Fire Management Plan

Central Eyre Peninsula

Incorporating *Barwell, Bascombe Well, Carappee Hill, Darke Range, Franklin Harbor, Heggaton, Hincks, Ironstone Hill, Malgra, Middlecamp Hills, Moody Tank, Munyaroo, Peachna, Rudall, Shannon, Sheoak Hill, The Plug Range, Verran Tanks, Wharminda, and Yeldulknie Conservation Parks, Lacroma Conservation Reserve, Hambidge and Hincks Wilderness Protection Areas, and included Crown Lands and participating Heritage Agreements*

Department of Environment, Water and Natural Resources

Government of South Australia

www.environment.sa.gov.au

The Native Vegetation Council approved extension of this plan as a bushfire management plan until 31 December 2026 through the Native Vegetation Regulations 2017, Reg 9(1) Sch 1(17).

Please note that the Department for Environment, Water and Natural Resources is now the Department for Environment and Water.

For further information please contact:
Department of Environment, Water and Natural Resources
Phone Information Line (08) 8204 1910, or
see SA White Pages for your local
Department of Environment, Water and Natural Resources office.

This Fire Management Plan is also available from: https://www.environment.sa.gov.au/topics/fire-management/fire-science-and-planning/fire-management-plans/current-fire-management-plans

Front Cover: Hincks Wilderness Protection Area © Shaun Irrgang

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EXECUTIVE SUMMARY

This Fire Management Plan for the Central Eyre Peninsula includes Barwell, Bascombe Well, Carappee Hill, Darke Range, Franklin Harbor, Heggaton, Hincks, Ironstone Hill, Malgra, Middlecamp Hills, Moody Tank, Munyaroo, Peachna, Rudall, Shannon, Sheoak Hill, The Plug Range, Verran Tanks, Wharminda, and Yeldulknie Conservation Parks, Lacroma Conservation Reserve, Hambidge and Hincks Wilderness Protection Areas, and selected Crown land and participating Heritage Agreements.

This plan has been prepared to provide direction for fire management in the planning area, through the inclusion of strategies for bushfire risk modification on the identified land. The plan emphasises the protection of life and property and provides direction for land managers in the protection and enhancement of the natural and cultural heritage of the area. It is important to note that there will be a transitional stage where the management strategies and works proposed in the plan are undertaken and implementation depends upon fire management priorities and the allocation of regional resources.

The Central Eyre Peninsula planning area includes large contiguous areas of remnant native vegetation. Much of this remnant native vegetation is contained within DEWNR-managed reserves, and in many cases are the only significant remnants of intact native vegetation in an area where there has been historical widespread clearing for agriculture. The area was identified as a priority for fire management planning due to the potential for bushfires to start and build in the large contiguous areas of native vegetation, and for bushfires to impact on grazing and cropping land, and threatened species and ecological communities.

The issues identified above were addressed during the planning process by:

- undertaking risk assessments to identify life, property, and environmental values that may be threatened by bushfires
- applying Department of Environment, Water and Natural Resources Fire Management Zoning principles to guide the management of fuel in Fire Management Zones
- applying Department of Environment, Water and Natural Resources Ecological Fire Management Guidelines to determine appropriate fire regimes in Conservation-Land Management Zones
- assessing track standards using the Government Agencies Fire Management Working Group's guidelines for firebreaks and fire access tracks in South Australia (GAFM 2014).

The following recommendations have been identified as a result of applying the above processes.

- Fuel reduction:
    - in identified Fire Management Zones
    - in strategic areas within the Conservation-Land Management Zone to provide some landscape protection within the included lands and increase age class variability within the vegetation across larger areas
    - to complement strategies to manage species or habitats.

- Operational works to increase fire readiness, including upgrades to fire access tracks.
- Coordinated fire management between Department of Environment, Water and Natural Resources and adjacent landowners through Bushfire Management Area Plans.

The Department of Environment, Water and Natural Resources thanks those who contributed to the development of this plan and encourages their continued engagement in managing fire in the planning area. This fire management plan will form a significant component of the Upper Eyre Peninsula, Lower Eyre Peninsula, and Outback Bushfire Management Area Plans. As fire is a landscape issue, the community will need to implement fire management strategies to complement work undertaken by Department of Environment, Water and Natural Resources.

This draft plan was released for public comment for a period of six weeks over December 2013 and January 2014. Comments were then evaluated and incorporated where considered appropriate. A major review of this plan will occur after ten years of implementation, or earlier if required.

CONTENTS

List of Figures

List of Tables

Fire Management Maps

Maps supporting this fire management plan are interactive and are provided online via the web under five themes. To access this site please enter www.environment.sa.gov.au/fire/ into your internet browser and follow the links to 'Fire Management Maps'.

'Fire Management Maps' is designed to illustrate the text in the plans, particularly the works listed in Appendix 1, using five standard thematic maps. Users can view maps referred to in the text by selecting the appropriate map. Data displayed on each map become more detailed at smaller scales. Once centred on an area of interest, it is possible to move between map themes and also print A3 maps. Please note that data displayed on Fire Management Maps may be more current than what is described in this Fire Management Plan.

The map themes are:

- Map 1 – Terrain, Tenure and Infrastructure
- Map 2 – Vegetation Communities
- Map 3 – Fire History
- Map 4 – Fire Management and Access
- Map 5 – Implementation Strategy – Proposed Burns.

1 SCOPE AND PURPOSE

The plan drives the delivery of fire management on Department of Environment, Water and Natural Resources (DEWNR) managed land by defining objectives for the protection of life and property (particularly in relation to visitors and adjacent landholders), protection of the environment and for ecological fire management. Strategies are recommended to meet objectives, which will increase the level of bushfire readiness and guide management and suppression strategies during bushfire incidents.

This plan provides a strategic framework for fire management in DEWNR-managed reserves and other included land. This plan incorporates Barwell, Bascombe Well, Carappee Hill, Darke Range, Franklin Harbor, Heggaton, Hincks, Ironstone Hill, Malgra, Middlecamp Hills, Moody Tank, Munyaroo, Peachna, Rudall, Shannon, Sheoak Hill, The Plug Range, Verran Tanks, Wharminda, and Yeldulknie Conservation Parks (CP), Lacroma Conservation Reserve (CR), Hambidge and Hincks Wilderness Protection Areas (WPA), selected Crown land and participating Heritage Agreements (HA).

The area was identified for fire management planning to address:

- the general protection of life, property and the environment within and adjacent to the included lands
- the occurrence of species, populations, and ecological communities of conservation significance within the plan area
- the potential for large-scale bushfires to develop, should a fire start
- the likelihood of accidental and natural fire ignitions
- the potential impacts to biodiversity as a result of any reserve burning in its entirety in a single fire event by limiting the area impacted by bushfires
- the use of fire as a management tool for community protection and/or conservation management.

This Fire Management Plan aims to:

- assess the level of risk (particularly in relation to the above issues) and the existing fire management and reserve management objectives
- identify objectives for fire management within the planning area
- outline strategies for risk mitigation and propose operational works to increase the level of bushfire readiness and guide suppression management during bushfire incidents
- inform the preparation of Bushfire Response Plans for the included lands, which provide specific operational information useful in the early stages of an incident.

Operational works outlined in this plan will be implemented in a staged manner depending on available resources in the DEWNR Eyre Peninsula Region. Adjoining lands are considered in the plan, but only in the context of works required to minimise the risk to assets from fires originating in the included reserves. However, DEWNR will support and complement landscape-scale fire planning for adjoining lands. Fire management planning for other lands within the planning area is the responsibility of the SA Country Fire Service (CFS) through the Upper Eyre Peninsula, Lower Eyre Peninsula and Outback Bushfire Management Area Committees (BMC), in accordance with the requirements of the *Fire and Emergency Services Act 2005*. DEWNR is represented on these Committees, along with Local Government and the CFS.

1.1 Objectives

The fire management objectives that apply to all DEWNR-managed land are as follows.

General Objectives for Fire Management

- To reduce the risk to life, property, and the environment during bushfire events.
- To ensure that sound conservation and land management principles are applied to fire management activities.
- To apply an adaptive management approach to fire management on DEWNR-managed land supported by contemporary research and monitoring.
- To support the strategic containment of bushfires (i.e. to minimise the likelihood of a fire entering/exiting a block or reserve).
- To complement Bushfire Management Area Plans prepared by BMC under the *Fire and Emergency Services Act 2005*.
- To undertake bushfire suppression activities in a safe and professional manner.
- To inhibit the spread of bushfire through DEWNR-managed land.
- To manage fire regimes to ensure consistency with the ecological fire management guidelines in Conservation-Land Management Zones (refer to Table 7).

The fire management objectives that apply specifically to the Central Eyre Peninsula Fire Management Plan are as follows.

Objectives for Fire Management in the Central Eyre Peninsula planning area

- To reduce the impact of bushfire on human life and improve community safety on and adjacent to public land as a priority.
- To minimise the likelihood of a significant portion of a reserve burning in a single fire event and/or a landscape-scale fire occurring within the planning area.
- To maintain or improve the viability of native species, populations, ecological communities, and habitats within the planning area.
- To minimise the impact of fire and fire management activities on threatened species, populations, and ecological communities, and provide for the protection of significant habitat areas within the planning area.
- To improve knowledge of appropriate fire regimes required to maintain and enhance native species, populations, ecological communities, and habitats, and ensure that any new information is used to inform future management actions.
- To establish and maintain an appropriate level of preparedness for bushfire response and prescribed burning activities.
- To work with research institutions and non-government organisations to develop research programs that inform prescribed burning on public land where appropriate.

2 THE PLANNING FRAMEWORK

2.1 Legislation

Fire management planning for public land is influenced by several pieces of state and federal legislation (Table 1). Of most relevance, the *Fire and Emergency Services Act 2005* (SA) identifies the responsibilities for the CFS and land management agencies in minimising the risks and impacts of bushfires. Fire management plans themselves are not statutory documents but provide the mechanism to meet the statutory requirements under the relevant legislation.

TABLE 1 – LEGISLATION INFLUENCING FIRE MANAGEMENT PLANNING

Legislation	Section	Relevance to fire management
Fire and Emergency Services Act 2005 (SA)	105H-1	Conveys the fire management responsibilities of DEWNR through requirements to minimise the risk of fire threatening life and property and to reduce the likelihood of fire ignitions and fire spreading through the land that they manage.
	97-6	States that CFS should consider the provisions of a management plan and make reasonable attempts to consult with the relevant land manager when responding to an incident within a government reserve.
National Parks & Wildlife Act 1972 (SA)	37	Defines overarching management objectives for proclaimed reserves managed by DEWNR, which includes 'the prevention and suppression of bushfires and other hazards', and provides protection for listed terrestrial flora and fauna.
Wilderness Protection Act 1991 (SA)	12	Directs DEWNR to prepare a *Wilderness Code of Management* (DEH 2004), which establishes principles for fire management and provides provisions for fire management in Wilderness Protection Areas and Zones if deemed an 'essential management operation'.
Crown Land Management Act 2009 (SA)	9c	Assigns DEWNR, through the Minister for Sustainability, Environment and Conservation, with responsibilities for the on-ground management of unalienated Crown land and any Crown land dedicated to, owned by or under the care and control of the Minister.
Native Vegetation Act 1991 (SA)	29	DEWNR must meet the provisions of the Act if intending to modify native vegetation on their land (this includes burning). Clearance applications are assessed by Native Vegetation Council in accordance with Schedule 1 of the Act.
	23	Outlines the provisions for the establishment of native vegetation Heritage Agreements for conservation purposes on private land.
Native Vegetation Regulations 2003 (SA)	5A-1	Clarifies which actions can be undertaken to modify native vegetation without approval from the Native Vegetation Council. This includes fuel reduction: for asset protection, on DEWNR reserves or during bushfire emergencies, when establishing or maintaining fire access tracks or fuel breaks for fire control or if required by Bushfire Management Area Plans.
	5(1)(zi)	Where clearance is to preserve or enhance ecological processes (e.g. prescribed burning for ecological reasons), a management plan needs to be approved by the Native Vegetation Council, as per the *Guidelines for Ecological Prescribed Burning* (Native Vegetation Council 2014).
Environment Protection and Biodiversity Conservation Act 1999 (Cwlth)	18	Regulation of actions likely to impact nationally-listed species and ecological communities.
	269AA	Describes when Recovery Plans should be prepared for nationally-listed species and ecological communities (see Section 3.6.4).

2.2 Fire Management Policy and Procedures

The *DEWNR Fire Management Policy and Procedures* (DEWNR 2013c) outlines the agency's fire management responsibilities to protect life, property, and the environment. The Policy states that DEWNR fire management plans will:

- identify fire related risks to natural and cultural heritage values and built assets
- define objectives for fire management in the planning area
- identify strategies to achieve these objectives.

DEWNR fire management plans are developed in accordance with DEWNR's procedures for project management, risk assessment, and zoning (DEWNR 2013c).

2.3 Other Influences and Considerations

2.3.1 Land Management

DEWNR reserve management plans are statutory requirements under the *National Parks and Wildlife Act 1972* (NPW Act) and the *Wilderness Protection Act 1992* (WP Act) where relevant. They may identify the requirement for a fire management plan based on the nature of the fire-related issues within a reserve. The *Mallee Parks of the Central Eyre Peninsula Management Plan* covers Barwell, Bascombe Well, Hincks, Peachna, Shannon, Verran Tanks, and Wharminda CP, and Hambidge and Hincks WPA (DEH 2007b). This multi-reserve management plan states that prescribed burning will be used for ecological management and fuel reduction purposes and also be in accordance with the *Wilderness Code of Management* (DEH 2004) for Hambidge and Hincks WPA.

The *Conservation Parks of the Lower Eyre Peninsula* reserve management plan includes Moody Tank CP (DEH 2007a). Fire management objectives in that plan state that prescribed burning will be implemented to assist in the protection of built assets and for ecological management purposes.

The reserve management plan for the *Eastern Eyre Peninsula Parks* includes Munyaroo, Ironstone Hill, Malgra, Heggaton, The Plug Range, and Sheoak Hill CP (DEWNR 2014). The development and implementation of a fire management plan that provides a strategic approach to the protection of life, property and the environment is a recommended objective. It is stated that prescribed burning should be a part of this strategy.

This fire management plan will take the objectives of each reserve management plan into consideration. The risk treatments to minimise the impact of bushfire on public land proposed herein will be consistent with the current management direction of DEWNR.

The WildEyre Project is a cooperative partnership formed in 2007 between three non-government organisations (Greening Australia, The Wilderness Society, and the Nature Conservation Society of SA), the Eyre Peninsula Natural Resources Management (NRM) Board, and DEWNR. The project covers more than 1.2 million hectares (ha) of the west coast of the Eyre Peninsula, forming part of the East meets West NatureLink. The WildEyre boundary falls within the western part of the planning area, and those DEWNR-managed lands included in the WildEyre project are Hambidge and Hincks WAs, and Shannon, Hincks, Peachna, Bascombe Well, and Barwell CP.

The overarching aim of the project is the recovery and conservation of large areas of habitat across the western Eyre Peninsula. Such large-scale connectivity could contribute to an increased bushfire risk in the landscape, and as such would require local land

managers to manage fire risk on their properties. The Conservation Action Plan for the WildEyre project identifies inappropriate fire regimes in mallee ecosystems as one of the 16 conservation objectives for the project, and aims to restore ecological fire regimes, minimise the risk of large fires destroying populations of threatened species, manage vegetation age classes, and regenerate fire dependent plants (Berkinshaw & Durant 2013). The Eyre Hills Project is a landcare project facilitated by Natural Resources Eyre Peninsula (DEWNR), working with private landholders to identify ecological values and conduct on-ground works in the Lincoln, Koppio, and Cleve Hills. Part of the Eyre Hills Project boundary falls within this planning area.

The Middleback Alliance is a formal cooperative partnership between Ecological Horizons Pty Ltd, which owns the Secret Rocks Heritage Agreement to the west of Ironstone Hill CP, OneSteel Manufacturing Pty Ltd's mining business, Arrium Mining, which operates several large open-cut iron ore mines in the Middleback Ranges to the east of Ironstone Hill CP, and DEWNR. The Middleback Alliance seeks to achieve complementary land use through coordinated management activities that extend beyond park boundaries.

2.3.2 Bushfire Planning

Fire management planning at a landscape-scale, regardless of tenure, will be addressed within Bushfire Management Area Plans (BMAP) prepared by BMC as a statutory requirement under the *Fire and Emergency Services Act 2005*. DEWNR fire management plans and BMAP will be complementary and each are developed in collaboration with the other. The planning area falls across three Bushfire Management Areas; the Upper Eyre Peninsula, Lower Eyre Peninsula, and Outback Bushfire Management Areas. BMAP for these areas are currently under development (CFS In Prep.-a, In Prep.-b, In Prep.-c).

Following the finalisation of this fire management plan, the risk treatments identified will be integrated within the BMAP for the planning area. DEWNR will ensure that the BMC are aware of all fire management planning and actions undertaken on DEWNR-managed land, and that proposed actions are incorporated within the BMC annual works plans supporting the implementation of the BMAP.

2.4 Partnership Agencies

An agreement exists between the state government public land management agencies (DEWNR, ForestrySA, and SA Water) and the CFS to cooperatively manage fire in high fire risk areas. *The Code of Practice for Fire Management on Public Land in South Australia* (DEWNR *et al.* 2012) aims to improve public safety, reduce the risk to private and community assets, and to reduce the impacts of inappropriate fire regimes on the environment.

Bushfire suppression in rural South Australia is led by the CFS, and DEWNR is a CFS Brigade under the *Fire and Emergency Services Act 2005* (FES Act). Responding to a fire in DEWNR reserves is undertaken jointly by DEWNR and other CFS Brigades. Local CFS brigades are heavily relied upon for fire suppression activities, particularly in the early stages of an incident. The cooperation, support, and understanding between CFS brigades, DEWNR, and the local community have been critical to successful fire suppression in the past, and will be critical to the success of this plan.

