FIRE MANAGEMENT PLAN 2016–2026

South Para Collaborative
incorporating
Department of Environment, Water and Natural Resources
ForestrySA and SA Water managed lands

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

CFS

SA Water

ForestrySA

Government of South Australia

PREPARE. ACT. SURVIVE. BUSHFIRE READY

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Acronyms

AFAC	Australasian Fire & Emergency Services Authorities Council
AMLR	Adelaide and Mount Lofty Ranges
A-zone	Asset Protection Zone
BMAP	Bushfire Management Area Plan
BMC	Bushfire Management Committee
B-zone	Bushfire Buffer Zone
CFS	SA Country Fire Service
CP	Conservation Park
Cwlth	Commonwealth
Cpt	Compartment
C-zone	Conservation-Land Management Zone
DEH	The (former) SA Dept. for Environment and Heritage
DENR	The (former) SA Dept. for Environment and Natural Resources
DEWNR	The SA Dept. of Environment, Water and Natural Resources
EA	Environmental Assessment
EFMG	Ecological Fire Management Guidelines
EFMS	Ecological Fire Management Strategy
FDI	Fire Danger Index
FL	Forest Locality
FSA	ForestrySA
GAFLC	The (former) Government Agencies Fire Liaison Committee
GAFMWG	Government Agencies Fire Management Working Group
GRN	Government Radio Network
HA	Heritage Agreement
ha	Hectares
IC	Incident Controller
IMT	Incident Management Team
KFRS	Key Fire Response Species
MFS	Metropolitan Fire Service
MLRFC	Mount Lofty Ranges Fire Cooperative
MSEC	SA Minister for Sustainability, Environment and Conservation
MVG	Major Vegetation Group
MVS	Major Vegetation Sub-group
NFR	Native Forest Reserve
NP	National Park
NVC	Native Vegetation Council
NVIS	National Vegetation Information System
PF	Plantation Forest
PPE	Personal Protective Equipment
RP	Recreation Park
RR	Reservoir Reserve
SA	South Australia
SAW	SA Water
sp.	Species (singular)
spp.	Species (plural)
ssp.	Subspecies
TPC	Threshold of Potential Concern

EXECUTIVE SUMMARY

This Fire Management Plan covers over 20 000 hectares of public land managed by the Department of Environment, Water and Natural Resources, ForestrySA, and SA Water in the South Para area of the Mount Lofty Ranges, as well as privately owned Heritage Agreement areas. The lands included in this plan are managed for conservation, recreation, forestry, or catchment management purposes. This includes:

- plantation forests and Native Forest Reserves (which are proclaimed for conservation purposes) within the Mount Crawford Forest Reserve managed by ForestrySA
- Barossa, South Para, Little Para, Millbrook, Kangaroo Creek, and Warren Reservoir Reserves managed by SA Water
- Cromer, Cudlee Creek, Hale, Kaiserstuhl, Kenneth Stirling (Burdetts Block), Montacute, Para Wirra, Sandy Creek, Warren, and Wiljani Conservation Parks, and Para Woodlands proposed Conservation Park managed by DEWNR
- selected Crown land managed by DEWNR
- privately owned Heritage Agreements adjoining public land.

This Fire Management Plan has been developed through a partnership between these State Government land management agencies and the South Australian Country Fire Service to promote collaborative bushfire risk mitigation. The plan emphasises the protection of human life as the highest priority, proposes strategies to reduce the risk of bushfire threatening assets and infrastructure and provides direction for land managers in the protection and enhancement of environmental values. It is important to note that there will be transitional stages throughout the implementation of the proposed works and strategies which will be dependent upon annual prioritisations and the allocation of resources to each agency over the 10 year life of this Fire Management Plan.

The South Para planning area includes the largest contiguous expanse of remnant native vegetation in the Mount Lofty Ranges. The Adelaide and Mount Lofty Ranges are unique due to relatively high rainfall and hilly topography, surrounded by coastal environments to the west and south. The diversity of landscapes within a comparatively small area supports a diverse array of ecosystems and species. Many of these species are endemic to the region or geographically separated from other state or interstate populations. Historic native vegetation clearance throughout the region has resulted in as little as 13% of original native vegetation remaining. Species have become extinct and many more are continuing to decline. The native vegetation within this plan acts as a stronghold for a number of endemic and threatened species and ecological communities.

The area was identified as a priority for fire management planning due to the potential for bushfire to threaten the local community (such as Williamstown and other centres), essential infrastructure, Adelaide's drinking water catchment, commercial forestry plantations, and threatened species and ecological communities.

On Friday 2 January 2015 this potential became a reality when the Sampson Flat bushfire burnt 12,569 ha from Parra Wirra to Cudlee Creek and Hermitage to Forreston, over six days. Large areas of Millbrook Reservoir Reserve and Mount Gawler Forest Reserve were burnt at varying intensities. By the end of the event reported losses included 28 houses, 11 businesses, 103 sheds and other buildings.

This plan seeks to address such impacts and risks during the planning process by:

- undertaking a risk assessment to identify life, property, and environmental values that may be threatened by bushfire
- applying DEWNR Fire Management Zoning principles to guide the management of fuel in Asset Protection and Bushfire Buffer Zones and designating Conservation-Land Management Zones
- applying DEWNR Ecological Fire Management Guidelines to determine appropriate fire regimes in Conservation-Land Management Zones
- assessing track standards using the Government Agencies Fire Management Working Group guidelines for firebreaks and fire access tracks in South Australia.

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

- Fuel reduction:
    - in Asset Protection and Bushfire Buffer Zones using a variety of methods, including prescribed burning and mechanical removal
    - in strategic areas within the Conservation-Land Management Zone to provide some landscape protection within the reserves and increase patchiness within the vegetation across larger areas
    - to complement strategies to manage species or ecological communities.
- Fire management actions to increase fire readiness, including changes to fire access and mitigation and suppression infrastructure.
- Coordinated fire management between the agencies and adjacent landowners through Bushfire Management Area Plans.

The agencies thank those who have contributed to the development of this plan and encourage their continued engagement in managing fire in the South Para planning area. The plan will form a significant component of the *Adelaide Mount Lofty Ranges Bushfire Management Area Plan*. As fire is a landscape issue, the community will also need to implement fire management strategies to complement and enhance work undertaken by the agencies.

The draft plan was released for public comment for a period of four weeks over July and August 2013. Comments were then evaluated and incorporated where considered appropriate. Subsequent to this, a review occurred in 2015 post the Sampson Flat bushfire. A major review of this plan will occur after ten years of implementation, or earlier if required.

CONTENTS

List of Figures

List of Tables

Fire Management Maps

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

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

The map themes are:

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

1 SCOPE AND PURPOSE

This Fire Management Plan (the plan) provides a strategic framework for fire management activities on public land and included Heritage Agreements (HA) in the South Para planning area. The South Para planning area covers forestry plantations and native vegetation in Mount Crawford Forest Reserve and adjoining protected areas, incorporating:

- Mount Crawford Forest Reserve, Cudlee Creek, Coralinga, Kaiserstuhl, Kersbrook, Little Mount Crawford, Mount Gawler, Tower Hill, and Watts Gully Native Forest Reserves (NFR) managed by ForestrySA
- Barossa, South Para, Little Para, Millbrook, Kangaroo Creek, and Warren Reservoir Reserves managed by SA Water
- Cromer, Cudlee Creek, Hale, Kaiserstuhl, Kenneth Stirling (Burdetts Block), Montacute, Para Wirra, Sandy Creek, Warren, and Wiljani Conservation Parks, and Para Woodlands proposed Conservation Park managed by DEWNR
- Conservation Reserves and other Crown land managed by the Department of Environment, Water and Natural Resources (DEWNR)
- privately owned HA adjoining public land.

The plan drives the delivery of fire management across the included lands by defining management objectives for the protection of human life and property (particularly in relation to visitors and adjacent landholders), protection of the environment, and for ecological fire management. Strategies recommended to meet objectives will increase the level of bushfire readiness and guide management and suppression strategies during bushfire incidents.

The South Para district was identified for fire management planning due to:

- the potential for bushfire to build into a landscape-scale event due to the large areas of continuous vegetation in the area
- the need to enhance the protection of human life within and adjacent to the planning area, especially those of communities in key Adelaide Hills population centres, such as Williamstown, and recreational users
- the potential impact that bushfire will have on Adelaide's drinking water catchment and water infrastructure, commercial plantation forests and other critical infrastructure and services, including the Gould Creek power substation
- the potential impact that bushfire will have on built assets, natural and cultural heritage values, minor public infrastructure, and revegetation assets
- the occurrence of and potential impacts on native species, populations, and ecological communities of conservation significance within and adjacent to the planning area and the need to increase our knowledge of the fire regimes required to maximise biodiversity.

The plan aims to:

- assess the level of risk (particularly in relation to the above issues) and the existing fire management and reserve management objectives
- identify objectives for fire management within the planning area
- outline strategies for risk mitigation and propose operational works to increase the level of bushfire preparedness and guide suppression management during bushfire incidents

- inform the preparation of Bushfire Response Plans for the included lands, which provide specific operational information useful in the early stages of an incident.

Fire management actions outlined in the plan will be implemented in a staged manner depending on available resources. Unforeseen events such as large-scale bushfires or significantly altered fuel hazards may also influence the implementation of the recommended works. The agencies will cooperate in the implementation and delivery of prevention strategies where there is a demonstrated operational, logistical and/or environmental benefit (DEWNR *et al*. 2012). This will be coordinated through the Mount Lofty Ranges Fire Cooperative (MLRFC) – a committee of representatives from the CFS, DEWNR, ForestrySA, and SA Water responsible for the coordination and integration of fire management activities on public lands.

