

Fire Management Plan

Billiatt District

2009-2019



Incorporating Billiatt Wilderness Protection Area; Billiatt, Peebinga and Karte Conservation Parks; included Crown Lands and participating Heritage Agreements

Department
for Environment
and Heritage



Department for Environment
and Heritage
South Australian Murray-Darling
Basin Natural Resources
Management Board

PREPARE. ACT. SURVIVE.



This plan has been produced by the South Australian Department for Environment and Heritage with the support of the Australian Government through the Natural Heritage Trust (NHT, 2005).

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This Fire Management Plan is also available from:

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EXECUTIVE SUMMARY

Billiatt Wilderness Protection Area (WPA) is one of the largest protected areas of remnant native vegetation in settled South Australia. It was proclaimed a Wilderness Protection Area under the *Wilderness Protection Act 1992* in 2008. The reserve, along with Billiatt, Karte and Peebinga Conservation Parks, adjacent unalienated Crown land and Heritage Agreements represents more than 115 000 hectares of mallee heath and shrubland habitat. The planning area contains a diverse range of flora and fauna species, including some threatened species exclusively found within the region. The recognition that inappropriate fire regimes present a threat to biodiversity regardless of land tenure is important in such a fire-prone landscape. Consequently, the development of this plan has been funded by the Natural Heritage Trust (NHT) through the South Australian Murray-Darling Basin (SAMDB) Natural Resources Management (NRM) Board.

This Fire Management Plan has been developed to provide direction for fire management activities, including bushfire suppression, in the Billiatt District. The plan emphasises the protection of life and property as well as providing direction for land managers in the protection and enhancement of the district's natural and cultural heritage. It is important to note there will be a transitional phase while the activities and works proposed in the plan are implemented. Some degree of flexibility is needed for fire suppression in those areas where there has only been partial implementation of works.

The Billiatt District was identified as a priority area for fire management planning within the DEH Murraylands Region to address the following issues:

- General protection of life, property and environmental values in the planning area.
- Protection of important habitat for many species and communities including those with conservation ratings.
- The protection of fire management blocks and reserves, both public and private, within a landscape context, with the aim of reducing the likelihood of a whole reserve or a large portion of a reserve burning in a single fire event.

These issues were addressed by:

- applying a risk assessment process to identify life, property and environmental values at risk from bushfires
- applying DEH Fire Management zoning principles to manage fuel in Asset and Buffer Zones
- identifying significant ecological assets and applying Ecological Fire Management Guidelines to determine appropriate burning in Conservation Zones
- auditing tracks within Billiatt WPA and Billiatt, Peebinga and Karte Conservation Parks using the Government Agencies Fire Liaison Committee's (GAFLC) '*South Australian Firebreaks, Fire Access Tracks and Sign Standards Guidelines*'.

A number of recommendations as a result of applying the above processes will be made including the following:

- Prescribed burning to:
 - reduce fuel in Asset and Buffer zones as outlined in the plan. Other methods of fuel reduction will also be used, and in some cases are specifically mentioned
 - reduce fuel in strategic areas within Conservation zones to provide landscape and habitat protection for included lands and known threatened species populations
 - create mosaics with a range of fire ages.
- Track upgrades in accordance with GAFLC standards.
- Identification of suppression considerations that may assist bushfire suppression operations to contribute to improved fire management.

The local community and South Australian Country Fire Service (CFS) volunteers have contributed extensive amounts of time, energy and resources to fire suppression in the Billiatt District and they are to be commended for this contribution. The co-operation of both stakeholders and the local community will be critical to the success of the plan. The risk that fire presents to a variety of land tenures provides a unique opportunity to manage the landscape with respect to fire through combining the resources and experience of stakeholders such as the South Australian Department for Environment and Heritage, CFS and Heritage Agreement owners.

A major review of the plan will occur after ten years of implementation, or earlier if required. Recommended works will be reviewed on an annual basis.

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1 RATIONALE AND KEY OBJECTIVES

1.1 Background

The intention of this plan is to provide strategic direction and a framework for fire management activities in the Billiatt District. It defines objectives for ecological fire management, life and property protection, but more specifically, it lists recommendations and strategies and suggests works to allow those objectives to be met. The pre-suppression works and activities will increase the level of preparedness for bushfires and guide suppression during bushfire incidents.

This plan is unique as it includes adjoining conservation lands such as Heritage Agreements and unalienated Crown land in the knowledge that fire in this area is a landscape process, impacting on a variety of ecological communities regardless of land tenure. As the lead agency for biodiversity management in South Australia, the Department for Environment and Heritage (DEH), through the support of the SAMDB NRM Board and NHT, has developed this plan with the objective of improving ecological fire management outcomes for the area. Fire prevention planning for land outside DEH reserves is the currently the responsibility of the District Bushfire Prevention Committee, in accordance with the requirements of the *Fire and Emergency Services Act 2005*. This may change in the future, however, with the formation of regional committees. DEH Regional Conservation is represented on this committee, along with local government and local CFS brigades, in a collaborative approach to fire prevention planning and decision-making. Management of fire on public land in the planning area is the responsibility of DEH.

Fire has been a natural process within the Billiatt District since well before European settlement. The vegetation, predominantly Mallee heath and shrubland with a shrub understorey, has evolved with fire as a key ecological process. Despite alteration to fire regimes through fragmentation of the landscape, the contiguous nature of the remnant vegetation in the area still produces large fire events. Previously, funding and works for fire management within the planning area have been largely restricted to track and firebreak maintenance and practices have been largely reactionary rather than preventative and proactive.

“Fire prevention” is neither desirable nor achievable in this landscape; fires have and will continue to occur as a natural process, regardless of any human intervention. However, the risk that fire poses to both biodiversity and built assets can be managed proactively within an adaptive framework that seeks to implement actions and learn from results. This plan is designed to provide direction for the mitigation of this threat through both pre-suppression and suppression activities.

Reducing Costs

Whilst the impacts of fire in the Billiatt District are largely environmental given its low population density and lack of infrastructure, the economic and social costs of suppressing large fires can be an issue. Often the effort expended in suppressing large bushfires has been disproportionate to the success of suppression operations. It is hoped that the pre-

suppression strategies prescribed in this document will serve to mitigate some of this cost and serve to reduce the time taken to suppress bushfires.

Identifying Assets and Assessing Risks

There are comparatively few built assets within or adjacent to the planning area. However, identifying the risk to these assets, along with quantifying risks to ecological assets is a priority for effective fire management in the District. The identification of rare or significant populations or communities of flora is relatively simple given their sessile nature. Conversely, identifying corresponding fauna assets in a landscape of this size is rather more problematic given they are either rare, mobile, cryptic or a combination of all three. Along with known population or community locations and ranges, there is also the need to identify potential sites for habitation if fire management is to be holistic in its approach. Actions prescribed will source ecological information provided on a range of threatened and significant species in the planning area to meet this objective.

Managing Fire Regimes

Historically, much of the focus of fire management within Billiatt District, and indeed across Australia has centred on event-based management. Ecologically, better management of fire regimes is required across this landscape to ensure the conservation of the ecological communities it supports. Large fires at frequent intervals often in combination with drought conditions will not sustain the significant ecological assets in the area. Attempts to manipulate, in the first instance, the extent and location of bushfires within the District is pivotal in the sustainable management of not only significant or threatened species in the area, but all of the communities it supports.

The scale of manipulation is dependant on its objectives. Initial strategies will seek to provide protection through prescribed burning across the landscape at a variety of scales. Whereas the major concern with fire events within the planning area centres on proportionally large fires relative to the extent of remnant native vegetation, bushfires of much smaller magnitudes can be equally destructive at a local or habitat scale.

Increasing Knowledge

Improving our fire management knowledge with respect to fire suppression techniques, fire behaviour and fire ecology is a key goal. Existing knowledge needs to be built on, particularly with respect to the interactions of significant species or communities and fire regimes if the prescribed use of fire is to meet the set ecological objectives. Projects such as 'Mallee Fire and Biodiversity' being conducted by Latrobe and Deakin Universities and other partners, including DEH, are aimed at researching the ecological impact of different fire regimes on a landscape scale. It is also hoped that the knowledge gained from studies in other areas, such as Bushfire CRC's 'Project FuSE', focussing on fire behaviour in Ngarkat Conservation Park (CP), can be applied to the wider region, including the Billiatt District.

Improving Response

The Billiatt District is an extremely difficult environment in which to combat fire. The size of the area, lack of access and water, steep sandy terrain and often-rapid rate of fire-spread all contribute to a volatile fire environment. DEH, in collaboration with CFS and private land holders, will continue to improve fire response capacity through supporting and encouraging the exchange of ideas and the development of plant and equipment to better manage bushfires in the area.

1.2 Key Objectives

The following eight key objectives provide the focus of the plan. Specific management objectives for designated fire management zones and individual fire management blocks within the plan are described in Sections 9 -13.

These are:

1. To protect life and property on all reserves and protected areas listed within the Plan.
2. To contain (where operationally feasible) all bushfires within the boundaries of the planning area.
3. To manage fires and fire regimes to meet the ecological requirements of species and communities that may be at risk from inappropriate fire regimes.
4. Minimise the risk of bushfires greater than 10,000 hectares occurring.
5. Promote patchiness using prescribed burns and bushfire suppression.
6. Improve our understanding of the role of fire in mallee-heath and shrublands with a view to improving fire management practices within the District.
7. Minimise the impacts of all fire management operations on the environment.

2 THE PLANNING FRAMEWORK

2.1 Legislation

2.1.1 State Legislation

DEH has responsibilities for fire management activities within Reserves constituted under the [National Parks and Wildlife Act 1972](#) (NPW Act), and the [Wilderness Protection Act 1992](#).

Due to the presence of Billiatt WPA in the planning area, this plan must demonstrate compliance with the requirements of the SA Code of Management for Wilderness Protection Areas and Zones (DEH, 2004a) with respect to fire, emergency and essential management operations under Sections 3.6 and 3.10 (Appendix 1). The plan will also comply with the DEH Fire Policy and Procedure for Wilderness Fire Management (DEH, 2008a).

In prescribing any works or activities that involve clearance or the use of fire (which is also defined as 'clearance' under the *Native Vegetation Act 1991*), the plan must also meet any relevant provisions under the *Native Vegetation Act 1991*. All prescribed burns must be approved through the process delegated to DEH by the Native Vegetation Council (NVC).

2.1.2 Commonwealth Legislation

Overarching these three State Acts is the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Billiatt WPA, Billatt CP, Karte CP and Peebinga CP are afforded protection under this Act as they provide habitat for nationally listed species including the Malleefowl (*Leipoa ocellata*), Red-lored Whistler (*Pachycephala rufolugaris*), Mallee Emu-wren (*Stipiturus mallee*) and Western Whipbird (*Psophodes nigrogularis leucogaster*).

2.2 DEH Fire Management Policy

DEH has a Fire Management Policy (DEH, 2008b), which contains a number of key principles:

- Fire is a natural component in Australian ecosystems.
- Reserves play a crucial role in protecting biodiversity, particularly within a fragmented landscape, and are acknowledged as valuable ecological assets.
- Land development has limited the extent, contiguity and biodiversity of these ecosystems such that those remaining areas of natural vegetation now protected in reserves may become vulnerable to irreversible change if unprotected from inappropriate fire regimes.
- Development of residential, agricultural and horticultural assets has resulted in increased risk to life and property from uncontrolled fire.
- The community has an expectation that their developed assets should be protected from the threat of unplanned fire.
- Intervention to suppress unplanned fire is sometimes necessary to limit damage to natural and developed assets.

Under this policy direction, appropriate consideration is given in fire management planning by DEH to achieve the dual aims of protecting the environment as well as protecting human

life, property and assets. Property protection activities, where recognised as a priority, will be carried out in such a way as to reflect, wherever practicable, the importance of protecting the dynamics of natural ecosystems.

2.3 Zoning Policy

DEH has a Zoning Policy that outlines the zoning standard that is used for fire management planning on DEH managed lands (DEH, 2006c). Zoning is derived from:

- the level of perceived risk, using the *Policy and Procedure for Risk Assessment in DEH Fire Planning* (DEH, 2006d)
- the Overall Fuel Hazard, which is assessed using the *Overall Fuel Hazard Guide for South Australia* (DEH, 2006f)
- the activities considered appropriate to mitigate the threat that fire poses to life, property and environmental assets.

Three distinct zones exist: Asset zone (A-zone), Buffer zone (B-zone) and Conservation zone (C-zone). These are applied according to fire management objectives. A- and B-zones are determined by fuel management objectives whereas C-zones are designated to assist in the conservation of biodiversity through the application of appropriate fire regimes (DEH, 2006c). For more information on zoning, refer to Section 8 of this plan and the *Policy and Procedure for Fire Management Zoning in DEH Fire Planning* (DEH, 2006c).

2.4 Local and Regional Environmental Planning / Recovery Planning

The South Australian Murray-Darling Basin Biodiversity Plan (Kahrimanis, *et al.*, 2001) is one of several regional biodiversity plans developed by DEH. The Plan guides the conservation, management and rehabilitation of habitats at a regional level. In developing fire management planning objectives, strategies, works and activities for this plan careful consideration has been given to biodiversity-related issues, to ensure they are consistent with those in the Biodiversity Plan.

The Billiatt District Fire Management Plan is directed by strategies and actions detailed in a number of recovery plans prepared for listed species found within the planning area. These plans recognise the significant threat that inadequate fire regimes pose to target species and list a number of management recommendations accordingly. They are:

- the *Regional Recovery Plan for the Mallee Emu-wren Stipiturus mallee, Striated Grasswren Amytornis striatus, Western Whipbird Psophodes nigrogularis leucogaster and Red-Lored Whistler in the South Australian Murray Darling Basin* (DEH, 2005b)
- the *South Australian Murray Darling Basin Threatened Flora Recovery Plan* (Obst, 2005).

Both have provided significant direction for the specific fire management requirements or a range of threatened flora and fauna.

2.5 Reserve Management Planning

Reserve Management Plans provide the overarching strategy for all management activities in reserves. A Management Plan is in preparation for Billiatt WPA and Billiatt, Karte and

Peebinga Conservation Parks, which will supersede the existing plan (NPWS, 1984). Management Plans are a statutory requirement under the *National Parks and Wildlife Act 1972* and the *Wilderness Protection Act 1992*, and will therefore be produced.

In relation to fire, a Reserve Management Plan will:

- provide an overview of any fire-related issues in the reserve in question
- state DEH responsibilities for managing fire in the reserve system in accordance with DEH Fire Management Policy (DEH, 2008b)
- identify the requirement for a Fire Management Plan based on the nature of any fire-related issues.

In the absence of a Reserve Management Plan, a Fire Management Plan for a reserve may still be prepared consistent with the objectives of the *National Parks and Wildlife Act 1972* and the *Wilderness Protection Act 1992* (if the reserve is a Wilderness Protection Area).

2.6 Fire Management in Heritage Agreements

The inclusion in the plan of private land under Heritage Agreement is unique, but appropriate when placed in the context of the landscape. Prior to European settlement and the associated land clearance The Billiatt District formed part of what was once a much larger area of mallee heath and shrubland. The ecosystem is strongly adapted to the impacts of fire; with many species of fire obligate flora found in the area. As such, the development of a more holistic approach when managing these remnants for fire is necessary in order to maximise biodiversity within the system.

Prescribed fire may be used for the following purposes in Heritage Agreements contained within this plan to:

- achieve fuel reduction around or adjacent to built assets
- provide landscape protection for populations and or communities of threatened or significant flora and fauna
- meet specific ecological objectives such as weed management, threatened species populations or habitat restoration.

To facilitate a consistent approach across the planning area and to ensure that the objective of any prescribed action is aligned with the objectives stated within the plan, any fire management actions prescribed and implemented on Heritage Agreements are undertaken by individual landholders within the following constraints:

- Any prescribed action undertaken on private land will comply with the guidelines stated within the plan and the relevant Acts listed.
- All prescribed burning planned for Heritage Agreement areas will be prepared in accordance with the DEH *Policy and Procedures for Prescribed Burning* (DEH, 2008c) and the GAFLC *South Australian Prescribed Burning Code of Practice* (GAFLC, 2004).
- All prescribed burning conducted within Heritage Agreement areas will be completed only in conjunction with an adequate monitoring program (refer to Section 14).

