-season moist climate, influenced by warm currents circulating through the Tasman Sea, providing rainfall and humidity whilst moderating extreme temperatures;
- ▶ Rainfall is closely linked to topography, with higher rainfall in the D'Aguilar and Conondale ranges (Mt Glorious 1623 mm Mt Nebo 1382 mm) and broadly uniform precipitation across the remainder of the shire (Mt Mee 1151 mm, Dayboro 1241 mm, Morayfield 1263 mm, Bribie Island 1276 mm, Lawnton 1220 mm);
- ▶ Summers are generally very warm, wet and very humid (with mean maximum December temperatures of approximately 28.3°C on the coast (Redcliffe) and 25.3°C at higher elevation (Mt Glorious) (BoM 2011¹⁰), while winters are relatively dry and mild;
- ▶ The bushfire season in South-East Queensland begins in late winter to spring, with the bushfire threat lessening with the summer rainfall period associated with tropical storms. Fire risk is elevated in those seasons that follow a previous wet summer, a drier winter with westerly winds and where spring and early summer rains are delayed;
- ▶ The most significant fires are likely to occur in spring and early summer, associated with very high fire danger days which peak in November. From spring through to early summer native vegetation is dry and grasslands may be cured. Higher fire danger typically occurs when a deep low frontal system establishes, resulting in strong dry westerly winds, low humidity and higher temperatures for South-East Queensland. Unlike southern Australia, these conditions are generally short lived and are less likely to persist over consecutive days;
- ▶ It is estimated that sustained periods of severe fire weather conditions (two days or more of fire weather but rarely exceed three consecutive days) occur on average every 10 years, though in drought affected seasons these conditions may occur over consecutive years (Landmarc 2003¹¹). As such, short-lived running fires on blow up days are more likely in South-East Queensland than the longer lasting 'campaign' fires that occur in the southern States. It is noteworthy however, that the

¹⁰ Australian Bureau of Meteorology (BoM) (2011) Summary climate statistics Albany for Australian locations, viewed 19 September 2011, <http://www.bom.gov.au/climate/data/>

¹¹ Landmarc (2003) Final Report for the Bushfire Management Study. Report prepared for Pine Rivers Shire Council, September 2003



duration of the fire is less critical to bushfire consequence than fire behaviour in the first twenty four hours when the greatest impacts are likely. In the Victorian 'Black Saturday' bushfires the vast majority of the 173 fatalities were as a result the fire activity during the first afternoon/evening of the fire events;

- ▶ In drought years bushfire risks are increased both in length and severity, as fires are more likely to start, spread more readily, and remain alight for extended periods than in an average or wet year; and
- ▶ The annual number of severe fire danger days (Very High and greater) is forecast to increase in South-East Queensland (CSIRO 2007¹²) under climate change scenarios.

2.1.5 Ignition Issues

Another key risk factor is sources of fire ignition. Theoretically, even in places with extreme fire climate and weather, if there is no fire ignition source, then there is no fire risk. In MBRC the relatively high population that is associated with urbanised and peri-urban landscapes provides sources of fire ignition. Relative to less populated areas, ignition risks are elevated as there are greater numbers of people that may use fire in a careless manner or engage in arson (hence a higher likelihood of this happening).

Arson is the main source of ignition within the study area, and can be linked to demographic factors. Areas with a higher proportion of younger persons have been found to have a higher incidence of fires. When fire occurrence was compared between the similarly sized Caloundra and Caboolture it was identified that the three times as many fires occurring in Caboolture may be associated with the significantly younger demographic of the area (AIC 2008)¹³.

Less common ignition sources are accidental ignitions from agricultural, small farm or forestry activities or mechanical works, powerlines arcing or contacting with vegetation, and escaped agricultural burns, prescribed burns or camp fires. Powerline caused fires have resulted in fires within the study area. Powerlines arcing and contacting with vegetation are responsible for a small number of fires; however the proportion of ignitions increases on severe fire danger days (often as a result of contact with vegetation, sagging lines or structural failure during high winds). Powerlines include both lines owned by the distributor as well as privately owned lines, and private property owners may also need to be cognisant of their responsibilities in relation to maintaining vegetation hazard around powerlines.

Lightning is a significant contributor to bushfire ignition throughout Australia, but is a less common ignition source in the study area as the summer months in which it occurs coincide with wetter conditions. Typically thunderstorms occur between October and April each year with the peak months December followed by November. The risk of lightning induced ignitions is only an issue in those drought years where late spring and early summer rains are delayed, coinciding with dry lightning storms. Lightning occurring under these circumstances in higher elevation forested areas to the west of MBRC, may generate multiple near-simultaneous ignitions.

Where in the landscape ignitions occur is also an important factor influencing risk. In landscapes where there are sources of ignition in an upwind direction (from where adverse fire weather comes), such that fires can reach populated areas as an uncontrollable bushfire, risks will be significantly higher than they

¹² CSIRO / Australian Bureau of Meteorology (2007) *Climate change in Australia: technical report*, CSIRO, Australia

¹³ Australian Institute of Criminology (AIC) (2008) *Understanding bushfire: Trends in deliberate vegetation fires in Australia*, Australian Institute of Criminology, Australian Government



would be for areas where areas ignition sources are downwind or where ignition potential is primarily within small reserves.

A four point scale based on local knowledge of ignition issues and the historical frequency and proximity of ignition sources/areas can be used to assess the ignition risk factor (**Table 6**):



Table 6 Ignition Risks

Ignition Risk Factor	Very High	High	Moderate	Low
	Adjacent fire prone areas are within 10km of population centres, or 2km from major roads or camping / picnic areas, and public access nearby fire prone land is available, or fire prone land has a recurring history of lightning caused fires (occurring late in the fire season)	Adjacent fire prone areas are within 10km of human ignition sources (such as nearby population centres) but public access is highly restricted, vehicle access is closed, or fire prone land is prone to lightning – the vast majority of these factors do not result in fires >24hrs duration	Adjacent fire prone areas are > 10km for population centres, and public access is highly restricted, vehicle access is absent, or local vegetation types are mostly not fire prone including drought; lightning is not a historical cause of fires.	There are no common ignition sources within 10 km of at-risk areas, and vegetation types and land features will not support fire ignition.

2.1.6 Local Fire Suppression Capacity Issues

The following sections provide a summary of each of the key risk factors relating to local fire suppression.

Availability of Fire Fighters

Fire suppression capacity in peri-urban and rural parts of the MBRC is heavily dependent on volunteer rural bushfire brigades. Studies of recent volunteer bushfire brigade capacity trends, and how these might alter in the future, suggest a declining trend. From 1995-2003 total volunteer firefighter numbers across Australia declined appreciably, because of complex economic and demographic changes in Australian society (McLennan and Birch, 2005 in Bushfire CRC 2008¹⁴).

How the rural volunteer bushfire brigade capacity is utilised during major fire events may also impact on community fire risk. Sustained growth of Australia’s population, including the MBRC area, has seen a significant expansion of communities and built assets in fire prone landscape areas. This has translated in steady growth in the number of people at risk from bushfire impact. Within the MBRC area the vast majority of those at risk live and /or work at:

- ▶ The margins of population centres such as the Samford valley;
- ▶ Within peri-urban or intermix areas such as Dayboro, Samsonvale and Oceanview; and
- ▶ Small population centres within commuting distance of Brisbane such as Mt Nebo and Mt Glorious.

Projected demographic trends suggest an increase of persons living in high bushfire risk situations. A significant proportion of which may have long commuting distances, with limited time to commit to

¹⁴ Bushfire CRC (2008) *Fire Note 22 Keeping your recruits boosting volunteer retention*, Bushfire Cooperative Research Centre, Melbourne



volunteering. With volunteer firefighter numbers struggling to be maintained or declining, it is reasonable to assume volunteer firefighting capacity available for tasking will have reduced availability in the future.

All fire and emergency services have as their absolute highest priority the protection of human life. Typically, the result is that when bushfires develop and threaten human population centres, a very high proportion of the available suppression forces are tasked to community protection, largely higher density areas of greatest vulnerability. In fast developing fire incidents it is unlikely enough resources can be mobilised to provide community protection to all at-risk locations, and less populated peri-urban areas may be considered of lower consequence during a fire emergency.

Detection

Early fire detection contributes to improving initial attack response success. Landscape areas that have good visibility (from towers, lookouts or aircraft) will therefore have lower risk factors than areas with limited or poor coverage. The visibility of forested areas from adjacent residential areas or roads provides for an enhanced level of informal detection. Informal detection has increased significantly across rural areas as a consequence of improvements in the range and availability of mobile phone services (Mathews et al. 2010¹⁵).

Access to and within bushland reserves for suppression

Road and fire trail network density and quality are limiting factors on how quickly and how close fire suppression resources can get to fires starting in bushland reserves. Importantly also, they provide a network of available containment lines from which indirect or parallel attack containment strategies can be pursued. The level and standard of road/trail access will therefore influence local fire risk. Roads and trails also provide public access to reserves, and may therefore become sources of careless or deliberate fire ignition.

Access into the surrounding landscape for suppression

Roads and trails provide access for fire crews into adjacent forest and woodland areas, where fires may start, develop and spread across the landscape and impact on assets. The level and quality of access into adjacent lands, particularly forested land, will be a limiting factor on initial attack success. Given that most large fire losses have been from fires emanating from significant tracts of forested land, access for fire control on these lands is an important risk factor.

Different types of firefighting resources required

There are a number of resources routinely required for first attack and extended multi-shift forest firefighting operations. The extent to which these are locally available and are quickly mobilised in the event of a fire will have a significant influence on the level of local fire risk as they are limiting factors on the speed and strength of response, and in particular initial attack. QFRS are likely to be the first responders to wildfire in MBRC area, supplemented by land management agencies such as MBRC, and the experience and type of resources they have available will influence suppression success. Specific resources for which quick mobilisation will typically be required for successful initial attack on fires in, or threatening communities include:

- ▶ Experienced land management, forest and plantation firefighting crews and machinery operators, as forests and plantations are the areas in which landscape fires are most likely to develop, remain

¹⁵ Mathews, S, Sullivan, A, Gould, J, Hurley, R, Ellis, P and Larmour, J (2010) Evaluation of fire detection systems, prepared for the Bushfire CRC, CSIRO, Canberra



alight and impact on community assets (note: modestly experienced crews may be able to successfully suppress fires burning in mild to moderate conditions, however, as the level of suppression difficulty rises with increased fire danger, and the number and landscape location of fire(s) and their perimeter length increases, fire crew experience levels will become more of a suppression issue);

- ▶ Fast response 4WD 'striker' units (400-600 litre capacity) which can rapidly access and support initial attack operations;
- ▶ Large capacity 4WD fire tankers (3,500 – 4,000 litre capacity) that bring sustained water and firefighting apparatus to the fireline;
- ▶ Small bulldozers for mineral earth containment line construction and widening;
- ▶ Large bulldozers for use in stand conditions which are beyond the effective working capacity of small dozers;
- ▶ Surveillance system, such as a fire tower network, or good landscape lookout points for initial fire detection and monitoring of subsequent outbreaks;
- ▶ Light fixed or rotary wing aircraft for aerial reconnaissance;
- ▶ Waterbombing aircraft for initial attack and support of ground crews;
- ▶ Radio equipment fitted to tankers and machinery to facilitate coordinated fire control operations; and
- ▶ Accurate maps depicting landscape and fire control features.

The time taken to mobilise back-up resources for initial attack crews will also be important.

Local fire suppression capacity risk factors can be assessed by considering three key elements: detection capacity; initial attack capacity and sustained attack/community protection capacity (capacity to limit the damage potential of significant fires). A four point scale can be used to assess these capacity risk factors (**Table 7**):

Table 7 Detection, Initial Attack and Sustained Attack Risks

Detection risk factor	Very High	High	Moderate	Low
	<p>Fire lookout towers (if any) are remote from the at-risk area or have visibility substantially restricted by topography. Local rural populations are sparse. Some fires in more remote parts of the local landscape are not detected for a day or more after ignition.</p>	<p>Fire lookout towers provide only limited coverage across the landscape. Local rural populations are sparse or patchy. Fires attaining several hectares in size before being reported can and do occur from time to time</p>	<p>Fire lookout towers provide coverage across much of the local district. Lands in the locality are occupied by resident rural landowners with a culture of reporting fires. It is rare, but not unprecedented, for fires to reach several hectares in size before being detected.</p>	<p>A network of fire lookout towers is operated across the locality which results in fires starting in the locality routinely being detected and reported while they are small. Resident rural populations and visitors supplement fire towers as informal detection sources.</p>
<p>Initial attack risk factor</p>	<p>The at-risk area is relatively remote from fire suppression resources, and initial attack resources could be expected to have a response time exceeding 45 minutes. Local access to bulldozers is unreliable and may take longer than 2 hours. Use of aircraft for initial attack is uncommon</p>	<p>Multiple light and heavy tankers are based locally within a 45 minute response time from the locality; Bulldozers are routinely available locally for rapid deployment to fires within 2 hours. Use of aircraft for initial attack is uncommon</p>	<p>Multiple light and heavy tankers are based locally within a 30 minute response time from the at-risk area; One or more first attack bulldozers are routinely available locally for rapid deployment to fires</p>	<p>Multiple light and heavy tankers are based locally within a 20 minute response time from the at-risk area; One or more first attack bulldozers are routinely available locally for rapid deployment to fires; one or more waterbombing aircraft are available locally at short notice for initial aerial attack – use of aircraft for initial attack is considered routine</p>
<p>Sustained attack risk factor</p>	<p>Forest firefighting is almost totally reliant on volunteer rural fire brigades which are not numerous locally, resulting in reliance on out-of-area resources with little or no local knowledge</p>	<p>Substantial light and heavy tanker fleet mobilisation would consist of a high proportion of out-of-area resources with little local knowledge and relatively inexperienced at direct and close parallel attack night firefighting operations.</p>	<p>A substantial fleet of light tankers can be mobilised and on task by nightfall, operated by personnel experienced in night forest firefighting, but it is unlikely more than 20 heavy tankers could be mobilised and on task before the next day.</p>	<p>A substantial fleet of light and heavy tankers can be mobilised and on task by nightfall, operated by personnel experienced in night forest firefighting, to support flank containment operations (including burning-</p>



		Bulldozer operators may not be experienced operating in burnt forest areas at night	Multiple bulldozers capable of night operations are able to be mobilised before nightfall	out) and to support multiple bulldozer work on headfire containment during mild overnight conditions, and urgent control line reinforcement work
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2.2 Climate Change Factors

2.2.1 Projections

Under a range of climate change scenarios bushfire impacts and risk factors likely to be amplified for MBRC.