Adjoining lands are considered in the plan, but only in the context of actions required to minimise the risk from fires originating in the included lands. However, DEWNR, ForestrySA, and SA Water will support and complement landscape-scale fire planning for adjoining lands. Fire management planning for other lands is the responsibility of the CFS as part of the Adelaide and Mount Lofty Ranges (AMLR) Bushfire Management Committee (BMC), in accordance with the requirements of the *Fire and Emergency Services Act 2005* (FES Act). DEWNR, ForestrySA, and SA Water are represented on this Committee, along with Local Government and the CFS.

1.1 Objectives

General Objectives for Fire Management

- To reduce the risk to life, property, and the environment during bushfire events.
- To ensure that sound conservation and land management principles are applied to fire management activities.
- To apply an adaptive management approach to fire management on publicly managed land supported by contemporary research.
- To provide for the strategic containment of bushfires (e.g. to minimise the likelihood of a fire entering/exiting a reserve).
- To complement Bushfire Management Area Plans (BMAP), prepared by BMC under the FES Act.
- To undertake bushfire suppression activities in a safe and professional manner.
- To inhibit the spread of bushfire through publicly managed land.
- To manage fire regimes to ensure consistency with the fire management guidelines in Conservation-Land Management Zones (refer to Table 6).

The fire management objectives that apply specifically to the South Para planning area are as follows.

Objectives for Fire Management in the South Para planning area

- To reduce the impact of bushfire on human life and improve community safety on and adjacent to public land as a priority.
- To reduce the impact of bushfire on critical infrastructure and services on and adjacent to public land.
- To reduce the impact of bushfire on community functions by providing for the protection of significant community and recreational values/assets within and adjacent to public land.
- To minimise the likelihood of a significant portion of a reserve burning in a single fire event and/or a landscape-scale fire occurring within the planning area or spreading into the adjacent planning area.
- To reduce the impact of fire on water quality by minimising the likelihood of an entire catchment burning in a single fire event.
- To minimise the likelihood of fire threatening forestry plantations of significant commercial value.
- To maintain or improve the viability of native species, populations, ecological communities and habitats within the planning area.
- To minimise the impact of fire and fire management activities on threatened species, populations, and ecological communities, and provide for the protection of significant habitat areas within the planning area.
- To improve knowledge on appropriate fire regimes required to maintain and enhance native species, populations, ecological communities, and habitats, and ensure that any new information is used to inform future management actions in the planning area.
- To establish and maintain an appropriate level of preparedness (including employee and equipment resources) that will enable rapid and effective response for fire management by maintaining daily bushfire readiness through the MLRFC.
- To minimise the likelihood of fire threatening revegetation assets that represent significant capital investments and to inform restoration planning.
- To work with universities or other research institutions to develop research programs that inform prescribed burning on public land where appropriate.
- To inform the BMAP of risk reduction activities recommended within the included lands and identify significant areas of conservation value within the planning area, achieving a consistent approach across the landscape.

2 THE PLANNING FRAMEWORK

2.1 Legislation

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

TABLE 1 – LEGISLATION INFLUENCING FIRE MANAGEMENT PLANNING

Legislation	Sec.	Relevance to fire management
Fire and Emergency Services Act 2005 (SA)	105H-1	Conveys the fire management responsibilities of DEWNR, ForestrySA, and SA Water through requirements to minimise the risk of fire threatening life and property and to reduce the likelihood of fire ignitions and fire spreading through the land that they manage.
	97-6	States that the 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.
	97-7	States that the CFS must seek approval to undertake any action on land that is proclaimed as a Forest Reserve if a ForestrySA officer is present at the scene and if so, the CFS may be required to act under their direction.
Forestry Act 1950 (SA)	12	Authorises ForestrySA to undertake actions necessary to protect plantation forests and ensure their proper growth.
	17	Provides provisions for ForestrySA to undertake fire prevention on adjacent road reserves to reduce the risk of fire threatening Forest Reserves.
National Parks & Wildlife Act 1972 (SA)	37	Defines overarching management objectives for proclaimed reserves managed by DEWNR, which includes 'the prevention and suppression of bushfires and other hazards', and provides protection for listed terrestrial flora and fauna.
Wilderness Protection Act 1991 (SA)	12	Directs DEWNR to prepare a *Wilderness Code of Management* (DEH 2004), which establishes principles for fire management and provides provisions for fire management in Wilderness Protection Areas and Zones if deemed an 'essential management operation'.
Crown Land Management Act 2009 (SA)	9c	Assigns DEWNR, through the Minister for Sustainability, Environment and Conservation (MSEC), 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 MSEC.
	18 & 20	Imparts ForestrySA and SA Water with responsibilities for the management of Crown land that has been dedicated to their respective Minister (i.e. the Minister for Forests and the Minister for Water) by the MSEC.
Native Vegetation Act 1991 (SA)	29	DEWNR, ForestrySA and SA Water must meet the provisions of the Act if intending to modify native vegetation on their land (this includes burning). Clearance applications are assessed by NVC in accordance with Schedule 1 of the Act.
	23	Outlines the provisions for the establishment of native vegetation HA for conservation purposes on private land.
Native Vegetation Regulations 2003 (SA)	5A-1	Clarifies which actions can be undertaken to modify native vegetation without approval from the Native Vegetation Council. This includes fuel reduction: for asset protection, on publicly managed land or reserves or during bushfire emergencies, when establishing or maintaining fire access tracks or fuel breaks for fire control or if required by Bushfire Management Area Plans.

Legislation	Sec.	Relevance to fire management
	5(1)(zi)	Where clearance is to preserve or enhance ecological processes (e.g. prescribed burning for ecological reasons), a management plan needs to be approved by the Native Vegetation Council, as per the *Guidelines for Ecological Prescribed Burning* (Native Vegetation Council 2014).
Environment Protection & Biodiversity Conservation Act 1999 (Cwlth)	18	Regulation of actions likely to impact nationally-listed species and ecological communities.
	146, 146A, & 146B	Outlines the requirement for a strategic assessment to be undertaken. Strategic assessments are landscape-scale assessments and consider a broad set of actions. Where Matters of National Environmental Significance are involved, DEWNR must adhere to the *Fire Management Environmental Assessment and Management Procedure* (DEWNR 2015a) to meet EPBC Act requirements.
	269AA	Describes when Recovery Plans should be prepared for nationally-listed species and ecological communities (see Section 3).

2.2 Fire management policies and procedures

DEWNR, ForestrySA, and SA Water each have their own fire management policy stating that fire will be managed to protect life, property, and the environment on the land that they manage (DEWNR 2015b; ForestrySA 2010b; SA Water 2009a). Under these policies, each agency has procedural documents that provide a framework for fire management activities (DEWNR 2015b; ForestrySA 2010a,2010c; SA Water 2010a). The plan has been developed in accordance with *DEWNR's Project Management, Risk Assessment, Zoning, and Protection of Cultural Heritage Procedures* (DEWNR 2015b) for Fire Management Planning.

2.3 Heads of agencies agreement

An agreement exists between DEWNR, ForestrySA, and SA Water (as the state government land management agencies) and the CFS to cooperatively manage fire on public land for the protection of life, property, and the environment. The agencies have endorsed the *Code of Practice for fire management on public land in South Australia* (DEWNR *et al.* 2012), which establishes a common goal for the agencies and underpins the cooperative spirit that exists. The development of the plan was recommended and prioritised by the Heads of Agencies Committee. The Committee endorsed the plan for adoption in December 2014, and reviewed and noted the review post the Sampson Flat bushfire in May 2016. The MLRFC has been established by the Heads of Agencies Committee to coordinate the implementation of a strategic works program and bushfire response arrangements across public lands in the AMLR.

2.4 Other influences and considerations

2.4.1 Land management

DEWNR reserve management plans are a statutory requirement under the *National Parks and Wildlife Act 1972* (NPW Act) and the *Wilderness Protection Act 1992* (WP Act) (where relevant). They may identify the requirement for a fire management plan based on the nature of the fire-related issues within a reserve. In the planning area, reserve management plans have been developed for Para Wirra CP (DELM 1993) and Kaiserstuhl CP (DEH 2006b). The reserve management plan for Para Wirra CP states that fire management should be undertaken in the reserve to reduce the frequency and severity of bushfires. The reserve management plan for Kaiserstuhl CP recommends that DEWNR consider the use of fire as a management tool. The fire management strategies identified in this plan are consistent with the management objectives set out in these reserve management plans.

SA Water land management plans are developed for all major SA Water landholdings in conjunction with fire management plans. In the planning area, two land management plans have been developed: *South Para, Barossa and Warren Reservoir Reserves Land Management Plan* (SA Water 2009c) and *Millbrook and Kangaroo Creek Reservoir Reserves and Gorge and Gumeracha Weir Reserves Land Management Plan* (SA Water 2010d).

Forest management plans are the overarching planning documents prepared by ForestrySA for all conservation and plantation areas. The *Mount Lofty Ranges Forest Reserves Management Plan* covers all ForestrySA land included in this plan (ForestrySA 2014). Native forest management plans are prepared for individual reserves at the direction of forest management plans. In the planning area, native forest management plans have been developed for Cudlee Creek and Coralinga (ForestrySA 2006a), Kaiserstuhl (ForestrySA 2006b), Kersbrook and Mount Gawler (ForestrySA 2006c), Little Mount Crawford (ForestrySA 2006d), Tower Hill (ForestrySA 2006e), and Watts Gully (ForestrySA 2006f). These plans are due for review but state that ForestrySA will minimise the risk of bushfire using a range of fire protection measures.

The plan takes the objectives of each land management plan into consideration and the risk treatments proposed to minimise the impact of bushfire on public land while maintaining consistency with the current management direction of the respective agency.

2.4.2 Bushfire planning

Fire management plans have been prepared by SA Water for all reservoir reserves covered by this plan. This includes a fire management plan for Millbrook and Kangaroo Creek Reservoir Reserves, Gorge and Gumeracha Weirs (SA Water 2010e), and South Para, Barossa, and Warren Reservoir Reserves (SA Water 2009b). The strategies included in the SA Water plans were reviewed as part of the South Para planning process, however, SA Water will continue to work from their annual maintenance schedule as that level of detail has not been included in this plan.

