Alinytjara Wilurara

Fire Management Strategy

2014

Incorporating Aṉangu Pitjantjatjara Yankunytjatjara, Maralinga Tjarutja, Yalata, Mamungari, Tallaringa, Yumbarra Pureba and Boondina Conservation Parks, Yellabinna and Nullarbor Regional Reserves, Nullarbor National Park, Nullarbor & Yellabinna Wilderness Protection Areas

Natural Resources
Alinytjara Wilurara

Government of South Australia

Strategy Partners

Anangu Pitjantjatjara Yankunytjatjara Community

Maralinga Tjarutja Community

Yalata Community

Mamungari Conservation Park Co-management Board

Antakirinja Matu-Yankunytjatjara Aboriginal Corporation

Far West Coast Aboriginal Corporation

Nullarbor Co-management Board

Yumbarra Co-management Advisory Committee

Department of Environment, Water and Natural Resources

Alinytjara Wilurara Natural Resources Management Board

South Australian Country Fire Service

Native Vegetation Council

This project has been assisted by the Native Vegetation Council through its Significant Environmental Benefit/Research/Roadside Survey Heritage Agreement/ Heritage Agreement Fencing Grant.

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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: www.environment.sa.gov.au/fire/

Front Cover: Burning country APY Lands by J Robin & J Stelmann

November 2014

Government of South Australia
Department of Environment, Water and Natural Resources

FOREWORD

The Alinytjara Wilurara Fire Management Strategy provides a major step in the recognition of the role that fire plays in the Region's biodiversity. Fire is widely accepted as a natural element in the Australian environment and much of its animal and plant life are dependent on it for their continued existence.

For hundreds of years, Anangu, the traditional custodians of the Alinytjara Wilurara Region, extensively used fire as a tool to manipulate their environment for a variety of reasons including food gathering, personal safety and land management. These fires were often small, low intensity burns undertaken at specific times of the year for well-considered and predetermined outcomes. The burn mosaics or patches that resulted from this activity either stopped or greatly influenced hot summer bushfires from burning very large tracts of land.

The Alinytjara Wilurara Fire Management Strategy recognises and respects Anangu's enduring physical and cultural relationship to country. The land management knowledge and skills of traditional owners, combined with western knowledge of the Region's ecosystems, form a strong and informed basis for strategic maintenance regimes and practices that sustain healthy country.

In adopting a ngapartji-ngapartji (co-operative) land management partnership between Anangu and western cultural knowledge, a working relationship has been established that will ensure positive achievements and worthy outcomes for all. I have great pleasure in presenting the strategy to all South Australians.

Parry Agius
Presiding Member
Alinytjara Wilurara Natural Resources Management Board

EXECUTIVE SUMMARY

SCOPE

This fire management strategy has been developed for the Alinytjara Wilurara Natural Resources Management (AW NRM) Board by the Department of Environment, Water and Natural Resources (DEWNR). The strategy covers the entire AW NRM Region, which is made up of dedicated Aboriginal Lands, DEWNR reserves and other lands managed for conservation purposes, as follows:

Aboriginal Lands:

- Anangu Pitjantjatjara Yankunytjatjara (APY)
- Maralinga Tjarutja (MT) (including Mamungari Conservation Park (CP) co-managed by DEWNR)
- Yalata

DEWNR Reserves:

- Boondina CP
- Nullarbor National Park (NP)
- Nullarbor Regional Reserve (RR)
- Nullarbor Wilderness Protection Area (WA)
- Pureba CP
- Tallaringa CP
- Yellabinna RR
- Yellabinna WA
- Yumbarra CP

Other Lands:

- selected Crown land

The strategy has been developed with a ngapartji-ngapartji (partnership) approach between the SA Country Fire Service (CFS) and the landholders and managers in the area, namely:

- Anangu Pitjantjatjara Yankunytjatjara (APY)
- Maralinga Tjarutja (MT)
- Mamungari Co-Management Board
- Yalata
- AW NRM Board
- DEWNR

Aim

The Alinytjara Wilurara (AW) fire management strategy has been developed to help facilitate fire management planning across the AW NRM Region.

This strategy provides a framework for Anangu[1] to develop fire management plans and/or annual work programs for the seven Fire Management Landscapes in a ngapartji-ngapartji approach with supporting agencies. It uses a risk-based, landscape-scale approach to address life, property, cultural and ecological protection needs and combines traditional and western ecological knowledge to develop fire management strategies, which support contemporary Anangu aspirations and protect and enhance biodiversity.

[1] used in this strategy to refer to any Aboriginal person with an interest in the AW Region

Objectives

The objectives of the AW fire management strategy are to:

1. Support Aboriginal Fire Management Aspirations
2. Protect Life and Property
3. Protect Areas of Cultural Significance
4. Manage Fuels on a Landscape Scale
5. Protect and Enhance Biodiversity
6. Identify Training, Resource and Infrastructure Requirements
7. Identify Suppression Considerations
8. Manage Fire Risk in relation to Public Access
9. Manage Post-fire Rehabilitation and Recovery
10. Manage Adaptively

It is recognised that successful delivery of these objectives needs to be underpinned by the development of sustainable job pathways for Anangu, including long-term public/private partnership arrangements.

PURPOSE

It is not the intention of this strategy to replace or direct cultural fire management activities undertaken by Anangu on Anangu lands, whether executed by traditional or contemporary means. Rather, the strategy seeks to support Anangu to undertake cultural fire management where appropriate.

On Anangu owned land, it is the Anangu owners who must have final say about the management of their country, and be supported to implement their plans by relevant land management agencies. It is important that all agencies work together to build trust and collaborate effectively, to provide the best possible support to Anangu.

There are many similarities and differences between Anangu and western ecological knowledge; to ensure a successful ngapartji-ngapartji relationship, all parties need to acknowledge and consider these respectfully. It is also important to recognise that management and use of land by Anangu is governed by Traditional Owner responsibility and the oral tradition of Tjukurpa. Rather than focusing on documenting sites, or attempting to describe and codify traditional knowledge, the emphasis in management should be on encouraging the retention of traditional knowledge by Anangu and by developing and maintaining sincere relationships with people and their land.

This strategy provides a framework for the annual identification of fire management activities based upon discussion and engagement with Anangu. These orally based approaches are more likely to be accepted by Anangu and therefore more likely to achieve the desired outcomes for all project partners.

With the approval of the AW NRM Board, the draft strategy was released for public comment for a period of six weeks over March and April 2013. Comments were then evaluated and incorporated where appropriate. A major review of this strategy will occur after ten years of implementation or earlier if required.

LANGUAGE GLOSSARY

Alinytjara Wilurara	North west
Ananngu	A western desert language word for Aboriginal person. Commonly used to refer to any individual or group of western desert language people of Pitjantjatjara, Yankunytjatjara or Ngaanyatjarra descent. Importantly, other Aboriginal groups also have traditional claims to Alinytjara Wilurara (AW) Region, including Pila Nguru (Spinifex People) in Western Australia, Yabi Dinah (Western Kokatha), Wirangu, Ngalea, Nakako and Mirning people
Ananngu Pitjantjatjara Yankunytjatjara	Aboriginal people of the Pitjantjatjara and Yankunytjatjara Lands
Itjari itjari	Marsupial mole – *Notoryctes typhlops*
Kakalaya	Major Mitchell's/Pink Cockatoo – *Cacatua leadbeateri*
Kipara, Parulpa	Australian Bustard – *Ardeotis australis*
Mamungari	Anangu word for 'place of harmful spirits'
Maralinga Tjarutja	Aboriginal people who traditionally inhabit the remote western areas of South Australia. They are a southern Pitjantjatjara people
Nganamara	Malleefowl – *Leipoa ocellata*
Ngapartji-ngapartji	The Anangu term to describe 'reciprocally, cooperatively, in partnership'
Nguraritja	Someone that belongs to a place, Traditional Custodian, Traditional Owner`
Pila Nguru	Aboriginal people, or Spinifex people, whose traditional lands are situated within the Great Victoria Desert, Western Australia
Tjakura	Great Desert Skink – *Egernia kintorei*
Tjukurpa	The Anangu word for an oral tradition that represents the spiritual beliefs of the landowners and provides them with a theoretical and political framework for management and use of the land
Tjungu	'working together', united
Warru	Black-footed rock-wallaby – *Petrogale lateralis* MacDonnell Ranges Race
Warukul / Trikultriny	Striated Grasswren – *Amytornis striatus*
Wilytjiny	Sandhill Dunnart – *Sminthopsis psammophila*

Note: Anangu words are used where possible throughout the document, followed by the English translation, then scientific name (where required).

Glossary based upon Mamungari CP Co-Management Board (2011) and APYLM (2011).

ACRONYMS & ABBREVIATIONS

APY	Anangu Pitjantjatjara Yankunytjatjara
APYLM	Anangu Pitjantjatjara Yankunytjatjara Land Management
AW	Alinytjara Wilurara
AW NRM	Alinytjara Wilurara Natural Resources Management
A-zone	Asset Protection Zone
B-zone	Bushfire Buffer Zone
CFS	SA Country Fire Service
CP	Conservation Park
C-zone	Conservation-Land Management Zone
DEWNR	Department of Environment, Water and Natural Resources (SA)
DPTI	Department of Planning, Transport and Infrastructure (SA)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cwth)
FES Act	*Fire and Emergency Services Act 2005* (SA)
FWCAC	Far West Coast Aboriginal Corporation
EFMG	Ecological Fire Management Guidelines
IBRA	Interim Biogeographic Regions for Australia
IPA	Indigenous Protected Area
KFRS	Key Fire Response Species
MT	Maralinga Tjarutja
MT Land Rights Act	*Maralinga Tjarutja Land Rights Act 1984* (SA)
MVS	Major Vegetation Sub-group
NP	National Park
NPW Act	*National Parks and Wildlife Act 1972* (SA)
NVIS	Native Vegetation Information System
PPE	Personal Protective Equipment
RR	Regional Reserve
TPC	Threshold of Potential Concern
WA	Wilderness Protection Area
WA Act	*Wilderness Protection Act 1992* (SA)

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Fire Management Maps

Maps supporting this fire management plan are interactive and are provided via the web under four 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'. The maps listed below can be accessed by clicking on the 'Map Themes' button.

'Fire Management Maps' is designed to illustrate the text in the plans 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 Strategy.

Map Themes:

Map 1 – Terrain, Tenure & Infrastructure
Map 2 – Veg Communities & Significant Species
Map 3 – Fire History
Map 4 – Fire Management & Access
Map 5 – Implementation Strategy – Proposed Burns.

1 INTRODUCTION

1.1 Scope

The AW NRM Plan (AW NRM Board 2009) identifies altered and inappropriate fire regimes as a key threatening process in the region. A lack of knowledge regarding fire history, traditional burning and species response to fire were also identified as key concerns for the Board.

This strategy takes the first steps in compiling existing information and undertaking preliminary analysis to support future fire management in the region.

The AW fire management strategy covers a total area of approximately 28,500,000 ha made up of dedicated Aboriginal Lands, DEWNR reserves and other lands managed for conservation purposes (Table 4), as detailed below and in Figure 1.

Aboriginal Lands:

- Anangu Pitjantjatjara Yankunytjatjara (APY)
- Maralinga Tjarutja (MT) (including Mamungari CP co-managed by DEWNR)
- Yalata.

DEWNR Reserves:

- Boondina CP
- Nullarbor NP
- Nullarbor RR
- Nullarbor WA
- Pureba CP
- Tallaringa CP
- Yellabinna RR
- Yellabinna WA
- Yumbarra CP.

Other lands:

- selected Crown land.

This strategy promotes a ngapartji-ngapartji approach between the CFS and all landholders and managers in the area, namely:

- Anangu Pitjantjatjara Yankunytjatjara (APY)
- Maralinga Tjarutja (MT)
- Mamungari Co-Management Board
- Yalata
- AW NRM Board
- DEWNR
- All other Landholders and Lessees.

While the general DEWNR fire management planning template has been used in the preparation of this regional document, DEWNR fire management policy and procedures only apply to the DEWNR managed reserves. Note that in the case of Mamungari CP this is done in accordance with the co-management agreement and the reserve management plan (Mamungari CP Board of Management 2011).

The AW Fire Management Strategy document:

- describes the planning framework
- describes the fire environment
- describes cultural and ecological fire management practices
- assesses the risk to life, property, cultural and ecological values
- develops objectives and strategies to manage fire within the region.

FIGURE 1 – AW NRM REGION

This has been achieved by:

- collating and analysing existing information, including traditional fire management practices
- using satellite imagery to develop baseline fire history maps
- undertaking a risk assessment to identify life, property, cultural and ecological values that may be threatened by bushfire
- developing and applying DEWNR Ecological Fire Management Guidelines (EFMG) to determine appropriate fire regimes
- using 'best available' data and information to identify future actions to support effective and appropriate fire management in the strategy area.

1.2 Aim

The aim of the AW fire management strategy is as follows.

Aim

The AW fire management strategy has been developed to help facilitate fire management planning across the AW NRM Region.

The strategy provides a framework for Anangu (used in this strategy to refer to any Aboriginal person with an interest in the AW Region[2]) to develop fire management plans and/or annual work programs for the seven Fire Management Landscapes, in a ngapartji-ngapartji approach with supporting agencies, using a risk-based, landscape-scale approach to manage fire in the region. It combines Anangu knowledge with scientific information to develop fire management strategies that support contemporary Anangu aspirations while protecting life, property and environment.

1.3 Objectives

The fire management objectives for the AW fire management strategy are as follows.

Objectives

1. Support Anangu Fire Management Aspirations
    - support the integration and continuity of traditional knowledge into fire management in the region.
2. Protect Life and Property
    - minimise the risk that bushfire poses to life and property, including significant infrastructure, within the strategy area.
    - develop community awareness and education strategies.
3. Protect Areas of Cultural Significance
    - ensure that sites and areas important in Aboriginal culture and non-Aboriginal culture are protected from the threat of bushfire.
4. Manage Fuels on a Landscape Scale
    - reduce the likelihood of a whole reserve and/or area of contiguous native vegetation burning in a single bushfire event.
5. Protect and Enhance Biodiversity
    - protect important habitats and provide for the protection of fauna and flora species of cultural and conservation significance at a landscape scale.
    - integrate active management with natural fire events to maintain and improve the viability of native species, populations, communities and habitats in the strategy area.
6. Identify Training, Resource and Infrastructure Requirements

[2] The Plan recognises that there are several language groups and dialects in the Region. Various parts of this plan will be translated into Pitjantjatjara, the language understood by most Aboriginal people in the Region and neighbouring areas.

Objectives

7. Identify Suppression Considerations
    - identify existing response plans and associated suppression considerations.
8. Manage Fire Risk and Public Access
    - identify visitor management issues
9. Manage Post-fire Rehabilitation and Recovery
10. Manage Adaptively
    - manage adaptively by continuously improving knowledge of fire regimes required by species, populations, communities and habitats through ongoing monitoring and research.

1.4 Purpose

It is not the intention of this strategy to replace or direct cultural fire management activities undertaken by Anangu on Anangu lands, whether executed by traditional or western means (refer to Section 3.6.1 for further information on Anangu and western knowledge systems). Rather, this strategy supports the integration and continuity of traditional knowledge within fire management in the region, based upon contemporary Anangu aspirations and the maintenance and enhancement of biodiversity.

On DEWNR managed reserves within the strategy area standard DEWNR fire management policy and procedure has been applied, where appropriate and in accordance with existing reserve management plans.

On Anangu owned land, it is the Anangu owners who must have final say about the management of their country, and be supported to implement their plans by relevant land management agencies. It is important that all agencies work together to build trust and collaborate effectively, to provide the best possible support to Anangu. This includes sharing resources and information, and working with landowners and their organisations to make equitable and accepted resource allocation decisions.

On country that is to be jointly managed, it is vital that the process of Tjungu (joint management) "reinforces Nguraritja (Aboriginal traditional owners) as the custodians and interpreters of their own culture, and advocates for the own social and economic interests" (DELM 1993, pg 10).

As noted in the Walalkara Indigenous Protected Area (IPA) Country Management Plan, "respectful and effective communication lies at the heart of good partnerships" (APYLM 2010b, pg 22). To facilitate good partnerships it is important to recognise and understand the similarities and differences between traditional knowledge and western science.

Traditional knowledge refers to insights, observations, understandings and beliefs which are essential to decision-making but which do not arise from the application of conventional scientific expertise. Traditional knowledge is acquired from on-going local observations, which, in the case of Aboriginal land and fire management in Australia, have been continuously refined over many generations. Importantly, the term "traditional knowledge" does not imply that such knowledge is out-dated; in fact, it is as contemporary as any other knowledge that forms the basis for land and natural resources management throughout Australia today.

It is also important to recognise that management and use of land by Anangu is governed by the oral tradition of Tjukurpa. Rather than focusing on documenting sites, or attempting to describe and codify traditional knowledge, the emphasis in management needs to be working with a ngapartji-ngapartji approach so there is equal contribution of management strategies and decisions for management of country (DELM 1993). Developing and maintaining relationships on country is a critical basis for active land management work.

This strategy provides a framework for the annual identification of fire management activities based upon discussion and engagement with Anangu. This oral-based approach is more likely to be accepted by Anangu and therefore more likely to achieve the desired outcomes for all project partners.

1.5 Division of Planning Area

Due to the size of the strategy area and the nature of the land ownership and management arrangements, the region has been divided into seven Fire Management Landscapes, based on those identified in the AW Regional NRM Plan (AW NRM Board 2009), excluding coastal areas, i.e.:

- APY Ranges
- Eastern APY and Tallaringa
- Great Victoria Dessert
- Nullarbor Plain
- Southern APY
- Yalata lands
- Yellabinna and Yumbarra.

These landscapes have been primarily based on land and sea divide, the Interim Biogeographic Regionalisation of Australia (IBRA) Regions, soils and landforms, and logic for management and reporting of program and project initiatives, and follow the landscapes as devised in the AW regional NRM Plan.

The purpose of dividing the strategy area into smaller Fire Management Landscapes is to better organise assets, provide more specific information, identify values and threatening processes easier, and to guide the development of detailed fire management and/or annual work programs where issues are unique to a particular area can be addressed (refer to Section 5.1).

Fire regimes or species distribution areas that are larger than or include more than one landscape will still be managed as a whole.

2 THE PLANNING FRAMEWORK

Land management on Aboriginal lands is initiated and undertaken by the Aboriginal owners. The function of this strategy is to support the fire management aspirations of Anangu communities by providing a framework for Anangu to develop and implement fire management plans and/or annual work programs for smaller geographic/biological areas within the AW NRM Region.

Anangu Pitjantjatjara Yankunytjatjara Land Management (APYLM), for example, has undertaken significant fire management planning work over the past decade, and is already well advanced in the development and implementation of active fire management on a number of areas of the APY Lands.

2.1 Strategy Partners

The partners in this strategy are the landholders and managers within AW NRM Region, together with the bushfire hazard leader for the State (the CFS), and the AW NRM Board, which has land management support and policy roles in relation to resource management within the strategy area. Partnerships with interstate neighbours are also important when implementing landscape scale projects.

The strategy area includes significant areas of Aboriginal owned land (APY, MT and Yalata), and all of the DEWNR managed reserves included within the strategy are subject to Indigenous Land Use Agreements, including co-management arrangements.

On Anangu owned land, it is the Anangu owners who must have final say about the management of their country, and be supported to implement their plans by relevant land management agencies. It is important that all agencies work ngapartji-ngapartji to build trust and collaborate effectively, to provide the best possible support to Anangu. This includes sharing resources and information, and working with landowners and their organisations to make equitable and accepted resource allocation decisions.

A number of existing APYLM management plans outline processes for annual identification of fire management activities based upon discussion and engagement with Anangu. These Tjukurpa approaches depend upon sound working relationships with supporting agencies and are most likely to be accepted by Anangu.

2.2 Consultation and Communication

The strategy partners are committed to close cooperation and involvement with local communities, and local, State and Commonwealth organisations, to achieve the objectives of this strategy.

A communications plan has been developed to support the strategy, which identifies the stakeholders to be engaged in the process and appropriate methods of communication. In particular, Anangu will be consulted in the first instance before this document is released to the general public for comment.

2.3 Legislation

This section provides a brief overview of legislation applicable to the strategy (refer to Table 1) and demonstrates the interactions between the relevant legislation and other supporting processes (refer to Figure 2). It is important to highlight that the preparation of fire management plans or strategies themselves are not a statutory requirement and that Anangu are exempt from certain provisions in the following Acts. These exemptions are listed in Table 2.

TABLE 1 – LEGISLATION INFLUENCING FIRE MANAGEMENT PLANNING

Legislation	Relevance to fire management
Anangu Pitjantjatjara Yankunytjatjara Land Rights Act 1981 (SA)	APY is responsible for managing the lands that are the subject of this statute. There are no statutory requirements for land or fire management planning on the APY. However, APY established a Land Management Team in 1990, and has been working on fire management since the late 1990s.
Maralinga Tjarutja Land Rights Act 1984 (SA) (MT Land Rights Act)	MT is responsible for managing the lands that are the subject of this statute. There are no statutory requirements for land or fire management planning on MT. However, MT developed a draft land management plan in 2010 (refer Section 2.5.2 below).
Aboriginal Lands Trust Act 1966 (SA)	The Yalata lands are vested in the Aboriginal Lands Trust under the *Aboriginal Lands Trust Act 1966* and managed by the Yalata Community Council. There are no statutory requirements for land or fire management planning on Yalata, although Yalata do have a Land Management Team.
Fire and Emergency Services Act 2005 (SA)	s 105H-1: Conveys the fire management responsibilities of landowners 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.
	s 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 and Wildlife Act 1972 (SA) (NPW Act)	s 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.
	s 43D-H: Outlines the provisions for the co-management of NPW Act reserves.
Wilderness Protection Act 1991 (SA) (WP Act)	s 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'.
	s 33A: Outlines the provisions for the co-management of WP Act reserves.
Crown Land Management Act 2009 (SA)	s 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)	s 29: Applies to the whole of the state (see Table 2 (below) for exemptions). DEWNR Landowners must meet the provisions of the Act if intending to modify native vegetation on their land (this includes burning). Clearance applications are assessed by the Native Vegetation Council in accordance with Schedule 1 of the Act.
	s 23: Outlines the provisions for the establishment of native vegetation Heritage Agreements for conservation purposes on private land.
Native Vegetation Regulations 2003 (SA)	s 5A-1: Clarifies which actions can be undertaken to modify native vegetation for fire prevention and control. Subsection (b) (ii) (C) specifies clearance on NPW Act and *Wilderness Protection Act 1991* reserves can proceed when in accordance with a SOP approved by the Native Vegetation Council.

Legislation	Relevance to fire management
Native Vegetation Regulations 2003 (SA)	S 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 *Interim Guidelines for Ecological Prescribed Burning* (Native Vegetation Council 2013).
Environment Protection and Biodiversity Conservation Act 1999 (Cwth) (EPBC Act)	s 18: Regulation of actions likely to impact nationally-listed species and ecological communities.
	s 269AA: Describes when Recovery Plans should be prepared for nationally-listed species and ecological communities.
Aboriginal Heritage Act 1988 (SA)	The *Aboriginal Heritage Act 1988* applies throughout South Australia and exists to protect and preserve Aboriginal sites, objects and remains. The Act is currently under review. A Register of sites and objects is maintained by the Aboriginal Affairs and Reconciliation Division of the Department of Premier and Cabinet. This Register is consulted prior to proposing works within the strategy, as well as in the process of works planning (e.g. for a prescribed burn, or development of an access track).

TABLE 2 – ANANGU EXEMPTIONS UNDER FEDERAL AND STATE LEGISLATION

Legislation	Exemption
Native Vegetation Act 1991 (SA)	The *Native Vegetation Act 1991* applies to all areas of the state except for lands that are exempt.
Native Title Act 1993 (Cwth)	s 211: The *Native Title Act 1993* allows native title holders to undertake particular activities for the purpose of satisfying their personal, domestic or non-commercial communal needs and/or in exercise or enjoyment of their native title rights and interests.
Aboriginal Heritage Act 1988 (SA)	s 37 of the *Aboriginal Heritage Act 1988* preserves the right for Aboriginal people to act according to tradition, i.e. *"Nothing in this Act prevents Aboriginal people from doing anything in relation to Aboriginal sites, objects or remains in accordance with Aboriginal tradition".*

2.4 State Context

2.4.1 South Australian Country Fire Service

The SA Country Fire Service (CFS) is the lead bushfire management agency in the AW NRM Region and responsible for supporting the coordination of fire management through the State Bushfire Coordination Committee (SBCC) and nine Bushfire Management Committees (BMCs). The AW region falls largely within the Outback Bushfire Management Area (BMA), with small sections of the southern part of the region falling within the Upper Eyre Peninsula BMA. In accordance with the *Fire and Emergency Services Act 2005* (SA), the BMCs are responsible for the development of Bushfire Management Area Plans (BMAPs) for their area. It is likely that this strategy, once completed, will form a significant part of the BMAP for the Outback area.

The SA CFS is also the lead combatant agency for fire suppression activities in rural South Australia. Due to the remoteness and size of the areas covered by this strategy, active suppression of fire incidents has not historically been undertaken in these areas, except where life and property are under threat.

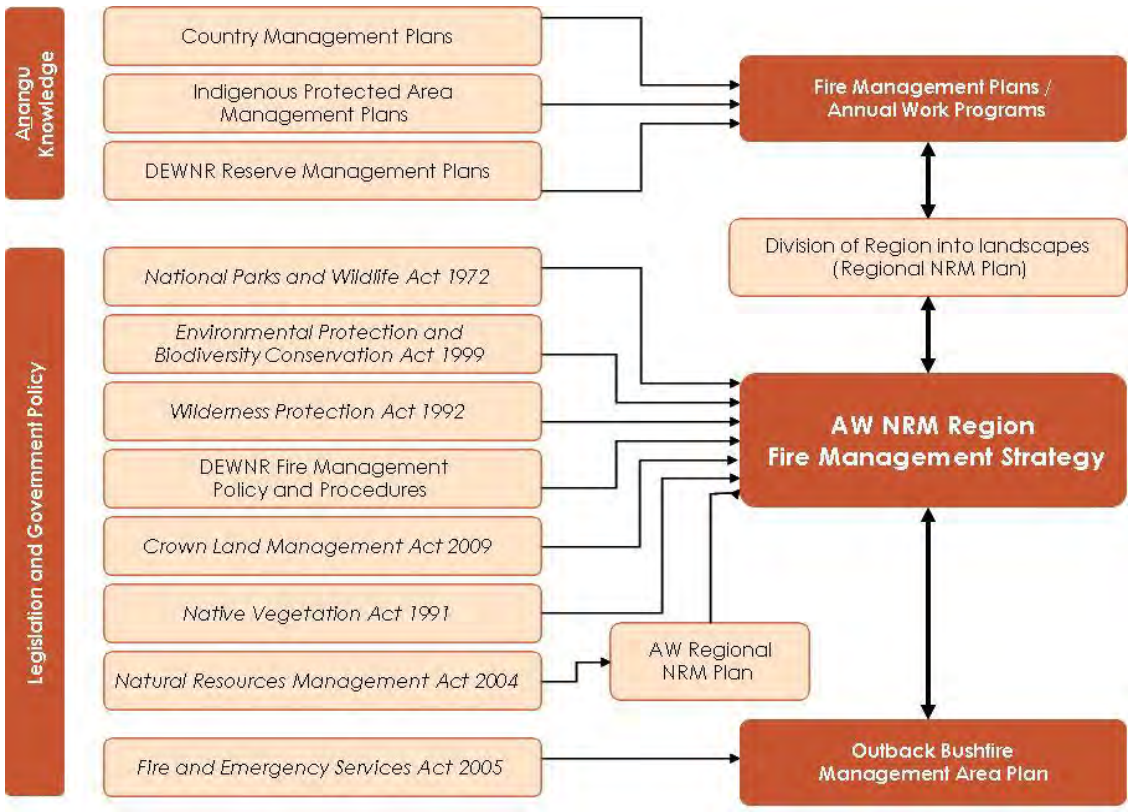

FIGURE 2 – INFLUENCES ON FIRE MANAGEMENT PLANNING IN AW NRM REGION

In 2002 CFS Region 4 staff prepared a bushfire prevention plan for the Amata (Musgrave Park) community and Tjurma homelands on the APY Lands (Vogel & Obst 2002). This plan recommended some on ground prevention works and community education to improve bushfire preparedness in these areas. In 2008 the South Australian Fire and Emergency Services Commission (SAFECOM) undertook an 'environmental scan' of a number of Aboriginal communities in South Australia, including several communities on the APY Lands, and the Yalata community (Heylen & Turner 2008). This 'scan' documented fire infrastructure and on ground works in place at the time, but did not include a bushfire risk assessment.

Fire Ban Districts

Most of the strategy area falls within the North West Pastoral fire ban district, with the southern part falling within the West Coast fire ban district. The fire danger season generally commences in both districts on 1 November and concludes on 31 March. Generalised fire danger season mapping undertaken by CSIRO[3] indicates that the northern part of the strategy area has a spring and summer fire season, the southern areas a summer fire season, and the coastal fringe and northern Eyre Peninsula a summer and autumn fire season.

2.4.2 Department of Environment, Water and Natural Resources

DEWNR has a *Fire Policy and Procedure Manual* (DEWNR 2013c) that contains a Fire Management Policy outlining DEWNR's fire management responsibilities and procedures that provide a framework for fire research, risk modification, readiness, response and recovery on DEWNR managed land. Under the Policy, DEWNR is responsible for:

- fire management on reserves dedicated under the NPW Act or *Wilderness Protection Act 1992* (WP Act)

[3] See http://www.csiro.au/files/images/pjjh.jpg

- fire management on any land under the *Crown Lands Management Act 2009* where the Minister for Sustainability, Environment and Conservation has fire management responsibilities
- fire suppression on other government lands where DEWNR have entered into a formal agreement with other government agencies.

The Policy states that DEWNR will undertake fire management activities to protect life, property and environmental assets and to enhance the conservation of natural and cultural heritage values. Furthermore, it is recognised that fire is a natural component of the environment and the maintenance of biodiversity and ecosystem processes is dependent on appropriate fire regimes.

2.5 Regional Context

This section provides an overview of the regional context for the strategy, including the legislative, policy and governance frameworks, and existing plans of management. Detailed elements of management plans relevant to the strategy are addressed in Section 5.

