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**Communities NSW
(Sport and Recreation)**

Southern Highlands Regional
Shooting Complex
Bushfire Management Plan

September 2010





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- A Property Bushfire Management Plan
- B APZ Maintenance Guide
- C Fire Trail Construction and Maintenance Guide
- D Bushfire Information and Fact Sheets
- E Bushfire Report Form
- F Indicative Fuel Monitoring Observations



Glossary of Terms/List of Abbreviations¹

APZ	A fuel-reduced, physical separation between buildings and bushfire hazards
Backburn	A fire started intentionally along the inner edge of a fireline during indirect attack operations to consume fuel in the path of a bushfire
BAP	Bushfire Awareness Program – Section 3 of the bushfire management plan (BMP)
Bark fuel ²	The bark on the bole and branches, either alive or dead, extending right back to the cambial layer
BFCC	Bush Fire Coordinating Committee
BKDI	Byram-Keetch Drought Index – see KBDI
Blacking Out	The process of extinguishing or removing burning material along or near the fire control line, felling stags, trenching logs to prevent rolling and the like, in order to make the fire safe.
BMP	Bushfire Management Plan
BMWS	Bushfire Mitigation Works Schedule – Section 2 of a BMP
BoM	Bureau of Meteorology
BRS	Bushfire Response Strategy – Section 4 of a BMP
Bushfire	An uncontrolled fire burning in forest scrub or grassland vegetation, also referred to as a wildfire
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 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. In general, a bushfire prone area is an area mapped for a local government area that identifies the vegetation types and associated buffer zones. Bush Fire Prone Land Maps are prepared by local councils and certified by the Commissioner of the RFS under section 146(2) of the <i>Environmental Planning and Assessment Act 1979</i>
Communities NSW	NSW Government agency, of which Sport and Recreation is a Division of.
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
DECCW	The NSW Department of Environment, Climate Change and Water

¹ Reference Source: Australasian Fire Authorities Council Wildfire Glossary and Planning for Bushfire Protection (NSW RFS 2006)

² Gould *et al* (2007a)



EEC	Endangered Ecological Community
Elevated Fuel Layer ²	Tall shrubs and other understorey plants without significant suspended material. This layer may include regeneration of the overstorey species intermixed with shrubs
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
FDR	Fire Danger Rating: A relative class, based on an FDI range, 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, High, Very High, Severe, Extreme or Catastrophic, indicating the relative evaluation of fire danger
Fine fuel ²	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
Fuel ²	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
ICS	Incident Command System
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
LMZ	Land Management Zone
Near Surface Fuel Layer	Grasses, low shrubs, creepers and collapsed understorey usually containing suspended leaf, twig and bark from the overstorey vegetation. The height of this layer can vary from a few centimetres to over a metre above the ground. Influences flame height and the rate of fire spread
NPWS	The NSW National Parks and Wildlife Service – part of the DECCW
NSF	Near Surface Fuels ³
NSWFB	New South Wales Fire Brigades

³ Hines *et al*, 2010



NSW RFS	New South Wales Rural Fire Service
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
RMC	Range Management Committee
RSPCA	Royal Society for the Prevention of Cruelty to Animals
SF	Surface Fuels
SFAZ	Strategic Fire Advantage Zone
SHRSC	Southern Highlands Regional Shooting Complex Incorporated. The property including the range and infrastructure, and surrounding buffer area to the property boundary
Surface Fuel Layer ³	Dead leaves, twigs and bark of overstorey and understorey plants (litter fuel)
UXO	Unexploded Ordnance
Water point	Any natural or constructed supply of water that is readily available for fire control operations
WIRES	Wildlife Information and Rescue Service



Introduction

Background

This Bushfire Management Plan (BMP) details the fire management objectives, strategies, actions and mitigation requirements for the Southern Highlands Regional Shooting Complex.

The Southern Highlands Regional Shooting Complex is a recreational shooting facility covering approximately 1036 ha, consisting of a 136 ha Special Activity Zone and a 900 ha Conservation Zone. The complex infrastructure is located in an eastern and western section. The eastern section consists of:

- ▶ A clubhouse building ('eastern clubhouse');
- ▶ Toilet facilities;
- ▶ An informal car parking area; and
- ▶ A seven-target rifle range 800 m long with firing mounds at 100 m intervals.

The western section consists of:

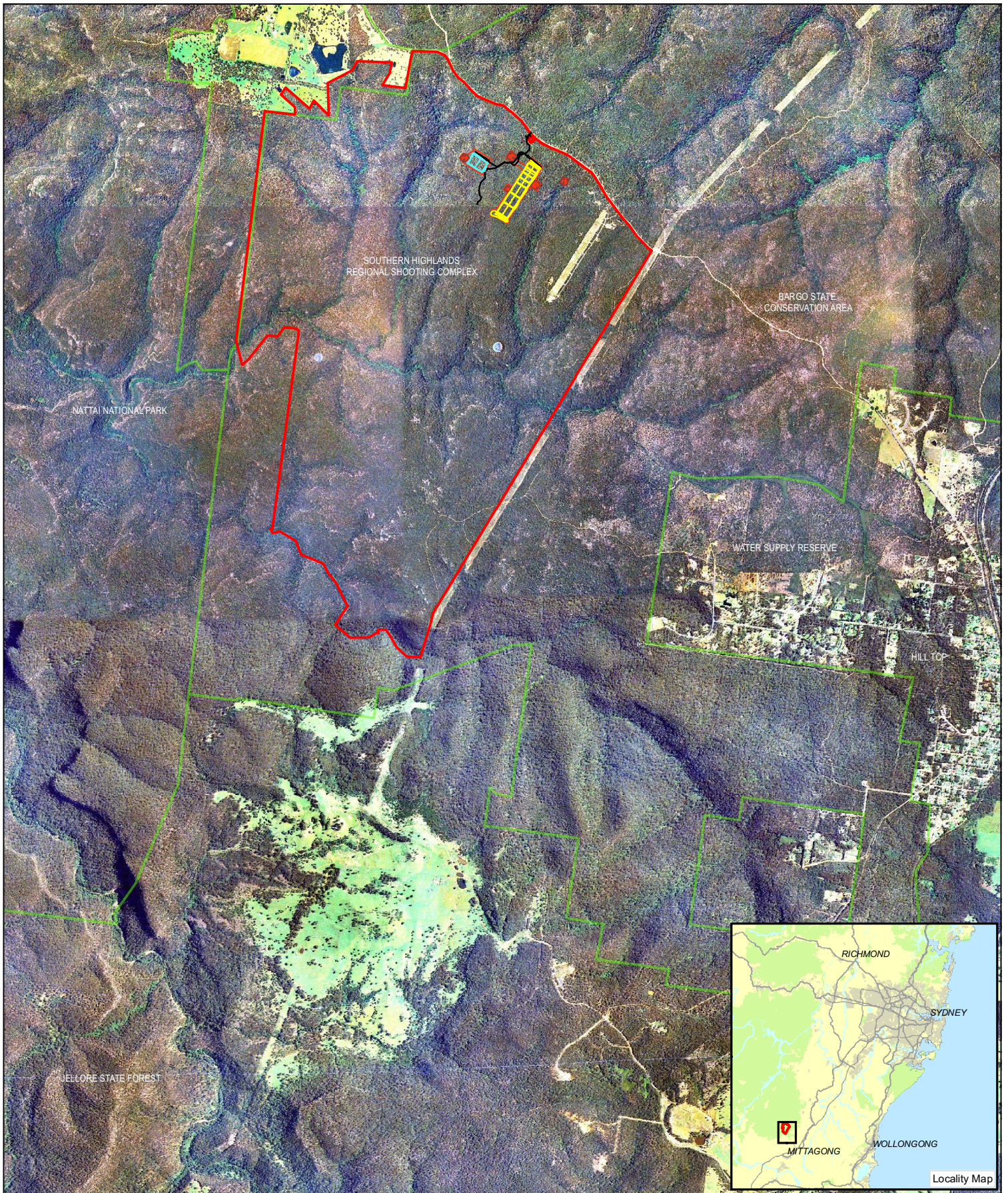
- ▶ Carpark and (western) clubhouse apron;
- ▶ 50 m pistol range (proposed);
- ▶ 500 m range; and
- ▶ Four sediment basins.

Future additional ranges (200m pistol/rifle range, shotgun range and indoor air range) are also approved under the terms of the Minister's Development Application consent. The remainder of the site is natural vegetation. Site extent is shown on Figure 1.

The site is owned by the Minister Administering the Sporting Venues Authorities Act 2008 and is administered by Communities NSW (Sport and Recreation). The Southern Highlands Regional Shooting Complex Inc is allowed under licence arrangements with Communities NSW (Sport and Recreation), on behalf of the Minister, to use the range and associated club facility'.

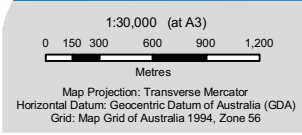
The facility is located in the Southern Highlands of NSW approximately five kilometres north-west of the village of Hill Top and 15 km north of Mittagong.

This plan was commissioned by Communities NSW Sport and Recreation and was prepared in accordance with the objectives in *Planning for Bushfire Protection* in relation to a site emergency plan. This plan is an updated version of the "Southern Highlands Regional Shooting Range Bushfire Management Plan (GHD 2010), which was prepared for the pre-existing facility (eastern section above), prior to the 2010 facility upgrade.



LEGEND

- Site Boundary
- Nature Conservation Reserve



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NSW Shooting & Recreation
Southern Highlands Regional Shooting Complex

Job Number	21-15073
Revision	A
Date	17 SEP 2010

Site Location

Figure 1



Purpose

This plan has been developed in a practical and user friendly format to assist implementation. It addresses the life and property protection, operational capability, and biodiversity conservation goals of bushfire management within the planning area. The implementation of the plan will assist in reducing the residual risk to site users and assets.

Fire is a part of the Australian environment and occurs regularly in temperate climates. The responsibility to address and prepare strategies for bushfire management is essential to protect life, property, assets and capability.

Objectives

The primary objectives of bushfire management and mitigation are to:

- a) Protect human life;
- b) Protect assets before, during and after the passage of destructive bushfires;
- c) Minimise the physical and environmental impact of bushfires;
- d) Provide for bushfire protection work to be undertaken in an environmentally sustainable and cost effective manner; and
- e) Maintain fire regimes that are appropriate and necessary to conserve environmental values.

This plan has been prepared with consideration of the above objectives.

Property owners and land managers have a responsibility to minimise the risk of bushfires impacting on their properties, spreading into neighbouring property or spreading uncontrolled within their property.

The Southern Highlands Regional Shooting Complex Bushfire Management Plan documents guiding principles for bushfire management. It incorporates bushfire research, awareness, fuel reduction, mitigation and response strategies that aim to reduce the rate of spread and intensity of bushfires as well as to protect the values of the site, including safe areas in which the site users can work and undertake recreational activity.

A bushfire management plan provides a consistent framework to define strategies to meet these primary objectives while defining actions to reduce the considerable risk bushfires potentially pose.

Plan Structure

This Bushfire Management Plan is divided into two parts as follows:

Bushfire Management Plan (Report Format) - Background site information and reference material and standards (this document).

Property Bushfire Management Plan (A1 Map Format) – Individual property specific fire management information and summarised operational reference information (Appendix A).

This approach allows consolidation of background and reference information into a single document complimented by a user friendly map based compilation of specific information for site users.



The Southern Highlands Shooting Complex Bushfire Management Plan is structured to ensure an approach to bushfire planning that is consistent with risk management framework recommended by the Council of Australian Governments and adopted by emergency service organisations. This framework consists of: Research, Information and Analysis; Risk Modification; Readiness; Response; and Recovery. Accordingly this Bushfire Management Plan has been structured as follows:

- Section 1 - Bushfire Resource Information
- Section 2 - Bushfire Mitigation Works Program
- Section 3 – Bushfire Awareness Program
- Section 4 – Bushfire Response Strategy
- Section 5 – Bushfire Recovery Requirements
- Section 6 – Monitoring and Reporting

Legislative, Planning and Policy Obligations

Legislative, planning and policy obligations relating to bushfire management are detailed and summarised in the following sections:

Commonwealth Legislation

- ▶ *Aboriginal and Torres Strait Islander Heritage Protection Act (1984)*. The Act provides framework for the preservation and protection of places, areas and objects of Aboriginal significance. Communities NSW Sport and Recreation and Southern Highlands Regional Shooting Complex are to comply with the Act where their activities have the potential to impact on an Aboriginal place, area or object;
- ▶ *Environmental Protection and Biodiversity Conservation Act (1999)*. The Act provides the legal framework for the protection and management of nationally and internationally important flora, fauna, ecological communities and heritage places defined in the Act as matters of national environmental significance. The Act comes into play when a proposal has the potential to have a significant impact on a matter of national environmental significance; and
- ▶ *Environment Protection and Biodiversity Conservation Regulations (2000)*. The Regulations support the provisions set forth in the Environment Protection and Biodiversity Conservation Act (1999).

NSW Legislation

- ▶ *Environmental Planning and Assessment Act (1979)*. The Act is the major piece of environmental legislation that deals with environmental planning and approvals. Subordinate to the Act are a number of environmental planning instruments:
 - State Environmental Planning Policy
 - Regional Environmental Plans; and
 - Local Environmental Plans

Communities NSW Sport and Recreation and the Southern Highlands Regional Shooting Complex occupiers and their contractors are to be aware of and comply with the conditions of any Development Consents issued by Council, or other approvals issued by local, state or national authorities.



- ▶ *Fire Brigades Act (1989)*. The Act provides for the management of land-based hazardous materials incidents and is applicable to the property in relation to stored materials and assets;
- ▶ *National Parks and Wildlife Act (1979)*. The Act protects Aboriginal objects and places in NSW. It is an offence to do any of the following things without the permission of the DECCW:
 - disturb or move an Aboriginal object;
 - excavate land for the purpose of discovering an Aboriginal object;
 - knowingly destroy, damage or deface an Aboriginal object or Aboriginal place;
 - knowingly cause or permit the destruction, damage or defacement of, an Aboriginal object or Aboriginal Place.

If Communities NSW Sport and Recreation or Southern Highlands Regional Shooting Complex occupiers or their contractors plan an activity that will disturb or destroy Aboriginal heritage, permission will need to be sought from DECCW. DECCW also maintains the Aboriginal Heritage Information Management System (AHIMS) that contains a database and recording cards for all Aboriginal objects, Aboriginal places and other Aboriginal heritage values in NSW that have been reported to the NPWS;

- ▶ *Native Vegetation Act (2003)*. The Act regulates the clearing of native vegetation on all land in NSW and outlines what landowners can and cannot do in clearing native vegetation. Clearing remnant native vegetation or protected regrowth requires approval under the Act unless the clearing is a permitted activity. Clearing of native vegetation does not require approval under the *Native Vegetation Act 2003* if it is:
 - a permitted clearing under the Act;
 - on land that is excluded from the Act – refer to section 254.

The exclusions in section 25 of the Act include for example certain clearing under the Rural Fire Act 1997 when done in accordance with a bush fire management plan;

- ▶ *Rural Fires Act (1997)*. The Act provides for the prevention, control and suppression of bush fires, and for the mitigation of danger resulting from fires. The Act contains provisions for the control and suppression of fires that are imminent or burning, including a definition of the responsibilities of various authorities during bush fire emergencies. Importantly, it also ensures that measures to reduce the hazards that contribute to the occurrence, intensity and spread of fire are carried out by responsible agencies;
- ▶ *Sporting Venues Authority Act (2008)*. The Act allows for the establishment of the State Sporting Venues Authority. The Authority is responsible for maintaining and improving the Authority's land and to ensure that asset management plans are in place for that land. Communities NSW Sport and Recreation are responsible to the Authority.
- ▶ *State Emergency and Rescue Management Act (1989)*. The Act allows for the formation of a State Rescue Board of NSW, responsible for rescue management at State, Local and District levels; and
- ▶ *Threatened Species Conservation Act (1995)*. The Act lists threatened species, endangered populations and endangered ecological communities. The Act with some exceptions prohibits actions that will affect threatened species and their habitat unless undertaken in accordance with an approval.

⁴ However, approval for clearing may also be required under other legislation including Local Environmental Plans



NSW State Policy

- ▶ Bush Fire Coordinating Committee (BFCC) *Policy No. 2/2007 – Fire Trails* (BFCC 2007a) describes the construction and maintenance requirements appropriate to effective fire trails;
- ▶ BFCC *Policy No 3/2007– Bush Fire Risk Management* (BFCC 2007b) provides guidelines for reporting on bushfire risk management works;
- ▶ BFCC *Policy No 3/2007- Bush Fire Risk Management Planning Guidelines for Bush Fire Management Committees* (Annex B to BFCC Policy No. 3/2007 Bush Fire Risk Management) (BFCC 2007b); and
- ▶ *Bushfire Environmental Assessment Code for NSW* (NSW RFS 2006b) The Code has been prepared pursuant to sections 100J to 100N of the *Rural Fires Act 1997*. The purpose of the Code is to provide a streamlined environmental assessment process for use by issuing authorities and certifying authorities in determining bush fire hazard reduction certificates.

Relevant Plans

- ▶ Wingecarribee Local Disaster Plan (DISPLAN). The DISPLAN provides a description of arrangements at a district level to “*prevent, prepare for, respond to and recover from incidents and emergencies, and also provides policy direction for the preparation of Local Displans and District and Local Sub Plans and Supporting Plans within the District*”. The Wingecarribee DISPLAN coordinates the response of agencies in a disaster;
- ▶ Wingecarribee Bush Fire Management Committee (2001) *Bush Fire Risk Management Plan*, NSW, Australia. Updated District Bush Fire Risk Management Plans are in preparation for NSW Bush Fire Management Committee areas. The Plan offers “*broad-scale fire management strategies for the whole of the Wingecarribee Shire Council*”; and
- ▶ *Planning for Bushfire Protection* (NSW RFS 2006a) describes planning considerations for development in areas in close proximity to bushfire hazard.

Consultation

Consultation and information collection for this plan (including the previous version) consists of the following stages:

- ▶ Project inception including the provision of background information and confirmation of project timeframes;
- ▶ Stakeholder survey submitted to key site stakeholders;
- ▶ Direct consultation with fire authorities; and
- ▶ Circulation of draft Property and Regional Bushfire Management Plan to obtain feedback on the plan content and strategies.

Information provided at these stages was incorporated in the development of this Bushfire Management Plan.



Cooperative Bushfire Mitigation and Management Arrangements

A cooperative approach engaging major stakeholders will increase the effectiveness of bushfire prevention, mitigation and management within the Southern Highlands Regional Shooting Range Bushfire Management Plan. Indeed, many of the works outlined in this plan are reliant on cooperative relationships; e.g. effective response and hazard reduction burning.

The relevant Communities NSW Sport and Recreation personnel, Southern Highlands Regional Shooting Complex Management Committee members, and the person responsible for implementation of the plan at the site (Section 6) should maintain a working knowledge of this Bushfire Management Plan. The Range Management Committee delegate responsible should, prior to each bushfire season, review the implementation of the Bushfire Management Plan, and in particular check that actions for implementation of the Bushfire Mitigation Works Schedule (BMWS) and Bushfire Awareness Strategy are complete or planned.

In reviewing the implementation of the fire plan and to foster a cooperative approach to bushfire management, the following should be considered:

- ▶ Arrangement for local brigade member familiarisation of the site;
- ▶ Monitoring of scheduling and completion of bushfire mitigation works and bushfire awareness programs;
- ▶ Discussion and resolution of issues regarding access, fire-fighter safety, roads, and water supplies;
- ▶ Communication of bushfire management strategies for the site to Wingecarribee Bush Fire Management Committee and identification of areas of collaboration/assistance required from local fire services to improve fire protection; and
- ▶ Identify and discuss safety and environmental restrictions and safeguards.

Actions should be identified to occur prior to the summer bushfire danger period. A post fire season meeting/debrief may also be appropriate when a bushfire has significantly impacted the site.

Plan Circulation

The plan is to be circulated to:

- ▶ Appropriate internal and external stakeholders;
- ▶ Relevant fire management authorities and suppression agencies including NSW Fire Brigades and NSW Rural Fire Service; and
- ▶ NSW Department of Environment, Climate Change and Water – Parks and Wildlife Division.

Plan Implementation

Responsibilities for the implementation of actions identified in this plan are described in Section 6.1



Review Schedule

The initial review of this Bushfire Management Plan is three years after the date of publication. Subsequent reviews should be at periods not exceeding five years and the plan should be updated as necessary after any bushfire.

There is an assumption on behalf of Communities NSW Sport and Recreation that the extent of the Shooting Range and associated facilities and intensity of use of the property may be altered within the life of this plan, to include the additional approved shotgun range and access track. The Bushfire Management Plan would be updated to reflect altered conditions and would form part of an Ecological Management Plan.



1. Bushfire Resource Information

The Southern Highlands Region has a range of natural and demographic attributes that make it one of the most fire prone areas in NSW. These attributes include:

- ▶ A significant proportion of the landscape covered in fire prone vegetation including tableland and escarpment Eucalypt forests and heathlands;
- ▶ A 'wilderness' area consisting of exposed plateaux and deeply incised rugged gorges, with very limited vehicle access;
- ▶ A long history of large fires which run under dangerous north-west to south-west winds towards Southern Highlands townships and villages and potentially the Southern Highlands Regional Shooting Complex;
- ▶ Regularly occurring drought seasons which render the landscape fire prone for months on end from mid spring through summer;
- ▶ A relatively long fire season commencing from late spring (early November) due to the predominance of strong north-southwest winds and relatively dry winters;
- ▶ Regularly occurring Very High and Severe fire danger days, particularly ahead of strong weather fronts in late spring and through summer, which have in the recent past caused fires to make high intensity runs of more than 30 km in a single day, and are uncontrollable in such conditions;
- ▶ Populations (increasingly significantly during holiday periods and weekends) residing and holidaying in areas of high fire risk;
- ▶ Regular sources of fire ignition from lightning and higher population centres, providing further fire sources from deliberate and accidental fire lighting by people; and
- ▶ A dominance of local vegetation types which are 'fire maintained' and require fire at appropriate intervals to maintain their range, health and diversity.

This section provides relevant site information and identification of the factors that contribute to the levels of bushfire risk existing at the Southern Highlands Regional Shooting Complex.

1.1 Fire History and Ignition Sources

The Southern Highlands Regional Shooting Complex is potentially at risk from bushfires entering from adjacent lands or ignition on the property itself. Routine recreational shooting activities generally do not have the potential to cause ignition as munitions used are not explosive, do not contain phosphorous or involve tracer ammunition. Bushfire cause can be categorised into three categories:

- ▶ Natural – fires caused by lightning;
- ▶ Accidental – fires caused through sparks from machinery use (welders, vehicles, plant), escaped prescribed burning operations, permit burns or campfires; or
- ▶ Deliberate – fires caused by arson, the occurrence of which can correspond with distance from urban areas, proximity of major roads and school holidays.



The management of fuels and maintenance of fire control infrastructure can significantly limit bushfire potential. The ignition potential for the Southern Highlands Regional Shooting Complex and strategies to limit fire spread and residual risk are detailed in the Bushfire Mitigation Works Program (Section 2).