Fire management planning at a landscape-scale, regardless of tenure, will be addressed in the BMAP prepared by the AMLR BMC, as a statutory requirement under the FES Act. Fire management plans for public land and BMAPs will be complementary and both are developed in collaboration with each other. The draft ALMR BMAP (CFS 2016) has been released for public consultation. It is anticipated that the AMLR BMC will finalise the AMLR BMAP in the near future. The risk treatments identified in this plan will be integrated within the BMAP for the AMLR. The agencies will ensure that the AMLR BMC is aware of all fire management planning and actions undertaken on public land, and that proposed actions are incorporated within the AMLR BMC annual works plan supporting the implementation of the BMAP.

2.5 Partnership agencies

Bushfire suppression in rural South Australia is led by the CFS, and supported by DEWNR, ForestrySA, and SA Water. Responding to a fire on public land is undertaken jointly by the agencies and CFS Brigades. Local CFS brigades are heavily relied upon for fire suppression, particularly in the early stages of an incident. The cooperation, support, and understanding between CFS brigades, the agencies, and the local community have been critical to successful fire suppression in the past, and will be critical to the success of the plan.

2.6 Consultation

The CFS, DEWNR, ForestrySA, and SA Water, are committed to close cooperation and involvement with state and commonwealth organisations, special interest groups, and the broader community to achieve the goals of protection of life, property, and the environment.

Consultation is not a statutory requirement for fire management plans, but is a DEWNR policy (DEWNR 2015b), and the consultation strategy for the plan has been endorsed by the Heads of Agencies Committee. Before the development of the plan commenced, the community was invited to submit their views on fire management in the South Para area. This was done to ensure that a wide-range of issues were raised early and could be considered within the plan. Significant benefits were gained by undertaking a collaborative approach. Engagement with the community has provided local knowledge, resulting in improved cross-tenure fire management.

The draft plan was released for public consultation for a period of four weeks in August 2013. In response to the Sampson Flat bushfire a review of the plan was undertaken in 2015. The final plan was put forward to the Native Vegetation Council's Fire Committee for endorsement, before it was approved by the Heads of Agencies Committee in December 2014, and then amendments noted by the Heads of Agencies Committee in May 2016, subsequent the Sampson Flat bushfire review.

2.7 Plan review and currency

The plan will undergo a major review after ten years of implementation, or earlier if required. Causes for earlier review could include legislation changes, altered fuel hazards, large-scale bushfires, and new information relevant to the risk assessment (DEWNR 2015b). In addition to this, the CFS are developing BMAP, which may influence the works and/or treatments the plan seeks to achieve by planning for fire at a landscape-scale, regardless of tenure.

An annual works program will be derived from the recommendations listed in the plan by the MLRFC and reviewed on an annual basis.

3 BUSHFIRE ENVIRONMENT

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

3.1 Description of the Planning Area

3.1.1 Location and included lands

The South Para planning area covers approximately 20 900 hectares (ha) of public land falling between the Barossa and Lenswood Valleys of the Mount Lofty Ranges, incorporating the entire Mount Crawford Forest plus adjoining conservation land and reservoir reserves used to store Adelaide's drinking water (Figure 1).

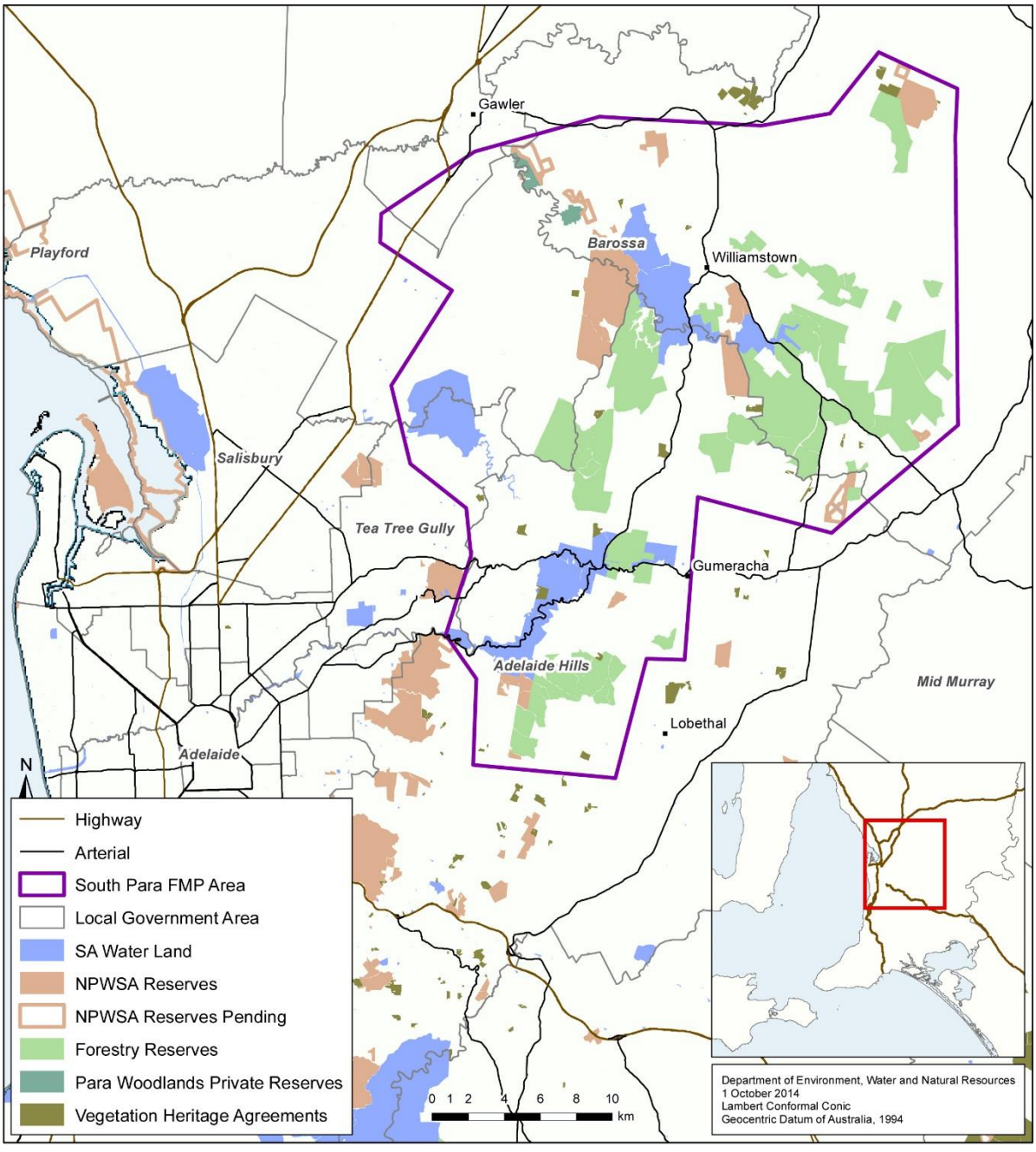

FIGURE 1 – SOUTH PARA FIRE MANAGEMENT PLAN AREA

Five local government areas fall within the planning area. The Adelaide Hills Council and Barossa District Council cover the majority of the included lands, with the City of Tea Tree Gully, City of Playford, and Town of Gawler covering small areas on the western edge of the planning area.

The plan incorporates eight conservation parks, eight native forest reserves, six reservoir reserves, one recreation park, plantation forests, and Crown land in the South Para district. Specifically this includes:

- Mount Crawford Forest Reserve, which includes Cudlee Creek, Coralinga, Kaiserstuhl, Kersbrook, Little Mount Crawford, Mount Gawler, Tower Hill, and Watts Gully NFR managed by ForestrySA
- Barossa, South Para, Little Para, Millbrook, Kangaroo Creek, and Warren Reservoir Reserves managed by SA Water
- Cromer, Cudlee Creek, Hale, Kaiserstuhl, Kenneth Stirling (Burdetts Block), Montacute, Para Wirra, Sandy Creek, Warren, and Wiljani Conservation Parks managed by DEWNR
- Conservation Reserves and other Crown land, including Para Woodlands proposed Conservation Park and a proposed addition to Cromer Conservation Park managed by DEWNR
- privately owned HAs adjoining public land.

Approximately 3 564 ha of the planning area is managed by DEWNR (17%), 12 070 ha by ForestrySA (58%) and 5 271 ha by SA Water (25%).

A total of 27 parcels of Crown land (259 ha) have been included in the plan. Crown land dedicated to, owned by, or under the control of the MSEC was identified for inclusion in the plan through a risk assessment process, which considered existing and potential issues for fire management. The proximity to built assets, presence of native vegetation, location, and size of the parcel was considered during this process.

Nine landowners expressed their interest in including their HA areas in the plan. These areas (157 ha; Table 2) will be included subject to final approval by the HA owner. The inclusion of HA in the plan does not change the fire management responsibilities of private landholders and the final decision to undertake any proposed activity still rests with the respective landholder. The CFS, DEWNR, ForestrySA, and/or SA Water will provide support and advice to these neighbours where appropriate, and will only contribute toward the implementation of any recommended action on private land where there is demonstrated benefit or shared risk to public land.

Hereafter, 'included lands' means the proclaimed reserves and Crown lands managed by DEWNR, ForestrySA, and SA Water that are located within the planning area, and HA where the owners have agreed to participate in this plan.