- The final decision to implement any prescribed action listed within the plan for a specific Heritage Agreement rests with the landowner.
- DEH, through the Murraylands Conservation Program Unit staff will provide technical support and expertise in the preparation of prescribed burn plans, environmental assessment tables and pre- and post-fire monitoring. Funding for monitoring programs can be sought through the Native Vegetation Council grants scheme.
- DEH will not contribute toward the implementation (either through resources or financially) of any prescribed action on private land unless it is demonstrated that there is a benefit or shared risk to public land.

Recommendation

Heritage Agreements

1. To assist in the implementation of prescribed burning and other pre-suppression works within Heritage Agreements it is recommended that funding be sought through the SAMDB NRM Board to assist in fire management on private land. This money should be managed through the DEH Murraylands Conservation Programs Unit.

2.7 The Role of the Local Country Fire Service

The Country Fire Service has overall responsibility for fire suppression activities. Responding to a fire on conservation land is undertaken jointly by CFS brigades and the DEH brigade (on DEH reserves). Within Heritage Agreements the responsibility lies with the CFS, with DEH participation if the fire is within close proximity to public land. Over the last three decades, DEH has formed a close working relationship with the Mallee and Chaffey CFS groups whose response zones the Billiatt District falls in. The co-operation, support and understanding between CFS, DEH and the local community have been critical to successful fire suppression both on- and off-reserve in the past, and will be critical to the success of this plan.

The role of the CFS in prescribed burning at this point is informal and based on a case-by-case negotiation between the CFS and DEH. It is hoped that this plan will serve to foster a partnership between public and private land managers and the CFS toward the common goal of reducing fire impacts within the area. The value of including the CFS in prescribed burning operations within the Billiatt District can be measured in a number of ways:

- Inter-agency operations promote a better understanding of the policies and approaches used to manage fire at a landscape level.
- Such activities provide excellent training opportunities for both DEH and CFS staff on a joint platform. Better knowledge of fire behaviour in mallee, fire ecology, operational procedures and local resource capacity are benefits directly attributed to such exercises.

3 BUSHFIRE ENVIRONMENT

The basic components of any landscape contributing to the bushfire potential include terrain, slope and aspect, climate and weather, vegetation and land use. The Billiatt District has a high seasonal potential for bushfires, supporting over 100 000 hectares of flammable mallee heath and shrubland intermittent with grazing and cereal cropping. The continuous nature of fuels, particularly those found on sandy soils, creates a fire-prone environment.

3.1 Location

The Billiatt District is located 200 kilometres east of Adelaide, to the north of the Mallee Highway through Lameroo and south of Loxton (refer to Map 1). The planning area incorporates Billiatt WPA and Billiatt, Karte and Peebinga Conservation Parks, adjacent unalienated Crown land and Heritage Agreements (subject to owner consent).

3.2 Terrain

Terrain in the planning area is dominated by rolling Aeolian sand dunes intermittent with swales of heavier soil types. Dunes are often very large (in excess of 100 metres above sea level) and steep on their leeward (predominantly eastern aspect) side. As such, the terrain, in combination with the flammability of the vegetation, creates an extremely difficult environment to suppress bushfires.

3.3 Climate

The Billiatt District has a Mediterranean climate predominated by hot, dry summers and cool, wet winters characterised by frontal systems. Average rainfall is 389.6 mm per annum in Lameroo, grading to 300 mm at Peebinga and 274 mm in Loxton (BOM, 2005a; b).

Summer temperatures have an average maximum of 30.7°C and average minimum of 13.1°C in Lameroo in January. Daily maximum temperatures in excess of 40°C are common in the summer. Maximum winter temperatures at the same location have an average of 14.9°C in July, with an average daily minimum of 4.3°C. Overnight winter temperatures can drop to as low as -4.3°C. Winter conditions occasionally produce extensive frosts, often associated with this is widespread frost damage and, if severe enough, mortality in vegetation communities.

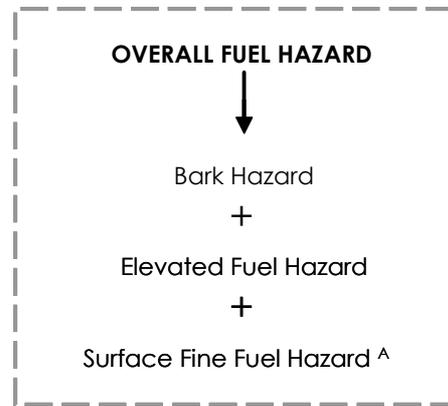
Wind speed and direction varies seasonably within the Billiatt District. In the presence of a high-pressure system ahead of a cold front or thundery low-pressure system, winds are frequently from the north before swinging to the southwest. These conditions are the most conducive to bushfires, as winds are often strong both before and after the frontal system arrives.

3.4 Fire Behaviour in Mallee Ecosystems

Factors contributing to the flammable nature of the Billiatt District's mallee heath and shrubland include aerated fine fuels, the persistence of dead foliage, the influence of wind on exposed fuels and a variety of terpenes, waxes and oils contained in mallee and understorey vegetative matter (Keith, *et al.*, 2002). Fires have been recorded in the planning area from September to early May.

3.5 Fuel

Fuel hazard assessment methodology is based on the Overall Fuel Hazard Guide for South Australia (DNRE, 1999), which is ultimately an assessment of four fuel layers (components). These are surface fuel (litter), near surface fuel, elevated fuel and bark fuel (Figure 1). The Overall Fuel Hazard is used to determine the level of risk posed by bushfire to life, property and environmental assets in the risk assessment.



[^] Surface Fine Fuel Hazard adjusted to account for the presence of Near Surface Fuel

FIGURE 1: OVERALL FUEL HAZARD

Each fuel layer contributes to different aspects of fire behaviour: flame depth and height, surface fire combustion and rate of spread, spotting and crown fire (DEH, 2006f). Each layer, as well as the Overall Fuel Hazard can be assessed as: *Low, Moderate, High, Very High or Extreme*.

Research conducted by McCarthy and Tolhurst (2004) into the effectiveness of fuel reduction burning in Victoria concluded that maintaining Overall Fuel Hazard levels at *High* or less aids in slowing the rate of spread of a subsequent bushfire. It was determined that to achieve long-term fuel reduction effects the focus should be on the reduction of bark and elevated fuels as these fuel layers are likely to contribute the most to the overall fuel hazard.

The likely maximum Overall Fuel Hazard that occurs in the Mallee Heath and shrubland (MVS No. 29) and Mallee with hummock grass (MVS No. 27) vegetation communities in the plan area is rated as *Extreme*. These communities are shown on Map 2 (Vegetation Communities). For more information on fuel hazard assessment methodology and evaluation refer to the *Overall Fuel Hazard Guide for South Australia* (DEH, 2006f). The process used to derive Major Vegetation Sub-groups (MVS) is described in Section 6.2, and the extent of each MVS within the planning area is shown on Map 2 (Vegetation Communities).

3.5.1 Conditions for Large Fire Events

For many areas of South Australia, there has been little collation, analysis and interpretation of fire event data, including associated fuel and weather conditions. The current knowledge base on fire in Mallee-Heath will continue to be developed through a research project (Project FuSE: **F**ire **E**xperiments in **S**crub, with attention to wind 'u') into mallee-heath fire

behaviour in conjunction with the Bushfire CRC. Historical evidence of the conditions conducive to large bushfires in the area is as follows:

- Fires are predominantly started by lightning strikes produced by thunderstorms (often dry). These storms are most frequent over the period from mid-September to March.
- These thunderstorms often break ahead of cool changes on the back of periods of hot, dry, weather with often strong northerly to north-westerly winds.
- Within a period of 6 to 24 hours after the initial storm the wind will swing to the southwest associated with an approaching cold front. Wind strength and direction following the change is often variable for several days depending on the strength of the change before reverting back to the north under the influence of an approaching high pressure system.
- the resulting patterns of fire spread are classically represented by the fire heading south east following the strike before the wind change to the south west converts the eastern flank of the fire to a head fire which then travels on a north easterly trajectory producing a "tick" shaped fire. Fire history reflects this pattern (Refer to Map 3).

4 FIRE HISTORY AND FIRE REGIMES

4.1 Fire Regimes in Mallee Communities

Fire regimes in Mallee exhibit considerable variability, driven amongst other things, by climate, topography, and land tenure. The minimum inter-fire interval varies considerably based on a number of factors. The most influential of these factors is the amount of post-fire rainfall, which dictates the recovery rate of plant species, and subsequent build-up of fuels.

The diversity of fire regimes in Mallee has shaped diverse vegetation communities. Within these communities, a variety of plant response mechanisms have evolved to cope with the disturbance of fire and indeed in many instances to flourish following it. Gaining an understanding of these components and their contribution to fire regimes at a variety of scales is pivotal if one is to effectively manage fire regimes in Mallee.

4.2 Prior to European Settlement

Unfortunately, little is known of what fire regimes, if any, were applied by Aboriginal occupants of the region. The Billiatt District was occupied by the Ngarkat People (AIATSIS, 2005). Any observations regarding the role that traditional owners have played in altering fire regimes in Mallee are largely speculative (Harris, 1989). Observations would suggest that some localised patches of vegetation may have been burnt either purposely or inadvertently by traditional owners; suffice to say that the practices employed were nowhere near the scale, intensity and frequency of the groups of northern Australia and as such have not shaped the landscape to the same extent.

4.3 Twentieth Century Fires

4.3.1 Mapping Fire Occurrences

Maps displaying fire history have been compiled from DEH and CFS records of fire incidents (Table 2 and Map 3). The thematic fire history map shows two main features:

- Last fire (i.e. the most recent fire event for any given location within the planning area up to the end of the 2007/8 Fire Season).
- Fire frequency (i.e. the number of times an area has burnt since records have been kept (1945) up to the end of the 2007/8 Fire Season).

The quality of the fire scar mapping varies, depending on the methods of capture, which range from digitising enlarged aerial photographs to interpretation of hand drawn maps. Where fire scars were visible on historic aerial photography (largely at 1:40,000 scale) they have been digitised for mapping and future analysis in a Geographic Information System (GIS). It is important to note that only visible fire scars were mapped. As such, the mapped fires should be regarded as a *minimum* estimate of fire occurrences.

4.3.2 Lightning and Fires / Human-caused Fires

Historically pastoral activities produced frequent fires through the late 19th Century and early to mid 20th Century to promote the growth of pasture fodder (Harris, 1982). It is impossible to quantify what impact or influence this would have had on existing fire regimes, as there are no detailed records of burning practices and associated fire history prior to 1945.

Lightning has always been, and will continue to be, the principle ignition source for fires in the region. Dry thunderstorms are a common occurrence in the region from September through to March. Ignitions are most common at the head of a cool change late in the afternoon of early evening as the wind is shifting from the north to the west. These thunderstorms frequently produce multiple strikes and ignitions across the area as they move through.

Given the relative isolation of the Billiatt District and the limited access to its reserves, the risk of deliberate human-caused fires is presently minimal. Machinery-caused incidents are a risk during the summer months, particularly during harvesting.

4.3.3 Fire Frequency and Impact

The Mallee of the Billiatt District is fire-prone, however the recorded fire history of Billiatt WPA is dominated by a single fire event in 1988. The region is not prone to the relatively high fire frequency of the heath and mallee-heath further south, however there are instances within the planning area of patches burning at intervals as short as twelve years. For the most part, however, these patches are small and the vast majority of the planning area has burned only once since records began, if at all.

Heritage Agreement areas and other reserves outside Billiatt WPA are subject to infrequent and smaller fire events. This pattern is almost certainly a function of landscape fragmentation in the case of the smaller reserves and Heritage Agreements in the planning area (i.e. smaller patches of native vegetation have a lower probability of being struck by lightning). Map 3 displays the fire frequencies over the planning area since records have been kept.

4.4 Present and Future Fire Regimes

4.4.1 Impact of Land Use and Operational Capacity on Fire Regimes

Land use changes have increased the economic, political and community pressure on CFS and DEH to suppress bushfires when they occur. Concurrently, the operational capacity to suppress fires has increased through several mechanisms including improved access, well-equipped and trained fire fighters, aerial suppression support and improved management of incidents. The suppression strategies and tactics adopted, such as back burning, can also maximise our capacity to suppress fires, but may result in a different pattern of burning, patchiness and extent than what may have occurred naturally in the past, and can increase the amount of area burned if used indiscriminately.

The combination of pressure to suppress all fires, along with our capacity to control fires of low to moderate intensity, means that such fires are extinguished sooner than would happen naturally. This in turn means the natural fire regime is altered, as are the fuel and flammability patterns across the landscape. Given the vast size of Billiatt WPA, the scarce settlement within the region and the comparatively low operational suppression capacity, the influence of European settlement on fire regimes within Billiatt WPA is not as pronounced as it has been in other areas of the state. This said, it is still logical to assume that, prior to settlement, fires would have burnt unchecked over enormous areas for extended periods during the summer months. Land clearance and pastoralism are therefore likely to have modified the fire regimes of the region through the activity of prescribed burning and reducing the extent of native vegetation.

Smaller patches of native vegetation, such as Heritage Agreements, have less chance of being struck by lightning, better access from all sides and therefore offer a better suppression advantage to fire fighters. As such, these areas experience fire less frequently and when they do, they are rarely exposed to large events. Conversely, however, these smaller patches of vegetation are at greater risk of burning completely in a single fire event.

4.4.2 Influences on Current Fire Regimes

Whilst there are differences between current fire regimes and historical ones, they are not readily identified. Current fire patterns on the landscape are a result of factors including climatic and vegetation changes, Aboriginal presence and absence, European settlement, accompanying vegetation clearance and associated fires, fire exclusion, changing land use and fire suppression. Agriculture and pastoralism in the region have had the most pronounced impact on fire regimes since settlement. Large areas of bushland surrounding Billiatt WPA and CP have been cleared for cropping and grazing, thus altering fuel levels. The resultant fragmented landscape will certainly continue to shape the size and frequency of bushfires.

4.4.3 Future Fire Regimes

The fire-prone nature of the Billiatt District would suggest that fires of varying seasonality, intensity, duration and spatial extent would continue to shape the landscape and the ecological communities it supports. The projected increase in 'very high and 'extreme' fire danger days and an increase in fire season durations in South-Eastern Australia as a result of climate change (Lucas, *et al.*, 2007) has the potential to alter fire regimes. If these predictions are accurate, increase fire size, frequency and intensity can be expected.

The proactive management strategy prescribed in this plan will serve to shape in some part the extent, intensity and duration of bushfires. However, they are by no means designed to prevent fire from occurring in a landscape that has evolved with it. One challenge facing land managers in this area with respect to fire is to manage fire regimes at a variety of scales for a range of communities and species.

5 DAMAGE POTENTIAL TO BUILT ASSETS

5.1 Land Use

The major use for land adjoining the planning area is agriculture (Map 1). Cropping, grazing and some broad-acre horticultural farming are the most frequent uses. Scattered throughout this farmland are areas of native scrub, many of which are protected under Heritage Agreement. In many instances, these Heritage Agreements abut Billiatt WPA and Billiatt, Karte and Peebinga Conservation Parks, thus increasing the extent of continuous mallee heath and shrubland.

5.2 Built Assets and Property Protection

Whilst a very large percentage of the planning area is sparsely populated, there are a number of built assets and associated population both within and adjacent the planning area requiring protection from fire. These include homes, outbuildings such as shearing sheds, implement sheds, vineyards, orchards, reserve visitor facilities, and information bays.

DEH will undertake fire management works and activities on reserves to minimise the impact of fire on built assets, for both public and private buildings and agricultural areas. The difficulty is in striking a balance between property protection and conservation management objectives. More detail is provided on Map 4 (Fire Management and Access) and in Section 10-13 (Fire Management Blocks).

All landholders are obliged to comply with the *Fire and Emergency Services Act 2005*, which outlines responsibilities for fire preparedness. DEH will implement works for fire management on DEH managed lands within the planning area in order to minimise risks, however adjoining landholders are also required to implement works on their own property to minimise the threat of fire.

5.3 Tourism

Tourism in Billiatt WPA and CP, Karte CP and Peebinga CP is currently of minimal importance due to their limited access and visitor facilities. Both Billiatt WPA and CP and Peebinga CP are free of visitor facilities, whilst Karte CP provides a small picnic area and walking trail. In the event that additional visitor facilities are installed, fire management will undertake appropriate zoning and fuel reduction as required.