2.5 Consultation

DEWNR is committed to close cooperation and involvement with state and commonwealth organisations, special interest groups, and the broader community to achieve the goals of protection of life, property, and the environment.

Consultation is not a statutory requirement for fire management plans, but is DEWNR policy (DEWNR 2013c). Before the development of this plan commenced, the community were invited to submit their views on fire management in the Central Eyre Peninsula area. This was done to ensure that a wide range of issues were raised early and could be considered within the draft fire management plan.

The draft plan was released for public consultation for a period of six weeks in late 2013 and early 2014. The finalised plan was put forward for approval to the Native Vegetation Council's Fire Committee, before it was adopted for implementation by DEWNR.

2.6 Plan Review and Currency

This fire management plan will undergo a major review after ten years of implementation, or earlier if required. The *Fire Management Planning Project Management Procedure* (DEWNR 2013c) outlines the reasons for early review, which include major changes in risks or circumstances (such as might result from a major bushfire), changes in policy, or changes in land management objectives. A works program will be derived from the recommendations listed in this fire management plan and reviewed on an annual basis.

3 BUSHFIRE ENVIRONMENT

This section provides an overview of the planning area, including its location, land use, terrain, vegetation, fire history, weather, and climate. The potential impacts of climate change and conditions conducive to extreme fire intensity and behaviour are also discussed.

3.1 Description of the Planning Area

3.1.1 Location and Included Lands

The planning area is located in the central eastern area of the Eyre Peninsula, spanning from just south of Kimba to just north of Cummins (Figure 1). It incorporates over 213 300 ha of DEWNR reserves (Table 2). The included lands are divided into Fire Management Blocks (discussed further in Section 4.1.1), with management strategies for each block discussed in Appendix 1.

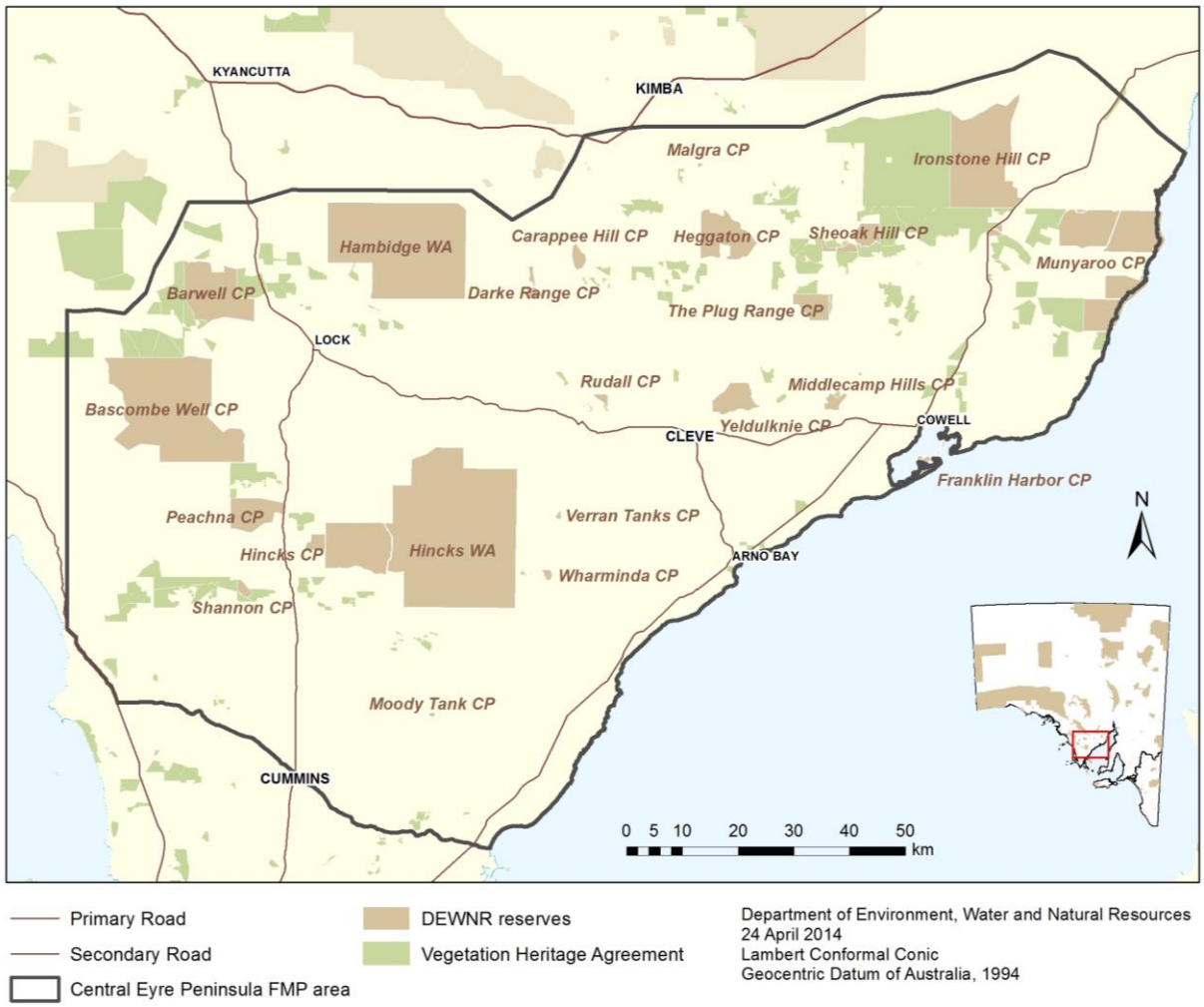

FIGURE 1 – CENTRAL EYRE PENINSULA PLANNING AREA

TABLE 2 – RESERVES INCLUDED IN THIS FIRE MANAGEMENT PLAN

Type	Name	Size (ha)
Conservation Park	Barwell	10 142
	Bascombe Well	33 430
	Carappee Hill	850
	Darke Range	700
	Franklin Harbor	1 356
	Heggaton	6 476
	Hincks	878
	Ironstone Hill	19 650
	Malgra	66
	Middlecamp Hills	835
	Moody Tank	77
	Munyaroo	20 139
	Peachna	4 584
	Rudall	357
	Shannon	544
	Sheoak Hill	2 427
	The Plug Range	2 582
	Verran Tanks	119
	Wharminda *	310
	Yeldulknie	3 283
Conservation Reserve	Lacroma	45
Wilderness Protection Area	Hambidge	37 908
	Hincks	66 658

** includes 42 ha of land earmarked for addition to Wharminda CP*

Land parcels that are earmarked for addition to the reserve system in the future have been included in this plan to ensure issues are identified and strategies for bushfire risk minimisation are established prior to dedication. Within the planning area, only Wharminda CP has land earmarked for addition.

In addition to proclaimed reserves, Crown land dedicated to, owned by, or under the control of the Minister for Sustainability, Environment and Conservation (MSEC) was identified for inclusion in this plan through a risk assessment process considering existing and potential issues for fire management. The proximity to built assets, presence of native vegetation, location, and size of the parcel was considered during this process. Parcels

deemed important for fire management issues have been included in the planning area. In this plan there are an additional 85 parcels (3 600 ha) of Crown lands included (Table 3).

Privately owned HA abutting DEWNR reserves or other included lands have been considered during the planning process; however, it is the responsibility of the individual owners to approve the adoption of the fire management plan for their land and undertake any proposed works. Sixty-one HA were considered in the planning process; the final number of HA owners agreeing to be included in the plan is still being resolved at time of writing.

Hereafter, 'included lands' means the proclaimed reserves and Crown lands managed by DEWNR that are located within the planning area, and HA where the owners have agreed to participate in this plan. All included lands are shown in Map 4 (Fire Management and Access; online).

3.1.2 Surrounding Land Use

Lands adjoining the planning area have a variety of uses including livestock grazing, cropping, quarrying, tourist facilities, rural and coastal living, and conservation (Map 1, Terrain, Tenure and Infrastructure; online).

On farmlands, particularly following spring and summer rains, grass and pasture can create a significant fuel load, resulting in quick-moving grass fires that may impact on adjacent native vegetation. The remaining native vegetation on farm properties in the planning area is confined to small isolated blocks, roadsides, and creeklines. Within the planning area there is significant vegetation along road reserves and on private lands that provide important habitat for threatened species. The fire planning for these non-DEWNR-managed environmental assets will be included by the CFS in the BMAP processes (see Section 2.3.2). Such areas of privately owned native vegetation often experience long periods without fire.

3.1.3 Terrain

Across the Eyre Peninsula soils are generally alkaline over a granite and gneiss basement (Twidale, Campbell & Foale 1987). The western side of the planning area is made up of undulating plains of parallel sand dunes with some exposed sheet limestone, while the lands to the north and east have some isolated hills, stony rises, and peaks amongst the dunes (Gillam & Urban 2009). The highest peak across the Eyre Peninsula is the granite outcrop of Carappee Hill (located within Carappee Hill CP, 495 m) (EP NRM Board 2009).

3.1.4 Climate and Fire Weather

The planning area experiences a Mediterranean climate of mild, wet winters and dry, warm to hot summers. Average annual rainfall varies from approximately 450 mm to the south and 300 mm to the north of the planning area (Schwerdtfeger 1985).

Over the summer months the subtropical high pressure belt is displaced to the south of Australia, and frontal activity results in northerly to south to south-east wind changes (known as summer 'cool changes'), with minimal to no rain (Griffin & McCaskill 1986). This frontal activity is often associated with significant fire weather: strong northerly winds, high temperatures (high 30°c or low 40°c) and low relative humidity. Occasionally, thunderstorms and heavy rainfall can be produced during summer as a result of an unstable 'moist infeed' at the middle to lower levels of the atmosphere, which is associated with tropical weather systems over northern Australia (Griffin & McCaskill 1986). Sea breezes can influence all

areas of the Eyre Peninsula and range from south easterlies on the eastern side of the Peninsula to south westerlies on the western side (Schwerdtfeger 1985).

TABLE 3 – OTHER LANDS INCLUDED IN THIS FIRE MANAGEMENT PLAN

Tenure	Custodian	Plan	Parcel	Area (ha)
Fee Simple Entirety	MSEC	Hundred of Solomon	Section 130	1
		Town plan 532501	Allotments 6 – 8	>1
		Town plan 551201	Allotment 11	>1
Reserve	MSEC	Deposited plan 26437	Allotment 117	81
		Hundred of Solomon	Section 193	77
		Hundred of Palkagee	Section 34	60
		Hundred of McLachlan	Section 114	25
		Hundred of Ulyerra	Sections 58 – 61, 63	271
Unalienated Crown land	MSEC	Deposited plan 79326	Allotments 85 – 87	227
		Deposited plan 83666	Allotments 82, 83, 85 – 89 Pieces 79, 80	1 784
		Hundred of Yalanda	Sections 21, 25	28
		Hundred of Heggaton	Sections 2 – 5, 7	182
		Hundred of Mangalo	Sections 21, 22	56
		Hundred of Pascoe	Sections 111 – 114, 117 – 119	96
		Hundred of Verran	Sections 85 – 89, 91	49
		Hundred of Peachna	Sections 1, 34, 45 – 51	91
		Hundred of Ponyton	Section 64	134
		Hundred of Moonabie	Section 7	512
		Hundred of Nilginee	Section 6	1
		Out of Hundreds (Whyalla)	Section 1575	9
		Town plan 532501	Allotments 1 – 5, 9 – 11, 14 – 18, 20 – 58	6
		Town plan 551201	Allotments 1, 10, 12 – 19, 21 – 27, 29 – 37	3

3.2 Climate Change and Bushfire

The Australian climate has shown to be changing (CSIRO & Bureau of Meteorology 2014), and that trend is mirrored in South Australia (DENR 2010b; Suppiah *et al.* 2006). Warmer and longer Fire Danger Seasons are likely (CSIRO & Bureau of Meteorology 2014), with reduced opportunities to undertake fuel management prescribed burns (Hennessy *et al.* 2005). However, the specific ways that climate change will impact all aspects of fire management are unknown: fuel accumulation rates, plant decomposition rates, fuel moisture, humidity,

and particularly rainfall patterns are either unknown or likely to be impacted in a complex manner, making accurate predictions difficult on a local scale (Enright & Fontaine 2014).

Climate change models predict the Eyre Peninsula will generally be warmer and drier (DENR 2010a; Suppiah *et al.* 2006); annual temperatures are predicted to increase by up to 1.3 °C by 2030, and rainfall could be reduced by as much as 15% (Suppiah *et al.* 2006). Summers are likely to be warmer and perhaps wetter (but summer rainfall has shown difficult to predict, and any increases in rainfall may be offset by increased rates of evaporation); autumns, winters, and springs are likely to be warmer and drier (Suppiah *et al.* 2006).

While land managers may grapple with the uncertainty of the climate predictions, adaptive management principles remain the most logical strategy for fire management programs.

3.3 Extreme Fire Conditions

Strong winds combined with high temperatures and low humidity increase the likelihood of extreme fire intensity and behaviour. Under such conditions, suppression activities are unlikely to be effective. Fires will be unpredictable and fast moving, will produce embers, and spot fires will occur some distance ahead of the fire front. There is a very high likelihood that people in the path of the fire will be at significant risk.

Buildings constructed to the requirements of the Australian Standard (AS3959) will not necessarily survive a bushfire event on every occasion, but are intended to reduce the risk to occupants (Eadie & Herbert 2009).

The following factors will contribute to a dramatic increase in fire behaviour:

- Fire Danger Indices of High and above
- Very High to Extreme overall fuel hazard levels
- Broad areas of continuous Very High to Extreme fuel hazard levels, making fire suppression less effective
- The presence of Very High to Extreme bark fuel hazard levels, increasing the chance of spot fires and crown fires
- Low humidity, decreased soil and fuel moisture, particularly during drought years
- Strong winds shifting direction during the course of a fire, typically southwest/east to north/northwest
- Lightning strikes as a result of increased thunderstorm activity in early and late summer
- Steep terrain.

3.4 Fire History

3.4.1 Mapping Fire Occurrences

Map 3 (Fire History; online) has been compiled from the latest DEWNR fire incident reports. The quality of this mapping varies, depending on the method of capture. It is important to note that only visible burn areas over 0.5 ha in size have been mapped and that mapping is limited to fires that have occurred on DEWNR-managed land or fires where DEWNR was in attendance. Consequently, the mapped fires should be regarded as a minimum estimate of fire occurrences.

The Fire History Map (Map 3; online) shows fires occurring in the last 10 years, the last fire for a particular location (regardless of year), and fire frequency (assuming no more than one fire per year).

3.4.2 Bushfires

Detailed records of recent fire incidents that have occurred within DEWNR-managed land are stored within the Department's fire reporting database. This database, along with spatial records, was reviewed during the development of this fire management plan.

Since 1950 a total of 93 bushfire incidents have been recorded on or close to DEWNR-managed land in the planning area. The largest recorded incidents (those greater than 10 000 ha) are listed here.

- 1953: bushfire burnt 24 229 ha in and around Hincks WPA, including 8 382 ha of private land
- 1959: bushfires burnt 53 565 ha in and around Hincks WPA and CP, 42 825 ha on DEWNR-managed land (that is 68% of the total reserve area)
- 1965: bushfire burnt 21 005 ha in and around Hambidge WPA
- 1972: bushfire burnt 25 313 ha in and around Ironstone Hill CP: 2 445 ha of DEWNR-managed land, 13 393 ha of Heritage Agreements, and a further 9 475 ha on other private land
- 1977: bushfire burnt 13 775 ha in Hincks WPA
- 1980: bushfire burnt 11 959 ha in and to the North of Sheoak Hill CP, burnt 10 321 ha of Heritage Agreements
- 1983: bushfire burnt 10 447 ha in Hincks WPA
- 1991: bushfire burnt 15 675 ha in Ironstone Hill CP
- 2000: bushfire burnt 28 500 ha in Hambidge WPA (that is 75% of the total reserve area)

There is also anecdotal evidence of additional unmapped fires with ignition causes including lightning and farm machinery.

3.4.3 Prescribed Burning

Since 2006, prescribed burning has been undertaken for landscape protection within four of the 23 reserves included in this fire management plan; these are Bascombe Well and Heggaton CP, and Hambidge and Hincks WAs. In addition, prescribed burns have been carried out on Heritage Agreements adjacent to Ironstone Hill CP, and on Crown land located to the north-east of Heggaton CR (Hundred of Yalanda). To date, 14 prescribed burns have been undertaken within the planning area, totalling 6 880 ha.

3.5 Vegetation Communities

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 (ESCAVI 2003). The Major Vegetation Sub-group (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. Within this fire management plan MVS

have been used as these groupings are accepted by fire managers for predicting maximum overall fuel hazard levels (see Section 4.2.2).

Map 2 (Vegetation Communities; online) shows the distribution of MVS in the planning area. There are 21 MVS mapped by DEWNR within the planning area; 13 of which are considered fire-prone (DEWNR 2013a). Table 4 lists the species composition for each of these fire-prone MVS.