TABLE 2 – OTHER LANDS INCLUDED IN THIS FIRE MANAGEMENT PLAN

Tenure	Custodian	Title Reference	Plan	Parcel	Area (ha)
Unalienated Crown land	MSEC	CR 5760/391 CR 5762/326 CR 5766/817 CR 5760/396 CR 5760/398 CR 5761/975	Hundred of Para Wirra	Section 256, 338, 470, 475, 478, 496 and 508	5.2
		CR 5310/402	Deposited Plan 44106	Allotment 1	1.9
		CR 5313/706	Deposited Plan 44244	Allotment 10	3.9
		CR 5335/135	Deposited Plan 44597	Allotment 50	2.1
		CR 5318/27	Deposited Plan 44433	Allotment 50	4.8
		CR 5760/409	Hundred of Talunga	Section 76	0.8
		CR 5760/537	Hundred of Moorooroo	Section 599	1.2
		CR 5766/806 CR 5905/84	Hundred of Munno Para	Section 3187 and 3188	69.2
		CR 5763/822 CR 5763/82	Filed Plan 11632	Allotment 1 and 2	22.8
		CR 5750/461 CR 5750/462	Deposited Plan 24726	Allotment 1 and 2	40
		CR 5779/767	Deposited Plan 29986	Allotment 1	8
		CT 5546/745	Deposited Plan 7992	Allotment 42	28.4
		CR 5763/806 CR 5763/807	Deposited Plan 6328	Allotment 80 and 85	5.9
		CR 5760/371 CR 5760/372 CR 5760/374	Hundred of Barossa	Section 338, 339, 341	2.1
		CR 5748/275	Filed Plan 30401	Allotment 1	.2
		CR 5305/764	Deposited Plan 43885	Allotment 1	4.1
		CR 5760/386 CR 5760/387 CR 5760/388	Hundred of Onkaparinga	Section 207, 216 and 537	4
Proposed Addition to Cromer CP	MSEC	CR 5748/825 CR 5744/253 CR 5748/826 CR 5764/781 CR 5751/450	Hundred of Talunga	Section 1, 2, 4, 82 and 6397	135.4
Proposed Addition to Para Woodlands CP	MSEC	CR 5764/792	Hundred of Munno Para	Section 90	1.3

		CT 5905/437	Deposited Plan 60894	Allotment 17	80
		CT 5905/435	Deposited Plan 60894	Allotment Piece 13, 14 and 15	72.6
		CT 5455/303	Deposited Plan 20808	Allotment 4	12
		CT 5461/895 CT 5462/231	Deposited Plan 19107	Allotment 1 and 2	20
		CT 5812/245	Filed Plan 171805	Allotment 354	26.6
		CT 5801/51	Filed Plan 171806	Allotment 355	19.3
Proposed Addition to Kaiserstuhl CP	MSEC	CT 5837/926	Hundred of Moorooroo	Section 724	32.4
Heritage Agreement	Freehold	CT 5405/631	Hundred of Para Wirra	Section 245	2
		CT 5199/914	Hundred of Para Wirra	Block 298	5.9
		CT 5485/828	Filed Plan 7414	Allotment 33	19
		CT 5750/181	Filed Plan 155039	Allotment 24	25.7
		CT 5595/239	Hundred of Talunga	Section 6360	9.8
		CT 5739/195	Filed Plan 155256	Allotment 41	3.8
		CT 5194/906	Hundred of Moorooroo	Section 734	32.3
		CT 5194/967	Hundred of Moorooroo	Section 735	32.1
		CT 5454/310	Deposited Plan 19962	Allotment 2	26
Nature Foundation SA	Freehold	CT 6027/217	Deposited Plan 79212	Allotment 711	100.2
		CT 6058/183	Deposited Plan 81785	Allotment Piece 204 and 205	161

3.1.2 Surrounding land use

Land use surrounding the included lands in the plan are predominantly rural, residential, and agricultural, with activities focused generally on hobby farming, livestock, horticulture, viticulture, and forestry.

The Mount Lofty Ranges are the interface between metropolitan Adelaide and rural South Australia. The highly fertile soils of the valleys and foothill soils, accompanied by good rainfall in the region, make it an ideal location for the production of fruit and wine.

The urban sprawl of Adelaide and Gawler is expanding, with high density housing developments planned for previously designated agricultural areas. These new developments are going to require a significant change in fire management activities on public land in the western section of the planning area, adjacent to Concordia, Evanston, and Greenwith. Some key hills settlements abut public land; one of the most at risk is Williamstown, which is north-east of the South Para Reservoir Reserve.

The native vegetation across the Mount Lofty Ranges is largely fragmented due to the impacts that occurred during European occupation. Much of the remaining vegetation is

on infertile soils, in steep, inaccessible terrain as it was not deemed suitable for agriculture or forestry. On adjacent land, most of the remnant native vegetation is found in areas less than 10 ha in size and in some areas, only along roadsides (AMLR NRM Board 2008). Within the South Para district, the remnant native vegetation protects important biodiversity values and drinking water catchments. A significant corridor of relatively continuous mature stringybark forest (dominated by *Eucalyptus obliqua* and/or *E. baxteri*) extends from Williamstown as far south as Stirling.

Map 1 (Terrain, Tenure and Infrastructure; online) provides an overview of the planning area, including surrounding land tenure.

3.1.3 Terrain

The terrain varies across the South Para planning area from steep riverine gorges and valleys, such as those at Cudlee Creek and Montacute, to gently undulating hills near Mount Pleasant. The steepest areas are often inaccessible which makes fire management challenging. Hill slopes of the ranges are generally characterised by sandy loam to clay loam soils. Ironstone soils over weathered rock over clay subsoils exist on some hilltops and plateaus.

The planning area incorporates six reservoir reserves and their associated tributaries. This includes the South Para, Barossa, Warren, Little Para, Kangaroo Creek, and Millbrook reservoirs, with the majority of the planning area falling within the Torrens, Gawler, and Little Para River catchments.

3.1.4 Climate and Fire Weather

The planning area experiences a Mediterranean maritime climate of mild, wet winters and dry, warm to hot summers. Average annual rainfall varies from approximately 500 mm on the plains near Gawler up to 900 mm near Montacute and over 700 mm at Mount Crawford.

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

3.2 Climate Change and Bushfire

The Australian climate has shown to be changing (CSIRO & Bureau of Meteorology 2014; Hughes & Fenwick 2015), and that trend is mirrored in South Australia (DENR 2010b; Suppiah *et al.* 2006). Hennessy *et al.* (2005) documented that since 1950, rainfall has decreased in south-east Australia, droughts have become more severe and the number of extremely hot days has risen. With South-eastern Australia already one of the most bushfire-prone areas in the world, it is projected that it is likely to become hotter and drier in the future. Warmer and longer Fire Danger Seasons are likely (CSIRO & Bureau of Meteorology 2014; Hughes & Fenwick 2015), 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). The impacts of these changes on fire management are discussed below.

- Warming temperatures and a tendency for reductions in average annual rainfall (Suppiah *et al.* 2006) may lead to an increased incidence and intensity of fires in the future.
- Increases in the frequency of fire danger days has also been predicted (Williams, Karoly & Tapper 2001), which will potentially lead to longer fire danger seasons and may reduce the time available for prescribed burning (Hennessy *et al.* 2005).
- Vegetation growth is also likely to be influenced by a changing climate, contributing to variations in fuel availability (Bardsley 2006; Hughes 2003).
- Increased fuel dryness in some vegetation types and reductions in relative humidity due to rising temperatures is likely to be prevalent in areas where rainfall has decreased (Hughes 2003).

The South Australian Government acknowledges the significance of climate change and the potential impacts it will have on managing bushfire risk. With bushfire seasons increasingly longer and overlapping with the Northern Hemisphere, Australia's bushfire preparedness will come under elevated strain (Hughes & Fenwick 2015). In response to the challenge of climate change the South Australian Government has developed *South Australia's Climate Change Strategy 2015 – 2050: Towards a low carbon economy* (DEWNR 2015c). The Strategy identifies managing bushfire risk as a key component of Theme 5: Creating a Prosperous and Resilient State:

> *Changes in our climate will impact the way we all live and work in South Australia. The responsibility for preparing for these changes will involve all South Australians including individuals, communities, governments, non-government organisations and the business and industry sectors.*

While land managers may grapple with the uncertainty of the climate predictions, adaptive management principles remain the most logical strategy for fire management programs. Expanding our options for dealing with climate change will be critical to delivering effective responses in the future. This preparedness is especially important given that the precise timing and magnitude of climate change impacts are uncertain (DEWNR 2012).

3.3 Extreme Fire Conditions

Strong winds, combined with high temperatures and low humidity increases the likelihood of extreme fire intensity and behaviour. Under such conditions, suppression activities are unlikely to be effective. Fires will be unpredictable and fast moving. 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.

Buildings constructed to the requirements of the *Australian Standard for Construction of Buildings in Bushfire Prone Areas* (*AS3959*) will not necessarily survive a bushfire event under all conditions, but will reduce the risk to occupants (Eadie & Herbert 2009).

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

- Fire Danger Indices of Very High or greater
- Very High to Extreme overall fuel hazard levels

- broad areas of continuous Very High to Extreme fuel hazard levels, making fire suppression less effective
- the presence of Very High to Extreme bark fuel hazard levels, increasing the chance of spot fires and crown fires
- low humidity, decreased soil and fuel moisture, particularly during drought years
- strong winds shifting direction during the course of a fire, typically blowing from the north, then shifting to west or south-westerly
- steep terrain.

3.4 Fire History

3.4.1 Mapping Fire Occurrences

Map 3 (Fire History; online) has been compiled from the fire incident records kept by DEWNR and ForestrySA. The quality of this mapping varies, depending on the method of capture. Many smaller fires, typically 0.5 ha in size or less and fires outside public land have not been mapped. Consequently, the mapped fires should be regarded as a minimum estimate of fire occurrences.

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

3.4.2 Bushfires

Detailed records of recent fire incidents that have occurred within or immediately adjacent to the included lands are stored within DEWNR's fire reporting database. This database along with spatial records from ForestrySA and any other historical records were reviewed during the development of the plan. All fire history data are available at Fire Management Maps online.