5.4 Cultural Heritage

5.4.1 Aboriginal Heritage

Aboriginal history in the Billiatt District is not extensively documented. There are no documented cultural sites in the planning area, however, it is known that Karte translates to 'thick low scrub', and Peebinga to 'place of pines' in the Ngarkat language.

5.4.2 European Heritage

The northern part of Billiatt WPA was included in Pastoral Lease 2056, taken up by James White in 1892. As part of this lease, a well and tank were built in the north-eastern section of the reserve. These supplied water to the pastoral lease, as well as forming part of a stock

route between Taillem Bend and the Sunset Country in Victoria. A steam traction engine was used to pump from the well, and it is believed that this still lies near the site. Part of the Western side of the existing reserve was under pastoral lease until 1979, under the name of Pankina Station. A part of this was a small cleared area west of the Alawoona Road near the northern boundary of the reserve. This was the site of the homestead, however very little evidence of this remains.

Peebinga CP was home to the Giles and Radford Farms, however only traces remain of the original infrastructure. The townships of Kringin and Mootatunga, both adjacent to the CP, once thrived, but advances in transportation and marginal farming conditions have seen them decline to their current state, which is at little risk from fire.

No clearing or grazing is known to have taken place on Karte, and consequently there are no European heritage sites on the reserve.

6 BIODIVERSITY

6.1 Fire and Mallee Ecosystems

Whilst adaptations to fire are most evident in vegetation, there is considerable evidence to suggest that the many mallee invertebrates, reptiles, birds and mammals have also developed mechanisms to not only persist but thrive in the post-fire environment. These adaptations may be behavioural, physiological, anatomical or biological, and in some cases many species would cease to exist in the absence of fire. Conversely, given the dramatic changes to the landscape associated with European settlement, there is an equal threat posed by too frequent fire, even in remnant areas as large as Billiatt WPA and CP. As such, the management of fire and more importantly fire regimes is essential to ensure the long-term conservation of these communities.

6.2 Vegetation

Mallee heath and shrubland vegetation communities are best described as fire tolerant (Willson, 1997). The Billiatt District includes a vegetative structure similar to that of mallee communities further north, however the understorey comprises mainly shrub species and *Triodia* and is more characteristic of parts of Ngarkat CP to the south. The soils in the area are sandy and nutrient poor, particularly with regard to Nitrogen and Phosphorous.

Like the majority of Australian plant species, vegetation in the planning area has evolved a number of strategies for coping with fire in order to ensure their long-term survival. For example, the Eucalypts that characterise mallee ecosystems resprout from a lignotuber below the ground following fire. *Triodia* will senesce if it is not burned for too long a period, and its structure therefore promotes fire. It will then resprout from its base or from seed.

6.2.1 Vegetation Mapping

The vegetation of the Billiatt District was mapped in 2000 as part of the Biological Survey of the Murray Mallee of South Australia (Foulkes and Gillen, 2000). The area was mapped using aerial photography interpretation in conjunction with site-based sampling in representative areas. The data was then digitised.

Floristic mapping for this plan uses a compilation of regional vegetation mapping data that has been reclassified to comply with the National Vegetation Information System (NVIS) classification for Australia. The MVS level of the NVIS classification emphasises the structural and floristic composition of the dominant stratum but with additional types identified according to typical shrub or ground layers occurring with a dominant tree or shrub stratum. The Billiatt District is classified primarily as Mallee Heath and Shrublands (MVS No. 29), with small and very occasional patches of Mallee with Hummock Grass (MVS No. 27) (Map 2). Within these broad vegetation communities there are seven minor vegetation groups. These are taken from the SA Veg ID, and are based on the dominant species in each vegetation storey. These groups are as follows:

- Mallee Honey-myrtle (*Melaleuca acuminata* ssp. *acuminata*), Dryland Tea-tree (*M. lanceolata*), Beaked Red Mallee (*Eucalyptus socialis* ssp.) and Narrow-leaf Red Mallee (*E. leptophylla*) tall open shrubland over Wallaby Grass (*Danthonia* sp.) and Spear Grass (*Austrostipa* sp.) tussock grasses

- Cypress Pine (*Callitris verrucosa*) tall open shrubland over Desert Tea-tree (*Leptospermum coriaceum*) over *Hibbertia australis* shrubs
- Ridge-fruited Mallee (*Eucalyptus incrassata*) mid-mallee woodland, over Desert Tea-tree (mixed) mixed shrubs, over *Hibbertia australis* (mixed) shrubs
- Square-fruit Mallee (*Eucalyptus calycogona* ssp.) mid-open mallee woodland over Mallee Honey-myrtle shrubs and Spear Grass (mixed) tussock grasses.
- Narrow-leaf Red Mallee, Dryland Tea-tree mid mallee woodland over Spear Grass, Wallaby Grass and Spreading Sword Sedge (*Lepidosperma concavum*) tussock grasses
- Narrow-leaf Red Mallee mid-mallee woodland over Dryland Tea-tree shrubs and Spinifex (*Triodia irritans*) (mixed) hummock grasses
- White Mallee (*Eucalyptus dumosa*) and Narrow-leaf Red Mallee mid open mallee forest over Wallaby Grass, Spear Grass and Spreading Sword Sedge tussock grasses.

These descriptions provide additional detail to the broad MVS No. 29 (Mallee Heath and Shrublands) and MVS No. 27 (Mallee with Hummock Grass) vegetation classifications.

6.3 Fauna

As with the majority of fire-based ecological research, our understanding of faunal response mechanisms and strategies is inferior to that of flora. This is a function of the simplicity in studying the respective groups. Plants are sessile organisms with easily tracked responses to environmental change, whereas animals are often highly mobile and frequently experience mortality during or immediately following a bushfire. Consequently, responses are far more cryptic and as such difficult to study and interpret.

The role of fire regimes will strongly shape the success of a given species post-fire recovery. Favourable post-fire weather conditions will promote better regeneration and recruitment opportunities for vegetation communities, and in doing so, aid the recovery of fauna. Favourable seasons in existing habitat will also enable source populations to recruit, disperse and recolonise regenerating habitat- often when that habitat may be sub-optimal. Similarly, suitable inter-fire periods will also allow for both plant and animal populations to replenish numbers and disperse and as such better deal with the impacts of the next disturbance.

6.3.1 Avifauna

Inappropriate fire regimes, rather than individual fires themselves, have been identified as a key threatening process for a range of threatened mallee birds (DEH, 2005b). These are predominantly created by landscape fragmentation. Even in landscapes as large as the Billiatt District, land clearance has left species with a reduced number of viable refugia in the event of large-scale bushfires: hence the need to proactively manage this.

When compared with other mallee fauna there is a better understanding of the fire ecology of birds through work on specific threatened species (Baker-Gabb, 2004; Clarke, 2005; DEH, 2005b; Paton, 2000; Ward and Paton, 2004). This knowledge, in conjunction with information provided by the NHT-funded Threatened Mallee Birds project will drive the decision making process for fire management in or adjacent to areas that contain or have historically contained these species.

The majority of bird species in the planning area prefer vegetation communities between 6 and 40 years of age. There are some exceptions, such as the Malleefowl, which prefers habitat of 40 plus years of age. It is also clear that large fires do not benefit any bird species, and indeed, in recent times they have been detrimental to the long-term survival of species such as the Mallee Emu-wren and the Western Whipbird. Successive large fire events in areas supporting both remnant populations and potential habitat have reduced numbers of these birds to critically low levels. Therefore, the importance of strategies tailored toward reducing the probability and impacts of large fire events is critical to the management of these species. As a result of these requirements, maintaining mosaics over large areas with a wide range of patch ages, from very recently burned to long unburned, would benefit the avifauna of the District.

6.3.2 Mammals and Reptiles

Comparatively little published work has been produced on post fire response dynamics of mammals and reptiles in mallee environments. Few species appear to prefer very early post-fire conditions. This may be for a number of reasons including lack of shelter, lack of suitable food resources or an increased risk of predation. There is little doubt that the strategies and adaptations observed in these animals are similar to those employed by birds. Species will certainly exploit improved resource availability and transiently occupy these areas to feed as their productivity increases. The Western Pygmy Possum (*Cercartetus concinnus*) (Paton, 2006 unpublished data) is a testament to this. The species requires proximity to both old and recently burnt areas, hence the need for fire management strategies aimed at reducing bushfire size and increasing the patchiness of bushfire events.

6.3.3 Species of Conservation Significance: Flora and Fauna

The Environmental Database of South Australia contains records from several data sources including the Threatened Plant Population Database, the Biological Survey of South Australia and opportunistic sightings of significant animals, plants and birds.

In this plan 'of conservation significance' is used to describe ecologically important or *rated* communities, populations or species of animals, plants or birds. Species may be:

- Australian rated, that is, listed as threatened (with a rating of Endangered, Vulnerable or Rare) under the Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*;
- South Australian rated, listed as Threatened (with a rating of Endangered, Vulnerable or Rare) under the *National Parks and Wildlife Act 1972, Revised Schedules 7, 8 and 9, or*;
- Of significant value within an ecosystem based on its ecological importance, either as food resource, habitat or dominant/keystone species/community regardless of its conservation status.

Species ratings reflect that given species or communities are in danger of extinction at two levels:

- **State** - species will be extinct from South Australia, or;
- **Australia** – species will be extinct, not occurring anywhere across the continent.

Refer to Appendix 4 for a key of EPBC Act and South Australian Conservation Status Codes.

Given the importance of threatened species within the Billiatt District, the use of species distributions records has been pivotal in the development of the plan. A number of flora and fauna species of conservation significance occur in Billiatt WPA and CP. These are listed, along with information on their status, preferred fire regime and information source, in Appendices 1 and 2. Included within these tables are the status of these species under both the *National Parks and Wildlife Act 1972* and the *Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act 1999*, information on the fire ecology of the species (if any) and the source of that information. The tables also summarise threatened and significant species/community responses to fire and as such demonstrate justifications for the management prescriptions listed within the plan. The information gathered through monitoring programs and research projects will build on this baseline over time to make more informed fire management decisions for threatened species.

It should be noted that many of these species distributions are poorly defined because the database only contains point locations from site visits or observations. Importantly, distributions for key threatened species such as the Malleefowl are better mapped due to more intensive surveying. The Murray Mallee Biological Survey records for the region are now fifteen years old and will require current verification before any management actions are based on them.

There is a commitment to incorporate species' requirements into improved ecological fire management. However, how each or all of a site's unique attributes (in terms of vegetation, soil, lithology, aspect, terrain, fire regimes, post-fire age of vegetation) contribute to the survival of a particular species is a complex question. It is beyond the scope of this plan to extrapolate site records for species across a landscape or to determine what the critical habitat requirements are for all species.

6.4 Ecological Fire Management

The management of fire to maintain biodiversity is discussed in more detail in the Draft DEH *Guidelines for Ecological Fire Management* (DEH, 2006a). This approach is being used as a sound basis for the management of fire for biodiversity across Australia (Andersen, *et al.*, 2003; FEWG, 2004; Hopkins and Saunders, 1987; Whelan, *et al.*, 2002). It is based on accumulating knowledge of species, populations and communities and their response to fire regimes, and then applying this knowledge to fire management practices to maximise biodiversity outcomes. Ecological Fire Management Guidelines are used to assist in achieving management objectives in Conservation Zones (C-zones) within all DEH Fire Management Plans. For more information on C-zones, refer to Section 8.5 of this Fire Management Plan.

6.4.1 Fire Regimes for Biodiversity Conservation

Fire regime is described as the history of fire in a particular vegetation type or area including the fire frequency, interval, intensity, extent and seasonality of burning (Brooks, *et al.*, 2004). It is therefore assumed that avoiding adverse fire regimes across the majority of the habitat for any given species should minimise the risk of adverse impacts or local extinction. That is, an adverse fire regime confined to a minor proportion of the habitat of any particular species may influence local distribution, but will have little effect on the persistence of that species

across the landscape. A range of different fire intensities, frequencies, seasons and scales of burning need to be incorporated into ecologically based regimes if they are to result in the conservation of biodiversity.

6.4.2 Methodology

Ecological Fire Management Guidelines have been developed from the research and analysis of available data relating to the *Key Fire Response Species* within the planning area. The approach used by DEH to define the Ecological Fire Management Guidelines involves the identification of fire regime thresholds using flora and the assessment of the potential impacts of these thresholds against known faunal requirements, particularly the requirements of species of conservation significance. The steps taken in the development of the Ecological Fire Management Guidelines are as follows:

- Vital attributes data of plant and animal species, and ecological communities are gathered and assessed.
- This knowledge is used to identify the *Thresholds of Potential Concern* (TPC) of fire regime (fire interval, intensity, season and type) where species significantly decrease.
- Ecological Fire Management Guidelines are formed from these thresholds and are then used to guide the fire management practices to ensure that adequate habitat is available to maintain biodiversity (i.e. species, populations and communities).

6.4.3 Interpreting Ecological Fire Management Guidelines

Ecological Fire Management Guidelines have been defined for Major Vegetation Subgroups (MVS), enabling strategic fire management across the planning area in a way that will ensure maintenance of biodiversity (Table 1). Guidelines for five aspects of fire regime (interval, frequency, spatial, intensity and season) have been determined for all MVS within the planning area (where data is available). The upper and lower limits of fire interval for a particular MVS have been proposed, as well as recommendations on the management of fire frequency. Fire intensity requirements for species regeneration and undesired seasonal burning patterns have also been identified. Ecological Fire Management Guidelines **should not be used as prescriptions**; instead, they define a window of "acceptable" fire regime that ensures the conservation of existing species.

TABLE 1: ECOLOGICAL FIRE MANAGEMENT GUIDELINES FOR MVS IN THE PLANNING AREA

MVS No	MVS NAME	FIRE REGIME						
		Interval		Spatial Criteria	Frequency		Intensity	Season
		TPC1: Lower threshold in years	TPC2: Upper threshold in years	Inter-fire intervals within TPC1 & TPC2 across more than X% of the extent of this MVS within the planning area ¹	Avoid 2 or more fires within X years	Avoid 3 or more successive fires of low intensity	Some medium to high intensity fire needed to regenerate some species	Avoid 2 or more successive fires in season
27	Mallee with hummock grass	20	50	50%	40	Y	Y	Dry years
29	Mallee heath and shrublands	10	50	50%	40	Y	Y	Spring

Denotes that fire response is unknown or ambiguous for this MVS thus the required data is not available to propose Ecological Fire Management Guidelines. When data becomes available this table will be updated.

6.5 Other Threats to Biodiversity

6.5.1 Pest Plants

It is well known that fires can provide the opportunity for some weed species to better establish and proliferate, with many of these weeds out-competing native species in regenerating post-fire. While this is not likely to be a problem in the larger blocks, where the perimeter to area ratio, or 'edge effect', is low and the areas are relatively weed-free, it may cause a problem in areas adjacent to farmland or in existing modified vegetation. Historically, farming has been short-lived in Billiatt WPA and Billiatt, Peebinga and Karte Conservation Parks, and installation of water points has also been minimal. These factors, combined with low-nutrient soils, keep the risk of large-scale weed invasion relatively low.

6.5.2 Pest and Abundant Native Animals

As with weeds, feral animals can flourish in the conditions existing after a fire. The primary feral species in the Billiatt District are goats (*Capra hircus*), deer (various sp.), rabbits (*Oryctolagus cuniculus*), cats (*Felis catus*), foxes (*Vulpes vulpes*), wild dogs (*Canis familiaris*) and hares (*Lepus europaeus*). All species can benefit from the regrowth readily available post-fire or the increased access a fire provides. Native species, such as kangaroos may also thrive and concentrate in the regenerating areas, finding suitable food. The degree of impact that these species have post-fire depends on a number of factors, including pre-fire numbers, size, shape and location of fire etc. Post-fire grazing is considered by the Threatened Mallee Bird Program as of potentially great concern. Consequently, burned areas will require close post-fire monitoring to quantify the impacts of post-fire grazing on

both flora and fauna recovery given the perceived threat grazing poses to the survival of the species (Obst, 2005).

6.5.3 Plant Pathogens/Diseases

Generally, plant pathogens have not been an issue within the Billiatt District. The risk of *Phytophthora cinnamomi* infection is low given the average rainfall and deep, sandy soils however precautions should be taken with appliances and heavy plant sourced from known regions of the state where *Phytophthora* is prevalent.