TABLE 4 – DOMINANT SPECIES LAYERS FOR FIRE-PRONE MAJOR VEGETATION SUB-GROUPS

MVS No.	MVS Name	Dominant Species Layers
5	Eucalyptus forests with a grassy understorey	*Eucalyptus petiolaris, E. odorata*
9	Eucalyptus woodlands with a grassy understorey	*Eucalyptus camaldulensis* var. *camaldulensis, E. gracilis, Callistemon rugulosus*
12	Callitris forest and woodlands	*Callitris gracilis, C. verrucosa, Eucalyptus incrassata, E. leptophylla*
15	Melaleuca open forests and woodlands	*Melaleuca armillaris*
26	Casuarina and Allocasuarina forest and woodlands	*Allocasuarina verticillata*
27	Mallee with hummock grass	*Eucalyptus calycogona, E.dumosa, E. socialis, E. yalatensis, E. oleosa, E. incrassata, E. leptophylla, E. phenax, E. brachycalyx, E. pileata*
28	Low closed forest or tall closed shrublands (including Acacia, Melaleuca and Banksia)	*Callistemon rugulosus, Melaleuca halmaturorum*
29	Mallee heath and shrublands	*Eucalyptus brachycalyx, E. gracilis, E. oleosa, E. calcareana, E. diversifolia, E. calycogona, E. phenax, E. cretata, E. dumosa, E. leptophylla, E. yalatensis, E. socialis, E. incrassata, E. odorata, E. peninsularis, E. pileata, E. porosa, Melaleuca acuminata, M. pauperiflora, M. lanceolata*
33	Arid and semi-arid hummock grasslands	*Triodia compacta, T. irritans, Frankenia pauciflora var fruticulosa, Gahnia lanigera*
36	Temperate tussock grasslands	*Austrostipa* ssp.
49	Melaleuca shrublands and open shrublands	*Melaleuca brevifolia, M. decussata, M. halmaturorum, M. lanceolata, M. uncinata, Olearia axillaris, Leucopogon parviflorus*
55	Mallee with an open shrubby understorey	*Eucalyptus gracilis, E. oleosa* ssp. *oleosa*

MVS No.	MVS Name	Dominant Species Layers
61	Mallee with a tussock grass understorey	*E. porosa*

3.6 Values and Assets

3.6.1 Visitor Use

The reserves of the Central Eyre Peninsula receive low visitor numbers compared to other areas around the state. Activities undertaken by visitors include four-wheel driving, picnicking, camping, viewing wildlife, visiting historic ruins, and conducting scientific research and monitoring. Hincks WPA and Bascombe Well, Carrappee Hill, Darke Range, and Munyaroo CP receive the majority of visitors, mainly for four-wheel and motorbike driving activities and camping.

Management Strategies	
Visitor Use	1. Consider reserve closures when significant fire weather is forecast to maximise visitor safety (at the discretion of the Chief Executive).
	2. Implement appropriate fuel management strategies as shown Map 4 (Fire Management and Access; online) to increase visitor safety.

3.6.2 Built Assets

There are a number of built assets at risk from bushfires within the reserves, including:

- DEWNR infrastructure such as shelters, barriers, signs, campsites, toilet blocks, water tanks, and fencing
- historical ruins in Bascombe Well and Verran Tanks CP
- historical tanks in Verran Tanks and Moody Tank CP.

DEWNR will undertake fire management works and activities to minimise the likelihood of fire impacting built assets (both public and private buildings) if required.

Appendix 1 details significant assets within and adjacent to DEWNR-managed land and the corresponding fire management strategies. Map 1 (Terrain, Tenure and Infrastructure; online) shows the location of assets within the planning area.

Management Strategies	
Built Assets	3. Implement fuel management strategies for asset protection consistent with the fire management zoning shown on Map 4 (Fire Management and Access; online) and other risk mitigation works as detailed in Appendix 1.
	4. Through the BMAP process, encourage adjacent property owners to work with CFS and local government to implement appropriate and coordinated fire management works on their own land to minimise the threat of bushfire.

3.6.3 *Cultural Heritage*

Information on Aboriginal and European heritage is collected during prescribed burn planning as part of the Environmental Assessment (refer to Section 5.3.4)(DEWNR 2013b). Any fire operations must be in accordance with the *Protection of Cultural Heritage Procedure* (DEWNR 2013c).

Aboriginal Heritage

The land comprising the Central Eyre Peninsula forms part of the country of the Barngarla and Nauo people as described by Tindale (1974).

The Aboriginal Affairs and Reconciliation Division of the Department of Premier and Cabinet maintain the Central Archive, which includes the Register of Aboriginal Sites and Objects (the Register). It should be noted that the Register is not a comprehensive record of all Aboriginal sites and objects in South Australia, therefore sites or objects may exist in the planning area, even though the Register does not identify them. When implementing this plan, DEWNR will comply with the *Aboriginal Heritage Act 1988* to facilitate the protection of sites during bushfire suppression and prescribed burns.

European Heritage

Throughout the planning area there are many structures and remains of structures that are of cultural and heritage value, providing examples of European history in the region: Bascombe Will CP contains a homestead building and several ruins, Munyaroo CP contains stone ruins, and Verran Tank CP contains a stone tank. The location of these and other sites across the state are recorded on the South Australian Heritage Register. The majority of the heritage structures are built of stone, and therefore are not generally fire prone. Many are sited in cleared areas offering some protection from bushfire.

Management Strategies

Cultural Heritage

5. Implement fuel management strategies appropriate for the protection of cultural assets as shown on Map 4 (Fire Management and Access; online).
6. During bushfires, ensure suppression strategies take into account cultural assets in order to minimise impacts from these activities and undertake post-fire rehabilitation.

3.6.4 *Natural Values*

Semi-arid mallee

The relationship between fire regime elements and habitat requirements for fauna is generally not well understood across a range of habitat types (Clarke 2008). Recent investigations into the effects of different landscape-scale (four kilometre radius) fire mosaic characteristics (e.g. the proportional extent of fire age classes, the diversity of fire age classes, the extent of the dominant vegetation type, and rainfall history) on the diversity of bird (Taylor *et al.* 2013; Taylor *et al.* 2012), small mammal (Kelly *et al.* 2012) and reptile (Nimmo *et al.* 2013) species of semi-arid mallee, have advanced our understanding in this area. These studies suggest that in semi-arid mallee ecosystems, management practices that promote mid-age (11 to 35 years post-fire) and older vegetation (older than 35 years) are likely to benefit bird (Taylor *et al.* 2013) and mammal (Kelly *et al.* 2011) species richness. Older mallee vegetation is heterogeneous; it includes dense, patchy cover of spinifex,

complex ground litter and larger trees, which provide high quality habitat components and associated attributes that take decades to develop (Haslem *et al.* 2011).

Post-fire changes in mallee vegetation influence fire hazard and faunal habitat in different ways. Haslem *et al.* (2011) found that in mallee habitats, the cover or abundance of most primary fuel sources does not increase substantially beyond around 30 years post-fire. They also found that leaf litter and spinifex grass *Triodia scariosa*, which function as both habitat and fuel, increase rapidly after fire followed by a plateau or slow decline after 20 to 30 years. However, important habitat attributes change in ways that affect faunal occurrence for over 100 years; for example, live tree stems do not develop hollows until 40 years, after which time the density of live hollow-bearing stems increases steadily (Haslem *et al.* 2011).

For reptiles, a larger scale (e.g. greater than 1 000 ha) mosaic of areas of mid-successional vegetation may be important in supporting the greatest range of fire sensitive species, but such an objective needs to be balanced against the short-term negative effects of large fires and the potential impact on early successional nocturnal burrowing species (Smith, Bull & Driscoll 2013), together with the documented preference of birds for older vegetation (Nimmo *et al.* 2013). In recently burnt landscapes, species response may be driven by climate factors, particularly time to rainfall post-fire.

Fine scale spatial patterns in the patchiness of fires and the proximity of burnt sites to source populations facilitate post-fire recovery of bird populations (Watson *et al.* 2012). This effect must be balanced against the potential to subject regenerating vegetation to higher grazing pressures than that seen in larger fires (Cohn & Bradstock 2000), which could result in altered post-fire plant species successional patterns.

Maintaining sufficient habitat at a suitable seral stage within the landscape is a key requirement for species conservation. Accordingly, a key management challenge for fauna conservation in mallee ecosystems is to ensure a continuous provision of mid-age vegetation in the landscape, while maintaining extensive areas of older vegetation (Taylor *et al.* 2013). Large proportions of recently burned vegetation, or a high diversity of age classes, will negatively affect more bird species than they would aid (Taylor *et al.* 2013). Importantly, few bird species are strongly associated with landscapes containing extensive areas of recently burnt vegetation (Taylor *et al.* 2013). The role of fuel reduction, therefore, in protection of areas of significant or longer unburnt habitat, or as a means of preventing reserve-scale fires, needs to be considered as a management strategy (Kelly *et al.* 2012).

Management Strategies

Semi-arid Mallee

7. Implement landscape protection prescribed burns to mitigate the risk of a whole block/reserve/area burning in a single bushfire event.
8. Conduct prescribed burning to improve diversity of vegetation age class, including protection of long-unburnt areas of vegetation.

Flora, Fauna and Ecological Communities

DEWNR has a central database (the Biological Databases of South Australia) where specimen and observation records for South Australian flora and fauna are stored. It contains records from several data sources, including the Biological Survey of South Australia, State Herbarium, SA Museum, BirdLife Australia (previously Birds Australia), and

Birds SA, as well as research data sets and opportunistic sightings of significant flora and fauna.

Additional data held by research organisations and non-government organisations may be used to inform fire management planning (and prescribed burn planning) where appropriate and possible.

Fire response information, where known, is included for species and communities of conservation significance in Appendices 3, 4 and 5.

In this plan 'of conservation significance' is used to describe rated populations or species of flora and fauna as well as vegetation communities. These may be:

- nationally rated, that is, listed as Threatened (with a rating of Extinct, Critically Endangered, Endangered, or Vulnerable) under the federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- South Australian rated, listed as Threatened (with a rating of Endangered, Vulnerable, or Rare) under the NPW Act, 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 *DEWNR Provisional List of Threatened Ecosystems of South Australia* (DEH 2005).

While fire is a natural component of the ecosystem within the South Australian environment, the ecological effect of fire on the plants, animals and ecosystems is strongly influenced by the fire regime (DEWNR 2013a). Fire regimes consist of multiple components that interact across different temporal, spatial and physical scales. Elements of fire regimes include the time since the last fire, the time between successive fires, the intensity of the fire, the season in which a fire occurs, and the spatial extent and pattern of the fire (DEWNR 2013a). These elements contribute to the conditions required for the germination and flowering of different plant species, which in turn influences the displacement or promotion of certain fauna due to localised habitat changes, among other processes (DEWNR 2013a).

This plan is based on the best available information and guided by ecological fire regimes that contain spatial and temporal elements to provide ecologically sustainable outcomes for biodiversity conservation.

In addition to the information provided within the appendices, species response and ecological information for selected significant flora, fauna, and ecological communities have been detailed in the following section. These are species listed as threatened at a national or state level for which appropriate fire management is regarded as being critically important for their long-term conservation. These species include **Malleefowl** (*Leipoa ocellata*), **Sandhill dunnart** (*Sminthopsis psammophila)*, **Inland green-comb spider-orchid** (*Caladenia tensa*) and **Fat-leaf wattle** (*Acacia pinguifolia*).

DEWNR is committed to increasing its capacity to incorporate species' requirements into improved ecological fire management. The actions in this plan relate specifically to fire management actions on DEWNR-managed land; nevertheless DEWNR will work with the community on landscape-scale biodiversity conservation.

Malleefowl

The Malleefowl is listed as Vulnerable at both state and national levels. These birds have disappeared from much of their former range across southern Australia, with habitat

clearance the major cause of the decline in the distribution of the species. The national recovery plan notes that mallee habitats are particularly important for the remaining Malleefowl populations and that such habitats are capable of carrying large and intense fires (Benshemesh 2007). The birds are poor fliers and as such individuals are likely to be killed in fire events, and if they do survive they are unlikely to be able to relocate to unburnt refuges. In addition, the leaf litter material available for nesting is greatly reduced following fire, and the resultant burnt habitat gives greater exposure to predators.

The degree of fragmentation of the remaining Malleefowl habitat is of particular concern for conservation of the species. Bushfires which burn a large area of native vegetation in a single event present a significant threat to Malleefowl in the planning area.

Malleefowl populations on Eyre Peninsula are monitored under the National Malleefowl Monitoring System, a project that operates at a national scale across four states and over 100 sites, collecting data and providing information on trends in Malleefowl abundance. This information allows assessments to be made on the conservation status of the species across their range and to identify areas in which the bird is declining. Four sites, or grids, are located on Central Eyre Peninsula: two are within Heritage Agreements not included in the blocks for this plan, and one grid is located in Hincks CP and one in Munyaroo CP. These grids are monitored annually by community volunteers and staff from DEWNR over the last 10 to 15 years. Monitoring data for the Central Eyre Peninsula population have shown a decline in Malleefowl breeding activity, however, this has generally stabilised over the last seven or so years, with some fluctuations (Gillam 2013, pers. comm.).

Management Strategies	
Malleefowl	9. Implement fire management strategies (e.g. fuel management) that will reduce the likelihood of local extinctions of Malleefowl from a single bushfire event.
	10. Conduct prescribed burning to improve diversity of vegetation age class, including protection of long-unburnt areas of vegetation.
	11. Develop an Ecological Fire Management Strategy for Malleefowl.

Sandhill Dunnart

The Sandhill dunnart is listed as Endangered nationally and Vulnerable in South Australia. Eyre Peninsula is one of the two locations where the species is known to occur in South Australia, the other being the Great Victoria Desert. On Eyre Peninsula, individuals were trapped near Cowell and the Middleback Ranges (adjacent Ironstone Hill CP) in 2000 (Churchill 2001).

The Eyre Peninsula populations have been found in sandy dunes, with large spinifex (*Triodia* spp.) hummocks (aged between eight and 20 years) needed for breeding. Such habitats are strongly influenced by fire history, and as such the recovery plan lists 'change in fire patterns' and 'fire age of spinifex' as some of the potential threats to the species (Churchill 2001).

Within the planning area, in addition to the known population at Middleback Ranges (adjacent Ironstone Hill CP), likely habitat has been identified at Hambidge and Munyaroo CP (Churchill 2001).

The following management strategies have been adopted from the *Ecological Fire Management Strategy for the Sandhill Dunnart (Sminthopsis psammophila)* (DENR 2012).

Management Strategies

Sandhill Dunnart

12. Implement fire management strategies (e.g. fuel management) to protect key habitat of the Sandhill dunnart from burning a single bushfire event.
13. Implement fire management strategies (i.e. fuel management) to maintain suitable age classes of tussocks for known populations of Sandhill dunnart.
14. Trial the use of small scale ecological prescribed burns to improve Sandhill dunnart habitat in areas where habitat quality is perceived to have declined.

Threatened Mallee Birds

Mallee woodlands are the dominant vegetation formation on Eyre Peninsula and provide habitat for many species of conservation significance. The composition of bird communities in tree mallee vegetation aged between 10 and 30 years differs from communities occupying older vegetation with a sparser understorey and taller canopy (Woinarski 1999). Overviews of the management of mallee birds have recommended that fire regimes maintain a mosaic of vegetation ages, which bias the retention of mid-age classes while also maintaining extensive areas of older vegetation (Taylor *et al.* 2013; Woinarski 1989). Management to protect older vegetation is supported and essential if future climate change results in increased fire frequency (Pitman, Narisma & McAneney 2007; Taylor *et al.* 2013; Taylor *et al.* 2012). Inappropriate fire regime (spatial/temporal/intensity) is considered one of the most serious threatening processes for threatened mallee birds and has the potential to cause significant impacts in the fragmented landscape of the Eyre Peninsula. It should also be noted that maintaining a mosaic of age classes is unlikely to be achieved by unplanned, natural, random burns alone (Woinarski 1989).

Successful conservation of threatened mallee bird populations is likely to be best addressed by managing habitats in a healthy state, this may generally be achieved through maintaining a mosaic of habitat age classes at a landscape-scale. However, it should be noted that several species recorded within the planning area demonstrate a bias toward long unburnt habitat (see Appendix 4) and species with specialised habitat needs require habitat-scale fire management.

Management Strategies

Threatened Mallee Birds

15. Implement fire management strategies (e.g. fuel management) to enhance key mallee woodland bird habitat, and prevent significant habitat from burning in a single bushfire event.

Threatened Orchids

Several threatened orchid species exist within the planning area, including Metallic sun-orchid (*Thelymitra epipactoides*) and Winter spider-orchid (*Caladenia brumalis*). Within the planning area they occur on DEWNR-managed land, privately owned land, and roadside and rail reserves. A state recovery plan has been drafted for 23 species of Eyre Peninsula's threatened flora species, including the Metallic sun-orchid and Winter spider orchid (Pobke 2007).

Metallic sun-orchids are known to flower abundantly after late summer fires, and are post-disturbance colonisers (Pobke 2007). Known populations of the orchid in Central Eyre Peninsula reserves only occur in Barwell CP, with other populations occurring on roadsides, rail reserves and land managed by SA Water and SA Power Networks.

Winter spider-orchid is known to occur in Franklin Harbor CP and believed to occur in Carappee Hill, although genetic testing is required to verify this. Due to the small size of its known range, all known Winter spider-orchid habitat is considered critical to its survival (Pobke 2007). Research is needed to identify the anecdotal relationship between fire and seed germination for this species (Pobke 2007).

While fire management strategies may be used to enhance populations of threatened orchids, the potential benefits in improved habitat quality must be balanced against the potential to subject regenerating vegetation to higher grazing pressures (Cohn & Bradstock 2000). Post-fire management may be required to prevent excessive grazing on the subsequent regrowth. When prescribed burns are planned, the impacts of fire management, including temporal and spatial elements of the fire regime, and post-fire grazing, will be considered.

Specific information on how threatened orchids respond to fire is also included in Appendix 3.

Management Strategies

Threatened Orchids	16. Implement fire management strategies (e.g. fuel management) to minimise the spread of bushfire through key populations of threatened orchids.
	17. Trial the use of small scale prescribed burns to improve threatened orchid habitat in areas where habitat quality is perceived to have declined.
	18. Monitor the effects of fire on orchid populations and use this information to inform the DEWNR flora and fauna vital attributes database for use in Ecological Fire Management Guidelines (Appendix 3).