2.5.1 Anangu Pitjantjatjara Yankunytjatjara

The *Anangu Pitjantjatjara Yankunytjatjara Land Rights Act 1982* confers freehold land rights to the Pitjantjatjara, Yankunytjatjara and Ngaanyatjarra people who are custodians of this country. The APY Lands are managed by an Executive Board made up of ten members representing communities on the lands. The preliminary population estimate for the APY Lands at 30 June 2011 is 2,493 (ABS 2012), mostly concentrated in a number of larger settlements, together with many smaller homeland areas, generally in the northern and eastern parts of the lands.

In 1990 APY Community Council established a land management unit, known as APY Land Management (APYLM) "to assist Pitjantjatjara and Yankunytjatjara people to realise their aspirations for the management of their land" (APYLM 2011). APYLM also supports the social and economic objectives of APY by identifying and creating opportunities for Anangu employment in natural resources management. This has included the creation of five IPAs under the Australian Government's IPA program – Watarru, Walalkara, Kalka-Pipalyatjara, Apara-Makiri-Punti and Antara-Sandy Bore (APYLM 2008a,2008b,2010a,2010b,2011). APYLM supports land management activities in a wide range of fields, including community landscaping, feral animal control, information management, maintenance of traditional land management (including fire management) (APYLM 2004; Paltridge & Latz 2009), pastoral industry development and livestock management, protected area management, storm water management, threatened species management (Paltridge et al. 2009b), and water security.

In 2004 APYLM developed a fire management strategy for the APY Lands (unpublished). The strategy divided the APY Lands into fire management regions, identified communities with particular fire sensitivity, listed management objectives and strategies, proposed monitoring approaches, and outlined a process for developing annual fire management programmes. In 2009 a more detailed fire management plan for the Mann and Musgrave Ranges regions of the APY Lands was developed by Paltridge and Latz (2009). The focus on these regions reflected the presence of significant threatened flora and fauna species in these areas of the APY Lands. This plan also includes a process for annual development of fire management programmes. Elements of the detailed strategies contained in both plans

and the IPA Country Management Plans are addressed in Section 5, and incorporated within the strategy actions.

2.5.2 Maralinga Tjarutja

The *Maralinga Tjarutja Land Rights Act 1984* confers freehold land rights on the Anangu people who are custodians of this country. Like APY, MT is managed by a governing council. There is one community on the MT lands, located at Oak Valley, with a preliminary estimated population at 30 June 2012 of around 110 (ABS 2012). However, the population is mobile and people for whom MT is part of their homelands also live at Yalata, Ceduna, Umoona, in communities on the APY Lands and in Western Australia.

In 2009 Section 400 (the area of the MT lands formerly utilised for atomic weapons testing by the British government in the 1950s) was handed back to MT Ngurariţja. In 2010 a strategic-level land management plan was developed for the MT lands, with the assistance of a private consultant and the Aboriginal Affairs and Reconciliation Division of the Department of Premier and Cabinet (Maralinga Tjarutja 2010). The intention of the plan is to develop a land management structure and team to support on ground activities on the MT lands. The traditional use of fire on the MT lands was limited in geographic extent – that is, it was not used to 'clean up the country' at a landscape scale, but was utilised for hunting, foraging, domestic recreational and cultural purposes.

2.5.3 Mamungari Conservation Park Co-Management Board

The Unnamed CP was originally proclaimed in 1970, and in 1993 the first Tjungu arrangement in South Australia was captured in a management plan for the reserve by MT and the then Department of Environment and Land Management (DELM 1993). At the time the plan was developed, there were no legal mechanisms within the NPW Act for joint management, or for conferring title over the reserve to Ngurariţja. The plan established a Board of Management, including Ngurariţja and departmental representatives. It also identified the need to seek the cooperation of Western Australian authorities and Ngurariţja in the management of adjacent land in Western Australia. In relation to fire, the plan identified that "traditional owners did not burn this country in the same way that occurred, and is being revived, in the country to the north and west" (DELM 1993, pg 17), and no landscape scale fire management activities were proposed, other than those traditionally undertaken for ceremony, hunting and domestic purposes.

In 2004, following amendment of the *National Parks and Wildlife Act 1972* to enable co-management arrangements, a co-management agreement for the reserve was established between the State of South Australia, MT and Pila Nguru. (Note: most Pila Nguru people live over the Western Australian border, but many formerly lived on the Maralinga lands, (Cane 2002)). In 2006 the reserve was re-named Mamungari CP, which is an Anangu word for 'place of harmful spirits'. The Co-management Board and the Minister endorsed a revised plan of management for the reserve in 2011. This revised plan reinforces the view of fire management contained in the 1993 plan (Mamungari CP Board of Management 2011).

2.5.4 Yalata

The Yalata Aboriginal lands are held on a 99-year lease from the Aboriginal Lands Trust by Yalata Community and are inhabited by around 200 Anangu. Yalata is also an IPA and has a Land Management Team. A major focus of land management activities is visitor access to the Head of the Bight for whale watching and camping.

In 2010 Yalata Community Council developed a draft "Healthy Country Plan" for Yalata IPA (Yalata LM and Yalata Community Inc 2011). This plan identified the possibility of 'wrong way fire' occurring due to a loss of knowledge regarding patch burning and fuel build up. The plan identified that both the lack of fire and the occurrence of dangerous bushfires could result in loss of plants and animals, and also cause soil erosion (Yalata LM and Yalata Community Inc 2011).

2.5.5 Antakirinja Matu-Yankunytjatjara Aboriginal Corporation

The Antakirinja Matu-Yankunytjatjara Aboriginal Corporation (AMYAC) was established in 1997, and in May 2011 native title was determined over an area of traditional lands for the group, including the Tallaringa CP. Many Antakirinja people live at Umoona community and on the APY Lands. In 2012 AMYAC negotiated an Indigenous Land Use Agreement with the South Australian Government (including DEWNR) over Tallaringa CP. That agreement provided the Breakaways Co-management Board with an advisory role to the Minister for Sustainability, Environment and Conservation and the Director National Parks and Wildlife, and established the Tallaringa Advisory Committee.

2.5.6 Far West Coast Aboriginal Corporation

In December 2013 native title was determined over an area of traditional lands for the Kokatha, Mirning and Wirangu people, collectively recognised under the Far West Coast Aboriginal Corporation (FWCAC). At the same time, Indigenous Land Use Agreements were established for the 16 DEWNR managed reserves within the claim area, which defined two co-management agreements. The Nullarbor WA Co-management Advisory Committee, comprising representatives from Mirning and DEWNR, has an advisory role to the Director of National Parks and Wildlife for the management of Nullarbor WA, NP and RR. The Yumbarra Co-management Board, comprised of FWCAC and DEWNR representatives, has responsibility for managing Yumbarra CP, as well as providing advice on the management of the other 13 reserves (some fall outside the AW NRM boundary, as listed below). These two co-management bodies will work ngapartji-ngapartji.

In summary:

- Nullarbor Wilderness Area Co-management Advisory Committee advises on the management of **Nullarbor NP, RR and WA** (noting that Nullarbor NP is earmarked for abolishment, with the parcels to be added to Nullarbor RR and WA).
- Yumbarra Co-management Board has responsibility for management of **Yumbarra CP**, and an additional advisory role in the management of:
    - Acraman Creek CP (in part, the eastern side of the reserve falls outside of the claim area)
    - **Boondina CP**
    - Chadinga CP
    - Fowlers Bay CP (including the land earmarked as proposed addition to the reserve)
    - **Great Australian Bight Marine NP (in part, the western section of the reserve is not part of the claim area)**
    - Laura Bay CP, including those parcels earmarked as additions to Laura Bay CP, currently gazetted as Laura Bay CR
    - Point Bell CP

- **Pureba CP (in part, the south eastern side of the reserve falls outside of the claim area)**
- Wahgunyah CP (including the land earmarked as proposed addition to the reserve)
- Wittelbee CP
- **Yellabinna RR & WA.**

Of these, only those marked in bold fall within the AW NRM planning boundary, the others are within the Eyre Peninsula NRM region.

2.5.7 DEWNR Managed Reserves

The following reserves managed by DEWNR are within the strategy area.

- Boondina CP
- Mamungari CP (discussed above and considered as part of MT for the purposes of this strategy)
- Nullarbor NP
- Nullarbor RR
- Nullarbor WA
- Pureba CP
- Tallaringa CP
- Yellabinna RR
- Yellabinna WA
- Yumbarra CP.

There are no existing fire management plans for these reserves.

DEWNR reserve management plans are a statutory requirement under the NPW Act and the WP Act (where relevant), and may identify the need for a fire management plan based on the fire-related issues within the reserve.

Mamungari CP has a reserve management plan (discussed in section 2.5.3 above). A reserve management plan has also been adopted for Yellabinna RR, Yellabinna WA, Yumbarra CP, Pureba CP and Boondina CP (DEWNR 2013e). The plan recognises the critical importance of fire to Anangu and in maintaining the large tracts of mallee in the Yellabinna reserves, while acknowledging the impact of fire on threatened species such as Wilytjiny. To this end, the plan supports the use of fire for cultural purposes and to protect critical habitat.

2.5.8 Local and Regional Environmental Planning

Natural Resources Management Plan

The *Alinytjara Wilurara Regional Natural Resources Management Plan* has been developed by the AW NRM Board (2009), as a requirement under the *Natural Resources Management Act 2004*, in consultation with the community and stakeholders. The plan, which is linked to the State NRM Plan (DWLBC 2006b), describes the condition of the region and the natural resources within the region and identifies goals to improve NRM outcomes.

The draft plan identified "altered fire regimes and lack of documented information regarding fire history, cultural burning and species' response to fire" as a "major threat to the country asset" (AW NRM Board 2009, pg 105). The NRM plan also identified significant knowledge gaps in relation to fire management:

- Mapping of historical fire scars and regimes
- EFMG
- Fire requirements of species, particularly threatened species
- Traditional practices and knowledge around fire

- Clarity around legislative and policy requirements relating to remote arid area prescribed burning and cultural burning
- Monitoring
- Climate change and fire interaction (AW NRM Board 2009).

The intent of this fire management strategy is to commence the process of addressing these knowledge gaps within the context of contemporary Anangu aspirations for fire management and DEWNR fire management policy.

Biological Surveys

Biological surveys have been undertaken for most of the strategy area, including:

- APY Lands (Robinson et al. 2003)
- Great Victoria Desert (focusing on Mamungari CP) (Greenslade, Joseph & Barley 1986)
- MT lands (Foulkes & Thompson 2008)
- Nullarbor (McKenzie & Robinson 1984)
- Tallaringa area (Robinson, Copley & Drewien 1988)
- Yalata lands (Neagle 2009)
- Yellabinna region (Copley & Kemper 1992).

The surveys for the APY and MT lands, and the Yellabinna region, identified inappropriate fire regimes as a potentially threatening ecological process. The APY and MT surveys made specific recommendations regarding the development of fire management strategies for the protection of cultural heritage and species of significance, as well preparation of fire history mapping, developing a 'patch burning' strategy, and a program of education and training for Anangu to support implementation of fire management.

Threatened Species Recovery Planning

Recovery plans are prepared for nationally threatened species that are listed under the EPBC Act. In the AW region a number of species of national conservation significance have been recorded and the following species either have recovery plans that are under development or in place.

- APY Threatened Flora Recovery Plan (Paltridge et al. 2009b)
- Eyre Peninsula Flora Recovery Plan (Pobke 2007)
- Itjari itjari (Marsupial Mole) Recovery Plan (Benshemesh 2004)
- Nganamara (Malleefowl) Recovery Plan (Benshemesh 2007)
- Sandhill Dunnart Recovery Plan (Churchill 2001)
- Tjakura (Great Desert Skink) Recovery Plan (McAlpin 2001)
- Warru (Black-flanked Rock-wallaby) Recovery Plan (Read & Ward 2010).

EPBC Act Advice

Conservation advice statements have been approved under the EPBC Act for:

- Mt Finke Grevillea (*Grevillea treueriana*) (TSSC 2008b)
- Naked Mintbush (*Prostanthera nudula*) (TSSC 2008d)
- Ooldea Guinea-flower (*Hibbertia crispula*) (TSSC 2008c)

- Princess Parrot (*Polytelis alexandrae*) (TSSC 2008e)
- Slender-billed Thornbill (*Acanthiza iredalei iredalei*) (TSSC 2008a).

Weed Management

Buffel Grass (*Cenchrus ciliaris*) is a perennial tussock grass native to Africa, India and Asia that has been introduced as a pasture and dust suppression species in central Australia. It is a highly invasive environmental weed and extremely difficult to control. Within this fire management strategy area, it is found in the APY Lands, and in some areas of MT and Yalata. The *AW Regional NRM Plan* (AW NRM Board 2011) identifies Buffel Grass as "one of the greatest risks to biodiversity in the region". Recent research has confirmed a significant correlation between Buffel Grass and increased fuel loads, and that there is a positive fire invasion feedback for Buffel Grass in the Alice Springs region (Miller et al. 2010). The situation is likely to be similar throughout the strategy area.

In recognition of the weed risk of Buffel Grass across South Australia but particularly in the state's arid rangelands, Biosecurity SA has developed the *South Australia Buffel Grass Strategic Plan* (Biosecurity SA 2012), along with the *State Buffel Grass Operational Plan* (Biosecurity SA 2010) to address the risk. The operational plan was prepared following a government stakeholder workshop in September 2010 and is being used to guide on-ground management across the State. In accordance with this plan, the AW NRM Board is undertaking monitoring and eradication actions within the region. The latter has included mapping, and trial burning and spraying combinations at various locations on identified Buffel Grass sites within the MT and Yalata lands.

The Strategic Plan outlines an approach to management that divides the state into three management zones, where different management goals apply in each of the zones. The AW NRM region lies in Management Zones 1 and 3. In Zone 1 (northern part of AW NRM region) where infestations are widespread and numerous, the goal is to manage the impacts of Buffel Grass, whereas in Zone 3 (southern part of AW NRM region) where infestations are smaller and more widely scattered, the goal is to destroy the infestations, aiming for local eradication where feasible (Biosecurity SA 2012).

A standard operating procedure (SOP) has been developed by DEWNR and the AW NRM Board to provide advice regarding minimisation of Buffel Grass spread by people, vehicles and machinery. In 2007 a national workshop developed a research agenda for Buffel Grass management (Friedel et al. 2007). Both the SOP and the research agenda have also informed action recommendations in relation to Buffel Grass contained in this strategy.

2.5.9 Bushfire Planning for Lands Adjoining DEWNR Reserves

Privately owned lands adjoining the strategy area are considered in this fire management strategy, in the context of works required to minimise the risk to the strategy area from external fires and the risk to private assets from fires originating in the strategy area. This includes a number of privately owned Heritage Agreements adjacent to the southern reserves (see Section 3.1.1). All landholders are obliged to comply with the *Fire and Emergency Services Act 2005*, which states that property owners are required to take reasonable steps to implement works on their own land to minimise the threat of fire. A number of recommendations have been made in this fire management strategy for non-reserve lands that will require the assistance and support of the Outback Bushfire Management Committee.

3 FIRE MANAGEMENT ENVIRONMENT

The components of any landscape contributing to its bushfire potential include terrain, slope and aspect, climate and weather, vegetation, land use, and past and present fire management practices. An overview of these elements is provided in this section.

3.1 Location

Figure 3 shows the major topographical features and land tenure for the strategy area.

3.1.1 Land Tenure

In addition to the Aboriginal lands and DEWNR reserves shown in Table 3, Crown lands dedicated to, owned by, or under the control of the Minister for Sustainability, Environment and Conservation were identified for inclusion in this strategy. Some of those parcels are not within the strategy area but are located immediately adjacent to the strategy area boundary. These have been included to allow continuity of management and to help identify Crown lands for inclusion in the Landscape Fire Management Plans. A total of 50 parcels of Crown lands, more than 100,000 ha, have been incorporated into this strategy (Table 4).

Heritage Agreements abutting DEWNR reserves or included lands will be considered during the development of the Landscape Fire Management Plans.

3.1.2 Landscape Description

The AW NRM Region contains some of the driest and most remote areas in South Australia with no permanent rivers or creeks. Water is a limiting factor throughout the Region; rock-holes, springs and soaks are the only source of water available in dry times, and even these may become dry (AW NRM Board 2009).

In the southern part of the Region lie the Nullarbor complex, Yalata Aboriginal Lands and Yellabinna complex. The Nullarbor complex, containing Nullarbor NP, RR, and WA is the world's largest limestone karst landscape covering 270,000 km² and is comprised primarily of chenopod shrublands. The Yalata Aboriginal Lands are at the eastern edge of the Nullarbor Plain and form part of the corridor of native vegetation that stretches from Eyre Peninsula to Western Australia. This vegetation is comprised of mallee woodlands, Black Oak and Western Myall low woodlands, and chenopod and mixed shrublands. The Yellabinna complex lies further east again and also forms part of the corridor of native vegetation described above. This area includes Yellabinna WA and RR, Pureba CP and Yumbarra CP.

Further north lie the MT Lands, named after the MT people who traditionally inhabited the area, and the start of the Great Victoria Desert. The Great Victoria Desert is a vast area (approximately 400,000 km²) extending about 750 km west into Western Australia, north to the Musgrave Ranges, and south to the Nullarbor Plain (AW NRM Board 2009). About half of the Great Victoria Desert lies in South Australia and consists primarily of red sand dunes, stony plains and dry salt lakes with little surface water apart from rock-holes and soaks. The Great Victoria Desert is rich in flora and fauna with many species of conservation significance occurring in the Spinifex hummocks and tussock grasslands, shrublands and woodlands of mulga wattles, mallee Eucalypts and black oak (AW NRM Board 2009). This area includes the Mamungari CP.

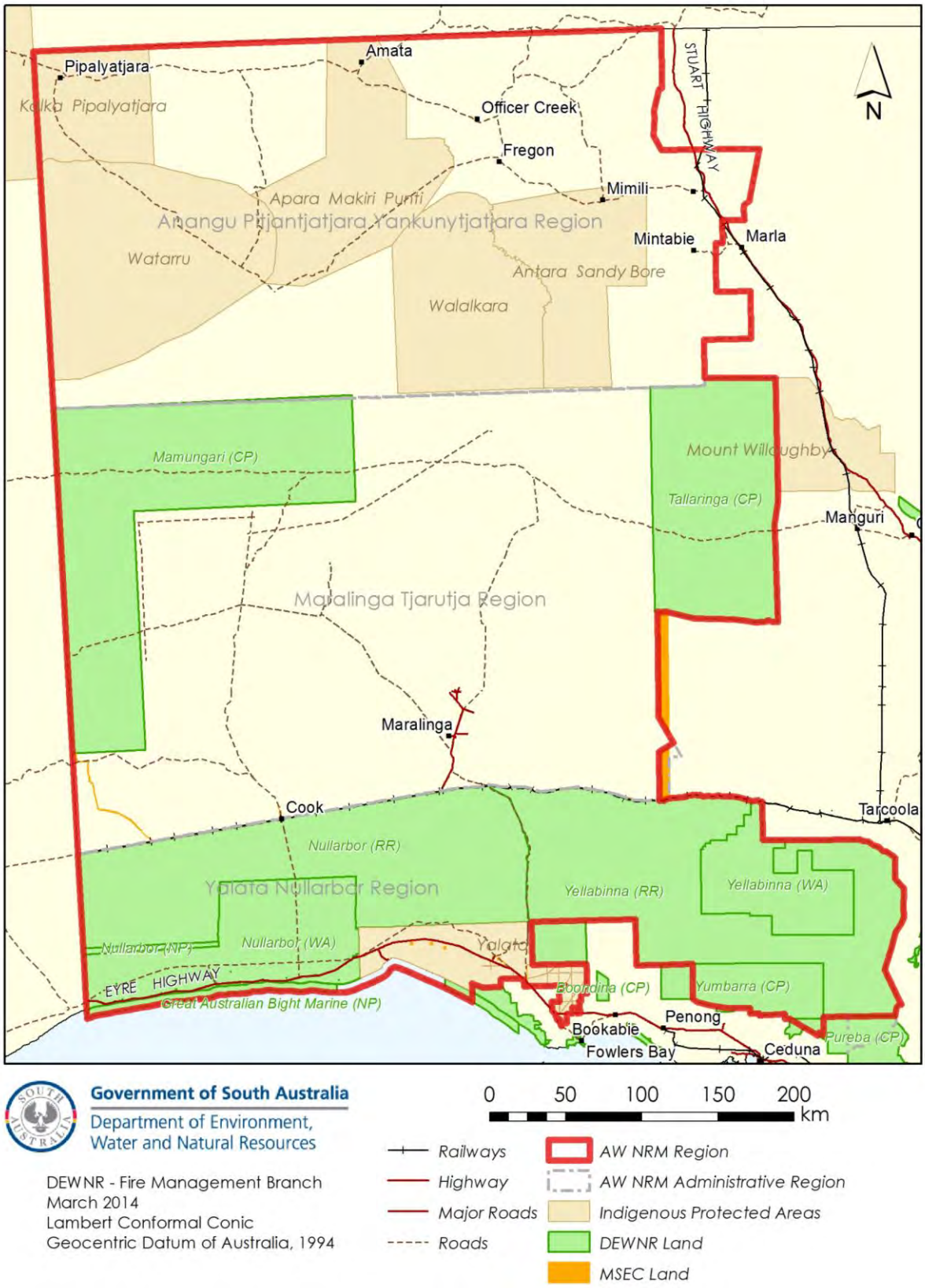

FIGURE 3 – AW NRM REGION SHOWING MAJOR TOPOGRAPHIC FEATURES AND LAND TENURE

TABLE 3 – FORMAL LAND TENURE IN THE AW NRM REGION

ABORIGINAL LANDS		
Inalienable Freehold Title These Lands cannot be sold, mortgaged or traded to other people.		
Yalata	~4,600 km^2	The *Aboriginal Lands Trust Act 1966* covers many of South Australia's Aboriginal Lands. It vests inalienable freehold title in the Aboriginal Lands Trust, including Yalata Lands. In effect, this makes the ALT the 'landowner'. However, it is ALT policy to lease the land it owns to appropriate Aboriginal community and family organisations, thus, the Yalata Lands are leased back to the Yalata community. In effect, this makes the Yalata Community the 'lessee'. The ALT Board includes representatives from the various Aboriginal communities located on ALT Lands.
Maralinga Tjarutja (MT) Lands	~100,000 km^2	MT Land Rights Act vests the land in MT under inalienable freehold title. The members of MT Council are elected from the community.
Anangu Pitjantjatjara Yankunytjatjara (APY) Lands	~100,000 km^2	The *Pitjantjatjara Land Rights Act 1981* vests the land in Anangu Pitjantjatjara under inalienable freehold title. All Anangu own the land. The members of APY Executive Board are elected Anangu members representing the communities on APY. In addition, many APY communities have their own incorporated bodies.
Indigenous Protected Areas These are areas of Aboriginal Lands declared a protected area by the Australian Government. Each IPA is managed by Aboriginal traditional owners as per a management plan, and they are recognised by the Australian Government as being part of the National Reserve System. They receive funding and other support from the Commonwealth IPA Program.		
Walalkara IPA	~10,000 km^2	
Watarru IPA	~14,000 km^2	
Yalata IPA	~4,600 km^2	
Antara-Sandy Bore IPA	~8440 km^2	
Apara-Makiri-Punti IPA	~11,110 km^2	
Kalka-Pipalyatjara IPA	~5,600 km^2	
SOUTH AUSTRALIAN GOVERNMENT RESERVES		
National Parks and Wildlife Act Reserves These reserves have been proclaimed under the NPW Act and managed in accordance with the objectives of management stated in s 37 of that Act.		
Regional Reserves		
Nullarbor RR	~22,700 km^2	
Yellabinna RR	~20,000 km^2	
National Parks		
Nullarbor NP	~5,800 km^2	

SOUTH AUSTRALIAN GOVERNMENT RESERVES		
Conservation Parks		
Mamungari CP	~21,300 km^2	**Formalised Cooperatively Managed Park:** formalised agreements as regulations under the NPW Act for management jointly by the traditional owners and DEWNR. Anangu people, including Maralinga Tjarutja and the Pila Nguru (or Spinifex people) from Western Australia, co-manage Mamungari CP in cooperation with DEWNR in accordance with *National Parks and Wildlife (Unnamed Conservation Park - Maralinga Tjarutja Lands) Regulations 2004*.
Pureba CP	~2,200 km^2	
Tallaringa CP	~12,700 km^2	
Yumbarra CP	~3,200 km^2	
Mamungari CP	~21,300 km^2	
Wilderness Protection Act Reserves These reserves have been proclaimed under the *Wilderness Protection Act 1992* and managed in a manner consistent with the Wilderness Code of Management under section 12(2) of that Act.		
Yellabinna WA	~5,000 km^2	
Nullarbor WA	~90,000 km^2	Incorporates part of existing Nullarbor reserves.
DEPARTMENT OF PLANNING, TRANSPORT AND INFRASTRUCTURE (DPTI) RESERVES		
DPTI has formal titles on stone reserves across the Nullarbor and the road reserves of the Eyre and Stuart Highways, and controls the road reserves in unincorporated areas (e.g. all lands west of the Ceduna Council boundary).		
WORLD BIOSPHERE RESERVE		
Mamungari	~21,300 km^2	As well as being a co-managed park, Mamungari is also a declared United Nations Educational, Scientific and Cultural Organization World Biosphere Reserve. It is managed jointly by the traditional owners and DEWNR.

In the northern-most reaches of the Region are the APY Lands, named after the area's Aboriginal people. Here, the Great Victoria Desert is replaced by gentle, undulating plains and drainage systems. The APY Lands are dominated by arid ranges, including the high, rocky Mann and Musgrave Ranges and the smaller, isolated granite ranges that rise out of the plains, known as inselbergs. The inselbergs include the Tomkinson, Everard, Birksgate and Indulkana Ranges. The ranges of the APY Lands contain the highest point in South Australia, Mt Woodroofe, at 1,435 metres above sea level (AW NRM Board 2009).

The southern part of the APY Lands comprises of several vegetation types including arid and semi-arid Acacia, mulga, desert oak or mallee woodlands with varying understoreys, a variety of mixed shrublands, chenopod shrublands and wide areas of Spinifex grass. The northern part of the APY Lands, containing the Mann and Musgrave Ranges, encompass a variety of landforms, rock and soil types, altitudes, and aspects. This provides a wide diversity of vegetation habitats, including mixed shrublands, Spinifex grasslands, River Red Gum woodlands (which are found in the drainage lines) and Melaleuca shrublands.

TABLE 4 – OTHER LANDS INCLUDED IN THIS FIRE MANAGEMENT STRATEGY

Type	Dedication	Hundred/ Folio	Parcel Type & Number	Size (ha)
Reserve	The Crown	H834200	Sections 993, 998	528
Unalienated Crown Land	Minister for Sustainability, Environment and Conservation (MSEC)	D31180	Allotment 15	4,305
Unalienated Crown Land	MSEC	D41811	Allotment 8	648
Unalienated Crown Land	MSEC	D69241	Allotment 100	85
Unalienated Crown Land	MSEC	F199215	Allotment 321	0.1
Unalienated Crown Land	MSEC	F217137	Allotment 50	639
Unalienated Crown Land	MSEC	F41260	Allotment 10, 11	75,179
Unalienated Crown Land	MSEC	H620100	Section 30	211
Unalienated Crown land	MSEC	H620300	Section 31-35	538
Unalienated Crown Land	MSEC	H620700	Section 36, 37	229
Unalienated Crown Land	MSEC	H833300	Section 209-215, 217-219, 1303, 1439	9,443
Unalienated Crown Land	MSEC	H833400	Section 197-200, 202-204, 206, 207	5,498
Unalienated Crown Land	MSEC	H833500	Section 186-190, 192-195	5,065
Unalienated Crown Land	MSEC	H834200	Section 995-997	792

The eastern part of the APY Lands comprises several habitats, including varying and mixed woodlands, mixed shrublands containing different combinations of shrubs, varying chenopod shrublands, tussock grasslands or grassy understoreys and hummock grasslands or understoreys of Spinifex grass. This area includes Tallaringa CP.

3.1.3 Surrounding Land Use

Lands adjoining the strategy area to the east are largely pastoral in nature, featuring extensive livestock grazing and some cropping. Mineral exploration and mining production are also undertaken on adjoining lands. Cropping and grazing is undertaken on the adjacent lands to the south of the strategy area, and there are a number of Heritage Agreements adjacent to the Yalata lands and on the southern boundaries of Boondina CP, Pureba CP and Yumbarra CP. Mining access is available to Nullarbor and Yellabinna RRs, and to Boondina, Pureba, Tallaringa and Yumbarra CPs.

3.2 Climate

There are variations in the climate and fire conditions across the strategy area, as summarised below.

3.2.1 Temperature and Rainfall

The APY Lands have a very hot dry desert climate with short, cool to cold winters. The area receives a low and unreliable rainfall and although there is no pronounced pattern, there is a tendency to summer rather than winter rainfall (Robinson et al. 2003).

Summer daytime temperatures average in the mid-high 30s. Rainfall data collected by the Bureau of Meteorology for Coober Pedy, Amata, Mulga Park (NT), and Giles (WA) indicate average annual rainfall on the lands would generally be around 200 to 300 mm. From the limited available rainfall data with any longevity (Coober Pedy and Giles stations) within this area it appears that significant rainfall events may occur every 30 to 50 years. Robinson et al. (2003, pg 17) noted that "the highest mean annual rainfalls occur in the Musgrave Ranges where Pukatja [Ernabella] at 676 m above sea level has an annual average of 275 mm".

Although the MT lands are also predominantly a hot and arid desert environment, the temperatures become somewhat milder further south in both summer and winter, with summer daytime temperatures averaging in the low 30s. Seasonal rainfall patterns are similarly unpronounced as in the APY Lands. Rainfall data collected by the Bureau of Meteorology for Maralinga (55 years, but with gaps) indicate a long term mean of 224.5mm, while 92 years of continuous data at Cook indicate a long term mean of 184 mm. Above average rainfall events through these areas appear somewhat more frequent, occurring roughly every 10 to15 years.