Published studies for South-East Queensland (Department of Climate Change and Energy Efficiency (2010)¹⁶, Queensland Climate Change Centre of Excellence (2010)¹⁷ and McDonald *et al.* (2010)¹⁸) identify the following trends:

- ▶ A 1-1.2 °C increase in mean maximum temperature;
- ▶ A 6-7% increase in potential evapotranspiration;
- ▶ Little change in relative humidity in coastal areas and up to 2% reduction inland;
- ▶ Decreased mean annual rainfall (by as much as 5%) with increased rainfall intensity and largest change in seasonality projected to occur in spring; and
- ▶ More days over 35°C.

A specific analysis of very high to extreme fire days is not available for the MBRC area, however for South-East Queensland Lucas *et al* (2007)¹⁹ found that:

- ▶ Brisbane averaged 4.7 x Very High fire danger days and 0.5 Severe or greater days annually;
- ▶ Amberley, approximately 40 km west of Brisbane, averaged 12.1 x Very High fire danger days and 1.2 Severe or greater days annually; and
- ▶ More intense fire seasons are likely, starting earlier and ending slightly later.

By 2050 under a high emissions scenario the number of Very High and greater fire danger days will increase in Brisbane by 45-63% and in Amberley by 57-70% (Lucas *et al* 2007). These trends can be used as a guide for MBRC area (using Brisbane for coastal areas and Amberley for the west of the ranges) and, considering the number of days over 35°C are projected to increase for the study area, it is

¹⁶ Department of Climate Change and Energy Efficiency (2010) 'Queensland', *Impacts of climate change*, Australian Government, viewed 18 November 2010, <http://www.climatechange.gov.au/climate-change/impacts/national-impacts/south-east-qld.aspx>

¹⁷ Queensland Climate Change Centre of Excellence (2010) *Climate change in Queensland – What the science is telling us*, Queensland Department of Environment and Resource Management

¹⁸ McDonald, J, Baum, S, Crick, F, Czarniecki, J, Field, G, Low Choy, D, Mustelin, J, Sanò, M and Serrao-Neumann, S (2010) *Climate change adaptation in South East Queensland human settlements: Issues and context*, unpublished report for the South East Queensland Climate Adaptation Research Initiative, Griffith University

¹⁹ Lucas, C, Hennessy, K, Mills, G and Bathols, J (2007) *Bushfire weather in southeast Australia: Recent trends and projected climate change impacts*. Report for Climate Institute of Australia, Bushfire CRC and CSIRO Marine and Atmospheric Research



likely the number of Very High and greater fire danger days will also increase. By 2100 a range of climate models predict both an earlier fire season and more severe fire weather (Clarke *et al* 2011²⁰).

2.2.2 Climate Change Impacts on Risk Factors

The following table identifies the potential sensitivity of fire risk factors under climate change projections for MBRC. There are many uncertainties involved including the extent of climate change and the success of mitigation actions implemented to reduce climate change risk. In addition there are a range of socio-economic factors that will also improve or exaggerate this risk profile. Potential impacts are summarised below (**Table 8**).

Table 8 Potential Changes to Fire Risk Factors Under Climate Change Scenarios

Factor	Potential Change	Detail
Fuel quantity and arrangement	Increased risk	<p>Projected precipitation and temperature is scenario dependant (CSIRO and BoM 2007). Best estimates indicate increased temperature and decreased rainfall, which may lead to drier and more available fuels. Worse case scenarios suggest increases in both temperature and rainfall, and may lead to increased vegetation growth, with an expected increase in available fuels complicated by increased evaporation rates.</p> <p>Woody weeds (such as lantana) may increase surface and near surface fuels, increasing fire residence time and vertical fire spread, although it is less fire prone than many native sclerophyllous shrubs.</p> <p>Increased vegetation growth rates may result in greater litter production and earlier build-up to fuel threshold levels (Pinkard <i>et al</i> 2010²¹).</p>
Native vegetation condition and ignition	Uncertain	<p>Land use in the MBRC is dominated by residential sub-division, rural subdivision, agriculture and nature conservation /forestry. A large proportion of the fuel landscape within the study area is associated with native forest and woodland in discrete blocks or regenerating on sub-divided rural residential areas.</p> <p>Climate change is not expected to impact the viability of grazing or native forest and woodland land uses, however strong population growth expected in the region may potentially lead to more subdivision of rural lands (currently limited to 100 hectare minimum area), fragmenting the fuel landscape and increasing</p>

²⁰ Clarke, H.G., Smith, P.L. and Pitman, A.J. (2011) *Regional signatures of future fire weather over eastern Australia from global climate models*. International Journal of Wildland Fire 2011, 20, 550-562

²¹ Pinkard, L, Battaglia, M, Howden, M, Bruce, J, and Potter, K (2010) *Adaptation to climate change in Australia's plantation industry*, prepared for the National Association of Forest Industries, CSIRO



Factor	Potential Change	Detail
		risk of both accidental and non-accidental ignitions.
Native vegetation range and distribution	Negligible	Gradual changes in the distribution of forest and woodland vegetation types may occur, with trends towards dryer range formations (eg from forest toward woodland structure) occurring under a drying scenario.
Native vegetation fire regimes	Increased Risk	<p>Possible increased growth rates and increased C:N ration of foliage under elevated CO₂ may result in greater litter production, reduced rates of litter decomposition and an earlier build-up to threshold levels. Possible increased weed growth, particularly of woody weeds may result in greater litter production and changes in litter structure, as well as drier fuel (Pinkard et al 2010).</p> <p>Note that decreased rainfall may outweigh the effects of increased CO₂ fertilisation (Battaglia <i>et al.</i> 2009²²).</p> <p>A combination of possible increased growth, warmer temperatures, increased evaporation and more days over 35°C point to a likely increase in fire frequency through a widening of the window in which fires can start and make runs.</p> <p>An increase in fire frequency may result in lower landscape fuel loads, changes to drier vegetation types (from repeated fire incursions into rainforest and wet sclerophyll) and more open vegetation structure.</p>
Vegetation cover / land use changes from socio-economic or demographic factors	Increased Risk	Native vegetation occurs adjacent or in close proximity to rural and residential land uses, particularly small population centres and urban expansion areas in the hinterland of the ranges. Population growth is likely to remain high, leading to increased urban and forest interface, combined with higher fire ignition risk associated with increased human activity.
Severe fire weather	Increased Risk	Projected precipitation and temperature is scenario dependant (CSIRO and BoM 2007). Best estimates indicate increased temperature and decreased rainfall, and combined with an increase in days over 35°C may lead to increased incidence of high to extreme fire days.
More severe drought	Negligible/ Increased Risk	Recurring drought is a feature of South-East Queensland. Current climate data shows an overall decrease in rainfall, characterised by a dry winter and spring period and wetter summer and autumn. While rainfall has decreased significantly in

²² Battaglia, M, Bruce, J, Brack, C and Baker, T (2009) *Climate change and Australia's plantation estate: analysis of the vulnerability and preliminary investigation of the adaptation options*, Forest and Wood Products Australia Limited, Hobart



Factor	Potential Change	Detail
		each season, there is little change in rainfall seasonality evident.
Fire ignition	Uncertain	<p>In South-East Queensland thunderstorms are most common in summer, a seasonally wet period, when moister conditions limit lightning strike fire ignitions. Whilst research on climate change implications for lightning occurrence across Australia is inconclusive, if an increased frequency of dry thunderstorms were to occur in spring, natural ignition could increase.</p> <p>As people are the leading cause of fires, climate change impacts on ignition issues will principally be through any climate associated changes in demographics. Fire ignition is often a result of non-accidental events, occurring near built-up or recreational areas. Population growth is likely to remain high, resulting in higher fire ignition risk associated with increased human activity and recreational forest use.</p>
Suppression capability	Negligible / Increased Risk	<p>If higher temperatures and reduced rainfall occur under best case scenario projections are likely to result in a drier fuel landscape. Combined with an increase in the frequency of very high and extreme fire danger days, periods suitable for prescribed burning may shift and potentially have significant implications for delivery of prescribed burning programs (Clarke <i>et al</i> 2011)²³.</p> <p>Firefighting capacity may be impacted by a decline in recruitment and training of new volunteers. Population increases may increase the volunteer base available, however recent trends indicate a decline due to a range of issues.</p> <p>Increasing extreme weather may also change the costs of fire prevention and suppression (Pinkard <i>et al</i> 2010).</p>
Fire detection	Negligible	Increases in rural populations and improvements in mobile phone coverage increase the likelihood of incidental fire reporting.

2.3 Fire Scenario Assessments of MBRC Localities

The worst case scenario for the residents of MBRC is a drought affected season in which a fire starts to the north, north-west or west and spreads South-East during the heat of the afternoon driven by hot dry north to westerly winds and coinciding with an unstable atmosphere. A fire starting under such conditions may impact residential areas in a very short period and prior to any official warning being issued or significant fire fighting resources mobilised.

²³ Clarke, H.G., Smith, P.L. and Pitman, A.J. (2011) *Regional signatures of future fire weather over eastern Australia from global climate models*. International Journal of Wildland Fire 2011, 20, 550-562

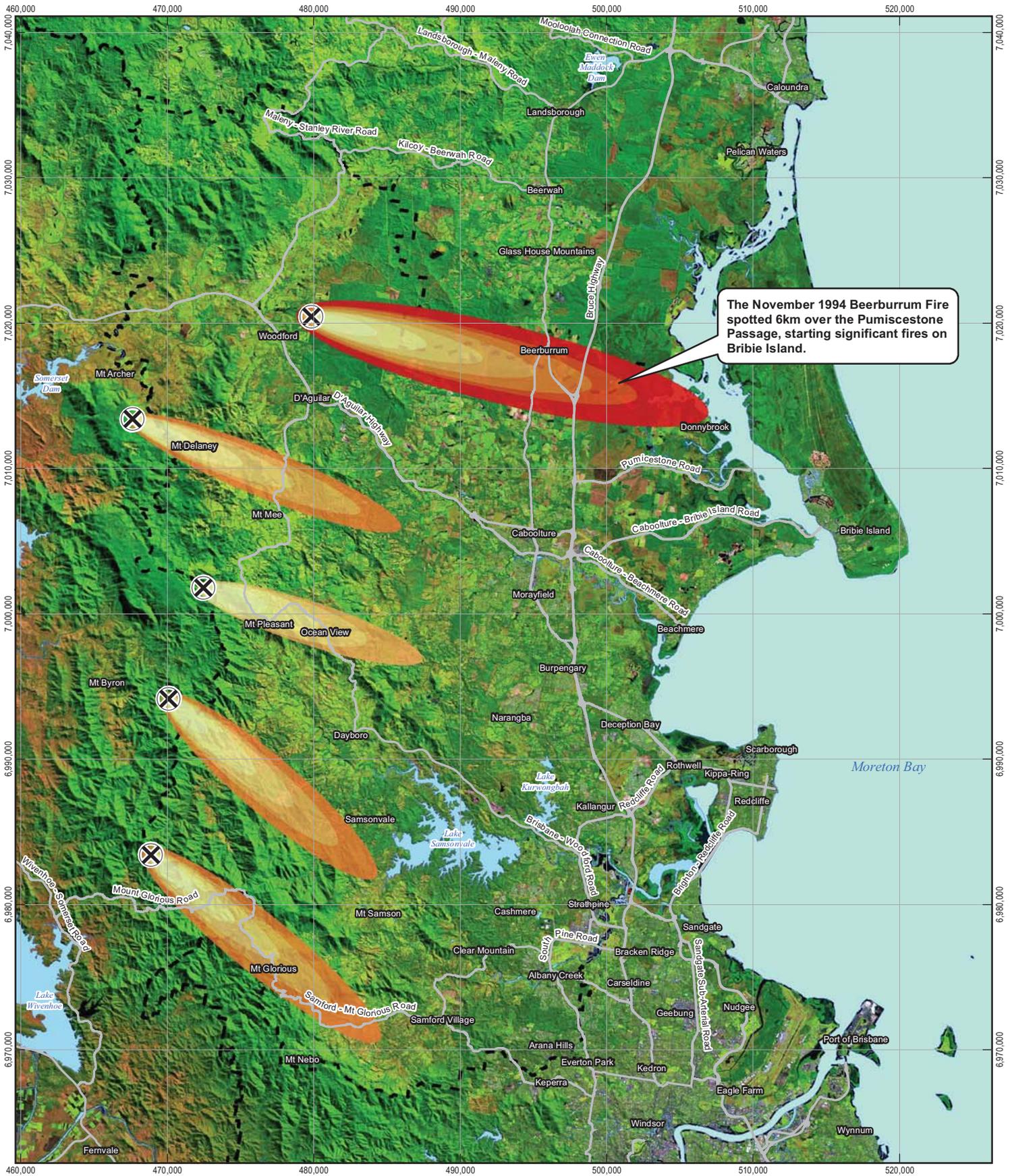


The Beerburrum bushfires of September and November 1994 provide a real example of a worst case type scenario from the MBRC area. These fires burnt under extreme conditions, destroying more than 4800 hectares of pine plantation, and crossing large parts of the landscape in a very short period. Seasonal conditions prior to these fires were extremely dry, with very low rainfall from May 1994 onwards. Both fires developed when a high pressure system sitting in the Great Australian Bight generated strong north-westerly winds and maintained Fire Danger at Very High or Extreme continuously for nearly two days. Under these conditions these fires developed and became uncontrollable very quickly, with massive advance spotting (including 6 km across the Pumicestone Passage to Bribie Island) and burning at more than 3.6km hour (Hunt *et al* ²⁴). Based on these conditions and assuming high overall fuel hazard, the rates of spreads for fire scenarios are shown in **Figure 2**. The most northerly scenario (starting near Woodford) is a very general approximation of the Beerburrum fire.