7 BUSHFIRE SUPPRESSION

7.1 Legislation

Section 97 of the *Fire and Emergency Services Act 2005* explains the importance of this Fire Management Plan and the role of the CFS during a fire incident on DEH land. The legislation states that under fire or threat of a fire a member of the CFS, as the lead combatant agency for bushfire suppression in SA, must consult with the person in charge (if that person is in the presence of, or may be immediately contacted by, the member of the CFS of that reserve) and if the prescribed action would affect a government reserve, they must take into account any relevant provisions of a management plan for the reserve that have been brought to the attention of the member.

7.2 Policies and Procedures

The following Policies and Procedures are to be used in conjunction with this Fire Management Plan:

- DEH Fire Management Policy
- DEH Fire Management Policy and Procedure Manual (covering various aspects of fire management)
- CFS Chief Officer Standing Orders (COSOs)
- CFS Standard Operating Procedures (SOPs)
- CFS Operations Management Guidelines (OMGs).

Strategies implemented during an incident will be determined by the Incident Management Team (IMT), taking this plan into consideration.

7.3 Fire Emergency Procedures and Response Planning

DEH has developed a Response Plan for the Mallee District, which details fire response for all its reserves. Such details include a brief description of the reserves' priority fire management considerations, hazards and firebreaks. It also includes overarching details such as DEH fire management principals, despatch levels, resources and communication plan.

7.4 General Objectives for Fire Suppression

- To provide for the protection of human life during fire suppression activities.
- To provide for the protection of built assets and neighbouring properties from bushfires.
- To ensure that sound conservation and land management principles are applied to fire suppression and fire management activities.
- To provide for the strategic containment of bushfires.

7.5 Strategies and Actions to Achieve Objectives

- Control lines will be established for use during bushfire incidents. These are fire access tracks that have been upgraded to GAFLC guidelines and will be subject to ongoing maintenance.

- New access tracks on all reserves will only be constructed for suppression purposes, where provided for in planning, or where approved by the Incident Controller in liaison with DEH staff.
- When bushfires occur, unless otherwise stated, only recognised control lines will be utilised for vehicle-based suppression activities.
- Previous fire scars (bushfires or prescribed burns); changes in vegetation type and topography and the resultant variations in fuel patterns will be used to assist suppression activities.
- The use of heavy machinery to construct control lines within blocks for fire suppression will be used in accordance with DEH Policy and Procedures following authorisation from the Incident Controller in liaison with a DEH representative or (in the case of private land) the landowner involved.
- The use of retardant should be restricted to the protection of human life, built reserve and private assets, or to contain hotspots where ground crew access is hindered by terrain and vegetation and it is possible that a fire will build before these areas can be blacked out. Approval must be given by the Incident Controller in liaison with a DEH representative or (in the case of private land) the landowner involved.

7.5.1 Justification for Suppression Strategies

All land management organisations have an obligation to maximise safety for fire suppression activities. For this plan, standards for control lines are in line with the GAFLC Standards. Where the combination of vegetation, fuel loads and terrain is likely to reduce the effectiveness of these control lines, they may be widened or perimeter burns undertaken in the immediate vicinity of control lines to minimise the likelihood of bushfires crossing control lines.

By utilising control lines, and through the strategic use of previous fire scars and fuel patterns, the need to undertake other high impact suppression measures such as mineral earth breaks during a running fire will be reduced.

7.5.2 Aerial Observation

The relatively large size of the planning area and lack of adequate lookouts necessitates the deployment of aircraft to accurately locate a fire. The weather conditions that are conducive to fires will often result in multiple widespread strikes and ignitions. Locating these ignition points from the ground is both time-consuming and potentially dangerous given the distances involved and the lack of vantage points.

Recommendation	
Aerial Observation	<p>2. It is strongly recommended that Incident Management Teams request aerial observation as early as possible in the incident. An aerial platform should be deployed when smoke is first sighted or in the event of an electrical storm passing through the area during the months September through to March.</p>

7.5.3 *Aerial Suppression in the Billiatt District*

Aerial suppression is a costly exercise and requires considerable ground support. It is ineffective in halting a running fire unless used in conjunction with ground crews and established control lines. Bombers are not present in the Murraylands and as such, they need to be requested from either the South East or Adelaide. Primary aerial response zones will be given priority.

Aerial suppression is recommended throughout the planning area after careful consideration of the following:

- If adequate ground based support is available to compliment bomber work
- The proximity of the airstrip to the fire, expected turnarounds times for filling and dropping and the capacity of the strip to handle multiple trips under load.

The maximum ideal drop radius is 20 km however this may be extended to greater distances, at the expense of maximum effectiveness as the time between dropping loads is increased. Presently large portions of the planning area are further than 20 km from a CFS approved airstrip, reducing the effectiveness of air operations. Established strips are at Lameroo and Pinnaroo (Map 4).

7.5.4 *Backburning Operations in the Billiatt District*

DEH supports the use of backburning as a bushfire suppression tool under appropriate conditions with adequate safety precautions. Used correctly within the planning area it can be a highly effective tool in containing bushfires. However, some tradeoffs require consideration before works are implemented. An IMT should consider three critical aspects:

A > *When should backburning be conducted?*

Backburning should **only** be conducted when authorised by the IMT under favourable weather conditions. Weather conditions should maximise the probability of managing the backburn, but they should also ensure that the appropriate fire behaviour is produced to provide an effective break against an approaching bushfire. As such, backburning in the early hours of the morning under sub-optimal fire conditions may not produce an adequate result.

B > *Where should backburning be conducted?*

Backburning is most effective when it augments existing low fuel areas (either changes in vegetation type or age). Operations should be sited from existing designated control lines that may be widened by the use of heavy machinery. The width of these burns should be determined by the IMT based on the weather conditions and the observed and predicted fire behaviour of the fuels in the area concerned. Existing buffers may be reburnt if the IMT deems that a fire will carry through them under the current conditions.

C > *How should backburning be conducted?*

A backburn is essentially a prescribed burn, excepting that it is implemented under emergency conditions with a fraction of the preplanning that occurs with similar landscape protection or fuel reduction burns. For this reason there must be consultation with DEH when planning to backburn areas.

7.6 Fire Access Tracks and Firebreaks

The Government Agencies Fire Liaison Committee (GAFLC) has drafted *Guidelines for Firebreaks and Fire Access Tracks* (2005). This document specifically details parameters for fire management access tracks and control lines, including adjacent fuel management, siting and maintenance, mapping, signage and safety.

All existing tracks within planning area are deemed essential for fire management operations and are to be maintained at the minimum standard detailed in the GAFLC guidelines unless otherwise stated within this plan.

7.6.1 Track Standards

The planning area is dissected by a range of access tracks (refer to Map 4), all varying in quality, width and level of maintenance. For the purposes of this plan, tracks are categorised in accordance with GAFLC guidelines (see below). Firebreaks are often associated with access tracks. Many of the Reserve boundaries in the Billiatt District are currently treated with a 20m rolled firebreak. Designated fire access tracks and firebreaks are presently treated on a four-year cyclic basis. Tracks are placed into one of four categories:

- **Vehicle or Service Tracks:** Includes vehicular access tracks of no fixed width for reserve management staff, apiarists or private access to Heritage Agreement areas
- **Minor Fire Tracks:** Trafficable in one direction, maintained at a width of four metres both at ground and canopy level
- **Standard Fire Tracks:** As above, trafficable in a two-way direction through the provision of passing bays at intervals of 400 metres
- **Major Fire Tracks:** Maintained at a minimum width of seven metres at both ground and canopy level to provide safe two-way access

Refer to Map 4 for information on existing fire access tracks.

7.6.2 Firebreak / Fire Access Signage

Presently, adequate signage displaying information on the type of access, the name of the track or break, physical location, dead ends or steep terrain as defined in the GAFLC (2005) guidelines does not exist in the planning area. Consequently, signs should be implemented across the planning area on public lands and adjacent Heritage Agreements. This is not a major undertaking given the lack of existing public access in the planning area. Money for signage should be sought through the Bushfire Mitigation Fund through joint applications via DEH, the CFS and the relevant District Bushfire Prevention Committee.

Justification: The large size of the planning area and lack of conspicuous landmarks could result in firefighters becoming disoriented, particularly with personnel with limited local knowledge or who are operating at night.

7.6.3 Fire Access Track Standards (Private Land)

For those areas of the plan that are not managed by DEH, it is recommended that the GAFLC (2005) guidelines are adopted by all landowners in the planning area to maintain consistency in the standard of fire access tracks and control lines. For example, it may be recommended that sections under Heritage Agreement abutting Billiatt WPA or CP may, if deemed

appropriate (subject to agreement from the relevant landholder), implement a perimeter firebreak to a width of 20 metres.

Justification: A consistent minimum standard, regardless of tenure or terrain, will provide Incident Management Teams with greater confidence when planning strategies to suppress fires. Fire crew can access areas and execute these strategies with the confidence that access tracks are at a suitable standard.

Recommendations	
Fire Access	3. Erect track signs across the planning area as per the GAFLC guidelines
	4. Encourage adjacent landowners to upgrade/maintain their tracks as per the GAFLC guidelines.

7.6.4 Use of Control Lines During Fire Incidents

The use of control lines should be determined by the IMT, based on fire severity and weather conditions, and giving due consideration to safety and strategic advantage. If control lines are not up to the recognised standard, they may be fuel reduced to the desired standard during a bushfire or prescribed burn using any means deemed appropriate by the IMT under the following provisos:

- All mechanically treated edges, either existing or new, are rehabilitated during prescribed burns and bushfires (wherever it is practically safe and feasible to do so) to encourage vegetation recovery
- New control lines implemented to control fire edges should avoid dune crests and where possible run in as close as possible to a straight line to minimise the chance of rekindles escaping and maximise the chance of crews suppressing fire flanks. In areas where this line is away from the fire edge, fuel should be burnt wherever possible.

7.6.5 Heavy Machinery

Bushfire management and suppression within the planning area will often involve the use of heavy machinery. Historically, the most commonly used method of implementing control lines or securing fire edges in the region has been a bulldozer towing a cross-ribbed roller. This method has been favoured over mineral earth or ploughed breaks because they can access difficult terrain and provide an area of modified fuel with minimal long-term impact on vegetation community composition (Pelton and Conran, 2002; Pelton unpub. data). The decision to deploy heavy machinery for direct attack should be made by the IMT at the earliest possible point in time given:

- the time it takes to deploy heavy machinery is anywhere between two and 12 hours depending on the location of the machine, the state of the access roads, the mode of transportation and the location of the fire
- the quicker the response time, the earlier in the incident work can commence, thereby increasing the probability that control lines will be successful and decreasing the overall area cleared in the establishment of these lines
- the fire weather and associated fire behaviour conditions under which the machinery will be operating.

All actions involving heavy machinery are to be authorised by the IMT following liaison with DEH or the relevant landowner. Heavy machinery is only to be used when the IMT has determined that:

- there is a significant threat to life and/or property
- the sensitivity of vegetation and habitat define a critical need to stop the fire entering an adjacent area (i.e. known threatened species habitat)
- there is unlikely to be irreversible or an unacceptable level of impact on cultural heritage sites (Aboriginal or European), significant ecological communities, species or habitats
- the topography is suitable and/or safe for heavy machinery and the line will be trafficable by 14s (small fire appliances) to support implementation and mop-up.

No heavy machinery is to operate without a support appliance with firefighting capability or adequate communication capabilities.

Within Billiatt WPA, all heavy machinery use should take in to account the wilderness value of the reserve.

7.7 Fire Management Infrastructure

Existing water sources and facilities are illustrated on Map 4. Access to water sources for firefighting purposes should be negotiated directly with neighbours, through the CFS Group or the District Bushfire Prevention Committee. A Response Plan, dealing with DEH response to bushfire, will be updated as required, to reflect alterations and additions to utilities and facilities (DEH, 2006b).

7.7.1 Water Supply

Whilst there is a significant reliance on dry firefighting techniques such as heavy machinery usage in the planning area, water supply is critical to both firefighter safety and effective mopping up operations in both bushfires and indeed prescribed burning. The lack of adequate water supplies is problematic within the planning area during large campaign fires, as turn around times for refilling tanks are often over two hours. The recommended designated firewater tank sites are listed in the block prescriptions (refer to Sections 10-20).

Recommendations	
Water Supply	5. Identify water sources adjacent to the reserves and surrounding Heritage Agreements and negotiate access to the water with the owner.
	6. Provide tanks and fittings on private property if there is a strategic benefit in having access to water at that location.

8 FIRE MANAGEMENT ZONES

8.1 Zoning Background

Fire management zones as detailed in the *Policy and Procedures for Fire Management Zoning in DEH Fire Planning* (DEH, 2006c) have been introduced into DEH fire management planning to:

- ensure that appropriate management actions are implemented to meet the requirements for asset protection and ecological management in DEH reserves
- clarify the areas where different fire management activities will be undertaken on DEH managed land and reserves
- ensure a standard approach to the application of fire management zones on DEH managed lands and reserves in South Australia
- assist in the development of Fire Management Plans and programs for reserves.

Fire management zones are categorised according to the primary objective for fire management; Asset Zone (A-zone), Buffer Zone (B-zone) or Conservation Zone (C-zone). These zones were determined giving consideration to the level of risk and the protection and management of built assets, natural and cultural values (DEH, 2006c). The zones allocated to sections of blocks are described in the relevant Block Prescriptions and are displayed on Map 4 (Fire Management and Access).

8.2 Risk Assessment

A risk assessment was conducted in line with the *Policy and Procedures for Risk Assessment in DEH Fire Planning* (DEH, 2006d), as a requirement of the compilation of this Fire Management Plan. The risk assessment is a tool used to gauge the risks arising from bushfire to life, property and environmental values within the planning area. It considers visitor use, assets (built, heritage and environmental) and neighbouring properties for all parcels of remnant native vegetation. The overall risk rating was then used to determine Fire Management Zones.

The following sections briefly describe each of the zoning categories, and describe the objectives and strategies for each category.

8.3 Asset (A) Zone

A-zones contain built or significant cultural assets archaeological or heritage listed sites, homes, outbuildings, visitor centres, tanks and interpretive signs. They could possibly be sources of human-caused ignitions but, to date, the statistics suggest this is unlikely. However, they are areas that need to provide safe zones for visitors during significant fire incidents. Current fire protection standards around assets within the planning area are acceptable given the risk fire poses, if these standards are adhered to annually then no further work will be required to improve asset safety. The overall fuel hazard in A-zones should not exceed *Moderate*.

Note: All built assets within the planning area are by default A-zones; fuel levels in these areas may be modified by any means deemed appropriate by reserve management in accordance with DEH policy or by private landholders in liaison with the Bushfire Prevention Committee or Bush Mgt adviser.

A-zone Objectives

- To protect visitors, firefighters and firefighting equipment from bushfires
- To protect cultural heritage sites from the impacts of bushfire and bushfire suppression
- To minimise bushfire damage to infrastructure
- To lower the risk of human-caused ignitions

8.3.1 Detailed Strategies in A-zones

A > Low Fuel Buffers

Provide an area of low fuel to a radius of at least 40 metres to act as a buffer during a bushfire and to provide suppression advantage should a fire start in the zone. Options for achieving this include mulching, slashing, rolling, manual removal of standing fuels, or small prescribed fires on the perimeter of the zone. Prioritising the order and means in which these zones are to be maintained is the responsibility of the Regional Fire Management Officer and the District Ranger, Murray-Mallee based on the relative risk to the site in question, the resources available and the priority of protecting the site when compared to other landscape or habitat protection works prescribed in other zones.

Justification: As many of the areas are also assembly points during emergencies it is critical they offer protection from bushfire.

B > Managing and Educating Visitors

The management of ignition risks associated with visitor use and at reserve facilities and the education of visitors with respect to the aims of this plan is essential.

Visitors to the planning area during the fire danger season (approximately November to April) will continue to be provided with information detailing pre-suppression measures (including prescribed burning) and emergency procedures in the event of a bushfire.

Justification: Human-caused ignitions are attributed to a very small percentage of fires in Billiatt WPA and CP. There is considerable benefit gained from presenting overarching philosophies and objectives of the plan to the public. Strategies such as fire access signage, explaining the presence of C-zone burning, B-zones, A-zones and monitoring sites will provide a strong message that land managers in the area are proactive regarding fire management as opposed to reactive.