The temperature and rainfall on the Yalata lands are influenced by the proximity of the Southern Ocean, and the lands have a semi-arid climate with warm dry summers and mild wet winters, by comparison with the APY and MT lands. Summer daytime temperatures average around 26 degrees Celsius. The mean annual rainfall at Nullarbor, based on 121 years of data (with short gaps in the 1940s and 1980s), is 248.3 mm. The reserves of the Nullarbor complex have similar characteristics, with the northern areas bearing greater similarity to the MT lands.

The reserves within the Yellabinna complex are characterised by warm to hot summer daytime temperatures and mild to warm winter conditions (Copley & Kemper 1992). The southern and eastern areas of the complex are characterised by predominantly winter rainfall and an annual total of around 300 mm, while the areas to the northwest bear greater similarity to the MT lands, both in terms of the lack of pronounced seasonality in rainfall, and a lower annual total of around 180 to 200 mm.

Tallaringa CP is likely to have the lowest annual average rainfall within the strategy area, based on the nearest weather station with long term data. Based on 101 years of rainfall records (with some small gaps), Coober Pedy has a mean annual rainfall of 157.6 mm, with apparent gaps of around more than 50 years between significant rainfall events in this area.

As Gill (2000), Cheney and Sullivan (2008), and others have noted, the arid and semi-arid desert regions in Australia are characterised by ephemeral grasses that resprout following successive seasons of higher than average rainfall, resulting in increased likelihood of major fire events in the season after these rain events. This pattern led to the 1974/75 fires, estimated to have burnt in excess of 117 million ha through central Australia, over four times the size of the strategy area (Luke & McArthur 1978). The 2011/12 fire danger season was preceded by a season with higher than average rainfall. A number of bushfires started as a result of lightning and were perpetuated by higher than normal fuel loads. This included 1,730,000 ha in Strzelecki, 1,200 ha at Nullarbor and 60,000 ha at Yellabinna.

An important related point is the shifting rainfall pattern apparent in the long-term climatic observations for the region (see Figure 4). These 30-year time series images depict rainfall in the north western corner of South Australia shifting further inland to south east, and a simultaneous northerly inland shift of the rainfall along the Great Australian Bight and

northern Eyre Peninsula over the 90 year period from 1911 to 2001. This shifting rainfall pattern has the potential to increase the extent of major fire events through the landscape given its ephemeral nature.

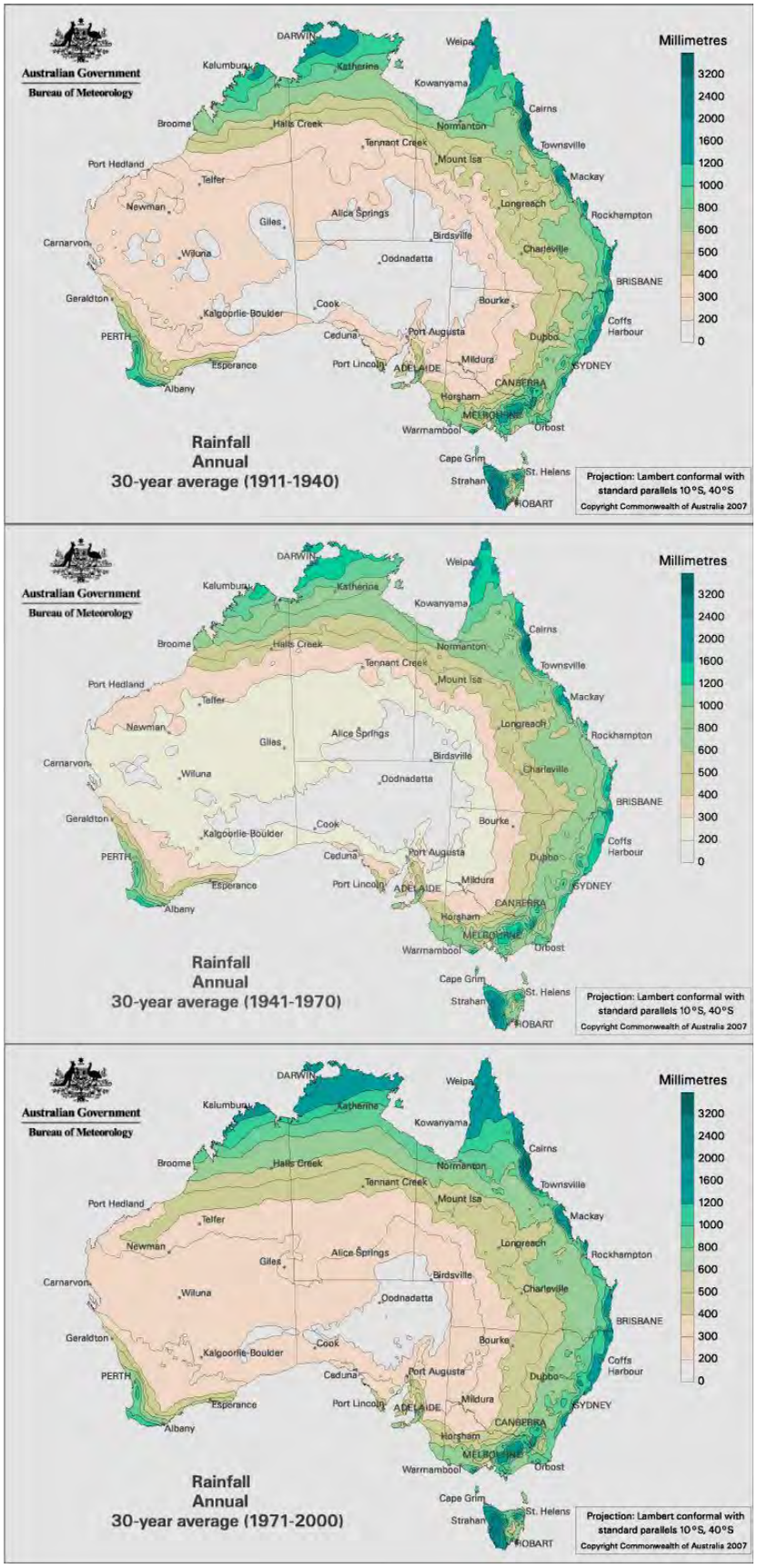

FIGURE 4 – 30-YEAR ANNUAL RAINFALL AVERAGES 1911-2000 (BOM 2007)

3.2.2 Wind direction

There are no wind roses available from within the APY Lands, with the nearest available wind roses being located at Giles in WA and at Oodnadatta. These indicate that the predominant wind direction in these areas is easterly and south easterly. However, it is likely that the small proportion of northerly and north westerly winds occurring in the area would support initial dry lightning ignitions, with most fires then following the 'big tick' pattern commonly seen in south eastern Australian fire events as the wind swings around through to west then to the south and east (the fire history mapping indicates most fire scars burn to the north.)

The available wind roses from the southern part of the region, namely Eucla, Cook, Ceduna and Woomera, suggest greater variability in wind direction, with much stronger northerly and westerly wind influences for these southern locations, even though the south easterlies continue to dominate.

3.2.3 Significant fire weather

In general terms, strong winds, combined with high temperatures and low humidity increase the likelihood of extreme fire intensity and behaviour. Under such conditions, fires will be unpredictable and fast moving, and suppression activities are unlikely to be effective. In some areas fires 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.

Within this strategy area, fire suppression activities are not generally undertaken, due to the remoteness and inaccessibility of much of the country. Noting that grassfires can move very quickly (with rates of spread recorded at more than 20 km/h in extreme conditions (Cheney & Sullivan 2008)), it is likely that fires will travel enormous distances unchecked through much of the strategy area landscape, dying down overnight, and then building again during the day when temperatures and winds increase. Several factors contribute to a dramatic increase in fire behaviour.

- *Severe* (>50) and above Fire Danger Indices
- *Very High* to *Extreme* overall fuel hazard levels. While grass fuel loads may not reach these levels, they may burn with considerable intensity and will spread much more rapidly than fires in scrubland
- 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 in the mallee associations, increasing the chance of spot fires and crown fires
- Low humidity, decreased soil and fuel moisture, in an already arid environment, particularly during drought years
- Strong winds shifting direction during the course of a fire, typically north-north west to south east
- Lightning strikes as a result of increased thunderstorm activity, particularly in the spring and summer months, although these may occur all year round in the northern parts of the strategy area
- Steep terrain. The Mann and Musgrave Ranges would represent the most elevated areas within the strategy region at 676 m (Robinson et al. 2003). However, the area is also characterised by extensive dune fields, in some cases 20 m or more in height, and flat 'run on' grassy plains, both of which may facilitate fire runs.

3.2.4 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 projections indicate that the AW Region of South Australia is likely to become hotter and drier in future (DENR 2010a; Suppiah et al. 2006); annual temperatures are predicted to increase by up to 1.5 degrees C and for rainfall to reduce as much as 9% by 2030 (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).

In arid and semi-arid regions dominated by grass fuel systems fire generally follows peak rainfall events, which is the reverse situation to that observed where woody fuels dominate, where fire generally follows drought (Williams et al. 2009). Recent research modelling the interaction of predicted climate change, fire regimes and biodiversity in Australia to 2070 suggests that in arid woodlands, fire danger is likely to increase (Williams et al. 2009). However, a concurrent significant decline in rainfall "may lead to a decrease in area burned and fire frequency" in herbaceous ecosystems (Williams et al. 2009, pg 75). The impact of Buffel Grass is predicted to be significant, due its high drought tolerance, which is likely to provide "levels of biomass and spatial connectivity that may exceed that contributed by native grasses and herbage" and potentially support more frequent and high intensity fires (Williams et al. 2009, pg 73).

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 Fire History

When work on the strategy started, limited fire history mapping was available for the reserves within the region. As fire history information is obviously critical for future planning, developing this information was a crucial part in compiling this strategy. Available Landsat imagery dating back to 1972 has been interpreted to develop fire history data for the strategy area, up to and including 2013. Generally, fire scars in desert country remain visible for many years; however, factors such as fire severity, vegetation type and age class, geographical features, and seasonal variation can complicate the process (Miles et al. 2011). The exception to this is grassy areas, where fire scars are quickly lost due to regrowth. Interpreting the older satellite imagery presented significant challenges, due to the poor quality of the imagery. To support interpretation, additional image analysis was undertaken, and regular quality assurance workshops were held as the mapping was undertaken. Further fire history mapping work is recommended in Section 5.1.2 to complete the 1974/75 fire scar, and map older scars from black and white aerial imagery from the 1950s and 1960s.

Maps of Last Fire and Fire Frequency (Map 3 Fire History, online) have been compiled from the recently interpreted fire history. This mapping shows significant large scale and frequent

fires on the APY and northern part of that the MT lands, particularly the northern part of Mamungari CP. It is important to note that, due to the size of the region, the fire history has been mapped at a scale of 1:100,000 or greater, so it is unlikely that small fire scars will be identified. Therefore, mapped fire scars should only be considered a minimum estimate of fire occurrences. Note also that fire scars are generalised outer boundaries only, so unburnt areas within the scar are not mapped. Last Fire mapping (Map 3 Fire History, online) indicates very large fire events occurred prior to 1972, between 1973 and 1980 (i.e. the 1973/74 fire), between 1981 and 1985, and in the 1991/92 and 2001/02 seasons. It is highly likely that large fires occurred one or two years after wet years (e.g. 1973-75, 1980-83, 1990-93 and 2001-02).

Fire Frequency mapping (Map 3 Fire History, online) indicates that there are some areas in the northern APY Lands (i.e. Mann and Musgrave Ranges) that have burnt seven or eight times in the last forty years or more. This suggests a high fire frequency of once every five years. However, most parts of the southern APY have burnt just two to four times in the last forty years or more suggesting a fire frequency of once every ten to twenty years. Fire frequency in the northern MT lands appears to be less frequent again with fire occurring once every twenty to forty years. The Yellabinna complex appears to have a similar fire frequency to the MT lands and there is very little or no fire activity recorded in Tallaringa CP and the Nullarbor complex. It is possible that fire frequency is underestimated due to issues with the methodology as described above.

3.4 Vegetation Communities

Floristic mapping for this strategy uses a combination of regional vegetation mapping data that have been reclassified to comply with the National Vegetation Information System (NVIS) classification for Australia. 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 strategy MVS have been used as these groupings are accepted by fire managers for predicting maximum overall fuel hazard levels (see Section 4.3.2). There are nineteen MVS within the strategy area that have been mapped by DEWNR. Map 2 (Vegetation Communities and Significant species, online) shows the distribution of MVS in the strategy area. Table 5 lists the dominant species composition for each MVS and the EFMG are outlined in Table 6.

TABLE 5 – DOMINANT SPECIES LAYERS FOR MAJOR VEGETATION SUB-GROUPS

MVS No.	MVS Name	Dominant Species Layers
9	Eucalyptus woodlands with a grassy understorey	*Eucalyptus odorata* mid woodland over *Austrostipa nodosa* (mixed) tussock grasses
12	Callitris forests and woodlands	*Callitris glaucophylla* low woodland over *Austrostipa scabra* ssp. (mixed) low open tussock grassland
16	Other forests and woodlands	*Alyxia buxifolia* (mixed) tall open shrubland over *Senna artemisioides* ssp. shrubs
20	Mulga *(Acacia aneura)* woodlands and tall shrublands with tussock grass	*Acacia aneura* complex tall sparse shrubland over *Eremophila latrobei* ssp. *glabra* mid sparse shrubland and *Eriachne mucronata* low sparse tussock grassland

MVS No.	MVS Name	Dominant Species Layers
21	Other Acacia tall open shrublands and shrublands	Emergent *Casuarina pauper* low open woodland over *Acacia ligulata* (mixed) mid open shrubland and *Senna artemisioides* ssp. *petiolaris* (mixed) low sparse shrubland and *Atriplex velutinella* low sparse shrubland
22	Arid and semi-arid Acacia low open woodlands and shrublands with chenopods	*Acacia victoriae* ssp. tall open shrubland over *Maireana pyramidata* (mixed) low open shrubland and *Sclerolaena ventricosa* (mixed) low open shrubland
24	Arid and semi-arid Acacia low open woodlands and shrublands with tussock grass	*Acacia aneura* complex low open woodland over *Aristida contorta* (mixed) mid sparse tussock grassland
26	Casuarina and Allocasuarina forests and woodlands	*Casuarina pauper, Eucalyptus brachycalyx* low woodland over *Alectryon oleifolius* ssp. *canescens* trees and *Enchylaena tomentosa* var. *tomentosa* shrubs
27	Mallee with hummock grass	*Eucalyptus porosa* (mixed) mid mallee woodland over *Cassinia laevis* (mixed) shrubs and *Triodia* ssp. (mixed) hummock grasses
29	Mallee heath with shrublands	*Eucalyptus porosa* (mixed) mid mallee woodland over *Bursaria spinosa* ssp. *spinosa* shrubs and *Dianella revoluta* var. (mixed) tussock grasses
31	Chenopod shrublands	*Maireana brevifolia* (mixed) low sparse shrubland over *Enchylaena tomentosa* var. *tomentosa* shrubs
32	Other shrublands	*Leucopogon parviflorus, Olearia axillaris* mid open shrubland over *Scaevola crassifolia* (mixed) shrubs
33	Arid and semi-arid hummock grasslands	Emergent *Callitris glaucophylla, Eucalyptus* sp. low open woodland over *Acacia* sp. (mixed) mid open shrubland and *Triodia* sp. low open hummock grassland
37	Temperate tussock grasslands	Emergent *Eragrostis australasica* mid open hummock grassland over *Tecticornia* sp. (mixed) low open shrubland
38	Wet tussock grassland, herbland, sedgeland or rushland	*Baumea arthrophylla* (mixed) mid sedgeland
39	Mixed chenopod, samphire or forblands	*Atriplex nummularia* ssp. *nummularia* (mixed) mid shrubland over *Atriplex stipitata* shrubs
47	Eucalyptus open woodlands with shrubby understorey	*Eucalyptus leucoxylon* ssp. *leucoxylon* mid open woodland over *Melaleuca lanceolata* shrubs and *Acacia paradoxa* shrubs
49	Melaleuca shrublands and open shrublands	*Melaleuca brevifolia* tall shrubland over *Phragmites australis* (mixed) grasses
52	Allocasuarina woodland and open woodland with hummock grass	*Allocasuarina decaisneana* low open woodland over *Eremophila longifolia, Xanthorrhoea thorntonii* tall sparse shrubland and *Triodia basedowii* low hummock grassland
55	Mallee with open shrubby understorey	*Eucalyptus porosa* mid open mallee forest over *Cassinia laevis* (mixed) mid sparse shrubland and *Enchylaena tomentosa* var. (mixed) low open shrubland
61	Mallee with a tussock grass understorey	*Eucalyptus brachycalyx* mid mallee woodland over *Eremophila scoparia* mid sparse shrubland and *Austrostipa nitida* low sparse tussock grassland

Please note that the MVS mappings used for this strategy are 'best available' data. However, there are some anomalies in the information that have resulted from the

application of different statistical processing packages to the vegetation survey data on the APY and MT lands. These anomalies have been made worse by the interpretation of the data into the NVIS. The southern areas of the APY Lands appear to be the most affected, partly due to the fact that there has been limited vegetation survey work undertaken in these areas, so the degree of extrapolation is high (refer Robinson et al. 2003). Please also note that the *Mann and Musgrave Ranges FMP* (Paltridge & Latz 2009) and the *Antara-Sandy Bore Country Management Plan* (APYLM 2011) identify the need for additional flora and fauna surveys in the APY Lands.

The vegetation structure and regeneration timeframes are related to the rainfall deciles across the strategy area, and there are significant temporal differences for the same vegetation types occurring in different locations.

3.5 Ecological Fire Management

The process of ecological fire management described below is applied to the DEWNR reserves within the strategy area. The Guidelines may also be applied to Anangu owned and managed land in the strategy area at the discretion of the landowners and managers.

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 re-sprouting), 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. 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 Conservation-Land Management Zones (C-zones) within all DEWNR Fire Management Plans.

3.5.1 Methodology

The approach for determining the EFMG for the different MVS is described in detail in the *Ecological Fire Management Guidelines for Native Vegetation in South Australia* (DEWNR 2013b). Briefly, the species most susceptible to decline from inappropriate fire regimes need to be identified using available knowledge of plant vital attributes and life histories. These species are 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)). TPC are defined as 'the limits of tolerance to a particular fire regime' (Kenny et al. 2004) and are intended as a guide for fire managers; specific fire prescriptions may vary across the state depending on climate, soils and topography.

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 adequate seed set or reproduction)
- **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 to when 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 KFRS (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 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).

Figure 5 illustrates the process of determining EFMG.

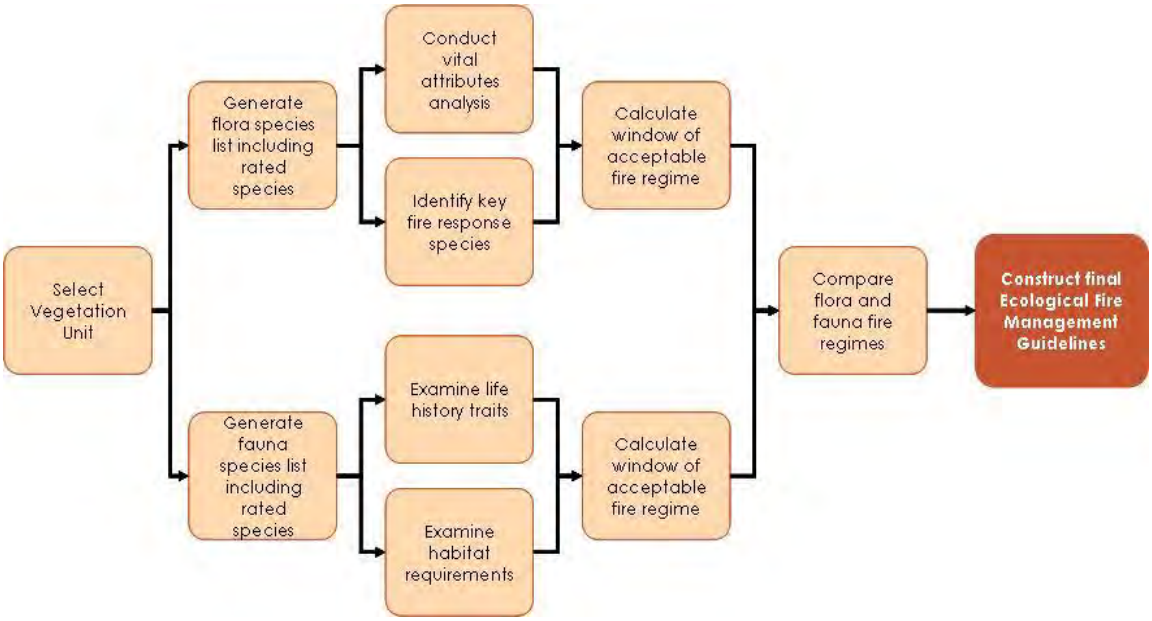

FIGURE 5 – APPROACH FOR DETERMINING ECOLOGICAL FIRE MANAGEMENT GUIDELINES

3.5.2 Interpreting Ecological Fire Management Guidelines

EFMG have been defined for MVS within the strategy area (refer Table 6) to assist strategic planning and management of fire within the reserves in the strategy 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 strategy area (where data are available). The upper and lower TPC 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 6 – ECOLOGICAL FIRE MANAGEMENT GUIDELINES FOR MVS IN THE STRATEGY AREA

		Interval		Spatial Criteria		Frequency	Intensity		Season
MVS Number and 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 strategy area	% > TPC2	Avoid more than 2 fires within a period of X years	Avoid more than 2 successive fires of low intensity	Some medium to high intensity fire needed to regenerate some species	Avoid 2 or more successive fires in season
9	Eucalyptus woodlands with a grassy understorey	5	50	40	30	30	Y	Y	Spring or following drought
12	Callitris forests and woodlands	15	60	40	30	70	Y	Y	Following Drought
16	Other forests and woodlands	15	50	40	30	40	Y	Y	Spring or following drought
20	Mulga (*Acacia aneura*) woodlands and tall shrublands with tussock grass	20	60	40	30	100			Following drought
21	Other Acacia tall open shrublands and shrublands	10	50	40	30	60	Y	Y	Following Drought
22	Arid and semi-arid Acacia low open woodlands and shrublands with chenopods	20	60	40	30	70			Following Drought
24	Arid and semi-arid Acacia low open woodlands and shrublands with tussock grass	10	60	40	30	70			Following Drought
26	Casuarina and Allocasuarina forests and woodlands	20	50	40	30	60			Following Drought
27	Mallee with hummock grass	20	50	40	30	60	Y	Y	Following Drought

MVS Number and MVS Name		Interval		Spatial Criteria		Frequency	Intensity		Season
		TPC1: Lower threshold in years	TPC2: Upper threshold in years	Inter-fire intervals within TPC1 & TPC2 across more than X% of the extent of this MVS within the strategy area	% > TPC2	Avoid more than 2 fires within a period of X years	Avoid more than 2 successive fires of low intensity	Some medium to high intensity fire needed to regenerate some species	Avoid 2 or more successive fires in season
29	Mallee heath and shrublands	20	40	40	30	40	Y	Y	Spring or following drought
31	Chenopod shrublands	*Avoid fire*							
32	Other shrublands	20	35	40	30	40			Following Drought
33	Arid and semi-arid hummock grasslands	10	50	40	30	60	Y	Y	Following Drought
36	Temperate tussock grasslands	3	10	40	30	20			Autumn
37	Other tussock grasslands	3	15	40	30	20			Autumn
38	Wet tussock grassland, herbland, sedgeland or rushland	20	35	40	30	40			Spring or following drought
39	Mixed chenopod, samphire or forblands	*Avoid fire*							
47	Eucalyptus open woodlands with shrubby understorey	20	50	40	30	60			
49	Melaleuca shrublands and open shrublands	20	60	40	30	70			Spring
52	Allocasuarina woodland and open woodland with hummock grass	20	60	40	30	70			
55	Mallee with an open shrubby understorey	20	40	40	30	40	Y	Y	Spring or following drought
61	Mallee with a tussock grass understorey	10	40	40	30	50			Following Drought

3.6 Anangu Fire Management

3.6.1 Knowledge Systems

> *"Traditional knowledge combined with data, information and technologies offered by contemporary western science can provide a collaborative, cross-cultural 'double toolkit' approach to fire management"* (Smith, Whitehead & Cooke 2009).

Traditional knowledge refers to insights, observations and beliefs that are essential to decision-making but which do not arise from the application of conventional scientific expertise. In the context of natural resources management, it refers to knowledge and practices concerning the relationship of living beings to one another and to the physical

environment (Berkes 1993). Traditional knowledge is acquired from on-going local observations, which, in the case of Aboriginal land and fire management in Australia, have been continuously refined over many generations. Importantly, the term 'traditional knowledge' does not imply that such knowledge is out-dated or obsolete; in fact, it is as contemporary as any other knowledge that forms the basis for land and natural resources management throughout Australia today.

To the extent that traditional knowledge is based on the accumulation of observations it is similar to western science, and yet the two differ in some fundamental aspects (Berkes, Colding & Folke 2000). First, traditional knowledge is typically experience-based, relying more on personal observation than on quantitative data and controlled experimentation. Second, local knowledge tends to be expressed in ways that are more holistic (often reflecting eco-systemic properties) and less reductionist than that of western science (Berkes & Folke 2002). Third, traditional knowledge is usually anchored firmly in the experience of place, and as such tends to deal with particular things rather than categories of things, and time- and context- specific observations and conclusions rather than fixed or generalised rules (Becker & Ghimire 2003). Other ways in which traditional and western knowledge differ are further described in Table 7.

3.6.2 Traditional Fire Management

Traditional knowledge is of particular importance to both fire management and biodiversity conservation in the AW NRM region. Such knowledge includes historical and current understanding of:

- local languages and customary law
- frequency and timing of burning regimes
- scale and distribution of burn mosaics
- key cultural sites to be protected from fire
- fire-sensitive and fire-dependant species
- linkages between species
- weather, land form, seasonal variants and other indicators that form part of Anangu decision making processes for fire
- impacts of colonisation, including the introduction of non-native and pest species
- impacts of drought and climate change.

TABLE 7 – COMPARISON OF TRADITIONAL AND WESTERN KNOWLEDGE

Traditional Knowledge	Western Knowledge
Qualitative	Quantitative
Holistic	Reductionist
Oral	Textual
Long-term observation (many generations)	Short-term experimentation
Intuitive (from experience)	Analytical
Historical	Statistical

Traditional Knowledge	Western Knowledge
Practical	Theoretical
Cyclical	Linear
Nature-centred	Human-centred
Inclusive	Selective
Consensus-based management	Regulation-based management

(See: Berkes 1993; Berneshawi 1997; Grenier 1998; Wolfe et al. 1992)

There is a significant body of academic literature regarding the traditional use of fire by Aboriginal people in different parts of Australia, particularly in desert areas. Much of this literature is focused upon traditional burning practices in areas characterised by Spinifex (*Triodia* spp.) and Mulga (*Acacia aneura*) or various mallee associations.

When Aboriginal people walked country as a way of life, fire was used as a key land management tool, promoting food supplies (hunting and foraging), as well as for cultural business, communication, and domestic purposes (such as cooking, warmth, and clearance of camping areas). It is likely that the use of fire was more intensive in areas that were regularly visited, with this usage affected by the presence or absence of water supplies. As a consequence there would have been significant variations in traditional fire regimes within the area covered by this strategy, as there are significant areas where natural water supplies are rare and very limited. In these areas water only appears after prolonged periods of major rain events.

Within the strategy area, it is likely that the most intensive traditional fire management would have been in the northern and western areas of the APY Lands due to the availability of permanent water and a relatively large nomadic population. Based upon comments from Ngurar̲itja, use of fire in the Great Victoria Desert within the MT lands was confined to regularly used tracks between waterholes, and focused on hunting, camping and cultural business uses (Morelli 1992 citing Cane 1990). This observation is also noted by Gill (2000, pg 8-9) who comments:

> *From the explorer's journals, particularly the accounts of Giles (1889) it would appear that the extent of burning in the Great Victoria Desert was much less than that of deserts to the north.*

It is possible that traditional burning regimes may have also been more intensive in areas to the south and east of the MT lands, including the Yellabinna reserve complex (Morelli 1992).

The scale of traditional fire management has also been a source of debate. In areas where there was continuous and intensive use, patch burn size may have ranged from a few square metres to about 500 to 1000 ha, when fires occurred during the cooler months. However, Gill (2000) calculated that the size of 'patch' burns over the spring and summer months ranged from 140,000 to 353,000 ha, based on a number of sources. Recent work by Gammage (2011) reinforces that the scale of traditional landscape burning may have been far greater than generally contemplated in much of the literature to date. Gammage's historical analysis also clearly indicates specific burning regimes tailored for different landscapes.

Lightning strikes may have resulted in a proportion of bushfire ignitions, although the traditional use of fire, particularly in the areas regularly utilised by Aboriginal groups, is likely

to have assisted in the mitigation of the intensity, and probably the extent, of very large bushfire events. This is likely to have been due to the existence of a mosaic of vegetation of different age classes on a significant scale, together with significant fuel reduced areas, strategically located to support concentration of resources to support habitation (Gammage 2011).

Indeed, the nature of traditional burning is a contested matter deeply imbued with conflicting value systems. The resistance to acknowledge active Aboriginal land management of this country on a vast scale in accordance with Tjukurpa is well documented, and continues to persist. Intentionally or not, such perspectives deny the existence of sophisticated land management systems in favour of assumptions that Australia was a 'natural wilderness' prior to 1788.

As there has been a decline in Anangu walking country, and elements of 'westernisation' have taken hold in communities, traditional use of fire may have diminished and changed in execution (for example, ignition occurring from vehicles rather than on foot). This process of change in management approaches is likely to have commenced from the late 1800s, although people were still walking country in the late 1970s, and parts of the MT lands until the mid-1980s. Arguably, particularly in areas where more intensive and widespread fire management was traditionally undertaken, a decline in traditional land use and associated fire management activities may be a contributing factor to the incidence of much larger, higher intensity fires that have occurred in the past. However, in areas where traditional fire management was confined to specific, regularly used areas, it is less likely that this is the case. Gill (2000) notes three fires recorded in the period 1970 to 1980 that burned between 1 and 2 million ha, possibly fuelled by extensive grass growth following very wet periods. It should also be noted that the extent of intentional burning for community and resource protection undertaken following these wet seasons was also likely to have been significant. By way of example, extensive intentional burning activity has been observed on the APY Lands in the 2011/2012 season following a wet year. Satellite imagery indicates that there is some mosaic that occurs by natural fires where there is no evidence of traditional burning practices occurring (i.e. very remote areas).