These scenarios show that based on the real life conditions experienced in the Beerburrum fires that:

- ▶ The capacity of the landscape to support large fires can develop in a short time where rainfall deficiencies occur (below average rainfall commenced only four months prior to the Beerburrum fires); and
- ▶ Based on fire history (**Section 1.1**) a previous wet season one or two years before may generate enhanced fuel loads in the landscape, which are able to support landscape fires.

²⁴ Hunt, S., Hamwood, R. and Ollerenshaw, S. (1995) *Beerburrum Wildfires - September & November 1994*. Report by the Wildfire Investigation Committee



The November 1994 Beerburrrum Fire spotted 6km over the Pumicestone Passage, starting significant fires on Bribie Island.

LEGEND

Fire Spread (Indicative)	1100 Hours	1300 Hours	1400 Hours	1500 Hours	1600 Hours	1700 Hours	Ignition Points
	1200 Hours						State Controlled Roads
						Waterbodies	Local Government Boundaries

- Assumptions:**
- Potential fire runs based on a Westerly or North-Westerly wind stream
 - All runs based on an 11:00 AM commencement
 - Fire behaviour based on 7 November 1994 Beerburrrum Fire
 - Rate of Spread ~4kms per hour
 - During the 1994 Beerburrrum Fire the fire danger remained at severe or extreme (FFDI > 50) for more than 7 hours
 - Fire spread 'ellipses' are based on an approximate 6:1 ratio

1:350,000 (at A4)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56



Moreton Bay Regional Council
Moreton Bay Bushfire Management Plan

Job Number 41-23979
Revision 0
Date 03 NOV 2011

Fire Spread Scenarios (Indicative) Figure 3

N:\AU\Toowoomba\Projects\41\23979\GIS\Maps\4123979_12.mxd 201 Charlotte Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com.au
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Data source: Geoscience Australia - Place Names, LGA Boundaries (2009). Navteq - Major Roads, Waterbodies (2008). ESRI - Shaded Relief (2009). GHD - Fire Spread (Indicative), Ignition Points, Oceans (2011). Created by: CM



- ▶ A bushfire can develop and cover significant distances in short period. For the scenarios shown a fire starting and making run over a two hour period could start:
 - east of Woodford and have reached the rural subdivisions of Wamuran;
 - in the D'Aguilar National Park and moved east of Mt Delaney;
 - in the D'Aguilar National Park west of Mt Mee and reached Ocean View;
 - in the D'Aguilar National Park and reached the western part of Lacey's Creek; and
 - in the D'Aguilar National Park north of the Northbrook Parkway and reached the western parts of Mt Glorious.

Under these scenarios fires will be impacting on more developed areas by late afternoon and spot fires may be developing in advance of the fire front. These scenarios do not include the possibility of a southerly or south-westerly wind change that would significantly increase the fire 'footprint'.

- ▶ Fire can quickly cut off communities with little or no warning considering that there may be a lag time from initial smoke sighting to confirmation of actual fire location, then issuance of advice to communities;
- ▶ Smoke impacts would be even more broadly dispersed, contributing to more widespread community anxiety, and placing increased pressure on control agencies, managing the fires, traffic and community messages; and
- ▶ As a fire spreads and reaches more developed areas there may be a significant chance of life and property loss from direct fire impacts, ember attack and motor vehicle accidents.

2.4 Risk Ranking of MBRC Localities

Localities within MBRC have been ranked according to risk, based on proximity to hazard and consequence. This order of risk is derived from previous studies (Landmarc 2003²⁵, Institute for International Development 2008²⁶) and reviewed as part of the stakeholder workshop for this project. Each locality was also reviewed against the general risk factors (**Section 2.1.2 - 2.1.6**) with a summary provided in **Table 9**. Those areas adjoining or within large expanses of vegetation recorded the highest risk ranking (D'Aguilar and Conondale ranges, Highland rural) with those in consolidated urban areas a lower ranking (Urban core, Urban fringe). All localities were considered to have a Very High ignition factor. The risk ranking for MBRC localities follows.

Across these localities, there may also be areas of higher localised risk such as pockets of vegetation located next to high consequence assets (such as a nursing home), and a small fire burning within such an area may also have significant consequences. Where such areas are reserves managed by MBRC, specific measures to mitigate this risk (such as prescribed burning or asset protection zone establishment) should be incorporated into individual reserve mitigation plans (**Section 4**).

²⁵ Landmarc (2003) Final Report for the Bushfire Management Study. Report prepared for Pine Rivers Shire Council, September 2003

²⁶ Institute for International Development (2008) Caboolture Shire Natural Disaster Risk Management Study. Report prepared for Caboolture Shire Council, March 2008



Highest



Lowest

1. *D'Aguilar Range and Conondale Range* (Bellthorpe, Jollys Lookout, Mount Nebo, Mount Glorious, Mount Delaney, Neurum and Stony Creek);
2. *Highland rural* (Cedar Creek, Clear Mountain, D'Aguilar, Delaneys Creek, Lacey's Creek, Mount Pleasant, Mount Mee, and Woodford);
3. *Foothills rural* (Armstrong Creek, Bracalba, Campbells Pocket, Camp Mountain, Draper, Kobbie Creek, Kurwongbah, Rocksberg, Samsonvale, Wamuran, Wamuran Basin, Whiteside and Yugar);
4. *Non-urban residential* (Bunya, Cashmere, Closeburn, Elimbah, Highvale, Mount Samson, Rush Creek, Samford Valley and Wights Mountain);
5. *Rural* (Booroobin, Cedarton, Commissioner's Flat, Dayboro, King Scrub, Ocean View, Samford Village and Stanmore);
6. *Coastal* (Beachmere, Donnybrook, Godwin Beach, Meldale, Ningi, Sandstone Point and Toorbul);
7. *Urban hills* (Arana Hills, Eatons Hill, Everton Hills and Ferny Hills);
8. *Urban fringe* (Banksia Beach, Bellara, Bellmere, Bongaree, Brendale, Burpengary East, Clontarf, Dakabin, Griffin, Joyner, Kallangur, Rothwell, Kippa-Ring, Mango Hill, Moodlu, Moorina, Narangba, Upper Caboolture, Warner, Welsby and White Patch); and
9. *Urban core* (Albany Creek, Bray Park, Burpengary, Caboolture, Caboolture South, Deception Bay, Lawnton, Margate, Morayfield, Murrumba Downs, North Lakes, Petrie, Redcliffe, Scarborough, Strathpine and Woody Point).



Table 9 General Risk Factor Overview for MBRC Localities

	Surrounding Landscape	Proximity of vegetation on adjacent lands	Vegetation type/spotting	Surrounding land use	Surrounding and topography access	Ignition	Detection	Initial attack	Sustained attack
D'Aguilar Range & Conondale Range	VH	VH	VH	VH	VH	VH	H	VH	VH
Highland rural	VH	H	VH	H	VH	VH	M	H	H
Foothills rural	H	H	H	H	H	VH	M	H	H
Non-urban residential	H	H	H	M	H	VH	L	M	M
Rural	H	H	M	H	H	VH	L	H	M
Coastal	M	M	L	M	M	VH	L	M	M
Urban hills	H	M	M	L	M	VH	L	L	L
Urban fringe	M	L	L	L	L	VH	L	L	L
Urban core	L	L	L	L	L	VH	L	L	L



3. Shared Responsibility

Amongst fire and emergency services, and many of their partners, bushfire risk management is widely regarded as a **shared responsibility**. With this management principle comes an obligation, and a significant challenge, to educate the community in particular of the important role that individuals have in managing bushfire risk and personal safety. Local government has a key share of the responsibility for bushfire risk management, as a both a land manager, and custodian of local knowledge about bushfire risks and local community safety issues.

The following statements elaborate on the importance of 'shared responsibility' as a key principle for bushfire risk management:

The Australasian Fire and Emergency Service Authorities Council (AFAC), of which the Queensland Fire and Rescue Service (QFRS) is a member, views the concept of shared responsibility as follows:

*AFAC believes managing risk and reducing loss is a **shared responsibility** between government, householders, property owners and land managers. Fire agencies and some land management agencies have statutory responsibilities for managing bushfires. However, the steps that householders and business owners take to prepare for bushfires are crucial to the protection of their life and property. Communities need to be assisted in building their resilience to be able to better cope with bushfires. AFAC, 2010²⁷*

In relation to shared responsibility QFRS state:

*Perhaps the greatest single challenge is the need to promote a **shared responsibility** between individuals, the community and emergency services. QFRS will never have sufficient resources to meet all demands placed on it, or expected of it during major emergencies. When a bushfire threatens a community there is a hard choice by the firefighters on-site to save what property they can with the resources available, should the community's measures to protect their individual property be overwhelmed. QFRS, 2008²⁸*

The Victorian Bushfires Royal Commission (VBRC) considered the notion of shared responsibility in some depth, devoting a whole chapter of their report to its consideration. The VBRC noted:

*Pervading the Commission's report is the idea that **responsibility** for community safety during bushfires is **shared** by the State, municipal councils, individuals, household members and the broader community. A fundamental aspect of the Commission's recommendations is the notion that each of these groups must accept increased responsibility for bushfire safety in the future and that many of these responsibilities must be shared. VBRC, 2010²⁹*

²⁷ AFAC (2010) AFAC Submission to the Senate Select Committee on Agricultural and Related Industries Inquiry into Bushfires in Australia. Australasian Fire and Emergency Service Authorities Council (AFAC), Melbourne

²⁸ Queensland Fire and Rescue (2008) *Foundations of the Queensland Fire and Rescue Service*. Report prepared QFRS, Kedron Queensland.

²⁹ 2009 Victorian Bushfires Royal Commission. & Teague, Bernard (2010) *2009 Victorian Bushfires Royal Commission : final report* 2009 Victorian Bushfires Royal Commission, <http://www.royalcommission.vic.gov.au/Commission-Reports>



The recent Special Inquiry into the 2011 bushfires in the Perth Hills, undertaken by former Federal Police Commissioner Mick Keelty was titled 'A Shared Responsibility'. The report emphasised:

*The Special Inquiry strongly believes that bushfire risk management is a **shared responsibility**, which relies upon all relevant agencies and community members working together effectively. This shared responsibility, understanding and commitment needs to be underpinned by contemporary and relevant policies and legislation, effective coordination mechanisms at the State and local level and active engagement with local communities.* M. Keelty, 2011³⁰

3.1 The Implications of 'Shared Responsibility' For Local Government

There are a number of partners in the 'shared responsibility' model for bushfire risk management in MBRC. Key areas of responsibility include:

Responsible Organisation/ Individual	Responsibilities
Queensland Fire and Rescue Service	<ul style="list-style-type: none"> ▶ Build and maintain fire and rescue service delivery capability, providing 24/7/365 service provision, appropriate to the levels of risk; ▶ Design and deliver community safety/preparedness policies and programs aimed at reducing the occurrence of preventable bushfires, and increasing the resilience and safety of communities at risk from bushfire (this includes developing appropriately researched bushfire safety policy approaches, consistent messages for use across QFRS and by program delivery partners, and appropriate self-help systems and advice for community use); ▶ Design and develop programs to assist those in the community who are unable, or less able, to engage in self-help preparedness activities; ▶ Issue advice and warnings to communities regarding seasonal and daily fire danger, and fire threat warnings when fires occur; ▶ Respond to bushfire events as they occur, to manage public safety and minimise adverse fire consequences; ▶ Provide advice to Local Governments in relation to bushfire safety requirements for developments in the iZone (fire prone land); and ▶ Community education.
Department of Community Safety	<ul style="list-style-type: none"> ▶ Develop State Planning Policy (presently SPP 1/03) and implementation guidelines for mitigating the adverse impacts of bushfires (and other natural hazards including floods and landslides); and ▶ Community education.

³⁰ Keelty, M. (2011) *A shared responsibility : the report of the Perth Hills Bushfire February 2011*. Review for the Government of Western Australia, Perth WA



Responsible Organisation/ Individual	Responsibilities
Local Government (see also <i>Land Managers</i>)	<ul style="list-style-type: none"> ▶ Implement State Planning Policy 1/03; ▶ Manage fuels and bushfire risk on Council managed lands; ▶ Take appropriate measures to inform local communities about bushfire risks in the Council area, and raise awareness regarding the suite of self-help actions land owners and occupiers can take to reduce their bushfire risk (tailored to the locally prevailing risks), and where to obtain information about how to undertake such self-help actions; and ▶ Community education.
Members of Local Communities - Property Owners/Occupiers and Individuals	<ul style="list-style-type: none"> ▶ Make appropriate efforts to understand the level of bushfire risk in their area; ▶ Families/Businesses/Individuals should plan ahead how they will respond in the event of becoming aware a bush fire poses a potential threat to their property (eg. go early plan, or prepare stay and defend plan); ▶ Families/Businesses/Individuals who value their home/business and wish to maximise its chances of survival in a bushfire should maintain their home and property/garden in a condition such that the likelihood of garden/house ignition during a bushfire is minimised (this is regardless of whether the occupants plan to prepare, stay and defend or go early); and ▶ Families/Businesses/Individuals should take appropriate action to stay informed about daily fire danger levels and fire activity in their area.
Land Managers (such as Local Government, DERM, SEQWater, FPQ, Unity Water, Main Roads)	<ul style="list-style-type: none"> ▶ Maintain fire risk management infrastructure in a condition that it is safe and effective to use in the event of a fire (eg. maintaining fire trails in an appropriate condition); ▶ Managing fuels on their property such that they do not pose unacceptable risks to others, or to firefighters that may need to enter their land to contain/extinguish fires. This includes monitoring (fuel and moisture levels) and preparing areas identified for prescribed burning, participating in and supporting fire authorities and volunteers in prescribed burning, mop up and patrol, and undertaking post fire recovery actions on lands for which they are responsible; and ▶ Take reasonable measures to minimise the occurrence and spread of fires from their land.
Lifeline Infrastructure Managers (such as communication, electricity, water utilities, gas and access)	<ul style="list-style-type: none"> ▶ Take reasonable measures to prevent their infrastructure from starting fires, and becoming unserviceable or dangerous in the event of fire; and ▶ Plan ahead for lifeline infrastructure service restoration in the event that services are disrupted by fires.