Recommendation

Managing Visitors

7. Interpretive signage, describing evacuation procedures and the aims and strategies of the Billiatt District Fire Management Plan, should be installed on DEH reserves and at relevant Visitor Centres and the DEH Regional and District Offices.

8.4 Buffer (B) Zone

These are areas where the protection of buildings, farms, horticultural or ecological assets is of critical importance. B-zones are strategically located to protect built assets or are located

against major fire access points (e.g. the Alawoona Road), with the aim of providing greater protection and suppression opportunities to fire fighters and assisting in halting the easterly spread of a bushfire. In this plan, they are prescribed within DEH reserves only. Areas designated as B-zones will be retreated cyclically to manage fuel levels. The overall fuel hazard in B-zones should not exceed *High*.

Note: This does not mean that the blocks that contain these zones do not include areas of conservation significance or that conservation objectives will be disregarded in these areas.

B-zone Objectives

- To minimise the risk of property and ecological asset losses due to bushfire
- To minimise the likelihood of fires entering blocks from adjacent areas
- To define a level of prescribed fire that is both effective in halting the spread of bushfires and ecologically sustainable for the communities impacted on
- To promote patchiness in fires, prescribed or otherwise
- To provide greater protection and an increased suppression advantage for firefighters and greater protection for the public on major public roads traversing the planning area

8.4.1 Detailed Strategies in B-zones

A > Establish strategic areas of low fuel using prescribed fire.

Prescribed burning within these zones consists of linear strips. Strips approximately 500 metres wide shall be implemented at strategic points across the landscape adjacent to fire access tracks.

In areas with conservation land situated either side of the fire access track the alternate side of the fire access track will be burnt to the same width once the fuel level reaches *High*. This will effectively produce a minimum 1000 metre wide buffer of reduced fuel designed to aid in halting the spread of smaller, less intense fires, and slowing the progression of larger, more intense events.

In areas where B-zones are situated against private land, the zone will be retreated again once the fuel hazard reaches *High*. In these areas, DEH will negotiate with the relevant adjacent landholder and District Bushfire Prevention Officer to ensure that adequate complimentary or reciprocal fire management work is carried out on the boundary of the adjacent property in question.

Alterations to the width or continuity of a designated B-zone are permitted under the following circumstances:

- Operational restrictions and risks associated with implementing a prescribed burn in steep and/or sandy terrain.
- Variation in fuel hazard levels across the pre-designated area of the zone.
- An identified, viable and significant population of a listed species of flora or fauna is located within the zone area.

Note: any decision to alter the extent or continuity of a prescribed burn in this instance needs to be negotiated between the Regional Fire Management Officer, the Mallee District Ranger and Murraylands Conservation Programs staff.

B-zones are not to be retreated if the fuel hazard is estimated at less than *High* except when backburning in the event of a bushfire. Designated B-zones should be retreated first in the event of a bushfire, thereby limiting the impacts to an area already altered by management prescriptions.

All B-zones should be implemented against a major fire access track. If a second, parallel scrub break is employed to secure the fire during the treatment of the zone, this break will be burnt, rehabilitated and closed once prescribed burning operations are completed to promote regeneration of vegetation.

Justification: Areas of modified or reduced fuel strategically located across the planning area will provide a safer operating environment for firefighters, greater protection for assets within and adjacent to the planning area, increase the patchiness of bushfires and restrict their extent and as such minimise the impacts upon ecological communities.

8.5 Conservation (C) Zone

Conservation zones are defined as those areas where the primary objective of fire management is the conservation of ecological communities and species, or biodiversity. Given the minimal built assets in the Billiatt District planning area the greater percentage of the planning area is a designated C- zone.

B-zone Objectives

- To manage fires and fire regimes to meet the ecological fire requirements of species and communities that may be at risk from inappropriate fire regimes
- To minimise the risk of any large block (>10 000 ha), or multiple blocks burning in a single high intensity bushfire event
- To provide refuge areas for fauna species during a large bushfire, either within large blocks or in adjacent blocks
- To promote patchiness in fires, prescribed or otherwise
- To minimise the negative impacts of fire management and suppression activities on conservation values and provide a suppression advantage for bushfire operations wherever possible

8.5.1 Guidelines for the Prescribed Use of Fire

Prescribed burning in C-zones will be used for one of three purposes, with strategies in the short to medium term (i.e. during the review period of this plan) geared toward using fire in the landscape to protect landscapes or specific habitat from being burnt in single large-scale fire events. The controlled use of fire for ecological purposes is something that is necessary in the long term to manage biodiversity in the planning area.

All prescribed burning (regardless of the objective or tenure) within C-zones will adhere to the process described in Figure 2 and the Ecological Fire Management Guidelines detailed in the

Draft DEH *Guidelines for Ecological Fire Management* (DEH, 2006a). It may be done on three levels:

A > Landscape Protection Burning

Landscape Protection Burning will be conducted in C-zones with the aim of providing landscape scale protection to adjacent ecological communities or private lands, and, where relevant, to provide a suppression advantage for crews in the event of a bushfire. Proposed Landscape Protection Burns are displayed on Map 3 and Map 4.

B > Habitat Protection Burning

Habitat Protection Burning will be conducted with the specific ecological objective of providing smaller scale *in situ* protection to known populations or communities of threatened or significant species. An example of this is the use of habitat protection burning for Mallee Emu-wrens in Ngarkat CP. As knowledge of other threatened species' distributions is developed in the Billiatt District, similar techniques could be applied under appropriate circumstances.

C > Ecological Burning

Ecological Burning may be conducted with the following objectives:

- To promote suitable conditions for the conservation/propagation of a known population or community of a threatened or significant species.
- To increase specific knowledge on the fire ecology of a particular species or community.
- To develop knowledge on fire behaviour, fire suppression techniques or the efficacy of pre-suppression measures.
- To increase understanding of the processes shaping fire regimes.

Note: proposed burn areas are subject to alteration due to fire history, regime, weather, funding and resource availability.

Justification: These guidelines will ensure the responsible use of prescribed fire by not allowing large areas to be burnt at any one time or over a short period. Ideally, bushfires should be managed to restrict the burnt area to within a single block or less than 10 000 hectares to reduce the ecological, economic and social impacts of the fire on the District. At the same time, the strategy employed will firstly limit the impact upon optimal habitat for species in these areas and reduce the costs of suppression associated with large bushfires whilst seeking to increase and enhance our knowledge of the ecological role of fire in heath and mallee-heath systems.

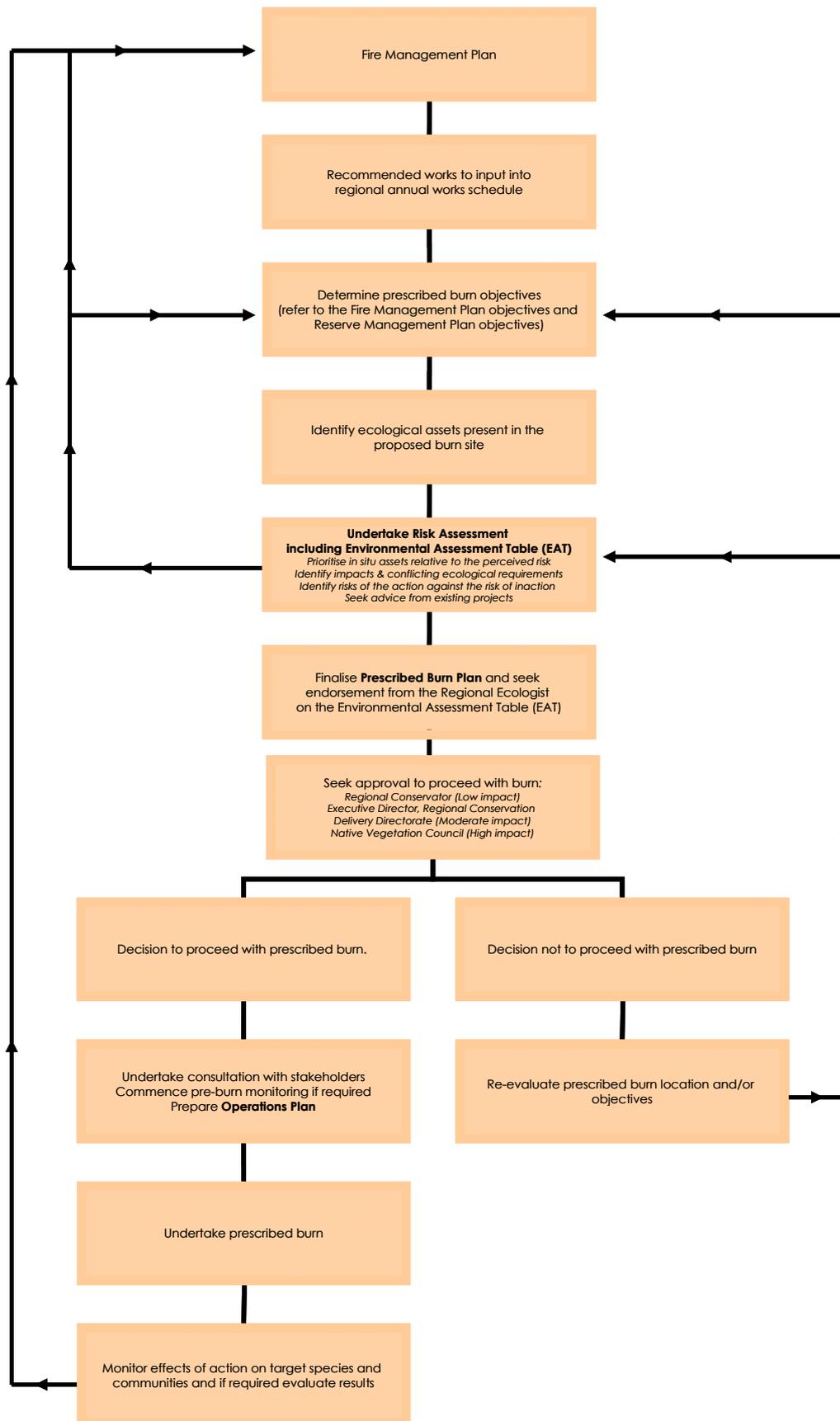


FIGURE 2: PROCESS FOR B- AND C-ZONE PRESCRIBED BURN PREPARATION

8.5.2 Establishing Landscape/Habitat Protection Burns

Defining a method of establishing Landscape/Habitat Protection Burns will be achieved through prescribed burning to provide an area of low fuel to act as a buffer during a bushfire. Control lines may be implemented using heavy machinery (preferably rolled or A-framed), or alternatively the use of existing fire scars wherever possible is preferred to reduce the impact on the environment.

Pre-burning the perimeter of such burns is permissible during the winter months to a width of 30 metres (including the firebreak). Landscape protection burns are to be burnt to a width of approximately 500 metres wide (terrain, built and ecological asset proximity permitting), with a preference given to late spring or early autumn for burning. Note that in areas supporting breeding populations of threatened species, consultation is required with Murraylands Conservation Programs staff before designating a date for prescribed burning.

The primary objective for these burns is landscape/habitat protection on a temporary basis. Sites will be selected based on existing fire regime, proximity to control lines and access points for suppression operation in the event of a bushfire, and the location of threatened and/or significant populations/communities.

Justification: It is unacceptable to allow large high intensity bushfires to burn out large blocks of native vegetation, due to the risk of local extinction to both flora and fauna.

Given the restrictions placed on fire management activities by the terrain, size of the area, resources available and the threat of impinging upon threatened species, the options for minimising the size of fire within a block are limited. The option chosen is to use prescribed fires to provide buffer areas on existing block boundaries or control lines in areas that do not require repeated treatment, or alternatively in areas that are identified as requiring protection from large bushfire events due to the presence of populations of significant or threatened species. These resulting lower fuel loads will aid in impeding the spread and intensity of a bushfire and promote patchiness to increase available refuge areas for fauna.

8.5.3 Excluding Bushfire from Areas of Concern

Bushfire should be excluded from Regenerating Areas, Areas of Significant Biodiversity Value or Cultural Heritage Sites.

Consecutive bushfires in any conservation zone in the planning area should be no less than the Threshold of Potential Concern (Refer to Table 2) for the MVS in question. This will be achieved by implementing prescribed burning to assist in excluding bushfire (and promoting patchiness in the event of bushfire).

Justification: It is important to allow time without fire for adequate vegetation regeneration, to ensure post-fire maturity and reproduction of most perennial components and obligate seed regenerators across as large an area as possible. Information suggests that many species of heath and mallee-heath fauna (including the Malleefowl and Mallee Emu-wren) will not inhabit these areas with any regularity until at least 15 years post fire. There is currently no evidence to suggest that the exclusion of bushfire from an area over such a time frame will be detrimental in the long term to any species of flora or fauna.

For known cultural heritage sites, mechanical disturbance shall not occur any closer than 100 metres from these areas in either pre-suppression or suppression operations, nor should they

be used as staging or safe areas for persons or equipment unless in an emergency situation. The preferred method for reducing fuels (if warranted as many are naturally low in fuel) in these areas is prescribed burning. Protecting culturally significant sites such as archaeological sites or previous settlements from the impacts of bushfire suppression activities helps to preserve the heritage value of the area. Management of all sites should be consistent with the *DEH Aboriginal Heritage Handbook and Strategy* (DEH, 2006e) and the *Aboriginal Heritage Act 1988*.

9 FIRE MANAGEMENT BLOCKS

There are general fire management objectives that apply to all zones and blocks in relation to suppression and fire fighter safety. There are also fire management objectives that are zone specific, applying to all blocks in a particular zone. Finally, there are objectives that may only apply to a specific block. Within the planning area, a block may have two designated zones based on the management objectives.

9.1 Block Prescriptions

Information specific for each block has been included, aided by the accompanying map. A summary of vegetation and fire history is presented for each block. The number of flora and fauna of conservation significance that have been recorded for each block has been summarised. Objectives and actions that apply to a specific block are included in the block's prescription.

Note: The information on more mobile species, such as birds, may not give an accurate picture of species' distribution. Also, the absence of records for a species in a block does not mean that the particular species does not occur in it, because the data represents one point collection in time in most cases, rather than any extended ecological studies. Many of the Blocks within this Plan have only one or two survey (in some cases none) sites, as such, any inference one draws about flora and fauna species distributions should not be considered holistic.

10 PEEBINGA BLOCK

Tenure, Land Use

Peebinga Conservation Park (Department for Environment and Heritage) and adjacent or nearby Heritage Agreements.

TABLE 2: HUNDRED NAMES AND SECTION NO'S OF HERITAGE AGREEMENTS IN PEEBINGA BLOCK

	Hundred	
	McGorrery	Peebinga
Vegetation Heritage Agreement ID	HA 506	HA 358
	HA 518-001	HA 432001
	HA 518-002	HA 432002
	HA 1006	HA 432003
		HA 623

Size 9 062 ha (Peebinga CP is 3 381 ha, plus two adjacent and three nearby Heritage Agreements).

Vegetation

Peebinga CP and associated vegetation Heritage Agreements in the block contain the following vegetation communities within the overall MVS No. 29 (Mallee Heath and Shrublands) and MVS No. 27 (Mallee with Hummock Grass)

- Ridge-fruited Mallee mid-mallee woodland, over Desert Tea-tree (mixed) mixed shrubs, over *Hibbertia australis* (mixed) shrubs
- Yorrell (*Eucalyptus gracilis*) mid open woodland over Dryland Tea-tree shrubs and Grey Bindyi (*Sclerolaena dicantha/uniflora*) (mixed) shrubs
- Square-fruit Mallee mid-open mallee woodland over Mallee Honey-myrtle shrubs and Spear Grass (mixed) tussock grasses
- Narrow-leaf Red Mallee mid-mallee woodland over Dryland Tea-tree shrubs and Spinifex (mixed) hummock grasses.

The dominant vegetation type throughout the block is Ridge-fruited Mallee mid-mallee woodland, with all others occurring in small patches. Additional understorey shrubs within this vegetation type include Desert Tea-tree, Broombush (*Melaleuca uncinata*), Cypress Pine and Silver Broom (*Babingtonia behrii*).