Since 1960 more than 235 records pertaining to bushfire incidents have occurred within or adjacent the planning area. Some of the larger incidents include:

- 1960 bushfire at Mount Gawler (1 467 ha)
- 1965 Gumeracha to Harrogate bushfire (1 798 ha)
- 1971 bushfire that burnt to the north of the Barossa Reservoir Reserve and private land near Williamstown (876 ha)
- 1975 bushfire that burnt from Para Wirra to the South Para Reservoir Reserve (1 681 ha)
- 1976 bushfire at Kaiserstuhl (Mitchell 2015, pers. comm.)
- 1983 Ash Wednesday bushfire burnt Montacute CP, Coralinga NFR, Cudlee Creek NFR, Millbrook RR, Kangaroo Creek RR, and the Chain of Ponds area (9 125 ha).
- 1988 Mewett Road, Kersbrook to Watts Gully bushfire (360 ha)
- 1988 Mount Gawler bushfire (172 ha)
- 1990 bushfire that travelled from Millbrook Reservoir Reserve to Gumeracha (670 ha)
- 1996 Mount Torrens to Palmer bushfire (3 122 ha)
- 2004 Little Para RR bushfire that burnt the majority of the reservoir reserve and disrupted power to Adelaide (1 177 ha)
- 2013 Cherryville bushfire burnt Kenneth Stirling CP and Hornes Forest Locality, which is part of the Coralinga NFR (621 ha)

- 2014 Flaxman Valley bushfire (253 ha)
- 2014 Eden Valley bushfire (24 628 ha)
- 2015 Sampson Flat bushfire (12 569 ha)
- 2015 Pinery bushfire (82 500 ha).

3.4.3 Traditional Burning Practices

There is a lack of knowledge regarding fire history and traditional burning practices throughout the AMLR region. Sources indicate that traditional use of fire across the region was undertaken. Future aspirations for traditional fire management will be supported and where appropriate traditional knowledge factored into future fire management.

3.5 Prescribed Burning

Prescribed burning is the planned application of fire under prescribed environmental conditions and within defined boundaries for fuel hazard management, mitigating bushfire risk and to achieve ecological and research objectives. The CFS is the lead agency in fire management and suppression.

In 2009 the MLRFC was formed with representation from the CFS, DEWNR, ForestrySA, and SA Water. The cooperative seeks to deliver joint agency integrated prescribed burning and coordinated bushfire response arrangements across the planning region (MLRFC 2009).

The CFS, DEWNR, ForestrySA, and SA Water have agreed to collaborative arrangements to reduce the impact of bushfires on public land (DENR 2010a).

Prescribed burning will be carried out in the plan area in the future to achieve fire management objectives. Fuel reduction in A-, B-, and C-zones is discussed in Section 5.3.4.

3.5.1 Prescribed Burning History

Prescribed burning has been an important land management tool for ForestrySA for over 60 years. Records indicate that ForestrySA began prescribed burning within the planning area in 1951: two burns of 2.44 ha and 5.86 ha were undertaken at Watts Gully. Regular burning since 1951 has been practised within the planning area, predominantly by ForestrySA, to reduce fuel loads and create mosaics of successional stages of vegetation. DEWNR commenced a statewide prescribed burning program in 2004, and SA Water in 2008 (DEWNR 2015b; SA Water 2012).

The largest prescribed burn to date occurred in Mt Gawler NFR in 1977 and covered 262 ha. Over 117 prescribed burns have been undertaken within the planning area since 1951.

3.6 Vegetation Communities

Floristic mapping for this plan uses a compilation of regional vegetation mapping data that has been reclassified to comply with the National Vegetation Information System (NVIS) classification for Australia. 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 the plan MVS have been used as these groupings are accepted by fire managers for predicting maximum overall fuel hazard levels (see Section 4.2.2). There are 12 MVS within the planning area that have been mapped. Map 2 (The Vegetation Communities & Significant Species; online) shows the distribution of MVS in the

planning area. Table 3 lists the species composition for each MVS and the Ecological Fire Management Guidelines (EFMG) are outlined in Table 6.

TABLE 3 – DOMINANT SPECIES LAYERS FOR MAJOR VEGETATION SUB-GROUPS

MVS No.	MVS Name	Dominant Species Layers
5	*Eucalyptus* forests with a grassy understorey	*Eucalyptus leucoxylon* ssp., *Medicago* sp.*, *Bromus rubens**, *Avena barbata, Lolium* sp., *Astroloma conostephioides, Austrostipa elegantissima, Austrodanthonia caespitosa, Chrysocephalum apiculatum.*
8	*Eucalyptus* woodlands with a shrubby understorey	*Eucalyptus baxteri, E. leucoxylon* ssp., *E. fasciculosa, E. goniocalyx* ssp. *goniocalyx , E. obliqua, Allocasuarina verticillata, A. muelleriana* ssp. *muelleriana, Xanthorrhoea semiplana* ssp. *semiplana, Acacia pycnantha, A. paradoxa, Banksia marginata, Hakea carinata, H. rostrata, Callitris gracilis, Astroloma conostephioides, Calytrix tetragona, Spyridium parvifolius, Leptospermum myrsinoides, Lepidosperma semiteres, Pultenaea daphnoides, Lomandra multiflora* ssp. *dura, Hibbertia riparia, Olearia ramulosa.*
9	*Eucalyptus* woodlands with a grassy understorey	*Eucalyptus camaldulensis* var. *camaldulensis, E. leucoxylon* ssp., *E. fasciculosa, E. odorata, E. porosa, Banksia marginata, Acacia pycnantha, A. paradoxa, Callitris gracilis, Xanthorrhoea semiplana* ssp. *semiplana, Olea europaea* ssp. *europaea**, *Austrostipa* sp., *Austrodanthonia* sp, , *Lomandra* sp., *Poa* sp., *Themada triandra, Phalaris* sp.*, *Bromus* sp.*, *Avena barbata**, *Briza maxima**, *Senecio pterophorus**, *Hibbertia exutiacies, Vulpia* sp.*, *Astroloma humifusum, A. conostephioides, Olearia ramulosa, Medicago* sp.*, *Leptospermum myrsinoides, Arthropodium strictum, Acrotriche fasciculiflora.*
12	*Callitris* forests and woodlands	*Callitris gracilis, E. leucoxylon* ssp., *E. fasciculosa, Avena barbata**, *Austrostipa elegantissima, Astroloma conostephioides, Bromus diandrus**, *Rhagodia parabolica, Leptomeria aphylla, Briza maxima**, *Leptomeria aphylla, Chrysanthemoides monilifera, Calytrix tetragona.*
19	*Eucalyptus* low open woodlands with tussock grass	*Eucalyptus camaldulensis* var. *camaldulensis, E. leucoxylon* ssp., *Linum trigynum, Briza maxima**, *Anagallis arvensis, Avena barbata**, *Austrostipa elegantissima, Austrodanthonia caespitosa.*
21	Other *Acacia* tall open shrublands and shrublands	*Acacia paradoxa, A. pycnantha, Banksia marginata, Eucalyptus leucoxylon* ssp. *leucoxylon, Xanthorrhoea semiplana* ssp., *Leptospermum continentale*, *L. myrsinoides.*
26	*Casuarina* and *Allocasuarina* forests and woodlands	*Allocasuarina verticillata, Banksia marginata, Eucalyptus fasciculosa, E. viminalis* ssp., *Acacia pycnantha, A. retinodes* var. *retinodes, Xanthorrhoea semiplana* ssp., *X. quadrangulata, Bursaria spinosa* ssp. *spinosa, Themeda triandra, Gonocarpus elatus, Lomandra multiflora* ssp. *dura, Lomandra densiflora, Astroloma humifusum, A. conostephioides, Aristida behriana, Olea europaea* ssp. *europaea, Dodonaea viscosa* ssp. *spatulata, Lomandra* sp., *Calytrix tetragona, Briza maxima**.
30	Heath	*Leptospermum continentale, Acacia retinodes* var. *retinodes, Epacris impressa, Hibbertia* sp., *Dianella revoluta.*
32	Other shrublands	*Xanthorrhoea semiplana* ssp., *X. quadrangulata, Maireana aphylla, Dodonaea viscosa* ssp. *spatulata, Leptospermum* sp., *Austrostipa gibbosa.*
38	Wet tussock grassland, herbland and sedgeland	*Eucalyptus camaldulensis* var., *Lepidosperma longitudinale, L. concavum, Juncus kraussii, Cyperus gymnocaulos, Phragmites australis, Typha domingensis, Samolus repens, Isolepis* sp., *Chorizandra* sp., *Eleocharis* sp.
39	Mixed chenopod, samphire and forblands	*Drosera* sp., *Vittadinia* sp., *Chrysocephalum apiculatum, Bulbine bulbosa, Aristida behriana, Caladenia carnea* var. *carnea, Hibbertia* sp.
48	*Eucalyptus* open woodlands with a grassy understorey	*Eucalyptus leucoxylon* ssp, *Lomandra effusa, Austrostipa* sp., *Austrodanthonia* sp., *Lomandra* sp., *Poa* sp., *Themada triandra, Phalaris* sp.*, *Bromus* sp.*, *Avena barbata**, *Briza maxima**.

*denotes introduced species

3.7 Values and Assets

3.7.1 Visitor Use

ForestrySA

Forest reserves in the planning area receive a significant number of visitors per year. During 2008-09, ForestrySA Forest Information Centres received over 12 500 enquiries, while nearly 35 000 people participated in 316 events, and more than 145 000 forest visitors were recorded across the Mount Lofty Ranges (ForestrySA 2006a). Mount Crawford Forest Reserve hosts approximately 60 000 visitors per year. This includes campers, walkers, cyclists, picnickers, horse riders, fossickers (ForestrySA 2006a), and participants in large events including orienteering, horse riding, scout jamborees, sled dog racing, and car rallies. It is estimated that less than half of the actual visitations are recorded by permits and vehicle counters; it can be assumed that actual visitor numbers are much higher (ForestrySA 2006a).