3.7 Abundant and Pest Species Management

3.7.1 Fauna

Some fauna species (exotic and native) flourish in post-fire conditions. The impact these species have on biodiversity will depend on a number of factors, including the pre-fire abundance of the species and the characteristics of the fire (e.g. fire size, shape, season, intensity, and location). Herbivores such as kangaroos (*Macropus* spp.) for example, can benefit from post-fire plant regeneration, finding highly palatable food within the recently burnt area (Gill & Catling 2002; Murphy & Bowman 2007).

Within the planning area, a number of pest fauna have been observed. These include the Common starling (*Sturnus vulgaris*), House sparrow (*Passer domesticus*), Red fox (*Vulpes vulpes*), Cat (*Felis catus*), House mouse (*Mus musculus*), Fallow deer (*Dama dama*), Feral goat (*Capra hircus*), Black rat (*Rattus rattus*) and European rabbit (*Oryctolagus cuniculus*).

Prior to any prescribed burn, potential impacts are considered to determine whether post-fire management is required. Management of abundant and pest fauna is implemented based on a risk assessment. Prescribed burning practices can provide opportunities for research and monitoring to be undertaken to inform and improve the management of flora and fauna post-fire. Section 5.3.4 provides more information on burn preparation, while Section 7.2 details the research aspects of DEWNR fire management.

3.7.2 Flora

DEWNR has responsibility for managing weeds on DEWNR-managed lands. Weeds can have significant impacts on native vegetation and ecological communities within remnants (DPC 2003), and may impact fauna by changing habitat composition and functionality. Generally, the vegetation within reserves in the planning area are relatively intact with some evidence of edge effects showing in weed distribution. Disturbance (e.g. grazing, nutrient inputs, erosion, fragmentation) is likely to promote weed invasion, and fire in areas already affected by one or more of these disturbance mechanisms is likely to lead to weed proliferation (Hobbs 1991; Hobbs 2002; Hobbs & Huenneke 1992). However, it is also well known that fire is an important source of disturbance in natural systems (Hobbs & Huenneke 1992) and that fire can be used as a tool for weed management, prescribed as part of an integrated approach (Hobbs 2003). An integrated approach to weed management involves the planned use of fire coupled with minimum disturbance weed control techniques (including herbicide, biological, mechanical, and physical control, i.e. hand pulling) noting that the combination, timing, and application of methods is likely to differ depending on the target species and to minimise off-target damage.

Some of the most significant weed species within the planning area include:

- African boxthorn (*Lycium ferocissimum*)*#
- African daisy or South African daisy (*Senecio pterophorus*)
- African fountain grass (*Cenchrus setaceus*)
- African lovegrass (*Eragrostis curvula*)
- Aleppo pine (*Pinus halepensis*) #
- Boneseed (*Chrysanthemoides monilifera* ssp. *monilifera*)* #
- Bridal creeper (*Asparagus asparagoides*)* #
- Buffel grass (*Cenchrus ciliaris*)
- Cape weed (*Arctotheca calendula*)
- Coolatai grass (*Hypharrhenia hirta*) #
- European olive (*Olea europaea* ssp. *europaea*) #
- False caper (*Euphorbia terracina*) #
- Gorse (*Ulex europaeus*)* #
- Horehound (*Marrubium vulgare*) #
- Italian buckthorn (*Rhamnus alaternus*)
- Longstyle feather grass (*Cenchrus longisetus*)

- Myrtle-leaf milkwort (*Polygala myrtifolia*)
- One-leaf cape tulip (*Moraea flaccida*) #
- Perennial veldt grass (*Ehrharta calycina*)
- Quaking grass (*Briza maxima*)
- Salvation jane or Paterson's curse (*Echium plantagineum*) #
- Slender thistle (*Carduus tenuiflorus*) #
- Texas needle grass (*Nassella leucotricha*) #
- Veldt grass (*Ehrharta longiflora*).

Asterisks (*) indicate Weeds of National Significance (WoNS), hash symbols (#) indicate weeds declared under the *Natural Resources Management Act 2004*.

Despite its significance in other areas of the state, at the time of writing, Buffel grass (*Cenchrus ciliaris*) is not considered to be a major fire management concern within the planning area, as infestations are generally small and isolated (Biosecurity SA 2012). Management of this species may be needed in the future, and will be considered when this plan is reviewed (after ten years of implementation). In northern South Australia, Buffel grass forms dense monocultures, changes fire regimes, and displaces native plants. If this species infests lands within the planning area, management actions will be considered and this plan amended as appropriate.

Fire management guidelines for the most significant weeds are included in Appendix 3.

Significant weeds within prescribed burn areas will be listed in the individual prescribed burn plans and mitigation actions will be identified in those plans (DEWNR 2013b,2013c). Post-fire weed control will be conducted where necessary; however, investment in weed control will be based on the reserves' overall habitat quality and also weed management priorities within the broader region. Monitoring programs should ensure that vulnerable areas are evaluated pre- and post-fire to determine what post-fire weed control is required and to assess the effectiveness of control efforts.

3.7.3 Plant Pathogens

Plant pathogens have not been identified as a major threat to biodiversity in the planning area. The risk of Phytophthora (*Phytophthora cinnamomi*) is low due to sandy soils and low rainfall, however, it is suspected to occur in southern parts of Eyre Peninsula, and as such precautions should be taken with plant and equipment sourced from other areas.

DEWNR has a Standard Operating Procedure that outlines hygiene procedures and guidelines to minimise the risk of Phytophthora infestation and spread in DEWNR reserves (DEH 2002).

Management Strategies

Abundant and Pest Species

19. During prescribed burn planning refer to guidelines for management of introduced flora species (Appendix 3).
20. Consider the use of fire as a tool that forms part of integrated pest management strategies.
21. Consider the likely post-fire responses and impacts of weed species and implement post-fire weed control and monitoring accordingly (subject to regional priorities).
22. Collect relevant information during prescribed burn planning on introduced fauna and undertake a risk assessment to determine the need for post-fire management, including predator control where appropriate.
23. Adhere to the *Standard Operating Procedure – Phytophthora Threat Management (SOP-002)* (DEH 2002) where plant and equipment are sourced from other areas known to have Phytophthora.
24. Ensure hygiene practices are implemented for plant and equipment to reduce the spread of weeds or pathogens into/within the planning area. Refer to the *Phytophthora Vehicle Disinfection Unit Operating Procedure* (DEH 2003).

4 RISK

4.1 Risk Assessment

A risk assessment was conducted in line with the *Risk Assessment in Fire Management Planning Procedure* (DEWNR 2013c), as a requirement for 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 in the planning area, including the risk of no action. The risk assessment considered visitor use, assets (built, cultural, and natural values), and neighbouring properties for all included lands in the planning area. Risk assessment is a function of likelihood and consequence.

- Likelihood considers the possibility that a fire-related risk will occur and is assessed as Rare, Unlikely, Possible, Likely, or Almost Certain.
- Consequence considers bushfire risk based on impacts to life, property and environmental values and is ranked as Insignificant, Minor, Moderate, Major, or Critical.
- Based on the derived likelihood and consequence ratings, the overall risk for each scenario is determined using a Risk Matrix and assigned a risk ranking of Low, Medium, High, Very High, or Extreme.

The *Risk Assessment in Fire Management Planning Procedure* (DEWNR 2013c) provides more information on this process. Risk assessment is ongoing and continually reviewed to reflect the changing landscape. The application of fire management zones as well as recommended actions and works in this plan are derived from the risk assessment process.

4.1.1 Fire Management Blocks

The planning area has been divided into 33 fire management blocks to ensure that information and issues unique to a particular area have been addressed (Table 5). Block boundaries are based on access and the practicalities of implementing fire management objectives.

TABLE 5 – FIRE MANAGEMENT BLOCK INFORMATION

Block	Included lands	Size (ha)
Balumbah Block	Crown land	78
Barwell Block	Barwell CP, Crown land	16 821
Bascombe Well Block	Bascombe Well CP, HA	39 024
Caralue Township Block	Crown land	104
Carappee Hill Block	Carappee Hill CP	850
Coompana Reservoir Block	Crown land	228
Darke Range Block	Darke Range CP	702
Franklin Harbor Block	Franklin Harbor CP	1 357
Gypsum Hill Block	Crown land	81
Hambidge Block	Hambidge WPA	37 908

Block	Included lands	Size (ha)
Heggaton Block	Heggaton CP	6 476
Hincks Block	Hincks WPA & CP	67 593
Ironstone Hill Block	Ironstone Hill CP, Crown land	21 956
Lacroma Block	Lacroma CP	50
Malgra Block	Malgra CP	66
Middlecamp Hills Block	Middlecamp Hills CP, HA	920
Moody Tank Block	Moody Tank CP	77
Munyaroo North Block	Munyaroo CP, HA, Crown land	15 081
Munyaroo South Block	Munyaroo CP, HA	10 055
Munyaroo West Block	Munyaroo CP, HA	3 618
Peachna Block	Peachna CP, HA	4 765
Rudall Block	Rudall CP, HA	402
Secret Rocks Block	HA, Crown land	34 968
Shannon Block	Shannon CP, HA	3 898
Sheoak Hill Block	Sheoak Hill CP, HA	5 633
Taraleah Block	Crown land	60
The Plug Range Block	The Plug Range CP, HA	3 383
Tooligie Block	Crown land	94
Verran Block	Crown land	51
Verran Tanks Block	Verran Tanks CP	119
Wharminda Block	Wharminda CP	310
Yalanda Hill Block	Crown land	254
Yeldulknie Block	Yeldulknie CP	3 283

4.2 Fuel Hazard

4.2.1 Overall Fuel Hazard

The overall fuel hazard is used in fire management planning to determine the level of risk posed by bushfire to life, property, and environmental assets in the risk assessment. The overall fuel hazard is derived from the assessment of four fuel layers in vegetation: Surface, Near-surface, Elevated and Bark fuel (Figure 2). Canopy fuel is not measured as part of overall fuel hazard.

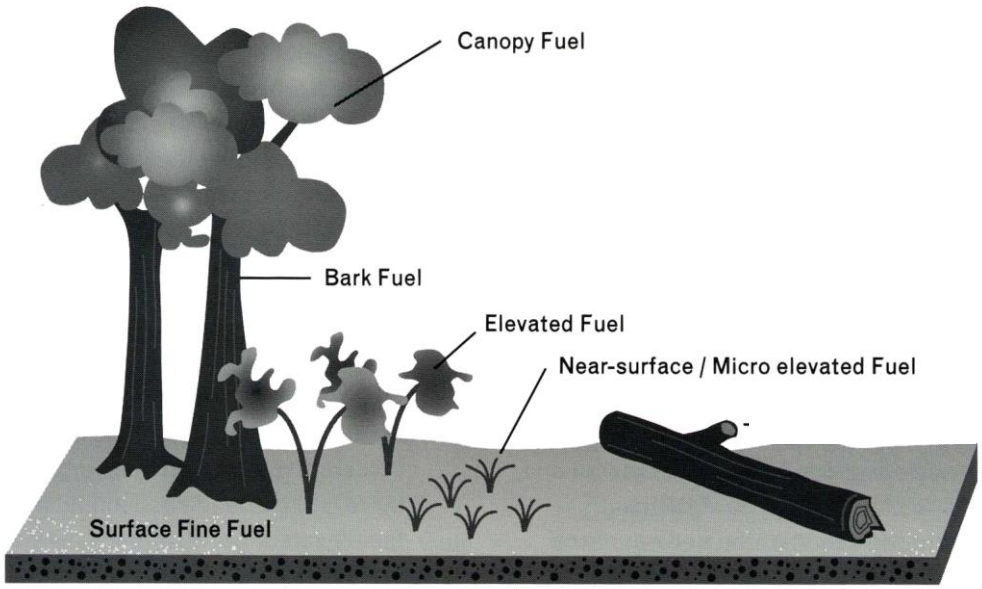

FIGURE 2 – COMPONENTS OF FUEL IN VEGETATION

(Tolhurst & Cheney 1999)

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 (DENR 2011d). Each layer, as well as the overall fuel hazard can be assessed as: Low, Moderate, High, Very High, or Extreme (DENR 2011d).

Fuel loads within a particular area will be influenced by the types of vegetation (floristics) found in the landscape. The majority of vegetation communities within the planning area are dominated by mallee communities with a relatively intact understorey, which corresponds with Very High to Extreme elevated fuels. This helps to explain the history of high intensity bushfires in this area (see Section 3.4.2).

Research conducted by McCarthy and Tolhurst (2004) investigated the effectiveness of fuel reduction burning in Victoria, which concluded that maintaining overall fuel hazard levels at High or less aids in slowing the rate of spread of a subsequent bushfire. To achieve long-term fuel reduction effects, the researchers recommended that the focus of fuel reduction burning should be on the reduction of bark and elevated fuels, as these fuel layers are likely to contribute to the overall fuel hazard.

For more information on fuel hazard assessment methodology and evaluation refer to the Overall Fuel Hazard Guide for South Australia (DENR 2011d). DEWNR maintains a database containing fuel hazard assessment records. The process for recording and submitting fuel hazard data is explained in the *Fuel Hazard Assessment Procedure* (DEWNR 2013c).

4.2.2 Likely Maximum Overall Fuel Hazard

Maximum overall fuel hazard levels have been estimated for fire-prone MVS within the planning area in order to provide a guide for fire management (Table 6). The process used to derive MVS is described in Section 3.5 and the extent of each MVS within the planning area is shown on Map 2 (Vegetation Communities; online).

The likely maximum overall fuel hazard is based on on-ground sampling and vegetation mapping within the planning area, adjusted to account for the time since last fire. It can be used for planning and incident management; however, this estimate should be supported

by on-ground inspection as areas of vegetation remain unmapped and it is likely that other factors (such as high weed density, or above-average rainfall) will influence the overall fuel hazard.

TABLE 6 – LIKELY MAXIMUM OVERALL FUEL HAZARD FOR FIRE-PRONE MVS IN THE PLANNING AREA

MVS No.	MVS Name	Likely Maximum Overall Fuel Hazard	Significant Fuel Layers
5	Eucalyptus forests with a grassy understorey	VH	Surface Near-surface
9	Eucalyptus woodlands with a grassy understorey	VH	Surface Near-surface
12	Callitris forest and woodlands	H	Elevated
15	Melaleuca open forests and woodlands	H	Elevated
26	Casuarina and Allocasuarina forest and woodlands	H	Elevated
27	Mallee with hummock grass	VH	Near-surface
28	Low closed forest or tall closed shrublands (including Acacia, Melaleuca and Banksia)	H	Elevated
29	Mallee heath and shrublands	E	Elevated
33	Arid and semi-arid hummock grasslands	VH	Near-surface
36	Temperate tussock grasslands	H	Surface Near-surface
49	Melaleuca shrublands and open shrublands	VH	Elevated
55	Mallee with an open shrubby understorey	H	Near-surface Elevated
61	Mallee with a tussock grass understorey	H	Surface Near-surface

4.2.3 Potential for Fire Impact

The planning area is sparsely populated, with few inhabited dwellings and remote townships. Those that are present are mostly at a distance from DEWNR-managed lands. However, large tracts of native vegetation are present, so large-scale, high intensity bushfires are possible. While the likelihood of private citizens being injured or killed by bushfires moving out of DEWNR-managed lands is low, if people were caught in a bushfire the consequences could be dire.

The potential for significant fire impact is higher where there is continuous vegetation in the landscape. This occurs in between Barwell, Bascombe Well, and Peachna CP, and Hincks WPA, where private lands including HA contribute to a continuous corridor of native vegetation.

The impact of fire on mallee flora and fauna can vary greatly. In mallee habitats greater than 30 years of age (post-fire), there is little additional fuel accumulation. For example, at approximately 20 years post-fire spinifex (*Triodia* spp.) hummocks start to become sparse and open (DENR 2011b), altering both the contiguous fuels available to carry a fire, and the suitable habitat for fauna such as the Sandhill Dunnart (see Section 3.6.4 for more information about significant flora and fauna in the planning area). Other habitat attributes that can be affected by fire regime include the development of hollows in trees, which can in turn influence faunal occurrence for over 100 years (Haslem *et al.* 2011).

4.2.4 Influence of a Changing Climate

There is potential for climate change to influence fire regimes and fire management practices into the future (see Section 3.2) and this has implications for biodiversity and the community across the planning area. Therefore, it is acknowledged that adaptation of fire management strategies to improve resilience may be required in the future in response to climate change.

Management Strategies

Changing Climate

25. Support research of species and ecosystems to inform future fire management strategies in a changing climate.

5 READINESS

5.1 Equipment

DEWNR maintains specialised fire suppression equipment and communications systems to optimise fire management and response capabilities. These resources form part of the standard CFS response on public land and may be deployed to fires anywhere in South Australia or interstate.

DEWNR ensures all personal protective equipment (PPE) and equipment is consistent with Australian Standards (where they exist), CFS requirements, and the Australasian Fire and Emergency Services Authorities Council (AFAC) guidelines (AFAC 2013).

All firefighting equipment is inspected prior to the commencement of the fire season and after use at fires to ensure that minimum requirements are met as prescribed in DEWNR Fire Policy and Procedure Manual (DEWNR 2013c).

5.2 Training

Firefighting is a specialised activity with a range of associated hazards. All firefighters shall be trained to carry out their duties safely and recognise hazardous situations. DEWNR staff involved, directly or indirectly, in the management of fire incidents are required to complete the Basic Firefighting 1 CFS course at a minimum.

All DEWNR personnel engaged in fire management operations are trained in accordance with the *Fire Training Procedure* (DEWNR 2013c) and CFS standards. All staff involved in fire suppression are required to undertake annual pre-season training and health and fitness checks to ensure that they are able to carry out assigned duties safely and competently (see the *Fighting Fit Program Procedure* (DEWNR 2013c) for details).