Fire History

A number of small fire events have been recorded in Peebinga block over recent decades. The largest and most recent of these is a fire of 800 ha in the southern arm of the CP that also burned in to adjacent blocks. Prior to this, a small fire burned in section 38 (Hundred of Peebinga) in 1987, section 36 (Hundred of Peebinga) in 1979 and in the north of the CP in 1977. In total, Peebinga Block has been affected by known fires resulting in a total burned area of 1 516 ha.

Natural Values

Peebinga CP was originally declared a reserve for the protection of the Western Whipbird, however this species has not been found in the reserve for many years. This is possibly due to

habitat degradation through too infrequent fires. Malleefowl inhabit Peebinga CP and surrounds, and a Malleefowl monitoring grid exists in the CP. The Striated Grasswren (*Amytornis striatus*), Major Mitchell's Cockatoo (*Cacatua leadbeateri*), Chestnut Quail-thrush (*Cinclosoma castanotus*) and Regent Parrot (*Polytelis anthoepus*) have all been recorded within the block. No rated flora has been recorded in the block.

Built Assets

There are no built assets within the block, with the exception of a ruin in Section 55. Adjacent properties and agricultural land incorporate farm assets, including fencing. The highest concentration of built assets close to Peebinga block is around Peebinga CP, which has a railway line running along its northern boundary, with associated railway sidings. There is also a radio tower at the south-western corner of the reserve. The Loxton-Pinnaroo Road bisects the block from north to south, and is the only sealed road in the block. It lies directly adjacent to Sections 55, 60 and 59 (Hundred of McGorrey) and 30 (Hundred of Peebinga).

Fire Access

All sections of the block are best accessed from the Loxton-Pinnaroo Road, which runs through its centre. The northern boundary of Peebinga CP has a lengthy exposure to the unnamed road from Kringin to the Loxton-Pinnaroo Road, which, although unsealed, provides 2WD access from the east and west. The CP can be accessed from the east via Conservation Road (marked in the Riverland and Murray Mallee Map Book, Map 158, as Three Mile Road), and from the south via Lebas' Road. There is 4WD access to the entire perimeter of the CP; however 2WD vehicles are restricted within the reserve to Conservation Road (from Kringin to the eastern boundary) and for the northern 1.5km of the road heading south from Mootatunga.

In the northern sections of the block (Hundred of McGorrey), there is a 2WD access track adjacent to the southern boundary of Sections 59 and 62. Refer to Map 4 for further detail.

Fire Risk

The only part of Peebinga Block with an existing fire break is in the southern arm of Peebinga CP, which burned in 2002, and is unlikely to currently hold sufficient fuel to support a bushfire. The other fire scars in the block are from the 1970s, and have sufficiently high fuel to support a fire. Given the lack of recorded fires in the remainder of the block, the risk of fire moving through these is high. The highest risk occurs in Peebinga CP and adjoining Heritage Agreements in sections 18 and 32, for three reasons:

- This is the largest continuous area of native vegetation in the fire management block.
- It adjoins scrub in West Billiatt Block, and is therefore at risk of fires burning in to it from the west.
- There is a risk of fire spreading through remnant scrub to the Victorian border.

Dry lightning strikes create the largest ignition hazard in the block, however its proximity to the Loxton-Pinnaroo Road gives it a moderate exposure to human-caused ignitions.

Fire Water

Fire water is available pending consultation with adjacent landholders.

Specific Management Objectives for Peebinga Block

1. To prevent fire from escaping any component of the block into adjacent private lands and threatening life and property.
2. To minimise the risk of any component of the block being burnt out in a single fire event.

3. To promote patchiness in bushfires and a diversity of different aged vegetation communities within the block to promote high quality community and habitat development.
4. To monitor the effects of prescribed burning on the ecological assets within the block with respect to potential displacement of threatened species.

Actions and Works

Pre-Suppression

- A 500 m B-zone is to be implemented from the north-west to the south-east of Peebinga CP along Conservation Road, heading south-east from Kringin. This includes a B-zone along the boundary between the reserve and the Heritage Agreement in Section 18 (Hundred of Peebinga). This road is also to be maintained to a width of seven metres.
- It is recommended that perimeter tracks in participating Heritage Agreements should be maintained at a minimum width of four metres (GAFLC minor fire access track) to ensure adequate access for appliances during incidents.
- The road beginning in Mootatunga to the northeast of Peebinga CP and heading south is to be maintained at a width of seven metres to allow safe access to the eastern boundary of the reserve.
- The eastern boundary of the CP north of Conservation Road is to be maintained at a width of 20 m using a cross-ribbed roller on a five year cycle.

Suppression

Firefighting in Peebinga block should be conducted from perimeter tracks or the major fire tracks within Peebinga CP. Quick response with small units (14s) is essential to restrict the size of fires. In addition, heavy machinery and back burning may be employed at the discretion of the Incident Controller, but may only be permitted after consultation with DEH. Police should be notified of any threat to public traffic on the Loxton-Pinnaroo Road as soon as possible to facilitate patrols and road closures.

All suppression activities should seek to use areas of reduced fuels through either natural vegetation breaks or existing buffers. Knowledge regarding service track standards should be sought from adjacent property owners. Guidelines for heavy machinery usage, aerial suppression and backburning are discussed in Chapter 7.

11 KARTE BLOCK

Tenure, Land Use

Karte Conservation Park (Department for Environment and Heritage)

Size 3 613 ha.

Vegetation

Karte CP contains the following vegetation communities within the overall MVS No. 29 (Mallee Heath and Shrublands):

- Ridge-fruited Mallee mid-mallee woodland, over Desert Tea-tree (mixed) mixed shrubs, over *Hibbertia australis* (mixed) shrubs
- Square-fruit Mallee mid-open mallee woodland over Mallee Honey-myrtle shrubs and Spear Grass (mixed) tussock grasses

The dominant vegetation type throughout the block is Ridge-fruited Mallee mid-mallee woodland, with all others occurring in small patches. Additional understorey shrubs within this vegetation type include Broombush, Cypress Pine and Silver Broom.

Fire History

There is no recorded fire history in Karte CP since the beginning of records in 1931.

Natural Values

The Great Sun-orchid is the only rated flora species to have been recorded in Karte. Anecdotal reports have mentioned records of the Western Whipbird during the 1980s, however there have been no recent records of this species. It has been speculated that the long time since fire of the reserve has resulted in the vegetation structure becoming inappropriate for the Western Whipbird to persist. Chestnut Quail-thrush and Malleefowl have recently been recorded in Karte CP, and a Malleefowl monitoring grid exists in the Park.

Built Assets

The only built asset within Karte CP is a picnic area on the southeastern boundary. Adjacent to the reserve, there are a number of buildings within a kilometre of the western and northern boundaries, and a radio tower exists near the north-western corner. Agricultural assets, including fencing, surround the reserve; however there are no sealed roads in the vicinity.

Fire Access

Access to Karte block is best achieved from the west via the Karte West Road, from the east (from Pinnaroo) via Karte Road or from the Loxton-Pinnaroo Road via Kringin Road. The township of Karte, at the reserve's northern tip, provides a good central staging point for fire suppression activities.

4WDs can access the perimeter of Karte CP perimeter; however 2WD access is restricted to the eastern boundary. Care should be taken when accessing the eastern boundary during a fire, as the track runs some metres inside the perimeter, and is densely vegetated on both sides.

Fire Risk

The lack of scrub adjoining Karte CP minimises the risk of fire moving in from outside the block. Despite this, there is a high fire risk within the block due to high fuel loads resulting from

mature vegetation and accumulated litter and bark. The highest risk of ignition is from dry lightning strikes, as the low visitation rates for the reserve and its low exposure to major roads reduce the risk of human-caused ignition sources. Fires starting in the reserve would be likely to burn large sections due to the lack of access, steep, sandy terrain and continuous accumulated fuel.

Fire Water

Adjacent private properties will have supplies subject to negotiation with the landowner.

Specific Management Objectives for Karte Block

1. To prevent fire from escaping any component of the block into adjacent private lands and threatening life and property.
2. To minimise the risk of any component of the block being burnt out in a single fire event.
3. To promote patchiness in bushfires and a diversity of different aged vegetation communities within the block to promote high quality community and habitat development.
4. To monitor the effects of prescribed burning on the ecological assets within the block with respect to potential displacement of threatened species.

Actions and Works

Pre-Suppression

- The eastern boundary track should be maintained at a width of seven metres using a cross-ribbed roller on a ten-year cycle. This will give access and protection to firefighters in the most vulnerable part of the reserve under the most common fire conditions.
- All other boundary tracks should be treated and maintained at a width of four metres to ensure basic access to the entire reserve perimeter.
- Ecological burning should be considered given the long-term accumulation of fuel and vegetation growth in the reserve. This strategy could be used to enhance habitat for species such as the Western Whipbird pending thorough investigation and planning.

Suppression

Quick response with small units (14s) and suitable heavy plant to any incident is essential to restrict the movement of fire out of Karte CP. Suppression efforts should seek to act on any threats to properties adjacent to the reserves, particularly with regard to fire escaping in to crops or stubble.

Any suppression activities within the reserves should seek to use areas of reduced fuels through either natural vegetation breaks or existing buffers. Heavy machinery usage and back burning may still be employed at the discretion of the Incident Controller, but may only be permitted after consultation with DEH. Guidelines for heavy machinery usage, aerial suppression and backburning are discussed in Chapter 7.

12 WEST BILLIATT BLOCK

Tenure, Land Use

Billiatt Wilderness Protection Area and Conservation Park (Department for Environment and Heritage) and adjacent and nearby vegetation Heritage Agreements (Table 3).

TABLE 3: HUNDRED NAMES AND SECTION NO'S OF HERITAGE AGREEMENTS IN WEST BILLIATT BLOCK

		Hundred						
		Mindarie	Allen	McPherson	Auld	Molineaux	Cotton	Bews
Vegetation Heritage Agreement ID	HA 944-001	HA	HA 134	HA	HA 960003	HA 176	HA 141	
	HA 909	HA	HA 412001	HA 281			HA 242	
		HA	HA 412001	HA 621			HA	
		HA 593	HA 412002	HA			HA	
		HA	HA 412003	HA			HA	
		HA	HA 612	HA				
		HA 896	HA 706001	HA				
		HA 1046	HA 706003	HA 910				
			HA 960001	HA				
			HA 960002	HA 976				
			HA 1342	HA				
			HA 1343	HA				

Size 47 286 ha

Vegetation

West Billiatt and associated vegetation Heritage Agreements in the block contain the following vegetation communities within the overall MVS No. 29 (Mallee Heath and Shrublands) and MVS No. 27 (Mallee with Hummock Grass):

- Mallee Honey-myrtle, Dryland Tea-tree, Beaked Red Mallee, Narrow-leaf Red Mallee tall open shrubland over Spear Grass and Wallaby Grass tussock grasses.
- Cypre tall open shrubland over Desert Tea-tree over *Hibbertia australis* shrubs.
- Ridge-fruited Mallee mid-mallee woodland, over Desert Tea-tree (mixed) mixed shrubs, over *Hibbertia australis* (mixed) shrubs.
- Square-fruit Mallee mid-open mallee woodland over Mallee Honey-myrtle shrubs and Spear Grass (mixed) tussock grasses.
- Narrow-leaf Red Mallee, Dryland Tea-tree mid mallee woodland over Spear Grass, Wallaby Grass and Spreading Sword Sedge tussock grasses.
- Narrow-leaf Red Mallee mid-mallee woodland over Dryland Tea-tree shrubs and Spinifex (mixed) hummock grasses.
- White Mallee, Narrow-leaf Red Mallee mid open mallee forest over Wallaby Grass Spear Grass and Spreading Sword Sedge tussock grasses.

The dominant vegetation type throughout the block is Ridge-fruited Mallee mid-mallee woodland, with all others occurring in small patches. Additional understorey shrubs within this vegetation type include, Broombush, Cypress Pine, and Silver Broom.

Fire History

The dominant fire event in West Billiatt Block was in 1988, when a fire burned throughout Billiatt WPA. West Billiatt Block, whilst badly affected, was burned more patchily than the East Billiatt Block. Sections 2 and 16, north of Billiatt WPA, also experienced fires in 2005 and 1975. West of the WPA, part of Sections 38, 39, 40, 60 and 58 burned in 1997. These are shown in Map 4.

Natural Values

The Streaked Wattle (*Acacia lineata*) and Williamson's Riceflower (*Pimelea williamsonii*) are the only rated flora species in West Billiatt. Records of Western Whipbirds have been scarce since the extensive fire of 1988, with the latest being in February of 2007. The Striated Grasswren, Red-lored Whistler, Southern Scub-robin and Chestnut Quail-thrush are all present in West Billiatt. Importantly, Mallee Emu-wrens have been recorded in Section 13, in the north of the block, despite a lack of records within Billiatt WPA since the 1988 fire. A Malleefowl monitoring grid also straddles the Alawoona-Lameroo Road, thereby falling partially in West Billiatt.

Built Assets

There are no built assets within the block, with the exception of the Alawoona Road, of which the northern section is bitumised, running along the block's eastern boundary. Numerous farming and residential assets exist in land adjacent the WPA and Heritage Agreements, however fencing is the only asset directly adjacent to the block.

Fire Access

Access to the block can be via a number of different routes, particularly from the west. The eastern side is best accessed from the Alawoona Road, from Alawoona to the north or Lameroo to the south. The Alawoona Road is only paved from Alawoona to approximately half way through Billiatt WPA, but the entire road is of a high standard. The west has access from the Loxton-Karoonda Road via Mindarie (Manvel Road), Halidon (Knowling Road) or Sandalwood (Boughen Road). Vehicle tracks of varying standards are spread throughout the western side of the block, but Jim Jolly Road provides the best access within the western section. Access from Kulkami, to the south, is best achieved via Probert Road. Refer to Map 1 for visual detail.

Fire Risk

Fire risk in West Billiatt is variable given the mixed recovery success of vegetation since the 1988 fires and the patchy arrangement of native vegetation Heritage Agreements in the landscape. In general terms, it varies from moderate to high.

A 1997 fire in the Heritage Agreements of sections 38, 39, 40, 60 and 58 in the Hundred of McPherson has resulted in relatively low fuel levels over this large patch of continuous scrub. A similar scenario exists for sections 14 and 16 (Hundred of Mindarie) and 2 (Hundred of Auld), resulting from a fire in 2005. Investigation suggests that *Triodia* cover within the Reserve is not extensive, thus reducing the near-surface fine fuel hazard. The numerous patches of native vegetation that have remained unburned for long periods are likely to bring higher risk.

The highest risk of ignition is from dry lightning strikes, as the low visitation rates for the reserve and its low exposure to major roads reduce the risk of human-caused ignition sources. Fires starting in Billiatt WPA or CP would be likely to burn large sections unchecked under extreme conditions due to the lack of access, steep, sandy terrain and relatively continuous fuel.

Fire Water

Halidon and Kulkami are the closest townships with both CFS brigades and water supplies; however adjacent private properties will have supplies subject to negotiation with the landowner.

Specific Management Objectives for West Billiatt Block

1. To prevent fire from escaping any component of the block into adjacent private lands and threatening life and property.
2. To minimise the risk of any component of the block being burnt out in a single fire event, particularly Billiatt WPA and CP.
3. Minimise the impacts of fire and promote patchiness in the parts of the block with large tracts of continuous vegetation.
4. To monitor the effects of prescribed burning and other management works on the ecological assets within the block with respect to potential displacement of threatened species.
5. To manage fire within the guidelines of the Wilderness Code of Management within Billiatt WPA (Refer to Appendix 1).

Actions and Works

All pre-suppression and suppression works within Billiatt WPA should be conducted within the guidelines of the Wilderness Code of Management (Appendix 1).

Pre-Suppression

- A 500 metre-wide B-zone is to be implemented on the Alawoona Road on a rotation of at least 10 years with another B-zone on the eastern side of the road.
- The northern and southern boundaries of Billiatt WPA should be rolled and maintained to a width of 20 m. The western boundary should be rolled to a width of 20 m where practical, however the continuous nature of the vegetation across the boundary may necessitate consultation with landholders to ensure rolled breaks are implemented in the most practical and strategic locations.
- The Hundred Line road that runs from the Alawoona-Lameroo Road to the western boundary of Billiatt WPA should be maintained at a width of 20 m. Landscape protection burns can also be conducted from this road;
- It is recommended that perimeter tracks in participating Heritage Agreements should be maintained at a minimum width of four metres (GAFLC minor fire access track) to ensure adequate access for appliances during incidents, and;
- Unbounded landscape protection burns should be implemented within Billiatt WPA and CP to promote fire patchiness and prevent an entire section of the block being burned in a single fire event.