While the focus of contemporary fire management may be upon preventing or mitigating large-scale bushfires by undertaking patch burning, as reflected in all of the existing management plans for the Anangu-owned lands within the strategy area, it is balanced by concerns to maintain habitat for key food species. This approach is reflected in the objectives relating to fire management contained in the IPA Country Management Plans for the APY Lands (APYLM 2008b,2010a,2010b,2010c,2011; Paltridge & Latz 2009).

The challenge for this strategy is to support cultural fire management by Anangu in an effective and appropriate manner. It attempts to do this on two levels:

- in terms of the general framework applied to fire management (a landscape-scale approach)
- by advocating an 'action based' approach to fire management on Anangu lands, underpinned by sound working relationships between the project partners, with discussion and engagement occurring on country.

Of contemporary Australian fire management frameworks, a landscape-based approach incorporating EFMG (as underpins this strategy) is perhaps the closest to traditional fire management. This approach attempts to manipulate the environment as a whole, regardless

of land ownership, for the purposes of life and property protection, as well as the protection of cultural and environmental assets. However, the scale upon which burning may be required to achieve the desired outcomes may not be reflected in practice, for both economic and social reasons. Indeed, the issue of the scale of landscape burning required for both ecological and life and property protection continues to be a matter of significant debate, with figures varying from 5 to 30% of the landscape (Penman et al. 2011).

Traditional knowledge can be collated as work is done, but always and only with the consent of Ngurar̲itja, obtained in accordance with accepted codes of ethics (AIATSIS 2010). It is also important to emphasise that on An̲angu land, An̲angu can and will burn areas without necessarily engaging in any form of 'western' planning process, and this strategy does not seek to change that in any way (Penman et al. 2011).

3.6.3 Adaptive Management

Adaptive management is a formal, systematic, and rigorous approach to learning from the outcomes of management actions, accommodating change and improving future management (Nyberg 1999). One of the main benefits of adaptive management is that management can be applied in the face of significant uncertainty as a means of learning and gathering more information about the system being managed. Both science and management perspectives can be included through stakeholder involvement in the formulation of strategic management objectives and appropriate performance indicators against which management is assessed. The full range of management options for addressing the objectives will be considered based on existing knowledge, including EFMG, and local ecosystem knowledge gathered from traditional and contemporary sources (Figure 6). Central to any adaptive management framework is ongoing monitoring of the outcomes. Management prescriptions will then be refined based on feedback from monitoring and the results of additional research and input based on local ecosystem knowledge, providing a continuous improvement loop. This approach complements DEWNR's Guidelines for Ecological Fire Management (*DEWNR Ecological Fire Management Guidelines for Native Vegetation in South Australia* (DEWNR 2013b)) and is critical for this strategy given a starting position of traditional knowledge collection followed by implementation and continuous learning. Central to the adaptive management process adopted in this strategy will be the needs and aspirations of An̲angu, and their cultural and custodial land management responsibilities (Wilson & Woodrow 2009).

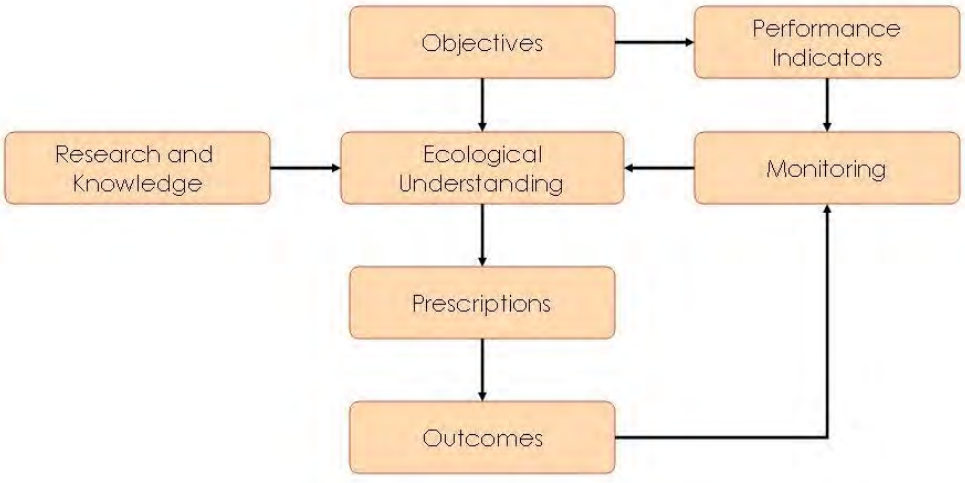

FIGURE 6 – ADAPTIVE MANAGEMENT PROCESS (Andersen, Cook & Williams 2003)

4 RISK

4.1 Risk Assessment

A risk assessment was conducted in line with the *Risk Assessment in Fire Management Planning Policy and Procedure* (DEWNR 2013c), as a requirement for the compilation of this fire management strategy. The risk assessment is a tool used to gauge the risks arising from bushfire to life, property, cultural and environmental values in the strategy area. The risk assessment also considered visitor use, assets (built, cultural and natural values) and neighbouring properties for all reserves in the strategy 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. It assesses the likelihood of ignition in conjunction with the probability of a fire having an impact once it starts. Fire history mapping and fire cause statistics may be a starting point, but should not be the only consideration. Anecdotal evidence, incidents in similar areas, fuel hazard, weather, terrain and associated fire behaviour will assist in assessing the likelihood.
- Consequence considers bushfire risk based on impacts to community (i.e. injuries and fatalities, access to services), economy (i.e. loss of assets, cost of recovery, financial impacts), and environment (i.e. species, populations, ecological communities and processes) 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 ranked as Low, Moderate, High, Very High or Extreme.

The *Fire Policy and Procedure for Risk Assessment in Fire Management Planning* provides more information on this process. Risk assessment is ongoing and continually reviewed to reflect the changing landscape.

4.2 Fire Ignition

Historically fires within the AW region are often not reported or detected so existing fire records are limited, both in terms of the cause of ignition and extent. The high proportion of incidents for which the cause is undetermined or not recorded within the Outback Bushfire Management Area and the Western Eyre CFS Group (including the Yalata lands) reflects this situation. It is likely that a significant proportion of fires in the region are the result of dry lightning (that is, lightning with no rain) ignitions. However, the number of deliberately lit fires, including for cultural purposes, is also unknown.

Some anecdotal information regarding the sources of ignition on Aboriginal lands is summarised below, together with available information regarding the causes of ignition on DEWNR reserves.

4.2.1 Fires on Aboriginal lands

Existing fire management strategies and information for the APY Lands and the Great Victoria Desert document a number of sources of fires in these areas (APYLM 2004; Morelli 1992). Information from a workshop of Anangu women residing in the strategy area held

in 2010 (Stelmann 2010) is also included in the overview ignition sources below. The various ignition sources indicate how integral fire is to daily Anangu life in contemporary as well as traditional contexts.

- **Roadside fires**: within the APY Lands Anangu "habitually light fires beside the road. If a car breaks down, gets a flat tire, runs out of fuel – all commonplace occurrences – then a fire is lit" (APYLM 2004). Such fires can be for light, warmth, or as a signal, and may be small or very large and destructive if they occur in extreme weather conditions and/or following wet years when there has been significant grass growth (APYLM 2004).
- '**Rubbish clearing**': refers to removal of Spinifex for a camping area, and to drive out snakes, or removal of grass around communities (APYLM 2004; Morelli 1992).
- **Play**: "especially around communities, children regularly light fires" (APYLM 2004).
- **Patch burning**: for hunting and increasing the availability of plant and animal food; and protection of important sites and areas in the landscape (not burning of sites) (APYLM 2004; Morelli 1992; Stelmann 2010).
- '**Institutional fires**': APYLM use this term to describe planned fires undertaken by senior Nguraritja with the support of APYLM to protect species and look after country (APYLM 2004).
- **Accidental fires**: these include roadside fires but also other sources such as dropped cigarettes, escaped cooking fires and so on.
- **Arson**: APYLM (2004) indicates that:

  "it is difficult to assess just how common the incidence of arson is. It has been suggested that the lighting of bushfires in someone's country is a means by which scores can be settled or jealousies expressed. Most incidents of arson, however, are more likely to lean toward mere play, or sensory gratification than they are toward malicious intent, ("Anyway-anyway fires"). There is a widespread perception that car-loads of youths habitually set fire to the country and non-specific accusations of arson are common. It is likely that many such inferences (for they are too vague to warrant the term 'accusations'), are merely cover for an accidental fire about which the accuser knows more that he or she is letting on, or simply for the shame of having a bushfire in one's country, a situation that is taken by Anangu as indicative of weakness and poor management."

- **Fires connected with ceremonies**: during men's business fires smoke plumes are sent into the air to signal to women and the uninitiated should stay away and the road should be kept clear to allow for the 'passage of business' (APYLM 2004). Fire is also generally used in ceremonies for the deceased (Morelli 1992).
- **Signalling**: as noted above, fires have an important role in signalling location in desert country, and such fires are not generally extinguished (Morelli 1992).
- **Lightning**: fires ignited by lightning are generally concentrated in the warmer months, and this can increase the extent of the area burnt, particularly following wet years with significant grass growth. Lightning activity can be very significant and is likely to account for a large proportion of major fires on the lands.

4.2.2 Fires in DEWNR Reserves

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 and any other historical records was reviewed during the development of this fire management strategy.

Since 1962, a total of 298 bushfire incidents have been recorded within or in close proximity to DEWNR managed land in the strategy area. Of these incidents, four fires greater than 50,000 ha have occurred in both Mamungari CP and the Yellabinna complex, and one fire greater than 50,000 ha has occurred in the Nullarbor complex. The largest incident recorded during this time burnt 438,000 ha of the Yellabinna complex in 1974, with two other fires of greater than 235,000 ha (within Nullarbor NP in 2007 and the Yellabinna complex in 2002) and three greater than 110,000 ha (within the Yellabinna complex in 2001 and in 1978, and within Mamungari CP in 2000).

In the past there has been no active fire management within the reserves in the strategy area. The only prescribed burning undertaken to date is a 170 ha area in Yellabinna RR to protect identified Sandhill Dunnart (*Sminthopsis psammophila*) habitat. A further 500 ha Sandhill Dunnart habitat protection burn is planned. The fire history mapping undertaken to support development of this strategy indicates the existence of a significant bushfire history in the reserves over the past 40 years (refer to Section 3.2.2).

4.3 Fuel Hazard

4.3.1 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 7). Canopy fuel is measured as part of overall fuel hazard in mallee, and is incorporated into the elevated fuel assessment.

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

As noted earlier in Section 4.2.1, the general pattern of fire incidents in semi-arid and arid regions such as those within the strategy area, is often, but not always, characterised by fire following rain, due to ephemeral grass growth that generally results from significant rainfall in an otherwise dry environment. Gill (2000) analysed 100 year rainfall data for Alice Springs and found that these suggested a major fire cycle of around 50 years. However, the same calculation over a ten year period suggested a 20 year fire cycle (Gill 2000), which is in fact closer to the generalised frequency apparent from the epochal fire history mapping undertaken to support development of this strategy.

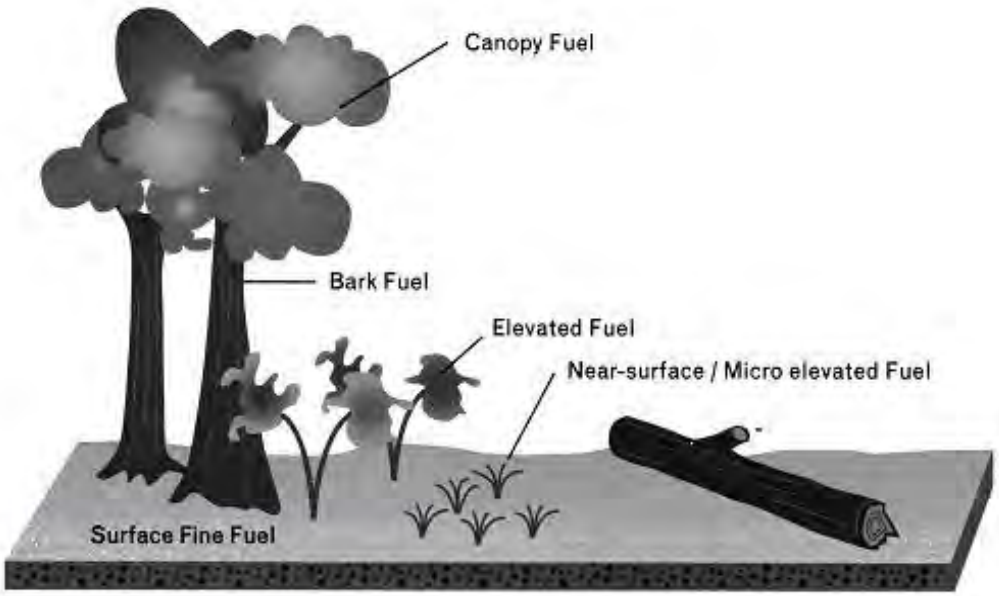

FIGURE 7 – COMPONENTS OF FUEL IN VEGETATION (TOLHURST & CHENEY 1999)

Within the strategy area, traditional 'patch' burning in the APY Lands is likely to have contributed to mitigation of large scale landscape fires prior to the 1950s. These activities may have also occurred sporadically on the MT (including Mamungari CP) and Yalata lands, in association with ceremony, hunting, camping and signalling, when fires may have escaped or been deliberately lit in some areas. There has been no active fire suppression throughout the strategy landscape for fires resulting from either human-caused or natural ignition. There are few tracks and no deliberate fire control lines have been put in place or prescribed burns undertaken in DEWNR reserves within the strategy area, other than 170 ha for Mingkari kutjarpa (Sandhill Dunnart, *Sminthopsis psammophila*) habitat protection in 2010.

Research undertaken by McCarthy and Tolhurst (2004) in Victoria suggested that focusing on reduction of bark and elevated fuels, and maintaining overall fuel hazards at High or less may aid in slowing the progress of a bushfire. However, this analysis does not necessarily apply to the remote and ephemeral landscapes within the strategy area, in which the overall fuel hazard will generally be High or less, but very large fires may still occur.

For more information on fuel hazard assessment methodology and evaluation, refer to the Overall Fuel Hazard Guide for South Australia (DENR 2011). 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 Policy and Procedure* (DEWNR 2013c).

4.3.2 Likely Maximum Overall Fuel Hazard

The likely maximum overall fuel hazard is based on limited on-ground sampling and vegetation mapping within the strategy area (Table 8). 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 (e.g. Buffel Grass) density, will influence the overall fuel hazard.

Considerations

Although chenopods are relatively fire retardant, they will burn in summer when the bushes dry out, and providing there is sufficient fuel connectivity and extreme fire weather. This was the case in the 2006 and 2007 Nullarbor fires. However, generally the overall fuel hazard in chenopod shrublands would be *Low* to *Moderate*.

Much of the strategy area is characterised by undulating sand dune country, often with isolated patches of woodland and scrubland, which are havens for biodiversity, and large areas of Spinifex. In areas where Spinifex is present, the rate of regrowth has a significant bearing upon the capacity of fire to carry through the landscape. As Cheney and Sullivan (2008) identify, spatial distribution, hummock size, fuel moisture content and wind speed are the critical factors in fire spread in Spinifex fuels.

TABLE 8 – LIKELY MAXIMUM OVERALL FUEL HAZARD FOR MVS IN THE STRATEGY AREA

MVS No.	MVS Name	Likely Maximum Overall Fuel Hazard	Significant Fuel Layers
9	Eucalyptus woodlands with a grassy understorey	Moderate to High	Surface, bark
12	Callitris forests and woodlands	Moderate to High	Surface
16	Other forests and woodlands	Moderate to High	Surface
20	Mulga *(Acacia aneura)* woodlands and tall shrublands with tussock grass	Moderate to High	Surface
21	Other Acacia tall open shrublands and shrublands	Moderate to High	Surface
22	Arid and semi-arid Acacia low open woodlands and shrublands with chenopods	Low to Moderate	Surface
24	Arid and semi-arid Acacia low open woodlands and shrublands with tussock grass	Moderate to High	Surface
26	Casuarina and Allocasuarina forests and woodlands	Moderate to High	Surface
27	Mallee with hummock grass	High to Very High	Surface, bark
29	Mallee heath with shrublands	High to Very High	Surface, bark
31	Chenopod shrublands	Low	Surface
32	Other shrublands	Low to Moderate	Surface
33	Arid and semi-arid hummock grasslands	High to Very High	Surface
36	Temperate tussock grasslands	Low to Moderate	Surface
38	Wet tussock grassland, herbland, sedgeland or rushland	Low	Surface
39	Mixed chenopod, samphire or forblands	Low	Surface

MVS No.	MVS Name	Likely Maximum Overall Fuel Hazard	Significant Fuel Layers
47	Eucalyptus open woodlands with shrubby understorey	Moderate to High	Surface, bark
49	Melaleuca shrublands and open shrublands	Moderate to High	Surface
52	Allocasuarina woodland and open woodland with hummock grass	High to Very High	Surface
55	Mallee with open shrubby understorey	Moderate to High	Surface, bark
61	Mallee with a tussock grass understorey	High to Very High	Surface, bark

Opportunistic observation suggests that in mallee woodland areas substantial bark build up around the base of individual trees can support significant spotting in high wind conditions.

These factors are likely to result in fires 'meandering' through grass (hummock and tussock) dominated landscapes in accordance with fluctuating wind speed and growth patterns. In years where there is significant ephemeral grass growth, the spatial connectivity of the fuel increases markedly, potentially resulting in uninterrupted fire runs of significant intensity.

The presence of Buffel Grass will also impact upon the likelihood of fire carrying through the landscape due to the increased fuel loads and connectivity this introduced grass presents.

Generally the overall fuel hazard in grass dominated woodlands and shrublands would be *Moderate* to *High*, but it is possible that there will be areas of *Very High* fuel hazard in long unburnt patches.

4.4 Potential for Fire Impact

Potential for fire impact is assessed for life and property, and for cultural and environmental assets. A preliminary risk assessment has been undertaken for each of these elements during the development of the draft strategy. Please note that assessment of risks to cultural assets has only been undertaken to date for registered cultural heritage sites located within the DEWNR reserves within the strategy area.

4.4.1 Life and Property

Although bushfires are relatively large and frequent in the strategy area, the region is very sparsely populated, and built assets are in few, and confined, locations and generally surrounded by areas of low overall fuel hazard. A preliminary risk assessment of life and property throughout the strategy area has been undertaken, with the majority of life and property assets identified as being at Low or Medium risk of bushfire impact. Only those rated as being at *High* risk and above are outlined below.

Following one or more seasons of significant rains in the strategy landscape, extensive, fast moving and high intensity surface fires may occur due to ephemeral grass growth. In these years, such as the 1974/75 fire season and the 2011/2012 fire season, the risk to life,

property, cultural and environmental assets within the strategy area is potentially increased.

APY Lands

A preliminary risk assessment identified the communities of Pukatja and Amata, together with the homelands surrounding these communities as being at High risk of bushfire impact.

Nullarbor

The Border Village, which is surrounded by mallee woodland, was identified as being at High risk from bushfire impact. The Village provides fuel, accommodation and food for people travelling across the Nullarbor, as well as for local residents.

4.4.2 Cultural Assets

Flora and fauna of cultural significance that may be impacted by fire, and/or which has been identified by Anangu as of concern in relation to fire, have been recorded in risk assessment table. A search of cultural heritage sites registered or reported under the *Aboriginal Heritage Act 1988* has also been undertaken for the DEWNR reserves within the strategy area. This information will be used internally when considering proposed risk mitigation works within the strategy area. It is also noted that a search of the Aboriginal Heritage Register is undertaken during the planning phase for all on-ground fire management works on DEWNR reserves. On the APY, MT and Yalata lands, it is the responsibility of the relevant organisations to ensure compliance with the *Aboriginal Heritage Act 1988*. In reality, Ngurariţja will indicate country that is significant or forbidden and guide appropriate management on Anangu owned and managed lands.

The *Aboriginal Heritage Handbook and Strategy* (DEH 2006) outlines the DEWNR consultation processes in relation to cultural heritage matters.

4.4.3 Natural Values

Inappropriate Fire Regimes

An 'inappropriate fire regime' refers to too frequent fire or too infrequent fire and /or fire in the wrong season or wrong intensity as described in the EFMG in Section 3.5 and Table 6. If any of the thresholds are compromised, fire sensitive species are at risk of decline.

The available landscape fire history data (Section 3.2.2) indicate that the EFMG are compromised for many of the MVS in the strategy area, particularly in the APY Lands. This part of the landscape is at risk from frequent fire and/or high intensity fires that burn large areas of contiguous vegetation. Other parts of the landscape, e.g. southern MT lands, Tallaringa CP and Yellabinna complex, may be suffering from an absence of fire and are therefore also at risk from large high intensity fires.

Threatened Flora and fauna

The strategy area includes habitat for a significant number of threatened flora and fauna species. A preliminary risk assessment conducted using the *Risk Assessment in Fire Management Planning Policy and Procedure* (DEWNR 2013c) has identified that many of the species are at risk from large landscape scale fires and inappropriate fire regimes as described above. Tables 10 and 11 list these species and their preliminary risk rating.

Recovery plans are in place for a number of these species and some provide guidance regarding appropriate fire management.

Several other bushfire related threats to biodiversity have been identified in the strategy area, including:

- Buffel Grass due to its tendency to increase fuel hazard (*Extreme* risk rating)
- soil erosion, sedimentation of rock-holes and alteration of floodplains resulting from large bushfire events (*High* risk rating).

5 FIRE MANAGEMENT OBJECTIVES AND STRATEGIES

Objectives and strategies for fire management are based upon information collated and the risk assessment undertaken for the strategy area, together with existing plans of management.

5.1 Support Anangu Fire Management Aspirations

This strategy has been developed to help facilitate fire management planning across the AW NRM Region. It provides a framework for Anangu to develop fire management plans and/or annual work programs for smaller geographic/biological areas within the AW NRM Region in partnership with supporting agencies. Specifically, it does this by:

- dividing the area into smaller Fire Management Landscapes (see Section 5.1.1)
- providing a template for developing fire management plans and/or programs for these Landscapes, which support contemporary Anangu aspirations and protect and enhance biodiversity (see Section 5.1.2)
- providing strategies for the protection of life, property and the environment as described throughout the remainder of this chapter.

5.1.1 Fire Management Landscapes

Due to the size of the strategy area and the nature of land ownership and management arrangements, the region has been divided into seven Fire Management Landscapes, which are based on the AW Regional NRM Plan 'Regional Landscapes', excluding the coastal areas (AW NRM Board 2009) (see Table 9 and Figure 8). These landscapes have been primarily based on land and sea divide, the IBRA Regions, soils and landforms, and logic for management and reporting of program and project initiatives. The purpose of dividing the strategy area in this manner is to provide management information and guide the development of detailed fire management plans and/or annual work programs where issues unique to a particular area can be addressed. The seven landscapes are listed in Table 9.

TABLE 9 – FIRE MANAGEMENT LANDSCAPES

Fire Management Landscape		Hectares	Tenure	IBRA Regions
1	Nullarbor Plain	4,216,353	Nullarbor NP Nullarbor RR Nullarbor WA (i.e. the Nullarbor complex)	Nullarbor
2	Yalata Lands	464,143	Yalata Lands Yalata IPA	Nullarbor
3	Yellabinna and Yumburra	2,694,829	Yellabinna WA Yellabinna RR Yumbarra CP Pureba CP Boondina CP	Nullarbor Great Victoria Desert
4	Great Victoria Desert	7,753,199	MT Lands Mamungari CP	Great Victoria Desert Gawler
5	Southern APY	6,823,100	APY Lands Watarru IPA Walalkarra IPA Antara-Sandy Bore IPA Apara-Makiri-Punti IPA	Great Victoria Desert Central Ranges
6	APY Ranges	1,776,333	APY Lands Kalka-Pipalyatjara IPA	Central Ranges
7	Eastern APY and Tallaringa	4,389,920	APY Lands Tallaringa CP	Great Victoria Desert Central Ranges Finke

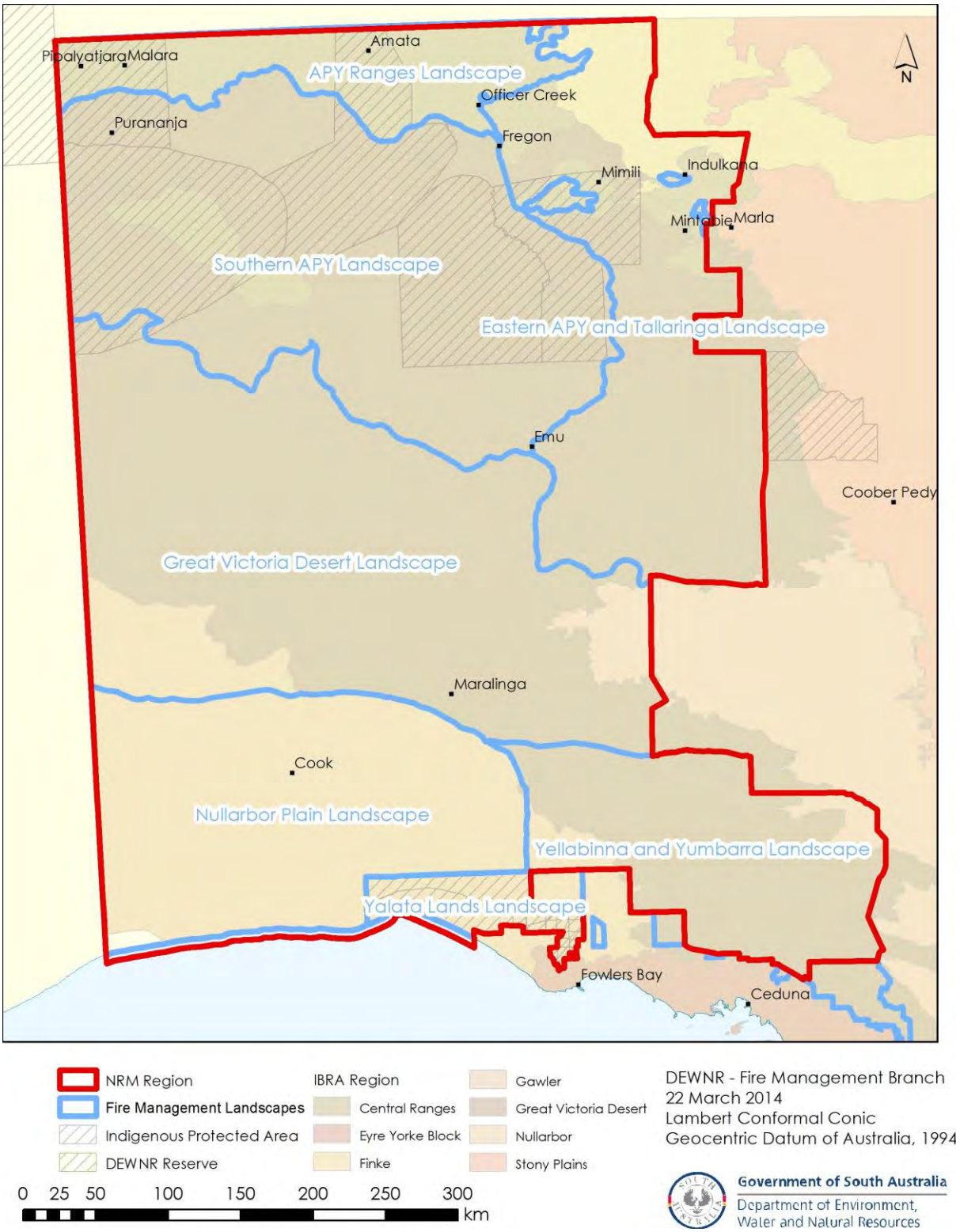

FIGURE 8 – AW NRM REGION SHOWING FIRE MANAGEMENT LANDSCAPES, TENURE AND IBRA REGIONS

5.1.2 Fire Management Planning

Fire Management Plans

A fire management plan template has been developed to help guide fire management planning in each of the seven Fire Management Landscapes identified above (refer to Appendix 1). The template follows the format of this strategy, which in turn is based on the *Fire Policy and Procedure Manual* (DEWNR 2013c). However, as previously stated, on

Anangu land, Anangu can and will burn areas without necessarily engaging in any form of 'western' planning process and this strategy does not seek to change that in any way. Therefore, the template should be treated as a prompt to enable the guiding principles in this strategy to be integrated with traditional management practices to develop best practice fire management for the region.

A fire management plan is already in place for the Mann and Musgrave Ranges (Paltridge & Latz 2009), which encompasses the APY Ranges Fire Management Landscape. That plan was developed prior to this strategy and therefore doesn't follow the template but does address all of its major themes. Some of the objectives and actions in the *Mann and Musgrave Ranges Fire Management Plan* (particularly those pertaining to management of key flora and fauna species) have been reproduced in this strategy.

Annual Works Programs

APYLM has also developed a process for planning annual burning based around fire history information (APYLM 2004). This process includes plan documentation and reporting, but the major focus is upon discussion and agreement around areas needing work, including traditional and ecological management of flora and fauna. This process, to be led by APYLM staff, is reproduced in Figure 9.

Fire History Mapping

To support the development of this strategy, fire history mapping for the whole strategy area was undertaken (see Section 3.2.2). Further fire history mapping to complete the 1974/75 fire scar, and to map older scars from black and white aerial imagery from the 1950s and 1960s may provide a more comprehensive view of fire history over the strategy area. Ongoing digitisation of new fire scars, as well as the management of existing fire history data will contribute to more effective decision making and priority setting for fire management activities.

	Management Strategies	Responsibility
Fire Management Planning	1. Support Anangu to develop fire management plans and/or annual works programs to address unique issues within each of the fire management landscapes.	Anangu DEWNR AW NRM Board CFS
	2. Integrate traditional knowledge about fire management with scientific principles and technology to develop best practice for the region.	Anangu DEWNR AW NRM Board
	3. Maintain and update fire history mapping for the strategy area.	DEWNR AW NRM Board

5.1.3 Knowledge Transfer

One of the objectives in the *Mann and Musgrave Ranges Fire Management Plan* (Paltridge & Latz 2009), pertains to the transfer of fire management knowledge between the senior Ngurariitja and young rangers. In the plan it recommends that:

> *Senior traditional owners experienced in fire management should be taken out on burning trips with younger rangers as much as possible to provide advice to*

the rangers on where and when burning should be conducted. The rangers should be encouraged to document this knowledge in some way for future generations, perhaps with a digital camcorder. In turn the (younger) rangers should be able to explain western fire perspectives to the older people regarding the protection of old growth stands of various vegetation types that have no value to Anangu.