1.1.1 Fire History

Previous management plans prepared for the wider region indicate that, consistent with fire occurrence within the wider region, minor and major fires are a regular occurrence at the site. Large fires, often burning under adverse conditions, have occurred on an infrequent basis. Records indicate that major fires have impacted on the site at least three times in recent history (NSW RFS 2008), with the most recent fire in 2001/2 (NPWS 2006) which burnt a large proportion of the Nattai reserves.

In addition to the large fires, numerous other fires may have started on or within adjoining areas. Such fires are often contained by firefighting resources while small, thus preventing them from becoming larger fires which could later make dangerous runs in adverse weather conditions. Historically smaller fires quickly contained may not always be recorded, therefore their incidence may be greater than records indicate.

Fire history is shown on the Southern Highlands Regional Shooting Complex Property Bushfire Management Plan (Appendix A).

1.1.2 Ignitions

Ignitions have primarily occurred in the vicinity as a consequence of lightning.

1.1.3 Prescribed Fires

There are no records of prescribed burning on the Southern Highlands Regional Shooting Complex, though adjacent areas have been subject to prescribed burning. The maintenance of ground fuels (grass) through mowing and pruning of elevated fuels near buildings will compliment the use of fire for hazard reduction adjacent to structures within the Southern Highlands Regional Shooting Complex.

1.2 Weather and Climate Factors

Weather and climate have a significant effect on bushfire occurrence and behaviour. The timing and length of bushfire seasons is driven by seasonal climate and weather factors.

The behaviour of fires is strongly influenced by weather conditions at the time fire is burning. Furthermore, historical weather patterns can be used as a general indication of bushfire behaviour potential, and the historical direction, intensity and spread of bushfires.

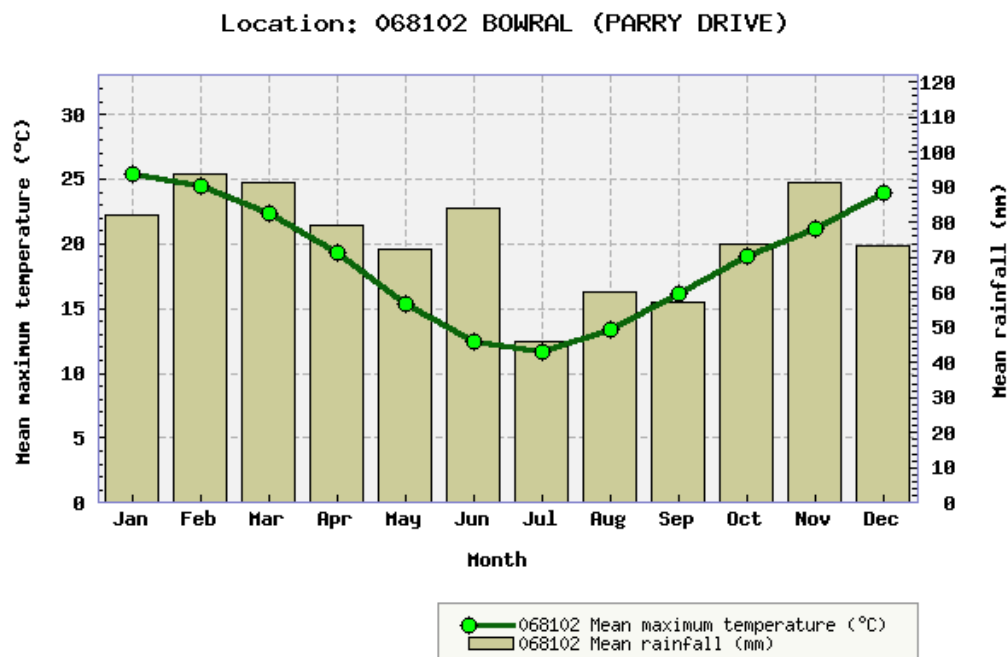
1.2.1 Typical Bushfire Season

The bushfire season for the Southern Highlands Regional Shooting Complex is driven by the temperate local climate of the Southern Highlands Region of typically warm summers and cool winters. Climate data for the Bowral (Parry Avenue) Bureau of Metrology (BoM) weather station (mean maximum temperatures and monthly rainfall figures) provides an indication of annual rainfall distribution and temperature trend (Figure 1-1).

Mean maximum temperatures at the Southern Highlands Regional Shooting Complex range from 25.4° in January to 11.6° in July. The site experiences the most rainfall from January to March, with means



ranging from 82.0mm to 91.2mm (representing almost 30% of the mean annual rainfall of 903.3 mm). The driest period for the site is July to September when mean monthly rainfall is between 46.2mm and 57.2mm. This period is characterised by predominantly westerly winds. November has the highest number of rain days, with an average of 9.8, compared with July and August with the lowest average of 6.3 rain days.



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Figure 1-1 Mean Max Temperature and Annual Rainfall – Bowral 1961-Current

Source: Bureau of Meteorology Website (2009)

The Statutory NSW Bushfire Danger Period commences on 1 October and continues until 31 March each year. This is the period of the year when fuels may be dry enough to support fires and weather conditions may attain levels which can create difficulty for fire containment. Higher fire danger days are associated with an increase in temperature coinciding with a period of rainfall deficiency or drought (see below). Bushfire danger decreases with the onset of a higher rainfall period between January and March, although below average summer rainfall can extend the fire season into early autumn. It should be noted that such fuel and weather conditions can and do occur outside the Statutory Bushfire Danger Period.

The commencement/finish date of the NSW Bushfire Danger Period may be brought forward or pushed back at the discretion of the NSW Rural Fire Service Commissioner, with amendments declared on a Local Government Area basis. In seasons when local conditions are affected by drought, it is common for Bushfire Danger Period commencement to be brought forward to 1 September, and in severe seasons this may be even earlier.



Very High to Extreme fire weather conditions generally develop when a slow moving high pressure system establishes in the Tasman Sea resulting in hot and dry north westerly winds. Low-pressure fronts that follow may create dry lightning storms with little rain, often causing lightning ignited fires. Fires developing under these conditions are generally characterised by significant south easterly runs ahead of the front followed by northerly runs with the wind change.

The greatest potential for large, high intensity fires occurs in the summer months (December-February), however adverse fire conditions (High to Extreme fire danger) can and do occur in late spring and autumn. It is rare for such conditions to occur in winter, but high fire danger can occur on dry windy days.

1.2.2 Drought Affected Fire Seasons

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. In Australia there is a strong correlation between drought years and high consequence bushfire events (for example the 1939 fires in Victoria; 1968 fires in NSW; early 1980's fires in NSW and Victoria; 1994 fires in NSW; 2000/01 and 2001/02 fires in NSW; 2003 fires in NSW; ACT and Victoria; 2005/06 fires in Victoria and SA; and the 2009 fires in Victoria).

Severe hydrological droughts, which can be categorised as extended periods (several years) of well below average rainfall (e.g. 1939, 1958, 1968, 1982, 2003), have occurred approximately every 20 years. The potential for large scale high intensity fires is high during fire seasons occurring in severe drought years.

Droughts are predicted to become more frequent, more widespread, and more severe as climate change impacts occur (Hennessy *et al.* 2008). Under mid-range CO² level rise scenarios, severe (hydrological) drought is forecast to occur 1 to 2 times in twenty years – a doubling of the frequency of conditions associated with severe fire seasons. For the Southern Highlands droughts per decade are forecast to vary to 1-5 per decade in 2030 and 1-9 per decade in 2070 (CSIRO 2007).

1.2.3 Fire Weather Factors

Prolonged dry conditions, hot temperatures and low humidity during late spring and summer are experienced at the Southern Highlands Regional Shooting Complex. Along with wind, these climate features contribute significantly to the behaviour of a fire (ignition potential, build-up time, rate of spread, combustibility of fuels, intensity and spotting).

During prolonged hot dry periods a greater proportion of fuels in the landscape are in a condition available for burning and therefore fires are more likely to remain alight and continue spreading through the night. Fires are also more intense, spread faster and move through areas that may not have supported fires in less dry periods, increasing the difficulty of suppression and mop up. As the ignition of grasses and fine fuels is also highly dependent on fuel moisture content, the bushfire risk increases as lightning, burning cigarettes, sparks and other ignition sources are more likely to start fires.

The correlation between very dangerous fire weather conditions, major wildfire events and long hot dry periods is strong. Significant examples include Black Friday in Victoria (1939), Tasmania fires in 1967 and 2006/07, Ash Wednesday in Victoria and South Australia (1983), east coast fires in 1994 and 2001, ACT fires in 1983 and 2003, and the Victorian 'Black Saturday' fires in 2009.



In addition to drought, there are three main weather factors that influence the occurrence of fires, their propensity to spread and escalate in intensity and their containment difficulty:

<i>Recent rainfall</i>	During periods of significant rain, surface fuels become damp and can be difficult or impossible to ignite, however, as the time since rain extends, fuels progressively dry out and become available to burn. Periods when forest fuels become sufficiently dry can occur at any time of year, but are most frequent during early spring and summer (and sometimes extending into autumn) when local average temperatures are in the high end of their range, daylight hours are longest, and significant periods without rain can be expected.
<i>Fuel moisture content</i>	<p>Fine fuel moisture of forest and woodland fine fuels is driven by daily cycles of temperature and relative humidity. The fine fuel moisture content can fall to very low levels on days with high temperatures and low relative humidity. Such days most often occur in late spring and summer.</p> <p>Reduced rainfall in late spring and increased temperatures leading into summer may contribute to grass curing and increasing fuel availability (Section 1.3).</p>
<i>Wind speed</i>	The rate of spread and intensity of fires is strongly influenced by wind speed. The higher the wind speed, the higher the rate of spread and intensity of a forest fire. When high wind speeds coincide with low fuel moisture content (i.e. on hot days with low humidity) fire behaviour can escalate to the uppermost levels of severity possible. Days when high winds, high temperature and low humidity coincide occur most frequently in summer, but can occur less frequently in spring and autumn.

1.2.4 Fire Danger

In Australia the above factors are combined to determine fire danger. Fire danger is a combination of factors that determine if fires are likely to start, spread, impact on assets or be controlled. For the Southern Highlands Regional Shooting Complex the Forest Fire Danger Rating (FDR) (McArthur 1973) provides a measure to modify or restrict activities, or increase bushfire preparedness levels (Section 4.1). FDR is calculated from wind speed, temperature, relative humidity and long term dryness and is expressed as Low, Moderate, High, Severe, Very High, Extreme or Catastrophic.

Very High and greater fire days typically occur ahead of frontal movements with low humidity and high temperatures and wind ahead of the front, followed by a drop in temperature following the front and often significant changes in wind direction and speed. Typically Very High to Severe fire days are experienced for 4 days for each summer month and 1-2 days per month in the shoulder season (spring/autumn).

During the fire season the BoM prepares daily fire danger ratings for selected sites. FDR forecasts are posted on the BoM website (under NSW Forecasts) at approximately 1600 hours for the following day. Forecasts of Very High, Severe, Extreme or Catastrophic fire danger and any associated 'Total Fire Ban' issued by the NSW Rural Fire Service are also generally broadcast by the media. A significant threshold for house and property losses has been suggested where an Extreme fire danger (Forest Fire Danger Index of 75+) is forecast (Fogerty unpubl.).



Recent research indicates that the fire behaviour tables published on the McArthur fire danger meter under predict fire behaviour under Very High to Extreme conditions. The *Field Guide – Fuel Assessment and Fire Behaviour Prediction in Dry Eucalypt Forest* (Gould et al 2007a) should be used to make fire behaviour predictions where forest vegetation types are present.

1.2.5 Summary of climate/weather bushfire risk factors

Following is a summary of the effects of local climate and weather on bushfire risk for the Southern Highlands Regional Shooting Complex:

- ▶ During late spring the Southern Highlands can expect days of High bushfire danger, with Very High fire danger days likely about once a fortnight. Whilst Severe (FDR 50-74) fire danger days can occur in the shoulder season they are more likely in spring than autumn.
- ▶ During summer a typical summer weather pattern generates Very High to Severe fire danger days about once a week, generally ahead of the passage of a frontal system. Strong dry north-westerly winds from the central and western plains influence conditions. These winds are of sufficient strength that they may prevent or delay moderating sea breezes that influence more coastal areas. Generally summer days reach the High fire danger level (except on days of sustained rainfall).
- ▶ During summer watchout conditions occur when higher fire dangers are forecast coinciding with a forecast Moderate (5) or High (6) Haines Index.
- ▶ Days of Low to Moderate fire danger suitable for prescribed burning occur chiefly in autumn and winter.
- ▶ The Southern Highlands is subject to cyclical drought. Years with below average winter, spring and early summer rainfall significantly elevate bushfire risk. During drought affected fire seasons a greater proportion of fuels in the landscape are in a condition available for burning, with fires more likely to remain alight and spread through the night and through areas that may not support fires in less dry seasons. Fires can also be more intense, spread faster, and be more difficult to suppress and mop up. The Southern Highlands Regional Shooting Complex is likely to face drought affected bushfire seasons up to 3 times a decade (CSIRO 2007).
- ▶ Severe and prolonged drought is experienced cyclically. Severe seasons in the Central and Southern Tablelands of NSW include 1977, 1982, 1994 and 2001/02 when large fires were experienced. During such periods large destructive fires can occur and are can be very difficult to contain.
- ▶ A worst case weather/climate scenario is a drought affected season in which a fire starts to the west or north-west of the Southern Highlands Regional Shooting Complex and spreads east during the heat of the afternoon driven by hot dry north to west quadrant winds, in an unstable atmosphere (Haines Index ≥ 5). Should south/south-westerly wind change occur whilst such a fire is running, particularly on or adjacent to the Southern Highlands Regional Shooting Complex, very serious consequences could result for both life and property and adjacent rural-residential communities (Figure 1-2).

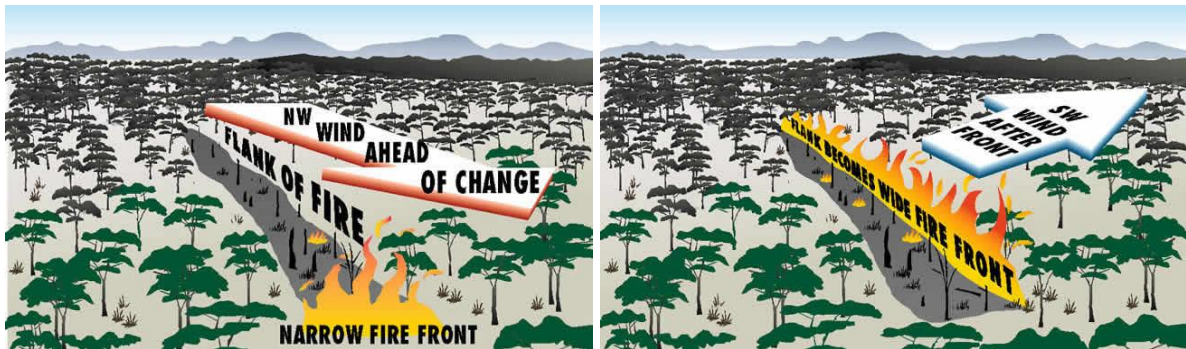


Figure 1-2 Passage of a Cold Front and Change in Wind Direction (BoM 2009)

1.2.6 Site Topography Factors

Topography at the Southern Highlands Regional Shooting Complex is a series of plateaux and ridges dissected by steeper rock escarpments. The major drainage features on the site are Rocky Waterholes and Iron Creeks which drain from the east of the property to western boundary. Minor creeks and drainage features feed into these creeks in a generally north-south direction.

Features of the site providing advantages for fire management, in particular:

- ▶ Wet gullies that may form natural fire advantages in milder, non drought-affected conditions;
- ▶ Fuel reduced and cleared areas around site facilities; and
- ▶ A relatively high standard (two wheel drive all weather) external access road to Hill Top village;

The main impediment for fire management on the site is the steep forested topography that limits access across the entire site. The effect of slope can considerably amplify fire behaviour and as such fires burning upslope under higher fire dangers are likely to be of higher intensity. Exposed slopes with a north through west aspect are more exposed to the western sun, and therefore can contain drier and more available fuels. The steepness of these slopes can increase the complexity of implementing prescribed burning operations. These site characteristics are a feature of the surrounding landscape, and fires burning in these areas may be difficult to contain and present an elevated likelihood that they will enter and move off the site.

1.3 Vegetation and Fuel Factors

1.3.1 Vegetation

Vegetation is generally uniform across the study area and can be classified as Sydney Hinterland Dry Sclerophyll Forest which falls into the Dry Sclerophyll Forest (shrubby subformation) vegetation class (Keith 2004).

Across the study area, the dominant canopy species is Blue-leaved Stringybark (*Eucalyptus agglomerata*) with Grey Gum (*Eucalyptus punctata*), Red Bloodwood (*Corymbia gummifera*), Hard-leaved Scribbly Gum (*Eucalyptus sclerophylla*) Sydney Peppermint (*Eucalyptus piperita*), and Yertchuk (*Eucalyptus consideriana*) occurring as co-dominants or sub-dominants.

Common midstorey species include Wattles such as Prickly Moses (*Acacia ulicifolia*), Flax Wattle (*Acacia terminalis*), White Wattle (*Acacia linifolia*), Red-stemmed Wattle (*Acacia myrtifolia*), Sweet Wattle



(*Acacia suaveolens*) and White Sally Wattle (*Acacia floribunda*), as well as Banksia species such as Hairpin Banksia (*Banksia spinulosa*) and Old Man Banksia (*Banksia serrata*), and pea-flowers including Eggs and Bacon (*Dillwynia retorta*), Gorse Bitter Pea (*Daviesia ulicifolia*), Rough Bush-pea (*Pultenaea scabra*) and the abundant *Pultenaea hispidula*. Other mid-storey species include Pink Wax-flower (*Eriostemon australisus*), Crinkle Bush (*Lomatia silaifolia*) with occasional Waratah (*Telopea speciocissima*).

The dominant ground layer species is the tuft-forming, grass-like *Cyathochaeta diandra*, with Mat-rush (*Lomandra confertifolia*), Sword-sedge (*Lepidospermum concavum*), Blue Flax-lily (*Dianella caerulea*), and Purple Coral Pea (*Hardenbergia violacea*) also common.

Sandstone Dry Temperate Rainforest, falling into the category of Northern Warm Temperate Rainforest (Keith 2004), occurs as isolated pockets in protected gullies at the foot of steep terrain. The overstorey is dominated by Lill Pilly (*Acmena smithii*), Coachwood (*Ceratopetalum apetalum*) and Sassafras (*Doryphora sassafras*). The midstorey typically consists of scattered saplings and shrubs with an understorey of ferns and herbs.

The shooting range itself represents a modified environment consisting primarily of grasses. This area is maintained to promote the amenity of the shooting area.

Whilst the overall site is not highly modified it is likely to have been subject to agricultural activities which may have included clearing for agriculture and timber harvesting.

1.3.2 Fuel Assessment Objectives

Reducing fuels through prescribed burning is the most effective and economic means of reducing the potential for wildfires impacting on assets, degrading environmental and cultural values, and disrupting operations and recreational activities. Planning of prescribed burning should aim to break up the continuity of fuel in the landscape through the application of mosaic burning.

Fuel load assessed in terms of fine ground fuel (such as bark, twigs and leaves <6 mm thickness), as well as near-surface, elevated and canopy fuels also contribute significantly to fire behaviour (Gould *et al.* 2007b). These components make up the overall fuel hazard. Fuel assessment must include procedures that incorporate an assessment of the overall fuel hazard as detailed in the *Overall Fuel Hazard Assessment Guide* (Hines *et al.* 2010) in undertaking forest fuel assessment.

Fuel assessment and monitoring requirements are detailed in the Bushfire Mitigation Works Program of the Southern Highlands Regional Shooting Complex Property Bushfire Management Plan (Section 2, Appendix A) and Section 2 of this report.

1.3.3 Fuel Accumulation

Fuel accumulation rates vary with each vegetation formation with maximum fuel loads identified *Planning for Bushfire Protection* (NSW RFS 2006) on a NSW statewide basis as follows:

- ▶ Dry Sclerophyll (shrubby) 25 t/ha
- ▶ Rainforest 8/10 t/ha

The following table (Table 1-1) is broadly indicative of fuel accumulation after fire for more densely stocked regrowth eucalypt woodland/forest stands with shrubby understorey vegetation:



Table 1-1 Fuel Hazard Development Since Fire for Eucalypt Woodland/Forests

Time since fire	Surface fine (SF) fuels	Near surface fine (NSF) fuels	Bark fuels
12 months	<60% surface litter cover Discontinuous litter cover, more soil than litter. Sparse and patchy 2-4 t/ha LOW	<10% near surface plant cover Near surface fuels absent or virtually absent. Very high proportion of fuels are live (emergent seedlings) 1-2 t/ha LOW	<1 t/ha LOW
3 years	60-80% surface litter cover Well connected litter cover, some bare soil or rock 4-10 t/ha MODERATE	10-20% near surface plant cover Gaps in fuel are many times larger than the size of fuel patches. High proportion of fuels are live (young regeneration). Mix of live and dead fuels 2-3 t/ha MODERATE	1 t/ha MODERATE
6 years	80-90% surface litter cover Well connected litter cover, little bare soil		2 t/ha HIGH
10 years	8-14 t/ha HIGH	20-40% near surface plant cover Gaps in fuel are larger than the size of fuel patches. Mix of live and dead fuels	5 t/ha VERY HIGH
15 years	>90% surface litter cover Litter completely connected 12-20 t/ha VERY HIGH	3-4 t/ha HIGH	

Adapted from Gould *et al.* (2007a) and Hines *et al.* (2010).

The above post-fire fuel recovery table is derived from a generic model for Dry Eucalypt Forests (Gould *et al.* 2007a) and the Overall Fuel Hazard Assessment Guide (Hines *et al.* 2010). An important objective of fuel monitoring should be to validate (or quantify variances for localising the model) of the modelled fuel accumulation.

Note: For fire behaviour prediction the *Fuel Assessment and Fire Behaviour Prediction in Dry Eucalypt Forest Field Guide* (Gould *et al.* 2007a) requires fuel inputs for surface fuels, near surface fuels and bark fuels. Where these are unknown, fuel hazards from Table 1-1 above can be used as assumptions, with appropriate caution.

Indicative fuel hazards for the site are provided in Table 1-2 (note these hazards are indicative only and specific fuel assessments should be conducted if planning prescribed burn operational plans).

In general terms the highest overall fuel hazards were recorded in the southern buffer (surface fuel very high or ~12-16 t/ha available surface fuel), with high surface fuels adjacent to the range (~10-14 t/ha available surface fuel) and moderate surface fuel hazard rating on the ridge to the west of the range (~6-10 t/ha available surface fuel). Full transect observations are provided in Appendix F.