Suppression

Quick response to any incident with small units (14s) and suitable heavy machinery is essential on Heritage Agreements to restrict fires to the patch of vegetation in which they are burning. Incident Controllers should be made aware of the Wilderness Protection Area status of the majority of the block. As such, consideration should be given to minimum impact suppression techniques when using heavy plant, machinery or backburning, consistent with the Wilderness Code of Management. DEH should be consulted in the event that any such action is deemed necessary. The use of existing buffers or areas of naturally low fuel to provide a low-impact suppression advantage is recommended.

SA police should be notified of any threat to public traffic on the Alawoona Road.

Guidelines for heavy machinery usage, aerial suppression and backburning are discussed in Chapter 7.

Fire History

As in West Billiatt, all of the WPA section of East Billiatt was burned in the extensive fires of 1988. The north-eastern section of the reserve was burned almost entirely, with very few patches. Prior to this fire, the southeastern part of the block burned in 1976 and 1979, and a small fire of 1 157 ha also occurred in 2002.

Natural Values

The rated flora within East Billiatt consists of Cushion Centrolepis (*Centrolepis cephaliformis* ssp. *cephaliformis*) and Williamson's Riceflower. Mallee Emu-wrens were last recorded in the block in an area that was burned in the 2002 fire, and have not been found since. Western Whipbirds were last recorded in East Billiatt block in 2003, however the block is known to support Red-lored Whistler, Chestnut Quail-thrush, Striated Grasswren and Southern Scrub-robin. A Malleefowl monitoring grid straddles the Alawoona-Lameroo Road, thereby falling partially in East Billiatt.

Built Assets

There are no built assets within the block, with the exception of the Alawoona – Lameroo Road, which is bitumised to the southern edge of the WPA, running along the block's western boundary. Native vegetation in Sections 22, 23, 24 & 26 Hundred of Kingsford link the East Billiatt Block to Kringin, the Kringin Telephone exchange and Peebinga CP. Numerous farming and residential assets exist in land adjacent the WPA and Heritage Agreements. A TV relay tower exists 2.5km north of Karte on Atze's Road, whilst a small vegetation Heritage Agreement lies adjacent to the township of Karte, which includes houses and some campsites located in scrub.

Fire Access

East Billiatt Block can be accessed from the northwest (Alawoona) and southwest (Lameroo) via the Alawoona road. Kringin Road provides access from the northeast, whilst Atze Road and Huckels Road access the southeast. A road network of varying standards exists in the eastern side of the block, however many of these are useable for 2WD vehicles only in dry periods. Access to the northern and eastern boundary of Billiatt WPA is quite limited.

Fire Risk

Fire risk in East Billiatt is variable given the mixed recovery success of vegetation since the 1988 fires and the patchy arrangement of vegetation Heritage Agreements in the landscape. In general terms, it varies from moderate to high.

The only area of reduced fuel is in the south-east of Billiatt WPA. The remainder of the burned area in the reserve is from events in 1976 and 1988. Investigation suggests that *Triodia* cover within these is not extensive, thus reducing the near-surface fine fuel hazard, however fire risk is still high given the relatively dense mallee and associated bark hazard. The numerous Heritage Agreements that have remained unburned for long periods are at a higher risk of fire.

The highest risk of ignition is from dry lightning strikes, as the low visitation rates for the reserve and its low exposure to major roads reduce the risk of human-caused ignition sources. Fires starting in Billiatt WPA would be likely to burn large sections unchecked under extreme conditions due to the lack of access, steep, sandy terrain and relatively continuous fuel.

Fire Water

CFS stations and water are located at Brown's Well and Kulkami. Adjacent private properties will have supplies subject to negotiation with the landowner, particularly in Karte.

Specific Management Objectives for East Billiatt Block

1. To prevent fire from escaping any component of the block into adjacent private lands and threatening life and property.
2. To minimise the risk of any component of the block being burnt out in a single fire event, particularly Billiatt WPA.
3. To prevent the easterly movement of fire into Peebinga CP.
4. To minimise the impacts of fire and promote patchiness in the parts of the block with large tracts of continuous vegetation.
5. To monitor the effects of prescribed burning and other management works on the ecological assets within the block with respect to potential displacement of threatened species.
6. To manage fire within the guidelines of the Wilderness Code of Management within Billiatt WPA (Refer to Appendix 1).

Actions and Works

All pre-suppression and suppression works within Billiatt WPA should be conducted within the guidelines of the Wilderness Code of Management (Appendix 1).

Pre-Suppression

- A 500 metre-wide B-zone is to be implemented on the eastern side of the Alawoona Road on a rotation of at least 10 years with another B-zone on the western side of the road.
- The northern and southern boundaries of Billiatt WPA should be rolled and maintained to a width of 20 m. The eastern boundary should be rolled to a width of 20 m where practical, however the continuous nature of the vegetation across the boundary may necessitate consultation with landholders to ensure rolled breaks are implemented in the most practical and strategic locations.
- It is recommended that perimeter tracks in participating Heritage Agreements should be maintained at a minimum width of four metres (GAFLC minor fire access track) to ensure adequate access for appliances during incidents.
- Unbounded landscape protection burns should be implemented within Billiatt WPA to promote fire patchiness and prevent the entire block being burned in a single fire event.
- Fire management works are recommended in Vegetation Heritage Agreement 408, Hundred of Kingsford, to stop the eastward movement of fire from Billiatt WPA to Peebinga CP via the continuous band of native vegetation that exists between the two reserves.

Suppression

Quick response to any incident with small units (14s) and suitable heavy plant is essential on Heritage Agreements to restrict fires to the patch of vegetation in which they are burning. Incident Controllers should be made aware of the Wilderness Protection Area status of the majority of the block. As such, consideration should be given to minimum impact suppression techniques when using heavy plant, machinery or backburning, consistent with the Wilderness Code of Management. DEH should be consulted in the event that any such action is deemed necessary. The use of existing buffers or areas of naturally low fuel to provide a low-impact suppression advantage is recommended.

SA police should be notified of any threat to public traffic on the Alawoona Road.

Guidelines for heavy machinery usage, aerial suppression and backburning are discussed in Chapter 7.

14 RESEARCH AND MONITORING

Monitoring and assessing the response of species and communities to fire and fire regimes forms a critical component of this Fire Management Plan. Regardless of tenure or the management activity prescribed, pre and post-fire monitoring is critical to ensure information is gathered on the impacts (positive and negative) of management actions. Monitoring is a mandatory requirement for any management action involving prescribed fire as burning is a form of vegetation clearance under the *Native Vegetation Act 1991*. Similarly, there is a requirement under the EPBC Act (1999) to identify and improve understanding of any identified threatening process for listed flora or fauna. The desired outcome of the program is the protection and enhancement of biodiversity within the Billiatt District, through the provision of an adaptive management framework that guides future fire management within the area.

Listed following are a number of distinct research and monitoring questions that will be addressed:

A > *To create a database for species response mechanisms to fire for the planning area.*

Species response to fire in the Billiatt District is not well understood both with respect to response mechanisms and community succession. Measures of pre and post fire species richness and diversity, as well as response mechanisms of individual species are essential baseline information. Within this, the impacts of burning in the cooler months and the influence on the response of biota requires assessment to provide informed adaptive management. Specific detail on threatened flora response should be sought through targeted research projects.

The key questions the monitoring program will address:

B > *What are the impacts of prescribed burning on threatened/significant species with particular emphasis on localised displacement of populations?*

Pre and post fire monitoring of colonies or sub-populations of target species such as the Mallee Emu-wren, Malleefowl, Western Whipbird is critical to measuring the sustainability of prescribed burning practices in Planning area. Responsibility for the management and implementation of the threatened mallee bird aspects of the program will rest with the Murraylands Conservation Programs Manager.

C > *What is the efficacy of the prescribed works implemented in mitigating the effects of a bushfire?*

Project FuSE, based in the heaths and mallee-heaths of Ngarkat, will provide a basis for this component of the program, however the different vegetation types in much of the Planning area may necessitate some more site-specific monitoring. DEH will record in greater detail the effectiveness of prescribed works in meeting fire management objectives. This question will only be tested in circumstances where bushfires occur in treated areas, however it is important to record the effectiveness of the program in meeting objectives in order to learn and improve the strategies used. Information required should include the weather conditions experienced when bushfires burn into buffer zones, the vegetation type/fuel levels in the area

burnt, the age of community burnt and the nature of any breaches across fuel modified areas.

No fire management blocks within the planning area currently contain survey plots, and not all of the questions listed above are relevant to all land managers or indeed can be addressed given the resources available. Implementation budgets will include provision for an annual monitoring component (either through DEH for public land or through the Native Vegetation Fund for Heritage Agreements), with the outcomes of the monitoring program to be fed into the review process.

Monitoring in zones will be ongoing, with measurements made both pre-fire and immediately post-fire, and at intervals following such that the responses of biodiversity to fire can be identified. Opportunistic plots may be established in recently burnt zones if they are deemed to contribute further to the information being collected through the program.

Recommendations	
Research and Monitoring	8. Create a database for species response mechanisms to fire for the planning area.
	9. Investigate the influence of prescribed burning on threatened/significant species with particular emphasis on localised displacement of populations.
	10. Investigate the efficacy of the prescribed works implemented in mitigating the effects of a bushfire.

15 RECOMMENDATIONS

Implementation of the recommendations and works listed in this plan is subject to available resources as well as regional and state-wide priorities. A schedule of works, including proposed prescribed burns, will be developed annually to meet the recommendations listed in this plan. This schedule will be available from the Regional Fire Management Officer.

Prescribed burning within Heritage Agreements is not included in this schedule (except where there is continuity with public land). Prescribed burning in Heritage Agreements is to be planned by the individual landholder in consultation with the relevant Bush Management Advisor. Individual burn plans will be developed prior to any prescribed burning as described in Section 2.6.

15.1 Summary of Recommendations

Heritage Agreements

1. To assist in the implementation of prescribed burning and other pre-suppression works within Heritage Agreements it is recommended that funding be sought through the SAMDB NRM Board to assist in fire management on private land. This money should be managed through the DEH Murraylands Conservation Programs Unit.

Aerial Observation

2. It is strongly recommended that Incident Management Teams request aerial observation as early as possible in the incident. An aerial platform should be deployed when smoke is first sighted or in the event of an electrical storm passing through the area during the months September through to March.

Fire Access

3. Erect track signs across the planning area as per the GAFLC guidelines
4. Encourage adjacent landowners to upgrade/maintain their tracks as per the GAFLC guidelines.

Water Supply

5. Identify water sources adjacent to the reserves and surrounding Heritage Agreements and negotiate access to the water with the owner.
6. Provide tanks and fittings on private property if there is a strategic benefit in having access to water at that location.

Managing Visitors

7. Interpretive signage, describing evacuation procedures and the aims and strategies of the Billiatt District Fire Management Plan, should be installed on DEH reserves and at relevant Visitor Centres and the DEH Regional and District Offices.

Research and Monitoring

8. Create a database for species response mechanisms to fire for the planning area.
9. Investigate the influence of prescribed burning on threatened/significant species with particular emphasis on localised displacement of populations.
10. Investigate the efficacy of the prescribed works implemented in mitigating the effects of a bushfire.

15.2 Summary of Works

TABLE 4: RECOMMENDED WORKS TO BE UNDERTAKEN IN FIRE MANAGEMENT BLOCKS

Recommended Works	
Peebinga Block	A 500 m B-zone is to be implemented from the northwest to the southeast of Peebinga CP along Conservation Road, heading southeast from Kringin. This includes a B-zone along the boundary between the reserve and the Heritage Agreement in Section 18 (Hundred of Peebinga). This road is also to be maintained to a width of 7 m.
	It is recommended that perimeter tracks in participating Heritage Agreements should be maintained at a minimum width of 4 m (GAFLC Minor Track) to ensure adequate access for appliances during incidents
	The road beginning in Mootatunga to the northeast of Peebinga CP and heading south is to be maintained at a width of 7 m to allow safe access to the reserves eastern boundary
	The eastern boundary of the CP north of Three Mile Road is to be maintained at a width of 20 m using a cross-ribbed roller on a five year cycle.
Karte Block	The eastern boundary track should be maintained at a width of 7 m using a cross-ribbed roller on a ten-year cycle. This will give access and protection to firefighters in the most vulnerable part of the reserve under the most common fire conditions.
	The reserve boundary should be graded and maintained at a width of 4 m to ensure basic access to the entire reserve perimeter.
	Ecological burning should be considered given the long-term build up of fuel and vegetation growth in the reserve. This strategy could be used to enhance habitat for species such as the Western Whipbird pending thorough investigation and planning.
West Billiatt Block	A 500 m wide B-zone is to be implemented on the Alawoona Road on a rotation of at least 10 years with another B-zone on the eastern side of the road
	The northern and southern boundaries of Billiatt WPA and CP should be rolled and maintained to a width of 20 m. The western boundary should be rolled to a width of 20 m where practical, however the continuous nature of the vegetation across the boundary may necessitate consultation with landholders to ensure rolled breaks are implemented in the most practical and strategic locations
	The Hundred Line road that runs from the Alawoona-Lameroo Road to the western boundary of Billiatt WPA should be maintained at a width of 20 m. Landscape protection burns can also be conducted from this road.
	It is recommended that perimeter tracks in participating Heritage Agreements should be maintained at a minimum width of 4 m (GAFLC Minor Track) to ensure adequate access for appliances during incidents
	Unbounded landscape protection burns should be implemented within Billiatt WPA and CP to promote fire patchiness and prevent the block burning in its entirety in a single fire event.
	SA police should be notified of any threat to public traffic on the Alawoona Road.
	All pre-suppression and suppression works within Billiatt WPA should be conducted within the guidelines of the Wilderness Code of Management (Appendix 1).

Recommended Works

East Billiatt Block

A 500 m wide B-zone is to be implemented on the eastern side of Alawoona Road on a rotation of at least 10 years with another B-zone on the western side of the road

The northern and southern boundaries of Billiatt WPA should be rolled and maintained to a width of 20 m. The eastern boundary should be rolled to a width of 20 m where practical, however the continuous nature of the vegetation across the boundary may necessitate consultation with landholders to ensure rolled breaks are implemented in the most practical and strategic locations.

It is recommended that perimeter tracks in participating Heritage Agreements should be maintained at a minimum width of 4 m (GAFLC Minor Track) to ensure adequate access for appliances during incidents.

Unbounded landscape protection burns should be implemented within Billiatt WPA to promote fire patchiness and prevent the entire block being burned in a single fire event.

Fire management works are recommended in Heritage Agreement 408, Hundred of Kingsford, to stop the eastward movement of fire from Billiatt WPA to Peebinga CP via the continuous band of native vegetation that exists between the two reserves.

SA police should be notified of any threat to public traffic on the Alawoona Road.

All pre-suppression and suppression works within Billiatt WPA should be conducted within the guidelines of the Wilderness Code of Management.

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17 APPENDICES

Appendix 1: Wilderness Code of Management Sections 3.6 and 3.10

Section 3.6 Fire

- (i) Fire management will be based on continuing research into the fire history of the area, the relationships between fire and the natural communities occurring within the area, and on the maintenance of wilderness quality.
- (ii) Deliberately lit fires will be used only in emergency situations, and in essential management operations as listed in 3.10 and subject to (i) above.
- (iii) Other human caused fires should, where practicable, be extinguished consistent with maintenance of wilderness quality.
- (iv) Naturally caused fires will be extinguished when, in view of the direction, intensity and extent of the fire and the fire suppression techniques available, they pose a threat to human life and property, and to habitats requiring protection.
- (v) Where fire suppression action is required, the methods utilised will be, wherever possible, those which will have the least long-term impact on wilderness quality.
- (vi) The use of heavy machinery for fire suppression within a wilderness area will be prohibited except:
 - (a) where it is considered to be the only way of preventing greater long-term loss of wilderness quality;
 - (b) where specific machinery use techniques, that do not result in significant disturbance to the landscape or create a new access network, are considered the only feasible method of preventing long-term loss of wilderness quality; or
 - (c) to mitigate hazard to human life, where alternative measures which do not impact on the wilderness quality of the area are unavailable.
- (vii) Wherever possible, fire management practices designed to protect land adjacent to or within a wilderness area will be conducted outside the wilderness area.