As previously stated, traditional knowledge can be collated as work is done, but always and only with the consent of Nguraritja, obtained in accordance with accepted codes of ethics (AIATSIS 2010). The ultimate aim of fire management programs conducted on Anangu land is for Nguraritja to eventually manage their own programs using best practice techniques that integrate traditional and contemporary knowledge.

Management Strategies		Responsibility
Knowledge Transfer	4. Support the integration and transfer of fire management knowledge and develop the capacity of Anangu to manage fire in the region.	Anangu DEWNR AW NRM Board

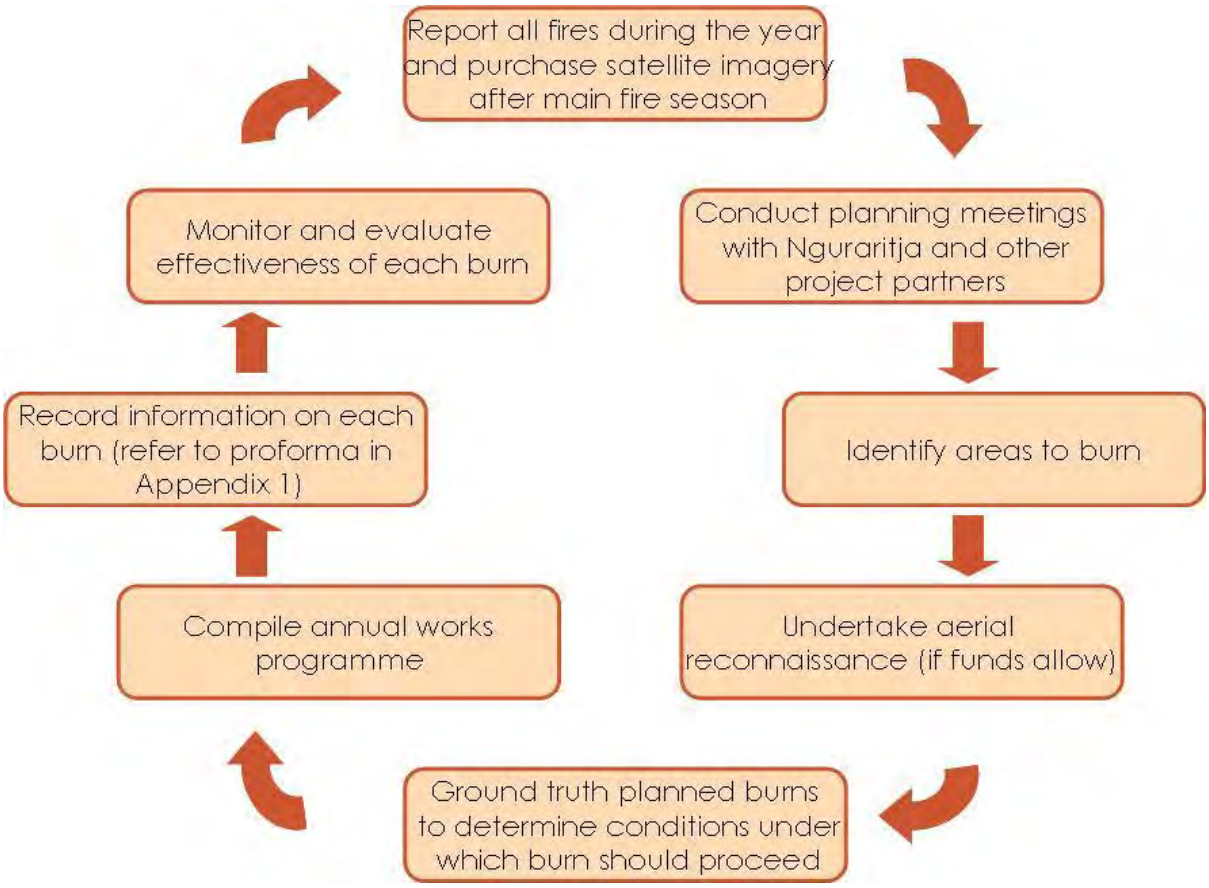

FIGURE 9 – PROCESS FOR DEVELOPING ANNUAL WORKS PROGRAMS

5.2 Protect Life and Property

5.2.1 Community preparedness, awareness and education

A number of specific community education strategies have been identified for the strategy area relating to bushfire preparedness.

Management Strategies		Responsibility
Community Preparedness	5. Continue to disseminate bushfire preparedness education programs for residents, mining companies and travellers in the strategy area.	CFS
	6. Manage reserve closures during periods of high fire danger and where incidents may impact upon life, property and the environment.	DEWNR
	7. Develop emergency response plans for key transport routes (road and rail) within the strategy area.	CFS

5.2.2 Built Assets

Buildings constructed to the requirements of 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). As the strategy area is not designated as 'bushfire prone' for the purposes of development assessment, AS3959 has not been (and is not currently) applied to buildings in the region through the planning approvals process. Due to the remoteness of the region, there are many transportable buildings and structures clad in corrugated iron within the strategy area. Few, if any of these, would be compliant with AS3959.

Risk Assessments should be completed seasonally, to identify built assets at risk of bushfire, and appropriate management actions to mitigate that risk.

Management Strategies		Responsibility
Built Assets	8. In developing Landscape Fire Management Plans, undertake seasonal risk assessments to identify built assets at high risk of bushfire.	CFS Anangu Land Owners & Managers Asset Owners & Managers
	9. Where required, implement on-ground works to mitigate risks to built assets, as identified in Landscape Fire Management Plans.	CFS Anangu Land owners & managers Asset owners & managers

5.3 Protect Areas of Cultural Significance

There are several types of assets of cultural significance included in this strategy, incorporating both Anangu and non-Indigenous cultural assets. It is also important to note that cultural heritage assets are considered in detail in the Landscape Fire Management Plans.

On DEWNR managed lands, information on Aboriginal and European heritage is collected during prescribed burn planning as part of the Environmental Assessment (refer to Section 4 and Figure 10 (DEWNR 2014)). Any fire operations on those lands must be in accordance with the *Protection of Cultural Heritage Policy and Procedure* (DEWNR 2013c).

Anangu cultural heritage is incorporated within the strategy at a number of levels: Ngurariitja apply their knowledge in identifying areas for fire management works, and sites recorded in the Register maintained pursuant to the *Aboriginal Heritage Act 1988* are also considered.

Aboriginal heritage sites are recorded in the Register of Aboriginal Sites and Objects (the Register). Sites that are located in DEWNR managed reserves within the Nullarbor and Yellabinna complexes in the strategy area have been internally reviewed in the allocation of proposed fire management works. 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 strategy area, even though the Register does not identify them. When implementing works identified in the strategy, DEWNR will comply with the *Aboriginal Heritage Handbook and Strategy* (DEH 2006) and support should be sought from the Traditional Owners of the land during the prescribed burn planning process to facilitate the protection of sites.

Flora and fauna of significance to Anangu, that are not listed species, have also been considered in developing this strategy. These species are considered in the 'natural values' section below (Section 6.5.4).

	Management Strategies	Responsibility
Cultural Heritage	10. Implement fuel management strategies appropriate for the protection of assets of cultural heritage significance.	Land owners & managers DEWNR CFS
	11. Engage with Traditional Owners to develop appropriate information that can be used to inform bushfire managers during suppression activities.	Land owners & managers CFS Anangu DEWNR AW NRM Board

5.4 Manage Fuel on a Landscape Scale

5.4.1 Fire Management Zones

Fire management zones are used to categorise areas of land according to their overall risk rating: Asset Protection Zone (A-zone), Bushfire Buffer Zone (B-zone) or Conservation-Land Management Zone (C-zone). Risk mitigation activities are determined by giving consideration to overall fuel hazard levels in the different zones.

On DEWNR managed lands, fire management zones are used to:

- ensure that appropriate management actions 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 (DEWNR 2013c).

Objectives for A, B and C-zones

The following general objectives apply for fire management zoning across DEWNR reserves in the strategy area. They may also be applied to Anangu owned and managed lands within the strategy area at the discretion of the landowners and managers.

Asset Protection Zone Objectives

- To provide a low fuel area of at least 40 m to help protect life (residents/owners/firefighters) and property/built assets from radiant heat damage, flame contact and short distance ember attack.
- To modify the rate of spread and fire intensity providing the highest degree of safety for fire crews during suppression.

Bushfire Buffer Zone Objectives

- To minimise the likelihood of bushfire impacting on environmental assets.
- To assist in reducing bushfire intensity within the included lands.
- To 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.
- To reduce the likelihood that significant areas of contiguous vegetation burns in a single fire event.

Conservation-Land Management Zone Objectives

- To manage fire to meet the reserve management objectives as specified within the Reserve Management Plans listed in Section 2.5.7 of this document.
- To assist in the conservation of species and populations through the application of appropriate fire regimes, including localised protection burns for fire-sensitive species where appropriate.
- To reduce the likelihood of contiguous vegetation burning in a single fire event.
- To promote heterogeneity within the environment through the creation of variability in the fire regime.
- To use fire as part of an integrated weed management program to improve habitat quality.

- To manage fire to maintain wilderness in Wilderness Protection Areas.
- To manage fire to minimise the impact on areas of cultural significance.

Prescriptions for Fuels in A, B and C-zones

The overall fuel hazard:

- should not exceed *Moderate* for the areas designated as A-zones
- should not exceed *High* for the areas designated as B-zones.

In A- and B-zones, fuel management will be undertaken to achieve the desired level of overall fuel hazard, once it exceeds the prescribed limit. Note that within C-zones management is not dictated by overall fuel hazard levels, rather zoning allows for fire management to meet ecological and conservation management objectives.

As noted in Section 4.3.2, the overall fuel hazard within the strategy area will generally be between *Low* and *High*, meaning that, in most areas, existing fuel levels will usually fall within the envelope recommended for A- and B-zones. In years with extensive ephemeral growth, the overall fuel hazard is likely to increase significantly, as will the spatial connectivity, thus providing the potential for fast-moving fires of considerable intensity that have the capacity to burn very large areas of the landscape. Fire Management Landscape Plans will assist in process of applying A- and B-zones, and this is reflected in the general statement of objectives for the zones outlined above.

5.4.2 Application of Zoning within the Strategy Area

It is recommended that the Landscape Fire Management Plans and/or annual work programs developed for the Landscapes identified in Section 5.1.1, include zoning as described above.

Management Strategies		Responsibility
Fire Management Zoning	12. Implement zoning as determined by the risk assessment process.	CFS DEWNR AW NRM Board Anangu Land owners & managers Asset owners & managers

5.4.3 Cultural / Prescribed Burning

Cultural Burning on Aboriginal Lands

APY Land Management has been supporting cultural burning on the APY Lands since the late 1990s. Some degree of burning by Ngurariṯja is also undertaken on an ongoing basis for a range of purposes, as outlined in Section 4.2.1 'Fires on Aboriginal lands' above. Indeed, the fire history mapping undertaken for this project indicates that it is likely that cultural burning has continued to be widely undertaken on the APY Lands, as at least a proportion of the fire incidents mapped are likely to be human caused ignitions. Some records of past burns have been kept by APYLM but most of these are not spatial. More recently, habitat protection burning has been undertaken around Warru (Black-flanked Rock Wallaby –

Petrogale lateralis) habitat in the Mann and Musgrave Ranges areas. Some grass burning for the purpose of fire prevention is undertaken around communities on the APY Lands when required (Heylen & Turner 2008), and some burning of Buffel Grass was also undertaken in 2011 on the APY and MT lands as part of integrated treatment trials.

APYLM has identified broad strategies for habitat protection burning within the fire management plan for the APY Lands (APYLM 2004), the *Mann and Musgrave Ranges Fire Management Plan* (Paltridge & Latz 2009) and the various IPA country management plans (APYLM 2008a,2010a,2010c,2011). The process for identification of areas to be burnt needs to occur on an annual basis, and the fire management plans for the APY Lands and Mann and Musgrave Ranges outline processes for the involvement of Ngurar̲itja to direct fire management activities (refer to Section 5.1.2 'Fire Management Planning').

Detailed strategies are included for particular flora species within the *Mann and Musgrave Ranges Fire Management Plan* (Paltridge & Latz 2009) (refer to Section 5.5.2 below for details). There are also some key principles for prescribed burning identified in this plan, and these are summarised below.

- When to burn: in the winter months, during a stable slow-moving high pressure system generally lasting 4-5 days, on a light southerly around 10 km/h – start burning at the beginning of the system; rainy conditions are ideal for hazard reduction burning in fire sensitive communities, need at least 10 mm, other than in cooler winter conditions, where less rain may be sufficient (Paltridge & Latz 2009). Maximum daytime temperature of 25°C, overnight lows around 5°C, need lower temperatures to burn on slopes, with a high likelihood of frost (Paltridge & Latz 2009).
- Spinifex: Note that old growth Spinifex will not self-extinguish without heavy rain, heavy frost or dew, or human intervention (Paltridge & Latz 2009). Patch-burning in Spinifex can be undertaken as an open-ended burn, preferably under a range of weather conditions to provide both low and high intensity burns and retain patchiness in Spinifex (Paltridge & Latz 2009). Burning in Spinifex requires either connectivity of fuels or wind of sufficient strength so as to cause the flame angle to reach the next plant (Cheney & Sullivan 2008).
- How to burn: clear around built assets first, then burn from the top of hills/mid-slope to protect vegetation in elevated areas and/or create breaks around fire sensitive vegetation/important habitats, and lastly undertake patch-burning in Spinifex (Paltridge & Latz 2009). This order of activities mitigates the risk of Spinifex burns escaping into areas of fire sensitive vegetation and impacting settlement areas.

Management Strategies		Responsibility
Cultural Burning on Aboriginal Lands	13. Support Anangu in cultural burning by taking an adaptive management approach, ensuring discussion and engagement occur on country where possible.	Anangu DEWNR AW NRM Board

Prescribed Burning on DEWNR Reserves

Different flora and fauna species respond differently to fires of varying intensities, seasonality and frequency. Within the strategy area there are a number of species that are sensitive to high intensity fires (e.g. mulga, Itjari itjari), others that require relatively regular fires (e.g. Tjakura), and others that require habitat that is long unburnt (e.g. Nganamara).

Recent research reviewing prescribed burning literature and modelling (Penman et al. 2011) indicates that very significant areas of the landscape need to be in a low fuel state to have a major impact on the extent of unplanned fires. Modelling of potential fuel management treatments has indicated that 30% of a landscape being in a low fuel state "resulted in an approximately commensurate reduction in area burned" (Cary et al. 2009, pg 152). At such levels, prescribed burning would significantly increase the overall area of the landscape burnt, and have a potentially major and detrimental impact on biodiversity values (Penman et al. 2011). In order to maximise the effectiveness of prescribed burning for both fuel reduction and ecological purposes, a number of key elements require consideration (Penman et al. 2011).

- Fire regimes (based on best available species fire response information).
- Examination of fire history and MVS spatial layers to determine the proportion of each MVS that has a time since fire that is below the minimum fire return interval (<TPC1), between the minimum and maximum fire return intervals (between TPC1 and TPC2), and above the maximum fire return interval (>TPC2) as described in the Environmental Fire Management Guidelines.
- Defining meaningful and measurable objectives for prescribed burning.
- Economic analysis of fire management options (what is the most efficient allocation of funds towards prescribed burning for achieving both the fuel reduction and ecological objectives?).
- Improved collaboration between land managers and scientists.

Application of these elements within an adaptive risk management context is the preferred approach to undertaking prescribed burning within the DEWNR managed reserves within the strategy area.

In the context of the existing fire history within the DEWNR managed reserves within the strategy area, and following consultation with Ngurarritja in the relevant areas, the following fire management activities are proposed.

Management Strategies		Responsibility
Prescribed Burning on DEWNR Reserves	14. Map time since last fire and compare with the EFMG for each MVS.	DEWNR
	15. Use EFMG to develop a Prescribed Burning program for the purpose of enhancing biodiversity.	DEWNR

Prescribed burning activities may be amended or additional activities undertaken, subject to the development of fire management plans and/or annual work programs and subject to approvals as described in Figure 10.

5.5 Protect and Enhance Biodiversity

5.5.1 Natural Values

The Environmental Database of South Australia contains records from several data sources, including the Threatened Plant Population Database, the Biological Survey of South Australia, Adelaide Herbarium, research data sets and opportunistic sightings of significant flora and fauna. Appendices 2 and 3 contain lists of flora and fauna of conservation significance as well as species that are considered important in terms of fire management and attempts to summarise the current level of fire response knowledge for these species.

In this strategy 'of conservation significance' is used to describe rated flora and fauna species as well as ecological communities. These may be:

- nationally rated, that is, listed as Threatened (with a rating of Extinct, Critically Endangered, Endangered or Vulnerable) under the federal EPBC Act
- South Australian rated, listed as Threatened (with a rating of Endangered, Vulnerable or Rare) under the NPW Act, Revised Schedules 7, 8 and 9
- provisionally listed as Threatened (with a rating of Endangered or Vulnerable) in South Australia, that is, included on the unpublished DEWNR Provisional List of Threatened Ecosystems of South Australia (DEH 2005).

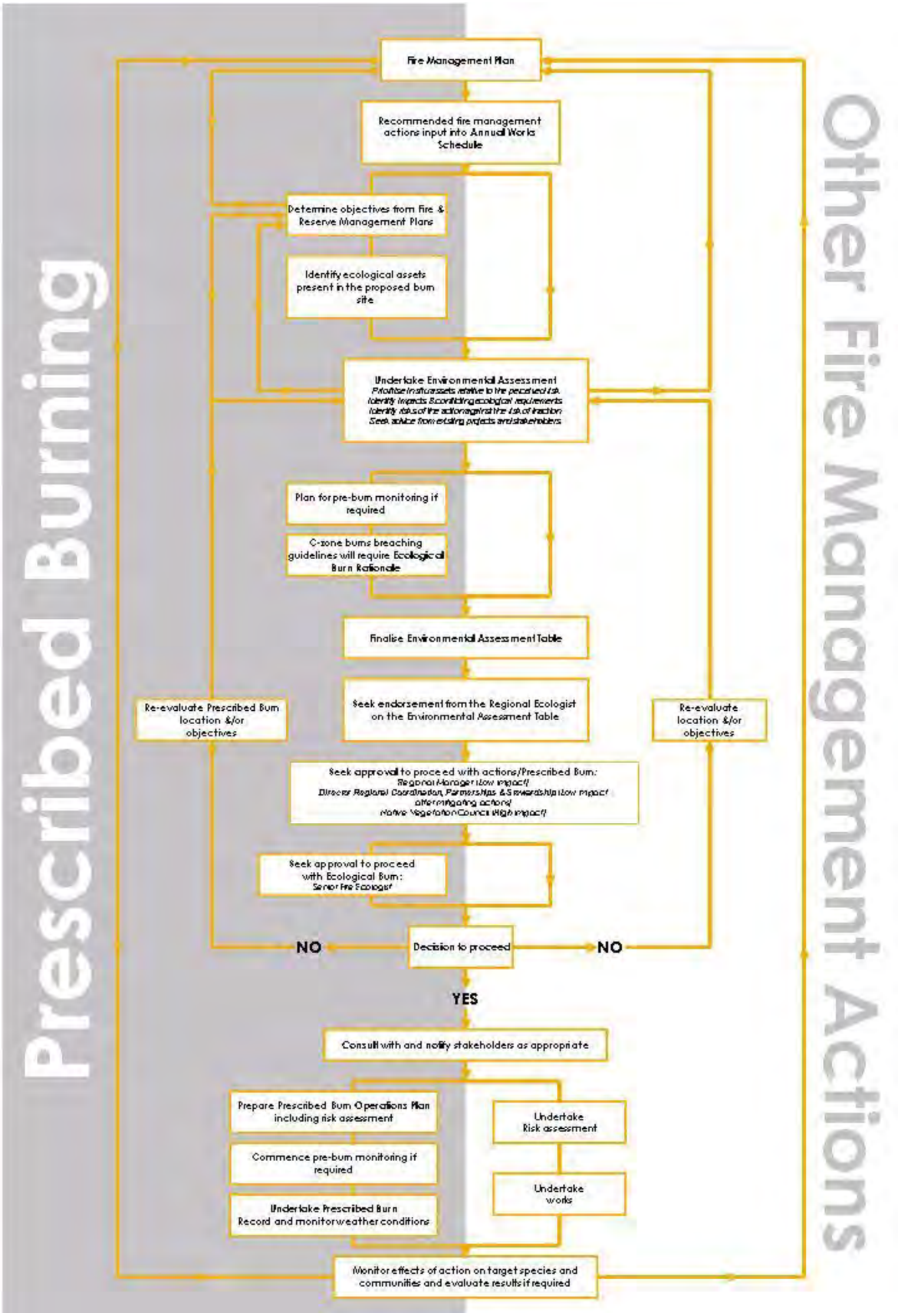

FIGURE 10 – PLANNING PROCESS FOR BURNING AND OTHER FIRE MANAGEMENT WORKS ON DEWNR-MANAGED RESERVES

Note that the appendices are not intended to be an exhaustive list of rated species within the strategy area as they do not include species that are regionally threatened and they exclude rated species that are considered to be functionally extinct or unlikely to be affected by fire management activities.

In addition to the information provided within the appendices, ecological information and fire response for a selection of significant flora and fauna have been detailed in the following sections. These are species listed as threatened at a National or State level for which inappropriate fire regimes have been identified as a threatening process.

5.5.2 Threatened Flora

There are a number of threatened plant species within the strategy area that are considered to be vulnerable to fire. The status of each is listed in Table 10. Ecological and fire response information for species with an EPBC Act rating is described in greater detail in the Landscape Fire Management Plans. A summary is provided in Table 10 and in Appendix 2. Each of the listed species have specific fire management strategies identified within the *Management Plan for Rare and Threatened Fauna in the Anangu Pitjantjatjara Yankunytjatjara Lands of South Australia* (Paltridge et al. 2009a). These management strategies are derived from the *Mann and Musgrave Ranges Fire Management Plan* (Paltridge & Latz 2009) and are reproduced in Appendix 2.

TABLE 10 – THREATENED FLORA SPECIES IN THE STRATEGY AREA

*Landscape definition; APY: including APY Ranges, Southern and Eastern APY & Tallaringa, GVD: Great Victoria Desert, Nulla: Nullarbor, Yalat: Yalata, Yella & Yumb: Yellabinna & Yumbarra.

Traditional Name & Common Name	Scientific Name	EPBC Status	NPW Status	*Location Landscapes
Mt Connor Wattle	*Acacia ammobia*		R	APY
Central Ranges Wattle	*Acacia tenuior*		R	APY
	Alyogyne pinoniana var. microandra		V	Yella
	Atriplex morrisii		V	Nulla
Club Spear-grass	*Austrostipa nullanulla*		V	GVD Yella Yumb
	Bergia occultipetala		V	APY
Apita Everard Garland Lilly	*Calostemma abdicatum*		R	APY
Musgrave Ranges Fuschia#	*Eremophila willsii subsp. indeterminate*			APY
Central Ranges Goodenia	*Goodenia brunnea*		R	APY
Mt Finke Grevillea	*Grevillea treueriana*	VU	V	Yella Yumb
Ooldea Guinea-flower	*Hibbertia crispula*	VU	V	GVD Yella Yumb
Leafless Lechenaultia	*Lechenaultia aphylla*		V	Yella

Traditional Name & Common Name	Scientific Name	EPBC Status	NPW Status	*Location Landscapes
Central Australian Rapier Sedge or Desert Rush	*Lepidosperma avium*		R	APY
Granite Mudwort	*Limosella granitica*	VU	V	Yella Yumb
Wrinkled Honey Myrtle	*Melaleuca fulgens subsp. corrugata*		R	APY
	Microlepidium alatum	VU	V	Yella Yumb
Desert Daisy-bush	*Olearia arida*		V	APY
Nullarbor Cress	*Phlegmatospermum richardsii*		V	Nulla
West Coast Mintbush	*Prostanthera calycina*	V	V	Yella Yumb
Mount Illbillee Mintbush	*Prostanthera nudula*	VU	V	APY
Desert Greenhood	*Pterostylis xerophila*	VU	V	Yella Yumb
Sandalwood	*Santalum spicatum*		V	All
Ridged Noon-flower	*Sarcozona bicarinata*		V	Nulla
	Sauropus ramosissimus		V	APY GVD
	Scaevola obovata		V	APY
	Sclerolaena fusiformis		V	GVD
Symon's Bindyi	*Sclerolaena symoniana*		V	APY GVD
Rusty Spyridium	*Spyridium tricolor*		V	Yella Yumb
Ayers Rock Triggerplant	*Stylidium inaequipetalum*		V	APY
	Swainsona kingii		V	GVD
Small-flower Swainson-pea	*Swainsona minutiflora*		V	APY
Yellow Swainson-pea	*Swainsona pyrophila*	VU	R	Yella Yumb
	Teucrium grandiusculum ssp. grandiusculum		V	APY
	Teucrium grandiusculum ssp. pilosum		E	GVD Yella Yumb
Showy germander	*Teucrium reidii*		R	APY

Not listed as threatened under State or Federal legislation, but included here as considered to be at risk from fire (Paltridge et al. 2009b).

Fire management strategies need to be developed for the remaining species with a high risk rating as specified below.

Management Strategies		Responsibility
Threatened Flora	16. Develop ecological fire management strategies for threatened flora across the AW NRM Region.	DEWNR AW NRM Board

5.5.3 Threatened Fauna

There are a number of threatened fauna species within the strategy area for which inappropriate fire regimes have been identified as a threatening process. The status of each is listed in Table 11 along with the preliminary risk rating. Ecological and fire response information for species with an EPBC Act rating is described in greater detail in the Landscape Fire Management Plans. A summary is provided in Table 11 and in Appendix 3.

TABLE 11 – THREATENED FAUNA SPECIES IN THE STRATEGY AREA

*Landscape definition; APY: including APY Ranges, Southern and Eastern APY & Tallaringa, GVD: Great Victoria Desert, Nulla: Nullarbor, Yalata: Yalat, Yella & Yumb: Yellabinna & Yumbarra.

Traditional Name & Common Name	Scientific Name	EPBC Status	NPW Status	*Location Landscapes
Kakalyalya Major Mitchell's Cockatoo/ Pink Cockatoo	*Cacatua leadbeateri*		R	All
Kiilykiilykari Scarlet-Chested Parrot	*Neopherma Splendida*		R	All
Princess Parrot	*Polytelis alexandrae*	VU	V	APY GVD
Blue Bonnet *western ssp*	*Northiella haematogaster narethae*		R	Nulla
Night Parrot	*Pezoporus occidentalis*	E	E	APY GVD Nulla
Gilberts Whistler	*Pachycephala inornata*		R	GVD Nulla Yalat Yella Yumb
Nganamara Malleefowl	*Leipoa ocellata*	VU	V	APY GVD Yella Yumb Yalat
Kipara/Parulpa Australian Bustard	*Ardeotis australis*		V	All
Shy Heathwren	*Calamanthus Cautus*		R	Yalat Yella Yumb
Grey Honeyeater	*Conopophila whitei*		R	APY GVD
Slender-billed Thornbill *western ssp*	*Acanthiza iredalei iredalei*	VU	R	All

Traditional Name & Common Name	Scientific Name	EPBC Status	NPW Status	*Location Landscapes
Waruku / Trikutriny Striated Grass-Wren	*Amytornis striatus*		R	APY GVD Yella Yumb
Rufus-crowned Emu-wren	*Stipiturus ruficeps*		R	APY GVD
Painted Finch	*Emblema pictum*		R	APY GVD
White-browed Treecreeper	*Cilmacteris affinis*		R	APY GVD
Western Gerygone	*Gerygone fusca*		R	APY
Spinifex Pigeon	*Geophaps plumifera*		R	APY
Banded Stilt	*Cladorhynchus leucocephalus*		V	APY GVD
Spinifexbird	*Eremiornis carteri*		E	APY
Wiilu Bush Stone-curlew	*Burhinus grallarius*		R	APY
Black-breasted Buzzard	*Hamirostra melanosternon*		R	APY
Square-tailed Kite	*Lophoictinia isura*		E	APY
Grey Falcon	*Falco hypoleucos*		R	All
Ikarka Western Bower Bird	*Chlamydera guttata*		R	APY
Tjalku-tjalku/wiṟatju Masked Owl	*Tyto novaehollandiae*		E	Nulla
Grey Currawong *north west ssp*	*Strepera versicolour plumbea*		E	APY
Murtja Brush-tailed Mulgara (Ampurta)	*Dasycercus blythi (Dasycercus hillier)*	EN	E	APY
Murtja Crested-tailed Mulgara	*Dasycercus cristicauda*	VU	E	APY GVD
Warru Black-flanked Rock-wallaby	*Petrogale lateralis (McDonnell Ranges race)*	VU	E	APY
Tajlku/Ninu Greater Bilby	*Macrotis lagotis*	VU	V	APY GVD
Tarkawaṟa Fawn Hopping-mouse	*Notomys cervinus*		V	Yella Yumb
Itjara Itjara Marsupial Mole	*Notoryctes typhlops*	EN	V	APY GVD Yella Yumb
Sandhill Dunnart	*Sminthopsis psammophila*	EN	V	GVD Yella Yumb
Paṉakuṟa Desert Death Adder	*Acanthophis pyrrhus*		V	APY GVD
Musgrave Slider	*Lerista speciosa*		V	APY
Tjakura Great Desert Skink	*Liopholis kintorei*	VU	E	APY
Heath Goanna	*Varanus rosenbergi*		V	Yalat
Shoemaker Frog	*Neobatrachus sutor*		V	APY
Everard Ranges Toadlet	*Pseudophryne occidentalis*		V	APY

Nganamara, Mingkiri kutjarpa and Tjakura have fire management strategies identified in the recovery plans and/or ecological fire management strategies developed for these species. These strategies are reproduced in Appendix 3.

Fire management strategies need to be developed for the other threatened species with a high to very high risk rating as specified below.