ForestrySA provides a variety of accommodation options from campsites and basic hut/shelters to a house with full facilities at the Thomas Hill Study Centre at Cudlee Creek.

SA Water

The Whispering Wall is a tourist attraction that is located within the Barossa Reservoir Reserve. Statistics collected by SA Water in 2009, show that during December, on a typical weekday approximately 164 visitors would visit the Whispering Wall, while up to approximately 308 would visit on a Saturday or Sunday.

DEWNR

Para Wirra Conservation Park was established as a National Park in 1962, dedicated as a Recreation Park in 1972 (DELM 1993), and re-dedicated as a Conservation Park in 2016. It is situated in a bushfire prone area in the northern Adelaide Hills, and is only 40 minutes from Adelaide and 20 minutes from Gawler, Golden Grove and Elizabeth. The park is open to visitors from 8:00 am to sunset every day except Christmas Day. Bushwalking is the most popular activity at the park, and many of the hikes are remote from vehicle access (DELM 1993). The park also provides day picnic areas and gas barbeques in a bushland setting on the main central ridge in the park where some open grassy areas occur (DELM 1993; DENR 2010d; Government of South Australia 2013; SA Water 2008).

The majority of visitors to the park arrive by car and are reasonably self-sufficient. The park may be closed on days of extreme fire danger on the Chief Executive Officer's direction (DENR 2010d). No evacuation plan or nominated safe zones exist within this park.

Management Strategies

Visitor Use

1. Consider closures of DEWNR reserves when significant fire weather is forecast.
2. Prepare visitor Bushfire Survival Plans as required and review annually. Plans for individual visitor facilities should be developed by the lessee, owner, or manager.
3. Educate and encourage visitors to reconsider travel into and through areas of high bushfire risk on days of heightened fire danger.
4. Implement appropriate fire management strategies as shown on Map 4 (Fire Management & Access; online) to increase visitor safety.

3.7.2 Forestry Assets

ForestrySA's Mount Crawford Forest Reserve represents high value economic, environmental and recreational assets, which ForestrySA seeks to protect from bushfire events (ForestrySA 2006d).

ForestrySA establishes and maintains significant areas of softwood plantations, which provide sawlog products to local industry and periodically for export, which contribute significantly to the local economy. The dominant species being *Pinus radiata* (Radiata Pine) comprises approximately 97% of the current plantation area.

Radiata Pine is a fire sensitive species, which responds poorly to fire, therefore bushfires represent a significant risk to ForestrySA plantations, as demonstrated by the 1983 Ash Wednesday fires when approximately 2 920 ha of Radiata Pine plantations were destroyed. ForestrySA manages commercial softwood plantations and NFR in the planning area in accordance with ForestrySA policies and procedures, which identify methods for plantation establishment, thinning, harvesting and fire risk mitigation (ForestrySA 2011).

Management Strategies

Forestry Assets	5. Implement appropriate fire management strategies for the protection of forestry assets as shown on Map 4 (Fire Management & Access; online).
	6. Ensure that Forest Reserves are managed in accordance with the *ForestrySA Plantation Forestry Manual* (ForestrySA 2011) and the *ForestrySA Fire Management Plan* (ForestrySA 2012).

3.7.3 Built Assets

There are a number of significant built assets at risk from bushfires within and adjacent to reserves including:

- Mount Crawford Forest Headquarters
- DEWNR office and workshop at Para Wirra CP
- SA Water works depot and office at South Para and Millbrook reservoir reserve
- power substations, powerlines, and SA Water infrastructure (tanks, pipes, treatment plants, and pump stations, etc.)
- telephone exchanges and telephone and GRN towers.

The agencies will undertake fire management works and activities to minimise the likelihood of fire impacting built assets (both public and private buildings).Appendix 1 – Recommended Works details significant assets within and adjacent to the included lands and the corresponding fire management strategies. Map 1 (Terrain, Tenure & Infrastructure; online) shows the location of assets within the planning area.

Water Infrastructure

Water management and infrastructure development is a key feature of the South Para planning areas and began in 1857 with the construction of the Gorge Weir, a diversion weir for Thorndon Park Reservoir (DENR 1997). Today SA Water continues to manage a number of Reservoir Reserves and infrastructure, namely:

- Little Para Reservoir
- Millbrook Reservoir
- Kangaroo Creek Reservoir
- Gumeracha Weir
- Gorge Weir
- South Para Reservoir
- Barossa Reservoir
- Warren Reservoir.

Water Quality Management

SA Water reservoirs and underground basin reserves are strategically positioned within catchments throughout South Australia. Their purpose is to collect and store bulk water prior to distribution to metropolitan Adelaide and other regional centres. The reserves directly influence the quality of rainfall run-off that enters the reservoirs and underground basins. Native vegetation acts as a natural buffer and filter for removing and trapping nutrients and sediment from run-off. The removal or disturbance of the native vegetation surrounding the reservoirs through events such as uncontrolled bushfires will have a detrimental effect on water quality. A sufficient buffer of unburnt native vegetation should remain at the water's edge to minimise this.

Bushfires produce large quantities of bioavailable nutrients such as nitrogen and phosphorus, which are transported to reservoirs via run-off as ash. Intense fires may result in the addition of minerals from the direct effects of heating the soil. The resulting increase in nutrient levels may lead to unwanted algal and bacterial blooms, which may in turn present significant health risk issues. In addition to increased nutrient levels, ash and sediment can affect the colour, turbidity, taste, and odour of water. Any streams, channels, or gullies that flow directly into a reservoir within the burn zone should have sediment traps installed dependant on rainfall forecast.

Management Strategies

Built Assets

7. Implement appropriate fire management strategies to protect assets as shown on Map 4 (Fire Management & Access; online).
8. Encourage adjacent property owners to work with the CFS and local government to implement appropriate and coordinated fire management works on their own land to minimise the threat of fire.
9. Ensure that infrastructure critical to Adelaide's water supply is protected against the threat of fire.
10. Ensure that fuel reduction of any native vegetation adjacent to or surrounding reservoirs is managed appropriately to minimise detrimental effect on water quality.
11. Ensure revegetation is consistent with fire management zoning and fire is excluded from juvenile revegetation sites.

3.7.4 Cultural Heritage

Information on Aboriginal and European heritage is collected during prescribed burn planning as part of the Environmental Assessment (EA) (refer to Section 5.3.5) (DEWNR 2013b). Any fire operation must be in accordance with the *DEWNR Protection of Cultural Heritage Procedure* (DEWNR 2015b).

Aboriginal Heritage

The included lands comprising the South Para planning area form part of the Country of the Ngadjuri and Peramangk people as described by Tindale (1974). The Plan is within the Kaurna Native Title claim, as such this plan will comply with the *Native Title Act 1993* (Cwlth).

Aboriginal heritage sites including painting, rock art, campsites, and scar trees have been recorded throughout the planning area. Kaiserstuhl Block (refer 5.3.6 Fire Management Blocks), Gawler Block, and Mount Crawford Block contain sites that have been listed on the Central Archive, which includes the Register of Aboriginal Sites and Objects (the register). However, the Aboriginal Affairs and Reconciliation Division of the Department of the Premier and Cabinet have no record of Aboriginal Heritage Sites in the area of the reservoir reserves. It should be noted that the register is not a comprehensive record of all Aboriginal sites and objects in South Australia, therefore sites or objects may exist in the planning area, even though the register does not identify them.

When implementing this plan, the agencies will comply with the *Aboriginal Heritage Act 1988* to facilitate the protection of sites during bushfire suppression and prescribed burns.

European Heritage

It is likely that the first activities by early settlers in the South Para planning area comprised small-scale farming and extensive grazing, as described by ForestrySA (ForestrySA 2006a,2006d). Dead ring-barked trees indicate early European clearing methods undertaken by owners to provide greater grazing areas. By 1868, settlers had established isolated dwellings, initially of timber then later of stone.

Gold mining was also conducted throughout the region, predominantly during the late 1860s, 1890s, and again during the depression years. A gold rush in 1885 saw at least 2 000 miners

live and work in the area (Drew 1996) following the discovery of gold in 1884 (Gordon & Manser 2003).

Scattered ruins can be found throughout the region such as the old stone ruin, *Stone Hut* (R Brockhoff pers. comm. in ForestrySA 2006d), gold mining shafts, adits, tunnels, remnants of a crusher, furnace and tumbler, and stone ruins associated with the areas gold mining and agricultural history (DELM 1993; ForestrySA 2006b).

The region's timber supply was also extensively exploited by the early settlers. The first timber cutting was for poles, 80 to 90 foot long, that were used for the wharves at Port Adelaide, the first bridge at Murray Bridge, and the barrages at Goolwa (ForestrySA 2006a,2006d). Additional timber-based industries occurred in parallel, such as firewood, used as bakers wood for bakeries, brick kilns at Nuriootpa, and furnaces at the Yalumba Winery (ForestrySA 2006d,2006e). Larger eucalypts were used for sleepers (ForestrySA 2006c). During the 1890s and from 1923 to 1936, bark from wattles (*Acacia* spp.), once used by the tanning industry, was stripped from trees on leased land within the boundaries of what is now Para Wirra CP (DELM 1993). This practice was also extended into the adjoining Kersbrook NFR when in the 1930s approximately 300 ha of *Acacia pycnantha* was planted for wattle bark harvesting (ForestrySA 2006a).

A consequence of this timber exploitation is that many of the trees throughout the region - Pink Gum (*Eucalyptus fasciculosa*), Blue Gum (*Eucalyptus leucoxylon*), Messmate Stringybark (*Eucalyptus obliqua*) and Brown Stringybark (*Eucalyptus baxteri*) - are characterised by multi-stemmed coppice regrowth (ForestrySA 2006c).