DEWNR is committed to maintaining a safe working environment during fire operations in compliance with the *Work Health and Safety Act 2012,* consistent with the *Occupational Health, Safety and Welfare Policy* (DEH 2008) and the *Safety, Health and Welfare Procedure* (DEWNR 2013c).

5.3 Risk Mitigation Strategies

Fire management plans identify risk mitigation strategies and recommended works for the planning area, based on a comprehensive assessment of risks to life, property, and the environment (as detailed in Section 4.1). These strategies and works can include but are not limited to: creation, maintenance, or upgrades to fire access tracks, installation or upgrade of fire infrastructure, and the application of fire management zoning.

5.3.1 Fire Access Tracks

DEWNR is committed to managing a strategic network of fire access tracks on DEWNR-managed land, in accordance with the Government Agencies Fire Management Working Group's (GAFM) Guidelines (GAFM 2014) and the *Fire Access Tracks Procedure* (DEWNR 2013c). Tracks occurring within the planning area, as well as external tracks/public roads considered important for fire suppression have been classified as a Major, Standard or a Minor track according to the standard. Tracks that are considered unsuitable for fire suppression have been classified as Service Tracks and should not be used during fire suppression operations, unless verified by on-ground inspection and with the approval of

the Incident Controller. Map 4 (Fire Management and Access; online) shows fire access tracks according to their GAFM classification.

Deep sandy tracks are present across the planning area, and may be difficult to access during the summer bushfire season. During fire suppression operations, these tracks are to be used with caution to ensure safe passage of firefighting vehicles.

Fire access tracks have been reviewed as part of this plan and proposed changes are summarised within Appendix 1, other tracks will be maintained to their current GAFM standard shown on Map 4 (Fire Management and Access; online). Works will be implemented on a priority needs basis, subject to resources, fuel hazard, and risk. The design and location of any new fire access tracks will take into consideration topography, soil type, and low fuel hazard areas to provide for the safety of firefighters during suppression.

Management Strategies

Fire Access Tracks

26. Unless identified for upgrade in Appendix 1, maintain fire access tracks to the GAFM standards as shown on Map 4 (Fire Management and Access; online).

5.3.2 Fire Infrastructure

Due to the remoteness of the planning area, there are very few pieces of infrastructure maintained for fire suppression activities, apart from a small number of static water supplies (tanks and dams) (Map 4, Fire Management and Access; online).

5.3.3 Fire Management Zones

Fire management zones as detailed in the *Fire Management Zoning Procedure* (DEWNR 2013c) are used in DEWNR fire management planning to:

- ensure that management actions identified by the risk assessment are implemented to meet the requirements for asset protection and ecological management on all DEWNR-managed land
- clarify the areas where different fire management activities will be undertaken on all DEWNR-managed land
- ensure a standard approach to the application of fire management zones on DEWNR reserves and DEWNR-managed land across South Australia.

Fire management zones are categorised according to the primary objective for fire management: Asset Protection Zone (A-zone), Bushfire Buffer Zone (B-zone) or Conservation-Land Management Zone (C-zone). Where A- or B-zones are not applied, C-zone is the default zone type. These zones are determined giving consideration to overall fuel hazard levels in different vegetation types and the level of risk to assets including life, property and cultural heritage, and biodiversity assets. A-zones have not been applied in this planning area due to a lack of built assets in close proximity to the included lands. A-zones shall not be discussed further in this plan.

The primary objective within B-zones is fuel management; Section 5.3.5 describes the objectives of C-zones. The zones allocated to the included lands within the planning area are described in Appendix 1 and shown on Map 4 (Fire Management and Access; online).

The following general objectives apply for fire management zoning across the included lands within the planning area.

Bushfire Buffer Zone Objectives

To ensure the overall fuel hazard does not exceed High, in order to:

- minimise the likelihood of bushfire impacting on property and ecological assets
- assist in reducing bushfire intensity, ember attack, and spotting potential likely to impact on assets within the included lands
- provide a suppression advantage to assist in containing bushfires within defined areas, that is to minimise the likelihood of fires entering the reserve from the wider landscape or exiting the reserve
- reduce the likelihood that significant areas of contiguous vegetation burn in a single fire event
- enhance safe access for road users and firefighters.

Conservation-Land Management Zone Objectives

C-zone management is not dictated by the overall fuel hazard, rather zoning allows for fire management to meet ecological and conservation management objectives. Proposed burns in C-zones will be applied where necessary to:

- reduce the likelihood of contiguous vegetation burning in a single fire event
- promote heterogeneity within the environment through the creation of variability in the fire regime
- implement fire management strategies which meet the objectives of maintaining appropriate age class distribution at a landscape-scale. Within the planning area this may be a bias towards older age classes to meet the ecological requirements of flora and fauna
- assist in the conservation of species and populations such as the rated species listed in Appendices 3 and 4, as well as threatened ecological communities listed in Appendix 5, through the application of appropriate fire regimes.

Major Strategies within the Planning Area

The following provides an overview of the major strategies that were developed based on the risk assessment.

- B-zones have been located to buffer significant roads, reducing the impact of bushfires on passing traffic and firefighters traversing the planning area, specifically the Cowell-Kimba Road adjacent Sheoak Hill CP and the Lincoln Highway adjacent Ironstone Hill CP.

- C-zone burns have been proposed to provide protection from landscape-scale fires by interrupting large contiguous areas of fuels and to create a mosaic of age classes in vegetation, and to protect significant habitat for species of conservation significance.
- C-zone burns are managed in accordance with ecological guidelines as part of ecological restoration, and research into fire as an ecological process.

These and other zones applied to the lands included in the fire management plan are shown on Map 4 (Fire Management and Access; online) and detailed in Appendix 1. Note that the mapped extent of these zones and proposed burns as currently mapped is indicative and the widths and locations will be more clearly defined in prescribed burn plans.

At the time of writing there is no formal process in place for undertaking fire management strategies, including prescribed burns, on private lands. The implementation of all management activities recommended in this plan is important to the effectiveness of the plan overall. In the interim, recommendations for private lands will be referred to the BMC for consideration and implementation.

Prescriptions for Fuels B-zones

Overall fuel hazard is assessed via on-ground observations. The *Overall Fuel Hazard Guide for South Australia* (DENR 2011d) assists fire management personnel to identify the hazard posed by Surface, Near-surface, Elevated and Bark fuels. The fuel hazard levels are then assessed against a table to determine the Overall Fuel Hazard rating.

The overall fuel hazard should not exceed High for the areas designated as B-zones. Fuel management will be undertaken to maintain overall fuel hazard to a maximum of High, once it exceeds the prescribed limit. Within this planning area, prescribed burning will be the primary fuel management technique in B-zones and C-zones.

Note that within C-zones management is not dictated by overall fuel hazard levels; Section 5.3.5 describes the objectives of C-zones.

5.3.4 Prescribed Burning

Prescribed burning is the planned application of fire within prescribed environmental conditions and predefined boundaries, either for bushfire risk mitigation or to achieve ecological or research objectives. DEWNR has developed operational prescriptions outlining the preferred range of weather variables for the different vegetation types suitable for prescribed burning (DENR 2011c).

Under DEWNR policy, individual prescribed burn plans are prepared and approved for every prescribed burn regardless of the objective (DEWNR 2013c).

Prescribed burn plans include:

- the objective of the prescribed burn, e.g. fuel reduction as described in Appendix 1 or for ecological or research purposes, and the area to be treated
- an environmental assessment of potential impacts on threatened species and ecological communities, cultural heritage, significant weeds, and vegetation age classes; for burns in C-zones, the application of the *Ecological Fire Management Guidelines for Native Vegetation in South Australia* (DEWNR 2013a). Mitigating

actions are implemented where impacts are identified. Burn plans are given an overall environmental impact rating, Low or High impact

- an operations plan detailing:
  - fuel hazard assessments,
  - prescriptions for the burn based on strategic objectives,
  - production of operational maps,
  - site preparatory work required before the burn is conducted,
  - forecasted weather,
  - the strategies and tactics to achieve the desired objectives,
  - the personnel required and their command,
  - plant and equipment,
  - site-specific safety considerations including control lines, fall-back lines, evacuation plans, and escape routes,
  - permits required, and
  - notifications to other agencies and stakeholders
- a burn risk assessment assessing the risk of escapes, potential for off-target damage, effectiveness of mitigation strategies, the potential for the burn to meet its objectives
- pre- and post-prescribed burn monitoring and follow-up works.

Approvals for prescribed burn plans vary depending on the level of complexity and risk. Where native vegetation is being treated, the environmental assessment is endorsed by regional staff, including those with ecological expertise. Where a burn is deemed to be 'low impact', plans are approved internally within DEWNR (DEWNR 2013c). 'High impact' prescribed burn plans are submitted to the Native Vegetation Council for approval, unless they form part of a fire management plan already approved by the Native Vegetation Council. Where matters of national environmental significance are likely to be significantly impacted, approval is required from the Commonwealth Department of the Environment under the EPBC Act. All C-zone burns require consultation with senior ecological DEWNR staff. Operations plans are approved by the nominated Incident Controller for each burn.

Prescribed burning in zones identified on Map 4 (Fire Management and Access; online) may not be treated in their entirety at one point in time, as the area may be divided and treated over a number of seasons, or the treated area may be patchy for environmental purposes or due to conditions at the time of the prescribed burn.

5.3.5 Prescribed Burning in C-zones

Under DEWNR policy, prescribed burning within C-zones may be implemented for the purpose of ecological management, cultural use (such as burning by traditional owners), research, or for landscape protection (DEWNR 2013c). A clearly defined, strategic program of landscape protection C-zone burning may be an appropriate way to mitigate the risk of a whole block/reserve/area burning in a single bushfire event (DEWNR 2013c). All prescribed burning within C-zones should be in accordance with the Ecological Fire Management Guidelines (EFMG) described within this Fire Management Plan (see Section 5.4).

Proposed prescribed burns in C-zones are listed in Appendix 1 and shown on Map 4 (Fire Management and Access; online). These burn areas are intended to be implemented over

the life of the plan and may be added to, altered, relocated, or may be withdrawn at the discretion of DEWNR at any time. Generally this would be as a result of unplanned fires or other factors that may have occurred since the time of writing, for example the incidence of drought. The implementation of any proposed burn is subject to suitable weather, resource availability and regional priorities.

Within this planning area, proposed C-zone prescribed burns have ecological, or landscape protection objectives.

Ecological Prescribed Burns

Prescribed burns within C-zones may be carried out for specific ecological purposes, including the management of vegetation age classes, weed management, and management of threatened species or ecological communities, as well as non-threatened fauna and flora. Ecological prescribed burns are conducted in accordance with the *Ecological Fire Management Guidelines for Native Vegetation in South Australia* (DEWNR 2013a) which are described in Section 5.4 of this plan. Where a proposed prescribed burn is not included in an approved management plan or other statutory document that outlines the requirements for application of fire regimes, an Ecological Burn Rationale must be prepared and approved as per the *Ecological Burning Procedure* (DEWNR 2013c).

The *Native Vegetation Council Guidelines, Ecological Prescribed Burning under Regulation 5(1)(zi)* (Native Vegetation Council 2014) under the *Native Vegetation Act 1991* also apply to these prescribed burns. All ecological burns on DEWNR-managed land are either, approved by the Native Vegetation Council under *Native Vegetation Regulation 5(1)(zi)* or are in line with the *DEWNR Fire Management Standard Operating Procedure Under the Native Vegetation Act* (Native Vegetation Council In Prep).

Landscape Protection Prescribed Burns

Prescribed burns within C-zones may be carried out for landscape protection purposes, where the reduction of fuel in a particular area reduces the likelihood of a whole reserve or large contiguous block of vegetation burning in a single fire event. Unlike prescribed burns in B-zones, there are no fuel management prescriptions for landscape protection prescribed burns, instead they are guided by the *Ecological Fire Management Guidelines for Native Vegetation in South Australia* (DEWNR 2013a).

5.4 Ecological Fire Management

The management of fire to maintain or enhance biodiversity is based on knowledge of the vital attributes (Noble & Slatyer 1980) of flora and fauna species, populations, and communities exposed to different fire regimes. Vital attributes are a functional approach to fire response based on groups of species that share critical life history characteristics. Consideration is given to the method of persistence after fire (e.g. seeding or resprouting), the environmental requirements for successful re-establishment (e.g. competition or some form of preconditioning), and the lifespan of the different stages within the lifecycle (e.g. time to become reproductive). A functional approach such as this can provide a means of both understanding and predicting species' response to a particular fire regime, with the specific objective of being able to predict the changes in plant communities subject to recurrent disturbance.

There are currently limited data available on the fire-related requirements of many fauna taxa, so these guidelines are based predominantly on the plant vital attribute information,

which have been compared against known fauna requirements. DEWNR collects vital attributes for flora and fauna. This approach is being used as a sound basis for the management of fire for biodiversity across Australia (Andersen, Cook & Williams 2003; FEWG 2004; Hopkins & Saunders 1987; Whelan *et al.* 2002) and is used to assist in achieving management objectives in C-zones within all DEWNR fire management plans and across agencies.

5.4.1 Methodology

The approach for determining the EFMG for the different fire-prone MVS is described in detail in the *Ecological Fire Management Guidelines for Native Vegetation in South Australia* (DEWNR 2013a). Briefly, the species most susceptible to decline from inappropriate fire regimes need to be identified using best available knowledge of plant vital attributes and life histories. These species (known as Key Fire Response Species – KFRS), and their needs in relation to the components of fire regime, provide a guide to the acceptable thresholds of fire regime for the community (Thresholds of Potential Concern – TPC). Thresholds of Potential Concern are defined as 'the limits of tolerance to a particular fire regime' (Kenny *et al.* 2004). Of particular importance are two TPC relating to the **fire interval** component of the fire regime:

- **TPC1** describes the lower threshold for fire interval (years between fires) 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. The KFRS that typically determine TPC1 are those species with the longest juvenile period (i.e. time to adequately set seed or reproduce)
- **TPC2** describes the upper threshold for fire interval (years between fires) 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. The KFRS that typically determine TPC2 are those species with the shortest extinction period (i.e. time until regeneration from seed or reproduction is no longer possible)

Fire intervals between TPC1 and TPC2 (Table 6) are predicted to maintain the species complement, whereas intervals shorter than TPC1 or longer than TPC2 are predicted to lead to the decline of the Key Fire Response Species (Kenny *et al.* 2004). Aspects of intensity, season and extent are then considered in regards to what is known of their likely impact on the KFRS. In summary, the steps taken in the development of the EFMG are as follows.

- Vital attributes data for flora are gathered and assessed.
- This knowledge is used to identify the KFRS which help to identify the TPC of fire regime (fire interval, intensity, and/or season).
- Fire regime thresholds using flora are assessed for potential impacts on known faunal requirements, particularly the requirements of species of conservation significance.
- EFMG 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).
- EFMG are reviewed periodically as new information becomes available.

Figure 3 illustrates this process.

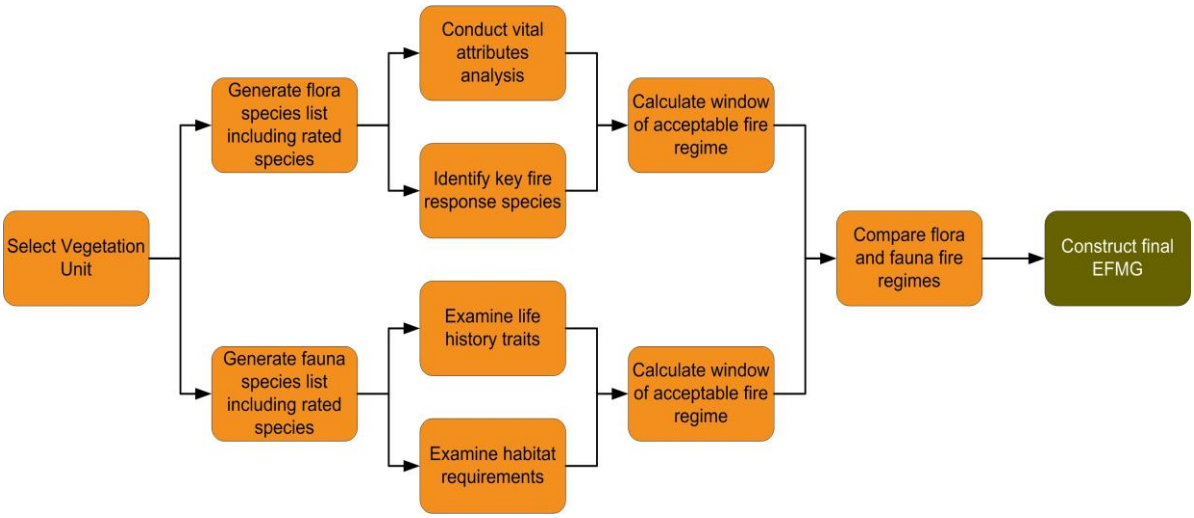

FIGURE 3 – APPROACH FOR DETERMINING ECOLOGICAL FIRE MANAGEMENT GUIDELINES

5.4.2 Interpreting Ecological Fire Management Guidelines

EFMG have been defined for MVS within the planning area (Table 7), to assist strategic planning and management of fire within the included lands in the planning area in a way that will support the maintenance and enhancement of biodiversity.

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 are available). The upper and lower thresholds of potential concern 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. EFMG should not be used as prescriptions; instead they define a window of *acceptable* fire regime that supports the conservation of existing species. The EFMG are based on the best available information and they will be refined as new research and monitoring data become available for KFRS.