	Management Strategies	Responsibility
Threatened Fauna	17. Develop ecological fire management strategies for threatened fauna across the AW NRM Region.	DEWNR

5.5.4 Species of Cultural Significance

During the development of this strategy a number of flora and fauna species were identified as having cultural significance to Anangu.

- Mangata (Quandong) (*Santalum acuminatum*)
- Kampurarpa (Bush Tomato) (*Solanum centrale*)
- Malu (Red Kangaroo) (*Macropus rufus*)
- Kulpir (Western Grey Kangaroo) (*Macropus fuliginosus*)
- Tjakipiri (Emu) (Dromaius novaehollandiae)
- Kuniya (Woma Python) (*Aspidites ramsayi*)
- Wayuta (Brushtailed Possum) (*Trichosurus vulpecula*)
- Mitika (Burrowing Bettong) (*Bettongia lesueur*)
- Tjala (Honey Ant) (*Camponotus inflatus*).

These species need to be taken into consideration when planning and implementing fuel management strategies and when suppressing bushfires, as recommended below.

	Management Strategies	Responsibility
Species of Cultural Significance	18. Implement fuel management strategies appropriate for the protection of species of cultural significance.	CFS Anangu DEWNR AW NRM Board
	19. Ensure traditional knowledge is considered during fire suppression and post-fire rehabilitation activities, in order to minimise negative impacts resulting from fire.	CFS DEWNR Anangu AW NRM Board

5.5.5 Pest Plants and Animals

Pest Plants

Weeds can have significant impacts on native vegetation and ecological communities within remnants (Saunders, Hobbs & Margules 1991). 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 other weed control techniques (including herbicide, biological, mechanical and physical control) noting that the combination, timing and application of methods is likely to differ depending on the target species and to minimise off target damage.

As mentioned in Section 4.4.3, Buffel Grass presents a particularly significant threat to biodiversity within the APY Lands, and is already spreading to parts of the MT and Yalata lands. Buffel Grass responds well to fire, regenerating rapidly and is also drought tolerant and very difficult to eradicate.

The potential implications of the spread of the grass for other species are significant. Recent research by Miller et al. (2010) identified that Buffel Grass:

- caused increased burn intensity which increased mortality in central Australian woodland shrubs, with Mulga (*Acacia aneura)* worst affected
- tends to colonise fertile soils beneath trees and shrubs, concentrating fire around the base of trees and increasing the risk of mortality to basal resprouters
- may rapidly re-establish resulting in competitive exclusion of seedlings of over storey species, and increase the risk of future fire. This is turn may impact upon species composition by altering fire regimes.

Miller et al. (2010, pg 363) also noted that:

> *Over time, it is possible that a Buffel Grass initiated fire-invasion feedback in open woodland will result in an ecological drift to a Buffel Grass-dominated grassland.*

The AW NRM Board has existing projects in place supporting mapping of Buffel Grass and integrated management trials involving use of fire. A state-wide strategic plan has been developed for Buffel Grass (Biosecurity SA 2012).

Prior to any prescribed burning on DEWNR reserves, potential weed impacts need to be considered to determine whether post-fire weed control is required. However, investment in weed control should also be based on the reserves' overall habitat quality and weed management priorities within the region. Any monitoring programs should ensure that vulnerable areas or species of concern are evaluated to determine what post-fire weed control is required and to assess the effectiveness of control efforts. Section 5.4.3 and Figure 10 provide more information on prescribed burn preparation.

Pest/Over-abundant Animals

Some pest animals (exotic and native) flourish in post-fire conditions. The impact these species have on other flora and fauna 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), which will affect the pest species and its food resources.

A number of pest animals have been observed within the strategy area. These include Arabian Camel *(Camelus dromedarius)*, Red Fox *(Vulpes vulpes),* Cat *(Felis catus),* the Wild Horse (*Equus caballus*), Donkey (*Equus africanus asinus*) and European Rabbit *(Oryctolagus cuniculus)* (AW NRM Board 2009). Vegetation browsing by rabbits and camels, particularly in high densities, can have significant impacts on flora regeneration. Increased predation

of small mammals, birds and reptiles by cats and foxes can result from the loss of ground and shrub cover post fire.

However, herbivores such as Kangaroos (*Macropus* sp.) for example, can benefit significantly from post-fire plant regeneration, finding highly palatable food within the recently burnt area (Gill & Catling 2002; Murphy & Bowman 2007). Traditional use of fire by Anangu supported hunting and foraging in significant parts of the strategy area.

Prior to any prescribed burning on DEWNR reserves, potential pest or over-abundant animal impacts should be considered to determine whether post-fire management is required to mitigate the risk of species loss. Prescribed burning also provides opportunities for research and monitoring into how pest fauna respond to and impact on native species post-fire. Section 5.4.3 and Figure 10 provide more information on prescribed burn preparation.

Management Strategies		Responsibility
Pest Plants & Animals	20. Consider the use of fire as a tool that forms part of integrated pest management strategies.	DEWNR AW NRM Board
	21. Consider the likely post-fire responses and impacts of weed species and implement post-fire weed control strategies accordingly (subject to regional priorities).	DEWNR CFS AW NRM Board
	22. Consider the likely-fire responses and impacts of pest animals and implement post-fire management strategies accordingly (subject to regional priorities).	DEWNR CFS AW NRM Board

5.6 Identify Training, Resource and Infrastructure Requirements

5.6.1 Anangu Lands

Training

Existing plans of management for the APY Lands have identified a range of needs in relation to training and equipment to support fire management. The APY fire management and country management plans have identified the need to train younger Anangu (including casual staff), Anangu rangers and others undertaking support roles in both on-ground works and professional roles. The need for a full-time fire management officer, for at least 8 months each year, to support fire management activities across the lands is identified in two of the plans (APYLM 2008a; Paltridge & Latz 2009). It is also noted that external expertise may be required from time to time to support fire management activities.

The CFS and DEWNR have provided some basic fire-fighting training to communities on the APY Lands. APYLM, DEWNR staff, and external consultants have also provided some support for prescribed burning activities. It is important to note that Nguraritja continue to burn country in a traditional manner and may only require CFS or DEWNR training for Work Health and Safety reasons, where deemed appropriate. However, younger Anangu and others supporting the community on the lands are identified within the APYLM plans as being people who would benefit from relevant training in fire management.

Equipment

The APY plans of management identify a range of equipment needs to support fire management activities, including:

- aerial incendiary capacity (only to be used with the consent of Ngurariţja)
- operational equipment: QRVs, drip torches, rake-hoes, knapsacks, and personal protective equipment (PPE)
- GIS resources.

CFS have located a large fire unit at Pukatja and DEWNR have provided APYLM two slip-on units to be used with smaller vehicles that can be utilised for prescribed burning and support suppression activities throughout the region.

Management Strategies		Responsibility
Training & Resources	23. Support Aṉangu to safely undertake fire management on their country.	DEWNR CFS AW NRM Board Land managers & owners

5.6.2 DEWNR Managed Reserves

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 Level 1 CFS course at a minimum.

All DEWNR personnel engaged in fire management operations are trained in accordance with the *Fire Training Policy and Procedure* (DEWNR 2013c) and CFS standards. All staff involved in fire suppression are required to undertake annual pre-season training, health checks and meet fitness requirements to ensure that they are able to carry out assigned duties safely and competently (see the *Fighting Fit Program Policy and 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 *DEWNR Work Health & Safety and Injury Management Foundation Policy* (DEWNR 2013d) and the *Fire Safety, Health and Welfare Policy and Procedure* (DEWNR 2013c).

Equipment

DEWNR is committed to purchasing and maintaining specialised fire equipment and communications systems to optimise fire management and response capabilities.

DEWNR issues PPE to all firefighting staff, designed to protect their safety and welfare and to improve fire suppression effectiveness. DEWNR ensures that PPE issued to firefighters meets recognised Australian Standards, where they exist, CFS requirements and Schedules as set out in the *Personal Firefighting Equipment Policy and Procedure* (DEWNR 2013c). PPE shall also be consistent with the *DEWNR Work Health & Safety and Injury Management Foundation Policy* (DEWNR 2013d).

DEWNR firefighting resources include a variety of firefighting vehicles and equipment, which may be deployed to fires anywhere in South Australia or interstate. DEWNR ensures that all firefighting equipment meets Australian Standards, where they exist, and complies with CFS standards, unless specified otherwise in DEWNR environmental policies and standards

(including the *Fire Appliance Equipment Standards Policy and Procedure for* (DEWNR 2013c) and the *Earthmoving Equipment Policy and Procedure* (DEWNR 2013c).

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 policies and standards.

Fire Access Tracks

The Fire Response Plans for the Eyre Peninsula and Outback Fire Response Zones identify the limited existing access tracks and their status on DEWNR managed reserves in the strategy area.

This strategy does not propose to place any new fire access tracks in the region. The extent of exploration and mining activity in the area is continuously expanding the existing track network, including on Anangu owned and managed lands.

5.7 Identify Suppression Considerations

5.7.1 Response Plans for DEWNR Reserves

A response plan exists for the DEWNR Eyre Peninsula and South Australian Arid Lands Regions, which incorporate all DEWNR reserves in the AW strategy area. These plans are reviewed on an annual basis in accordance with the *Response Planning Policy and Procedure* (DEWNR 2013c). The response plans provide reserve-specific information in relation to access, available fire infrastructure, assets, priority fire management considerations, visitor management, neighbouring assets, firebreaks/refuge areas, airstrip locations, and fire-fighting hazards.

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

5.7.2 Response Plans for Anangu Lands

The Outback Bushfire Response Plan produced by CFS, reviewed annually, covers unincorporated areas of South Australia, which includes the AW NRM Region.

5.7.3 Active Suppression

Active fire suppression is not traditionally undertaken on a landscape scale within the strategy area. As the strategy area is largely arid or semi-arid, firefighting will be primarily reliant upon dry-land strategies (such as back-burning, and use of plant and equipment). In general, a 'let-burn' policy has been adopted in the strategy area, unless there are specific threats to life and property.

Active suppression to protect life and property is likely to include back-burning and the use of earthmoving equipment. In many areas the deployment of heavy equipment would present considerable challenges and would only be undertaken where suitable tracks exist. Further detail regarding specific suppression strategies will be included in the Landscape Fire Management Plans, and summarised below.

5.7.4 Machinery Use

Considerations:

- Deployment of machinery will be limited within the strategy area due to the small number of suitable tracks and the remoteness of the area itself.
- Machinery use and deployment during fire suppression is to be in accordance with:

  - the *Earthmoving Equipment Policy and Procedure (DEWNR 2013c)*
  - the *CFS Supervision of Machinery Guidelines* (CFS 2007).
- Steep terrain/cliffs, unstable karst environments (e.g. on the Nullarbor) and deep sand will often reduce the effectiveness of machinery and pose risks to machinery operators.
- The decision to deploy machinery for direct attack should be made by the Incident Management Team (IMT) at the earliest point in time, providing:
  - the fire weather and associated fire behaviour conditions under which the machinery will be operating is acceptable
  - the response time and anticipated time of commencement is acceptable (e.g. to minimise the overall area cleared in the establishment of control lines and increase the likelihood of success)
  - the actions are authorised by the IMT, following liaison with the DEWNR Liaison Officer, Anangu or the relevant landholder/s
  - environmental and cultural impacts have been assessed.
- The construction of new tracks will only be considered in exceptional circumstances.
- Minimum Impact Suppression Techniques and specialised equipment that reduces impacts to the landscape shall be used wherever possible so that the impact of the control method is not greater than the potential or actual impact of the fire.
- Standards for control lines are to be accordance with the *Control Lines Fire Policy and Procedure* (DEWNR 2013c).

5.7.5 Aerial Suppression and Reconnaissance

Considerations:

- Aerial reconnaissance and/or remote sensing methods may be utilised to monitor the progress of fires within the AW NRM Region.
- Aerial ignition may be used for prescribed burning. During bushfires, aerial ignition may be used to reduce the impact of head fires on control lines and increase the probability of success in limiting the propagation of bushfire within the landscape.

5.8 Manage Fire Risk and Public Access

The AW NRM Region is covered by the North West Pastoral and West Coast Fire Ban Districts. The Fire Danger Season is set by the CFS each year, depending on seasonal conditions. Periods of elevated fire danger may commence in the strategy area from October to March. The safety of residents and lessees within reserves is managed in accordance with the 'Prepare Act Survive' principle, which advocates 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).

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.

5.8.1 Visitors to Anangu lands

Visitors to the APY, MT and Yalata lands are required to hold permits to enter and remain on the lands, including advising their presence to the relevant authority on the lands at all times.

Visitors should be prepared for any day of high bushfire risk, and are encouraged to develop their own personal 'Bushfire Survival Plan' for the time they are travelling through the area.

5.8.2 Visitors to DEWNR Reserves

Visitors to DEWNR reserves are managed according to the *Visitor Safety Policy and 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. To promote safety, DEWNR staff and DEWNR contractors working within reserves must comply with the DEWNR *Days of Heightened Fire Danger Procedures* (DEWNR 2013a).

The reserves of the AW Region receive limited annual visitors by comparison with other areas, generally confined to April-October. The 2011 Mamungari CP Management Plan notes that visitor "numbers are increasing, with at least 8-10 vehicles passing through the area [Anne Beadell Highway] per day during peak periods in mid-winter" (Mamungari CP Board of Management 2011, pg 11). As these figures only reflect the number of people that record their presence in a visitor's book, it can be assumed that actual visitor numbers may well be higher. Visitor activities in the reserves within the strategy area include four wheel driving and vehicle-based camping. Due to the remoteness of much of the strategy area and the lack of water supplies, bushwalking activities are minimal. The strategy area is remote, with few buildings suitable for providing shelter during a bushfire. As such it is possible that visitors to the area may be caught in the open during a fire incident.

Most of the reserves within the strategy area allow mining activities, and there are considerable mineral exploration activities occurring in the Yellabinna complex, parts of the Nullarbor complex, Tallaringa CP, and MT and APY Lands. Mining exploration staff and contractors are likely to have communications in place, and the capacity to undertake defensive earthworks or arrange helicopter airlift of staff from isolated locations. Companies undertaking mining and exploration activities on DEWNR managed reserves are strongly encouraged to address their bushfire preparedness as a component of the conditions of their licence to operate on reserves.

	Management Strategies	Responsibility
Public Access	24. Consider DEWNR reserve closures when significant fire weather is forecast to maximise visitor safety (at the discretion of the Director, National Parks and Wildlife).	DEWNR
	25. Place information signage regarding bushfire safety at appropriate visitor entry points to reserves.	DEWNR
	26. Undertake bushfire preparedness programs with the mining industry.	CFS
	27. Undertake community education program regarding bushfire preparedness for travellers through the AW Region during the Fire Danger Season.	CFS DEWNR

5.9 Manage Post-fire Rehabilitation and Recovery

DEWNR has a *Post-fire Rehabilitation Policy and Procedure* (DEWNR 2013c) to ensure that requirements for the rehabilitation and recovery of reserves affected by bushfire are identified during an incident. Any post-fire rehabilitation plans for fires on DEWNR reserves shall consider:

- specific objectives of post-fire rehabilitation plans are outlined in the policy and procedure
- impacts to infrastructure, built assets and natural and cultural heritage
- potential threats to biodiversity conservation, natural heritage and catchment / rock-hole protection
- actions, responsibilities and costs associated with the rehabilitation effort.

While specific policy does not exist for post-fire rehabilitation and recovery on Anangu lands, it is recommended that a similar process should be undertaken on all land tenures across the planning area.

Management Strategies		Responsibility
Post-fire Rehabilitation and Recovery	28. Support Anangu to develop strategies for post-fire rehabilitation and recovery	DEWNR AW NRM Board CFS

5.10 Manage Adaptively

5.10.1 Research

The *AW Regional NRM Plan* (AW NRM Board 2009) identified significant knowledge gaps in fire management, including fire response thresholds for flora and fauna in the strategy area. While the development of this strategy has triggered compilation of initial baseline information to support fire management, further research is required to assist in developing adaptive management techniques.

Anangu Fire Knowledge

In the western desert regions of South Australia, there is little knowledge documented on traditional fire management regimes. Due to the complexities of using fire as an effective land management tool and the lack of scientific knowledge of species and ecological communities' responses to fire in this area, an adaptive management approach, incorporating traditional knowledge and existing scientific expertise, is required in order to develop Landscape Fire Management Plans for the strategy area.

	Management Strategies	Responsibility
Research	29. Engage with Anangu to incorporate traditional fire management knowledge into adaptive management strategies.	DEWNR Land owners & managers AW NRM Board
	30. Determine the suitability of flora based thresholds for meeting biodiversity objectives in the strategy area.	DEWNR
	31. Continue to collect and collate vital attributes for fauna and incorporate into future EFMG, including those recommended for key fire sensitive species in this strategy.	DEWNR
	32. Assess whether the chosen KFRS are appropriately sensitive as community-wide indicators of inappropriate fire regimes in the strategy area.	DEWNR

5.10.2 Monitoring

In accordance with DEWNR policy and procedures, monitoring will be established in conjunction with any prescribed burns on DEWNR managed reserves to assess issues raised during prescribed burn planning. This includes the *Prescribed Burning Policy and Procedure* (DEWNR 2013c) and the *Ecological Burning Policy and Procedure* (DEWNR 2013c). Monitoring opportunities are currently limited in the strategy area due to resources and the remoteness. However this strategy is seeking to increase these opportunities and provide vital information that is required to feed into the adaptive management cycle.

Opportunities for monitoring will also be considered in all areas impacted by bushfire to improve knowledge about the response of species, communities and habitats to fire within the strategy area. The results from post-fire monitoring will be used to further refine fire management, consistent with an adaptive management approach.

A range of situations are likely to provide opportunities for measuring the response of biota to fire, including bushfire, planned fire, cultural and traditional fires, and the activities associated with fire management that impact on natural systems.

	Management Strategies	Responsibility
Monitoring	33. Investigate the fuel accumulation rates of the various MVS that occur within the strategy area (Table 8).	DEWNR Land owners & managers
	34. Determine the fire response of flora and fauna species to assess habitat preferences and requirements in relation to the TPC.	DEWNR Land owners & managers
	35. Assess the effectiveness of pest plant and animal control measures following fire and refine management information for the control of introduced species accordingly.	DEWNR Land owners & managers

5.10.3Influence of a Changing Climate

There is a strong possibility that climate change will influence fire regimes and fire management practices into the future (see Section 3.2.4). Adaptation of fire management strategies to improve ecosystem resilience will be required in response to climate change.

	Management Strategies	Responsibility
Climate Change	36. Monitor species and ecosystems and the processes that support them to understand their resilience to a changing climate.	DEWNR AW NRM Board Land owners & managers
	37. Review and adapt fire management strategies as the impacts of climate change are better understood.	DEWNR
	38. Monitor national and international best practice fire management policies, and partner with the research sector to increase knowledge on climate-altered fire regimes.	DEWNR

6 SUMMARY OF MANAGEMENT STRATEGIES

Fire Management Planning 45

1. Support Anangu to develop fire management plans and/or annual works programs to address unique issues within each of the fire management landscapes. 45
2. Integrate traditional knowledge about fire management with scientific principles and technology to develop best practice for the region. 45
3. Maintain and update fire history mapping for the strategy area. 45

Knowledge Transfer 46

4. Support the integration and transfer of fire management knowledge and develop the capacity of Anangu to manage fire in the region. 46

Community Preparedness 47

5. Continue to disseminate bushfire preparedness education programs for residents, mining companies and travellers in the strategy area. 47
6. Manage reserve closures during periods of high fire danger and where incidents may impact upon life, property and the environment. 47
7. Develop emergency response plans for key transport routes (road and rail) within the strategy area. 47

Built Assets 47

8. In developing Landscape Fire Management Plans, undertake seasonal risk assessments to identify built assets at high risk of bushfire. 47
9. Where required, implement on-ground works to mitigate risks to built assets, as identified in Landscape Fire Management Plans. 47

Cultural Heritage 48

10. Implement fuel management strategies appropriate for the protection of assets of cultural heritage significance. 48
11. Engage with Traditional Owners to develop appropriate information that can be used to inform bushfire managers during suppression activities. 48

Fire Management Zoning 50

12. Implement zoning as determined by the risk assessment process. 50

Cultural Burning on Aboriginal Lands 51

13. Support Anangu in cultural burning by taking an adaptive management approach, ensuring discussion and engagement occur on country where possible. 51

Prescribed Burning on DEWNR Reserves 52

14. Map time since last fire and compare with the EFMG for each MVS. 52
15. Use EFMG to develop a Prescribed Burning program for the purpose of enhancing biodiversity 52

Threatened Flora 57

16. Develop ecological fire management strategies for threatened flora across the AW NRM Region. 57

Threatened Fauna 59

17. Develop ecological fire management strategies for threatened fauna across the AW NRM Region. 59

Species of Cultural Significance 59

18. Implement fuel management strategies appropriate for the protection of species of cultural significance. 59
19. Ensure traditional knowledge is considered during fire suppression and post-fire rehabilitation activities, in order to minimise negative impacts resulting from fire. 59

Pest Plants & Animals 61

20. Consider the use of fire as a tool that forms part of integrated pest management strategies. 61
21. Consider the likely post-fire responses and impacts of weed species and implement post-fire weed control strategies accordingly (subject to regional priorities) 61
22. Consider the likely-fire responses and impacts of pest animals and implement post-fire management strategies accordingly (subject to regional priorities). 61

Training & Resources 62

23. Support Anangu to safely undertake fire management on their country. 62

Public Access 65

24. Consider DEWNR reserve closures when significant fire weather is forecast to maximise visitor safety (at the discretion of the Director, National Parks and Wildlife) 65
25. Place information signage regarding bushfire safety at appropriate visitor entry points to reserves. 65
26. Undertake bushfire preparedness programs with the mining industry 65
27. Undertake community education program regarding bushfire preparedness for travellers through the AW Region during the Fire Danger Season 65

Post-fire Rehabilitation and Recovery 66

28. Support Anangu to develop strategies for post-fire rehabilitation and recovery ..66

Research 67

29. Engage with Anangu to incorporate traditional fire management knowledge into adaptive management strategies 67
30. Determine the suitability of flora based thresholds for meeting biodiversity objectives in the strategy area. 67
31. Continue to collect and collate vital attributes for fauna and incorporate into future EFMG, including those recommended for key fire sensitive species in this strategy. 67
32. Assess whether the chosen KFRS are appropriately sensitive as community-wide indicators of inappropriate fire regimes in the strategy area. 67

Monitoring 67

33. Investigate the fuel accumulation rates of the various MVS that occur within the strategy area (Table 8). 67
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35. Assess the effectiveness of pest plant and animal control measures following fire and refine management information for the control of introduced species accordingly 67

Climate Change 68

36. Monitor species and ecosystems and the processes that support them to understand their resilience to a changing climate. 68
37. Review and adapt fire management strategies as the impacts of climate change are better understood. 68
38. Monitor national and international best practice fire management policies, and partner with the research sector to increase knowledge on climate-altered fire regimes. 68

7 REFERENCE LIST

ABS 2012, *Regional Population Growth Australia, 2010-11. Table 4. Estimated Resident Population, Statistical Local Areas, South Australia*, Australian Bureau of Statistics, Commonwealth of Australia, viewed 8 May 2012 2012, <http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3218.02010-11?OpenDocument>.

AFAC 2012, *Bushfire Glossary*, Australasian Fire and Emergency Services Authorities Council, East Melbourne, <http://www.afac.com.au/docs/corporate/bushfire-glossary.pdf?sfvrsn=4>.

AIATSIS 2010, *Guidelines for Ethical Research in Australian Indigenous Studies 2011*, 2nd edn, The Australian Institute of Aboriginal and Torres Strait Islander Studies, Canberra, ACT.

Andersen, A, Cook, G & Williams, R 2003, 'Synthesis: fire ecology and adaptive conservation management', in A Andersen, G Cook & R Williams (eds), *Fire in Tropical Savannas: the Kapalga Experiment*, Springer, New York.

ANRA 2007, *Biodiversity Assessment: Great Victoria Desert. Species at risk*, Australian Natural Resources Atlas, Government of Australia, viewed 3 January 2008, <http://www.anra.gov.au/topics/vegetation/assessment/sa/ibra-gvd-species.html>.

APYLM 2004, *The Future Depends On What We Do Now: A Fire Management Strategy for the Anangu Pitjantjatjara Yankunytjatjara Lands*. Anangu Pitjantjatjara Yankunytjatjara Land Management.

APYLM 2008a, *Kalka-Pipalyatjara Area Country Management Plan 2009-2019*. Kalka and Pipalyatjara Communities in partnership with Anangu Pitjantjatjara Yankunyjatjara Land Management.

APYLM 2008b, *Watarru Indigenous Protected Area Review and Plan of Management 2008-2018*, Community Development Services for Watarru Community and Anangu Pitjantjatjara Yankunyjatjara Land Management.

APYLM 2010a, *Apara-Makiri-Punti Country Management Plan*. Anangu Pitjantjatjara Yankunyjatjara Land Management.

APYLM 2010b, *Walalkara Indigenous Protected Area Country Management Plan (Document 3 of 5)*. Anangu Pitjantjatjara Yankunyjatjara Land Management in partnership with traditional owners.

APYLM 2010c, *Walalkara Indigenous Protected Area Country Operational Plan (Document 4 of 5)*. Anangu Pitjantjatjara Yankunyjatjara Land Management in partnership with traditional owners.

APYLM 2011, *Antara-Sandy Bore Country Management Plan*. Anangu Pitjantjatjara Yankunyjatjara Land Management in partnership with traditional owners.

Australian Weeds Committee 1999, *Weeds of National Significance*, National Weeds Strategy Executive Committee, Commonwealth of Australia, viewed 26 June 2007, <http://www.weeds.org.au/natsig.htm>.

AW NRM Board 2009, *Alinytjara Wilurara Regional Natural Resources Management Plan*. Alinytjara Wilurara Natural Resources Management Board, Government of South Australia, Adelaide.

AW NRM Board 2011, *Alinytjara Wilurara Regional Natural Resources Management Plan*. Alinytjara Wilurara Natural Resources Management Board, Government of South Australia, Adelaide.

Ayers, D, Nash, S & Baggett, K 1996, *Threatened Species of Western NSW*, New South Wales National Parks and Wildlife Service, Hurstville.

Becker, C & Ghimire, K 2003, Synergy between traditional ecological knowledge and conservation science supports forest preservation in Ecuador. *Conservation Ecology* **8**, [Online] URL: http://www.ecologyandsociety.org/vol8/iss1/art1/print.pdf.

Benshemesh, J 2004, *Recovery Plan for Marsupial moles Notorcytes typhlops and N. caurinus, 2005-2010*. Northern Territory Department of Infrastructure, Planning and Environment, Alice Springs.

Benshemesh, J 2007, *National Recovery Plan for Malleefowl*, Department for Environment and Heritage, Government of South Australia, Adelaide.

Berkes, F 1993, 'Traditional ecological knowledge in perspective', in J Inglis (ed.), *Traditional Ecological Knowledge: Concept and Cases*, International Program on Traditional Ecological Knowledge and International Development Research Centre, Ottawa, Canada.

Berkes, F, Colding, J & Folke, C 2000, Rediscovery of traditional ecological knowledge as adaptive management. *Ecological Applications* **10**, 1251-1262.

Berkes, F & Folke, C 2002, 'Back to the future: ecosystem dynamics and local knowledge', in L Gunderson & C Holling (eds), *Panarchy: Understanding Transformations in Human and Natural Systems*, Island Press, Washington.

Berneshawi, S 1997, Resource management and the Mi'kmaq Nation. *Canadian Journal of Native Studies* **1**, 115-148.

Biosecurity SA 2010, *Draft State Buffel Grass Operational Plan*, Biosecurity SA, Department of Primary Resources and Regions SA, Government of South Australia, Adelaide.

Biosecurity SA 2012, *South Australia Buffel Grass Strategic Plan 2012-2017*, Department of Primary Industries and Regions South Australia, Government of South Australia, Adelaide.

BOM 2007, *Multi-decadal (30 Year Averages) Rainfall Maps: 1911-1940; 1941-1970; 1971-2000.* , Bureau of Meteorology, Commonwealth of Australia, viewed 8 May 2012 2012, <http://www.bom.gov.au/jsp/ncc/climate_averages/decadal-rainfall/index.jsp?maptype=6&period=1140&product=totals>.

Brooks, M, D'Antonio, C, Richardson, D, Grace, J, Keeley, J, DiTomaso, J, Hobbs, R, Pellant, M & Pyke, D 2004, Effects of invasive alien plants on fire regimes. *BioScience* **54**, 677-688.

Cane, S 1990, *A proposal for the joint management of the Unnamed Conservation Park*, Report to Maralinga Tjarutja. National Heritage Studies Hall, Canberra, ACT.

Cane, S 2002, *Pila Nguru: The Spinifex People*, Freemantle Press, North Freemantle.

Cary, G, Flannigan, M, Keane, R, Bradstock, R, Davies, I, Lenihan, J, Li, C, Logan, K & Parsons, R 2009, Relative importance of fuel management, ignition management and weather for area burned: evidence from five landscape-fire-succession models. *International Journal of Wildland Fire* **18**, 147-156.

CFS 2007, *Supervision of Machinery Guidelines*, South Australian Country Fire Service, Government of South Australia, Adelaide.

CFS 2009, *CFS Fact Sheet - Prepare. Act. Survive.*, SA Country Fire Service, Government of South Australia, Adelaide.

Cheney, P & Sullivan, A 2008, *Grassfires: Fuel, weather and fire behaviour*, 2nd edn, CSIRO Publishing, Melbourne.

Churchill, S 2001, *Recovery plan for the Sandhill Dunnart (Sminthopsis psammophila)*. Department for Environment and Heritage, Government of South Australia, Adelaide.

Copley, P & Kemper, C 1992, *A Biological Survey of the Yellabinna Region South Australia in October 1987*. Department of Environment and Planning, Government of South Australia, Adelaide.

CSIRO & Bureau of Meteorology 2014, *State of the Climate 2014*. Commonwealth of Australia, Canberra.

DECC NSW 2005, *Austrostipa nullanulla Profile*, Department of Environment and Climate Change, Government of NSW, Sydney.

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

DEH 2005, *Provisional list of Threatened Ecosystems of South Australia*, Unpublished. Department for Environment and Heritage, Government of South Australia, Adelaide.