Table 1-2 Indicative* Fuel Hazards for Southern Highland Regional Shooting Complex

Locality	Indicative Fuel Hazard Rating (2010)			
	Surface	Near Surface	Elevated	Bark
Shooting Range –NW Side	H	L	M-H	H
Ridgeline off Wattle Ridge Road – W of Range	M	L	M-H	H
Southern Buffer (S of Rocky Waterholes Ck)	VH	L	L-M	M

* Note: specific sampling should be conducted for prescribed burning planning

1.3.4 Fire behaviour characteristics

Fire behaviour can vary from creeping, low intensity fires (as typically occur at low fire danger indices) to high intensity wind driven crown fires that can reach rates of spread exceeding 10 km/hr (for limited periods) in severe to extreme fire weather conditions or up steep slopes. Fire behaviour at any given location will be a function of the fuel arrangement and quantity (the greater the available fuel, the greater the fire behaviour), the weather factors influencing the site (the higher the FDR the greater the fire behaviour) and slope factors.

Recently burnt areas carry lower quantities of surface and near surface fuels and where the previous fire was of moderate to high intensity they are also likely to have significantly reduced quantities of available bark fuels. Accordingly, under the same weather conditions, recently burnt areas will support fires that have lower rates of spread and intensity than areas burnt less recently.

Fires spreading in Very High to Extreme fire danger may still spread through areas burnt less than 12 months before, particularly where the dimensions of the recently burnt area are relatively small. However, under the vast majority of weather conditions, fuel reduced areas will provide substantial fire behaviour reduction benefits that can improve bushfire containment options and make fire control safer and easier.

Prediction of fire behaviour for the Southern Highlands Regional Shooting Complex should be made using the *Fuel Assessment and Fire Behaviour Prediction in Dry Eucalypt Forest Field Guide* (Gould *et al.* 2007a) (Note: This fire behaviour prediction model is for fires with a head fire at least 100 m wide).

Typical fuel and fire behaviour characteristics for the dominant fuel types occurring in the Southern Highlands Regional Shooting Complex are shown in Table 1-3. The vegetation formations are consistent with those used by the NSW Rural Fire Service in *Bushfire Risk Management Planning and Planning for Bushfire Protection*, adapted from Keith (2004).



Table 1-3 General Fire Behaviour Characteristics of Vegetation Types

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>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>Warning: Do not rely on generalised fire behaviour characterisation during fire management operations. Predict dry sclerophyll forest fire behaviour using the <i>Fuel Assessment and Fire Behaviour Prediction in Dry Eucalypt Forest Field Guide</i> (Gould et al. 2007a).</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. In 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 indices are elevated. Fire behaviour may be increased from usual levels in drought affected periods.
<p>Rainforest</p> <p>Closed tree canopy composed of relatively soft, horizontally-held leaves. Generally does not include eucalypt species.</p> <p>Understorey typically includes ferns and herbs. Vines often present in canopy or understorey.</p>	<p>Usually occurring on sheltered or southerly aspects the fuel moisture content of dead surface fuels (predominantly leaf litter) is too high to sustain fire in all but the most severe drought seasons.</p>	<p>Warning: Do not rely on generalised fire behaviour characterisation during fire management operations. Predict dry sclerophyll forest fire behaviour using the <i>Fuel Assessment and Fire Behaviour Prediction in Dry Eucalypt Forest Field Guide</i> (Gould et al. 2007a).</p> <p>Will not sustain fire except in seasons affected by severe drought. Fire may burn through small rainforest patches in less severe droughts.</p>

1.4 Assets and Values at Risk

Bushfires have the potential to adversely impact life, property, environmental assets and operational capacity of the Southern Highlands Regional Shooting Complex. Well planned and managed bushfire mitigation works can reduce the risk of bushfire damage. These assets require special consideration in the location, magnitude or method of bushfire protection and mitigation works.

Protection of human life is the highest priority objective of all bushfire suppression and management activities. The most likely fire scenario to result in loss of life and large scale or high consequence property loss is from a large scale, fast moving high intensity fire event which burns (and/or generates ember attack) or impacts site assets.

1.4.1 Site Facilities and Classification

The majority of site infrastructure is located adjacent to the northern boundary adjoining Wattle Ridge Road. These assets comprise the following:

- ▶ Clubhouse and amenities buildings (Figure 1-3);
- ▶ Access infrastructure and parking;
- ▶ Site services;
- ▶ Dams; and
- ▶ Shooting ranges (Figure 1-3).



Figure 1-3 Eastern Club House Building and Amenities Block (L) and 800 m Shooting Range (R)

The Southern Highlands Regional Shooting Complex has a unique combination of features that make strategic and effective bushfire management planning and implementation across the site very important (Table 1-4).

The location of assets and landscape and environmental values to be protected for the site are detailed in the Property Bushfire Management Plan (Appendix A). Any new buildings are to comply with the design principles in AS3959-1999. Buildings within the site are subject to on-going maintenance and regular slashing to reduce the potential for grassfires impacting on structures (Section 2.4) with the appropriate readiness and response procedures applied in response to the fire danger rating (Section 4.1).

Residential houses, fences, powerlines, and municipal facilities are also potentially vulnerable to the effects of bushfire.



Table 1-4 Consequences of Fire on Features of the Southern Highlands Regional Shooting Complex

Site Feature	Consequences/Issues
The recreation areas and facilities are unique in the region	Key site facilities, if impacted by large scale high intensity fires, may have recovery times spanning many months, with adverse consequences for recreational shooting opportunities in the region.
The natural attributes of the site render it bushfire prone	The shrubby, dry eucalypt woodlands and forests which dominate the Southern Tablelands can support high intensity fire on or adjacent to site.
The proximity of the site to the east of a large expanse of rugged wilderness area	The existence of undeveloped wilderness area in close proximity to the boundary, particularly to north-west, provides the potential for reoccurring summer lightning fires which could spread into and within the site and generates a significantly increased risk from fires in adverse summer conditions.
The biodiversity present, whilst it has adapted to frequent fire over many thousands of years, has over many decades been subject to an 'altered' regime of infrequent – high intensity – large scale fire	There are areas within the site that have either burnt in the last decade by higher intensity fire, or not burnt at least one and possibly several decades (a low variety regime). This is potentially outside the historical and recommended fire regimes for Dry Sclerophyll forests and woodlands. Biodiversity conservation across the Southern Highlands Regional Shooting Complex site generates a significant commitment to deliver fire regime heterogeneity.
Site users unfamiliar with bushfire risks	Site users may not be familiar with site features, the capacity for a bushfire to develop in the surrounding landscape, and impact on the site and have site access and egress.

1.4.2 Natural Heritage

The Southern Highlands Regional Shooting Complex forms part of a larger landscape of natural vegetation contiguous with Bargo, Nattai and Thirlmere Lakes National Parks. Vegetation types occurring at the site are summarised in Section 1.3.1.

1.4.3 Fire Regimes

Inappropriate fire regimes have been identified as a key threatening process that may impact on biodiversity values or the loss of vegetation structure or composition in an area. Fire regimes are a function of fire frequency, intensity, seasonality and type of fire (Gill *et al.* 2002).

There are no areas within the Southern Highlands Regional Shooting Complex that are currently subject to fire regimes that are 'too frequent'. There are parts of site however where application of a more frequent fire interval is required to reduce fuels and the likelihood of fires leaving the site. Large parts of the site have not been burnt for a decade and significant areas for more than 20 years.



The most likely fire scenario to result in loss of life and large scale or high consequence damage to natural values is from a large scale high frequency, high intensity fire regime. There is potential for high consequence, potentially irreversible damage from a single large scale, high intensity fire event impacting on the site within the life of this plan. Widespread moderate to high intensity fire may also expose the steeper slopes to erosion, particularly if heavy rains occur before a vegetative ground cover regenerates.

It is important therefore that, to maintain the natural heritage values of the Southern Highlands Regional Shooting Complex, appropriate fire regimes are identified and applied and fire management prescriptions for threatened species implemented. The NSW National Parks and Wildlife Service has, in conjunction with the NSW Rural Fire Service, developed generic fire frequency guidelines for vegetation formations generally across NSW (NSW RFS 2006b) for application through the Hazard Reduction Environmental Assessment Code. These are shown for the dominant vegetation formations occurring within the Southern Highlands Regional Shooting Complex in Table 1-5.

Table 1-5 Fire Regimes

Vegetation Type	Fire Characteristics	Prescription	Threshold
Dry Sclerophyll (shrubby)	Moderate to high intensity fires burning in litter and shrub layer fuels. High intensity fires burning during adverse weather may kill very young age classes of woodland regrowth	Conduct moderate intensity burns outside the bushfire danger period (autumn burns and occasional spring burn) to maintain shrub species richness	SFAZ: 7 - 10 yrs LMZ: 10 - 15 yrs
Rainforest	Will not sustain fire except in seasons affected by severe drought. Fire may burn through small rainforest patches in less severe droughts.	Exclude fire where possible	

The above guidelines are generic and therefore not specifically for Southern Highland Regional Shooting Complex vegetation communities.

1.4.4 Threatened Flora

Table 1-6 lists those threatened flora that have been recorded in the locality (based on 10 km radius search of Atlas of NSW Wildlife (DECCW 2009), or are likely to occur within the locality (based on DEH Protected Matters Report (DEH 2006), together with their likelihood of occurring at the site. No threatened flora were identified during recent surveys conducted by GHD.

Endangered Ecological Communities

None of the vegetation communities recorded in the study area is considered to qualify as an endangered ecological community listed by either the TSC Act or EPBC Act.



Table 1-6 Assessment of Likelihood of Occurrence of Threatened Flora within the Study Area

Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurring in Study Area
Bynoe's Wattle (<i>Acacia bynoeana</i>)	E	V	<i>Acacia bynoeana</i> occurs mainly in heath and dry sclerophyll forest with sand and sandy clay substrates. This species prefers open, slightly disturbed areas such as trail edges.	Possible. Suitable habitat occurs within the site, particularly along existing trails.
Thick-lipped Spider Orchid (<i>Caladenia tessellata</i>)	E	V	This species of orchid inhabits grassy sclerophyll woodland on clay loam or sandy soils, and low woodland with stony soil. Flowering generally occurs between September and November, however late flowering in September or early October has been recorded in southern populations. This species is known from Sydney (historic records), Wyong, Ulladulla and Braidwood regions in NSW. Kiama and Queanbeyan populations are presumed extinct.	Unlikely. Not previously recorded within the locality. No appropriate habitat.
Leafless Tongue Orchid (<i>Cryptostylis hunteriana</i>)	V	V	The larger populations typically occur in woodland dominated by Scribbly Gum (<i>Eucalyptus sclerophylla</i>), Silvertop Ash (<i>E. sieberi</i>), Red Bloodwood (<i>Corymbia gummifera</i>) and Black Sheoak (<i>Allocasuarina littoralis</i>); appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (<i>C. subulata</i>) and the Tartan Tongue Orchid (<i>C. erecta</i>).	Possible. Suitable habitat present.
<i>Grevillea parviflora</i> ssp. <i>parviflora</i>	V	V	The habitat for this species is broad, and is known to occur in areas supporting heath, shrubby woodland and forest on light clay or sandy soils, and often in disturbed areas such as on the fringes of tracks. It has been known to flower over two periods throughout the year, July to December and April to May.	Unlikely. This species was not identified despite surveys being conducted during the species' flowering period. Not previously recorded within the locality.



Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurring in Study Area
Cabbage Kunzea (<i>Kunzea cabbagei</i>)	V	V	This species of groundcover occurs only on damp, sandy soils in wet heath or mallee open scrub at higher altitudes on sandstone outcrops or Silurian group sediments in the Yerranderie / Mt Werong area in the Blue Mountains NSW, as well as the Wanganderry Plateau, Medway, and the Wingecarribee River near Berrima. Flowering occurs from September to November. Threats include impacts on roadside populations from road maintenance and widening.	Unlikely. No appropriate habitat.
Deane's Paperbark (<i>Melaleuca deanei</i>)	V	V	This species is a shrub to 3 m high, with fibrous papery bark. It occurs in two distinct areas, in the Ku-ring-gai / Berowra and Holsworthy/Wedderburn areas. There are also more isolated occurrences at Springwood in the Blue Mountains, Wollemi National Park, Yalwal (west of Nowra), and Central Coast (Hawkesbury River) areas. It grows on sandstone and flowers in Summer.	Unlikely. This species is large and easily identifiable in the field. Although suitable habitat occurs within the site, the species was not identified during current surveys despite targeted searches.
Needle Geebung (<i>Persoonia acerosa</i>)	V	V	This species occurs in dry sclerophyll forest, scrubby low woodland and heath on low fertility soils.	Possible. Suitable habitat present.
Bargo Geebung (<i>Persoonia bargoensis</i>)	E	V	This species is restricted to a small area on the western edge of the Woronora Plateau and the northern edge of the Southern Highlands. It occurs in woodland or dry sclerophyll forest on sandstone and on heavier, well drained, loamy, gravelly soils.	Possible. Suitable habitat present.
Mittagong Geebung (<i>Persoonia glaucescens</i>)	E	V	This species occurs in woodland to dry sclerophyll forest on clayey and gravelly laterite.	Unlikely. Suitable habitat not present - the site is underlain by sandstone.



Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurring in Study Area
Hairy Geebung (<i>Persoonia hirsuta</i>)	E	E	This species occurs in sandy soils in dry sclerophyll forests, woodland and heath on sandstone.	Possible. Suitable habitat present.
Hairy Geebung (<i>Persoonia hirsuta</i> subsp. <i>evoluta</i>)	E	E	This species occurs in sandy soils in dry sclerophyll forests, woodland and heath on sandstone.	Possible. Suitable habitat present.
Brown Pomaderris (<i>Pomaderris brunnea</i>)	V	V	This species of shrub to 3 m grows in moist woodland and forest communities on clay and alluvial soils of flood plains and creek lines. It occurs in a restricted area near the Nepean and Hawkesbury Rivers in NSW, Walcha on the New England tablelands and in far eastern Gippsland in Victoria. Flowering occurs from September to October. Threats include clearing for rural subdivision, and too frequent fires near residential areas.	Unlikely. Suitable habitat not present - the site falls over sandstone.
Austral Toadflax (<i>Thesium australe</i>)	V	V	This species is a small straggling herb to 40 cm tall, and is found in very small populations scattered across eastern NSW. It occurs in grassland or grassy woodland, and is often found in association with Kangaroo Grass (<i>Themeda australis</i>). Threats include loss and degradation of habitat from development, grazing, weed invasion, and road works.	Unlikely. No grassy woodland or Kangaroo Grass identified on site.

E = Endangered, V = Vulnerable, TSC Act = *Threatened Species Conservation Act 1995*, EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*



1.4.5 Threatened Flora Management

Inappropriate fire regimes are a potential threat to a number of species occurring within or adjacent to the Southern Highlands Regional Shooting Complex that are listed on Schedules of the NSW *Threatened Species Conservation Act* (1995) (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act* (1998) (EPBC Act). The conservation significance of these species and recommended fire interval is described in Table 1-7.

Table 1-7 Conservation Significance of Threatened Flora Species

Species	Fire interval – No more than 1 fire within interval	Notes
Bynoe's Wattle (<i>Acacia bynoeana</i>)	7 years	Resprouts from woody rootstock after fire.
Thick-lipped Spider Orchid (<i>Caladenia tessellata</i>)	No fire	Fire is a threat to the species.
Leafless Tongue Orchid (<i>Cryptostylis hunteriana</i>)	10 years	Fire prior to flowering may stimulate flowering intensity. Fire during flowering may be a threat to the species.
<i>Grevillea parviflora ssp. parviflora</i>	7 years	Resprouts from underground rhizomes. Adults may be killed by fire.
Cabbage Kunzea (<i>Kunzea cabbagei</i>)	7 years	Seed germination and seedling growth may be enhanced by fire.
Deane's Paperbark (<i>Melaleuca deanei</i>)	8 years	Fire is a threat to the species.
Needle Geebung (<i>Persoonia acerosa</i>)	10 years	Recruitment is by seed. Adults generally killed by fire.
Bargo Geebung (<i>Persoonia bargoensis</i>)	15 years	Recruitment is by seed. Adults generally killed by fire.
Mittagong Geebung (<i>Persoonia glaucescens</i>)	10 years	Recruitment is by seed. Adults generally killed by fire.
Hairy Geebung (<i>Persoonia hirsuta</i>)	10 years	Recruitment is by seed. Adults generally killed by fire.
Hairy Geebung (<i>Persoonia hirsuta subsp. evoluta</i>)	10 years	Recruitment is by seed. Adults generally killed by fire.



Species	Fire interval – No more than 1 fire within interval	Notes
Brown Pomaderris (<i>Pomaderris brunnea</i>)	10 years	Recruitment is by seed. Adults generally killed by fire.
Austral Toadflax (<i>Thesium australe</i>)	5 years	Recruitment is by seed. Adults generally killed by fire.

NSW RFS (2004), Benson and McDougal (1996), Bell (2001), NPWS (2000a, b and c).

Management prescriptions including considerations of appropriate fire regimes arising for threatened flora species are detailed in the Property Bushfire Management Plan (Appendix A).

1.5 Threatened Fauna

Potential habitat for a variety of fauna is present within the site due to the extensive areas of intact vegetation and presence of mature, hollow-bearing trees. Small areas of rocky sandstone platforms and larger drop-offs provide crevices, overhangs, cracks and rocks suitable as sheltering and foraging sites exist for a range of fauna including reptiles and mammals. Gully areas are likely to provide important habitat for arboreal mammals, bats and birds.

Recent fires in 2001/2002 (NSW RFS 2008) resulted in many burnt out and newly formed stags and hollows in all surveyed areas. Many trees also possessed naturally developed hollows. These hollows may provide denning and nesting habitat for a range of fauna, including owls, bats, arboreal mammals, reptiles and frogs. Surveyed areas were found to contain high numbers of hollow-bearing trees with density not varying substantially throughout the area. Of significance is the apparent older growth attributes of canopy trees in the adjacent gully areas that appear to have less fire damage.

Scattered native grasses and shrubs and consistent ground cover would provide shelter and foraging habitat for ground-dwelling mammals.

Suitable foraging habitat for a number of threatened insectivorous microchiropteran bats is present within and above the forested areas. Some bat species roost in tree hollows, stags and under decorticated bark. These resources were abundant throughout the site and may provide suitable roosting habitat for such species.

The extensive eucalypt canopy of the site provides suitable shelter and foraging habitat for a range of woodland birds, owls and small insectivorous species. Areas of denser midstorey, abundant fallen timber, debris and decaying matter provide shelter and nesting sites for smaller species. Habitat for birds of prey is limited as there are few open areas within the site, with the exception of roads, the shooting range and old trails.

A disused dam provides suitable habitat for a number of frog species, with habitat supplemented by trees and tree hollows

Suitable foraging and shelter habitat is present for reptiles across the site. Much of the groundcover provides habitat for small skinks, while decorticated bark and rocky platforms provide habitat for geckos and snakes. Resources for larger reptiles are present amongst the abundant fallen debris and log



hollows. Large termite mounds are present within the site and these are considered a critical habitat component for the threatened Rosenberg's Goanna (*Varanus rosenbergi*).

Table 1-8 lists threatened fauna species recorded within the regional environment (that is, 10 km radius of the project location). An assessment of likelihood of occurrence within the project location was undertaken, based on the species' habitat requirements and the existence of recent local records (NPWS 2001, DECCW 2009).

1.5.1 Threatened fauna management

Vegetation of the Southern Highlands Regional Shooting Complex contains healthy, mature trees forming a canopy with an open forest, woodland or open woodland structure. The site contains quantities of hollow bearing trees and stags, a healthy and diverse small tree stratum and moderate recruitment of juveniles and seedlings. Based on these habitat attributes native vegetation at the site would be expected to support a diversity of native fauna including threatened species.



Table 1-8 Assessment of Likelihood of Occurrence of Threatened Fauna within the Study Area

Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Conditions relating to use of fire	Likelihood of Occurring in Study Area
Amphibians					
Giant Burrowing Frog <i>(Heleioporus australiacus)</i>	V	V	Found in sandy soils of heath, woodland and open forest where it burrows into deep litter or loose soil. Feeds on spiders, ants, beetles and other ground dwelling invertebrates.	No fire.	Possible. Suitable habitat likely to occur in gullies adjoining the site.
Green and Golden Bell Frog <i>(Litoria aurea)</i>	E	V	Inhabits a variety of freshwater habitats including marshes, swamps, lagoons, farm dams and ornamental ponds (Cogger 2000). Optimum habitat usually contains macrophyte cover (eg <i>Typha</i> spp. or <i>Eleocharis</i> spp.) for siurnal sheltering with nearby grassed areas and an unshaded waterbody free of predatory fish (Pyke and White 1996).	No burning adjacent to streams and no burning in and around ephemeral drainage lines at the headwaters of creeks.	Unlikely. No potential habitat exists on the site.
Red-crowned Toadlet <i>(Pseudophryne australis)</i>	V	-	Found in open forests with periodically wet drainage lines, often beneath sandstone ridges and shale lenses or cappings. Shelters and forages amongst leaf litter, vegetation and under rock.	No burning adjacent to streams and no burning in and around ephemeral drainage lines at the headwaters of creeks.	Possible. Potential habitat exists in ephemeral creeks in adjacent catchments to the north of the site. Geology of the site and downstream appear to be inconsistent with preferred habitat of the species.



Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Conditions relating to use of fire	Likelihood of Occurring in Study Area
Avifauna					
Gang-gang Cockatoo <i>(Callocephalon fimbriatum)</i>	V	-	Inhabits tall mountain forests and woodlands in summer. Lower altitudes are favoured in winter, when the species may be found in open eucalypt forests and woodlands (especially box-ironbark communities) and occasionally in temperate rainforests. High fidelity to nesting trees is displayed.	Avoid burning known nesting trees.	Possible. Marginal foraging habitat may exist in the site.
Glossy Black-Cockatoo <i>(Calyptorhynchus latham)</i>	V	E	Found in heavily timbered sheoak forests, particularly adjacent to watercourses. Main food source includes species of Allocasuarina and Casuarina.	No burning of Allocasuarina thickets.	Possible. This species has been recorded in the locality, however only juvenile foraging habitat has been recorded on the site.
Brown Treecreeper <i>(Climacteris picumnus)</i>	V	-	Inhabits eucalypt woodlands and dry open forests, preferring those dominated by stringybarks or rough-barked eucalypts. Forages in fallen tree timber and on trunks and branches. Feeds mainly on invertebrates, supplementing its diet with nectar from <i>E. sideroxylon</i> and paperbarks. Requires tree hollows for nesting.	Avoid frequent burning of fallen timber.	Possible. This species may occur as suitable habitat exists throughout the site.
Swift Parrot <i>(Lathamus discolor)</i>	E	E	Migratory species utilising dry, open forests and woodlands. Feeds on winter-flowering Eucalypts.	Avoid frequent burning of fallen timber.	Possible. <i>E. agglomerata</i> is a winter flowing species and dominates much of the vegetation.
Turquoise Parrot <i>(Neophema pulchella)</i>	V	-	Prefers eucalypt forest edges adjacent to grassy areas. Often found near sources of permanent water.	Avoid burning known nesting trees.	Unlikely. Suitable habitat not recorded in site.



Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Conditions relating to use of fire	Likelihood of Occurring in Study Area
Barking Owl (<i>Ninox connivens</i>)	V	-	Inhabits eucalypt woodlands, open forest, swamp woodlands, and, especially in inland areas, timber along watercourses. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as Acacia and Casuarina species, or in dense clumps of canopy leaves in large eucalypts. Feeds on a variety of prey, with invertebrates predominant for most of the year, and birds and mammals such as smaller gliders, possums, rodents and rabbits important during breeding. Nests are built in hollows of large, old eucalypts including River Red Gum (<i>Eucalyptus camandulensis</i>), White Box (<i>Eucalyptus albens</i>), Red Box (<i>Eucalyptus polyanthemos</i>), and Blakely's Red Gum (<i>Eucalyptus blakelyi</i>).	Avoid burning known nesting trees.	Recorded. Observed and calls recorded.
Powerful Owl (<i>Ninox strenua</i>)	V	-	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. Feeds on medium sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. Important habitat components include tree hollows and a shrub layer supporting preferred prey. Requires large tree hollows at least 0.5m deep for nesting and prefers large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old.	No burning around known nesting sites at any time.	Possible. Suitable foraging and nesting habitat present within the site.
Masked Owl (<i>Tyto novaehollandiae</i>)	V	-	Found in dry eucalypt forests and woodlands to an elevation of 1100m. Hunts in and along the edges of forests for tree and ground dwelling mammals. Roosts and breeds in moist eucalypt gullies. Nests in large tree hollows and sometimes caves.	No burning around known nesting sites at any time.	Possible. Foraging and nesting habitat for this species is present throughout the site.



Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Conditions relating to use of fire	Likelihood of Occurring in Study Area
Sooty Owl (<i>Tyto tenebricosa</i>)	V	-	Found in rainforest and moist eucalypt forests. Roosts in tree hollows or heavy vegetation during the day. Hunts by night, with prey including small ground or tree dwelling mammals such as the Common Ringtail Possum <i>Pseudocheirus peregrinus</i> or Sugar Glider <i>Petaurus breviceps</i> . Nests in very large tree hollows.	No burning around known nesting sites at any time.	Possible. Suitable foraging habitat present within the site.
Regent Honeyeater (<i>Xanthomyza phrygia</i>)	E	E	Prefers open forests and box-ironbark woodlands and communities consisting of Mugga Ironbark, White Box, Yellow Box and Yellow Gum trees. Main food source comprised of nectar and honeydew exuded from lerps and insects.	Avoid frequent burning of fallen timber.	Unlikely. Preferred habitat (Box-Ironbark woodland) absent from the site.
Bats					
Large-eared Pied Bat (<i>Chalinolobus dwyeri</i>)	V	V	Distributed between southeastern QLD to NSW from the coast to the western slopes of the divide. Roosts in caves and mines and has been most commonly recorded from dry sclerophyll forests and woodlands. Forages for insects over the canopy or along creek beds (Churchill 1998).	Avoid frequent burning and habitat alteration. No fire around known roost sites.	Possible. Suitable foraging habitat present within the study area. No roosting habitat occurs within the site.
Eastern False Pipistrelle (<i>Falsistrellus tasmaniensis</i>)	V	-	Inhabits moist forest generally with trees larger than 20 m and roosts in eucalypt hollows, underneath bark or in buildings. Diet consists of moths, beetles and other insects, which it collects within or just below the tree canopy.	Avoid frequent burning and habitat alteration. No fire around known roost sites.	Possible. Suitable foraging and roosting habitat present within the site.



Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Conditions relating to use of fire	Likelihood of Occurring in Study Area
Golden-tipped Bat (<i>Kerivoula papuensis</i>)	V	-	Found in rainforest and adjacent sclerophyll forest. Roosts in abandoned hanging Yellow-throated Scrubwren and Brown Gerygone nests located in rainforest gullies on small first- and second-order streams. Will fly up to two km from roosts to forage in rainforest and sclerophyll forest on upper-slopes and is a specialist feeder on small web-building spiders.	Avoid frequent burning and habitat alteration. No fire around known roost sites.	Unlikely. Limited potential foraging habitat present within the creek lines of the site.
Eastern Bentwing-bat (<i>Miniopterus schreibersii oceanensis</i>)	V	-	Roosts primarily in caves, however mines, stormwater tunnels and buildings are also utilised. Hunts above tree tops in forested areas for flying insects.	Avoid frequent burning and habitat alteration. No fire around known roost sites.	Possible. Suitable foraging habitat exists throughout the site.
Eastern Freetail-bat (<i>Mormopterus norfolkensis</i>)	V	-	Occurs in dry sclerophyll forest and woodland east of the Great Dividing Range. Roosts primarily in tree hollows but also in man-made structures or under bark. Feed on insects.	Avoid frequent burning and habitat alteration. No fire around known roost sites.	Possible. Suitable foraging and roosting habitat present within the site.
Large-footed Myotis (<i>Myotis macropus</i>)	V	-	Primarily a coastal species. Forages over streams and watercourses feeding on fish and insects. Roosts in a variety of habitats including caves, mine shafts, stormwater channels, buildings, under bridges and in dense foliage.	Avoid frequent burning and habitat alteration. No fire around known roost sites.	Unlikely. Very limited potential foraging or roosting habitat present within the site.
Grey-headed Flying Fox (<i>Pteropus poliocephalus</i>)	V	V	Roosts in camps generally located within 20 km of a regular food source. Found in gullies, close to water and in vegetation with a dense canopy. Forages in areas supporting subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps on the nectar and pollen of native trees, in particular eucalypts, melaleucas and banksias.	Avoid frequent burning and habitat alteration. No fire around known roost sites.	Possible. Suitable foraging habitat present within the site.



Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Conditions relating to use of fire	Likelihood of Occurring in Study Area
Yellow-bellied Sheathtail Bat <i>(Saccolaimus flaviventris)</i>	V	V	Forages for insects across a range of habitats including those with and without trees, from wet and dry sclerophyll forest, open woodland, Acacia shrubland, mallee, grasslands and desert. Roosts in tree hollows and buildings and in areas where trees are scarce or absent, and has been known to utilise mammal burrows.	Avoid frequent burning and habitat alteration. No fire around known roost sites.	Possible. Suitable foraging and roosting habitat present within the study area.
Greater Broad-nosed Bat <i>(Scoteanax rueppellii)</i>	V	-	Forages for insects from above rows of trees lining creeks and the edges of woodland in otherwise cleared paddocks. Roosts in hollow tree trunks and branches as well as the roofs of old buildings (Churchill 1998). Inhabits a variety of habitats ranging from moist and dry eucalypt forest and rainforest to tall wet forest, however tends to prefer moist gullies in mature coastal forest or rainforest from the Atherton Tablelands in north QLD, along the coastal regions to southern NSW.	Avoid frequent burning and habitat alteration. No fire around known roost sites.	Possible. Suitable foraging and roosting habitat present within the study area.
Other mammals					
Brush-tailed Bettong <i>(Bettongia penicillata penicillata)</i>	Extinct	Extinct	This sub species is presumed extinct. The western population was known to inhabit dry sclerophyll forest with dense understorey. The last record of this species within the locality was from 1906.	-	Unlikely. Presumed extinct in NSW.



Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Conditions relating to use of fire	Likelihood of Occurring in Study Area
Eastern Pygmy Possum (<i>Cerartetus nanus</i>)	V	-	Distributed along the coast of southern QLD, NSW, and Victoria, southeastern SA, and is present throughout Tasmania (Bowen and Goldingay 2000). Banksia spp. and myrtaceous shrubs and trees are favoured food sources and nesting sites in drier habitats. Feeds largely on pollen and nectar from Banksia spp., Eucalyptus spp., Callistemon spp. and insects (Turner and Ward 1995). Nests in hollows in trees and under the bark of Eucalypts, forks of tea-trees, and in abandoned bird nests (Turner and Ward 1995).	. Avoid frequent burning and habitat alteration.	Possible. Suitable foraging habitat present within the site.
Spotted-tailed Quoll (<i>Dasyurus maculatus</i>)	V	E	Inhabits forests, sheltering in hollow logs and rock crevices. Diet includes small mammals, eggs, insects, reptiles and birds.	Avoid frequent burning and habitat alteration.	Possible. Suitable denning and foraging habitat exists.
Southern Brown Bandicoot (<i>Isodon obesulus obesulus</i>)	E	E	Inhabits scrubby vegetation, including heath, shrubland, and heathy forest and woodland. Often associated with well-drained soils and dry heathland communities. Feeds primarily on invertebrates and earthworms as well as underground fungi. Generally found to be more abundant in areas following post-fire regeneration due to increases in vegetation diversity and insect availability.	Avoid high intensity burns and alteration of habitat.	Possible. Suitable foraging habitat present within the site.
Yellow-bellied Glider (<i>Petaurus australis</i>)	V	-	Found in mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Feeds on plant and insect exudates, including nectar, sap, honeydew and manna, pollen and insects. Makes a characteristic 'V' shaped incision into trunks and branches of favoured food trees for the purpose of extracting sap. Hollows of large trees are often favoured as a den for family groups.	Avoid frequent burning and habitat alteration.	Recorded. Observed and calls recorded. Feed trees were located throughout the site.



Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Conditions relating to use of fire	Likelihood of Occurring in Study Area
Koala (<i>Phascolarctos cinereus</i>)	V	-	Inhabits Eucalypt canopies in forests and remnant woodlands. Diet consists of leaves and shoots from certain Eucalypt species, including Ribbon Gum, White Box, Red Stringybark and Scribbly Gum.	Avoid high frequency, high intensity fire.	Recorded. Scats and tree markings have been observed on site. No roosts were observed at this time and habitat utilisation may be transitory.
Long-nosed Potoroo (<i>Potorous tridactylus</i>)	V	V	In NSW it is generally restricted to coastal heaths and forests east of the Great Dividing Range, with an annual rainfall exceeding 760 mm. Major habitat requirement is relatively thick ground cover with occasional open areas and may consist of grass trees, sedges, ferns or heath, or low shrubs of tea-trees and Melaleucas where soil is light and sandy. Feeds on the fruiting bodies of underground-fruiting fungi, roots, tubers, insects and their larvae, and other soft-bodied animals in the soil.	Avoid frequent burning and habitat alteration.	Unlikely. Suitable habitat not recorded on the site.
Reptiles					
Broad-headed Snake (<i>Hoplocephalus bungaroides</i>)	E	V	Found near large, flat sandstone formations providing crevices, caves and overhangs in which the species shelters. Tree hollows may also be utilised for shelter. Small lizards, frogs, birds and mammals are the species primary food source.	Avoid frequent burning and habitat alteration.	Possible. Suitable rocky habitat exists in the southern extremities of the site. Tree hollows provide potential Summer refuge sites.
Rosenberg's Goanna (<i>Varanus rosenbergi</i>)	V	-	Inhabits heath, open forest and woodland and is often found near termite mounds, which provide nesting habitat. Feeds on carrion, birds, eggs, reptiles and small mammals. Hollow logs, and rock crevices provide shelter and individuals may be found using the burrows of other species.	Avoid frequent burning and habitat alteration.	Possible. Suitable habitat exists and termite mounds were present within the study area.

E = Endangered, V = Vulnerable, TSC Act = *Threatened Species Conservation Act 1995*, EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*



Overall, fire regimes should aim to provide a balanced mix of habitat types. Fire regimes that result in homogenisation of understorey structure (either grassy or shrubby) should be avoided.

Specific environmental assessments prior to prescribed burning activities will determine if specific prescriptions are required around a specific record type to protect that species. Record types that require specific prescriptions include known roost, nest and maternity sites, specific habitat or foraging resources or high use areas. In NSW an environmental assessment for prescribed burning can be completed using the *Bush Fire Environmental Assessment Code* (Code) (NSW RFS 2006b). The Code may be used as a guide to provide a streamlined approach to environmental assessment of bushfire hazard reduction works.

1.5.2 Environmental Features Sensitive to Fire

Vegetation communities of the property have evolved with and become adapted to fire, though the sensitivity of each component is dependent on bushfire frequency, intensity and timing. Key environmental features sensitive to fire include:

- ▶ Fire sensitive vegetation communities (e.g. rainforest including riparian vegetation) (Bowman 1992). Rainforest and riparian communities occur within the site as small, isolated pockets, generally located adjacent to streams. Rainforest may be susceptible to impacts from large fires, particularly following periods of drought. The local distribution and species composition at the edge of rainforest communities is influenced strongly by fire (Stocker 1966, Wonarski *et al.* 2007). Higher intensity fires in riparian vegetation may also ignite soil organic matter contributing to significant carbon release. The location of these communities within the dissected terrain leads to difficulty in treating their immediate surrounds. Fuel moisture within the rainforest communities, coupled with their location within gullies and adjacent to water results in higher fuel moisture content than the surrounding dry sclerophyll vegetation. Factors of terrain, fuel load and moisture combine to decrease fire potential, and in some cases these communities will represent a natural fire containment line and an opportunity to decrease bushfire spread (Bradstock *et al.* 2009);
- ▶ Vegetation communities sensitive to fires of higher intensities and/or requiring an extended fire return interval (e.g. vulnerable species and vegetation communities). Even those species that are less sensitive to fire may be impacted by a high fire return interval. This includes *Persoonia acerosa*, *P. bargoensis*, *P. glaucescens*, *P. hirsuta* and *P. hirsuta* subsp. *evoluta*; threatened species for which seed abundance and follow up regeneration may be reduced by a high return interval of bushfire (Section 1.4.5); and
- ▶ Single high intensity fires impacting on the majority of the site creating a homogenised time since burnt age class. Maintaining heterogeneity in fire regimes in space and time is important in maintaining biodiversity. The spatial extent of adverse fire regimes is a key factor in biodiversity conservation (Gill *et al.* 2002) and when adverse fire regimes predominate, loss of species across an entire landscape may result (NPWS 2003b). Recolonisation of burnt areas may be rapid following a patchy fire time but may be considerably slower following a large intense fire. It is important for biodiversity of the site that a patchwork of different post fire age classes is maintained across the property.



1.5.3 Aboriginal and Historic Cultural Heritage

The location of asset, landscape and environmental values to be protected for the site is detailed on the Property Bushfire Management Plan (Appendix A), however specific Aboriginal Cultural Heritage sites are not referenced.

The Southern Highlands Regional Shooting Complex is within the traditional lands of the Gandangarra and Wodi Wodi peoples (Navin Officer 2007) and the presence of Aboriginal artifacts at the site indicates that the land was previously utilised by the Aboriginal people.

There are Aboriginal Cultural Heritage Sites that occur within the Southern Highlands Regional Shooting Complex and fall into the category of 'Artefacts' and is not likely to be associated with an archaeological deposit or large numbers of artefacts (Navin Officer 2007). Using the NSW Bushfire Assessment Code (*Conditions for Hazard Reduction and Aboriginal Heritage*) (NSW RFS 2006b) as a guide prescribed burning is identified as a low risk to this site types, however slashing/trittering and the use of earthmoving machinery are identified as higher risk. A description of these site types and associated site protection measures are provided in Table 1-9.

Table 1-9 Aboriginal Site Management Guidelines

Site Type	Description	Suggested Site Protection Measures for Hazard Reduction
Artefacts (AFT)	Objects such as stone tools, spears, manuports, grindstones, discarded stone flakes, modified glass or shell demonstrating evidence of use of the area by Aboriginal people	<p>Do not break earth around known sites, especially where there is surface evidence of artefacts, shell, charcoal or ochre</p> <p>Any surface impact adjacent to site must be immediately returned to previous state, a note made of site location</p> <p>Vehicles or heavy equipment must not be used on or within these sites unless a path exists that will not damage the site</p> <p>Vegetation which is screening the site must not be damaged</p> <p>There must be no slashing/trittering of vegetation, no tree removal, and no use of earthmoving equipment such as bulldozers</p> <p>If using fire place the control lines well away from the site</p>

Source: Conditions for Hazard Reduction and Aboriginal Heritage of the Code (NSW RFS 2006b)

While formal land titles relating to the site were allocated by 1898, the site was largely undeveloped and no listed Heritage items are identified.



1.6 Bushfire Management Units and Zones

1.6.1 Bushfire Prone Land

The Southern Highlands Regional Shooting Complex is identified as bushfire prone for the local government area covering the site (Wingecarribee Council). Bushfire mitigation works, identified in Section 2 of the Property Bushfire Management Plan (Appendix A), have been prepared to reduce the risk from bushfire prone vegetation on site assets.

1.6.2 Bushfire Management Zones

Partition of the Southern Highlands Regional Shooting Complex into bushfire management zones allows specific fire strategies and actions to be implemented based on fuels, proximity to assets and bushfire risk. Bushfire management zones are usually bounded by roads or trails, and where necessary by natural landscape features that provide barriers to fire spread under Low to Moderate fire danger conditions. Bushfire management zoning for the Southern Highlands Regional Shooting Complex is applied to align with the zoning system used by NSW fire authorities.

The following zoning types are used to classify management units in this Bushfire Management Plan.

- ▶ **Asset Protection Zone (APZ):** An area between an asset and a bushfire hazard where bushfire fuel has been reduced significantly to protect an asset that is vulnerable to bushfire, and also to provide a space for firefighters to safely defend the asset using direct attack suppression strategies;
- ▶ **Strategic Fire Advantage Zone (SFAZ):** A fuel reduced area to support the protection of assets (either alone or to compliment more intensely managed APZs), to limit fire spread and spot fire development (through placement in areas of high ignition potential or across known fire paths), or enable the safe use of parallel or indirect suppression strategies;
- ▶ **Land Management Zone (LMZ):** An area in which the fire regime is managed to meet general land management objectives and vegetation fire interval;

These management unit classifications remain constant for the life of the plan although the application of the prescribed burning prescriptions may need to be reviewed annually in the event of unforeseen circumstances such as fire events or updated ecological information. For example the areas categorised as SFAZ and the prescribed burning schedule may be revised to link up with and take advantage of areas burnt by bushfire to provide a strategic buffer.

Prescriptions may not be applied across the entire extent of a zone in all circumstances where there are site-specific ecological constraints, heritage, cultural or aesthetic considerations, or where implementing the zoning will not alter the residual risk to an asset. The protection of specific assets will generally take precedence over specific environmental considerations in APZs and SFAZs and require fire burning at greater intervals than specified fire thresholds (Section 1 of Property Bushfire Management Plan (Appendix A)) for vegetation communities.

Bushfire management zones identified and the fuel management objective of each zone are detailed in the Property Bushfire Management Plan (Appendix A).

1.6.3 Asset Protection Zones

The threat from flame contact and radiant heat to property (and thereby site users and visitors) within and adjacent to the planning area can be reduced by the establishment of Asset Protection Zones



(APZs) immediately surrounding buildings and other assets at risk. APZs are areas surrounding an asset where fuels (e.g. vegetation) are managed to reduce radiant heat and minimise the likelihood of flame contact with buildings.

APZ requirements for new buildings are guided by NSW planning legislation for development in bushfire prone areas (*Planning for Bushfire Protection* (NSW RFS 2006a)).

APZ recommendations for the clubhouse and amenities block are based on the following assumptions and parameters:

- ▶ Vegetation adjacent to the buildings is actively managed as reduced vegetation (such as maintained lawns, recreation areas or hard surface areas such as parking or access);
- ▶ Areas of reduced vegetation are a minimum of 20 metres wide from existing amenities buildings and eastern clubhouse, adjacent to the 800m range; and
- ▶ These minimum reduced vegetation areas constitute the APZ for those buildings.

The APZ for the western clubhouse (yet to be established) is incorporated into the surrounding carpark. The specifications of this APZ, including an inner protection area (IPA) and outer protection area (OPA), are:

- ▶ To the north-west an IPA of 60 m and an OPA of 25 m;
- ▶ To the north-east an IPA of 40 m and an OPA of 20 m;
- ▶ To the south-west an IPA of 50 m and an OPA of 20 m; and
- ▶ To the south-east an IPA of 40 m and an OPA of 20 m.

Procedures for the maintenance of APZs are detailed in the Bushfire Mitigation section of this Bushfire Management Plan (Section 2).

1.6.4 Strategic Fire Advantage Zones

Hazard reduction by prescribed burning reduces the rate of spread, flame height and intensity of a fire, as well as the number and distance of spotfires by changing the structure of the fuel bed and reducing the total fuel load (Gould *et al.* 2007b). Project Vesta (Gould *et al.* 2007b) has also demonstrated the following:

- ▶ The effects of hazard reduction burning (reduction of intensity and rate of spread) may persist for a considerable time (up to 20 years) in forests containing rough-barked trees and shrubby understorey;
- ▶ Post fire stimulation of the shrub layer will not increase the rate of spread until such time as a significant near-surface fuel layer accumulates; and
- ▶ Younger fuels produce fewer firebrands because fire intensities are low and less bark is consumed than older fuel types.

The strategic placement of hazard reduced areas in the landscape is therefore an important strategy helping to reduce the size that bushfires might otherwise attain (by providing areas in the landscape where fire suppression will have greater success probability). This complements work done to reduce asset vulnerability and hazards adjacent to assets and therefore enhances efforts to reduce risks to life, property and other assets.



The implementation of Strategic Fire Advantage Zones on the Southern Highlands Regional Shooting Complex is planned to provide areas in which fuels are managed to provide wildfire control options under a wider range of conditions than would be the case if fuel management was not undertaken, and to provide safer, less hazardous conditions for fire suppression operations.

Strategic Fire Advantage Zones identified in the Southern Highlands Regional Shooting Complex Property Bushfire Management Plan (Appendix A) are not yet in place and it may take more than five years of prescribed burning implementation to establish. The aim of hazard reduction burning in SFAZs proposed for the Southern Highlands Regional Shooting Complex during the life of this plan is to:

- ▶ Reduce the bushfire hazard adjacent to APZs and thereby improve their effectiveness;
- ▶ Reduce the bushfire hazard (and therefore the bushfire behaviour which potentially may occur) adjacent to areas with a history of fire ignition and areas considered likely to become high ignition areas (i.e. adjacent to public roads and at northern property boundary);
- ▶ Provide low fuel areas at strategic locations aligned with particular roads and fire trails to provide areas where the probability of fire suppression can be enhanced (so as to reduce the potential for bushfires to spread over larger proportions of the site); and
- ▶ Cooperatively work with NSW Rural Fire Service and DECCW to reduce bushfire risks to communities neighbouring the Southern Highlands Regional Shooting Complex.

1.6.5 Land Management Zones

Areas assigned as Land Management Zones do not require hazard reduction burning for the protection of specific assets, or to provide specific areas of advantage for fire control. Fire in Land Management Zones (the combination of planned and unplanned fires) is managed to provide appropriate and heterogeneity in fire regimes for the ecological communities occurring in the zone.

1.7 Bushfire Assets and Advantages

1.7.1 Water Supply

Water supply available at the Southern Highlands Regional Shooting Complex consists of:

- ▶ Tank water at the clubhouse for domestic use; and
- ▶ Agricultural dams.

Agricultural dams are the only sources suitable for fire fighting and are not suitable as drinking water. These water points are shown on the Property Bushfire Management Plan (Appendix A).

1.7.2 A ccess

Roads and fire trails provide a means of access for fire crews for fire suppression and prescribed burning operations. They also serve as an effective control line for prescribed burning and back burning, and as a mineral earth break or reduced fuel zone to limit the potential for unplanned fires to enter or leave the property.