TABLE 7 – ECOLOGICAL FIRE MANAGEMENT GUIDELINES FOR FIRE-PRONE MVS IN THE PLANNING AREA

		ECOLOGICAL FIRE REGIME							
		Interval		Spatial Criteria		Frequency	Intensity		Season
MVS No	MVS NAME	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	% > TPC2	Avoid more than 2 fires within a period of X years	Avoid more than 2 successive fires of low intensity (Yes/No)	Some medium to high intensity fire needed to regenerate some species (Yes/No)	Avoid more than 1 successive fire in season[1]
5	*Eucalyptus* forests with a grassy understorey	5	50	40	30	30	N	N	Spring or during & following drought
9	*Eucalyptus* woodlands with a grassy understorey	5	50	40	30	30	Y	Y	Spring or during & following drought
12	*Callitris* forests and woodlands	15	60	40	30	70	Y	Y	During & following drought
15	*Melaleuca* open forests and woodlands	15	60	40	30	70	N	N	During & following drought
16	Other forests and woodlands	15	50	50	30	40	Y	Y	Spring
21	Other *Acacia* tall open shrublands	20	40	50	30	40	Y	Y	Same season
26	*Casuarina* and *Allocasuarina* forests and woodlands	20	50	40	30	60	N	N	During & following drought
27	Mallee with hummock grass	20	50	40	30	60	Y	Y	During & following drought
28	Low closed forest or tall closed shrublands (including *Acacia*, *Melaleuca* and *Banksia*)	15	40	40	30	50	Y	Y	Same season
29	Mallee heath and shrublands	20	40	40	30	40	Y	Y	Spring or during & following drought
33	Arid and semi-arid hummock grasslands	10	50	40	30	60	Y	Y	During & following drought
36	Temperate tussock grasslands	3	10	40	30	20	N	N	Autumn
49	*Melaleuca* shrublands and open shrublands	20	60	40	30	70	N	N	Spring
55	Mallee with an open shrubby understorey	20	40	40	30	40	Y	Y	Spring or during & following drought
61	Mallee with a tussock grass understorey	10	40	40	30	50	N	N	During & following drought

[1] Note that this is not restricted to the same year, but may relate to fires occurring in the same season over a number of years.

6 RESPONSE

6.1 Response Plans

A Response Plan exists for the West Region (DEWNR 2012), which is reviewed on an annual basis in accordance with the *Response Planning Procedure* (DEWNR 2013c). The response plan provides reserve-specific information in relation to fire suppression including water points, equipment, and access, as well as levels of readiness.

Note that the Response Plan is for initial response only and that the Incident Controller should refer to this Fire Management Plan for more detailed fire management information, in conjunction with DEWNR staff.

6.2 Suppression Considerations

Initial efforts to contain bushfires should be made using existing access tracks, previously burnt areas and natural low fuel areas. If unsuccessful, alternative strategies may be considered providing the impact can be justified, and ecological consequences considered. The best available fire prediction should be used before decisions on strategies are made, to ensure all agencies are working to a common goal. For public land, it is likely that agency staff will be the best source of this information and they should be consulted during the development of any incident prediction. Consideration for firefighter safety and the protection of life are paramount during all suppression operations. The agencies will endeavour to supply a Liaison Officer to the Incident Management Team if there is a bushfire on or threatening public land. The role of the Liaison Officer is to provide policy advice, coordinate resources, and offer other logistical and planning support.

General principles:

- During appropriate weather conditions and depending on the location, a fire may be left to burn out if it does not pose any significant threat and the risk and forecast conditions are acceptable.
- Support the use of minimum impact suppression techniques, particularly in Wilderness Protection Areas.
- Aerial suppression techniques will be used where appropriate and when conditions permit, however, it should be noted that this includes appropriate use of bombers to lessen the intensity of a fire as it reaches a control line, assets, or where supported by ground crews. Bombers that are not supported by ground crews are generally ineffective once a fire is established. This is because bombers are unable to completely extinguish a fire in one drop and the short period of time it takes for fuels to dry out and reignite.

The use of fire suppression chemicals should be restricted to critical situations, such as the protection of built assets, both within the reserve and off reserve.

DEWNR has an obligation to maximise safety for fire suppression activities. For this plan, standards for control lines are in accordance with the *Control Line Procedure* (DEWNR 2013c). Where the combination of vegetation, fuel loads, and terrain is likely to reduce the effectiveness of these control lines, they may be widened using techniques such as chaining or rolling, or perimeter burns in their immediate vicinity. This will 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 chaining or constructing mineral earth breaks during a running fire will be reduced.

In some situations, it may be more appropriate for control lines to be constructed in neighbouring lands off-reserve, and this will be negotiated with neighbours and CFS on a case-by-case basis. Under the *Wilderness Code of Management* (DEH 2004), prescribed burning is permitted where it is considered an essential management tool to restore ecological processes, to mitigate hazard to human life, and for research purposes (see Appendix 2).

On all DEWNR-managed land across the planning area:

- Minimum Impact Suppression Techniques (MIST) and specialised equipment that reduces impacts to the landscape shall be used wherever possible and control methods will not be greater than the potential or actual impact of the fire.
- only chemicals qualified and approved by the United States Department of Agriculture (USDA) Forest Service and endorsed by AFAC will be used on public land (see USDA Forest Service (2008) document).
- implement precautionary hygiene measures to reduce the risk of Phytophthora infestation (see Section 3.7.3) and spread of weeds. Weed hygiene measures may incorporate cleaning by water (washdown), solvent-based cleaning, and/or air jets.

6.3 Visitor Management during Bushfire

The safety of lessees within reserves is managed in accordance with the 'Prepare Act Survive' principle, which advocates for the preparation of Bushfire Survival Plans ahead of time and explains the responsibility of individuals to stay well informed to assist in decision making to improve safety (CFS 2009).

Visitors within reserves are managed according to the *Visitor Safety Procedure* and the *Reserve Closures Procedure* (DEWNR 2013c), which allows for the temporary closure of reserves or cancellation of activities due to an actual emergency, imminent threat or extreme threat of a bushfire.

Directed evacuation will only be undertaken by the South Australian Police when it is safe to do so and adequate resources are available. These nominated authorities will only direct evacuation when it is evident that loss of life or injury is imminent and almost certain. DEWNR will comply with all requests from these authorities in evacuations during an emergency.

7 RECOVERY, RESEARCH AND MONITORING

7.1 Post-fire Rehabilitation and Recovery

DEWNR *Post-fire Rehabilitation Procedure* (DEWNR 2013c) ensures that requirements for the rehabilitation and recovery of areas affected by fire are identified following an incident. A post-fire rehabilitation plan shall consider:

- impacts to infrastructure, built assets, and natural and cultural heritage
- potential threats to biodiversity conservation, natural heritage, and catchment protection
- actions, responsibilities, and costs associated with the rehabilitation effort.

Specific objectives of post-fire rehabilitation plans are outlined in the procedure.

7.2 Research

Any fire-related research that is proposed within the reserves in the planning area should be discussed with the Senior Fire Ecologist and the Adaptive Management Fire Management Officer, be in accordance with the *Research Procedure* (DEWNR 2013c), and in consultation with the Eyre Peninsula Region. DEWNR has prepared a *Science Directions* document (DENR 2010c) that outlines some key questions for research in fire science and fire management. The research proposed below will contribute to improving the knowledge required to answer these priority research questions.

Management Strategies	
Research	27. Collect new and collate existing vital attributes data for flora and incorporate into future ecological fire management guidelines.
	28. Investigate the effect of fire on the species and ecological communities identified in Appendices 3 and 4.
	29. Investigate the use of fire for the management of weeds (e.g. Buffel grass).
	30. Monitor national and international fire management policy and best practice and partner with the research sector to increase our knowledge on altered fire regimes resulting from climate change.

7.3 Monitoring

Monitoring will be established in conjunction with prescribed burns to assess issues raised during prescribed burn planning, in accordance with *Monitoring Procedure* (DEWNR 2013c). Implementation will depend upon state and regional priorities and available resources. This includes the *Prescribed Burning Procedure* and the *Ecological Burning Procedure* (DEWNR 2013c).

Opportunities for monitoring will also be considered in areas impacted by bushfire to improve knowledge about the response of species, communities, and habitats to fire within the planning area, as per *Monitoring Procedure* (DEWNR 2013c). Research outcomes from other locations, both within South Australia and nationally, will be applied where appropriate to this planning area. The results from pre- and post-fire monitoring will be used to further refine fire management, consistent with an adaptive management approach.

Refer to Section 5.3.3 of this plan for general information on zoning, burning, and the planning requirements.

Management Strategies	
Monitoring	31. Continue to collect fuel hazard data for input into fire-spread models.
	32. Strategically monitor flora and fauna species pre- and post-fire to determine their fire response, including long-term monitoring (i.e. 20 years and greater) to establish time to maturity for KFRS to inform TPC.

8 SUMMARY OF MANAGEMENT STRATEGIES

Visitor Use

1. Consider reserve closures when significant fire weather is forecast to maximise visitor safety (at the discretion of the Chief Executive.
2. Implement appropriate fuel management strategies as shown Map 4 (Fire Management and Access; online) to increase visitor safety.

Built Assets

3. Implement fuel management strategies for asset protection consistent with the fire management zoning shown on Map 4 (Fire Management and Access; online) and other risk mitigation works as detailed in Appendix 1.
4. Through the BMAP process, encourage adjacent property owners to work with CFS and local government to implement appropriate and coordinated fire management works on their own land to minimise the threat of bushfire.

Cultural Heritage

5. Implement fuel management strategies appropriate for the protection of cultural assets as shown on Map 4 (Fire Management and Access; online).
6. During bushfires, ensure suppression strategies take into account cultural assets in order to minimise impacts from these activities and undertake post-fire rehabilitation.

Semi-arid Mallee

7. Implement landscape protection prescribed burns to mitigate the risk of a whole block/reserve/area burning in a single bushfire event.
8. Conduct prescribed burning to improve diversity of vegetation age class, including protection of long-unburnt areas of vegetation.

Malleefowl

9. Implement fire management strategies (e.g. fuel management) that will reduce the likelihood of local extinctions of Malleefowl from a single bushfire event.
10. Conduct prescribed burning to improve diversity of vegetation age class, including protection of long-unburnt areas of vegetation.
11. Develop an Ecological Fire Management Strategy for Malleefowl.

Sandhill Dunnart

12. Implement fire management strategies (e.g. fuel management) to protect key habitat of the Sandhill Dunnart from burning a single bushfire event.
13. Implement fire management strategies (i.e. fuel management) to maintain suitable age classes of tussocks for known populations of Sandhill Dunnart.
14. Trial the use of small scale ecological prescribed burns to improve Sandhill Dunnart habitat in areas where habitat quality is perceived to have declined.

Threatened Mallee Birds

15. Implement fire management strategies (e.g. fuel management) to enhance key mallee woodland bird habitat, and prevent significant habitat from burning in a single bushfire event.

Threatened Orchids

16. Implement fire management strategies (e.g. fuel management) to minimise the spread of bushfire through key populations of Threatened Orchids.
17. Trial the use of small scale prescribed burns to improve Threatened Orchid habitat in areas where habitat quality is perceived to have declined.
18. Monitor the effects of fire on Orchid populations and use this information to inform the DEWNR flora and fauna vital attributes database for use in Ecological Fire Management Guidelines (Appendix 3).

Abundant and Pest Species

19. During prescribed burn planning refer to guidelines for management of introduced flora species (Appendix 3).
20. Consider the use of fire as a tool that forms part of integrated pest management strategies.
21. Consider the likely post-fire responses and impacts of weed species and implement post-fire weed control and monitoring accordingly (subject to regional priorities).
22. Collect relevant information during prescribed burn planning on introduced fauna and undertake a risk assessment to determine the need for post-fire management, including predator control where appropriate.
23. Adhere to the *Standard Operating Procedure – Phytophthora Threat Management (SOP-002)* (DEH 2002) where plant and equipment are sourced from other areas known to have Phytophthora.
24. Ensure hygiene practices are implemented for plant and equipment to reduce the spread of weeds or pathogens into/within the planning area. Refer to the *Phytophthora Vehicle Disinfection Unit Operating Procedure* (DEH 2003).

Changing Climate

25. Support research of species and ecosystems to inform future fire management strategies in a changing climate.

Fire Access Tracks

26. Unless identified for upgrade in Appendix 1, maintain fire access tracks to the GAFM standards as shown on Map 4 (Fire Management and Access; online).

Research

27. Collect new and collate existing vital attributes data for flora and incorporate into future ecological fire management guidelines.
28. Investigate the effect of fire on the species and ecological communities identified in Appendices 3 and 4.
29. Investigate the use of fire for the management of weeds (e.g. Buffel Grass).
30. Monitor national and international fire management policy and best practice and partner with the research sector to increase our knowledge on altered fire regimes resulting from climate change.

Monitoring

31. Continue to collect fuel hazard data for input into fire-spread models.
32. Strategically monitor flora and fauna species pre- and post-fire to determine their fire response, including long-term monitoring (i.e. 20 years and greater) to

establish time to maturity for key fire response species to inform Thresholds of Potential Concern (TPC).

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10 APPENDICES

Appendix 1 – Risk Mitigation Works

	Values and Assets	Location	Recommended Works
Balumbah Block	• Contributes to a small tract of native vegetation • Malleefowl, *Leipoa ocellata*	• Crown land (reserve) 5 km north east of Lacroma CR	
Barwell Block	• Large tract of continuous vegetation • Adjacent Heritage Agreements • Metallic Sun-orchid, *Thelymitra epipactoides* • Malleefowl, *Leipoa ocellata*	• Barwell CP • Heritage Agreements to the west, south and east of Barwell CP • Crown land (reserve) adjacent to the Heritage Agreements	• Upgrade track on western boundary to Minor (currently Service). • Implement C-zone burns for landscape protection (Map 4, Fire Management and Access; online): Northern burn is ecological burn to improve conditions for Metallic Sun Orchid, other burns are intended to break up large areas of contiguous, long-unburnt vegetation.
Bascombe Well Block	• Large tract of continuous vegetation. Private dwellings located north of the Heritage Agreements • Private dwellings located to the south and east of the Heritage Agreements • Coast Dandelion, *Taraxacum cygnorum* • Late Spider-orchid, *Caladenia dilatata* • Limestone Leek-orchid, *Prasophyllum calcicola* • Malleefowl, *Leipoa ocellata*	• Bascombe Well CP • Heritage Agreements located between Bascombe Well and Barwell CP • Heritage Agreements located between Bascombe Well and Peachna CP	• Upgrade all existing internal tracks, except track to south-west boundary, to Minor (currently Service). • Implement C-zone burns for landscape protection (Map 4, Fire Management and Access; online): intended to break up large areas of contiguous, long-unburnt vegetation. • Recommend to the Bushfire Management Committee that HA landholder upgrade north-south track to Minor (currently Service) to provide access through to highway.

	Values and Assets	Location	Recommended Works
Caralue Township Block	• Isolated patch of native vegetation • Residential / rural living buildings on western boundary of Crown land	• Unalienated Crown land 5 km north west of Carappee Hill CP	• Recommend to the property owner to ensure a fuel reduced break is maintained between the assets and the adjacent native vegetation.
Carappee Hill Block	• Isolated patch of native vegetation, on mountainous terrain • Accommodation adjacent to eastern boundary of reserve • Granite Mudwort, *Limosella granitica* • Inland Green-comb Spider-orchid, *Caladenia tensa* • Nodding Grass-lily, *Stypandra glauca* • Winter Spider-orchid, *Caladenia brumalis* • Diamond Firetail, *Stagonopleura guttata* • Malleefowl, *Leipoa ocellata*	• Carappee Hill CP	
Coompana Reservoir Block	• Isolated patch of native vegetation • Coompana Reservoir • Resin Wattle, *Acacia rhetinocarpa*	• Unalienated Crown land located 5 km south of Heggaton CP	

	Values and Assets	Location	Recommended Works
Darke Range Block	• Large tract of continuous vegetation on mountainous terrain • Quarry • Bottle Fissure-plant, *Maireana excavata* • Erect Sundew, *Drosera stricticaulis* • Nodding Grass-lily, *Stypandra glauca* • Diamond Firetail, *Stagonopleura guttata*	• Darke Range CP	• Implement C-zone burns for landscape protection (Map 4, Fire Management and Access; online): intended to break up large areas of contiguous, long-unburnt vegetation.
Franklin Harbor Block	• Coastal strip of reserve, plus islands • Resin Wattle, *Acacia rhetinocarpa*	• Franklin Harbor CP	
Gypsum Hill Block	• Isolated patch of native vegetation	• Crown land (reserve) adjacent Tod Highway, 8 km north of Barwell CP	
Hambidge Block	• Large tract of continuous vegetation • Bottle Fissure-plant, *Maireana excavata* • Erect Sundew, *Drosera stricticaulis* • Resin Wattle, *Acacia rhetinocarpa* • Yellow Swainson-pea, *Swainsona pyrophila* • Malleefowl, *Leipoa ocellata* • Sandhill Dunnart, *Sminthopsis psammophila*	• Hambidge WPA	• Implement C-zone burns for landscape protection (Map 4, Fire Management and Access; online): intended to break up large areas of contiguous, long-unburnt vegetation, utilizing existing fire-scars.