For Councils, meeting the reasonable obligations under 'shared responsibility' arrangements entails:

- ▶ Having in place appropriate planning staff training programs and quality assurance systems that ensure that SPP 1/03 is applied appropriately to new development;
- ▶ Maintaining in-house capacity or engaging external services to develop appropriate fire risk management plans for Council managed lands, and capacity to implement planned activities including fuel reduction burning. QFRS is able to provide a lead role in the delivery of prescribed burning, largely completed by QFRS unpaid volunteers. However there is an expectation that this is supported by the responsible land manager (Council) completing the preparatory work for the prescribed burn, as well as the follow up fire mop up and fire patrol components (the evening after and over subsequent days), and the post fire monitoring;
- ▶ Developing and making available locally relevant information that assists residents and businesses to develop awareness about local bushfire risks, and make wise decisions about preparedness for, and response to bushfires. This includes providing areas where local residents wishing to 'go early' can safely assemble, information on safe routes to get there and how to maintain awareness of bushfire situation development. Equally important as developing the information is taking appropriate measures to ensure such information is communicated to residents at risk (see **Section 5**); and
- ▶ Building and maintaining professional relationships and inter-operability protocols/procedures with 'shared responsibility' partners to facilitate smooth response operations when high-tempo emergency incidents occur.

3.2 Queensland Floods Commission Findings Relevant For Fire?

There are key parallel emergency management themes and recommendations identified by the Queensland Floods Commission of Inquiry relevant for Local Government, which are as applicable for floods as well as a range of other natural hazards including bushfire. Should there be a subsequent inquiry into a future natural hazards event, it is highly likely the recommendations from the flood inquiry will be considered in the context of that event.

These recommendations identified the need to advise, in a structured approach, those community members susceptible to natural hazard impacts of:

- ▶ How to prepare;
- ▶ Who to contact;
- ▶ What warnings mean;
- ▶ How to obtain information;
- ▶ What should I do;
- ▶ How do I evacuate; and
- ▶ How are those requiring special attention (such as the young, elderly or those with special needs) are catered for?

While State level planning and guidelines can provide generic preparedness and response arrangements and guidelines, to maximise effectiveness, the inquiry identified that these need to be tailored to local risks and circumstances, as an appreciation of such risk and circumstances is likely to be best understood at the local level.



Among the relevant recommendations identified by the flood inquiry were:

Floods Commission Recommendation 3.4

Every local government susceptible to flooding should ensure that, before the next wet season, its local disaster management plan:

- ▶ *Is consistent with the Disaster Management Act 2003;*
- ▶ *Addresses local risks and circumstances; and*
- ▶ *Can be used easily in the event of a disaster.*

Floods Commission Recommendation 3.13

Before the next wet season, local governments susceptible to flooding should conduct community education programs which provide local information about (at least) the following topics:

- ▶ *The measures households should take to prepare for flooding;*
- ▶ *The roles and functions of the SES and details of how to contact and join it;*
- ▶ *Whom to contact if assistance is needed during a flood;*
- ▶ *Contact details for emergency services in the area;*
- ▶ *The types of warnings that are used in the area what they mean and what to do in the event of a warning;*
- ▶ *Where and how to obtain information before, during and after a disaster;*
- ▶ *What is likely to happen during a disaster (for example, power outages and road closures);*
- ▶ *Evacuation; and*
- ▶ *Measures available for groups who require particular assistance (for example, the elderly, ill and people with a disability).*



4. Bushfire Management Planning for Council Lands

Among numerous other things, MBRC is a land and asset manager. As such MBRC has obligations to manage its land holdings and assets responsibly. In bushfire prone areas, responsible land management incorporates responsible fire management, and asset management should incorporate measures to reduce the risk of loss or damage by bushfire.

4.1 Land and Fire Management Obligations

MBRC, and its predecessors, have previously identified that Council has an obligation to manage bushfire risks arising from its land and reserves, including undertaking appropriate and responsible fuel management measures. This acceptance of responsibility has long been affirmed as appropriate, as found in the audit review of bushfire strategies for Queensland (QES, 1994)³¹ which recommended that Councils with 'significant rural-urban interface area be encouraged to appoint Fire Management Officers to implement and oversee fire management planning in accordance with guidelines developed by the Queensland Fire Service'.

It is noteworthy that both the A.C.T. Government, and State and Local Governments in Victoria (actions relating to the Canberra fires of 2003 and Black Saturday fires of 2009 respectively) are presently defending potentially very high consequence legal actions against them which incorporates aspects of negligence in carrying out their land and fire management functions, particularly as they relate to fire trail maintenance and fuel management.

The Australasian Fire and Emergency Services Authorities Council is currently undertaking the National Burning Project that incorporates the development of National frameworks to assess fuel and smoke risk. When prepared these frameworks may provide MBRC with a consistent approach to assess fuel and smoke risk of mitigation options for its lands.

As well as the risk component, MBRC also has an objective to maintain and enhance the vegetation communities which it manages. This includes the application of prescribed fire to maintain vegetation guided by appropriate ecological burning intervals, either developed by MBRC or using intervals such as those identified by Watson (2001)³².

4.2 MBRC Land Portfolio

In total council manages a land portfolio totalling 9,820 hectares (**Figure 10**). This includes bushland reserves, and tracts of bushland in areas designated for Linear Linkage, Conservation, Environmental, and bushland areas within Council owned community facilities including, among other things, aquatic centres, dog pounds, waste facilities, and road reserves. Not all of these lands will require fuel management activities, however a presently unknown number will.

³¹ QES, (1994) *Bushfire strategies for Queensland: audit review recommendations implementation plan*, Queensland Emergency Services, Brisbane.

³² Watson, P (2001) *The role and use of fire for biodiversity conservation in South-east Queensland*. Fire management guidelines developed by the SE Queensland Fire and Biodiversity Consortium.



Table 10 MBRC's Land Portfolio as Recorded in MBRC Databases

MBRC Database	Total ha.	No Parcels Over 1000 m ²
Bushland Recreation	3,630	307
Conservation	422	4
Environmental	263	21
Linear Linkage	1,609	532
TOTAL	5,924	864
Councils total land portfolio	9,820	

4.3 Council Property and Land Attribute Data

Spatial data is required to undertake the analysis and planning of where, how much and how often fuel management activities should take place. As a minimum, the following spatial datasets are required to facilitate appropriate fire management planning on MBRC managed lands:

- ▶ Reserve/property locations and boundaries;
- ▶ Vegetation types within the properties (mapped and ground truthed);
- ▶ Roads and fire trails locations and classifications;
- ▶ Council asset locations and types (including community recreation areas);
- ▶ Aerial imagery of sites;
- ▶ Fire history (bushfire and prescribed burning);
- ▶ Topography (contours/digital elevation data); and
- ▶ Threatened species occurrence data.

Desirable additional information includes:

- ▶ Water points and fire hydrant locations;
- ▶ Locked gate/access locations;
- ▶ Lifeline infrastructure locations and classifications (eg. overhead powerlines; above ground water pipelines; telecommunications towers/facilities); and
- ▶ Spatial information on weed distributions.

Recommendation 1

MBRC take action to assemble the necessary land and asset management data to facilitate appropriate fire management planning for Council's lands.



4.4 Fire Management Planning For Council Managed Lands

MBRC undertakes a range of fire management activities on its lands including:

- ▶ Maintenance of roads and fire trails;
- ▶ Clearing and slashing of fire breaks;
- ▶ Fuel reduction works including burning (burn planning, stakeholder and fire authority liaison, site preparation and burn implementation);
- ▶ Community consultation activities; and
- ▶ Support for bushfire response, prescribed burning and mop up/patrol. While QFRS are able to supply volunteers to participate in burn delivery, it is expected that the land manager undertake the burn preparations, and provide the personnel to complete the prescribed burning/bushfire mopping up, burning out and patrol (including overnight and subsequent days) activities.

Presently these activities are planned on an ad hoc basis – largely on the basis of priorities assessed by MBRC’s Fire Management Officer and concerns/requests raised by local communities or neighbours, or other agencies such as QFRS.

A more structured and strategic basis for planning fire management works would be beneficial.

There is no standard format prescribed by the State, at any scale (Local Government Area; Landscape Unit; Township, Reserve or specific burn unit) for fire management planning in Queensland – it is a matter for local governments to develop and adopt bushfire planning standards appropriate to their area and risks. Various models are in place in other parts of South-East Queensland. Gold Coast City Council and Redland City Council presently have in place the most consistent and systematic bushfire planning processes of south east Queensland Councils.

Gold Coast City Council prepares bushfire management plans for its reserves by grouping reserves into planning area ‘clusters’. This is so as to reduce the number of plans required due to the large number of highly dispersed reserves. For each area a Bushfire Management Plan (Planning) and a Bushfire Management Plan (Operations) is produced. These are map and text box based and each is compiled in a single page format for production at A1 sheet scale. GCCC has clustered their reserves into 10 planning areas. Consultants were engaged to prepare the plans.

The Bushfire Management Plan (Planning) are at strategic level, categorising reserve areas into different fire management zones, management units, identifying the vegetation types they contain and identifying fire regimes and environmental safeguards to be applied. They do not contain any form of work or activity schedules, so this remains as a major area of work for Council to undertake.

The Bushfire Management Plan (Operations) is not a strategy document, but brings together highly summarised procedural guidelines, information or standards to be applied when conducting prescribed burn planning/operations and during bushfire response operations. Their main operational value lies in the map which brings together fire trail location and classification information and locations of water tanks.

The GCCC bushfire management plans have many strengths but also have substantial areas for improvement. Therefore GHD considers that MBRC should implement a bushfire risk management planning process that builds on the good work undertaken by GCCC but improves upon this by addressing gaps and weaknesses in their planning process.



From 2009, Redland City Council (RCC) has also been undertaking a fire management planning process. RCC's fire planning documentation consists of a Fire Management Framework, Operational Guidelines, and site-specific Bushfire Action Plans focussed on their bushland/conservation reserves.

The RCC Fire Management Framework document is not a strategy or a plan, rather it is a reference document identifying fire management objectives, zoning systems used in planning, governance arrangements, and RCC positions on a range of fire management matters. It does not contain risk assessments or differentiate different types or levels of risk, nor does it establish work programs or priorities. The RCC Operational Guidelines are at a tactical level, establishing standards and/or work practice guidelines for a range of operational activities.

The RCC's Bushfire Action Plans identify the types, locations and standards to which asset protection, fuel management, fire trail maintenance and emergency service access requirements are to be maintained. These plans, whilst more activity oriented than GCCC plans, do not establish work schedules. Like the GCCC plans they have strengths and weaknesses and can be improved upon.

4.4.1 MBRC Plan Scoping and Area Coverage

GHD recommends the following planning approach be adopted in MBRC:

- ▶ A clustering approach similar to that undertaken by GCCC be adopted (areas could be scoped on a rural fire brigades, or groups of brigades basis);
- ▶ A single plan be developed in each area (MBRC reserve or cluster of reserves) focussing on fuel management zoning, fire trail management, and prescribed burning works. GHD notes that this plan does not need to duplicate information that is currently prepared for fire suppression or response in relevant iZone Local Action Plans(LAPs) prepared by QFRS. The MBRC Bushfire Risk Mitigation plan as such is not a suppression or response document;
- ▶ The single page Bushfire Risk Mitigation Plan be designed for A1 scale and contain the following elements:
 - Map (using aerial imagery as base layer) depicting:
 - Main settlements/population centre names;
 - Roads and fire trails;
 - Cadastre/tenure;
 - Major contours;
 - Fire breaks requiring annual maintenance works;
 - Locations and boundaries of Council reserves;
 - Fuel management units in each reserve and their fuel management zoning;
 - Areas burnt by wildfire in the last 7 years;
 - Separate smaller vegetation type/group map;
 - Text box indicating the bushfire risk factors, including the risks associated with mitigation actions;
 - Text box/table listing appropriate fire regimes by vegetation type (such as from SEQ F&BC or locally developed alternatives);



- Text box/table indicating threatened species and whether they are likely to be adversely impacted by low intensity burning works within nominated fire regime thresholds;
- Table containing a schedule of Bushfire Mitigation Works for the next 5 years;
 - Fire trail inspection and maintenance;
 - Fire break and road verge vegetation maintenance;
 - Fire season preparedness actions for vulnerable assets within reserves;
 - Nominal year of burn for units to be treated in next 5 years;
- Table containing a schedule of bushfire awareness program activities for local communities;
- Any work/activity/access restrictions in reserves for escalating FDR; and
- Contact details and communications arrangements for partner agencies.

Note: To avoid cluttering the plans, standards and procedures relating to particular work/activity types should be documented in a separate overarching bushfire mitigation works procedures manual. This would draw heavily on guidelines already documented in the SEQ Fire and Biodiversity Consortium fire manuals and ecological guidelines, and where appropriate, Council (including RCC) operational guidelines.

Finding:

MBRC does not presently have a systematic or consistent approach/method to strategic planning of bushfire mitigation on the land it manages.

Recommendation 2

MBRC implement a bushfire risk mitigation planning program across its network of reserves, along the lines outlined in Section 4.4.1 of this strategy. Noting the volume of work to be achieved, a staged delivery schedule for plans should be considered, and in-sourced versus out-sourced development options considered. The risk ranking of localities (Section 2.4) can be used to prioritise plan preparation.