Management Strategies

Cultural Heritage

12. Implement appropriate fire management strategies for the protection of cultural assets as shown on Map 4 (Fire Management & Access; online).

13. Ensure liaison at bushfires occurs to identify cultural assets, where time allows. Once the fire has passed evaluate sites to establish if any damage has occurred.

14. Ensure suppression strategies take into account significant cultural assets to minimise impacts from these activities and where necessary undertake post-fire rehabilitation.

3.7.5 Natural Values

Flora, Fauna and Ecological Communities

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.

Fire response information, where known, is included for species and communities of conservation significance in Appendix 2 – Fire Response of Rated, Significant and Introduced Flora Species, Appendix 3 – Fire Response of Rated and Significant Fauna Species, and Appendix 4 – Ecological Communities of Conservation Significance.

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

- nationally rated species listed as Threatened (with a rating of Extinct, Critically Endangered, Endangered or Vulnerable) under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- migratory species listed under the EPBC Act
- South Australian rated species listed as Threatened (with a rating of Endangered, Vulnerable or Rare) under the NPW Act, Revised Schedules 7, 8 and 9
- species provisionally listed as Threatened (with a rating of Endangered or Vulnerable) in South Australia included on the unpublished *DEWNR Provisional List of Threatened Ecosystems of South Australia* (DEH 2005).

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

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

The SA Government has developed the conservation strategy *No Species Loss*, which aims to halt and where possible reverse the decline in the state's terrestrial, aquatic, and marine biodiversity over the next 10 years (DEH 2007). The plan will contribute to the goals and objectives of *No Species Loss* by ensuring that fire management activities in C-zones are consistent with the *Ecological Fire Management Guidelines for Native Vegetation in South Australia* (DEWNR 2013a)(see section 5.4).

In addition to the information provided within the appendices, species response and ecological information for selected significant flora, fauna, and ecological communities have been detailed in the following section. These are species and ecological communities listed as threatened at a national or state level for which appropriate fire management is regarded as being significant in their long-term conservation.

Southern Brown Bandicoot

The Southern Brown Bandicoot is the last remaining species of bandicoot occurring naturally in South Australia. The subspecies *Isoodon obesulus obesulus* is rated Endangered at the national level and Vulnerable in South Australia. Regionally, a recovery plan has been prepared for the species, which is aimed at maintaining or increasing the distribution and abundance of the Southern Brown Bandicoot in the Mount Lofty Ranges (Long 2010). New taxonomic information is currently being assessed for the Southern Brown Bandicoot, which may change the subspecies classification and hence the conservation status of the taxon that occurs in the Mount Lofty Ranges. A national recovery plan is currently under development for the species, however, this is likely to be amended based on the

aforementioned taxonomic review. Specific information on how the Southern Brown Bandicoot responds to fire is included in Appendix 3 – Fire Response of Rated and Significant Fauna Species. The *Ecological Fire Management Strategy for the Southern Brown Bandicoot (Isoodon obesulus obesulus*) has been published and is available online (DENR 2011b). This document should be referred to as the primary source of information for this species when implementing the following management strategies.

Southern Brown Bandicoots occupy a variety of structural vegetation communities including sclerophyllous forest and woodland, shrubland, and heathland. Pivotal to their habitat choice is the presence of a dense heathy or shrubby understorey up to one metre tall (MVS No. 8) (DEH 2006a).

The Southern Brown Bandicoot has previously been recorded in the Cudlee Creek, Mount Crawford, and Mount Gawler Blocks. Only one of these populations is confirmed to be extant in this area. This population is only known from a hair sample and observations of diggings and is therefore likely to be small. This population is the northern most population within the region and is at high risk of being burnt out in a single bushfire event. Map 2 (Vegetation Communities & Significant Species; online) shows records of threatened species within the planning area, including the Southern Brown Bandicoot. To protect the species, data are buffered to prevent fine-scale identification of their exact location.

The *Recovery Plan for the Southern Brown Bandicoot in the Mount Lofty Ranges* advocates the development and implementation of fire management plans that minimise the likelihood of bushfires burning entire habitat patches, as well as the implementation of monitoring programs to determine the effect of fire management regimes on Southern Brown Bandicoot populations (Long 2010). Providing a mosaic of successional stages is considered desirable. Current knowledge suggests that fire regimes that breach the EFMG requirements, being either too frequent or infrequent, simplify habitat structure (in the medium and long-term), which is undesirable.

The Mount Lofty Ranges Southern Brown Bandicoot Recovery Team supports the use of prescribed burns where they assist in achieving recovery actions. The effects of fire on the Southern Brown Bandicoot will be monitored to improve knowledge of the species response to fire.

Management Strategies

Southern Brown Bandicoot

15. Implement appropriate fire management strategies identified in the EFMS that will minimise the risk of local extinctions in the event of a bushfire.
16. Conduct prescribed burning to improve habitat suitability as identified in the Recovery Plan.
17. During bushfires, attempt to retain unburnt patches as refuge areas to minimise the risk of local extinctions.
18. Monitor the effects of fire on the Southern Brown Bandicoot populations and preferred habitat and structure. Use this information to inform the DEWNR vital attributes database (Appendix 2 – Fire Response of Rated, Significant and Introduced Flora Species & Appendix 3 – Fire Response of Rated and Significant Fauna Species).

Chestnut-rumped Heathwren

The Mount Lofty Ranges Chestnut-rumped Heathwren (*Hylacola pyrrhopygia parkeri*) is endemic to the Mount Lofty Ranges in South Australia (TSSC 2005), and is listed as Endangered at the national and state level.

Within the planning area, there are records of occurrence within Warren CP, Mount Gawler NFR and Cudlee Creek CP, although the latter may not be an accurate record. Surveys in recent years were only able to confirm the species at Mount Gawler NFR, making this the most northerly population in the species' range. This area was burnt in the January 2015 Sampson Flat bushfire and current surveys are attempting to ascertain whether the species still persists in the area or has become locally extinct. A review of the subspecies' classification status was conducted following the Sampson Flat and Cox Scrub bushfires, which impacted on two significant populations. The review findings have concluded that the Mount Lofty Ranges Chestnut-rumped Heathwren is now eligible for relisting under the national classification as Critically Endangered. However, this classification is yet to be formally adopted in the relevant state (or federal) government legislation. Map 2 (Vegetation Communities & Significant Species; online) displays records within the planning area. To protect the species, data are buffered to prevent fine-scale identification of their exact location. A threatened species action statement (Long & Bentley 2010) has been developed to provide a detailed overview of the subspecies.

The subspecies inhabits dense heathlands and sclerophyllous eucalyptus woodlands with a dense heathy understorey (MVS 4 and MVS 9 in the planning area) (Pickett 2007). A key habitat requirement is considered to be the presence of low, dense vegetation, which is typically found in areas of rocky ground or rocky outcrops (Pickett 2007).

The Mount Lofty Ranges Chestnut-rumped Heathwren is considered to be threatened by inappropriate fire regimes (TSSC 2005). Fire may influence the abundance of preferred food sources, availability of shelter sites and nesting materials, limit the dispersal capabilities of the subspecies, and contribute to population isolation (Pickett 2007). The subspecies appears to occur at low densities and therefore reductions in the availability of suitable habitat may affect population viability. Specific information on how the Mount Lofty Ranges Chestnut-rumped Heathwren responds to fire is listed in Appendix 3 – Fire Response of Rated and Significant Fauna Species.

In fragmented habitats, like the Mount Lofty Ranges, there is an increased risk of localised extinction if a fire burns a habitat patch in its entirety. Fire management strategies within this plan have been designed to minimise the likelihood of this occurring.

Mount Lofty Ranges Chestnut-rumped Heathwrens have been found utilising regenerating habitat from nine months post-prescribed burning, but the extent to which they use early successional habitats is unknown (Higgins & Peter 2002; Moise & Paton 2008; Pickett 2008). In some habitat types, occasional fires may be required to manage habitat quality for the species by ensuring a dense, diverse shrub/heath layer is maintained. The effects of fire on the Mount Lofty Ranges Chestnut-rumped Heathwren will be monitored to improve knowledge of the species response to fire.

Management Strategies

Chestnut-rumped Heathwren	19. If extant populations are confirmed to still occur in the area, implement appropriate fire management strategies that will minimise the risk of a whole population's habitat burning in a single bushfire event.
	20. If necessary, conduct prescribed burning to improve habitat suitability.
	21. During bushfires, attempt to retain unburnt patches of land as refuge areas to minimise the risk of local extinctions.
	22. Develop and implement an EFMS for the Mount Lofty Ranges Chestnut-rumped Heathwren.
	23. Monitor the effect of fire on Mount Lofty Ranges Chestnut-rumped Heathwren populations and preferred habitat and use this information in future EFMG (Appendix 2 – Fire Response of Rated, Significant and Introduced Flora Species & Appendix 3 – Fire Response of Rated and Significant Fauna Species).

Bassian Thrush

The Bassian Thrush is found across Australia. The subspecies *Zoothera lunulata halmaturina* (South Australian) is restricted to South Australia, occurring on Kangaroo Island, and on the mainland across the Mount Lofty Ranges and the southern Flinders Ranges (DEH 2008b; Department of the Environment 2015). Within the planning area, there are records of occurrence within Cromer, Kaiserstuhl, Mount Crawford, Millbrook, Para, and Watts Gully Block. The Bassian Thrush is listed as Vulnerable under the EPBC Act (Department of the Environment 2015).

The Bassian Thrush prefers densely forested, moist gully environments and so may have relatively limited distributions across many of the parks and reserves in the region (van Weenen 2013, pers. comm.). For this mostly sedentary species (Department of the Environment 2015), a key habitat requirement is considered to be the presence of a damp litter layer, which provides foraging habitat (DEH 2008b). Probing through damp leaf litter, the Bassian Thrush feeds mostly on invertebrates, mainly earthworms and beetles (Department of the Environment 2015).