In NSW fire trails are classified (BFCC 2003) using a vehicle carrying capacity classification and strategic classification. The vehicle carrying capacity classification types are shown in Table 1-10.



Table 1-10 Fire Trail Classifications – Carrying Capacity

Classification	Description
Cat 1	A trail that is safely traversed by a Category 1 fire-fighting appliance A Category 1 fire fighting appliance is a double or single cab all-wheel drive heavy appliance for grassland or forest, with a water capacity of 3000-4000 litres
Cat 7	A trail that is safely traversed by a Category 7 fire-fighting appliance A Category 7 fire fighting appliance is a double or single cab all-wheel drive light appliance for grassland or forest, with a water capacity of 800-1600 litres
Cat 9	A trail that is safely traversed by a Category 9 fire-fighting appliance A Category 9 fire fighting appliance is a dual or single cab drive four wheel drive primarily used for mop up in grassland or forest, with a water capacity of 300-800 litres

Source: (BFCC 2007a)

Fire access is shown on the Southern Highlands Regional Shooting Complex Property Bushfire Management Plan (Appendix A) with access roads, supplemented by natural surface trails providing access to the ranges and clubhouse. Category 1 fire trails service the eastern clubhouse, extending along the length of the 800 m range. To the east and west of the eastern clubhouse Cat 7/9 trails lead to two separate quarries, both of which are currently dead-ends.

Within the western part of the complex, Category 1 fire trails will provide access from Wattle Ridge Road:

- ▶ to the 50m pistol range (south of which is a dormant fire trail),
- ▶ to and along the length of 500m range, and east to the edge of the ridgeline; and
- ▶ to the carpark, western clubhouse location and westwards past the dam.

Further westwards a dormant trail occurs on ridge to the west and includes a horse track trail extending from the western property boundary.

All trails should be maintained to their access classification standard (i.e. in a condition trafficable by Category 1, 7 or 9 Fire Tankers for the duration of the declared bushfire danger period).

In NSW trails can also be formally classified using a strategic fire trail classification (essential, important or dormant). No trails on the Southern Highlands Regional Shooting Complex are categorised as essential or important, though this does not preclude their use for fire fighting. The 'horse track' trail and a number of smaller trails are classified as dormant (see Property Bushfire Management Plan), and could be reclaimed to serve as a fire control advantage.

Fire trails, particularly those with a natural surface, can represent a significant source of soil erosion and water pollution if poorly constructed and lacking temporary or permanent erosion control structures. All trails, including temporary trails prepared as part of fire operations, should include adequate drainage control measures installed at the time of construction and during routine maintenance. Access to fire breaks and trails should be limited to authorised users only and restricted in waterlogged areas where access is likely to damage the trail surface and create erosion. Consideration may be given to armouring trail surfaces or creating formal drainage crossings where regular access is required through areas prone to waterlogging.



In NSW Bush Fire Coordinating Committee guidelines (BFCC 2007a) provide an indication of suggested trail dimensions and specifications for Category 1, 7 and 9 fire trails (Table 1-10).

1.7.3 Access Points

Location of access points and vehicle gates is shown in the Southern Highlands Regional Shooting Complex Property Bushfire Management Plan (Appendix A). External fire access to the site is restricted to authorised users only.

1.7.4 Fire Fighting Equipment

There is no formal fire fighting response capacity maintained on the site. The Southern Highlands Regional Shooting Complex relies on the resources of external bushfire combat agencies, predominantly the NSW Rural Fire Service (NSW RFS). It is considered that in implementing the mitigation and response strategies detailed in the Bushfire Management Plan (for example maintaining trails, implementing prescribed burning or slashing identified in SFAZs, external fire fighting resources (NSWFB and NSW RFS)), that the residual risk to the Southern Highlands Regional Shooting Complex will be mitigated.



2. Bushfire Mitigation Works Schedule

2.1 Aims

The general aim of bushfire mitigation works is to reduce the impact of fire on values at risk (Section 1.4 and the Property Bushfire Management Plan (Appendix A)). Mitigation is achieved by a combination of the following and is documented in the bushfire mitigation works schedule of the Property Bushfire Management Plan:

- ▶ Altering site characteristics to improve the probability of successful fire response – Implementing site works (such as fire trail maintenance and strategic hazard reduction) that make safe fire suppression more likely to succeed, reducing the risk of fires being able to develop to large, high consequence fires;
- ▶ Hazard Modification - Altering the characteristics of bushfire hazards, particularly adjacent to assets, so that fires occurring have less damaging characteristics;
- ▶ Vulnerability Reduction – Constructing or managing assets in such a way that they are less vulnerable to fire damage; and
- ▶ Ignition Reduction – Managing operational and defence activities such that unplanned fire ignitions are minimised.

2.2 Mitigation Activities

The Bushfire Mitigation Works Schedule (BMWS) is prepared for the entire duration of the Bushfire Management Plan and details the mitigation works that need to be undertaken before and during the early parts of the bushfire season. Works include but are not limited to:

- ▶ Bushfire fuel reduction through prescribed burning or mechanical means (slashing, trittering);
- ▶ Ecological burning;
- ▶ Maintenance of fire trails, breaks and other fire control infrastructure;
- ▶ Implementation of APZs or SFAZs; and
- ▶ Building works and maintenance.

Prescribed burning operations are undertaken during autumn, winter or early spring to limit the impact of summer fires, and to permit safer execution and delivery of burning operations. Fuel moisture content is extremely important in the timing of prescribed burning operations, particularly if the moisture differential of natural fire advantages is being used to provide a control line. Therefore, the exact timing of burning works cannot be set in long-range strategic plans, and will require monitoring of conditions to determine the appropriate timing and availability of fuels.

Specific bushfire mitigation works are identified in the Bushfire Mitigation Works Schedule of the Property Bushfire Management Plan (Appendix A).



Opportunities to include adjoining properties in cooperative prescribed burns should be pursued where possible. As well as being potentially more cost effective it also permits the use of more suitable control lines or targeting of areas where treatment is more effective outside the property (e.g. areas of high ignition or likely fire spread). Such arrangements could be formalised through a memorandum of understanding, contract or other agreement.

A key objective of bushfire mitigation works is the protection of environmental values within operational burning areas (e.g. fire sensitive plant communities or fauna habitats). Protecting these values may require a specific ignition strategy (burning out from these features utilising the moisture differential or weather conditions) or by implementation of strategic fire advantages. Environmental considerations are identified in Section 1 of the Property Bushfire Management Plan (Appendix A).

Building works and maintenance may be carried out annually as part of the Southern Highlands Regional Shooting Complex working bee. Works would include inspection of roof guttering, external vent/ opening covers and fly screens. External combustible materials and fire hazards within 20m of the buildings would be removed. Vegetation clearance adjacent to buildings would be conducted in accordance with the Asset Protection Maintenance Guide (Appendix B).

2.3 Measures to Facilitate Successful Fire Response (reducing the number of large damaging fires)

Mitigation measures to facilitate successful fire response will include:

- ▶ Provision and maintenance of a good access (road and trail) network on the site to facilitate rapid, effective response and provide options within the site for parallel and indirect suppression strategies. The road and fire trail network is depicted in the Southern Highlands Regional Shooting Complex Property Bushfire Management Plan (Appendix A). The standards for fire trail maintenance detailed in Appendix C apply only to those trails depicted as fire trails on the Property Bushfire Management Plan; and
- ▶ Strategic location of fuel reduced areas managed in accordance with zoning.

Mitigation objectives for the Southern Highlands Regional Shooting Complex are shown in Table 2-1. Where fuels reach the desired maximum fuel loads the management unit should be considered for fuel reduction activities. Where maximum fuels have not been attained, a decision may be made to delay fuel reduction activities (see Figure 2-1),

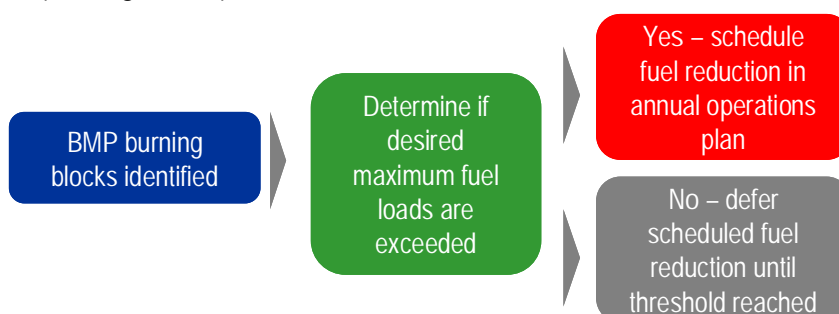


Figure 2-1 Determination of Bushfire Mitigation Works



Table 2-1 Bushfire Management Units

Zone	Elements	Desired Maximum Fuel Loads ⁵	General Management Strategies
Asset Protection Zone (APZ)	Built assets	Surface fine fuel – low Near Surface – low cover Elevated - low Bark – n/a	Implement existing slashing/mowing regimes General house-keeping <20m around assets, building inspections and maintenance.
Strategic Fire Advantage Zone (SFAZ)	Management units	Surface fine fuel – low Near Surface – low Elevated - low to moderate Bark – low to moderate	Maintain low to moderate fuel hazard to enhance effectiveness of APZs and to aid fire suppression Work cooperatively with NSW RFS to implement HR burns and bushfire awareness strategies (Section 3) Maintain fire trails adjacent to SFAZ in a condition trafficable by 4WD Category 1 fire tankers
Land Management Zone (LMZ)	Management units	Maintenance of appropriate ecological fire regimes	Section 1.3

2.4 Measures to Facilitate Protection of Life and Built Assets

Mitigation measures to facilitate the protection of life and property will include:

- ▶ **Hazard modification** – Asset Protection Zones around assets and locations where people work or congregate. Standards to guide the implementation of Asset Protection Zones are detailed in *Planning for Bushfire Protection* (NSW RFS 2006a) (see Appendix B);
- ▶ **Vulnerability management measures** – To ensure that bushfire vulnerability considerations are given due consideration for future development, all new buildings must comply with *Planning for Bushfire Protection* (NSW RFS 2006a) and AS3959 - 1999 Construction of buildings in bushfire-prone areas; and
- ▶ **Measures to use and maintain assets** - In such a way that their vulnerability is maintained at appropriate levels (asset maintenance and preparedness works) as identified in the Southern Highlands Regional Shooting Complex Property Bushfire Management Plan (Appendix A).

These measures are supported by a Bushfire Awareness Program (Section 3) to reduce the vulnerability of people to bushfire impacts.

⁵ Assessed using methodology outlined in the Field Guide for Fuel Assessment and Fire Behaviour Prediction in Dry Eucalypt Forest – Interim Edition (Gould *et al* 2007a)



2.5 Measures to Facilitate Protection of Environmental Values

The combination of bushfire mitigation and awareness strategies identified in this Bushfire Management Plan are designed to protect environmental values through pursuing action to avoid inappropriate fire regimes.

Fire frequency thresholds and general burning prescriptions aimed at providing fire regimes appropriate to vegetation types and threatened flora species are provided in Sections 1.3 and 1.4.5.

2.5.1 General Environmental Protection Measures for prescribed burning operations

The protection of a range of environmental values through prescribed burning operations can be guided by steps 4 to 11 of the NSW Rural Fire Service *Standards for Low Intensity Bushfire Hazard Reduction Burning* (NSW RFS undated) The *Bush Fire Environmental Assessment Code for NSW* (NSW RFS 2006b) can also be used as a guide to assist in environmental assessment of prescribed burn proposals.

2.6 Standards Applying to Bushfire Mitigation Works

2.6.1 Building and Site Maintenance

All buildings should be subjected to inspection and maintenance regimes before the commencement of the declared bushfire danger period (usually 1 October) and at regular intervals throughout the fire season. The aim of inspection and maintenance is to reduce the threat of embers and bushfire impacting on a structure.

As a guide the following items should be inspected and maintained (NSW RFS 2006a) (Table 2-2):

Table 2-2 Building and Site Maintenance Measures

Feature	Maintenance measure
Buildings	<ul style="list-style-type: none">Roof and gutters are free from accumulations of leaf litterPainted surfaces are in good condition with decaying timbers given particular attention to prevent the lodging of embers within gapsPumps and water supplies are available and in working orderTiles and rooflines have no broken tiles or dislodged roofing material and there are no gaps in the roof or eavesScreens on windows and doors are in good condition without breaks, tears or holes that allow penetration of airborne embers into the building in the event windows are openDraught excluders are functioning correctlyWoodpiles, garden sheds, dead plant material (including landscape chip/bark), leaf litter, and other combustible materials are located well away from the structure
Vegetation Adjacent to Buildings	<ul style="list-style-type: none">Maintain a clear area of low cut lawn or pavement adjacent to the buildingAvoid the use of organic mulch in bush fire prone areas with non flammable material used as an alternative ground cover, e.g. Scoria, pebbles, recycled crushed bricks



Feature	Maintenance measure
	<p>Avoid planting and maintain trees and shrubs such that:</p> <ul style="list-style-type: none"> – the branches will not overhang the roof – the tree canopy is not continuous – are of higher flammability <p>Trees and other vegetation in the vicinity of power lines are managed in accordance with the Electricity supplier specifications</p> <p>An Asset Protection Zone Maintenance Guide is provided in 0</p>

2.6.2 Asset Protection Zones (APZ) standards

Planning for Bushfire Protection (NSW RFS 2006a) provides information that can be used to guide the maintenance of Asset Protection Zones. A summary guide provided for managing the interface with areas of bushfire hazard is provided in Appendix B.

2.6.3 Strategic Fire Advantage Zones (SFAZ) standards

Strategic fire breaks limit the potential for fires to enter, leave or spread within the Southern Highlands Regional Shooting Complex. SFAZs are created along property boundaries (including adjoining lands) or across strategic parts of the property. Standards for SFAZs are derived from the NSW Rural Fire Service *Standards for Low Intensity Bushfire Hazard Reduction Burning* (NSW RFS undated), and from fuel reduction objectives for SFAZ burns.

The fuel reduction objectives for SFAZs are to:

- ▶ Reduce the Surface fuel hazard to LOW;
- ▶ Reduce the Near Surface fuel hazard to LOW;
- ▶ Reduce the Elevated fuel hazard to MODERATE or LOW;
- ▶ Reduce Bark fuel hazard to HIGH or less; and
- ▶ Achieve the above fuel hazard reductions in 60 to 80% of the area planned for each SFAZ burn.

Note: The fuel hazards referred to above are to be assessed in accordance with the methodology contained in the *Overall Fuel Hazard Assessment Guide* (Hines *et al.* 2010).

2.7 Monitoring Implementation of the BMWS

The position identified in Section 6 is responsible for monitoring the implementation of the BMWS. The schedule of works shall be reviewed and updated on an annual basis and modified as required on the basis of fire occurrence during the previous year.

Changes to the BMWS may be required when:

- ▶ Wildfire has impacted upon areas scheduled for burning;
- ▶ New buildings are constructed which require additional bushfire protection measures (e.g. asset protection zones);



- ▶ New research findings require an adjustment of burning prescriptions or asset protection zone depths;
- ▶ Weather impacts on timing and delivery;
- ▶ Capital works or resource limitations impact the ability to implement works;
- ▶ New policies or recovery plans are released for threatened species which may require an adjustment to management prescriptions; or
- ▶ A significant environmental, historical or cultural item is located on the property.



3. Bushfire Awareness Program

3.1 Bushfire Awareness Program Objectives

A Bushfire Awareness Program (BAP) aims to communicate information about fire and associated management activities to people who use, manage or live in areas neighbouring the Southern Highlands Regional Shooting Complex. This information can include:

- ▶ Awareness of the bushfire risks associated with the property;
- ▶ Knowledge of what to do in the case of a bushfire emergency on the property;
- ▶ Key messages about the management and potential risks posed by bushfire fuels;
- ▶ Advice of upcoming fuel reduction burns on the property; and
- ▶ A contact point within the Communities NSW Sport and Recreation or NSW Rural Fire Service for questions about or to report bushfire matters of the property.

Cooperation with NSW fire and emergency services and neighbours along boundary is the key to successful fire management within the Southern Highlands Regional Shooting Complex.

3.2 Point of Contact

Wingecarribee Rural Fire Service are the nominated Point of Contact for general fire management enquiries and awareness programs.

The Point of Contact (or their delegate) will be responsible for ensuring the following:

- ▶ Input to Bush Fire Management Committees including providing feedback to external agencies about bushfire management related issues;
- ▶ Responding to internal and external enquiries about bushfire management related issues;
- ▶ Confirming that there is a process to notify neighbours of future bushfire management activities that may effect them (e.g. confirming that the agency undertaking prescribed burning is responsible for notifying neighbours);
- ▶ Implementation of a Bushfire Awareness Program (BAP) in conjunction with the Range Management Committee; and
- ▶ Implementation of Bushfire Mitigation Works Program (BMWP).

Any or all of these responsibilities can be delegated to additional persons and incorporated into their works program (Table 3-1).



Table 3-1 Additional Mechanisms to Develop Bushfire Awareness

Mechanism	Details
Induction process	Induction of members, visitors, contractors and other range users to include bushfire awareness
Briefings and pre-season drills	Fire and emergency procedures are incorporated in briefings for site users
Fire training	Initial and refresher training, both formal and informal, for the Site Supervisor and others with a direct responsibility for emergency management
Advisory emails/ radio calls/ memorandums/SMS or meetings	Prior to the fire season, as part of bushfire preparedness when higher fire danger is forecast. This includes monitoring ABC Local Radio Illawarra 97.3, liaising with the NSW RFS and advising site users of changes or updates to forecast weather conditions. There are no mobile or fixed phone facilities at the site therefore such an approach would require the RFS to make direct contact with participants.
Standard Procedures	Review and display of operating procedures detailed in the Bushfire Management Plan
Communication with the community (in partnership with NSW fire authorities)	<p>Delivery of information, warnings and briefings to site users and administrators including:</p> <ul style="list-style-type: none"> ▶ Explanation of bushfire responsibilities (personal and Dept of Sport and Recreation); ▶ Fact sheets for bushfire preparedness; ▶ Fire restriction notifications; ▶ Advice on bushfire mitigation programs; and ▶ Emergency response and evacuation procedures. <p>Strategies and delivery mechanisms should be adaptive to accommodate a range of site users. The preferred approach is for Communities NSW Sport and Recreation to make appropriate information about bushfire management on the Southern Highlands Regional Shooting Complex available to the NSW Rural Fire Service through the Bush Fire Management Committee so this information can be packaged together with NSW RFS programs and delivered in the course of RFS community safety programs</p>

3.3 Existing Programs

Local Councils, NSW Fire Brigades, and NSW Rural Fire Service also conduct numerous bushfire awareness programs within the Southern Highlands. These include:

- ▶ Maintenance of websites that provide information on:
 - preparing for bushfires
 - what to do in the event of a bushfire
 - fire hazard notices and inspections
 - development in bush fire prone areas
- ▶ Development and dissemination of bushfire-related brochures;



- ▶ NSW Rural Fire Service bushfire awareness training courses;
- ▶ Bushfire education lines;
- ▶ Media releases and announcements; and
- ▶ School visits by fire fighters.

It is considered unnecessary for Communities NSW Sport and Recreation to duplicate these programs. It is more important to develop a relationship with NSW RFS and NSW Fire Brigades such that these programs may be offered for use on the Southern Highlands Regional Shooting Complex.

The RFS has produced a series of factsheets describing the Fire Danger Ratings system and Bushfire Alerts. Examples of these are included in Appendix D. It is recommended that a supply of these factsheets should be made available at the club house for staff and visitors to the site.

3.4 Ignition Prevention

The greatest potential for bushfire ignitions within the Southern Highlands Regional Shooting Complex is from the following sources:

- ▶ Accidental or deliberate ignition on site, or adjoining the site, (including ignitions from shooting activities during extreme fire conditions); and
- ▶ Lightning (which cannot be prevented).

NSW Police in association with NSW Fire Brigade and NSW Rural Fire Service are responsible for the prevention and investigation of accidental or deliberate ignition by members of the public at the rural /urban interface. Communities NSW Sport and Recreation will, as far as is practical, assist these authorities in their actions through the provision of access.

3.5 Bushfire Awareness Program Framework

A generic Bushfire Awareness Program (BAP) Framework is provided in Table 3-2.



Table 3-2 Generic Bushfire Awareness Plan Framework

Target Audience	Messages	Approach	Timing
Staff, visitors and contractors that utilise the site	Bushfire Response Procedures	Promulgation and display of the Property Bushfire Management Plan which includes bushfire response procedures	Prior to, and during, bushfire season
Site users undertaking activities that may have the potential for ignition	Current Fire Danger Rating and changes to FDR Activity restrictions Fire ignition prevention Assembly Areas	Dissemination of relevant emergency instructions, briefings and information Pre-season bushfire awareness presentations Fire danger awareness Practice site assembly and evacuation prior to fire season	Prior to /during bushfire season/ activity Revising activities if FDR requires (see Property Bushfire Management Plan, Appendix A)
Site Supervisor / Site Manager	General bushfire awareness. Response procedures	Appropriate training Emergency instructions Response procedures	Set up annually prior to the fire season
Neighbouring residential areas	Bushfire management programs conducted on the Southern Highlands Regional Shooting Complex	Delivered through NSW RFS community safety programs	Continually through cooperative management arrangements
Contractors and personnel operating within or adjacent to bushland	The bushfire potential of the Southern Highlands Regional Shooting Complex. To be contactable at all times Appropriate emergency response, i.e.: <ul style="list-style-type: none"> ▶ Notification of outbreak of fire; ▶ Comply with directions from IC; and ▶ Leave area giving way to emergency vehicles at all times. 	Part of Induction procedure Dissemination to staff, visitors, contractors entering the range and bushland area during the bushfire danger period (October to March) as part of daily briefing Notification during operations of significant changes in forecasts.	Prior to and during the fire season Daily with changes in FDR
NSW RFS	Bushfire management programs	Cooperative committee arrangements Dissemination of Bushfire Management Plan	Continually through cooperative management arrangements



4. Bushfire Response Strategy

The following Sections detail the readiness and response procedures for the Southern Highlands Regional Shooting Complex. Several key bushfire principles for bushfire response should be reinforced:

- ▶ Maintain the safety of fire fighters, staff, visitors, contractors and other persons;
- ▶ Ensure bushfires are extinguished as soon as possible unless a conscious decision is made not to extinguish the fire immediately and resources are available to manage the event to the desired end point;
- ▶ Previously prepared mitigation strategies (including prescribed burning) will effectively assist in reducing bushfire spread, intensity and impact;
- ▶ Cooperate with adjacent land owners and fire authorities to achieve success in bushfire suppression operations; and
- ▶ Facilitate early rapid initial attack as the most efficient means to extinguish a bushfire.

4.1 Readiness and Restrictions

Fire danger ratings issued by the Bureau of Meteorology (Section 1.2.4) provide a mechanism to restrict certain activities and increase preparedness levels at the Southern Highlands Regional Shooting Complex to reduce the likelihood of fire incidence and provide a quick response if a bushfire occurs.