4.5 Undertaking Fire Management Works

Planning and undertaking bushfire mitigation works requires significant effort, resources and timeframes. Specific requirements to develop and implement a prescribed burn for an area designated in a work schedule to be burnt are well documented (Tran and Peacock 2002³³), and will generally require the following process:

1. Assess fuels to confirm the scheduled burn unit does need burning in the scheduled year;
2. Assess the need for any trail or containment line works to be undertaken in preparation for the burn and organise for this to be done;
3. Assess whether the burn can be conducted entirely within Council lands or whether adjacent non-council lands may need to be included in the burn. If so, undertake the necessary neighbour consultation/negotiation to incorporate their property into the burn;

³³ Tran C. and Peacock C. (2002) *Fire Management Strategic Manual: Guidelines for Planning and Implementing a Council or Shire Wide Fire Management Strategy*. SEQ Fire and Biodiversity Consortium



4. Assess the risks to be managed during the burn (control/escape risks; asset damage risks; burn crew and public safety risks; cultural heritage and environmental issues; smoke management issues) – schedule and organise any preparatory works required for management of these risks;
5. Identify the resourcing requirements (internal and external) necessary to undertake the burn, and organise the necessary resources to be available for when the burn is to be scheduled;
6. Undertake neighbour/community/stakeholder consultation processes for the burn;
7. Prepare the burn plan (including burning prescriptions, safety plan and lighting patterns) and have it authorised to proceed;
8. As the scheduled burn period approaches, monitor fuel and weather conditions to confirm a day for burning – confirm the burn date and time with participating resources;
9. Undertake neighbour/community/agency notification processes communicating the confirmed date for the burn;
10. Conduct the burn and monitor until declared complete/safe; and
11. Assess and record details of the burn results and any follow up work that may be required (eg. second stage works to remedy areas where desired results were not achieved; any weed control follow up works)

The process outlined above requires significant planning effort by personnel skilled and experienced in planned burning works, and takes place over a period of weeks or months. It is often the case in local government that the same people who manage the annual bushfire mitigation works program, also do the detailed planning for each burn activity, organise and oversee the preparatory works, and supervise or conduct the burning operations. Therefore, where a significant program of burning works is scheduled, capacity issues will need to be examined to ensure program delivery is feasible with allocated resources and whether surge capacity can be obtained from other agencies or external service providers. Surge capacity can often be obtained for burning works implementation (eg. local brigade resources) but is usually in short to negligible supply for burn planning activities.

To ensure successful delivery of burning works programs, the annual 'batch' of burning works needs to be treated similar to a project, with project management systems and works scheduling applied.

Recommendation 3

Annual works programs, as derived annually from mitigation works schedules in MBRC Bushfire Risk Mitigation Plans, be organised into an annual work package and managed in accordance with project management principles.

4.6 Council Capacity to Undertake Fire Management Planning and Works

In order to cost-effectively plan and deliver a program of bushfire mitigation works appropriate to managing Council's bushfire risks, it is necessary to consider which activities will be undertaken by internal staff, the internal resourcing requirements, what activities can be out-sourced and the financial resources required to achieve this.

As MBRC is yet to prepare Bushfire Risk Mitigation Plans for all reserves (**Section 4.4**) and gain a comprehensive picture of mitigation works required (**Section 4.5**) it cannot presently be assessed



whether or not current resourcing levels are sufficient to undertake the range of recommendations identified in this strategy. It is highly likely that resourcing levels may need to be enhanced to meet MBRC's shared responsibility obligations. The likelihood that resourcing levels will need to be enhanced is on the basis that:

- ▶ MBRC has ahead of it a substantial task to prepare Bushfire Risk Mitigation Plans;
- ▶ MBRC has ahead of it a significant task to prepare Community Bushfire Preparedness Guides;
- ▶ MBRC has ongoing requirements to continue prescribed burning programs on its lands – depending on the outcomes of mitigation planning efforts this requirement may increase; and
- ▶ MBRC has ongoing requirements to continue other programs of fire trail maintenance, fire break and fire-prone road verge maintenance, and supporting partners in community education program delivery.

In assessing internal resourcing requirements for system development and program delivery, it will be necessary for MBRC to consider how long the transition period (for developing plans and systems) from the current situation to the desired ongoing delivery situation will be. This will be constrained by budget, and it will be necessary to consider what mix of internal and external resources will be used to achieve this.

Recommendation 4

Once MBRC area fire management plans are in place, and works program volumes are therefore quantifiable, assessment of resource requirements for works delivery should be undertaken. This assessment should consider a mix of permanent full-time internal resources, seasonal part-time resources, volunteer and partner provided resources, and resources acquired on a project basis by contract.



5. Community Awareness and Preparedness Programs

The Victorian Bushfires Royal Commission (VBRC) identified as a key outcome that contemporary approaches to community bushfire awareness and preparedness at the time of the Black Saturday fires may have contributed to the unprecedented number of fatalities. As such there has been a significant change in emphasis in community awareness and preparedness programs.

The VBRC critically reviewed the (former) nationally adopted bushfire policy, also known as the '*prepare, stay and defend or go early*' policy. Under this policy, communities residing in, visiting or working in bushfire prone areas were advised to prepare their own personal 'bushfire survival plans', and in times of elevated fire danger were issued with generic warnings to 'activate' these plans. The VBRC hearings heard that of those people living in areas impacted by the bushfires:

- ▶ A high proportion of people didn't have any bushfire survival plan at all;
- ▶ Of those that did, many didn't fully appreciate the conditions they would face in staying to defend (many changed their mind at the last minute, some were trapped with inadequate capability to defend), and a large number of individuals did not have the sufficient expertise to prepare an adequate bushfire survival plan; and
- ▶ A high proportion of people will actually adopt a 'wait and see' strategy (which in practice becomes a go late as fire threatens, or shelter in a low survivability prospect situation strategy).

In this context, the VBRC made a range of recommendations relating to community bushfire awareness, preparedness and warnings. The first three of the VBRC's 67 recommendations are reproduced at **Figure 4** with yellow highlighting added.

Following the VBRC, fire and emergency services have revised community preparedness planning approaches, with increased emphasis given to community awareness and preparedness program development. Some features of materials being developed in Victoria and NSW include:

- ▶ Planning scales have been brought down to specific communities-at-risk level so that information and messages can be tailored to the needs of local residents;
- ▶ Messages about levels of local bushfire risk and the factors that drive the risk are more 'direct' than in the past (explanation goes further than just stating an area is 'high fire risk') and include some description of what potential fire behaviour could be anticipated;
- ▶ Messaging is explicit that in the event of a fire, residents 'should not expect a fire truck at their property', and there is no guarantee fire authorities will be able to issue timely warnings of approaching fire that will allow early evacuation;
- ▶ Messaging emphasizes that even if your plan is to go early, if you want to enhance your home's prospects of survival you will need to undertake appropriate maintenance and preparedness – if your plan is to stay and defend, then your survival may depend on you having made such preparations;
- ▶ Emphasis is given to 'going early' being the safest option, with added emphasis that this entails leaving the night before on the most extreme days;

- ▶ Locally specific advice is given on where the location of safe places to relocate to are, with route and distance information provided;
- ▶ Local radio and emergency broadcaster details, websites and emergency contact details are identified to assist people maintain awareness about the local fire situation; and
- ▶ A local map showing the location of Neighborhood Safer Places (of last resort) and key community facilities such as hospitals, fire and police stations.

VICTORIA'S BUSHFIRE SAFETY POLICY

RECOMMENDATION 1

The State revise its bushfire safety policy. While adopting the national Prepare. Act. Survive. framework in Victoria, the policy should do the following:

- enhance the role of warnings—including providing for timely and informative advice about the predicted passage of a fire and the actions to be taken by people in areas potentially in its path
- emphasise that all fires are different in ways that require an awareness of fire conditions, local circumstances and personal capacity
- recognise that the heightened risk on the worst days demands a different response
- retain those elements of the existing bushfire policy that have proved effective
- strengthen the range of options available in the face of fire, including community refuges, bushfire shelters and evacuation
- ensure that local solutions are tailored and known to communities through local bushfire planning
- improve advice on the nature of fire and house defendability, taking account of broader landscape risks.

RECOMMENDATION 2

The State revise the approach to community bushfire safety education in order to:

- ensure that its publications and educational materials reflect the revised bushfire safety policy
- equip all fire agency personnel with the information needed to effectively communicate the policy to the public as required
- ensure that in content and delivery the program is flexible enough to engage individuals, households and communities and to accommodate their needs and circumstances
- regularly evaluate the effectiveness of community education programs and amend them as necessary.

RECOMMENDATION 3

The State establish mechanisms for helping municipal councils to undertake local planning that tailors bushfire safety options to the needs of individual communities. In doing this planning, councils should:

- urgently develop for communities at risk of bushfire local plans that contain contingency options such as evacuation and shelter
- document in municipal emergency management plans and other relevant plans facilities where vulnerable people are likely to be situated—for example, aged care facilities, hospitals, schools and child care centres
- compile and maintain a list of vulnerable residents who need tailored advice of a recommendation to evacuate and provide this list to local police and anyone else with pre-arranged responsibility for helping vulnerable residents evacuate.

Figure 4 2009 Bushfires Royal Commission Excerpt



This community preparedness guidance is one of the most important activities for supporting community safety, as there is always a residual risk that other strategies such as mitigation works and emergency response will be overwhelmed during large scale emergency events – it is imperative that communities understand their risk and know what to do in the event of fire so they can take the self-help measures to ensure their survival. State and local governments have a shared responsibility in making communities aware of local risks and options available to them in the event of life-threatening fires threatening their community.

Finding:

Individuals understanding their local bushfire risks, how they can prepare themselves and their property to reduce risks, and what to do in the event of a fire or extreme fire danger is critical to maximising their chances of survival. QFRS presently have a template for Bushfire Survival Plan preparation (within their on-line booklet *Bushfire Survival Plan - Prepare Act Survive*) on their website. However there is presently no locally tailored information for residents who, based on the recent Victorian experience, either will not have a plan or will have prepared a plan that is unrealistic or inadequate. In light of the recent VBRC findings and recommendations the lack of localised emergency community preparedness guides is a gap to be addressed.

Recommendation 5

MBRC implement a program of preparing locally tailored Community Bushfire Preparedness Guides in partnership with QFRS for its communities in High and Moderate Risk bushfire areas. One consistent format/template should be used for such plans (see GHD sample in **Appendix A** for Mount Nebo).

Recommendation 6

When prepared, Community Preparedness Guides should be sent out to all properties (to the property occupiers rather than rate-payers, to ensure renters receive the information) prior to the bushfire season.

Recommendation 7

MBRC should liaise with QFRS and local brigades to devise strategies as to how MBRC Community Preparedness Guides can be integrated into other QFRS and brigade Community Safety program activities undertaken locally.



6. Land Use Planning Provisions and Controls

Purpose of bushfire risk mitigation in the planning system

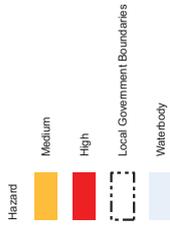
The overarching aim of Queensland's planning policies, framework and systems in relation to bushfire risk is to ensure that new development does not significantly increase the threat to life and property from bushfire.

In bushfire prone areas of MBRC, bushfire can present serious risks to the safety of communities. The bushfire hazard of MBRC has been modelled according to SP01/03 (*Figure 5*). However the effective mitigation of bushfire risk requires an integrated approach involving development planning and building standards, consideration of fire risk in land management, fire and emergency service delivery, and importantly, bushfire awareness, preparedness and survival planning by home owners and occupiers and others (eg businesses and facility managers). Within a broader, integrated approach to bushfire risk mitigation, the MBRC's planning provisions play an important role in reducing bushfire risk through a range of mechanisms:

- ▶ Preventing development from occurring in areas where the bushfire hazard characteristics make it too dangerous to develop;
- ▶ Preventing inappropriate development (fire hazardous or especially vulnerable developments) from occurring within or in close proximity to bushfire prone areas;
- ▶ Establishing subdivision design standards that provide adequate access and egress by communities in the event of bushfire, and by fire/emergency services responding to fires/emergencies;
- ▶ Applying standards for utility infrastructure and services that meet the needs of emergency services;
- ▶ Applying appropriate standards for separation of housing developments and individual homes and buildings from fire prone vegetation, thereby reducing bushfire attack levels and providing for defensible space; and
- ▶ Applying appropriate standards for access to water for safety and bushfire defence by home owners/occupiers and fire and emergency services during fires.

The degree to which bushfire risk mitigation measures applied through the planning system can be effective will be significantly affected by the extent to which other complementary bushfire risk mitigation measures are applied (noting MBRC cannot control building or construction standards). In particular, the degree to which individual home owners maintain their home and property, and both plan and prepare for bushfire survival are vitally important. GHD's review of MBRC's planning scheme is provided in *Appendix C*, and an overview of mitigation measures follows.

Bushfire Hazard



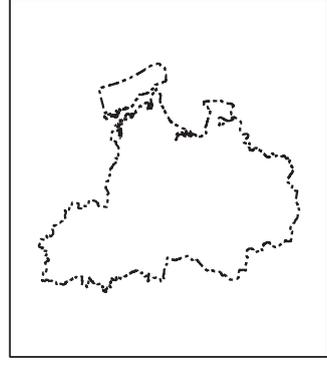
Data Sources: Moreton Bay Regional Council (2011) - Calabre
 Local Government Boundaries, Place Names, GHD (2011) - Bushfire Hazard,
 Waterbody.