DEH 2006, *Aboriginal Heritage Handbook and Strategy*, Department for Environment and Heritage, Government of South Australia, Adelaide.

DELM 1993, *Unnamed Conservation Park Management Plan*. Department of Environment and Land Management, Government of South Australia, Adelaide.

DENR 2010a, *Regional Climate Change Projections: Alinytjara Wilurara, South Australia* Department of Environment and Natural Resources, Government of South Australia, Adelaide.

DENR 2010b, *Regional Climate Change Projections: Eyre Peninsula, South Australia* Department of Environment and Natural Resources, Government of South Australia, Adelaide.

DENR 2011, *Overall Fuel Hazard Guide for South Australia*, 2nd edn, Department of Environment and Natural Resources, Government of South Australia, Adelaide.

DEWNR 2013a, *DEWNR Days of Heightened Fire Danger Procedures*. Department of Environment, Water and Natural Resources, Government of South Australia, Adelaide.

DEWNR 2013b, *Ecological Fire Management Guidelines for Native Vegetation in South Australia*. Department of Environment, Water and Natural Resources, Government of South Australia, Adelaide.

DEWNR 2013c, *Fire Policy and Procedure Manual*, Department of Environment, Water and Natural Resources, Government of South Australia, Adelaide.

DEWNR 2013d, *Work Health & Safety and Injury Management Foundation Policy*, Department of Environment, Water and Natural Resources, Government of South Australia, Adelaide.

DEWNR 2013e, *Yellabinna Reserves Management Plan*, Department of Environment, Water and Natural Resources, Government of South Australia, Adelaide.

DEWNR 2014, *FIMS User Guide*. Department of Environment, Water and Natural Resources, Government of South Australia, Adelaide.

Duncan, M 2010, *National Recovery Plan for the Desert Greenhood Pterostylis xerophila*. Department of Sustainability and Environment, Victoria.

DWLBC 2006a, *Native Vegetation Council of South Australia*, Department of Water, Land and Biodiversity Conservation, Government of South Australia, viewed 29 January 2007, <http://www.dwlbc.sa.gov.au/native/nvc/index.html>.

DWLBC 2006b, *State Natural Resources Management Plan*, Department of Water, Land and Biodiversity Conservation, Government of South Australia, Adelaide.

Eadie, B & Herbert, C 2009, *Living in Bushfire Prone Areas Handbook - a guide to reducing the threat and impact of bushfire attack and an explanation of the basis of AS 3959*. Standards Australia, Sydney NSW.

Enright, NJ & Fontaine, JB 2014, Climate change and the management of fire-prone vegetation in Southwest and Southeast Australia. *Geographical Research* **52**, 34-44.

FEWG 2004, *Guidelines and Procedures for Ecological Burning on Public Land in Victoria*, Fire Ecology Working Group, Department for Natural Resources and Environment, Government of South Australia, Adelaide, and Parks Victoria, Government of Victoria, Melbourne.

Foulkes, J & Thompson, D 2008, *Maralinga Tjarutja Lands Biological Survey*. Department for Environment and Heritage, Government of South Australia, Adelaide.

Friedel, M, Bastin, G, Brock, C, Butler, D, Clarke, A, Eyre, T, Fox, J, Grice, T, van Leeuwen, S, Pitt, J, Puckey, H & Smyth, A 2007, *Developing a research agenda for the distribution and rate of spread of Buffel Grass (Cenchrus ciliaris) and identification of landscapes and biodiversity assets at most risk from invasion*, A report to the Department of the Environment and Water Resources, Canberra.

GAFM 2014, *South Australian Firebreaks, Fire Access Tracks and Sign Standards Guidelines*. Government Agencies Fire Management Working Group, Government of South Australia, Adelaide.

Gammage, B 2011, *The Biggest Estate on Earth: How Aborigines Made Australia*, Allen and Unwin, Sydney.

Giles, E 1889, *Australia Twice Traversed*, vol. I & II, Sampson Low, Marston, Searle & Rivington, London.

Gill, A 2000, *Fire Pulses in the Heart of Australia: Fire Regimes and Fire Management in Central Australia*, CSIRO Centre for Plant Biodiversity Research, Canberra.

Gill, A & Catling, P 2002, 'Fire regimes and biodiversity of forested landscapes', in R Bradstock, J Williams & A Gill (eds), *Flammable Australia: The Fire Regimes and Biodiversity of a Continent*, Cambridge University Press, United Kingdom.

Greenslade, P, Joseph, L & Barley, R 1986, *The Great Victoria Desert*, Nature Conservation Society of South Australia, Adelaide.

Grenier, L 1998, *Working with Indigenous Knowledge. A Guide for Researchers*, International Development Research Centre, Ottawa, Canada.

Hennessy, K, Lucas, C, Nicholls, N, Bathols, J, Suppiah, R & Ricketts, J 2005, *Climate change impacts on fire-weather in south-east Australia*. CSIRO Marine and Atmospheric Research, Bushfire CRC and the Australian Bureau of Meteorology, Aspendale, Victoria.

Heylen, P & Turner, D 2008, *Environmental Scan of Emergency Management Capability in Remote Indigenous Communities in South Australia*. South Australian Fire and Emergency Services Commission, Government of South Australia, Adelaide.

Hobbs, R 1991, Disturbance a precursor to weed invasion in native vegetation. *Plant Protection Quarterly* **6**, 99-104.

Hobbs, R 2002, 'Fire regimes and their effects in Australian temperate woodlands', in R Bradstock, J Williams & A Gill (eds), *Flammable Australia: The Fire Regimes and Biodiversity of a Continent*, Cambridge University Press, United Kingdom.

Hobbs, R 2003, 'How fire regimes interact with other forms of ecosystem disturbance and modification', in I Abbott & N Burrows (eds), *Fire in Ecosystems of South-west Western Australia: Impacts and Management* Backhuys Publishers, The Netherlands.

Hobbs, R & Huenneke, L 1992, Disturbance, diversity and invasion: implications for conservation. *Conservation Biology* **6**, 324-337.

Hopkins, A & Saunders, D 1987, 'Ecological studies as the basis for management', in D Saunders, G Arnold, A Burbidge & A Hopkins (eds), *Nature Conservation: the Role of Remnants in Native Vegetation*, Surrey Beatty, Sydney.

Kenny, B, Sutherland, E, Tasker, E & Bradstock, R 2004, *Guidelines for Ecologically Sustainable Fire Management - NSW Biodiversity Strategy*, NSW National Parks and Wildlife Service, NSW Government, Hurstville.

Luke, R & McArthur, A 1978, *Bushfires in Australia*, Australian Government Publishing Service, Canberra.

Mamungari CP Board of Management 2011, *Mamungari Conservation Park Management Plan*. Department of Environment and Natural Resources, Government of South Australia, Adelaide.

Maralinga Tjarutja 2010, *Land Management: Kuwarila Tjaatarinyi - We're setting off, right away: Our Land Management Plan 2010-2011*. Maralinga Tjarutja and Department of Premier and Cabinet, Government of South Australia, Adelaide.

McAlpin, S 2001, *The Recovery Plan for the Great Desert Skink (Egernia kintorei) 2001-2011*. Arid Lands Environment Centre, Alice Springs.

McCarthy, G & Tolhurst, K 2004, *Effectiveness of broad scale fuel reduction burning in Victorian parks and forests*, Forest Science Centre Orbost and Creswick, Department for Sustainability and Environment, Government of Victoria, Melbourne.

McKenzie, N & Robinson, A 1984, *A Biological Survey of the Nullarbor region: south and western Australia in 1984*. Department of Environment and Planning, Government of South Australia., Adelaide.

Miles, M, Close, C, Gibson, D, Howard, A, Severin, N & Steele, R 2011, *Alinytjara Wilurara Region Fire History Mapping Technical Report*. Department of Environment and Natural Resources, Government of South Australia, Adelaide.

Miller, G, Friedel, M, Adam, P & Chewings, V 2010, Ecological impacts of Buffel Grass (Cenchrus ciliaris L.) invasion in central Australia - does field evidence support a fire-invasion feedback? *The Rangeland Journal* **32**, 353-365.

Morelli, J 1992, *Fire Management in the Great Victoria Desert. Report on a state cooperative project*. South Australian National Parks and Wildlife Service, Government of South Australia, Adelaide.

Murphy, B & Bowman, M 2007, The interdependence of fire, grass, kangaroos and Australian Aborigines: a case study from central Arnhem Land, northern Australia. *Journal of Biogeography* **34**, 237-250.

National Parks Policy & Strategy Division 2000, *State of the Parks 2000*, Parks Victoria, Government of Victoria, Melbourne.

Native Vegetation Council 2013, *Native Vegetation Council Interim Guideline, Ecological Prescribed Burning under Regulation 5(1)(zi)*. Department of Environment, Water and Natural Resources, Government of South Australia, Adelaide.

Neagle, N 2009, *A Biological Survey of the Yalata Indigenous Protected Area, South Australia, 2007-2008*. Department for Environment and Heritage, Government of South Australia, Adelaide.

Noble, I & Slatyer, R 1980, The use of vital attributes to predict successional changes in plant communities subject to recurrent disturbances. *Vegetation* **43**, 2-21.

Nyberg, J 1999, *An Introductory Guide to Adaptive Management For Project Leaders and Participants*, Forest Practices Branch, British Columbia Forest Service, Victoria, Canada.

Paltridge, R & Latz, P 2009, *Fire Management Plan for the Mann Ranges and Musgrave Ranges Fire Management Regions of the Anangu Pitjantjatjara Yankunyjatjara Lands*. APY Land Management.

Paltridge, R, Latz, P, Pickburn, A & Eldridge, S 2009a, *Establishing a monitoring program for rare and declining plants in the Anangu Pitjantjatjara Yankunytjatjara lands of South Australia*. Department for Environment and Heritage, Government of South Australia, Adelaide.

Paltridge, R, Latz, P, Pickburn, A & Eldridge, S 2009b, *Management Plan for Rare and Threatened Flora in the Anangu Pitjantjatjara Yankunytjatjara Lands of South Australia*. Department for Environment and Heritage, Government of South Australia, Adelaide.

Pausas, J, Ouadah, N, Ferran, A, Gimeno, T & Vallejo, R 2003, Fire severity and seedling establishment in *Pinus halepensis* woodlands, eastern Iberian Peninsula. *Plant Ecology* **169**, 205-213.

Penman, T, Christie, F, Anderson, A, Bradstock, R, Cary, G, Henderson, M, Price, O, Tran, C, Wardel, G, Williams, R & York, A 2011, Prescribed burning: how can we work to conserve the things we

value? *International Journal of Wildland Fire* **2011**, 721-733.

Pobke, K 2007, *Draft recovery plan for 23 threatened flora taxa on Eyre Peninsula, South Australia 2007-2012*, Department for Environment and Heritage, Government of South Australia, Adelaide.

Read, J & Ward, M 2010, *Warru Recovery Plan: Recovery of Petrogale lateralis (MacDonnell Ranges Race) in South Australia, 2010-2020*. Department of Environment and Natural Resources, Government of South Australia, Adelaide.

Robinson, A, Copley, P, Canty, P, Baker, L & Nesbitt, B 2003, *A Biological Survey of the Anangu Pitjantjatjara Lands South Australia 1999-2001*. Department for Environment and Heritage, Government of South Australia, Adelaide.

Robinson, A, Copley, P & Drewien, G 1988, *A Floristic Vegetation Map of the Tallaringa Area*. (Unpublished) Department of Environment and Planning, Government of South Australia, Adelaide.

Saunders, D, Hobbs, R & Margules, C 1991, Biological consequences of ecosystem fragmentation: a review. *Conservation Biology* **5**, 19-32.

Smith, JR, Whitehead, P & Cooke, P (eds) 2009, *Culture, Ecology and Economy of Fire Management in North Australian Savannas. Rekindling the Wurrk Tadition*, CSIRO Publishing, Collingwood.

Stelmann, J, Pers. Comm. 2010, *Information sourced from an Anangu Womens Workshop*.

Suppiah, R, Preston, B, Whetton, P, McInnes, K, Jones, R, Macadam, I, Bathols, J & Kirono, D 2006, *Climate change under enhanced greenhouse conditions in South Australia. An updated report on: Assessment of climate change, impacts and risk management strategies relevant to South Australia*. Undertaken for the South Australian Government by the Climate Impacts and Risk Group, CSIRO Marine and Atmospheric Research, Aspendale, Victoria.

Tolhurst, K & Cheney, P 1999, *Synopsis of the Knowledge Used in Prescribed Burning in Victoria*, Department of Natural Resources and Environment, Victorian Government East Melbourne, Victoria.

TSSC 2008a, *Approved Conservation Advice for Acanthiza iredalei iredalei (Slender-billed Thornbill (western))*. Threatened Species Scientific Committee. Approved by the Minister for Environment Protection, Heritage and the Arts on 26/03/2008, Australian Government, Canberra.

TSSC 2008b, *Approved Conservation Advice for Grevillea treueriana (Mt Finke Grevillea)*. Threatened Species Scientific Committee. Approved by the Minister for Environment Protection, Heritage and the Arts on 03/07/2008, Australian Government, Canberra.

TSSC 2008c, *Approved Conservation Advice for Hibbertia crispula (Ooldea Guinea-flower)*, Threatened Species Scientific Committee. Approved by the Minister for Environment Protection, Heritage and the Arts on 03/07/2008, Australian Government, Canberra.

TSSC 2008d, *Approved Conservation Advice for Polytelis alexandrae (Princess Parrot)*. Threatened Species Scientific Committee. Approved by the Minister for Environment Protection, Heritage and the Arts on 03/07/2008, Australian Government, Canberra.

TSSC 2008e, *Approved Conservation Advice for Prostanthera nudula*. Threatened Species Scientific Committee. Approved by the Minister for Environment Protection, Heritage and the Arts on 16/12/2008, Australian Government, Canberra.

Vogel, S & Obst, M 2002, *Amata Community and Tjurma Homelands Bushfire Prevention Plan*. Region 4, SA Country Fire Service, Government of South Australia.

WFLLC 2003, *Minimum Impact Suppression Techniques Guidelines*, Wildland Fire Lessons Learned Centre, viewed 9 January 2008 2008, <www.wildfirelessons.net/documents/GB_MIST_Guidelines.pdf>.

Whelan, R, Rodgerson, R, Dickman, C & Sutherland, E 2002, 'Critical life cycles of plants and animals: developing a process-based understanding of population changes in fire-prone landscapes', in R Bradstock, J Williams & A Gill (eds), *Flammable Australia: The Fire Regimes and Biodiversity of a Continent*, Cambridge University Press, United Kingdom.

Williams, R, Bradstock, R, Cary, G, Enright, N, Gil, M, Liedloff, A, Lucas, C, Whelna, R, Andersen, A, Bowman, D, Clarke, P, Cook, G, Hennessy, K & York, A 2009, *Interactions between climate change, fire regimes and biodiversity in Australia - a preliminary assessment*. Report to the Department of Climate Change and Department of the Environment, Water, Heritage and the Arts, Australian Government, Canberra.

Wilson, G & Woodrow, M 2009, 'Kuka Kanyini, Australian Indigenous Adaptive Management', in C Allan & G Stankey (eds), *Adaptive Management: A Practitoner's Guide*, Springer Science and Business Media B.V., Dordrecht, The

Netherlands and CSIRO Publishing, Collingwood, Australia.

Wolfe, J, Bechard, C, Cizek, P & Cole, D 1992, *Indigenous and Western knowledge and resource management systems*, University of Guelph, Ontario, Canada.

Yalata LM and Yalata Community Inc 2011, *Yalata Indigenous Protected Area Draft Healthy Country Plan, 2011-2016 (2nd Draft)*. Yalata Land Management and Yalata Community Incorporated.

8 GLOSSARY OF ACRONYMS AND FIRE MANAGEMENT TERMINOLOGY

TERM	DEFINITION
Aboriginal Lands	Any of the lands vested to Aboriginal Communities under the *Anangu Pitjantjatjara Yankunytjatjara Land Rights Act 1981*, *Maralinga Tjarutja Land Rights Act 1984* (including Mamungari Conservation Park), or *Aboriginal Lands Trust Act 1966* that occur within the AW NRM region.
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 2011).
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 Committee	Bushfire Management Committees are responsible for the governance, planning and coordination of local fire prevention work. Responsible for the development of Bushfire Management Area Plans. A total of 9 Bushfire Management Committees exist across the state, reporting to a central State Bushfire Coordination Committee.
Bushfire Area Management 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 2011).
CFS	The South Australian Country Fire Service.
Control line	A natural or constructed barrier, or treated fire edge, used in fire suppression and prescribed burning to limit the spread of fire.
CP	Conservation Park
DEWNR	The South Australian Department of Environment, Water and Natural Resources.
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
Environmental Assessment	Completed for all prescribed burns (as part of the Prescribed Burn Plan) and other fire management works where native vegetation is being cleared and is not exempt under the *Native Vegetation Act 1991* (DEWNR 2014).
Elevated Fuel	Shrubs and juvenile understorey plants up to 3 m in height (DENR 2011).
EPBC Act	The Commonwealth Environment Protection and Biodiversity Conservation Act 1999.
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.
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 ha.
Fuel arrangement	A general term referring to the spacing and arrangement of fuel in a given area.

TERM	DEFINITION
Fuel hazard	The overall fuel hazard is defined as the sum of the influences of bark fuel, elevated fuel and surface fine fuel (DENR 2011).
Fuel management	Modification of fuels by prescribed burning, or other means.
Heritage Agreement	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*.
IBRA Regions	Interim Biogeographical Regionalisation for Australia. IBRA represents a landscape based approach to classifying the land surface of Australia from a range of environmental attributes such as climate, geology, landform, vegetation and animal communities. The Australian land mass is divided into 85 Bioregions.
IBRA Sub-regions	IBRA Regions were subdivided in 2000 to create the IBRA Sub-regions to provide a finer scale breakup of the Australian landscape. There are currently 403 Sub-regions.
Incident Controller (IC)	The individual responsible for the management of all incident operations and IMT.
Incident Management Team (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.
Inselberg	An inselberg is an isolated rock hill, knob, ridge, or small mountain that rises abruptly from a gently sloping or virtually level surrounding plain.
Key Fire Response Species (KFRS)	Those 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.
Life history	The combination of attributes with respect to growth, shelter, food/nutrients and reproduction which determine species' requirements for existence (FEWG 2004).
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).
MVG	Major Vegetation Groups are broadly defined as representative of distinct vegetative environments; they may extend over large areas and often contain more than one vegetation association or community. There are currently 30 Major Vegetation Groups.
MVS	Major Vegetation Subgroups are defined for the purposes of finer scale mapping and regional analyses. There are currently 67 Major Vegetation Subgroups.

TERM	DEFINITION
Native Vegetation Council	Established under the provisions of the *Native Vegetation Act 1991*, responsible for making decisions on a wide range of matters concerning native vegetation in SA (DWLBC 2006a).
NPW Act	The South Australian National Parks and Wildlife Act 1972.
Of conservation significance	In this strategy, 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, Revised Schedules 7, 8 and 9. Provisionally listed as Threatened (with a rating of Endangered or Vulnerable) in South Australia, that is, included on the unpublished 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.
Retardant	A chemical generally mixed with water, designed to retard combustion by chemical or physical action. It is usually applied by aircraft but may be applied from tankers at the fire edge.
Risk assessment	Used in 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).
sp.	Species
Spotting	The ignition of spot fires from sparks or embers.
spp.	Species (plural)
ssp.	Subspecies

TERM	DEFINITION
TPC	The Threshold of Potential Concern is defined as a point in time where KFRS are likely to be affected by an aspect of fire regime.
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).
Weed of national significance	20 priority weeds that pose future threats to primary industries, land management, human or animal welfare, biodiversity and conservation values at a national level. These weeds were identified and ranked through the assessment of invasiveness, impacts, potential for spread and socioeconomic and environmental aspects (Australian Weeds Committee 1999).

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

9 APPENDICES

SUMMARY OF CODES USED IN APPENDICES

CODE	Landscapes
APY	Anangu Pitjantjatjara Yankunytjatjara, (APY Ranges, Southern & Eastern APY and Tallaringa area).
GVD	Great Victoria Desert
Nulla	Nullarbor
Yalat	Yalata
Yella & Yumb	Yellabinna & Yumbarra

NPW ACT STATUS		EPBC ACT STATUS	
E	Endangered	EX	Extinct
V	Vulnerable	CE	Critically Endangered
R	Rare	EN	Endangered
		VU	Vulnerable

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

FIRE RESPONSE SOURCE	
R	Regional or local data
SA	South Australian data
Aus	Interstate data
^	Data/observations derived from published or unpublished literature
E	Expert opinion
I	Inferred from similar species (Senior Fire Ecologist, Fire Management Unit, has inferred based on other species genera).

Appendix 1 – Fire Management Planning & Reporting

The following is an example of a burn planning process that could be used to develop detailed prescribed fire management actions for each of the seven Fire Management Landscapes identified in Section 5.1.1.

Ecological/Cultural Burn Plan *Template*

1. **Name of person developing this Plan:** **Date:**

2. **Burn objectives?** *(must be measureable and achievable.)*

3. **Vegetation Major Vegetation Sub-groups – MVS** *(obtained from the National Vegetation Information System (NVIS) classification for Australia)*
http://www.environment.gov.au/erin/nvis/index.html

MVS No	*MVS Name*	*Dominant Species Layers*

4. **Description of the burn area:** *(include maps and written description for items listed in blue below)*

Location - land status and land tenure:
Topography and aspect:
Identify access roads and tracks:
Identify potential hazards to fire fighters: *(identify steep slopes, drainage lines, high fuel load areas, hidden obstacles etc.)*
Identify escape routes and safety refuges:
Identify water supplies: *(location and type, e.g. stand pipe, tank, dam, and distances, etc)*
Identify assets e.g. buildings, fences, campsites and 'no go' cultural sites etc:
Identify biodiversity sites of importance e.g. location of listed threatened species etc: *(EPBC Act & SA NPW Act listed species that are known to be or could be in the area)*

5. **Describe how the burn will be undertaken:**

Fuel Hazard Assessment: *see 'Prescription Burning in SA', info booklet, may be a guide: http://www.environment.sa.gov.au/firemanagement/burns_and_bushfires/burning_prescriptions_for_south_australia)*

Required weather conditions: *see 'Prescription Burning in SA', info booklet, may be a guide: http://www.environment.sa.gov.au/firemanagement/burns_and_bushfires/burning_prescriptions_for_south_australia*
Proposed Lighting up Pattern: *(include options to allow for different weather conditions.)*
Control, Command and Communications: *(Who will be in control of the burn? Who will command the on ground operation if different? How will you communicate with all others present?)*
Resources Required: *(personnel, special skills, equipment – what type & how many etc.)*
Safety Risk Assessment: *(identify and evaluate threats to the safety and effective achievement of the objectives e.g. human injury/death, property damage, cultural site damage, environmental damage etc.)*
Contingency Plan: *(plan if the weather is not within the prescription requirements, fuel moisture is too high or low etc.)*
Traffic, smoke, public and media management: *(do any of these issues need consideration, do you have a traffic plan or a smoke plan if smoke drifts over other areas or road way? Do you need a specific wind direction to be preset before lighting up to prevent or control smoke danger, etc?)*
Fire History: *(please attached fire history maps or written description of previous fires in this area, e.g. when and where etc.)*
Special Management Objectives and Considerations that need to be considered:
Notifications and Approvals: *(do you have all permits and approvals from relevant agencies e.g. Native Vegetation Council, CFS or Local Council? Have you notified all e.g. neighbours, council, CFS, police, etc?)*
Monitoring and Evaluation: *(how will you evaluate that your **Burn Objectives** determined at the beginning of the process have been met? How will these be measured?)*

Ecological/Cultural Post Burn Report *Template*

The following is an example of a report template that could be used to capture minimum data after a burn is attempted for each of the seven Fire Management Landscapes identified in Section 5.1.1.

Name:	**Date:**
Burn location name:	
Burn start date: **Burn end date:** **Total days**:	**Weather conditions that were present:-** **Temp:** **Humidity:** **Wind Speed:** **Wind Direction:** **Days since last rain:**

People Present: ***(include TO's, rangers, Land Management staff, external stakeholders, etc)***	
Principle 'Burn Objectives' identified in the Burn Plan:	
MVS: **Dominant Plants Species and fuel type** ***(include height, cover, florescence, etc):*** **Curing rate:**	
Ignition methods: **Ignition pattern used:**	
Waypoints recorded:	
Approximate area burnt: ***(attach map and any photos taken)***	
Outcomes: **Were the Plan Objectives met:** **Was the burn implemented as planned:** **Lessons learnt:** ***(Provide maps and photos where possible)***	

Reproduced in part from the *Mann and Musgrave Ranges Fire Management Plan* (Paltridge & Latz 2009).

Appendix 2 – Fire Response of Rated, Significant and Introduced Flora Species

*Landscape definition; APY: including APY Ranges, Southern and Eastern APY & Tallaringa, GVD: Great Victoria Desert, Nulla: Nullarbor, Yalat: Yalata, Yella & Yumb: Yellabinna & Yumbarra.

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	*Landscape	Growth Form	Species Ecology	Fire Response & Fire Management Considerations	Source
Acacia ammobia	Mt Connor Wattle		R		APY	Shrub or small tree	• There is only one known population in South Australia at the eastern end of the Indulkana Range but it is more widespread in the Northern Territory • It occurs on rocky outcrops, colluvial slopes and rarely on deep sands of dune crests and swales • Reproductive maturity 6-10 years in Northern Territory but likely to be longer in drier areas	• Killed by all but the mildest fires, can tolerate cool 1 in 25 year fire events • Conduct cool season patch burning of understorey grasses if high fuel loads develop after significant (1 in 25 year) rain events • Avoid frequent fire	SA <
Acacia tenuior	Central Ranges Wattle		R		APY	Perennial Shrub	• Endemic to the Mann and Musgrave Ranges • It occurs on granite-gneiss ranges, often along drainage lines and in the Mann Ranges occurs in gully heads • All known stands are on south facing slopes and all occur on or near fire shadow areas	• Does not like frequent fire • Assess the three known *A. tenuior* sites on the ground to burn strategic fuel breaks around the plants, and then conduct broad scale aerial incendiary burning in the wider area to break up long unburnt Spinifex • Avoid frequent fire	SA <
Alyogyne pinoniana var. microandra			V		Yella	Perennial Shrub	• Life Span: More than three years, but lifespan not recorded • First seeds: 2-3 years • Resprouter (<30% mortality when subject to 100% leaf scorch) • Resprouting type: Basal (lignotuber)	• Fire response is unknown but it can be construed that frequent hot fires of less than 3 years interval would be detrimental on this species ability to recover	E <
Atriplex morrisii			V		Nulla	Perennial	• Short lived • Flowers Oct-Feb	• Unknown	SA <

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	*Landscape	Growth Form	Species Ecology	Fire Response & Fire Management Considerations	Source
Austrostipa nullanulla	Club Spear-grass		V		GVD Yella Yumb	Grass	• The species occurs on salt lake edges, crests, slopes and spurs and is particularly common where gypsum is exposed at the surface or where soils are derived from gypsum (Ayers, Nash & Baggett 1996; Pobke 2007) • Seed dispersal is mainly by wind, rain and flood events. Seed is traditionally believed to be viable for three to five years, so a long-lived seed bank is considered unlikely for this species (DECC NSW 2005) • Past threats include overgrazing by stock and rabbits, altered hydrological regimes, salinity from rising ground water and altered fire regimes (National Parks Policy & Strategy Division 2000)	• Specific fire management for this species is not available • Small fragmented patch burns may be beneficial, needs further investigation	Aus SA <
Bergia occultipetala			V		APY	Perennial Herb	• Prostrate perennial herb with mostly glabrous stems	• Unknown	#
Calostemma abdicatum	***Apita*** Everard Garland Lily		R		APY	Annual Lilly	• Endemic to the Everard Ranges in the APY Lands, only three populations have been recorded near Mimili • Grows in deep alluvial soils of creek beds, in rocky gullies and on steep south facing slopes of granite hills and gorges • Emerges annually Mar-Apr or earlier in response to good summer rain, requires adequate soil and shade	• Manage fuel loads in the catchment areas above populations of Apita by burning breaks through large stands of Spinifex in mild conditions • Manage fuel loads on the plains downstream of lily populations to prevent hot summer bushfires from carrying into stands of Apita	SA <
Eremophila willsii subsp. indeterminate	Musgrave Ranges Fuschia	Not yet rated			APY	Shrub	• Very restricted distribution • High fire frequency may be contributing to this as time to reproductive maturity not known	• Avoid frequent fires	SA <

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	*Landscape	Growth Form	Species Ecology	Fire Response & Fire Management Considerations	Source
Goodenia brunnea	Central Ranges Goodenia		R		APY	Shrub	• Early successional species • It is endemic to the Central Ranges Bioregion • Occurs in Spinifex dominated communities on the rocky slopes of ranges and is most abundant in recently burnt habitats	• Undertake cool season patch burning in Spinifex on the slopes of the ranges	SA <
Grevillea treueriana	Mt Finke Grevillea	VU	V		Yella Yumb	Shrub	• It is confined to Mt Finke in the Yellabinna complex and towards Ooldea in the Nullarbor complex • Mt Finke Grevillea grows in rocky crevices often on south slopes and usually in exposed open sites	• Avoid large extensive hot bushfires • Develop and implement a suitable fire management strategy	SA <
Hibbertia crispula	Ooldea Guinea-flower	VU	V		GVD Yella Yumb	Shrub	• It is found in the northern extent of the Yellabinna complex (Lake Everard) and within the MT lands (Ooldea region) • Occurs on dune ridges so some natural protection afforded • The main potential threats include exotic weeds, grazing by feral animals such as rabbits and goats, and fragmentation of habitat (ANRA 2007)	• Avoid large extensive hot bushfires • Mosaic burning may be beneficial for long-term persistence • Develop and implement a suitable fire management strategy • Provide maps of known occurrences to local and state rural fire services and seek inclusion of mitigative measures in bush fire risk management plans, risk register and/or operation maps (TSSC 2008c)	SA <
Lechenaultia aphylla	Leafless Lechenaultia		V		Yella	Shrub	• Known from only two collections, near Yellabinna, SA. Recorded from mallee patches in swales of hard red dune sand • Flowers sporadically	• Unknown	#