The generic bushfire readiness levels in Table 4-1 apply to the Southern Highlands Regional Shooting Complex. The readiness levels and triggers to those readiness levels are a key determinant for rapid response and prevention of fire.

Where staff, visitor or contractor activities occur within areas of hazardous vegetation, maintaining awareness of Fire Danger is critical in preventing accidental ignitions. All staff, visitors and contractors operating in the areas of bushfire hazard must confirm the FDR prior to conducting their planned activity. Grasses are particularly prone to ignition once > 60% cured.

Promulgation of Fire Danger Rating to staff, visitors and contractors should occur as part of daily briefings, or directly via radio when Fire Danger Rating exceeds forecast conditions.

4.2 Bushfire Detection and Reporting

Bushfire detection is achieved through formal and informal networks. There is no formal bushfire detection network (such as fire spotting towers) for the Southern Highlands Regional Shooting Complex. As the site is situated in close proximity to rural residential properties, fires or smoke plumes from within the site are likely to be detected by site users, neighbours or motorists.

All fire ignitions must be reported immediately and a general response procedure for fires is provided in the Property Bushfire Management Plan (Appendix A). The fire report template provided in Appendix E can be used to prepare an initial fire report and to provide to external fire authorities if requested.

Post fire reporting responsibilities are detailed in Section 6.



Table 4-1 Bushfire Readiness and Restrictions

Fire Danger Rating	Working Restrictions (All Areas)
Outside Fire Season – See the BUSHFIRE MITIGATION WORKS SCHEDULE and Section 2 of the Bushfire Management Plan	
During Fire Season (01 October to 31 March) Restrictions below	
Low [FDI 1-4]	No specific restrictions in place for staff, visitors or contractors. Contractor works must be consistent with instructions (including Hot Works Permit conditions).
Moderate [FDI 5-11]	
High [FDI 12-24]	<p><u>As for Low-Moderate plus:</u></p> <p>All staff, visitors or contractors using the range must be briefed on appropriate fire prevention measures and on what to do in a fire.</p>
	<p>Advice is to be made available at sign-on.</p> <p>The Site Supervisor should have an emergency contact system in place such as a portable radio or NextG Mobile (as there is little digital mobile coverage on the property).</p> <p>The Site Supervisor must listen to ABC Local Radio Illawarra 97.3 for fire warnings.</p>
Very High [FDI 25-49]	<p><u>As for High plus:</u></p> <p>Activities that might cause accidental ignitions (e.g. slashing, external welding) should be suspended. Non essential access to bushland should be limited and consideration must be given to closing the site.</p>
	<p>The Site Supervisor must be ready to evacuate the range if required or advised by the NSW RFS / NSW Police.</p> <p>Site users must be ready to follow higher level restrictions where fire danger increases above forecast and must be ready to evacuate.</p> <p>Users must maintain contact with the Site Supervisor (i.e. don't leave the Ranges or buildings).</p>
Severe [FDI 50-74] Extreme [FDI 75-99] Catastrophic [FDI 100+]	<p>The Range must be closed and any activities that might cause accidental ignitions must be suspended.</p>



4.3 Command and Control

The Australian Inter-Service Incident Management System Incident Control System (ICS) is the command and control structure utilised across Australia for the management of emergency events including bushfires. The ICS framework can be applied to an incident of any size with roles divided along functional lines (operations, planning, logistics) reporting to a single incident controller. The requirements to fill these positions are based on the Australian bushfire fighting competency requirements and staff/contractors involved in bushfire fighting should be assessed against these standards.

The lead fire fighting authority nominates an Incident Controller and incident management team, and in NSW this is generally carried out in accordance with the local Bush Fire Management Committee Plan of Operations. Shift patterns and briefing arrangements are set by the lead agency commensurate with the size of the incident.

The control centre for the management of emergency operations, as identified in the Property Bushfire Management Plan, is the Wingecarribee Rural Fire Service Headquarters.

4.4 Point of Contact

A point of contact, preferably contactable 24 hours per day and provides responding emergency services agencies with a person to seek further details about the location of a fire. The point of contact may be a single person able to provide “expert local knowledge” to external agencies. The person should be available to travel to the fire control centre where the fire response is being coordinated.

The Communication Details section of the Property Bushfire Management Plan (Appendix A) includes the details of the Point of Contact.

4.5 Fire-fighting Restrictions

The historic use of explosive munitions and projectiles leads to a possibility of unexploded ordnance (UXO) within the vicinity of the eastern 800 m range of the Southern Highlands Regional Shooting Complex. The potential for UXO varies across the 800 m range and due to the consequences of UXO explosion mitigation measures must be applied to reduce the risk to fire fighters. The following actions and fire fighting restrictions are designed to reduce the risk to fire fighters on, or adjacent to the 800 m range:

- ▶ Fire crews must be mindful that UXO may be encountered in any portion of the 800 m range;
- ▶ Wherever feasible fire fighting is to be restricted to direct attack and ‘back-burning’ from maintained fire trails and public roads; and
- ▶ Earthmoving equipment should only be used along the managed fire trails to remove surface fuels only.

Communication of these restrictions through briefings and awareness programs is critical.



5. Bushfire Recovery Requirements

Implementation of effective and timely recovery actions following bushfires and prescribed burning operations is essential to address human aspects, provide opportunities for debriefing and lessons learnt, ensure that the site capability and infrastructure are maintained, and to minimise environmental impact.

5.1 Human Aspects

Community

The NSW *State Emergency and Rescue Act 1989* and the NSW State Disaster Plan provide for community recovery and are likely to be coordinated by the Local or District Emergency Management Committees.

Fire Agencies

NSW RFS and NSW Fire Brigades have Chaplaincy, Family and Peer support programs that are available to their staff and brigade members.

The NSW Rural Fire Service's counselling service can be contacted on 1800 049 933.

5.2 Post-fire Debriefings

Debriefings provide an important forum to discuss and review the effectiveness of fire operations and management and the need for changes. Debriefings can take place at many different levels, from informal discussions with the position that undertook the role of Incident Controller (small fires without asset damage) to more complex multi-agency investigations (large multi-tenure fires with life and property harm). The Incident Controller (IC) should determine the scale of the debriefings.

Debriefings should be conducted as soon as possible at the conclusion of firefighting operations, regardless of the scale of the event. In most cases, post-fire debriefing will be undertaken with NSW RFS.

The IC will be responsible for organising the debriefing and preparation of subsequent report.

One of the main purposes of post-fire debriefs is to determine the effectiveness of the Bushfire Management Plan and the Bushfire Mitigation Works Schedule (BMWS) so that they can be reviewed and modified where necessary. The key factors to be investigated are outlined in Table 5-1.



Table 5-1 Key Themes for Post Fire Briefings

Theme	Example Debriefing Issues	Potential directions for amendments to BMP
Prevention	Asset protection arrangements Ignition source (Type) Ignition from Defence training/activity?	Effectiveness and maintenance of fuel managed areas? Additional procedures/standing orders to minimise ignition potential.
Preparedness	Detection Damage to Defence assets Provisions of BMWS in place Effectiveness of hazard reduction operations Bushfire awareness of residents	Procedures for notification Installation of additional protective measures Review and update BMWS Review and update BAP
Response	Initial response Command and control arrangements clear Access or communications issues Defence capability and adequacy of resources Inter-agency cooperation Safety Resident and neighbour response	Review preparedness and response procedure Review and document command and control arrangements, and resourcing Address access or communications issues Investigate safety near miss/accidents
Recovery	Critical incident stress management Timely and effective rehabilitation Reporting requirements	Review operating procedure if required Review and formalise rehabilitation processes Review reporting processes

5.3 Infrastructure and Utility Aspects

The Southern Highlands Regional Shooting Complex contains and is adjacent to a number of civil infrastructure installations, such as:

- ▶ Transgrid below and aboveground electricity mains and powerlines;
- ▶ TransGrid high voltage 330kV powerlines; and
- ▶ SydneyWater infrastructure.

Coordination with the respective authorities so that post-fire repairs are conducted in a timely manner is essential to ensure disruptions to the site are minimised.



5.4 Animal Welfare

Fire may have an impact on animals through injury and loss of habitat. The Department of Environment and Climate Change and Water (DECCW), Wildlife Rescue Carers, and the RSPCA may be able to treat animals affected by fire.

Relevant contact details are:

- ▶ NSW National Parks and Wildlife Service (Picton): (02) 4677 0859
- ▶ Department of Primary Industries (Animal Welfare Branch) (stock): (02) 6391 3149
- ▶ WIRES (New South Wales): 13000WIRES or 1300 094 737.
- ▶ RSPCA (emergencies only): (02) 9770 7556

Personnel from wildlife carer organisations should not be permitted onto the fireground to rescue injured wildlife until it is safe to do so. The Incident Controller must give this approval.

5.5 Bushfire Information

It is important to remain informed during periods of and exceeding High fire danger. Relevant contact details are:

- ▶ NSW RFS Bushfire information: 1800 679 737
- ▶ RTA Road Closure Information: 132 701

5.6 Environmental Rehabilitation

5.6.1 Rehabilitation

There can be significant environmental impacts following a fire. These 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. Short-term emergency works for stabilisation or rehabilitation should be instituted 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.

Table 5-2 provides potential options for rehabilitation against anticipated causes of damage from bushfire within the planning area.



Table 5-2 Post-fire Rehabilitation Options

Cause	Potential impacts	Recovery Options
New access trails constructed	Increased maintenance costs Erosion	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 Weed control
Damage to existing fire access trails	Erosion Widening to an excessive width Weed infestation	Install erosion controls Revegetate damaged areas and restrict access Weed control
Vegetation removed	Soil instability Increase in weeds Reduced habitat and shelter for animals and increased predation EECs and commonwealth protected species damaged Increased grazing/browsing or regeneration flora	Natural and/or assisted revegetation Post-fire pest and weed control Notify and seek advice from NSW Department of Environment and Climate Change and Water, and Commonwealth Department of Environment, Water Heritage and the Arts if EPBC species 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 the NSW Department of Environment and Climate Change and Water, Local Aboriginal Land Council and the Commonwealth Department of Environment, Water Heritage and the Arts for advice



6. Monitoring and Reporting

6.1 Bushfire Responsibilities

The responsibility for implementation of actions described in this BMP is detailed in Table 6-1. Responsibilities of the Southern Highlands Regional Shooting Complex, as the occupier of the property, are also referenced in the property BMP.

6.2 Bushfire Hazard Monitoring

A fuel hazard monitoring and recording procedure consistent with the *Overall Fuel Hazard Assessment Guide* (Hines *et al.* 2010) should be undertaken where fuel management is a priority.

The process is shown in Figure 6-1 and should include:

- ▶ Areas requiring more intensive fuel hazard management (Strategic Fire Advantage Zones (SFAZs) and Asset Protection Zones (APZs));
- ▶ General monitoring across the whole site where native vegetation occurs; and
- ▶ Monitoring the effectiveness of the BMWS prior to and following prescribed burning operations.

Objectives for APZs and SFAZ and subsequent mitigation works/fuel reduction works should reflect the desired overall fuel hazard level.



Table 6-1 Bushfire Responsibilities

Shooting Club Responsibilities – Club site supervisor & users	How	When
<i>Bushfire Plan</i>	✓ Display in a visible location and become familiar with the Property Bushfire Management Plan.	Prior to (September) and during the bushfire season
<i>Pre-season fire refresher</i>	✓ Hold an annual refresher day and drills prior to the bushfire season about what to do in the event of a bushfire. The local Rural Fire Service may be able to assist.	Prior to the bush fire season.
<i>Grass slashing</i>	✓ Keep grasses mown in existing slashed areas (<i>Asset Protection</i> and <i>Strategic Fire Advantage Zones</i>), and maintaining grass cover to less than 10 cm.	Prior to (September) and during the bushfire season
<i>Use trails wisely</i>	✓ Maintain and protect trail surfaces by restricting trail use during wet conditions.	Throughout the year
<i>Identified bushfire mitigation works</i>	✓ The Club site supervisor is to ensure that works described in the BUSHFIRE MITIGATION WORKS SCHEDULE have been conducted.	Prior to the bushfire season
<i>Asset maintenance and bushfire preparations</i>	✓ Annually the Club site supervisor is to maintain and prepare club buildings and surrounds for bushfires (clearing gutters, sealing gaps, trimming vegetation). This could be undertaken as part a club working bee, and coincide with the pre-season refresher day. See Sections One, Two and Appendix B of the Bushfire Management Plan for specifications.	Prior to the bushfire season Maintained during the season.
<i>Contact details</i>	✓ Check COMMUNICATION DETAILS and update on Property Bushfire Management Plan.	Prior to the bushfire season
<i>Site safety inductions</i>	<ul style="list-style-type: none"> ✓ The site supervisor ensures that all site users and visitors are inducted on arrival and understand safety requirements and response procedures. ✓ Site safety induction for contractors and persons undertaking work on the site is to include information specific to Hot Works Permits. See the BUSHFIRE AWARENESS PROGRAM for further details. 	Prior to site use



<i>Site communication</i>	✓ The site supervisor must have a portable radio or NextG Mobile phone and can contact site users.	During site use
<i>Contact with Wingecarribee Rural Fire Service</i>	✓ Site site supervisor contacts the Wingecarribee Rural Fire Service to determine the Fire Danger Rating for the day/weekend and to advise of the expected timing and duration of site access, including number of users. See the BUSHFIRE AWARENESS PROGRAM for further details.	Prior to opening the Range (during bushfire season only)
<i>Bushfire awareness and listen for fire warnings</i>	✓ The site supervisor must listen to ABC Local Radio Illawarra throughout the day for fire warnings. See the BUSHFIRE AWARENESS PROGRAM for further details.	During site use (during the bushfire season)
<i>Site use restrictions</i>	✓ The Club site supervisor must implement all restrictions listed in the FIRE PREPAREDNESS STRATEGY and is to remain observant for any smoke/ flames in the area.	During site use
<i>Bushfire notification</i>	✓ If smoke or flames are observed, the Club site supervisor is to stop activities in the area and notify all site users and fire authority.	During site use
<i>Follow fire alarm procedures</i>	✓ The Club site supervisor is to ensure that all site users follow emergency standard instructions during a bushfire. See BUSHFIRE RESOURCE INFORMATION and FLOW CHART.	During site use
Communities NSW Sport and Recreation Responsibilities	Action	Timing
<i>Scheduling hazard reduction works</i>	Liaison with Burn Contractor to determine appropriate burn schedule based on the BUSHFIRE MITIGATION WORKS SCHEDULE.	Burn plans are to be prepared 12 months prior to scheduled delivery
<i>Implementing hazard reduction works</i>	A Burn Contractor is to be engaged to conduct prescribed burning within Strategic Fire Advantage and Land Management Zones See BUSHFIRE MITIGATION WORKS SCHEDULE. This task includes community notifications.	Prior to bushfire season
<i>Fire trail maintenance and slashing</i>	Ensure that all fire trails are maintained in trafficable condition corresponding with their classification and trail type.	To be assessed prior to the fire season and maintained throughout the fire season

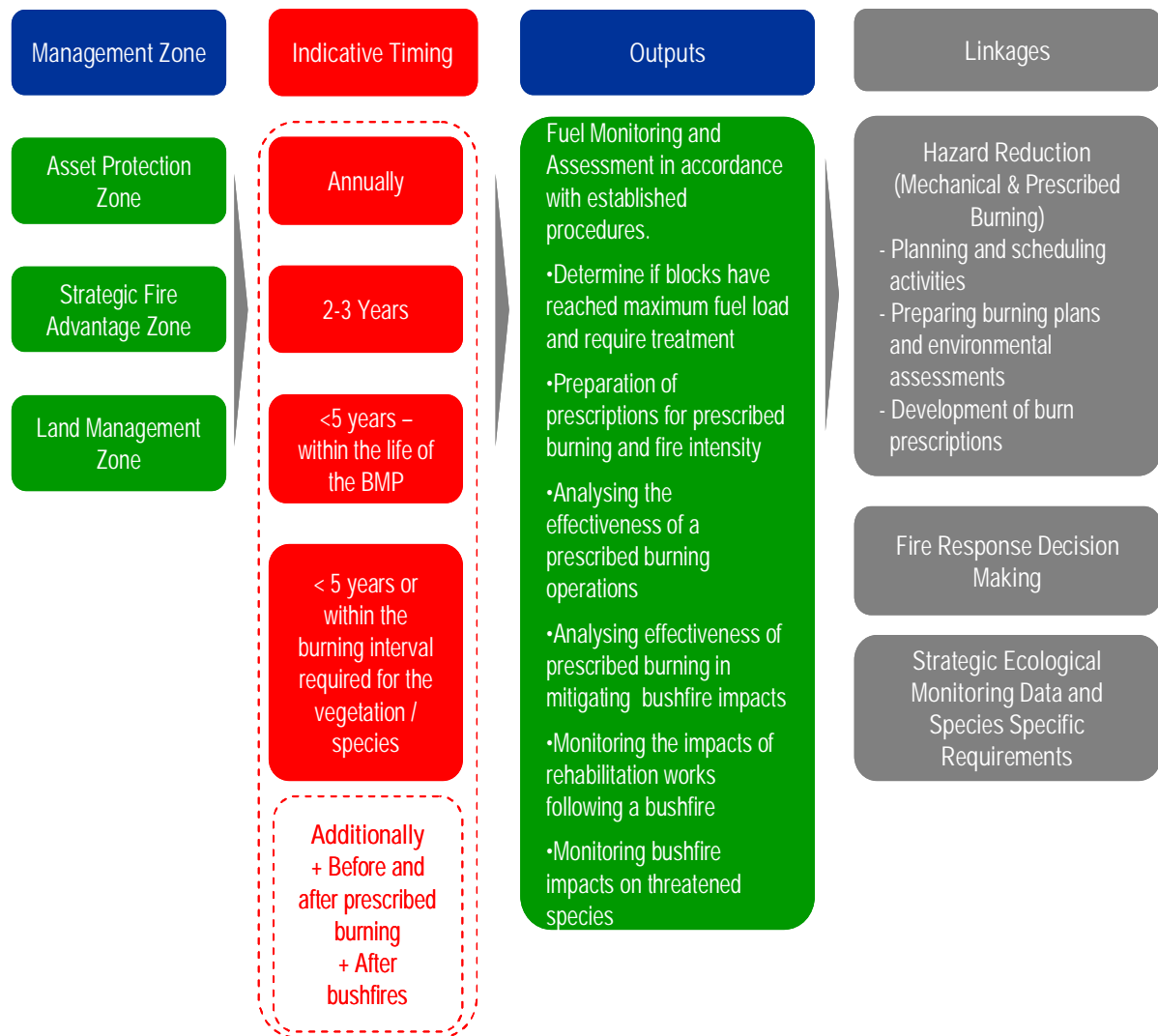


Figure 6-1 General Fuel Monitoring Requirements and Outputs

6.2.1 Monitoring After Prescribed Burns

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. It may also allow management 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 wildfires is provided as Table 6-2. 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 original burn plan to facilitate reporting and analysis of impacts.

6.2.2 Monitoring After Wildfire

The basic monitoring schedule provided in Table 6-1 is applicable to both wildfire and prescribed burns.

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 6-2 Basic Post Fire Monitoring Schedule

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	Burn Contractor
	Extent of scorch and combustion.	Measure scorch height Measure fuel load remaining (utilise <i>Overall Fuel Hazard Assessment Guide</i> (Hines et al. 2010)) Note % of ground cover remaining	Burn Contractor
	Determine if threatened species or Endangered Ecological Communities may have been affected.	Review previous records and studies	Burn Contractor
	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	Burn Contractor



When	What	How	Who
	Presence of Aboriginal sites/relics	Record if exposed Notify and seek advice from NSW Department of Environment and Climate Change, Commonwealth Department of Environment, Water and the Arts (Heritage Division) and Land Council	Burn Contractor
	If relevant, the presence or absence of threatened species or Endangered Ecological 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	Burn Contractor
6, 12, and 24 months after a fire	Presence of overabundant native species, weeds, and feral animal pests.	Observations, sightings, scats and markings Evidence of excessive browsing/grazing Identification of weeds species	Burn Contractor
	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	Burn Contractor
4, 8, and 12 years after the fire	The progress and effectiveness of rehabilitation works.	Review progress against rehabilitation plans (if prepared)	Burn Contractor
	Identify additional rectification works.	Note and recorded continued presence of environmental degradation	Burn Contractor
	Presence of overabundant native species, weeds, and feral animal pests.	Observations, scats and markings Evidence of excessive browsing/grazing Identification of weeds species	Burn Contractor
	Fuel hazard accumulation	Undertake Overall Fuel Hazard Assessment	Burn Contractor

6.3 Fire Recording

Reports should be prepared for all planned and unplanned fires on the site. As the incident controller, NSW Rural Fire Service / NSW Fire Brigade are to prepare bushfire reports. These may be requested from the Fire Authority by the Southern Highlands Regional Shooting Complex Management Committee for recording and site management purposes. A template bushfire report is provided in Appendix E should the Southern Highlands Regional Shooting Complex Management Committee wish to compile these reports, however there is no current requirement for them to do so.



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- National Parks and Wildlife Act* (1979)
- Rural Fires Act* (1997)
- State Emergency and Rescue Management Act* (1989)
- Threatened Species Conservation Act* (1995)

Appendix A

Property Bushfire Management Plan

(A1 Map Based Plan)

Southern Highlands Regional Shooting Complex PROPERTY BUSHFIRE MANAGEMENT PLAN 2010-2015

Communities NSW - Sport and Recreation

This plan is to be used in conjunction with the Southern Highlands Regional Shooting Complex BMP. During incidents or when planning prescribed burning operations this plan should be used in conjunction with field reconnaissance, operation and incident plans, and aerial satellite imagery.

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Data source: Communities NSW Sport and Recreation Created by B Hamby / J Q Chung

Version: 2 - Updated September 2010

Map Projection: Transverse Mercator
Horizontal Datum: Geostrophic Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56
Data Source: Navgate StreetMap 02/04/2009
NSW Department of Lands Roads 02/04/2009
NSW Department of Lands Cadastre 02/04/2009
G:\2117850\GIS\Map_Documents\2117850_2004_Fire_Manag
ementPlan.mxd



COMMUNICATION DETAILS

Update annually prior to the bushfire season

Contact	Number
Report All Fires / Emergencies	Dial 000 or 112 (mobile)
Southern Highlands Regional Shooting Complex site contact	0411 566 941
Communities NSW Sport and Recreation	(02) 9006 3840 (bh) 0402 038 344 (ah)
Utilities - Sydney Water	13 20 90
- TransGrid	(02) 6226 9666
Emergency Services (Fire, Police, Ambulance)	Dial 000 or 112 (mobile)
NSW Rural Fire Service (Wingecaribee)	(02) 4871 2666
NSW Police (Bowral)	(02) 4862 9299
Bowral and District Hospital	(02) 4861 0200
Bushfire Information - NSW Rural Fire Service	1800 679 737
RTA Road Closure Information	132 701
NSW National Parks - Duty Officer	0419 428 054

BUSHFIRE RESOURCE INFORMATION

Refer to Section 1 of the Bushfire Management Plan

Site Location

The facility is located on Watte Ridge Road approximately 5 km north-west of the village of Hill Top and 15 km north of Mittagong

Facility

The Southern Highlands Regional Shooting Complex is a recreational shooting complex covering approximately 1036 ha, consisting of a 136 ha Special Activity Zone and a 900 ha Conservation Zone. The facility comprises eastern (800 m long rifle range, clubhouse, toilet facilities and informal car parking) and western (500 m range, pistol range, carpark) sections.