While GHD has taken care to enable the accuracy of this product,
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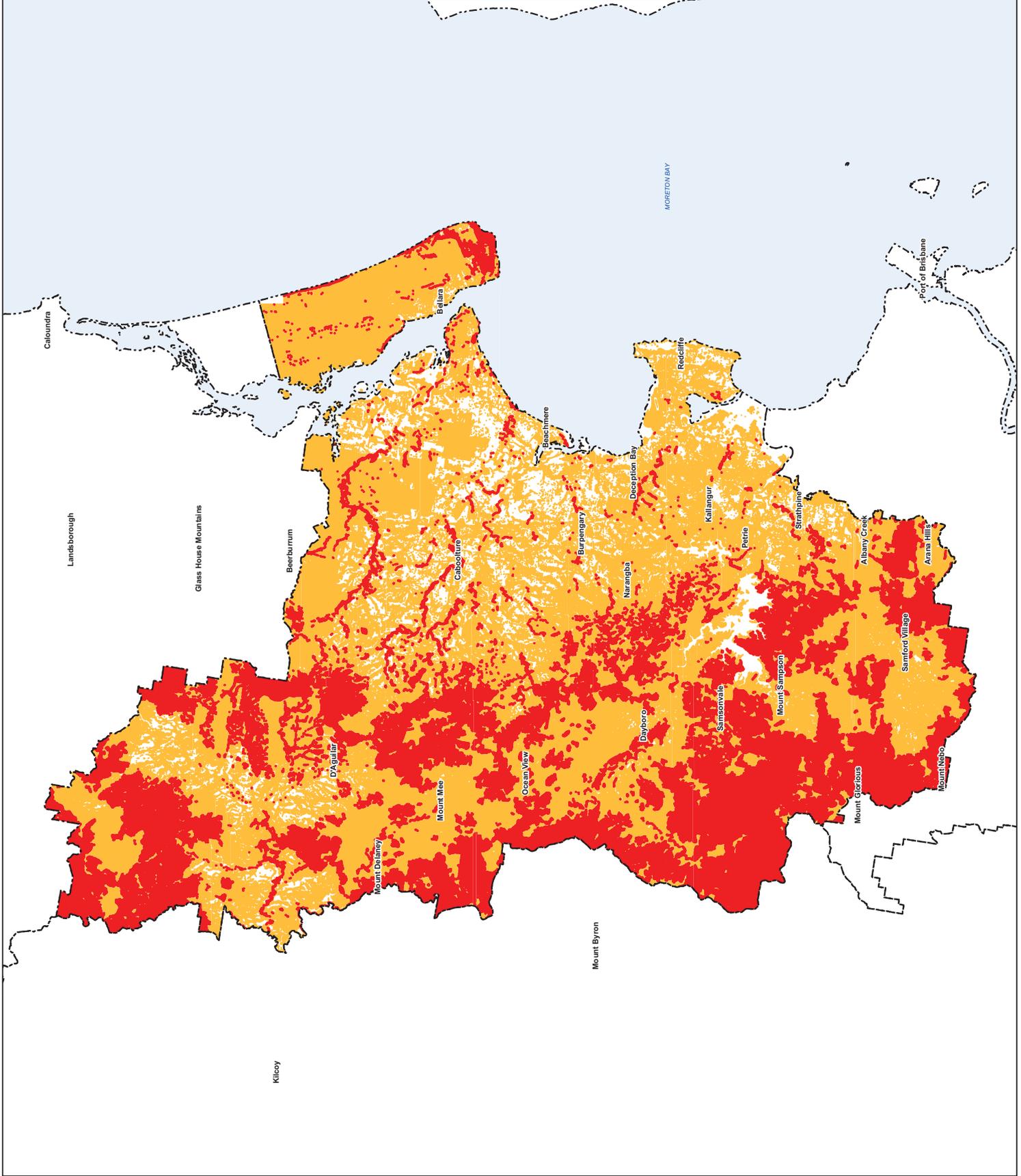
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Map Projection: Universal Transverse Mercator
 Horizontal Datum: Geocentric Datum of Australia 1994
 Grid: Map Grid Of Australia, Zone 56

Approx Scale @ A3 1:275,000



XXX Overlay Map - XX





6.1 Overview of Bushfire Mitigation Measures

6.1.1 Assessment of Whether a Site is too Dangerous to Develop

With regard to bushfire risk, some areas are just too dangerous to develop.

There are areas where local site characteristics have a combination of factors which make the site very dangerous in the event of a bushfire. Critical factors include poor access which impedes safe egress in the event of a fire, steep topography which can significantly escalate bushfire intensity, remote location which can make evacuation to a safe area long, difficult and potentially dangerous, the extent and nature of bushfire hazardous vegetation in a locality, and an inability to provide houses and buildings with adequate setbacks from fire-prone vegetation and defensible space.

Adequate setbacks from vegetation are particularly important. Without adequate setbacks, houses can be subject to direct flame attack and/or levels of radiant heat that can break glass windows and ignite combustible building components or combustibles adjacent to the house. Further, inadequate setbacks may preclude the possibility of defending a house against ember attack and to facilitate safe evacuation from the house in the event of unforeseen arrival of bushfire. It is not considered reasonable to expect that vegetation setbacks and defensible space be accommodated on bushfire-prone land other than that being developed. Therefore, the ability to provide adequate setbacks within the boundaries of property proposed for development is a key factor in assessing whether areas are too dangerous for development.

6.1.2 Controlling Development Types

Certain forms of development may be inappropriate in an area exposed to bushfire hazard. Some development types have potential to start bushfires or create additional significant hazards if they are impacted by a bushfire. Such uses include, but are not limited to: chemical/hazardous/flammable type industries, liquid fuel depots, service stations, sawmills, junk yards and power generation plants etc. Some development types may be used by fire-vulnerable groups which would be difficult to protect and evacuate in the event of an approaching bushfire (eg. child-care facilities, schools, aged-care facilities, and hospitals).

Appropriate planning aims to avoid exposure of fire-hazardous and fire-vulnerable developments to inappropriate levels of bushfire risk.

6.1.3 House/Building Siting

Bushfire risk for a specific property can vary considerably depending on the slope and vegetation characteristics and proximity. Wise selection of a house site within a property can maximise the separation of the house from vegetation, and minimise the degree to which slope influences fire behaviour at the house site, while having regard to other house site function and amenity issues.

Consideration of bushfire hazards in building site selection seeks to achieve the following outcomes:

- ▶ Avoid, or reduce to levels appropriate to the proposed building design, the potential for building exposure to direct flame contact and hazardous levels of radiant heat;
- ▶ Reduce the intensity of ember attack to which a building is exposed during a bushfire;
- ▶ Avoid exposure of home owners/occupiers and their visitors to life-threatening levels of radiant heat exposure during access and egress from properties while evacuating or defending the building during a bushfire; and



- ▶ Maximise the dimensions of defensible space for home owners/occupiers and fire/emergency services in the event of a bushfire.

These siting factors are considered in combination with other bushfire risk mitigation factors including, landscaping/ vegetation management, access to water supply and community education programs promoting emergency planning, property preparedness and maintenance.

6.1.4 Defendable Space

Defendable space around buildings which are subject to a bushfire hazard is of critical importance to assist in the protection of people and property. Defendable space is an area of reduced bushfire hazard around a building such that house ignition from direct flame contact or radiant heat is unlikely. The appropriate dimensions for a defendable space will depend on the site characteristics of individual sites, based on an assessment of vegetation type, slope, and aspect. Individual site assessment is required to determine the appropriate level of defendable space recommended by the Queensland Fire and Rescue Service (QFRS).

In accordance with QFRS guidance, defendable space is also known as the *Vegetation Management Zone*, which is comprised of an *Inner Zone* (in which the aim is to eliminate direct flame contact) and two *Outer Zones* (Outer North Western Zone and Outer Eastern Zone) in which the aim is to reduce fire intensity to a level that house ignition is unlikely. The total area of defendable space for a property is the combined Inner and Outer Zones.

The area closest to the building forms the Inner Zone, and requires a greater degree of intensive vegetation management than those in the Outer Zones. The Inner Zone is fixed at a minimum of 10 metres, regardless of surrounding vegetation type or slope, whilst the Outer Zone will vary in accordance with a bushfire risk assessment based on aspect and measurement of vegetation type and slope.

Both the Inner and Outer Zones around a building typically coincide with the area in which landscaping and garden design are considered. It is therefore important to ensure that landscape and garden designs take into account the requirements for ongoing maintenance of Inner and Outer bushfire protection zones. Use of plant species, and planting designs that are inconsistent with Inner and Outer Zone requirements are to be avoided.

The area defined as defendable space also provides a workable area in which residents, fire-fighters and other emergency services personnel can undertake property protection activities when fire conditions have moderated to appropriate levels, to undertake evacuation of occupants, including vulnerable people with restricted mobility and to defend structures against ember attack and moderating fires.

6.1.5 Construction Standards

For development on land which is known to be subject to bushfire hazard, it is necessary for preliminary consideration of construction techniques and standards to be undertaken at the planning permit stage. This is required to ensure the building design and layout specifically responds to the particular bushfire hazard presented on the specific site. This is also required to ensure there is consistency between the planning system and the building system with regard to the addressing bushfire risk and mitigation.

There is a requirement to undertake a site assessment to determine the Bushfire Attack Level (BAL) for a specific property at the building construction stage. Where the site characteristics result in a high BAL rating, and thereby pose some increased difficulties, higher levels of construction and design standards may be required. Australian Standard 3959 (AS/NZS 3959:2009) prescribes the relevant building construction standards for each specific BAL.



There are only limited opportunities for building design to be regulated by a planning scheme in Queensland. While it is acknowledged that considering construction techniques and standards should occur at the planning approval stage, the opportunities to do this in reality are limited. While a BAL assessment is required at the building construction phase, it is not required at the planning approval stage. It would be advantageous to know what the construction standards are so that Council can determine if and how the planning scheme may accommodate them during the design of a proposal that requires planning approval.

Specific design considerations should address various building elements, including building siting and associated locations and protection of windows. By providing opportunity for Australian Standards for building construction to be considered at the planning approvals stage, it seeks to achieve a greater degree of interaction between the planning and construction systems during the design and development of a project.

6.1.6 Access

When considering the design of new subdivisions, the design of access roads (both public and private), should aim to provide safe vehicular access, egress and defensible space for emergency services.. Application of appropriate access standards (relating to road width, alignment, slope, turning circles, passing bays, reversing space, clearance and construction standards etc.), assists residents, fire fighters, emergency service workers and those involved during evacuation and response in a bushfire incident.

Fire trails are also important as they facilitate access for fire management activities (such as fuel reduction) in areas adjoining defensible spaces. Safe property access and access for maintenance of defensible space should also be applied to other forms of development, noting that there may also be a focus on landscaping, construction standards and other bushfire protections measures.

6.1.7 Water Supply

The availability of an adequate water supply for fire fighting purposes is essential when considering all forms of development. The provision of an adequate water supply also requires adequate water pressure to assist with bushfire suppression operations.

Requirements for access to water supply differ depending on the individual circumstances of a site, however water supply can be provided by existing hydrant infrastructure or static water supply (such as a tank). Specific standards also apply to below ground water pipelines and above ground pipelines and fittings, which are required to be constructed of non-corrosive and non-combustible materials.

With regard to various other utility services it is important to ensure that they do not contribute to bushfire risk. Consideration should be given to ensure utility services such as gas and electricity are located so as not to contribute to the risk of fire or impede fire fighting efforts.

6.1.8 Other

There is no 'one size fits all' approach to the management and mitigation of bushfire risk. Accordingly, the above designated bushfire risk mitigation measures do not constitute an exhaustive list of appropriate considerations necessary to respond to a bushfire hazard. Having a clear understanding and appreciation of the characteristics of a site, and the characteristics of the bushfire hazard will inform the range of bushfire risk mitigation measures which may be required to be implemented.



6.1.9 Alternative Solutions

Planning provisions, these guidelines and guidance prepared by DCS/QFRS set out policy and guidance on what is acceptable risk mitigation in different circumstances. In some instances, a particular site opportunity or constraint may mean that an alternative solution would achieve the same outcome but in a different way. Where a planning application proposes an alternative solution it must be justified to the satisfaction of the relevant fire authority having regard to the policy and guidance contained in planning schemes and this document.

6.2 Non-Planning System Risk Mitigation

The planning system constitutes only a small part of the overall systems, processes and legislative frameworks which seek to address bushfire hazard and risk mitigation. The planning system assessment framework predominantly comes into play through specific development proposals, which provides the trigger for the bushfire hazard and risk to be assessed in terms of the proposed development. However the planning system does not and is not able to function as a retrospective assessment tool to consider existing properties and wider communities which are subject to bushfire risk.

For existing properties, residents and communities subject to bushfire hazard, there are other systems, process and legislation which have a formal responsibility to consider bushfire risk mitigation. This includes responsibilities both at the State, and Local levels of Government, including, but not limited to emergency services protocols, evacuation plans and procedures, and local fire management strategies/plans.

6.3 Legacy Issues

Like other Australian States, the planning scheme provisions pertaining to bushfire in Queensland are not applied retrospectively and therefore there are significant 'legacy' issues existing in MBRC whereby developments and residential properties have been constructed in the past that do not comply with current planning provisions and building standards. These areas are likely to be at substantially higher bushfire risk than areas developed to contemporary bushfire planning and building requirements. Examples of legacy issues include asset protection zones that were a condition of approval that have subsequently been left to shrub up, planted out and/or fuel hazard added (such as landscaping woodchips) significantly enhancing overall fuel hazard in an area identified to be kept free of fuel. Other ongoing property management issues are described below.

6.4 Ongoing Property Management Issues

Once a development is approved there are no ongoing mandatory compliance requirements for the property owner to maintain bushfire mitigation measures that may have been an approval condition.

Issues can include:

- ▶ Inadequate maintenance of cleared areas around residences to keep them free of vegetation and hazard. Inadequate maintenance may be purposeful (owner prefers revegetation of cleared areas), by neglect (no willingness to pay for maintenance or can't be bothered), through practical difficulties maintaining areas such as steep slopes, the capacity of the owner to complete the maintenance (age or financial), or for aesthetic reasons;
- ▶ Subsequent installation of structures or storage areas that increases the fire risk to the residence;
- ▶ Inadequate maintenance of private access tracks; or



- ▶ Whilst such property management issues are a matter for individual property owners to address, MBRC will raise community awareness of the existence of these issues through community awareness programs with our partners (QFRS) and identification of such issues in MBRC Community Preparedness Guides.

Recommendation 8

MBRC to review planning scheme provisions based on the information identified in this strategy.



7. Partnerships and Liaison During Response

MBRC is not a firefighting authority, and should not seek to take on such a role. For bushfire hazards, this role is undertaken by QFRS and the volunteer bushfire brigades. However, MBRC is a land manager, and has responsibility for managing fuels and maintaining appropriate fire regimes on its lands. Therefore, MBRC will need to maintain an operational fire management capacity appropriate to its land management responsibilities. This includes:

1. Maintain sufficient prescribed burning capacity (skilled people and resources for safely undertaking burning) to deliver its annual works programs;
2. Support QFRS during firefighting operations through the provision of local knowledge about hazards and risks associated with MBRC lands and assets; and
3. Maintain sufficient capacity to mop up and patrol fires deemed by QFRS to be in a state of containment suitable for handing control back to MBRC.