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	*Landscape	Growth Form	Species Ecology	Fire Response & Fire Management Considerations	Source
Lepidosperma avium	Central Australian Rapier Sedge or Desert Rush		R		APY	Sedge	• Grows on rocky hillsides, usually at the base of large granitic rock slabs or domes, which provide maximum runoff as well as restricting the passage of fire	• Appears to be restricted to fire shadow areas that support associated fire sensitive species (*A. olgana*) • Resprouts following fire but tolerance of intensity and frequency unknown • Increased fire frequency is the greatest threat to the species, mainly because of the potential soil loss when heavy rainfall occurs in recently burnt habitat • Spinifex encroachment into populations increases frequency of fire • Reduce fuel loads in adjacent areas, particularly if large stands of Spinifex are present	SA <
Limosella granitica	Granite Mudwort	VU	V		Yella Yumb	Perennial	• Granite Mudwort is a small perennial, aquatic plant, which grows submerged in water with leaves that float on the water surface • Distribution is confined to seasonally wet rock-pools (gnamma holes) on top of granite inselbergs and outcrops, across northern Eyre Peninsula • Pollination and germination requirements are unknown • It is also unknown how much disturbance it can tolerate	• Protect vegetation around inselbergs from fire to reduce consequential soil erosion and increase run off impacting gnamma holes	SA <

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	*Landscape	Growth Form	Species Ecology	Fire Response & Fire Management Considerations	Source
Melaleuca fulgens subsp. *corrugata*	Wrinkled Honey Myrtle		R		APY	Shrub	• There are several confirmed populations in South Australia, two in the Musgrave Ranges (Mt Woodroffe and east of Jacky's Pass), one on the summit of Mt Ilbillee in the Everard Ranges and one on Mt Lindsay in the Birksgate Ranges. Additional populations were found in the Musgrave Ranges in 2009 and it is also likely to occur in the Mann Ranges (south of Mt Mann) • Lignotuberous regeneration following cool fire • Flowers following rain	• Recorded as locally extinct following at least three fires in 36 years (interval unknown) • Undertake strategic protection burns around populations • Assess the priority *M. fulgens* subsp. *corrugata* sites on the ground to burn strategic fuel breaks around the plants, then conduct broad-scale aerial incendiary burning in the wider area to break up long unburnt Spinifex. Priority sites include Mt Woodroffe area, east of Jacky's pass and south of Mt Mann • Fire management of Triodia-dominated vegetation surrounding the known subpopulations is the priority management activity associated with this taxon. A key management objective would be to ensure a fire regime that is suitable to this species and such a regime is likely to be characterised by low frequency and long intervals between fires	SA <
Microlepidium alatum		VU	V		Yella Yumb	Annual Herb	• Grows in protected areas in semi-arid regions • Flowers in Sep	• Unknown	SA <
Olearia arida	Desert Daisy-bush		V		APY	Shrub	• Distribution: on sand hills • Flowers in Sep	• Unknown	SA <
Phlegmatospermum richardsii	Nullarbor Cress		V		Nulla	Annual Herb		• Unknown	SA <
Prostanthera calycina	West Coast Mintbush	V	V		Yella Yumb	Shrub	• Grows on shallow limestone soils	• Unknown	#

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	*Landscape	Growth Form	Species Ecology	Fire Response & Fire Management Considerations	Source
Prostanthera nudula	Mount Illbillee Mintbush	VU	V		APY	Shrub	• Occurs amongst granite outcrops usually near watercourses • Important medicinal plant for Anangu • Predominantly a seedling regenerator, fire not required for recruitment • Flowers Sep-Oct	• Erosion following fire a key threat	SA <
Pterostylis xerophila	Desert Greenhood	VU	V		Yella Yumb	Orchid	• Occurs singly or in small populations in fertile soils on or around granite or quartzite rock outcrops, less commonly on fertile alluvial flats • This species has been collected from areas receiving less than 200 mm mean annual rainfall near the Great Victoria Desert • Flowers Sep-Nov	• Response to fire is unknown (Duncan 2010) • Avoid prescribed burning during active growing, flowering or seed baring periods, i.e. June-Dec (Duncan 2010)	Aus SA <
Santalum acuminatum	***Mangata*** Desert Quandong	Culturally important			All	Small tree	• Included for cultural significance; fruit prized food, kernel used as liniment, wood used for carving • Slow growing and fire sensitive (trees killed when burnt) • Parasitic and dependent on host plant to establish • Flowers Oct-Dec and fruits ripen Sep-Oct following year	• Fire sensitive • Avoid large hot bushfires • Consider strategic protection burns around known stands and potential host plant localities	SA <
Santalum spicatum	Sandalwood		V		All	Tree	• Flowers throughout the year but mainly Mar-Jun • Fire sensitive • Seeder	• Avoid large hot bushfires • Consider strategic protection burns around known stands and host plants	SA <
Sarcozona bicarinata	Ridged Noon-flower		V		Nulla	Succulent	• Flowers Aug-Dec	• Unknown	SA <

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	*Landscape	Growth Form	Species Ecology	Fire Response & Fire Management Considerations	Source
Sauropus ramosissimus			V		APY GVD	Shrub	• Flowers in May • Resprouter	• Unknown	SA <
Scaevola obovata			V		APY	Shrub	• Occurs in the Tomkinson Ranges, SA • Grows on rocky hillsides • Flowers May-Aug • Spreading shrub to 50 cm tall, often with tough, woody lower branches	• Unknown	#
Sclerolaena fusiformis			V		GVD	Shrub		• Unknown	#
Sclerolaena symoniana	Symon's Bindyi		V		APY GVD			• Unknown	#
Spyridium tricolor	Rusty Spyridium		V		Yella Yumb	Shrub	• Erect dense rounded shrub 0.3-1.5 m high • Only two populations are known to exist today in South Australia, about 10 km apart, both NW of Ceduna	• Unknown	#
Stylidium inaequipetalum	Ayers Rock Triggerplant		V		APY	Herbaceous perennial		• Unknown	#
Swainsona kingii			V		GVD	Herb	• Prostrate or ascending annual or perennial, herb • Flowers May-Oct • Lives on sand, loam, clay. Rocky clay flats, creek-beds or lake-beds	• Unknown	#

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	*Landscape	Growth Form	Species Ecology	Fire Response & Fire Management Considerations	Source
Swainsona minutiflora	Small-flower Swainson-pea		V		APY	Herb		• Unknown	#
Swainsona pyrophila	Yellow Swainson-pea	VU	R		Yella Yumb	Herb		• Adapted to flower after fire and subsequent rain, which stimulate seed germination and growth • Plants will flower in their first year, from Jul-Oct, but often only live for two years after fire • It then survives as seed in the soil, waiting for a subsequent fire to stimulate germination and growth again • Control threats from pest animals after fire (if required)	#
Teucrium grandiusculum ssp. grandiusculum			V		APY	Sub-Shrub	• Facultative resprouter basal lignotuber • First seeds: 2-3 years	• Unknown	#
Teucrium grandiusculum ssp. *pilosum*			E		GVD Nulla Yella	Shrub	• *Teucrium gradisculum* ssp. *pilosum* is found in the Nullarbor and the Great Victoria Desert landscapes	• Avoid large hot bushfires • Consider strategic protection burns around known populations of *Teucrium gradisculum* ssp. *pilosum*	SA <
Teucrium reidii	Showy germander		R		APY	Grass	• Reproductive maturity 2-3 years • Lifespan 10-20 years	• Lignotuber regeneration after fire • 30% mortality when subjected to 100% leaf scorch • Buffel Grass invades post fire leading to higher intensity and higher frequency fires	SA <

Appendix 3 – Fire Response of Rated and Significant Fauna Species

*Landscape definition; APY: including APY Ranges, Southern and Eastern APY & Tallaringa, GVD: Great Victoria Desert, Nulla: Nullarbor, Yalat: Yalata, Yella & Yumb: Yellabinna & Yumbarra.

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	*Landscape	Diet	Species Ecology	Fire Response & Fire Management Considerations	Source
Bird	*Cacatua leadbeateri*	***Kakalaya*** Major Mitchell's Cockatoo/ Pink Cockatoo		R		All	Granivore / Herbivore	• Open woodlands, large mallee, saltbush, mulga etc. • Reach sexual maturity from 3-4 years • Breeds: Aug-Dec • Food: seeds, nuts, fruits, roots • Requires very old growth mallee with hollow logs to roost and nest in	• Avoid large hot extensive bushfires • Protect known nesting trees and potential nesting areas • Cool mosaic burns that protect and enhance nesting & feeding habitat	Aus SA ^
Bird	*Neopherma Splendida*	***Kiilykiilykari*** Scarlet-Chested Parrot		R		All	Granivore / Herbivore	• Habitat: Arid inland zones open Eucalyptus woodlands among sand-dunes or on sand plains • Breed: When conditions are favourable Late Aug-Oct • Highly nomadic • Food: Seeds of grasses, herbaceous plants, and Acacias • Also forages in the herbage found in recently burnt areas • Requires very old growth mallee with hollow logs to nest in	• Would be threatened locally by large hot summer bushfires that burn extensive habitat and nesting trees • Prefers reduced fire frequency • Avoid large extensive hot bushfires • Mosaic burns patterns beneficial for long-term persistence	Aus SA ^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	*Landscape	Diet	Species Ecology	Fire Response & Fire Management Considerations	Source
Bird	*Polytelis alexandrae*	Princess Parrot	VU	V		APY GVD	Nectivore / Granivore	• Highly nomadic and irregular visitor • Feed on seeds of grasses including Spinifex, & nectar from flowering trees • Habitat: Spinifex, with Eucalyptus, Acacias, desert oaks, succulents around salt lakes, often far from fresh water • Nests in hollows of River Red Gums, Desert Oak & Marble Gums • May breed in core areas in wet years then disperse more widely • Generation time 7.7 years • Can start breeding from 2 years old	• Avoid large bushfires which burn entire nesting trees • Cooler fires may promote hollow generation in Marble Gums • Protect known nesting trees and potential nesting areas • Cool mosaic burns that protect and enhance nesting & feeding habitat	Aus SA <
Bird	*Northiella haematogaster narethae*	Blue Bonnet (western ssp.)		R		Nulla	Granivore	• Breeds July-Dec or after rain • Nests in tree hollows in Eucalypts, Acacia, Casuarina • Feeds on fruits and seed of bluebush and saltbush, Acacia shrubs • Habitat; grassy woodlands, native pine, Casuarina, saltbush & bluebush shrublands	• Food sources are vulnerable to hot bushfires • Avoid large hot extensive bushfires • Protect known nesting trees and potential nesting areas • Cool mosaic burns that protect and enhance nesting & feeding habitat	<
Bird	*Pezoporus occidentalis*	Night Parrot	E	E		APY GVD Nulla	Granivore	• Habitat: Spinifex, breakaway country, shrubby glasswort, chenopods, succulents near salt lakes, saltbush, bluebush & bassia associations • Breeds Jul-Aug or after rain, in Spinifex clump or small stick platform in glasswort bush • Once widespread inland, threats include pastoral activities, drought, fire, introduced herbivores and carnivores • Predominantly ground dwelling	• Response to fire unknown, probably prefers small complex fire mosaics providing diverse nesting and feeding opportunities • Frequent, large-scale fire within remaining habitat could affect species abundance • Avoid large hot bushfires • Cooler fires would promote denser vegetation • Maintaining a landscape mosaic of varying vegetation age classes is likely to be important for this species	I <

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	*Landscape	Diet	Species Ecology	Fire Response & Fire Management Considerations	Source
Bird	*Pachycephala inornata*	Gilbert's Whistler		R		GVD Nulla Yalat Yella Yumb	Insectivore	• Breeds: Sep-Dec in tree forks • Habitat: Prefers older mallee. More abundant in unburnt vegetation • Sparsely distributed and apparently territorial, with a small home range • The birds prefer mature woodland or shrubland habitats with dense and continuous understorey	• Important to protect older mallee with intact shrub and litter layers from frequent fire • Areas burnt within 10 years are unsuitable for nesting • Some fire intervals greater than 40 years are desirable	SA ^
Bird	*Leipoa ocellata*	***Nganamara*** Malleefowl	VU	V		APY GVD Yella Yumb Yalat	Omnivore	• Poor fliers, mostly ground dwelling • Breeding: Mounds require high cover of leaf litter • Mound construction: Autumn-Spring • Breed: Sep-Mar • Prefer long unburnt mallee, 26-80 years post fire, highest densities in sites burnt 60-80 years ago	• Fires likely to cause high mortality • First breeding 6-17 years post-fire • Patch burning and/or protection of identified habitat sites, with the critical outcome being a reduction in the occurrence of large fires (Benshemesh 2007) • Undertake habitat protection burns • Monitor impacts of unplanned fires in key habitat	SA ^
Bird	*Ardeotis australis*	***Kipara/Parulpa*** Australian Bustard		V		All	Omnivore	• Habitat: Grasslands, Spinifex, open woodlands, burnt ground, open scrub • Food: Insectivorous & small mammals (mice during plagues) lizards etc. Also forages in recently burnt areas • Eggs are laid on stony rises with stones scraped away • Breed as single pairs within territories • Nestling: Southern Australia Aug-Nov; Northern Australia all months • Low breeding potential	• Mosaic beneficial for long-term persistence • Avoid large scale, intense bushfires which are likely to result in the direct loss of individuals as well as the degradation of habitat in the short term	SA ^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	*Landscape	Diet	Species Ecology	Fire Response & Fire Management Considerations	Source
Bird	*Calamanthus Cautus*	Shy Heathwren		R		Yalat Yella Yumb	Insectivore	• Habitat: Mallee, Callitris, heathy tea-tree, with dense understorey • Breeds Jul-Nov • Nests at foot of mallee, shrub or in grass tussock	• Appears to have a preference for early post-fire regenerating areas, when a dense ground cover is available, or long unburnt (40+ years) which have a dense shrubby understorey • Avoid large hot bushfires which wipe out entire populations • Cooler fire can help promote denser under-storey vegetation • Maintaining a landscape mosaic of vegetation age classes is likely to be important for this species	SA <
Bird	*Conopophila whitei*	Grey Honeyeater		R		APY GVD	Insectivore	• Habitat: Mature mulga, open woodland Spinifex, open scrub • Breeds Aug-Sep nests in tall shrub	• Habitat vulnerable to hot bushfires which may take many years to recover appropriately • Avoid large hot bushfires which wipe out entire populations • Cooler fire can help promote denser under-storey vegetation • Maintaining a variety of vegetation age classes is likely to be important for this species	SA <
Bird	*Acanthiza iredalei iredalei*	Slender-billed Thornbill (western ssp.)		R		All	Insectivore	• Habitat: chenopod shrubland, low dense saltbush, bluebush, sand plain heaths, mulga & other Acacias • Live in pairs or clans • Nests in dome of grass or plant down in low shrub	• Fire sensitive • Frequent, large-scale fire within remaining habitat could affect species abundance • Mosaic patch burning is beneficial for long-term persistence and protection from large scale bushfire	SA <

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	*Landscape	Diet	Species Ecology	Fire Response & Fire Management Considerations	Source
Bird	*Amytornis striatus*	***Waruku / Trikutriny*** Striated Grass-Wren		R		APY GVD Yella Yumb	Insectivore	• Predominantly ground dwelling • Cooperative breeder. Moderate productivity • Nest frequently in *Triodia* • Breeds Oct-Mar. In central desert regions breeds Apr and Jul-Dec • Domed nest composed primarily of Spinifex grass, sometimes bark with a lining of plant down, grass seeds and fur • 2-3 eggs	• Spinifex dependent so core suitable habitat highly dependent on fire regimes • More common in unburnt patches of land compared to burnt country • Recolonise burnt areas after 6-7 years and the habitat remains suitable up to around 40 years after fire, when the Spinifex deteriorates and the shrub layer starts to die out • Mosaic beneficial for long-term persistence • Avoid large scale, intense bushfires which are likely to result in the direct loss of individuals as well as the degradation of habitat in the short term	Aus SA <
Bird	*Stipiturus ruficeps*	Rufous-crowned Emu-wren		R		APY GVD	Insectivore	• Habitat: Spinifex on rocky gullies and slopes, sparse shrubs • Breeds Aug-Oct, domed nest in Spinifex clump	• Spinifex dependent so core suitable habitat highly dependent on fire regimes. Mosaic beneficial for long-term persistence • Avoid large scale, intense bushfires which are likely to result in the direct loss of individuals as well as the degradation of habitat in the short term	SA <
bird	*Emblema pictum*	Painted Finch		R		APY GVD	Granivore	• Habitat: Spinifex in rocky hills, Acacia scrub • Breeds any month after rain • Nests in Spinifex or on ground in a poorly constructed nest	• Reliant upon Spinifex and other grasses for food, shelter and nesting which are vulnerable to large hot bushfires • Cooler fire can protect nesting and feeding habitats • Maintaining a landscape mosaic of vegetation age classes is likely to be important for this species	SA <

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	*Landscape	Diet	Species Ecology	Fire Response & Fire Management Considerations	Source
Bird	*Cilmacteris affinis*	White-browed Treecreeper		R		APY GVD	Insectivore	• Habitat: Semi arid and arid saltbush, Spinifex, sparse veg • Breeds Aug-Dec • Nests in hollow stumps near ground level	• Feeding habitat vulnerable to hot fires • Cooler fire can protect nesting and feeding habitats • Maintaining a landscape mosaic of vegetation age classes is likely to be important for this species	<
Bird	*Gerygone fusca*	Western Gerygone		R		APY	Insectivore	• Habitat: Eucalypt woodlands, mulga, other Acacia woodlands • Breeds Aug–Nov • Nests in trees	• Habitat vulnerable to large hot bushfires • Avoid large hot bushfires which wipe out entire populations • Cooler fire can help promote denser under-storey vegetation • Maintaining a landscape mosaic of vegetation age classes is likely to be important for this species	<
Bird	*Geophaps plumifera*	Spinifex Pigeon		R		APY	Granivore	• Spinifex, grassy woodlands, hilly country, near water • Breeds spring – summer mostly after rain • Nests on rocky crevices	• Spinifex and grassy woodland habitat vulnerable to large hot bushfires • Maintaining a landscape mosaic of varying vegetation age classes is likely to be important for this species	<
Bird	*Cladorhynchus leucocephalus*	Banded Stilt		V		APY GVD	Omnivore	• Habitat: Occurs on inland salt and freshwater lakes • Breeds May-Dec & after heavy rains • 3-4 eggs laid in a small depression in soft ground	• Unknown	Aus <
Bird	*Eremiornis carteri*	Spinifexbird		E		APY	Granivore / Insectivore	• Breeds Aug-Nov or after good rains • Nests in Spinifex clumps • 2 eggs • Food: insects, small beetles & grasshoppers & some plant matter	• Preferred habitat vulnerable to large bushfire destruction • Mosaic beneficial for long-term Spinifex age class diversity and bushfire risk mitigation • Avoid large scale, intense bushfires which are likely to result in the direct loss of individuals as well as habitat	Aus <

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	*Landscape	Diet	Species Ecology	Fire Response & Fire Management Considerations	Source
Bird	*Burhinus grallarius*	***Wiilu*** Bush Stone-curlew		R		APY	Omnivore	• Mallee scrub, Spinifex, dry watercourses, sandplains • Breeds Aug–Jan • 2 eggs on bare ground, blotchy brown/grey coloured	• Preferred habitat vulnerable to large bushfire destruction • Mosaic beneficial for long-term Spinifex age class diversity and bushfire risk mitigation • Avoid large scale, intense bushfires which are likely to result in the direct loss of individuals as well as habitat degradation	<
Bird	*Hamirostra melanosternon*	Black-breasted Buzzard		R		APY	Carnivore	• Grasslands, sandhills, gibber deserts, timber watercourses • Breeds Aug–Nov • Nests in larger trees	• Food resources and nesting a roosting habitat would be vulnerable to hot bushfire impacts • Would benefit from scavenging opportunities resulting from cool burns • Cool burns near and under preferred food & nesting habitat • Protect habitat from hot bushfires	< I
Bird	*Lophoictinia isura*	Square-tailed Kite		E		APY	Carnivore	• Habitat: In arid Australia, timbered water courses • Food: Insects, small mammals & lizards • Spring-summer breeding • Migratory • Breed in single pairs within large territories	• Would benefit from scavenging opportunities resulting from cool burns • Cool burns near and under preferred food & nesting habitat • Protect habitat from hot bushfires	Aus <
Bird	*Falco hypoleucos*	Grey Falcon		R		All	Carnivore	• Sedentary to partly nomadic • Habitat: Open woodlands, Spinifex grasslands, wooded dry watercourses • Breeds June-Nov in refurbished raptor nest in tree	• Would migrate if habitat became unsuitable due to large fires • Nesting trees vulnerable to hot fires • Food resources vulnerable to large hot bushfires • Cool mosaic burns breaking up habitat and protecting it from large hot bushfires would ensure the birds continual presences within an established territory • Protect nesting and roosting trees	I

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	*Landscape	Diet	Species Ecology	Fire Response & Fire Management Considerations	Source
Bird	*Chlamydera guttata*	***Ikarka*** Western Bower Bird		R		APY	Herbivore	• Habitat: Rocky inland hills • Eats desert rock figs (*Ficus brachypoda*), Santalum fruits, mistletoe, insects & spiders • Nests in trees in mistletoe	• Preferred habitat vulnerable to large bushfire destruction especially in the presence of Buffel Grass • Cool burns near and under preferred food & nesting habitat • Protect habitat from hot bushfires	–
Bird	*Tyto novaehollandiae*	***Tjalku-tjalku/wiṟatju*** Masked Owl		E		Nulla	Carnivore	• Roosts and nests in tree hollows and caves • Prefers grassy plains, open woodlands, partly forested coastal plains • Hunts at night in woodlands and open plains • Prey includes rabbits, mice and other birds	• Large fires would impact on preferred food species habitats and on nesting and roosting hollows • Would benefit from complex mosaic burn patterns and varying age class habitats for shelter, fire safety and food resources	–
Bird	*Strepera versicolour plumbea*	Grey Currawong *north west ssp*		E		APY	Carnivore	• Habitat: Intact woodlands, mallee • Breeds Aug–Dec • Nests in larger trees • Eats small birds, bird chicks, reptiles and mammals	• Food sources are vulnerable to large hot bushfire impacts • Would benefit from complex mosaic burn patterns and varying age class habitats for shelter, safety from bushfire and protection of food resources	–
Bird	*Dromaius novaehollandiae*	***Kalaya/Tjakipiri*** Emu	Culturally significant bird			All	Omnivore	• Emus live in a great variety of habitats but prefer open grasslands and woodlands • Can reproduce from 2 years old • Breeds in winter lays eggs April-May • Nest of bark or leaves in a scrape in the ground • Average of 7-11 eggs per clutch • Male sits on the eggs for 8 weeks • Males caring for chicks do not breed again until the second December after the chicks have hatched	• Flightless so is vulnerable to large bushfires • Included for cultural reasons/hunting • Would benefit from complex mosaic burn patterns and varying age class habitats for shelter, fire safety and protection of food resources	Aus SA ^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	*Landscape	Diet	Species Ecology	Fire Response & Fire Management Considerations	Source
Mammal	*Dasycercus blythi* *(Dasycercus hillier)*	***Murtja*** Brush-tailed Mulgara	EN	E		APY	Carnivore	• Habitat: Sandy arid regions in a range of vegetation types but mainly in Spinifex • Primarily nocturnal • Use burrows up to 50 cm deep • Breeds in late winter with up to 6 young • Hunts large invertebrates, small vertebrates, including retiles, mammals and birds • Main threats include habitat degradation by grazing livestock and altered fire regimes, and predation by cats and foxes • Needs good vegetation cover to avoid predators during night time forages • Mulgara food species also requires good vegetation cover and a complex habitat to maintain numbers	• Though no specific fire management information exists for this species, it would be supposed that large hot bushfires would destroy both the Mulgara and their food species' habitats • A burn mosaic complexity of differing age class habitats created by cool to hot small burns would be beneficial to Mulgara survival	–
Mammal	*Dasycercus cristicauda*	***Murtja*** Crested-tailed Mulgara	VU	E		APY GVD	Carnivore	• As for Brush-tailed Mulgara, above	• As for Brush-tailed Mulgara, above	–
Mammal	*Macropus fuliginosus*	***Kulpir*** Western Grey Kangaroo	Cultural significant species			GVD Nulla Yalat Yella Yumb	Herbivore	• The species is abundant within its normal range and is included here for cultural significance – hunting value • Western Grey Kangaroos graze on native grasses and browse on forbs and bushes such as Acacias, Allocasuarinas etc. • Prefers good scrub cover • Generally feeds at night • Breeds throughout the year	• Burnt areas (if not too large and intensive) provide improved grazing and browsing opportunities • Bushfires may reduce vegetation cover used for daytime shelter • The species would benefit from a complex fire mosaic of different vegetation age classes • Differing aged fire mosaics will also fragment large bushfires and ensure suitable habitats remain in any given area	Aus SA ^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	*Landscape	Diet	Species Ecology	Fire Response & Fire Management Considerations	Source
Mammal	*Macropus rufus*	***Maḷu*** Red Kangaroo	Cultural significant species			All	Herbivore	• The species is included here for cultural significance – hunting value • Occurs throughout mainland Australia in the semi-arid and arid zones • Prefers green grass followed by forbs and then mature grasses • Prefers open grasslands but will shelter in scrub and woodland cover during the day if available • Continual breeding during times of adequate feed • Reproductively mature at 2-3 years	• Burnt areas (if not too large and intensive) provide improved grazing and browsing opportunities • The species would benefit from a complex fire mosaic of different vegetation age classes	Aus SA ^
Mammal	*Petrogale lateralis (McDonnell Ranges race)*	***Warru*** Black-flanked Rock-wallaby	VU	E		APY	Herbivore	• Live in rocky escarpment country, gorges, granite outcrops with hummock grassland • Reliant on narrow crevices and small caves for shelter and protection from predators	• Fire may cause short-term loss of feeding resources and increased exposure to predators • Fire may also regenerate areas of unpalatable vegetation to more palatable ephemerals and perennials • Undertake landscape protection burns to assist in preventing frequent large bushfires • Undertake landscape protection burns to improve feed quality	SA ^
Mammal	*Macrotis lagotis*	***Tajlku/Ninu*** Greater Bilby	VU	V		APY GVD	Omnivores	• Once occurred throughout the semi-arid and arid zones • Fragment populations now found in mulga woodlands and Spinifex grasslands • Generally solitary, living in complex burrows • Nocturnal feeding on seeds, insects, bulbs, fungi	• Changing fire patterns are influencing type and abundance of food plants • Little known of specific fire management considerations • The demise of traditional burning regimes and the increase of large bushfires is probably detrimental to their long-term survival	–

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	*Landscape	Diet	Species Ecology	Fire Response & Fire Management Considerations	Source
Mammal	*Notomys cervinus*	***Tarkawara*** Fawn Hopping-mouse		V		Yella Yumb	Omnivores	• Produces litters of up to 5 offspring • Burrows during the day up to 1 m deep. Lives in small family groups • Forages at night on ground • Food: Seeds, insects, green plant material	• Differing aged fire mosaics will also fragment large bushfires and ensure suitable habitats remain in any given area	–
Mammal	*Notoryctes typhlops*	***Itjara Itjara*** Marsupial Mole	EN	V		APY GVD Yella Yumb	Omnivores	• Little is known of the habitat requirements • Most often recorded in sand dunes supporting Acacias and other shrubs • Lives underground. Burrows to depths exceeding 2.5 m • Food includes: ant pupae, sawfly larvae, beetles, scarab & longicorn beetle larvae & the larvae of cossid moths	• Large fires have potential to cause widespread decline in food prey items • Avoid large hot bushfires • Undertake monitoring of moles in burnt and unburnt areas	Aus SA ^
Mammal	*Sminthopsis psammophila*	***Wilytjiny*** Sandhill Dunnart	EN	V		GVD Yella Yumb	Insectivore	• Habitat: Spinifex (>8 years post fire) and shrublands • Breeds in spring and early summer • Food: mainly insectivorous diet	• Avoid extensive hot bushfires • Consider strategic landscape protection burns around significant populations	Aus SA ^
Reptile	*Acanthophis pyrrhus*	***Panakura*** Desert Death Adder		V		APY GVD	Carnivore	• Only one specimen in SA in the Everard Range (1914) • Hunts lizards	• Unknown, but can be expected to be vulnerable to intense bushfires that destroys food prey habitat • Small mosaic patches burning would probably enhance this species' existence	–
Reptile	*Lerista speciosa*	Musgrave Slider		V		APY	Insectivore	• Restricted to the Musgrave Range • Only known from one site, Mt Morris, west of Amata	• Unknown, but can be expected to be vulnerable to intense bushfires that destroys food prey habitat • Small mosaic patches burning would probably enhance this species' existence	–

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	*Landscape	Diet	Species Ecology	Fire Response & Fire Management Considerations	Source
Reptile	*Liopholis kintorei*	***Tjakura*** Great Desert Skink	VU	E		APY	Omnivore	• Found in desert. Sandy, clay and loamy soils • A burrowing species. Large complex burrow systems may be occupied by family groups • Occurs on sandy plains with Mulga, Minyura and Eremophila associations	• Well adapted to patch burning • Not found in patches burnt more than 25 years ago • Majority of burrows in areas burnt in last 15 years • Undertake patch burning in areas with known populations • Preferable in cooler months when less active • Avoid large hot bushfires	Aus SA <
Reptile	*Varanus rosenbergi*	Heath Goanna		V		Yalat	Carnivore	• Habitat: Sandy heaths and coastal sand dunes • One specimen from region, road kill near Yalata • Mostly terrestrial. Burrows. Hollow logs and rock crevices • Termite mounds are a critical habitat component • Individuals require large areas of habitat • Very secretive	• Large fires would destroy prey habitat and expose the species to native and introduced predators • Would benefit from mosaic patch burns that promote prey species' habitats	Aus <
Amphibian	*Neobatrachus sutor*	Shoemaker Frog		V		APY	Insectivore	• A burrowing species • Lives in grassland areas near water-filled claypans	• Threats unknown	Aus <
Amphibian	*Pseudophryne robinsoni*	Springs Frog	Recently discovered very rare species. Yet to be rated			APY	Insectivore	• Found hiding under rocks, near mountain rockholes or beside running water in gorges • Isolated and limited distribution, only known to occur in five localities	• Avoid habitat disturbances at known breeding or refuge sites	E