Bushfire Fire Season and Patterns

Season: The statutory bushfire danger period for the Southern Highlands Regional Shooting Complex is from 1 October to 31 March annually. In drought affected seasons fire danger may commence earlier (as determined by the Commissioner NSW RFS), with fire potential across the landscape increasing once grasses are more than 60 - 70% cured

Ignition Sources: Ignition sources within the Southern Highlands Regional Shooting Complex may be accidental through equipment use, result from lightning strike or be caused by arson or accidental human ignition

Fire Path/Behaviour: The highest risk fires for the Southern Highlands Regional Shooting Complex are likely to come from the north / north-west under Very High to Catastrophic Fire Danger. The site is located amidst large areas of bushland and there is significant risk that fire may enter the property from surrounding bushland

Vegetation Types

Dry sclerophyll (shrubby understorey): These areas can support fast moving grassfires, and crowning and spotting may occur in shrubby or denser woodland patches where elevated and near surface fuels exist

Rainforest: Rainforest will not sustain fire except in seasons of severe drought and can slow the spread of fire due to the presence of moist fuels. Exclude fire from rainforest areas where possible

Threatened Species: Refer to the Southern Highlands Regional Shooting Complex Bushfire Management Plan (BMP)

Fire Recovery Monitoring & Reporting: See Sections 5 and 6 of the BMP

SHOOTING CLUB RESPONSIBILITIES - Club site supervisor and users (see also Section 6 of the Bushfire Management Plan)

What?	How?	When?
Bushfire Plan	Display in a visible location and become familiar with this Property Bushfire Management Plan	Before / during bushfire season
Pre-season fire refresher	Hold an annual refresher day and drills prior to the bushfire season about what to do in the event of a bushfire. The local Rural Fire Service may be able to assist	Before the bushfire season
Grass slashing	Keep grasses mown in existing slashed areas (Asset Protection and Strategic Fire Advantage Zones), and maintain grass cover to less than 10 cm.	Before / during bushfire season
Use trails wisely	Maintain and protect trail surfaces by restricting trail use during wet conditions	Throughout the year
Bushfire mitigation works	The Club site supervisor is to ensure that works described in the BUSHFIRE MITIGATION WORKS SCHEDULE have been conducted	Before the bushfire season
Asset maintenance and bushfire preparations	Annually the Club site supervisor is to maintain and prepare club buildings and surrounds for bushfires (cleaning gutters, sealing gaps, trimming vegetation within the APZ). This could be undertaken as part a club working bee, and coincide with the pre-season refresher day. (See Sections One, Two and Appendix B of the Bushfire Management Plan for specifications)	Prior to the bushfire season and maintained during the season.
Contact details	Check COMMUNICATION DETAILS and update on this Property Bushfire Management Plan	Before the bushfire season
Site safety inductions	The site supervisor ensures that all site users and visitors are inducted on arrival and understand safety requirements and response procedures (BUSHFIRE RESPONSE STRATEGY, FLOW CHART and FIRE PREPAREDNESS STRATEGY sections) Site safety induction for contractors and persons undertaking work on the site is to include information specific to Hot Works Permits. See the BUSHFIRE AWARENESS PROGRAM for further details	Prior to site use
Site communications	The site supervisor must have a portable radio or NextG Mobile phone and can contact site users	During site use
Contact with Wingecaribee RFS	Site supervisor contacts the Wingecaribee Rural Fire Service to determine the Fire Danger Rating for the day/weekend of operation and to advise of the expected timing and duration of site access, including number of users. See the BUSHFIRE AWARENESS PROGRAM for further details	Prior to opening the Complex (during bushfire season only)
Fire awareness and warnings	The site supervisor must listen to ABC Local Radio Illawarra 97.3 throughout the day for bushfire warnings and changes to fire danger. See the BUSHFIRE AWARENESS PROGRAM for further details.	During site use (during the bushfire season only)
Site use restrictions	The Club site supervisor must implement all restrictions listed in the FIRE PREPAREDNESS STRATEGY and is to remain observant for any smoke/ flames in the area	During site use
Bushfire notification and response	If smoke or flames are observed, the Club site supervisor is to stop activities in the area and notify all site users and fire authority, and ensure that all site users follow emergency standard instructions during a bushfire. See BUSHFIRE RESOURCE INFORMATION and FLOW CHART	During site use

BUSHFIRE RESPONSE STRATEGY

Refer to Section 4 of the Bushfire Management Plan

Fire Command and Incident Control On arrival, the Incident Controller from the NSW Rural Fire Service or NSW Fire Brigade will assume Incident Control functions

Site Response Structural fires may be attended to by NSW Rural Fire Service / NSW Fire Brigade
Bush / grass fires may be attended to by NSW Rural Fire Service. Note a response by a fire authority cannot always be expected, particularly on days of elevated fire danger with a high level of fire activity.

Site Liaison The Club site supervisor (if on site at time of fire response) will provide local site knowledge and information to the external fire authority

Control Room Wingecaribee Rural Fire Service will determine the location of the Incident Control Room

Fire Alarm Staff, visitors and contractors on site are to follow emergency standard instructions, and muster at a designated Assembly Area. See FLOW CHART

Assembly Areas - Location Details
East - Adjacent to the Eastern Clubhouse. Approximately 4.7 km NW along Watte Ridge Road from the intersection of West Road Fire Trail, Hill Top NSW. Lat/Long (decimal): -34.316391 S 150.458096E - MGA: 266100 E 6199750N
West - Western Range Carpark. Approximately 5.7 km NW along Watte Ridge Road from Hill Top NSW -1 km NW of the Eastern Clubhouse. Lat/Long (decimal): -34.309400 S 150.451167 E - MGA: 265450E 6200580 N

Offsite Evacuation Evacuation must be undertaken early to avoid being caught in the fire
Do not attempt to evacuate at the last minute, evacuate early if possible
Follow the advice of the Club site supervisor or the responding fire authority
If fire is close it may be safer to seek shelter within the Clubhouse buildings until the fire passes
Roads are extremely dangerous places to be caught during a fire. There are more than 2 km of road between the Southern Highlands Regional Shooting Complex and Hill Top
Stay clam, do not panic

Nearest Hospital Bowral & District Hospital Bowral Street. South on Hume Highway for approx. 24 km from Hill Top

Powerlines High voltage 330kV powerlines are located along the eastern boundary of the property. TransGrid contact details are included in the COMMUNICATION DETAILS table

Vehicle and Machinery Access and Use If possible, trails should not be used in wet conditions. Vehicles and machinery can damage wet soils and result in expensive damage to trail surfaces. Ensure plant is clean (seeds / dirt) prior to use on site.

BUSHFIRE AWARENESS PROGRAM

Refer to Section 3 of the Bushfire Management Plan

General A Site Safety Induction is to be conducted for all site staff, visitors and contractors at sign-on to the Complex. The induction is to include procedures for bushfire response (BUSHFIRE RESPONSE STRATEGY, FLOW CHART and FIRE PREPAREDNESS STRATEGY sections).

Prescribed Burning The Burn Contractor or Fire Authority is responsible for notifications prior to the commencement of burning. Notifications, neighbour liaison and reporting of prescribed burns are to be carried out in accordance with Fire Authority procedures. Liaison should include site users, neighbours, NSW fire authorities (including 000), SydneyWater and TransGrid. See the COMMUNICATION DETAILS table for contact phone numbers.

Subcontractors: The Club site supervisor or Communities NSW Sport and Recreation are responsible for informing individual subcontractors engaged by them of their responsibilities in relation to fire. This is to include the use of Hot Works Permits.

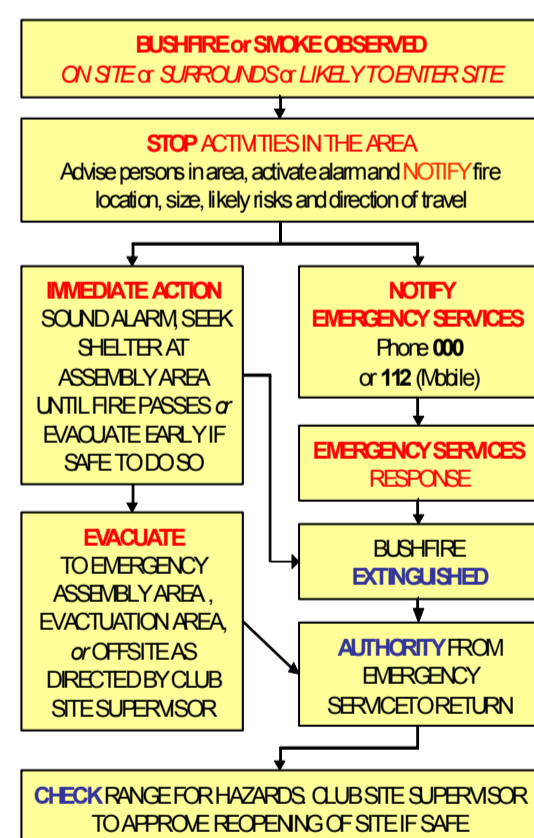
Emergency Liaison: Wingecaribee Rural Fire Service (RFS) is to be informed of all planned and unplanned fires on the site.

Pre-Season Briefing: The Club site supervisor and users are to be briefed on their responsibilities, fire preparedness levels, reporting and emergency assembly/evacuation procedures before the commencement of the fire season. Procedures are readily available and may be sourced from existing community awareness programs such as those provided by the RFS.

Mitigation Activities: The Club site supervisor or Communities NSW Sport and Recreation are to ensure that activities presented in the BUSHFIRE MITIGATION WORKS SCHEDULE (below) have been undertaken prior to the commencement of the fire season.

During Fire Season Notification: The Club site supervisor must contact Wingecaribee RFS and seek advice on the Fire Danger Rating prior to opening the Complex. The Club site supervisor must listen to ABC Local Radio Illawarra 97.3 throughout the day for fire warnings. The Club site supervisor must ensure that Restrictions listed in the FIRE PREPAREDNESS STRATEGY for Low, Moderate and High Fire Danger Ratings (below) are relayed to and followed by all persons on the site. If any uncertainty exists regarding forecast conditions, the Club site supervisor is to contact and seek advice from Wingecaribee Rural Fire Service.

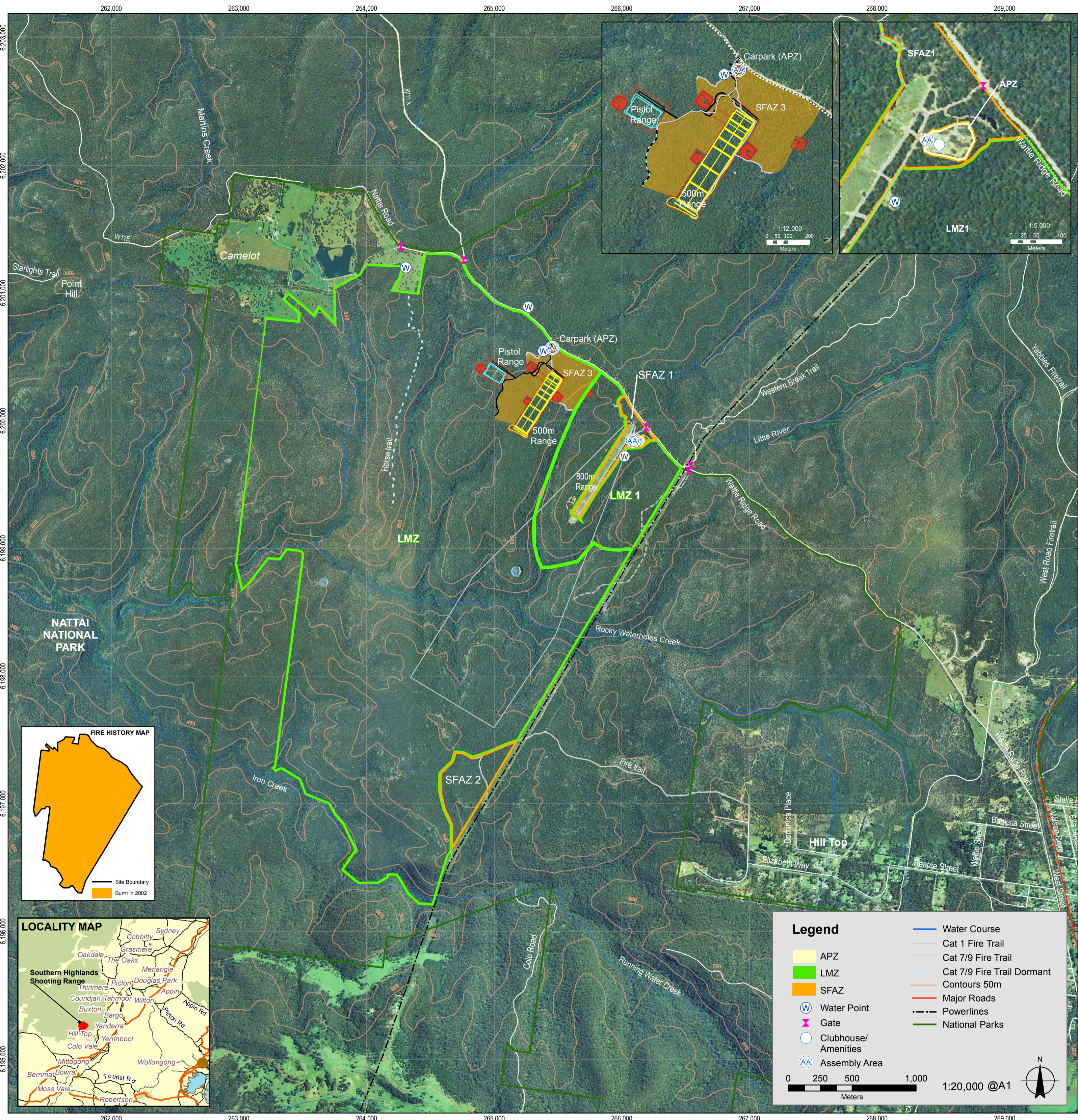
Restrictions: The Club site supervisor is to implement all Restrictions listed in the FIRE PREPAREDNESS STRATEGY for High, Very High, Severe, Extreme and Catastrophic Fire Danger Ratings (below) are adhered to.



BUSHFIRE MITIGATION WORKS SCHEDULE (including pre-season preparedness)

Refer to Section 2 of the Bushfire Management Plan

Works	Fire Management Zone	Standard	Timing	Delivery	Procedures	Monitoring
Asset maintenance and seasonal bushfire preparedness	Asset Protection Zone (APZ) Clubhouse and amenities	Refer to Sections 1, 2 and Appendix B of the BMP	Annually prior to fire season (September)	Southern Highlands Shooting Club	Inspect roof gutters, external vent/opening covers, fly screens, external combustible building materials and gardens/fire hazards adjacent to buildings	Communities NSW Sport and Recreation
Grass slashing	APZ and Strategic Fire Advantage Zone 1 (SFAZ) 1 Shooting range and existing mown areas	Low cut grass <10cm Refer to Section 2 and Appendix B of the BMP	Throughout Bushfire Season	Southern Highlands Shooting Club	Slashing when grass is approaching 60% cured, maintain slashing regime to keep grass cover at less than 10 cm	Communities NSW Sport and Recreation
Fire trail maintenance and slashing	Road and trail network - all areas	NSW RFS Fire Trail standards Refer to Section 1 and 2 and Appendix C of the BMP	Annually prior to fire season (September)	Communities NSW Sport and Recreation	Conduct pre-fire season assessment of roads and fire trails, identify areas untrafficable to firefighting vehicles Repair or identify detour routes Slash trails to maintain access throughout the fire season	Communities NSW Sport and Recreation
Hazard reduction prescribed burning	(SFAZ) and Land Management Zones (LMZ) Surrounding the shooting ranges, clubhouse and amenities, and south of Rocky Waterholes Ck	Fuel Hazard Rating: Surface Fuels ≤ LOW Near Surface Fuels ≤ LOW Elevated Fuels ≤ MODERATE Bark Fuels ≤ HIGH See Sections 1 and 2 of the BMP	2011 - SFAZ 1 & 2 2012 - LMZ 1 2013 - SFAZ 3	Burn Contractor	Prepare hazard reduction burn plans 12 months before scheduled month/season Engage resources for burning 2 months before scheduled burn period Mobilise identified burning resources as scheduled in accordance with burn plan	Communities NSW Sport and Recreation / Burn Contractor
Contractor Hot Works	All areas	Hot Works Permit procedures	Throughout Bushfire Season	Southern Highlands Shooting Club	Follow procedures for working with a Hot Works Permit	Communities NSW Sport and Recreation



FIRE PREPAREDNESS STRATEGY

Fire Danger Rating	Working Restrictions (All Areas)
Outside Fire Season - See the BUSHFIRE MITIGATION WORKS SCHEDULE and Section 2 of the Bushfire Management Plan	
During Fire Season (01 October to 31 March) Restrictions below	
Low (FDI 1-4)	No specific restrictions in place for staff, visitors or contractors. Contractor works must be consistent with instructions (including Hot Works Permit conditions).
Moderate (FDI 5-11)	As for Low/Moderate plus: All staff, visitors or contractors using the Complex must be briefed on appropriate fire prevention measures and on what to do in a fire. Advice is to be made available at sign-on.
High (FDI 12-24)	The Site Supervisor should have an emergency contact system in place such as a portable radio or NextG Mobile (as there is little digital mobile coverage on the property). The Site Supervisor must listen to ABC Local Radio Illawarra 97.3 for fire warnings.
Very High (FDI 25-49)	As for High plus: Activities that might cause accidental ignitions (e.g. slashing, external welding) should be suspended. Non essential access to bushland should be limited and consideration must be given to closing the site. The Site Supervisor must be ready to evacuate the Complex if required or advised by the NSW RFS / NSW Police. Site users must be ready to follow higher level restrictions where fire danger increases above forecast and must be ready to evacuate if safe. Users must maintain contact with the Site Supervisor (i.e. don't leave the Ranges or buildings).
Severe (FDI 50-74) Extreme (FDI 75-99) Catastrophic (FDI 100+)	Total Fire Ban declared. The Ranges must be closed and any activities that might cause accidental ignitions must be suspended.

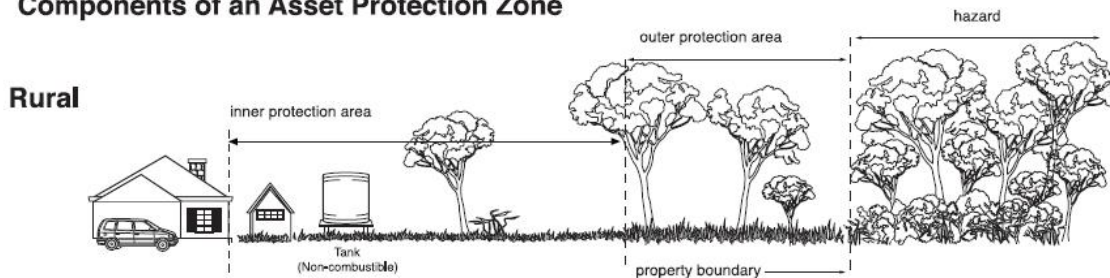
Appendix B

APZ Maintenance Guide

Asset Protection Maintenance Guide

Note: these guidelines are developed from the 'Inner Protection Area' standard of *Planning for Bushfire Protection 2006* (NSW RFS 2006a).

Components of an Asset Protection Zone



(Source: NSW RFS 2006a)

Where buildings/dwellings occur adjacent to/or at the interface with an area of bushfire hazard :

- ▶ Existing larger trees (> 200 mm dbh (diameter at breast height)) can remain within the APZ provided that:
 - no part of their crown occurs within 5 m of any building (significant habitat trees can remain 2 m out from the building line)
 - canopies are discontinuous, *i.e.*, canopies are separated by at least 2 m
 - they are smoothed barked species or, if rough barked, are maintained free of hanging bark and other ladder fuels
 - low branches holding fine fuel (*i.e.* leaves and twigs of <6mm in diameter) are pruned to 2 m from the ground.
- ▶ Where trees are removed they are removed by hand, leaving stumps cut at ground level and where accessible, stumps are to be 'ground' to just below soil level. Stumps of all species that have the capability of resprouting are to be treated with an appropriate herbicide (such as glyphosate biactive 360g/L) immediately after the cut is made;
- ▶ Trees and shrubs are to be continually suppressed and follow-up programs are to occur at least annually. Regrowth following mechanical clearing or poor cut stump treatment may require further suppression using herbicides. Cut-stump treatment in these situations is not viable. Consequently, the following herbicide applications can be used.
 - Stem inject around the base of the original plant and regrowth stems if accessible (and practical) with a herbicide such as Tordon DSH
 - Basal bark spray with a herbicide such as Access or Garlon 600
 - Granular application with a herbicide such as GraslanThe registered product label is to be referred to for details and instructions for the use of these herbicides.
- ▶ Smaller trees (*i.e.* less than 200 mm in diameter), shrubs, fallen trees and tree-limbs and stumps may be removed and continuously suppressed.
- ▶ All shrubs and tree saplings may be removed off-site or mulched.
- ▶ A minimal ground fuel is to be maintained to include either mown grass or less than 3 tonnes per hectare of fine fuel (*i.e.* material of <6 mm in diameter).

Appendix C

Fire Trail Construction and Maintenance Guide

Guidelines for Fire Trail Construction and Maintenance (BFCC 2007a)

Feature	Category 1 Tanker	Category 7 (& 9) Tanker
Width	4 metres	3 metres
Gradient	generally < 15° for natural surfaces	generally < 20° for natural surfaces
Cross slope Finished surface	Cross slope less than 5°, giving a 28cm drop over 4 m width	
Clearance height	4.5 metres	3.5 metres
Clearance side	Dead trees and other vegetation that may impede trucks or be dangerous during fire management activities should be removed	
Bridges /Culverts	15 Tonne capacity	8 Tonne Capacity
Passing/Turnaround Bays	At 500 m intervals where possible. Turnaround bays should be constructed to allow 3-point turns. If terrain is prohibitive, passing bays should be created adjacent to the hazardous sections of trail	
Dead ends	To be avoided where possible, dead end roads generally not >100 m in length and a minimum 12 m radius turning circle fuel reduced (or as per turnaround bays) are incorporated	
Safety Refuges	To be considered where practicable dependant on vegetation and terrain, with all vegetation removed from the area including wind rows	
Curves	Curves should have a minimum turning radius of 6 m	

Contour Bank Spacing (in accordance with Soil Class*)

Road Grade	A: Low soil erodibility (Brown and red soils derived from finer sediments and metasediments)	B: High soil erodibility (Red soils on fine granites, fine sandstone and basalt)	C: V-High soil erodibility (Grey and yellow soils derived from granites, sediment and metasediment, especially coarse drained types)
Up to 8°	70 to 90 m	60 to 70 m	20 to 30 m
8° to 12°	60 to 70 m	50 to 60 m	Not desirable
12° to 16°	40 to 60 m	Not desirable	Not desirable
16° to 20°	30 to 40 m	Not desirable	Not desirable
20° to 22°	20 to 90 m	Not desirable	Not desirable

*Class D – Extreme soil erodibility. Unconsolidated sediment. As a general rule, fire trails should not be built on Class D soils.