In relation to the above activities, it would be sub-optimal for MBRC to attempt building capacity to a level that all activities can be undertaken by MBRC resources without assistance from others. In theory, if MBRC were to pursue resourcing levels capable of dealing with peak work-loads, there would be substantial non-peak periods when excess capacity exists potentially resulting in under-utilisation if alternative work programs do not require supplementation. Therefore, the optimal strategy for MBRC will be to resource such that resourcing levels are adequate to carry out routine activities/workloads, and have in place partnerships/flexible arrangements for increasing resourcing to meet peak period demands.

For prescribed burning, MBRC should maintain sufficient resources to carry out typically standard risk moderate complexity burning operations, but have in place partnering arrangements that allow MBRC to work collaboratively with volunteer brigades and QFRS career staff (and other agencies - eg. QPWS and FP QLD - as deemed appropriate) for large or complex operations.

For supporting QFRS during fire response operations, MBRC should focus on having current and accurate information documented regarding the nature of hazards, assets, and features available to support response operations (such as fire trails, breaks, and water points) on its lands. Provision of staff to fulfil liaison roles during fire incidents/emergencies should also be planned for.

During bushfire response operations, it is usual for QFRS and volunteer brigades to lead and undertake fire suppression, however it is not always possible for them to maintain ongoing patrol and mop-up operations once a fire is contained as this may be required for many days or weeks during which time suppression resources may need to be available for response to other fires. Therefore, land managers such as MBRC will need to maintain an appropriate degree of capacity to undertake mop-up and patrol on fires where QFRS require the land manager to take responsibility for these functions.

The level of resourcing appropriate for MBRC to maintain will be strongly influenced by the requirements of MBRC's prescribed burning program. As quantitative requirements for burn program planning and implementation cannot be determined until fire management plans have been developed, MBRC resourcing requirements cannot be accurately assessed until such plans with their annual works



programs have been developed. In the interim, there is a need for MBRC to identify and formalise partnering and mutual support arrangements with other local land managers with fire management capacity and with fire and emergency service agencies.

Recommendation 9

MBRC to develop a fire management resourcing partnership/mutual support strategy, and formalise arrangements for exchange of resources (eg. through Memorandums of Understanding).



8. Recovery

Both planned burning and bushfire suppression operations can have impacts that require recovery phase activities including rehabilitation of temporary or adversely impacted fire trails and breaks, and control of post-fire weed response. Failure to address such risks promptly following fire can result in greatly increased restoration costs down the track. For bushfire suppression operations, it is advantageous to plan rehabilitation work requirements during the suppression operations so that these can be effected while machinery are still on site and potentially funded as part of the suppression operation. Short-term emergency works for stabilisation or rehabilitation can then be during or immediately following fire suppression operations to protect life and property, water quality and catchment values, and to prevent degradation of natural or cultural assets.

Significant environmental impacts following a fire include soil erosion, reduced water quality, poor recruitment of native vegetation, impacts on threatened species and cultural heritage sites, and the spread of weeds, pests and pathogens. **Table 11** provides potential options for rehabilitation against anticipated causes of damage from bushfire within the MBRC Reserves.

Table 11 Post Fire Rehabilitation Options

Cause	Potential Impacts	Recovery Options
New access trails constructed	Increased maintenance costs Erosion	Assess trails immediately after fire event Options will be dependent on whether the trail is useful for other purposes or is strategically located for future fire management Close and install erosion controls and/or keep and upgrade to a stable, trafficable surface Assess disturbed areas for weed infestations 6-12 months after fire event Implement primary weed and follow up weed control
Damage to existing fire access trails	Erosion Widening to an excessive width Weed infestation	Assess trails immediately after fire event Install temporary and permanent erosion controls Revegetate damaged areas and restrict access Assess disturbed areas for weed infestations 6-12 months after fire event Implement primary weed and follow up weed control



Cause	Potential Impacts	Recovery Options
Vegetation removed	Soil instability Increase in weeds Reduced habitat and shelter for animals and increased predation Increased grazing/browsing or regeneration flora	Natural and/or assisted revegetation Assess disturbed areas for weed infestations 6-12 months after fire event Post-fire pest and weed control, and access restrictions Seek advice from DERM if threatened species or ecosystems affected Control of pests and overabundant species
Damage to unknown Aboriginal sites	Artefacts could be damaged Artefacts can be exposed	If artefacts are found notify DERM for advice

For weed management, pre-planning is required which considers what the major weed species present in MBRC are, how they respond to fire, what are the optimal treatments to minimise major weed species outbreaks/proliferation after fire, and what will be the likely consequences of delaying action or not acting at all.

As with the greater South-East Queensland region, there are a significant number of weeds that may occur in MBRC reserves including:

- ▶ Lantana;
- ▶ Grasses such as Rats Tail Grass, Giant Rats Tail Grass, Whiskey Grass;
- ▶ Groundsel;
- ▶ Mother of Millions;
- ▶ Camphor Laurel; and
- ▶ Exotic vines and creepers such as siratro and asparagus fern.

Weed response following a bushfire or prescribed burn will vary by reserve, burn intensity, post fire conditions and species.

8.1 Monitoring

Monitoring prescribed burning operations is an important component of any fire management or fuel reduction burn program. Monitoring allows an assessment of the fuel reduction burn in meeting its objectives and to guide recovery actions. It may also allow MBRC to:

- ▶ Assess the need for fire rehabilitation/environmental recovery works;
- ▶ Adjust future fuel reduction burning activities;
- ▶ Rapidly detect and control infestations of weeds and pests;
- ▶ Evaluate the impact of the imposed fire regime on conservation;
- ▶ Monitor and 'fine tune' recovery programs (e.g. erosion controls, revegetation);
- ▶ Establish and/or 'fine tune' fire regime requirements for conservation of threatened species and biodiversity; and
- ▶ Evaluate the impact and value of fuel reduction burns.



A basic post fire monitoring schedule that may be utilised for both prescribed burns and bushfires is provided as **Table 12**. Improvements to the schedule can be made through the development of a more scientific method of study such as the pre-burn establishment of survey transects and quadrants and the subsequent recording of floristic data.

All records should be entered on a suitable database, or at least kept together with the fire report to facilitate reporting and analysis of impacts.

Table 12 Basic Post Fire Monitoring

When	What	How	Who
Immediately after fire	The burn area (size and location) including presence of unburnt islands.	GPS burn area perimeter and internal unburnt islands Aerial imagery 'Marking up' topographic maps to be digitised and converted to a GIS shapefile	MBRC
	Extent of scorch and combustion.	Measure scorch height Measure fuel load remaining (utilise <i>Overall Fuel Hazard Assessment Guide</i> (Hines <i>et al.</i> 2010)) Note % of ground cover remaining	MBRC
	Determine if threatened species or endangered communities are affected.	Review previous records and studies	MBRC
	Presence of severe disturbance caused by fire suppression operations.	Record and map disturbance areas such as newly created firebreaks, dozer trails, and heavy trafficked areas	MBRC
	Presence of Aboriginal sites/relics	Record if exposed & notify and seek advice from DERM	MBRC
6, 12, and 24 months after a fire	If relevant, the presence or absence of threatened species or communities (timing may need to be adjusted to suit the growth stage of the plant).	Survey previous known sites and note presence/absence and numbers Survey surrounding areas for the emergence of additional populations or individuals	MBRC
	Presence of overabundant native species, weeds, and feral animal pests.	Observations, sightings, scats and markings Evidence of excessive browsing/grazing Identification of weeds species	MBRC



When	What	How	Who
	The progress and effectiveness of rehabilitation works. Additional rectification works.	Review progress against rehabilitation plans (if prepared) Note and record continued presence of environmental degradation	MBRC
4, 8, and 12 years after the fire	The progress and effectiveness of rehabilitation works. Identify additional rectification works.	Review progress against rehabilitation plans (if prepared) Note and recorded continued presence of environmental degradation	MBRC
	Presence of overabundant native species, weeds, and feral animal pests.	Observations, scats and markings Evidence of excessive browsing/grazing Identification of weeds species	MBRC
	Fuel hazard accumulation	Undertake Overall Fuel Hazard Assessment	MBRC / QFRS

A fuel hazard monitoring and recording procedure consistent with the *Overall Fuel Hazard Assessment Guide* (Hines *et al.* 2010) should be undertaken targeting areas where fuel management is a priority (SFAZs and APZs) or where concerns about fuel levels have been raised to confirm if treatment should be applied.

Objectives for APZs and SFAZs and subsequent mitigation works/fuel reduction works identified in the Bushfire Risk Mitigation Plan for that MBRC Reserve (**Section 4**) should reflect the desired overall fuel hazard level.

Recommendation 10

MBRC should prepare guidelines/procedures for recovery and rehabilitation planning during bushfires, to optimise efficiencies and external funding opportunities for recovery works.

Recommendation 11

MBRC should develop post-fire weed management guidelines which identify how the major MBRC weed species are likely to respond to fires, and how best to minimise weed outbreaks post-fire.



9. Recommendations

The following is a list of the recommendations identified within this report.

Recommendation 1

MBRC take action to assemble the necessary land and asset management data to facilitate appropriate fire management planning for Council's lands.

Recommendation 2

MBRC implement a bushfire mitigation planning program across its network of reserves, along the lines outlined in **section 4.4.1** of this strategy. Noting the volume of work to be achieved, a staged delivery schedule for plans should be considered, and in-sourced versus out-sourced development options considered.

Recommendation 3

Annual works programs, as derived annually from mitigation works schedules in MBRC area fire management plans, be organised into an annual work package and managed in accordance with project management principles.

Recommendation 4

Once MBRC area fire management plans are in place, and works program volumes are therefore quantifiable, assessment of resource requirements for works delivery should be undertaken. This assessment should consider a mix of permanent full-time internal resources, seasonal part-time resources, volunteer and partner provided resources, and resources acquired on a project basis by contract.

Recommendation 5

MBRC implement a program of preparing locally tailored Community Bushfire Preparedness Guides, in partnership with QFRS, for its communities in High and Moderate Risk bushfire areas. One consistent format/template should be used for such plans. (See GHD sample for Mt Nebo).

Recommendation 6

When prepared, Community Preparedness Guides should be sent out to all properties (to the property occupiers in rather than rate-payers to ensure renters receive the information) prior to the bushfire season.

Recommendation 7

MBRC should liaise with QFRS and local brigades to devise strategies as to how MBRC Community Preparedness Guides can be integrated into other QFRS and brigade Community Safety program activities undertaken locally.

Recommendation 8

MBRC to review planning scheme provisions based on the information identified in this strategy.



Recommendation 9

MBRC to develop a fire management resourcing partnership/mutual support strategy, and formalise arrangements for exchange of resources (eg. through Memorandums of Understanding).

Recommendation 10

MBRC should prepare guidelines/procedures for recovery and rehabilitation planning during bushfires, to optimise efficiencies and external funding opportunities for recovery works.

Recommendation 11

MBRC should develop post-fire weed management guidelines which identify how the major MBRC weed species are likely to respond to fires, and how best to minimise weed outbreaks post-fire.



Appendix A
Mt Nebo Community Protection Plan



This highland township of 302 persons (2006 census) is situated on the D'Aguiar Range. Under **Severe, Extreme** or **Catastrophic** fire danger Mount Nebo is at extreme risk from bushfire due to the following risk factors:

- It is adjacent to continuous forested areas of National Park that can support a high intensity fast moving bushfire;
- Flammable native vegetation is extensive within the township both in bush reserves and on private properties – high intensity fires can spread within the township;
- A high proportion of houses are built in very close proximity to bushland, are not built to withstand bushfires and are not defensible in adverse fire weather conditions;
- Mount Nebo has access/egress routes which are very steep and run through forest, and therefore is vulnerable to, and may be cut off by, fires; and
- There is presently no approved Neighbourhood Safer Place in Mt Nebo, and relocation to safer localities north/east or south will involve road travel through fire prone forests – late evacuation can be a deadly option.

This *Community Preparedness Guide* is to assist you to **prepare** yourself, your family and your home for the threat of bushfire. You will need to **act** decisively in accordance with your [Bush Fire Survival Plan](#) as may not receive an official warning of a bushfire and cannot expect a bushfire tanker at your property. Your **survival** depends on your preparations and the decisions you make. This Guide contains important bushfire safety information and information sources to assist residents and visitors to make informed decisions to survive a bushfire.

PREPARE–ACT–SURVIVE

Protect your family – Protect your life

Every family in Mt Nebo is strongly encouraged to prepare a [Bush Fire Survival Plan](#)

Prepare: You must make important decisions before the fire season starts.

Act: The higher the fire danger the more dangerous are the conditions.

Survive: Fires may threaten you without warning so enact your plan to survive.

Important Emergency Contact Information

Emergency Information for local bush fire alerts

ABC Local Radio:	Listen to 612AM
Bush Fire Information Line	1800 MT NEBO or 1800 686 326
Rural Fire website	www.ruralfire.qld.gov.au
Road Closures	http://131940.qld.gov.au/ or ph:131 940

Other Information

Moreton Bay Regional Council website	http://www.moretonbav.qld.gov.au/
Moreton Bay Regional Council	(07) 3205 0555 - after hours (07) 3205 0555
Queensland Fire and Rescue	(07) 5420 1333
Queensland Fire and Rescue	www.fire.qld.gov.au
State Emergency Service	13 QGOV (13 7468)
Bureau of Meteorology	www.bom.gov.au
Crimestoppers	1800 333 000

IN AN EMERGENCY DIAL 000 (Text Emergency Call 106)

Do not call Triple Zero for information or advice. Calling Triple Zero unnecessarily may put others who are in a genuine emergency situation at risk.

Prepare

UNDERSTAND YOUR BUSHFIRE RISK

Mount Nebo is at extreme risk from bushfire, and a large landscape fire burning into Mount Nebo under higher fire danger is likely to have significant consequences. You, your family and your home may be at risk of fire, including ember attack, radiant heat and direct flame contact.

Assess the bushfire risk on your property – your home **may not** be defensible. **If your house is within the Flame Zone or Radiant Heat Zone, and is not built to current Australian Standards for Building in bushfire prone areas, it will not be safe to defend. Your only safe option is to leave early.**

If the distance ¹ between your house and vegetation is within:	
350 m	ember attack - one ember can result in house loss
100 m	You may be subject to: radiant heat - fatal to an unprotected person
50 m	direct flame zone - most structures cannot withstand
! These distances are extended on >20° sloping ground.	