Section 3.10 Emergency and Essential Management Operations

- (i) All emergency and essential management operations will be carried out with the least possible impact on wilderness quality.
- (ii) Actions that cause short-term degradation of wilderness quality but are necessary for emergency and/or essential management operations will be permitted. The only specific situations acknowledged in this Code as possibly requiring such actions are:
 - control or eradication of non-indigenous species;
 - conservation of threatened species, communities and habitats;
 - protection of fire-sensitive species and communities;
 - management of visitor use;
 - management action or use of devices to mitigate hazard to human life;
 - restoration of natural processes, communities and habitats; and
 - research

Where degradation has occurred as a result of these activities, rehabilitation will be undertaken as soon as practicable.

The plan will also comply with the *DEH Fire Policy and Procedure for Wilderness Fire Management*.

Appendix 2: Fire Response of Rated and Significant Flora Species Recorded in the Planning Area.

Common Name	Taxonomic Name	Status*		Life Form	Occurrence	Fire Response	Fire Management Guidelines	Source
		NPW Act	EPBC Act					
Cleland's Beard-heath	<i>Leucopogon clelandii</i>	R		Diffuse shrub to 0.3 m	Widespread record distribution throughout the planning area.			KI/Vic/N SW-other
Cushion Centrolepis	<i>Centrolepis cephaloformis</i> ssp. <i>cephaloformis</i>	V	VU					KI
Williamson's Riceflower	<i>Pimelea williamsonii</i>	V	VU	Small shrub to 0.6 m			Fire intervals between 10 and 30 years are required to maintain viable populations and seedbanks.	(Obst, 2005)

* Refer to Appendix 4 for a description of codes used

Appendix 3: Fire Response of Rated and Significant Avifauna Species Recorded in the Planning Area.

Common Name	Taxonomic Name	Status*		Preferred Habitat	Breeding	Extent	Dispersal & Home Range	Fire response	Fire Management Guidelines	Source
		NPW Act	EPBC Act							
Blue-winged Parrot	<i>Neophema chrystoma</i>	V		NA	NA	Seasonal visitor?	NA	NA	NA	(DEH, 2005b)
Chestnut Quail-thrush	<i>Cinclosoma castanotus</i>	R		Mallee with <i>Triodia</i> or shrubs. Also likely riparian woodland.	Pairs, productivity unknown. Nests on ground.	Restricted range	Unknown. HR unknown	Found in vegetation burnt 4-40 yrs ago. Highest densities in sites burnt <10 yrs ago.	Reduce the risk of extensive bushfires. Promote localised patchiness in bushfires in core habitat areas.	(Woinar ski, 1989)
Mallee Emu-wren	<i>Stipiturus mallee</i>	E	VU	<i>Triodia</i> and/or <i>Xanthorrhoea</i> Mallee or Heath	Pairs, mod. Productivity. Nesting in <i>Triodia</i> . Breed Sept-Dec?	Restricted range.	Max recorded 1.2 km within populations. Likely in order 10 km? HR c. 3ha	Recorded 4-42 yrs post-fire in <i>Triodia</i> . Lost from 20-27 yr post-fire <i>Triodia</i> .	Reduce the risk of extensive bushfires. Promote patchiness in bushfires in core habitat areas.	(Paton, 2000)
Malleefowl	<i>Leipoa ocellata</i>	V	VU	Mallee and arid & semi-arid shrubland, plus <i>Callitris</i> woodland.	Pairs, high productivity. Nesting in mound that requires high leaf litter. Mound construction Autumn-Spring. Breed Sept.-Mar.	Core of range.	Unknown but 10s of km. HR 1-2 km ²	Fires likely cause high mortality. First breeding post-fire 6-17 yrs, younger age rare. Found in vegetation burnt 26-80 yrs ago. Highest densities in sites burnt 60-80 yrs ago.	Reduce the risk of extensive bushfires. Maintain core areas of long unburnt mallee.	(Benshe mesh, 2000; Woinars ki, 1989)
Red-lored Whistler	<i>Pachycephala rufogularis</i>	R	VU	Mallee with <i>Triodia</i> or dense but patchy understorey	Pairs, low productivity. Breeding in <i>Triodia</i> , Aug-Dec	Restricted range	Potential long distance (rarely to 300 km) Low density.	Recorded 6 yrs post-fire.	Reduce the risk of extensive bushfires.	(Paton, 2000)

* Refer to Appendix 4 for a description of codes used

Common Name	Taxonomic Name	Status*		Preferred Habitat	Breeding	Extent	Dispersal & Home Range	Fire response	Fire Management Guidelines	Source
		NPW Act	EPBC Act							
Shy Heathwren	<i>Hylacola cauta cauta</i>	R		Mallee with dense understorey. High leaf litter/debris.	Pairs. Mod. productivity. Nesting frequently on ground in litter. Breed July-Dec.	Restricted range	Unknown. HR unknown.	Found in vegetation burnt 4-40 yrs ago. Highest densities in sites burnt <10 yrs ago.	Reduce the risk of extensive bushfires. Promote localised patchiness in bushfires in core habitat areas.	(Paton, 2000; Woinarski, 1989)
Striated Grasswren	<i>(Amytornis striatus)</i>	V		Generally <i>Triodia</i> with open shrubs and mallee overstorey. Can occur in dense shrub instead of <i>Triodia</i> .	Cooperative breeder. Mod. productivity. Nest frequently in <i>Triodia</i> . Breed Oct-Mar, likely opportunistic with high rainfall events	Southern edge of range.	Unknown but likely >10km? HR recorded 1-5 ha likely larger?	3-5 yrs post fire – Billiatt. 7-8 yrs post fire – Ngarkat.	Populations likely small, therefore need to locate and protect from catastrophic loss.	(DEH, 2005b)
Western Whipbird	<i>Psophodes nigrogularis leucogaster</i>	E	VU	Mallee with dense understorey, or heath	Pairs, low productivity Nesting in dense understorey. Breed July-Nov.	Restricted range.	Recorded at least 4.5km, likely greater. HR 10-20 ha	Preferred vegetation structure generally found 10-30 yr post-fire. Decline in understorey density with long fire age may result in decline.	Reduce the risk of extensive bushfires.	(Woinarski, 1989)

* Refer to Appendix 4 for a description of codes used

Appendix 4: EPBC Act and South Australian (SA) Conservation Status Codes

SOUTH AUSTRALIAN (SA) CONSERVATION STATUS CODES

- E Endangered:** rare and in danger of becoming extinct in the wild.
- V Vulnerable:** rare and at risk from potential threats or long-term threats which could cause the species to become endangered in the future.
- R Rare:** has a low overall frequency of occurrence (may be locally common with a very restricted distribution or may be scattered sparsely over a wider area). Not currently exposed to significant threats, but warrants monitoring and protective measures to prevent reduction of population sizes.

The list of Endangered, Threatened and Vulnerable flora and fauna species is updated at regular intervals in Schedules 7, 8 and 9 under the *National Parks and Wildlife Act 1972*. To view the most recently gazetted version, go to:

Endangered http://www.austlii.edu.au/au/legis/sa/consol_act/npawa1972247/sch7.html

Threatened http://www.austlii.edu.au/au/legis/sa/consol_act/npawa1972247/sch8.html

Vulnerable http://www.austlii.edu.au/au/legis/sa/consol_act/npawa1972247/sch9.html

EPBC ACT CONSERVATION STATUS CODES

Conservation status

The IUCN (1994) devised the following red list categories, with species categorised based on a series of five criteria:

- **Critically Endangered (CR):** A taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future, as defined by any of the criteria A to E.
- **Endangered (EN):** A taxon is Endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future, as defined by any of the criteria A to E.
- **Vulnerable (VU):** A taxon is Vulnerable when it is neither Critically Endangered nor Endangered, but is facing a high risk of extinction in the wild in the medium-term future, as defined by any of the criteria A to E.

18 GLOSSARY OF ACRONYMS AND FIRE MANAGEMENT TERMINOLOGY

Term	Definition
14	A 4WD firefighting appliance, with a capacity of up to 1000 litres of water, fitted with a pump and hose.
24	A 4WD firefighting appliance, with a capacity of up to 2000 litres of water, fitted with a pump and hose.
34	A 4WD firefighting appliance, with a capacity of up to 3000 litres of water, fitted with a pump and hose.
A-frame	Implement (two steel girders welded at the apex) towed behind a tractor used for creating mineral earth breaks.
Backburn(ing)	A fire started intentionally along the inner edge of a control line to consume the fuel in the path of a bushfire.
Bushfire	An unplanned fire. A generic term that includes grass fires, forest fires and scrub fires.
CFS	The South Australian Country Fire Service.
Coarse fuels	Dead woody material, greater than 25mm in diameter, in contact with the soil surface (fallen trees and branches).
Control line	A natural or constructed barrier, or treated fire edge, used in fire suppression and prescribed burning to limit the spread of fire.
Cross-ribbed roller	Adjustable roller towed behind a bulldozer, used for firebreak construction and bushfire response.
DEH	The South Australian Department for Environment and Heritage.
Direct attack	A method of bushfire attack where wet or dry firefighting techniques are used. It involves suppression action right on the fire edge, which becomes the control line.
Discontinuous fuels	Significant gaps between clumps or patches of fuel (DEH, 2006f).
DPBC	District Bushfire Prevention Committee.
EAT	DEH Environmental Assessment Table. Completed for all prescribed burns (as part of the Prescribed Burn Plan) and other fire management works where native vegetation is being cleared and is not exempt under the Native Vegetation Act 1991 (DEH, 2004b).
EPBC Act	The commonwealth Environment Protection and Biodiversity Conservation Act 1999.
Extreme fire behaviour	A level of bushfire behaviour characteristics that ordinarily precludes methods of direct suppression action. One or more of the following is usually involved: high rates of spread; prolific crowning and/or spotting; presence of fire whirls and/or a strong convective column. Predictability is difficult because such fires often exercise some degree of influence on their environment and behave erratically, sometimes dangerously.
Extreme fire danger	The highest fire danger classification.
Fine fuels	Grass, leaves, bark and twigs less than 6mm in diameter.

Term	Definition
Fire access track	A track constructed and maintained expressly for fire management purposes.
Fire behaviour	The manner in which a fire reacts to the variables of fuel, weather and topography.
Firebreak	An area or strip of land where vegetation has been removed or modified to reduce the risk of fires starting and reduce the intensity and rate of spread of fires that may occur (GAFLC, 2005).
Fire danger	The combination of all factors, which determine whether fires start, spread and do damage, and whether and to what extent they can be controlled.
Fire effects	The physical, biological and ecological impact of fire on the environment.
Fire hazard	Any fuel which if ignited, may be difficult to extinguish.
Fire management	All activities associated with the management of fire-prone land, including the use of fire to meet land management goals and objectives.
Fire regime	The history of fire in a particular vegetation type or area including the fire frequency, interval, intensity, extent and seasonality of burning (Brooks, <i>et al.</i> , 2004).
Fire scar	A destructive mark left on a landscape by fire.
Fire season	The period(s) of the year during which fires are likely to occur, spread and do sufficient damage to warrant organised fire control.
Fire suppression	The activities connected with restricting the spread of bushfire following its detection and making it safe.
Fuel	Any material such as grass, leaf litter and live vegetation, which can be ignited and sustains a fire. Fuel is usually measured in tonnes per hectare.
Fuel arrangement	A general term referring to the spacing and arrangement of fuel in a given area.
Fuel hazard	The Overall Fuel Hazard is defined as the sum of the influences of bark fuel, elevated fuel and surface fine fuel (DEH, 2006f)
Fuel management	Modification of fuels by prescribed burning, or other means.
Fuel reduction burning	The planned application of fire to reduce hazardous fuel quantities, undertaken in prescribed environmental conditions within defined boundaries.
Fuel type	An identifiable association of fuel elements of distinctive species, form, size, arrangement, or other characteristics that will cause predictable rate of spread or difficulty of control under specified weather conditions.
GAFLC	South Australian Government Agencies Fire Liaison Committee.
Incident Controller (IC)	The individual responsible for the management of all incident operations and IMT.
IMT	Incident Management Team. The group of incident management personnel comprising the Incident Controller and the people he/she appoints to be responsible for the functions of Operations, Planning and Logistics.

Term	Definition
Indirect attack	The use of backburning as a method of suppression to confine the fire within a defined area bounded by existing or prepared control lines. Control lines may be a considerable distance ahead of the fire.
Key Fire Response Species	In this fire management plan, these are the species most susceptible to decline due to inappropriate fire regimes: either too frequent or too infrequent fire, low or very high intensity fire, or fire in a particular season.
MVS	Major Vegetation Sub-group.
NHT	National Heritage Trust. Established by the Australian Government in 1997 to help restore and conserve Australia's environment and natural resources (NHT, 2005)
NPW Act	The South Australian <i>National Parks and Wildlife Act 1972</i> .
NVC	Native Vegetation Council. Established under the provisions of the <i>Native Vegetation Act 1991</i> , responsible for making decisions on a wide range of matters concerning native vegetation in South Australia (DWLBC, 2006)
'Of conservation significance'	In this plan, used to describe important or <u>rated</u> populations or species of flora and fauna as well as vegetation communities. These may be: <ul style="list-style-type: none"> Nationally rated, that is, listed as Threatened (with a rating of Extinct, Critically Endangered, Endangered, Vulnerable or Conservation Dependent) under the federal Environment Protection and Biodiversity Conservation (EPBC) Act 1999; South Australian rated, listed as Threatened (with a rating of Endangered, Vulnerable or Rare) under the National Parks and Wildlife Act 1972, Revised Schedules 7, 8 and 9. Provisionally listed as Threatened (with a rating of Endangered or Vulnerable) in South Australia, that is, included on the unpublished DEH Provisional List of Threatened Ecosystems of South Australia (DEH, 2005a).
Prescribed burn plan	The plan, which is approved for the conduct of prescribed burning. It contains a map identifying the area to be burnt and incorporates the specifications and conditions under which the operation is to be conducted.
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.
Response plan	A plan detailing the response for a risk or an area including the type and number of resources.
Retardant	A chemical generally mixed with water, designed to retard combustion by chemical or physical action. It is usually applied by aircraft but may be applied from tankers at the fire edge.
Risk assessment	Used in DEH fire planning to assist in evaluating the threat to life, property and environmental assets posed by bushfire and to aid in developing strategies and implementing actions and works for risk mitigation. Considers <i>Likelihood</i> and <i>Consequence</i> to determine an overall risk rating using a matrix as <i>Low, Moderate, High, Very High</i> or <i>Extreme</i> (DEH, 2006d)
SAMDB NRM Board	South Australian Murray-Darling Basin Natural Resource Management Board.
Spotting	The ignition of spot fires from sparks or embers.

Term	Definition
Total Fire Ban	A ban on lighting and maintaining of a fire in the open, which can be invoked at any time during the year. When invoked, the Total fire Ban is imposed for a period of 24 hours, from midnight to midnight, but may also be imposed for part of a day or days. (Country Fire Service Regulations, 2003)
TPC	<p>The <i>Threshold of Potential Concern</i> (TPC) for a vegetation type or community is the level of fire regime element (i.e. fire interval, frequency, intensity or season) where <i>Key Fire Response Species</i> are likely to significantly decline if exceeded. Fire regimes beyond that level are likely to lead to local extinction of significant biodiversity.</p> <ul style="list-style-type: none"> • TPC1 demonstrates the recommended lower limit for fire interval for a particular MVS. That is, vegetation within this MVS will be represented predominantly by early successional species if the inter-fire interval is less than the time specified, and those species that require longer to flower and set seed can disappear from a community. • TPC2 demonstrates the recommended upper limit for fire interval for a particular MVS. That is, populations of some species (e.g. obligate seeders) are likely to reduce within this MVS if fire is absent for more than the time specified.
'Weed of national significance'	20 priority weeds that pose future threats to primary industries, land management, human or animal welfare, biodiversity and conservation values at a national level. These weeds were identified and ranked through the assessment of invasiveness, impacts, potential for spread and socioeconomic and environmental aspects (Australian Weeds Committee, 1999)

Unless otherwise indicated, definitions for fire management terminology were adapted from: *Department for Environment and Heritage (DEH) (2006) Glossary of Fire Management Terms – Draft V00-01. Government of South Australia, Adelaide.*