Contour Bank Guideline

Notwithstanding the above, the stability of the fire trail in operation will dictate the need for variations in the location and spacing of contour banks. The following points are to be considered when choosing sites for contour banks:

- ▶ Recommendations for spacing tempered by experience and the existing condition of the fire trail;
- ▶ Location of stable and clear outlet points;

- Location of short sections of flatter track grade allowing contour bank construction on a generally steep track.

Select a suitable drainage outlet point for the bank, one that is not blocked by a stump or rock. Site the outlet so that runoff will spill into undisturbed vegetation and cannot flow back onto the track.

Rip the track to a depth of 20 to 30cm for a distance of one or two tractor lengths back from the chosen outlet point. Then push the loose earth down the track into a bank, commencing at the uphill side of the road and working across the outlet side. A long, shallow excavation for the bank is preferred to a short, deep excavation.

Sufficient loose earth must be used to give the required dimensions (Figure 1) after shaping and compaction. Depending on the size of the machine being used, up to eight ladlefuls of earth may be required (Figures 2 and 3). Ensure that the crest width dimensions are long enough to ensure comfortable vehicle access over the contour bank.

The channel depth dimensions are essential to prevent runoff from overtopping the bank.

Contour banks are most effective if construction with only a slight angle to the track obtaining a grade of approximately 1:20. This ensures that runoff does not pond in the bank channel.

A sweep with the blade will clean loose earth from the channel of the bank. The small bank of earth resulting at the outlet can often be left as silt trap and water spreader. Push this earth only just far enough so that draining water can clear the track effectively.

If you have to fill an eroded table drain to build a bank, compact the bank at the point with extra earth to allow for slumping and to cope with the concentrated runoff in the table drain.

Figure 1: Dimensions of cross banks

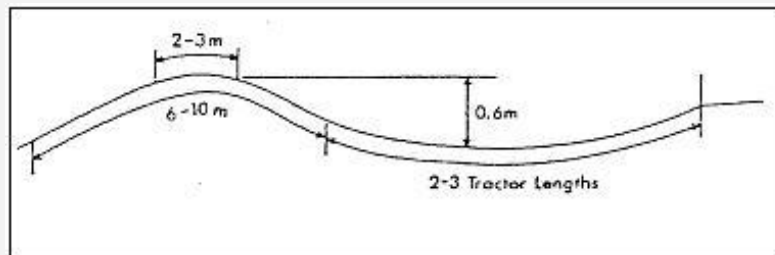


Figure 2: Cross bank construction

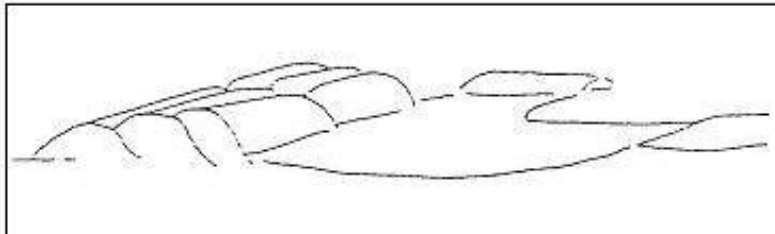
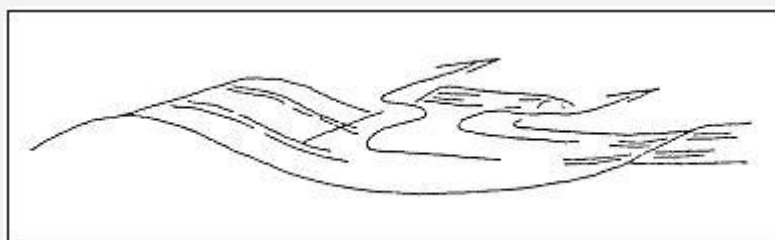


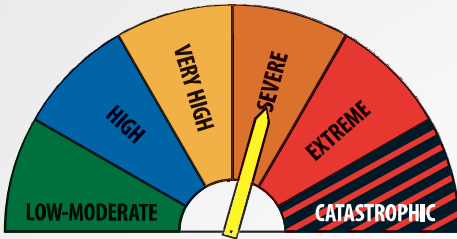
Figure 3: The bank of earth resulting from the spillway clearing can be left to act as a silt trap and water spreader.



Source: BFCC Policy No. 2/2007

Appendix D

Bushfire Information and Fact Sheets

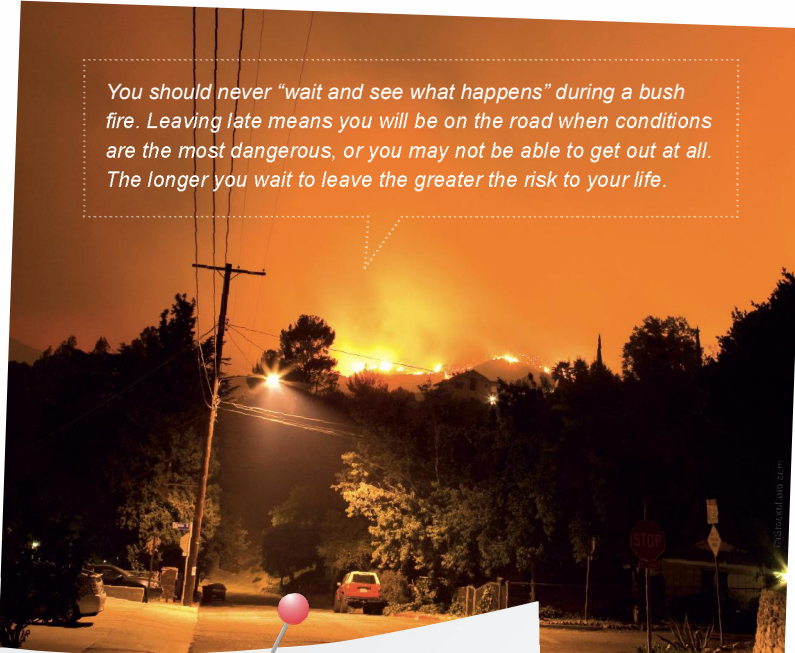


Leaving Early

LEAVE EARLY AND SURVIVE A BUSH FIRE

The safest option in a bush fire is always to leave early, well before the fire threatens. You should leave if:

- The Fire Danger Rating is Catastrophic.** On these days fires will be so intense it is not safe to defend any home - no matter how well prepared, Extreme and Severe days are also very dangerous and leaving early will always be the safest option
- You might be at home by yourself during a fire.** Defending your property requires at least two physically fit adults
- You have not made adequate preparations to defend.** This includes having sufficient water supplies and fire fighting equipment
- There are children, elderly, or disabled people in your home.** People who are vulnerable due to age, health or any other reason should always leave early
- Your house is not defensible.** Some houses, because of their location, construction, or surrounding vegetation are not safe to defend. The NSW RFS Bush Fire Household Assessment Tool can help you assess your home's level of risk and make an informed decision. On some days no properties will be defensible



Preparing to leave early means:

- Completing a Bush Fire Survival Plan, available at www.rfs.nsw.gov.au
- Planning where you will go, how to get there, and what you will take
- Knowing the daily Fire Danger Rating in your area and what it means
- Having transport organised for all members of the family, including pets
- Actively seek information on the fire situation and weather conditions from TV, local radio and the internet so you know when to leave
- Having a back-up plan in case you aren't able to leave early enough. What other safer places are there you could get to?
- Talking to family, friends, and neighbours about your plan to leave early

DID YOU KNOW
Being well away from a bush fire is the **ONLY** way to ensure your safety.



FACT SHEET 3 – Prepare.Act.Survive.

REVISED 01/10/2009



NSW RURAL FIRE SERVICE

PREPARE. ACT. SURVIVE.

Fact:

It is your responsibility to prepare yourself, your family and your home for the threat of bush fire. You need to **act** decisively in accordance with your Bush Fire Survival Plan when bush fires threaten. Your survival depends on your preparations and the decisions you make.

Prepare

Prepare a Bush Fire Survival Plan and discuss it with your family. One of the most important decisions you need to make to protect you and your family is will you “Leave Early” or “Stay and Defend” a well prepared property. Regardless of your decision preparation is the key to survival.

- If you are going to leave – prepare for where you are going to go, how you are going to get there and what you are going to take
- If you are going to stay, you must have a plan for how you are going to survive and where you will shelter. Know what equipment you need
- Have a contingency plan – know where your nearest Neighbourhood Safer Place is
- You need to be both mentally and physically prepared to carry out your survival plan
- Prepare your home and property to survive a fire front and ensure you have adequate levels of insurance

Act

Fires can threaten suddenly and without warning so you must be prepared to act without waiting for a warning.

- Don't “wait and see”. Put your preparations into action
- Know what the Fire Danger Rating is for your area
- Watch for signs of fire, especially smoke and flames
- If you receive a Bush Fire Alert, take it seriously and act promptly
- Seek out information from TV, local radio, the internet, mobile phones and neighbours
- Only consider staying and defending if you and your property are currently well prepared

Survive

Your life and your family's lives are always your first priority during bush fires. The safest option is always to be away from a fire, but recognise that fires can move so quickly that a warning is not always possible.

- Know the location of your nearest **Neighbourhood Safer Place** or other safer location that may provide you with greater protection
- Being involved in a fire will be one of the most traumatic experiences of your life

On days of **Catastrophic** fire danger rating leaving early is the safest option to ensure you and your families' survival as even well prepared and constructed homes will not be safe. On days of **Extreme** fire danger rating leaving early will always be the safest option.

FAILURE TO TAKE ACTION CAN RESULT IN DEATH OR INJURY TO YOU OR YOUR FAMILY MEMBERS.

For more information contact your local Fire Control Centre or:



NSW RFS INFORMATION LINE
1800 NSW RFS
1 8 0 0 6 7 9 7 3 7
www.rfs.nsw.gov.au

www.fire.nsw.gov.au ♦ www.esa.act.gov.au

A FIREWISE INITIATIVE



FACT SHEET 4 – Total Fire Bans.

REVISED 01/10/2009



NSW RURAL FIRE SERVICE

PREPARE. ACT. SURVIVE.

Fact: To reduce the risk of fires damaging or destroying life, property and the environment, the NSW RFS Commissioner may declare a Total Fire Ban on days of increased fire danger. The decision is based on advice about a combination of air temperature, relative humidity, wind speed and drought received from the Bureau of Meteorology.

The decision to issue a Total Fire Ban is generally made at 5pm each afternoon during the Bush Fire Danger Period and the Total Fire Ban normally applies for the following day, starting from midnight and lasting 24 hours.

Rules during a Total Fire Ban

- No fire may be lit in the open including incinerators and solid fuel barbecues
- all Fire Permits are immediately suspended

You may use a gas or electric barbecue, but only if

- It is on a residential property within 20 metres of the house ***or***
- It is a permanent fixture within a picnic area managed by Council, National Parks or Forests NSW

and

- It is under the direct control of a responsible adult
- There is a clear area for two metres around the barbecue
- You have an immediate and continuous supply of water

How to find out where Total Fire Bans have been declared

Total Fire Bans are declared according to NSW Fire Areas, which group Local Government Areas with similar weather, terrain and fire management issues. You can check if a Total Fire Ban applies by

- Checking the RFS or BOM websites at www.rfs.nsw.gov.au or www.bom.gov.au
- Ringing the RFS Information Line on 1800 679 737
- Monitoring weather reports on the radio, TV and in newspapers
- Contacting your local fire station

Fines and Penalties

- Up to \$5,500 and/or 12 months imprisonment for lighting a fire on a day of Total Fire Ban.
- Up to \$110,000 and/or 14 years imprisonment for lighting a fire on a day of Total Fire Ban that escapes and damages or destroys life, property or the environment.

The NSW RFS Commissioner may provide exemptions to Total Fire Bans for a range of activities such as emergency infrastructure work or ceremonial fires.

For more information contact your local Fire Control Centre or:



NSW RFS INFORMATION LINE
1800 NSW RFS
1 8 0 0 6 7 9 7 3 7
www.rfs.nsw.gov.au

www.fire.nsw.gov.au ♦ www.esa.act.gov.au

A FIREWISE INITIATIVE



FACT SHEET 5 – Fire Danger Ratings.

REVISED 01/10/2009



NSW RURAL FIRE SERVICE

PREPARE. ACT. SURVIVE.

Fact: The Fire Danger Rating (FDR) is an assessment of the potential fire behaviour, the difficulty of suppressing a fire, and the potential impact on the community should a bush fire occur on a given day. The FDR is an early indicator of potential danger and should act as a trigger for action.

The FDR is determined by the Fire Danger Index (FDI). The FDI is a combination of air temperature, relative humidity, wind speed and drought. An FDI of 1 (Low-Moderate) means that fire will not burn, or will burn so slowly that it will be easily controlled, whereas an FDI in excess of 100 (Catastrophic) means that fire will burn so fast and so hot that it will likely be uncontrollable.

FIRE DANGER RATING	RECOMMENDED ACTION AND POTENTIAL FIRE BEHAVIOUR
CATASTROPHIC FDI 100+	ACTION: The safest option is for you and your family to leave early, hours or the day before a fire occurs. Even well prepared and constructed homes will not be safe. <ul style="list-style-type: none"> ○ Fires will likely be uncontrollable, unpredictable and very fast moving with highly aggressive flames extending high above tree tops and buildings.
EXTREME FDI 75-99	ACTION: Leaving early (hours before) will always be the safest option for you and your family. Staying and defending should only be considered if your home is well prepared, specifically designed and constructed for bush fire and you are currently capable of actively defending it. <ul style="list-style-type: none"> ○ Fires will likely be uncontrollable, unpredictable and fast moving with flames in the tree tops, and higher than roof tops.
SEVERE FDI 50-74	ACTION: Leaving early will always be the safest option for you and your family, staying and defending is only an option if your home is well prepared, and you are currently capable of actively defending it. <ul style="list-style-type: none"> ○ Fires will likely be uncontrollable and fast moving with flames that may be higher than roof tops.
VERY HIGH FDI 25-49	ACTION: Be prepared to implement your Bush Fire Survival Plan and keep informed of current fire activity by monitoring local media and regularly checking for updates on the RFS website or Information Line. <ul style="list-style-type: none"> ○ Fires can be difficult to control and still present a threat.
HIGH FDI 12-24	ACTION: Ensure that you, your family, your home and property is well prepared for the risk of bush fire. <ul style="list-style-type: none"> ○ Fires can be controlled but can still present a threat.
LOW - MODERATE FDI 0-11	ACTION: Review and rehearse your Bush Fire Survival Plan. <ul style="list-style-type: none"> ○ Fires can be easily controlled but can still present a threat.

FAILURE TO TAKE ACTION CAN RESULT IN DEATH OR INJURY TO YOU OR YOUR FAMILY MEMBERS.

For more information contact your local Fire Control Centre or:



NSW RFS INFORMATION LINE
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www.rfs.nsw.gov.au

www.fire.nsw.gov.au ♦ www.esa.act.gov.au

A FIREWISE INITIATIVE



FACT SHEET 6 – Bush Fire Alerts.

REVISED 01/10/2009



NSW RURAL FIRE SERVICE

PREPARE. ACT. SURVIVE.

Fact: Bush Fire Alerts are about getting messages to the community when there is a fire, using a wide range of mediums such as the web, radio and television. They are contingent on the understanding that bush fires can threaten suddenly and without warning, and that the community must be prepared to take action regardless of whether they receive an official emergency warning.

The decision to issue a Bush Fire Alert is based on the threat posed by a fire. It considers the current Fire Danger Rating and the predicted rate of spread of the fire, which can vary depending on topography, fuel type, prolonged drought and other local conditions.

The messaging levels are designed with safety as the paramount consideration.

There are three types of alerts which are ranked on a sliding scale according to the threat.

Advice - a fire has started

- There is no immediate danger this is general information to keep you up to date with developments.

Watch and Act - represents a heightened level of threat

- Conditions are changing and you need to start taking action now to protect you and your family. Follow your Bush Fire Survival Plan.

Emergency Warning - you are in danger and need to take action immediately

- You will be impacted by fire.
- This message may be preceded by an emergency warning signal (a siren sound played on the radio or TV)

SEWS – Standard Emergency Warning Signal

SEWS is a siren designed to alert radio listeners and television viewers that an emergency announcement is about to be made concerning an actual or imminent emergency.

It is important that you do not rely solely on receiving a warning as a trigger for action, the inescapable fact is fires can threaten suddenly and without warning making it impossible to get messages out in time.

If you receive a Bush Fire Alert, you must take it seriously. Failure to take action can result in death or injury to you or your family members.

For more information contact your local Fire Control Centre or:



NSW RFS INFORMATION LINE
1800 NSW RFS
1 8 0 0 6 7 9 7 3 7
www.rfs.nsw.gov.au

www.fire.nsw.gov.au ♦ www.esa.act.gov.au

A FIREWISE INITIATIVE



Appendix E
Bushfire Report Form

Bushfire Report Form

(Amended from Appendix D – Defence National Guidelines (Department of Defence 2007))

Fire Information

Fire Name:	
Fire Number:	
Fire Report No:	

Fire Command and Control

Agency:	
---------	--

Fire Location – Map showing area burnt

Map Name:	
Map Scale:	
Estimate of Area Burnt	
Map Attached?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Location	
(x km xx direction	
from xxx location)	
GPS Coordinates	

Fire Origin

Origin (Date/Time):	
Finish (Date/Time):	
Point of Origin:	(grid ref /lat long/GPS)
Tenure	
Fire Cause:	
GPS Coordinates	
Initiate Investigation	<input type="checkbox"/> Yes <input type="checkbox"/> No
Weather Conditions	Wind speed & Direction
	Relative Humidity
	Temperature
	Fire Danger Rating

Fire Intensity

Vegetation Type:	
Height of Burnt Veg:	metres
Scorch Height:	
Surface Fuel Consumption	
Soil Area Exposed	

Fire Control Measures

Suppression Strategies [type of suppression applied i.e. direct, indirect, passive, ground, aerial, reconnaissance]	
---	--

Fire Damage Information

Area Burnt (ha)		Losses		Injuries	
Dry Sclerophyll Forest / Woodland		Infrastructure:		Fire Fighter	
Rainforest		Range area		Civilian	
		Vehicles		Fatalities	
				Fire Fighter	
				Civilian	

Reporting Person	
Position	
Date	

Appendix F

Indicative Fuel Monitoring Observations

Transect 1: Date 01/09/09 Easting 265154 Northing 6200358 to Easting 264989 to 6200117

Ridgeline off Wattle Ridge Rd to the NW of existing firing range, extending to the SW

Transect Length 300m, Plot Interval 10m, Topography Mid Slope 10%, Aspect NW

Dry Sclerophyll Shrubby Forest, Signs of Recent Fire >5 years

Plot	Fuel - Surface	Hazard Rating	Fuel- Near Surface	Hazard Rating	Fuel - Elevated	Hazard Rating	Fuel-Bark	Hazard Rating
1	2	M	3	H	3	H	2	H
2	2	M	2	M	2	M	2	H
3	2	M	2	M	2	M	2	H
4	2	M	2	M	3	H	1	M
5	2	M	2	M	2	M	2	H
6	2	M	2	M	2	M	1	M
7	2	M	2	M	2	M	2	H
8	2	M	3	H	3	H	2	H
9	2	M	1	L	2	M	1	M
10	2	M	1	L	1	L	1	M
Average		M		M		M		H

Transect 2: Date 01/09/09 Easting 264983 Northing 6200113 to Easting 265263 to 6200115

Take off point ~ 100m from end of transect 1, extending to N

Transect Length 300m, Plot Interval 10m, Topography Mid Slope, Ridge Top 7%, Aspect N

Dry Sclerophyll Shrubby Forest - Grassy Forest, Signs of Recent Fire >5 years

Plot	Fuel - Surface	Hazard Rating	Fuel- Near Surface	Hazard Rating	Fuel - Elevated	Hazard Rating	Fuel-Bark	Hazard Rating
2	3	H	1	L	1	L	2	H
2	2	M	2	M	2	M	2	H
3	3	H	3	H	2	M	2	H
4	2	M	2	M	1	L	2	H
5	2	M	2	M	2	M	2	H
6	2	M	1	L	2	M	2	H
7	2	M	3	H	2	M	2	H
8	2	M	2	M	2	M	2	H
9	2	M	2	M	2	M	2	H
10	2	M	3	H	2	M	2	H
Average		M		M		M		H

Transect 3: Date 01/09/09 Easting 265926 Northing 6199773 to Easting 265646 to 6199313

Parallel to the NW side of the firing range, from firing points extending to the SW

Transect Length 500m, Plot Interval 50m, Topography Ridge Top 7%, Aspect WSW

Dry Sclerophyll Shrub/Grassy Forest, Signs of Recent Fire >5 years

Plot	Fuel - Surface	Hazard Rating	Fuel- Near Surface	Hazard Rating	Fuel - Elevated	Hazard Rating	Fuel-Bark	Hazard Rating
1	2	M	1	L	1	L	1	M
2	3	H	2	M	3	H	1	M
3	3	H	3	H	3	H	2	H
4	2	M	1	L	1	L	2	H
5	3	H	3	H	3	H	2	H
6	2	M	1	L	1	L	2	H
7	3	H	1	L	3	H	2	H
8	3	H	1	L	2	M	1	M
9	3	H	1	L	3	H	2	H
10	3	H	1	L	1	L	1	M
Average		H		L		M		H

Transect 4: Date 01/09/09 Easting 264471 Northing 6196980								
Southern buffer of range - from S transmission line (TL) track (above Iron Ck) to N, then E to TL								
Transect Length 1000m, Plot Interval 100m, Topography Mid Slope 10%, Aspect NW								
Dry Sclerophyll Shrubby Forest, Signs of Recent Fire >5 years								
Plot	Fuel - Surface	Hazard Rating	Fuel- Near Surface	Hazard Rating	Fuel - Elevated	Hazard Rating	Fuel-Bark	Hazard Rating
1	3	H	1	L	1	L	1	M
2	4	E	1	L	1	L	1	M
3	3.5	VH	2	M	2	M	1	M
4	3.5	VH	1	L	1	L	1	M
5	3.5	VH	1	L	2	M	1	M
6	3.5	VH	1	L	1	L	1	M
7	2	M	1	L	1	L	1	M
8	2	M	1	L	1	L	1	M
9	3	H	1	L	1	L	1	M
10	4	E	1	L	1	L	1	M
Average		VH		L		L		M

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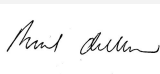


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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	Michelle Evans	Dominic Adshead		Paul de Mar		01/03/ 2010
1	Michelle Evans	Dominic Adshead		D.Adshead		10/9/2010