	Values and Assets	Location	Recommended Works
Heggaton Block	• Large tract of continuous vegetation • Grazing / cropping land surrounded by reserve (on three sides) • Yellow Swainson-pea, *Swainsona pyrophila* • Malleefowl, *Leipoa ocellata*	• Heggaton CP	• Upgrade tracks running north-south through the centre of the block to Minor (currently Service). • Upgrade northern boundary track to Minor (currently Service). • Implement C-zone burns for landscape protection (Map 4, Fire Management and Access; online): intended to break up large areas of contiguous, long-unburnt vegetation.
Hincks Block	• Large tract of continuous vegetation • Bundled Cord-rush, *Desmocladus diacolpicus* • Cloaked Spyridium, *Spyridium erymnocladum* • Inland Green-comb Spider-orchid, *Caladenia tensa* • Malleefowl, *Leipoa ocellata* • Sandhill Dunnart, *Sminthopsis psammophila*	• Hincks WPA & CP	• Upgrade Nicholls Track (which runs in a North-South direction on the western side of the Block) to Minor (currently is Service). • Implement C-zone burns for landscape protection (Map 4, Fire Management and Access; online): intended to break up large areas of contiguous, long-unburnt vegetation, utilising existing fire-scars.
Ironstone Hill Block	• Large tract of continuous vegetation • Yellow Swainson-pea, *Swainsona pyrophila* • Malleefowl, *Leipoa ocellata* • Sandhill Dunnart, *Sminthopsis psammophila*	• Ironstone Hill CP • Unalienated Crown land on the east and north east boundary of Ironstone Hill CP	• B-zone (width 250 m) on north-western side of the Lincoln Highway to improve safety of highway users. • Upgrade southern boundary track to Minor (currently Service). • Implement C-zone burns for landscape protection (Map 4, Fire Management and Access; online): intended to break up large areas of contiguous, long-unburnt vegetation, and to manage habitat and vegetation age classes for Sandhill Dunnart population.

	Values and Assets	Location	Recommended Works
Lacroma Block	• Isolated patch of native vegetation	• Lacroma CP	
Malgra Block	• Isolated patch of native vegetation	• Malgra CP	
Middlecamp Hills Block	• Contributes to a large tract of native vegetation • Jumping-jack Wattle, *Acacia enterocarpa* • Silver Daisy-bush, *Olearia pannosa* ssp. *pannosa* • Trailing Commersonia, *Commersonia multiloba* • Diamond Firetail, *Stagonopleura guttata*	• Middlecamp Hills CP • Heritage Agreement on the northern boundary of Middlecamp Hills CP	• Upgrade track on eastern side of block to Minor (currently Service). • Implement C-zone burns for landscape protection (Map 4, Fire Management and Access; online): intended to break up large areas of contiguous, long-unburnt vegetation.
Moody Tank Block	• Isolated patch of native vegetation • Fat-leaf Wattle, *Acacia pinguifolia* • Granite Mudwort, *Limosella granitica* • Diamond Firetail, *Stagonopleura guttata*	• Moody Tank CP	

	Values and Assets	Location	Recommended Works
Munyaroo North Block	• Large tract of continuous vegetation • Neighbouring beach shacks • Yellow Swainson-pea, *Swainsona pyrophila* • Slender-billed Thornbill (western ssp), *Acanthiza iredalei iredalei* • Western Grasswren, *Amytornis textilis myall* • Malleefowl, *Leipoa ocellata*	• Northern section of Munyaroo CP • Heritage Agreements on the western boundary of Munyaroo CP • Unalienated Crown land on the northern boundary of Munyaroo CP	• Implement C-zone burns for landscape protection (Map 4, Fire Management and Access; online): intended to break up large areas of contiguous, long-unburnt vegetation. • Recommend to the Bushfire Management Committee that residents and property owners at Murninnie Beach consider their bushfire readiness (Bushfire Action Plans), including suitability of access and egress routes.
Munyaroo South Block	• Large tract of continuous vegetation • Yellow Swainson-pea, *Swainsona pyrophila* • Malleefowl, *Leipoa ocellata*	• Southern section of Munyaroo CP • Heritage Agreement on the western and southern boundary of Munyaroo CP	• Implement C-zone burns for landscape protection (Map 4, Fire Management and Access; online): intended to break up large areas of contiguous, long-unburnt vegetation.
Munyaroo West Block	• Contributes to a very large tract of continuous vegetation • Yellow Swainson-pea, *Swainsona pyrophila* • Trailing Commersonia, *Commersonia multiloba* • Diamond Firetail, *Stagonopleura guttata* • Sandhill Dunnart, *Sminthopsis psammophila*	• Western section of Munyaroo CP • Heritage Agreements surrounding the western section of Munyaroo CP	• B-zone (width 250 m) on north-western side of the Lincoln Highway to improve safety of highway users. • Implement C-zone burns for landscape protection (Map 4, Fire Management and Access; online): intended to inhibit the spread of large bushfires through the landscape.

	Values and Assets	Location	Recommended Works
Peachna Block	• Contributes to a very large tract of continuous vegetation • Eyre Peninsula Yellow-tailed Black-Cockatoo, *Calyptorhynchus funereus whitei* • Diamond Firetail, *Stagonopleura guttata* • Malleefowl, *Leipoa ocellata*	• Peachna CP • Heritage Agreement on the northern boundary of Peachna CP	• Implement C-zone burns for landscape protection (Map 4, Fire Management and Access; online): intended to break up large areas of contiguous, long-unburnt vegetation.
Rudall Block	• Isolated patch of remnant native vegetation	• Rudall CP and Heritage Agreement	
Secret Rocks Block	• Contributes to a very large tract of continuous vegetation • Very large areas of land under Heritage Agreement • Yellow Swainson-pea, *Swainsona pyrophila* • Malleefowl, *Leipoa ocellata* • Sandhill Dunnart, *Sminthopsis psammophila*	• Heritage Agreement on the western boundary of Ironstone Hill CP • Unalienated Crown land on the northern boundary of the Heritage Agreement • Heritage Agreements on the south west boundary of Ironstone Hill CP, adjacent to Sheoak Hill CP	• Implement C-zone burns for landscape protection (Map 4, Fire Management and Access; online): intended to break up large areas of contiguous, long-unburnt vegetation. • Recommend that the Bushfire Management Committee consider constructing and maintaining fire access tracks in this area.
Shannon Block	• A large tract of continuous vegetation • Inland Green-comb Spider-orchid, *Caladenia tensa* • Malleefowl, *Leipoa ocellata*	• Shannon CP • Heritage Agreements to the west, east and south of Shannon CP	• Implement C-zone burn for landscape protection (Map 4, Fire Management and Access; online): intended to break up large areas of contiguous, long-unburnt vegetation.

	Values and Assets	Location	Recommended Works
Sheoak Hill Block	• Contributes to a very large tract of continuous vegetation • Malleefowl, *Leipoa ocellata*	• Sheoak Hill CP • Heritage Agreements to the north, south and west of Sheoak Hill CP	• B-zone (500 m) adjacent to the Cowell-Kimba Road to minimise bushfire risk to road users. • Implement C-zone burns for landscape protection (Map 4, Fire Management and Access; online): intended to break up large areas of contiguous, long-unburnt vegetation. • Reconstruct Minor Track along full length of southern boundary of block, adjacent Secret Rocks Block.
Taraleah Block	• Isolated patch of remnant vegetation	• Crown land (reserve) located 10 km north west of Hincks WPA	
The Plug Range Block	• Large tract of continuous vegetation • Jumping-jack Wattle, *Acacia enterocarpa*	• The Plug Range CP • Heritage Agreements on the northern and eastern boundary of The Plug Range CP	• Implement C-zone burns for landscape protection (Map 4, Fire Management and Access; online): intended to break up large areas of contiguous, long-unburnt vegetation.
Tooligie Block	• Part of continuous tract of native vegetation • Silos and private residential built assets • Malleefowl, *Leipoa ocellata*	• Unalienated Crown land located between Hincks and Peachna CP	• Recommend that the property owner ensure a fuel reduced break is maintained between their built assets and the adjacent native vegetation.

	Values and Assets	Location	Recommended Works
Verran Block	• Isolated patch of vegetation • Built assets	• Unalienated Crown land 7.5 km east of Verran Tanks CP	
Verran Tanks Block	• Isolated patch of native vegetation	• Verran Tanks CP	• Implement C-zone burn for landscape protection (Map 4, Fire Management and Access; online): intended to introduce variability in vegetation age class.
Wharminda Block	• Isolated patch of remnant native vegetation	• Wharminda CP (and proposed addition to Wharminda CP)	• Implement C-zone burn for landscape protection (Map 4, Fire Management and Access; online): intended to break up area of contiguous, long-unburnt vegetation.
Yalanda Hill Block	• Isolated patch of remnant native vegetation • Malleefowl, *Leipoa ocellata*	• Unalienated Crown land located 12 km north west of Sheoak Hill CP	

	Values and Assets	Location	Recommended Works
Yeldulknie Block	• Large tract of continuous vegetation • Senna Wattle, *Acacia praemorsa* • Silver Daisy-bush, *Olearia pannosa* ssp. *pannosa* • Malleefowl, Leipoa ocellata	• Yeldulknie CP	• Construct new Service track on southern boundary of block (western half only). • Implement C-zone burns for landscape protection (Map 4, Fire Management and Access; online): intended to break up large areas of contiguous, long-unburnt vegetation.

Appendix 2 – Wilderness Code of Management

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
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
- research

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

Source: DEH (2004) *South Australian Code of Management for Wilderness Protection Areas and Zones*, Department for Environment and Heritage, Government of South Australia, Adelaide.

The plan will also comply with the *Wilderness Fire Management Procedure* (DEWNR 2013c).

Appendix 3 – Fire Response of Rated, Significant and Introduced Flora Species

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	Block	Life Form	Species Ecology & Fire Response	Considerations for Fire Management	Source
Acacia cretacea	Chalky Wattle	EN	E	29	Not recorded in blocks, but located within the broader planning area	Tree	• Occurs in low shrubland and mallee scrub on deep red sand with *Eucalyptus incrassata*, *Melaleuca uncinata* and *Triodia irritans* • Flowers Jul-Jan, seed pods Jul-Oct • Seed germination is highly dependent on fire, and rainfall • Can produce suckers, particularly after fire	• Fire frequency and intensity (either not enough or too much) may threaten species • Fire should be considered to stimulate seedling regeneration if recruitment is poor/absent	(Way & van Weenen 2008)
Acacia enterocarpa	Jumping-jack Wattle	EN	E	27 49	Plug Range, Middlecamp Hills	Shrub	• Mainly associated with woodland to open forest • Flowers May-Oct • Response to fire is unknown		(Moritz & Bickerton 2011)
Acacia pinguifolia	Fat-leaf Wattle	EN	E	29 30	Moody Tank	Shrub	• The species is associated with *Eucalyptus odorata*, *E. incrassata* and *Melaleuca uncinata* in woodland or open scrub • Flowers Jul-Oct • Studies show high numbers of seedlings following fire events, rainfall required to maintain seedling survival	• Too frequent fire events likely to threaten species • Exclusion of fire likely to threaten species • Fire should be considered to stimulate seedling regeneration if recruitment is poor/absent	(Pound *et al.* 2011; Way & van Weenen 2008)
Acacia praemorsa	Senna Wattle	VU	E		Yeldulknie	Shrub	• Found in loamy soils amongst rocks on lower slopes of gullies. Confined and extremely localised on north-eastern Eyre Peninsula • Flowers Oct • Response to fire is unknown	• Fire frequency >10 years best for maintaining populations • Late summer or autumn fires preferable	SA^

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	Block	Life Form	Species Ecology & Fire Response	Considerations for Fire Management	Source
Acacia rhetinocarpa	Resin Wattle	VU	V	8 9 29 38	Coompana Reservoir, Franklin Harbor, Hambidge	Shrub	• Found scattered in a few small areas near the east coast of Eyre Peninsula. Usually in open scrub vegetation • Flowers Aug-Oct • Seed pods develop Nov-Jan • Recruitment is affected by the absence of fire • It is an early stage post-fire successional species	• Appropriate fire frequency unknown • Exclusion of fire likely to threaten species • Too frequent fire events likely to threaten species also • Fire should be considered to stimulate seedling regeneration if recruitment is poor/absent	(Way & van Weenen 2008)
Caladenia brumalis	Winter Spider-orchid	VU	V	8 9 26 29 32 49	Carappee Hill	Orchid	• Occurs mostly on terra rossa soils or fertile sands over limestone, in mallee-broombush associations, light woodland or sedge dominated grasslands • Flowers late Jun-Sep • Above-ground matter and soil seedbank likely to be killed by fire. Resprouts from root suckers or rhizomes • Observed to increase in abundance following intense summer fire on the Eyre Peninsula	• Avoid inter-fire intervals < 10years • Avoid burning from May-Nov • Protection/management of browsing should be considered post-fire	(Ecological Associates Pty Ltd 2007; Pobke 2007)
Caladenia dilatata	Late Spider-orchid		E		Bascombe Well Central	Orchid	• Occurs in dry woodland and mallee, in various soils • Flowers Sep-Oct • Resprouts from root suckers or rhizomes	• Avoid inter-fire intervals < 10years • Avoid burning from Jul-Dec • Protection/management of browsing should be considered post-fire	SA^

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	Block	Life Form	Species Ecology & Fire Response	Considerations for Fire Management	Source
Caladenia tensa	Inland Green-comb Spider-orchid	EN		8 29 31	Carappee Hill, Hincks, Shannon	Orchid	• Occurs in dry woodland, low scrub and about rock outcrops in a variety of soil types • Flowers late Aug-Oct • Fruits Oct-Nov • Colonises open areas caused by fire • Flowering is enhanced by fire	• Avoid inter-fire intervals < 10years • Avoid burning Jul-Nov • Protection/management of browsing should be considered post-fire	(Todd 2000)
Chrysanthemoides monilifera ssp. *monilifera)**	Boneseed					Shrub	• Weed of National Significance • Lifespan 10-20 years • Flowers: July-October • Fire kills seedlings and adult plants • Seedlings readily recruit post-fire	• Post fire weed control likely to be required since burning stimulates mass germination of the seed bank	(Weeds CRC 2003)
Commersonia multiloba	Trailing Commersonia		E		Middlecamp Hills, Munyaroo West	Shrub	• Flowers Aug-Jan • Fire response is unknown		Aus^
Desmocladus diacolpicus	Bundled Cord-rush		V		Hincks	Shrub	• Found in health with mallee eucalypts on sand • Flowers Nov-Jan • Adult plants killed by 100% scorch • Seeds regenerate post-fire		Aus^
Drosera stricticaulis	Erect Sundew		V		Darke Range, Hambidge	Herb	• Found near watercourses and granite outcrops in sandy clay or loam • Flowers Jul-Oct • Congeners respond to fire		Aus^

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	Block	Life Form	Species Ecology & Fire Response	Considerations for Fire Management	Source
Limosella granitica	Granite Mudwort	VU	V	32 49	Carappee Hill, Moody Tank	Perennial aquatic forb	• Confined to fine silt in granite rockholes • Flowers Aug - Oct • Fire response is unknown		SA^
*Lycium ferocissimum**	African Boxthorn					Shrub	• Weed of National Significance • Occurs in almost every vegetation type, usually found along watercourses or at watering places • Plants can start to flower at 2 years old and bear mainly fruit in summer, but flowering and fruiting can occur throughout the year • Resprouts after fire • Seeds are spread by frugivorous animals	• African boxthorn is not thought to be controlled by fire	SA^ Aus^
Maireana excavata	Bottle Fissure-plant		V		Darke Range, Hambidge	Shrub	• Occurs in open grasslands • Flowers/ fruits Jul-Dec • Congeners killed by fire	• Where possible, planned fire should be excluded from these species habitat	Aus^
Olearia pannosa ssp. *pannosa*	Silver Daisy-bush	VU	V	8 26 27 29 49	Yeldulknie, Middlecamp Hills	Shrub	• Occurs in mallee, woodland and forest communities • Flowers Aug-Oct • Resprouts from lignotubers after fire		(Pobke 2007) SA^

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	Block	Life Form	Species Ecology & Fire Response	Considerations for Fire Management	Source
Prasophyllum calcicola	Limestone Leek-orchid		V	29	Bascombe Well	Orchid	• Occurs in shallow soil pockets on travertine limestone, under mallee • Flowers late Aug – early Oct • Fire is known to kill tubers • Prolific flowering post summer fire on the Eyre Peninsula, but it is not known if this was a result of existing population stimulation or new individuals	• Avoid burning from Apr-Oct • Avoid inter-fire frequencies <10 years • Protection/management of browsing should be considered post-fire especially in small populations	SA^ Aus^
Santalum spicatum	Sandalwood		V		*Note: location is known, however, it is not stated here. Known populations are considered during prescribed burn planning.*	Shrub	• Flowers throughout the year but mainly March-June • Fire sensitive • Seeder	• Avoid large hot bushfires • Consider strategic protection burns around known stands and host plants • Protection/management of browsing should be considered post-fire	SA^ Aus^
Spyridium erymnocladum	Cloaked Spyridium		V		Hincks	Shrub	• Occurs in mixed mallee • Observed to regenerate after fire. Response unknown		SA^
Stypandra glauca	Nodding Grass-lily		V		Carappee Hill, Darke Range	Herb	• Found in open forests and woodlands • Flowers Aug-Oct • Regenerates vigorously by basal resprouting after fire	• Fire should be considered to stimulate seedling regeneration if recruitment is poor/absent	Aus^

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	Block	Life Form	Species Ecology & Fire Response	Considerations for Fire Management	Source
Swainsona pyrophila	Yellow Swainson-pea	VU	R	29	Hambidge, Heggaton, Ironstone Hill, Munyaroo North, Munyaroo South, Secret Rocks	Shrub	• Occurs in mallee vegetation communities on a variety of soil types • Flowers Jul-Oct • Adapted to flower after fire and subsequent rain, which stimulate seed germination and growth • Short-lived and sets seed for only one or two years after germination • Seedbank may require fire to stimulate germination	• Fire should be considered to stimulate seedling regeneration if recruitment is poor/absent • Protection/management of browsing should be considered post-fire	(Pobke 2007; Todd 2000; Tonkinson & Robertson 2010)
Taraxacum cygnorum	Coast Dandelion	VU			Bascombe Well	Herb	• Occurs near-coastal areas in shrubby woodlands on limestone with red-brown sandy loam soils • Short lived plant • Flowers Oct-Dec • Fire response is unknown		(Carter 2010)
Thelymitra epipactoides	Metallic Sun-orchid	EN	E		Barwell	Orchid	• Grows in fertile loams that are often covered by open forest, open heathland or grassland • Flowers Aug-Nov • Fruits Dec-Jan • Known to flower abundantly after late summer burns	• Avoid burning from Apr-Nov • Fire should be considered to stimulate seedling regeneration if recruitment is poor/absent • Protection/management of browsing should be considered post-fire	(Coates, Jeanes & Pritchard 2002; Pobke 2007)