REDUCE YOUR BUSHFIRE RISK

As your home may be at risk of bush fire you need to have a [bush fire survival plan](#). Your plan will help you make decisions that will give you and your family the best chance of surviving a bush fire, including:

1. How will you **Prepare, Act** and **Survive**?
2. Will you **Leave Early** or will you **Stay and Defend**? Leaving at the last minute **is not** an option and experience shows that it can be fatal.
3. What will your triggers be to act?
4. What will your back up plan be?

Update and practice your [bush fire survival plan](#) annually. Understand your risk by attending a community information session conducted by the Queensland Fire and Rescue Service.

PREPARE YOURSELF AND YOUR PROPERTY

Regardless of your decision to **Leave Early** or **Stay and Defend**, your property should be prepared for direct flames, radiant heat or ember attack from bushfire.

Your property is better prepared (even if you choose to go) and potentially defensible if by the start of the fire season (**annually before 1 September**) and during the fire season if you have:



✓	Sealed and painted gaps in external walls and cladding	
✓	Installed metal flyscreens or solid screens on outside doors and windows	
✓	Stored flammable items well away from the house	
✓	Kept garden mulch and woodchips more than 10 metres from house and grass kept very short	
✓	Underfloor areas and eaves are enclosed and roofs are intact	
✓	Trimmed overhanging trees and relocated flammable shrubs that are planted near windows, doors or the walls of your house	
✓	Private powerlines are trimmed clear of vegetation by an appropriately qualified and authorised person	
✓	Gutters, roof and downpipes are clear of leaves. Fit metal leaf guards	
✓	Checked your water supply is sufficient and not reliant on electricity and with long hose lengths	
✓	Purchased a battery powered radio. Mobile phone coverage at Mount Nebo is very limited and may not work in an emergency. Cordless handsets may not work.	
✓	Have you listed your phone numbers on the emergency callout database enabling us to contact / inform you? Call QFRS 07-5420-1333	

For all houses built in a bushfire prone such as Mount Nebo, if you have not undertaken these preparations your house may not be safe to defend.

LEAVING EARLY

Leaving early is always the safest option, preferably the night before or early in the morning on higher Fire Danger days. You should leave early when:

- **Severe, Extreme** or **Catastrophic** danger is forecast for **'South East Coast fire weather area'**.
- You are not physically or mentally prepared, and are not capable.
- Your house is not defensible.
- You are instructed by authorities to do so.

Where can you go? – Family and friends in a low fire risk area, a shopping complex or urban areas within Brisbane, or an evacuation centre (if activated and advised of by QFRS / Council).

STAY AND DEFEND

You cannot Stay and Defend without careful planning and preparation. In preparing your [bush fire survival plan](#) you need to carefully consider all the risk factors in developing your plan, and a backup plan. A decision to commit to the ordeal to Stay and Defend is very serious and should not be taken lightly.

¹ Zone dimensions are calculated using Australian Standard 3959-2009 (Building in bushfire prone areas) based a Fire Danger Index of 100 (Catastrophic) and fire burning up hill through forest on slopes of 15 to 20 degrees.

Maintaining Bushfire Awareness



- Monitor the Fire Danger Rating daily during spring and summer. This rating gives you an indication of the consequences of a fire, if it were to start.
- Listen for the Mount Nebo Emergency Warning System (see Bush Fire Alerts).
- As the Fire Danger Rating changes daily you must be prepared, as a bushfire can happen without warning.

Mount Nebo is in the South East Coast Fire Weather Area – Listen for Fire Danger or Total Fire Ban advice on ABC Local Radio 612 AM.

FORECAST FIRE DANGER RATING	WHAT YOU SHOULD DO?
CATASTROPHIC [Total Fire Ban]	For your survival, leaving early is the only option. Leave bush fire prone areas the night before or early in the day – do not just wait and see what happens as this can be fatal. Make a decision about when you will leave, where you will go, how you will get there and when you will return. Homes are not designed to withstand fires in catastrophic conditions, so you should leave early.
EXTREME [Total Fire Ban] Phase 2 Siren is sounded	Leaving early is the safest option for your survival - do not just wait and see what happens as this can be fatal. If you are not prepared to the highest level, leave early in the day. Only consider staying if you are prepared to the highest level – such as your home is specifically designed, constructed or modified, and is situated to withstand a fire, you are well prepared and can actively defend it if a fire starts.
SEVERE [Total Fire Ban] Phase 1 Siren is sounded	As for Very High plus Leaving EARLY is the safest option for your survival – notify Police at The Gap Station and School is redirected to Samford Primary. Well prepared homes that are actively defended can provide safety – but only if you are physically and mentally prepared to defend in these conditions. If you are not prepared, leave early in the day - do not just wait and see what happens as this can be fatal.
VERY HIGH	As for High / Low-Moderate plus Contain pets and animals so that they can be easily found; Check water pumps and generators and set up final house preparations; Listen out for the Emergency Siren and monitor ABC Local Radio 612 AM for information and Bush Fire Alerts Watch for signs of fire, especially smoke or the smell of smoke
HIGH	Review and prepare to activate your Bush Fire Survival Plan with your family.
LOW MODERATE	Keep yourself and your family informed, monitor conditions, and be ready to act if necessary.

Bush Fire Alerts

You may or may not receive an official Bush Fire Alert warning message of a bush fire that is threatening Mount Nebo. Some fires start so quickly there is not time for a warning. The Mount Nebo Emergency Warning System and bushfire alerts are as follows:

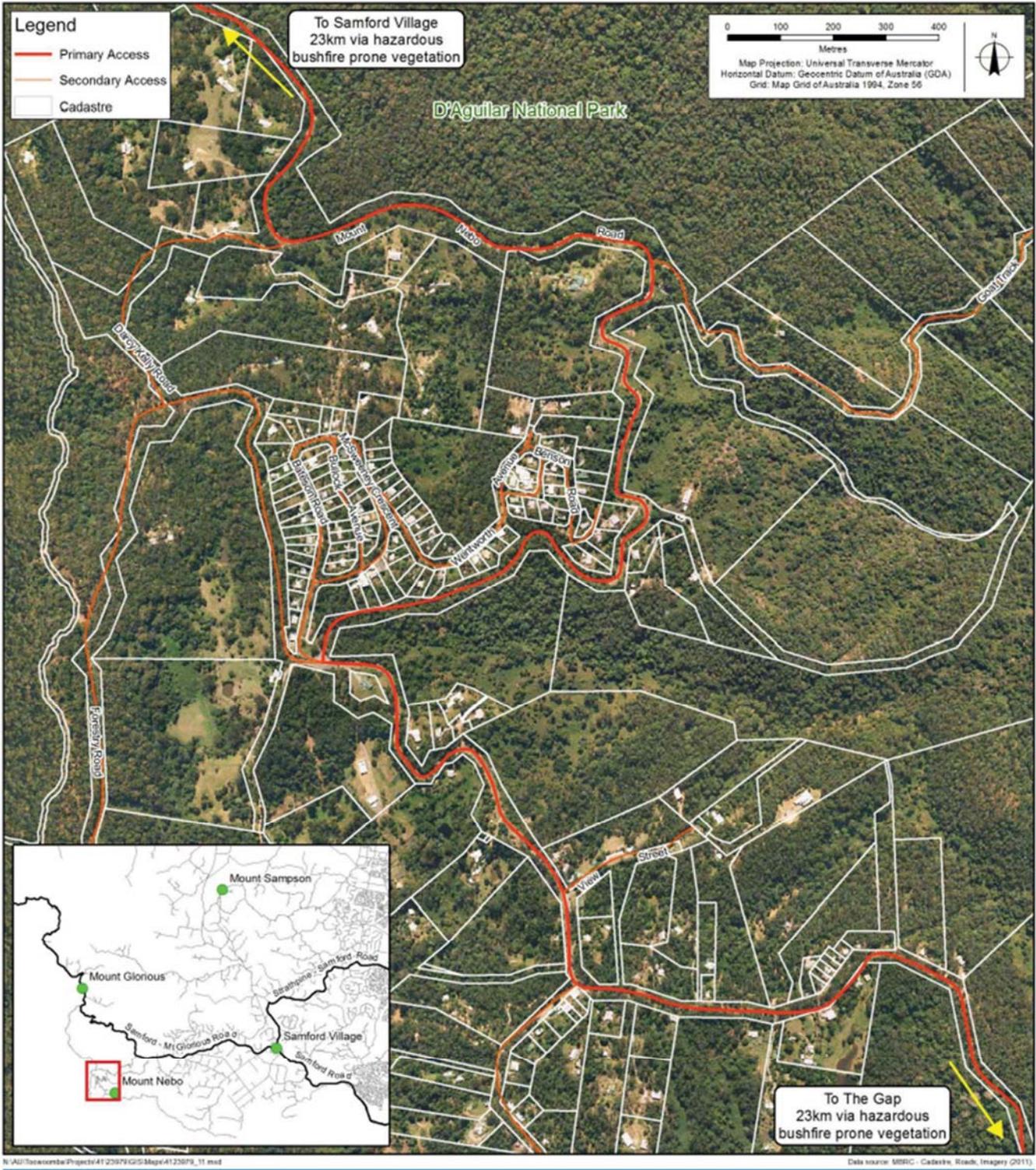
ADVICE / PHASE 1 ALERT	Severe fire danger rating, consider going Siren Sound:  Up/down/up Sounded at 5 PM, 7 PM, 7 AM & 12 NOON Leave EARLY, complete final house preparations, notify police at The Gap	A fire has started in the landscape Stay aware and consider going EARLY in case the situation changes
WATCH AND ACT / STAY OR GO NOW	Fire ignition and/or extreme fire conditions – still enough time to leave though you may <u>not</u> get time to evacuate Siren Sound:  Up/up/up Set up preparations for battening down and get moving • Stayers: engage your bushfire survival plan • Leavers: go to your chosen self-evacuation point and let Police at The Gap know you have left. School should have left	There is a heightened level of threat Conditions are changing and you need to start taking action now to protect you and your family
EMERGENCY WARNING / BATTEN DOWN	Immediate threat to life and property Evacuation no longer possible - you may be in danger and need to take action immediately - any delay now puts your life at risk. Siren Sound:  Constant Act in accordance with your Bushfire Survival Plan	This is the highest level of Bush Fire Alert

Leaving Late is Dangerous

- Fleeing at the last minute has proven to be fatal – activate your [bush fire survival plan](#) early.
- Traveling on the road is dangerous, visibility may be poor due to smoke and roads may be blocked by fallen trees or motor vehicle accidents.
- There is no neighbourhood safer place – place of last resort (NSP) at Mount Nebo.**

Mount Nebo Community Map

There is not a designated Neighbourhood Safer Place / Place of Last Resort at Mount Nebo



Disclaimer: © 2011. Whilst every care has been taken to prepare this map, GHD makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

► FURTHER INFORMATION

To prepare your bush fire survival plan, visit the Queensland Fire and Rescue website (<http://www.qfr.qld.gov.au>) or <http://www.qld.gov.au/Fire%20%26%20Safety%20%26%20Disaster%20%26%20Bushfire%20Survival%20Plans>) or call 1800 MT NEBO or 1800 686 326



Appendix B

Bushfire Mitigation Plan Template

Bushfire Mitigation Plan

This plan contains site specific information only for mitigation works

Site Resource Information

Location:

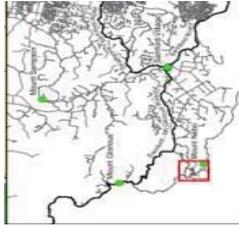


Figure 1. Locality Map (Example)

Risk Factors Table	Type of Fire that can be Supported	Type of Damage that can Result
RESERVE NAME		

Bushfire Characteristics: The site is Bushfire Prone due to fire prone vegetation in and adjacent to the XXXX part of the site. A bushfire generating ember attack to buildings in the southern part of the site is possible under adverse weather conditions. The most southerly of the XXXX may additionally be exposed to radiant heat attack or direct flame contact due to their close proximity to native vegetation in National Park.

Annual Bushfire Danger Period: 1 Oct - 31 Mar.

Access to the site is via XXX

Water can be sourced XXXX (see Figure 2).

Smoke sensitive receptors:

Site and Community Assets:

Fire Fighting Resources: QFRS

Relevant Zone Local Action Plans:

MAP - FIRE HISTORY

MAP - VEGETATION



Figure X. Main Map -- showing main settlements, roads and fire trails, cadastre / tenure, major contours, fire breaks requiring annual works, fuel management units in MBRC reserves, water points, major powerlines, natural and constructed assets

Bushfire Mitigation Works Program				
Works Type (one activity per line)	Reserve Name	Works Map Ref ID	Timing (Year/Season / Interval)	Procedures (including community consultation requirements) / Reference Standards / Contract
Fire Trail Inspection and Maintenance				
Asset Structure Preparation (Seasonal)				
Asset Break Preparation				
Fire Break Maintenance				
Fire Season Preparedness for Vulnerable Assets				
Prescribed Burning Works				
Other				

Vegetation Communities	Description	Fire Threshold
Community		
Threatened Species Sensitive to Mitigation Risk		
Species Name	Sensitivity / Risk	Fire Threshold
Needs to be followed up after mitigation works		
Species Name	Fire Response	Treatment
Bushfire Awareness Program for Local Communities		
Activity	Performance Indicator / Timing	Responsibility
Other issues for consideration in mitigation works (Cultural heritage, smoke receptors, road closures, powerlines, etc)		
Risk factor	Details	Response

Fire Danger Rating	Working Restrictions	Readiness/Emergency Warning monitoring
Low (FDI 1-4)		
Moderate (FDI 5-11)		
High (FDI 12-24)		
Very High (FDI 25-49)		
SEVERE (FDI 50-74)		
EXTREME (FDI 75-99)		
CATASTROPHIC (FDI 100+)		
All result in TOTAL FIRE BAN issue		

GHD

Level 8, Springfield Central QLD 4300
PO Box 4286 Springfield Central QLD 4300
T: (07) 3819 9500 F: (07) 3819 9599E: bnemail@ghd.com.au

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