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	Block	Life Form	Species Ecology & Fire Response	Considerations for Fire Management	Source
*Ulex europeaus**	Gorse					Shrub	• Weed of National Significance • 1 year to set seed • Soil stored seed • Germination of soil stored seed stimulated following fire • Fire kills adult plants	• Post fire weed control likely to be required since burning stimulates mass germination of the seed bank • Allow 10 years between burns to allow native understorey to develop • Burn in spring, such that subsequent seedlings are establishing in the heat of summer, and before seed dispersal (September)	(DENR 2011a)

Appendix 4 – Fire Response of Rated and Significant Fauna Species

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	Block	Diet	Breeding	Species Ecology & Fire Response	Considerations for Fire Management	Source
Bird	*Acanthiza iredalei iredalei*	Slender-billed Thornbill (western ssp)		R		Munyaroo North	I H	• Sites: Placed amongst the upper branches of small samphire shrubs • Material: A dome-shaped nest of strips of bark and grass bound with spiders web's • Season: Jul-Oct	• Prefers chenopod shrublands that are dominated by samphires or *Maireana* and *Atriplex* associations • Forages on the ground and in low shrubs • Congers highest densities observed in vegetation 1-12 yrs post-fire with lower density in 22 yrs post-fire	• Protect known nesting sites from the impact of prescribed burns	Aus^
Bird	*Amytornis textilis myall*	Western Grasswren			14	Munyaroo North	I	• Sites: Placed close to the ground and in the centre of a low shrub such as saltbush *Atriplex* spp. or bluebush *Maireana* spp. • Material: Open cup nest of grasses, twigs and strips of bark • Season: Jun-Sep	• Prefers open chenopod shrublands • Fire response is unknown	• Protect known nesting sites from the impact of prescribed burns	Aus^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	Block	Diet	Breeding	Species Ecology & Fire Response	Considerations for Fire Management	Source
Bird	*Calyptorhynchus funereus whitei*	Eyre Peninsula Yellow-tailed Black-Cockatoo		V	4 8 9 26 29 37 47	Peachna	G	• Sites: hollows high in canopy • Material: woodchips • Season: Nov-Mar • No known breeding sites in the planning area, more likely locations on southern Eyre Peninsula	• Inhabits woodland & often seen in pine plantations where it feeds on seeds • High mobility • Potential long-term loss of breeding habitat from extensive, high intensity fires • High intensity fire can increase hollow loss. However, fire exclusion may inhibit hollow development	• Avoid burning more than 20% of nesting patches in a single fire event • Avoid two or more successive fires in summer • Avoid high intensity fires • Minimise loss of tree hollows (avoid high intensity fire) • Minimise loss of important feeding sites and critical habitat (including Aleppo Pine stands) • Consideration should be given to replacement food sources if introduced pines are impacted by fire	(Way & van Weenen 2008)

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	Block	Diet	Breeding	Species Ecology & Fire Response	Considerations for Fire Management	Source
Bird	*Leipoa ocellata*	Malleefowl	VU	V	12 27 29 39 49 55	Balumbah, Barwell, Bascombe Well, Carappee Hill, Hambidge, Heggaton, Hincks, Ironstone Hill, Munyaroo North, Munyaroo South, Peachna, Secret Rocks, Shannon, Sheoak Hill, Tooligie, Yalanda Hill, Yeldulknie	G I	• Site: constructs a large nesting mound on the ground • Material: sand, gravel and vegetative matter • Season: mound construction autumn-spring, eggs are laid Sept-Apr	• Utilises mallee and woodland habitats • Requires a dense and extensive leaf litter layer to provide nest material for incubation • Fire in the mallee typically kills and removes all parts of vegetation above the surface and thus fire has a major influence on the structure and floristic composition of habitats occupied by Malleefowl • Vegetation <10 years post-fire may have greater food density than older sites • Breeding rarely occurs in sites burnt within 15 years • Unburnt patches within burnt areas appear critical for recolonisation and post-fire persistence • Ideal habitat age thresholds estimated between 20-60 years • Mortality as a result of fire may be substantial	• Ensure a bias towards vegetation of 20-60 years of age • Promote localised patchiness in core habitat areas • Provide unburnt areas for refuge • Reduce the likelihood of landscape-scale fires • Avoid disturbance of active nests with fire, including suppression and track construction • Fox baiting programs should be considered pre- and post-burn	(Benshemesh 1992,2007; Woinarski 1989)

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	Block	Diet	Breeding	Species Ecology & Fire Response	Considerations for Fire Management	Source
Bird	*Stagonopleura guttata*	Diamond Firetail		V	29 49	Carappee Hill, Darke Range, Middlecamp Hills, Moody Tank, Munyaroo West, Peachna	G	• Sites: shrub & tree canopy • Material: grass • Season: Oct-Jan	• Inhabits grassy Eucalypt communities • Feeds exclusively on the ground on grasses & forbs • Requires ground cover, including fallen timber • Local movements • Strong fliers likely to evade fire • Habitat likely to be temporarily impacted by fire	• >25% of habitat where populations are known to occur should not burn in a single fire event • Protect known nesting sites from the impact of prescribed burns • Post-fire woody weed control may be required to prevent habitat becoming more dense • Post-fire grazing pressure management may be required • Ensure that grassy woodland systems are managed to retain open structures	SA^ Aus^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	Block	Diet	Breeding	Species Ecology & Fire Response	Considerations for Fire Management	Source
Mammal	*Sminthopsis psammophila*	Sandhill Dunnart	EN	V	27 29 49	Hambidge, Hincks, Ironstone Hill, Munyaroo West, Secret Rocks	C	• Sites: large mature Spinifex clumps • Material: small nest chamber composed of Spinifex needles • Season: Spring and early summer	• Prefers Spinifex 8-20 years post-fire	• Minimise the loss of preferred nest sites • Mosaic of post-fire Spinifex is desirable (for future preferred nest sites) • Refer to the Ecological Fire Management Strategy	(Churchill 2001; DENR 2011b)

Appendix 5 – Ecological Communities of Conservation Significance

Ecological Community	SA Status (DEH 2005)	Other Status comments	Occurrence	Components	Fire Response	Considerations for Fire Management	Source
Eyre Peninsula Blue Gum (*E. petiolaris*) Grassy Woodland	On provisional list of threatened ecosystems in SA	Endangered under EPBC Act	Occurs south of the Gawler Ranges mainly in the Koppio Hills, Cleve Hills and west of the Marble Range	• Upper layer: dominated or co-dominated by Eucalyptus petiolaris, other species may include *Allocasuarina verticillate*, *E. camaldulensis*, *E. cladocalyx* and *E. odorata* • Mid-layer: may be an open or dense layer of sclerophyllous shrubs or small trees including *Bursaria spinosa*, *Hakea rugosa*, *Xanthorrhoea semiplana*, *Callistemon rugulosus*, *Melaleuca brevifolia* or *M. decussata* • Ground layer: density influenced by the density of the mid-layer, typically open, low and dominated by a variety of grasses and sedges *Rytidosperma* (formerly *Austrodanthonia*) spp., *Austrostipa* spp., *Carex* spp. and *Lepidosperma viscidum*, and/or rushes such as *Chorizandra enodis* and *Juncus subsecundus*, herbaceous species diversity tends to increase during spring and may include *Chamaescilla corymbosa* var. *corymbosa* (blue squill), Geranium *retrorsum* (common cranesbill) and *Lagenophora huegelii*, low shrubs may include *Dampiera rosmarinifolia*	• Inappropriate fire regimes are listed as a key threat: Fires can impact the perennial flora within the ecological community causing changes in species composition and/or interfering with regeneration capacity • Climate change is listed as a key threat: likely to adversely affect the hydrological and fire regimes experienced	• Manage age classes of vegetation • Protect populations from burning in a single fire event through the use of adjacent landscape protection burns	(EPBC Act Threatened Species Scientific Committee 2013)

Summary of Codes Used in Appendices

Reserve Codes

CODE	RESERVE	CODE	RESERVE
BW	Barwell CP	MT	Moody Tank CP
BC	Bascombe Well CP	MU	Munyaroo CP
CH	Carappee Hill CP	PE	Peachna CP
DR	Darke Range CP	RU	Rudall CP
FH	Franklin Harbor CP	SA	Shannon CP
HB	Hambidge WPA	SO	Sheoak Hill CP and CR
HE	Heggaton CR	PR	The Plug Range CR
HI	Hincks WPA and CP	VT	Verran Tanks CP
IR	Ironstone Hill CP	WH	Wharminda CP
LA	Lacroma CP	YE	Yeldulknie CP
MA	Malgra CP		
MH	Middlecamp Hills CP	HA	Heritage Agreement (brackets indicate nearest reserve)

Other Codes Used

NPW ACT STATUS		EPBC ACT STATUS		DIET OF RATED FAUNA SPECIES	
E	Endangered	EX	Extinct	C	Carnivore or scavenger. Mainly vertebrates
V	Vulnerable	CE	Critically Endangered	H	Herbivore. Includes folivores, grazers & browsers
R	Rare	EN	Endangered	N	Nectar feeder
		VU	Vulnerable	I	Insectivore/omnivore
				G	Granivore. Typically peak in abundance after a fire event in fire adapted vegetation, due to the stimulation of flowering and subsequent seed set.

MISCELLANEOUS CODES	
#	Fire response is unknown or ambiguous, thus the required data is not available to propose Ecological Fire Management Guidelines. When data becomes available the table will be updated
*	Introduced species

FIRE RESPONSE SOURCE	
SA	South Australian data
Aus	Interstate data
^	Data/observations derived from published or unpublished literature

11 GLOSSARY

List of Acronyms

ABBREVIATION	DEFINITION
BMC	Bushfire Management Committees are responsible for the governance, planning and coordination of local fire prevention work. Responsible for the development of Bushfire Risk Management Plans. A total of 16 Bushfire Management Committees exist across the state, reporting to a central State Bushfire Coordination Committee.
CFS	South Australian Country Fire Service
CP	Conservation Park
DEWNR	South Australian Department of Environment, Water and Natural Resources
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
GAFM	South Australian Government Agencies Fire Management Working Group
HA	Vegetation Heritage Agreement/s. Private conservation areas established through an agreement between the SA Minister for Sustainability, Environment and Conservation and the landholder under the *Native Vegetation Act 1991*.
MFS	South Australian Metropolitan Fire Service
IC	Incident Controller. The individual responsible for the management of all incident operations and IMT.
IMT	Incident Management Team. The group of incident management personnel comprising the IC and the people he/she appoints to be responsible for the functions of Operations, Planning and Logistics.
KFRS	Key Fire Response Species. 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.
MIST	Minimum Impact Suppression Techniques. Achieving fire management objectives using methods that are consistent with land and resource management objectives. When determining an appropriate suppression response, consideration will be given to undertaking suppression with greater sensitivity and the long-term effects (WFLLC 2003).
NPW Act	South Australian *National Parks and Wildlife Act 1972*
sp.	Species
spp.	Species (plural)

ABBREVIATION	DEFINITION
ssp.	Subspecies
TPC	The Threshold of Potential Concern is defined as a point in time where Key Fire Response Species are likely to be affected by an aspect of fire regime.
WoNS	Weeds of National Significance are 32 priority weeds that cause major impacts to the economy, the environment and society 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 2012).
WPA	Wilderness Protection Area

Glossary of Fire Management Terminology

TERM	DEFINITION
Backburn(ing)	A fire started intentionally along the inner edge of a control line to consume the fuel in the path of a bushfire.
Bark fuel	The flammable bark on tree trunks and upper branches (DENR 2011d).
Biodiversity	Biological diversity. The diversity of life in all its forms (i.e. plants, animals and micro-organisms) and at all its levels of organisation (i.e. genetic, species and ecosystem levels).
Bushfire	An unplanned fire. A generic term that includes grass fires, forest fires and scrub fires.
Bushfire Management Area Plan	Replaces a Bushfire Prevention Plan. Developed by Bushfire Management Committees as a requirement under the Fire and Emergency Services Act 2005.
Bushfire Survival Plan	Also known as a Bushfire Action Plan. A pre-prepared plan developed by people who live, visit or work in a bushfire prone area encompassing the decision to either "Leave Early" or to "Stay and Defend" to ensure that they are prepared and know what to do in the event of a bushfire (CFS 2009).
Canopy fuel	The crowns (leaves and fine twigs) of the tallest layer of trees in a forest or woodland. Not measured as part of the overall fuel hazard assessment (DENR 2011d).
Control line	A natural or constructed barrier, or treated fire edge, used in fire suppression and prescribed burning to limit the spread of fire.
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.
Ecological fire management	The active use of fire in nominated areas to achieve specified ecological objectives.

TERM	DEFINITION
Elevated fuel	Shrubs and juvenile understorey plants up to 3 m in height (DENR 2011d).
Fine fuels	Grass, leaves, bark and twigs less than 6 mm in diameter.
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 (GAFM 2014).
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 danger rating	An evaluation of fire rate of spread, or suppression difficulty for specific combinations of fuel, fuel moisture, temperature, humidity and wind speed. The rating can be Low, Moderate, High, Very High or Extreme.
Fire frequency	The number of fires that have occurred on the same area over a time period.
Fire intensity	The rate of energy or heat release per unit time per unit length of fire front, usually expressed in kilowatts per metre (kw/m) (Pausas *et al.* 2003).
Fire interval	The interval between successive fires.
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 *et al.* 2004).
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 severity	The effect of fire on an ecosystem, that is, on living plants, as well as on the amount and location of organic matter consumed during a fire (Pausas *et al.* 2003).
Fire suppression	The activities connected with restricting the spread of bushfire following its detection and making it safe.
Fire Suppression chemicals	Any 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.

TERM	DEFINITION
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 (DENR 2011d).
Fuel management	Modification of fuels by prescribed burning, or other means.
Included lands	The proclaimed reserves and Crown lands managed by DEWNR that are located within the planning area, and HA where the owners have agreed to participate in this plan.
Landscape protection (prescribed burns)	A clearly defined, strategic program of prescribed burns in C-zones, applied to mitigate the risk of a whole block/reserve/area burning in a single bushfire event (DEWNR 2013c).
Life history	The combination of attributes with respect to growth, shelter, food/nutrients and reproduction which determine species' requirements for existence (FEWG 2004).
Major track	A track designed, constructed and maintained for the safe passage of firefighting vehicles undertaking fire management activities. Track shall be a minimum of 7 metres wide and sufficiently clear of vegetation both sides and overhead to allow ready two-way access (GAFM 2014).
Mechanical removal	Physical modification of flammable material to reduce fuel hazard levels through selective logging, thinning, clearing, slashing, mowing and trimming of vegetation using machinery or equipment.
Minor track	A track designed, constructed and maintained for the safe passage of firefighting vehicles undertaking fire management activities. Track shall be 4 to 5 metres wide and sufficiently clear of vegetation both sides and overhead to permit single lane access (GAFM 2014).
Near-surface fuel	Grasses, low shrubs and heath, sometimes containing suspended components (leaves, bark and/or twigs).

TERM	DEFINITION
Of conservation significance	In this plan, used to describe important or rated populations or species of flora and fauna as well as vegetation communities. These may be: Nationally rated, that is, listed as Threatened (with a rating of Extinct, Critically Endangered, Endangered, Vulnerable or Conservation Dependent) under the federal EPBC Act. South Australian rated, listed as Threatened (with a rating of Endangered, Vulnerable or Rare) under the NPW Act, 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 DEWNR Provisional List of Threatened Ecosystems of South Australia (DEH 2005).
Patchiness	The uneven distribution of fire regime across an area. Patchiness can be used to describe variability within a single burn area or variability between burn areas across a landscape.
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.
Readiness	All activities undertaken in advance of an incident to decrease the impact, extent and severity of the incident and to ensure a more effective response.
Response plan	A plan detailing the response for a risk or an area including the type and number of resources.
Risk assessment	Used in DEWNR fire planning to assist in evaluating the threat to life, property and environmental assets posed by bushfire and also to aid in developing strategies and works for risk mitigation. Considers Likelihood and Consequence to determine an overall risk rating through a matrix (DEWNR 2013c).
Service track	All other access tracks which are not maintained to the Major, Standard or Minor Track requirements and therefore may not be trafficable or appropriate to use these for fire management purposes (GAFM 2014).
Spotting	The ignition of spot fires from sparks or embers.
Standard track	A track designed, constructed and maintained for the safe passage of firefighting vehicles undertaking fire management activities. Track shall be 4 to 5 metres wide, sufficiently clear of vegetation both sides and overhead and incorporate passing bays (a minimum of 17 metres long and up to 6 metres wide) every 400 metres or less (GAFM 2014).

TERM	DEFINITION
Surface fuel	Otherwise known as 'litter'. Comprised of leaves, twigs and bark on the ground (DENR 2011d).
Vital attributes	Vital attributes are the key life history features which determine how a species lives and reproduces. With respect to fire, these attributes govern how a species responds to fire and/or persists within a particular fire regime (FEWG 2004).

Unless otherwise indicated, definitions have been sourced from the DEWNR Fire Management Glossary (DEWNR 2013c) or the *AFAC Bushfire Glossary* (AFAC 2012).