The Bassian Thrush is considered to be threatened by inappropriate fire regimes, which can make remaining habitat unsuitable for the subspecies (Department of the Environment 2015). Frequent fire and high intensity fires that remove leaf litter and cover are likely to degrade habitat (DEH 2008b; Department of the Environment 2015).The effect of prescribed burning on suitable habitat needs to be consideration to ensure relative availability of habitat within the immediate area. Specific information on how the Bassian Thrush responds to fire is listed in Appendix 3 – Fire Response of Rated and Significant Fauna Species.

A significant area of the species' distribution in the Mount Lofty Ranges was burnt in the January 2015 Sampson Flat bushfire, meaning that its extent in this region may have contracted as a result. Map 2 (Vegetation Communities & Significant Species; online) displays records within the planning area. To protect the species, data are buffered to prevent fine-scale identification of their exact location.

In fragmented habitats, like the Mount Lofty Ranges, there is an increased risk of localised extinction if a fire burns a habitat patch in its entirety. Fire management strategies within this plan have been designed to minimise the likelihood of this occurring. The effects of fire on the Bassian Thrush will be monitored to improve knowledge of the species response to fire.

Management Strategies

Bassian Thrush

24. Implement appropriate fire management strategies that will minimise the risk of local extinctions in the event of a bushfire.
25. During bushfires, attempt to retain unburnt patches of land as refuge areas to minimise the risk of local extinctions.
26. Undertake post-burn weed management to avoid altering habitat structure.
27. Where possible, burning in known Bassian Thrush habitat should be avoided. Where prescribed burning is necessary, consultation with the Threatened Fauna Ecologist should occur.
28. Monitor the effect of fire on Bassian Thrush populations and preferred habitat and use this information in future EFMG (Appendix 2 – Fire Response of Rated, Significant and Introduced Flora Species & Appendix 3 – Fire Response of Rated and Significant Fauna Species).

Declining Woodland Birds

Within the AMLR region, a number of declining woodland birds are now generally restricted to the South Para planning area. The relatively large and contiguous native vegetation remnants that remain in the area subject to this plan are the principal reason these species persist (van Weenen 2013, pers. comm.).

Endangered species (NPW Act):

- Square-Tailed Kite (*Lophoictinia isura*).

Rare species (NPW Act):

- Hooded Robin (*Melanodryas cucullata*)
- Jacky Winter (*Microeca fascinans*)
- Restless Flycatcher (*Myiagra inquieta*)

Declining species in the AMLR:

- Zebra Finch (*Taeniopygia guttata*)
- Brown Treecreeper (*Climacteris picumnus*)
- Southern Whiteface (*Aphelocephala leucopsis*).

Important habitats for the majority of these species are characterised by open woodlands and grassy woodland habitats (examples include box or sheoak woodlands) (Higgins & Peter 2002). Vegetation structure is very important for these species as they typically require open ground/open grassy woodland for foraging. Habitat structure and food sources are likely to be impacted by fire (van Weenen 2013, pers. comm.).

<u>Seed Feeders</u>

Zebra Finch (*Taeniopygia guttata*) are obligate seed feeders. Prescribed burning activities need to take into account the diversity of native grasses and the ability to provide seed year round where populations of Zebra Finch are present (van Weenen 2013, pers. comm.).

Insectivores

The Hooded Robin, Jacky Winter, Restless Flycatcher and Southern Whiteface feed predominately on invertebrates, usually foraging at ground level, which is often bare or with little cover, or in sparse litter around the base of vegetation (Higgins & Peter 2002).

Records of the Southern Whiteface in the AMLR indicate that it favours habitat where dead trees or stumps result from previous fire (Higgins & Peter 2002). Species such as the Hooded Robin and Jacky Winter can occupy and utilise recently burnt habitats. However, their longer term use needs to be considered, as habitat quality can be diminished compared to vegetation of old age class which provides habitat features that are preferred habitat requirements. Prescribed burning in these areas should be carefully considered.

Brown Treecreeper

Brown Treecreepers generally requires open grassy woodland areas and the planning area is one of the last strongholds for the species in the AMLR region. Even as a stronghold, the species appears to be in decline within the region with places like Para Wirra CP supporting very few birds (Carpenter 2013).

Scattered clumps of trees in grassland areas and corridors of trees along riparian systems are important habitats. Increasing tree density and increased shrubbiness of grassy woodland areas are likely to reduce habitat quality for this species (van Weenen 2013, pers. comm.).

The species is highly dependent on old eucalypts (typically box species but also Blue Gum and Red Gum) that have numerous hollows. The risks associated with undertaking prescribed burns in woodlands used by this species includes loss/collapse of significant habitat trees (retreat and nest sites) and the possibility that mass regeneration of eucalypts or wattles will be triggered, which may change the habitat quality for this species (van Weenen 2013, pers. comm.).

There is a risk that numerous, significant and hollow bearing trees will be lost during a bushfire scenario. This occurs naturally, when trees are burnt and collapse but it can also occur as part of bushfire suppression operations or following a bushfire when potentially hazardous trees are cleared for risk mitigation. Since hollow-bearing tress are already scarce in the landscape, a further decline in their abundance could result in a significant and possibly lengthy retraction of the Brown Treecreeper's range within the region (van Weenen 2013, pers. comm.). The isolated nature of many of the woodland areas occupied by this species means that at least some habitat patches are likely to remain unburnt in a bushfire event. The naturally low fuel loads often associated with the species' habitat will also decrease the likelihood of these habitats being impacted by high intensity fire and this should reduce the proportion of hollow-bearing trees that area lost (van Weenen 2013, pers. comm.).

Square-tailed Kite

This species requires large tracts of vegetation and suitably abundant prey species for hunting (van Weenen 2013, pers. comm.). There is currently limited knowledge on how cumulative burning or the effects of a single, wide-spread bushfire may affect this species as it may take years for burnt habitats to support prey species at a high enough abundance to enable breeding pairs to nest successfully (van Weenen 2013, pers. comm.).

Management Strategies

Declining Woodland Birds

29. Implement appropriate fire management strategies that will minimise the risk of local extinctions in the event of a bushfire.
30. Identify and implement strategies for minimising the collapse of significant habitat and hollow bearing trees during prescribed burn operations and develop a process to facilitate the appropriate assessment and possible removal of potentially hazardous trees as part of bushfire operations.
31. During bushfires, attempt to retain unburnt patches of land as refuge areas to minimise the risk of local extinctions.
32. To ensure that adequate habitat resources are available for Square-tailed Kites, fire planners to ensure that >50% of remnant vegetation in planning area is >15 years age since last fire.
33. Undertake post-burn weed management to avoid altering habitat structure.
34. Where prescribed burning is necessary in known declining woodland bird habitat, consultation with the Threatened Fauna Ecologist should occur.

Diamond Firetail

The Diamond Firetail (*Stagonopleura guttata*) is one of five firetail species endemic to Australia. The Diamond Firetail is found mainly on the inland slopes of the Great Dividing Range and in the AMLR/Eyre Peninsula region of South Australia (DEH 2008a).

Listed as Vulnerable in South Australia under the NPW Act, the Diamond Firetail is in slow decline across its range. Whilst not completely understood, this decline is believed to be due to land clearance, grazing, habitat fragmentation, and the spread of exotic grasses (Garnett & Crowley 2000).

Favoured habitat varies from a wide range of eucalypt dominated vegetation communities, including woodland and forest to savannah and mesic woodland and mallee communities (DEH 2008a). Whilst able to live further from water sources than other firetail species, a reliable water source is still required (DEH 2008a).

Critical to the distribution patterns of the Diamond Firetail is the availability of suitable seed year round, which forms an essential habitat requirement. Although exotic grasses are a valuable seed source, the periodicity of this seed supply may be inadequate for maintaining populations. A diversity of native grasses with differing phenology and maturation patterns appears essential for their persistence in an area (DEH 2008a; Garnett & Crowley 2000).

Diamond Firetails occur mainly in grassy woodlands, particularly with Drooping Sheoak (*Allocasuarina verticillata*) (DEH 2008a). Within the South Para planning area, Diamond Firetails are known to be present at Sandy Creek and Kaiserstuhl CP during summer (Carpenter 2012) and also in Para Wirra CP during autumn/winter (Carpenter 2011; DEH 2008a).

Prescribed burning has the potential to impact on this species if annual weeds dominate the regeneration (DEH 2008a). This is due to the requirement for suitable seed throughout the year. Prescribed burning activities need to take into account the diversity of native grasses and the ability to provide seed year round where populations of Diamond Firetails are present.

Management Strategies

Diamond Firetail

35. Implement appropriate fire management strategies that will minimise the risk of local extinctions in the event of a bushfire.
36. If necessary, conduct prescribed burning to improve habitat suitability.
37. During bushfires, attempt to retain unburnt patches of land as refuge areas to minimise the risk of local extinctions.
38. Develop and implement an EFMS for the Diamond Firetail.
39. Encourage research into the ecology of the species to help inform future fire management activities in species' habitat.

Threatened Orchids

There are a number of nationally threatened orchids that occur within the planning area, including some of the largest, and most important populations. These include the Pink-lipped Spider-orchid (*Caladenia behrii*), White Spider-orchid (*Caladenia rigida*), and the White Beauty Spider-orchid (*Caladenia argocalla)* which are listed as Endangered at the national level under the EPBC Act and Endangered in South Australia under the NPW Act. A recovery plan covering these species has been developed (Quarmby 2010).

The Pink-lipped Spider-orchid occurs within Hale CP, Devils Gully Forestry Locality (FL), Kersbrook NFR, Mt Gawler NFR, Tower FL, Para Wirra CP, Warren CP, South Para Reservoir and Warren Reservoir Reserves. The White Spider-orchid occurs within Hale CP, Kersbrook NFR, Mt Gawler NFR, Millbrook Reservoir Reserve, Para Wirra CP, South Para Reservoir, Devils Gully FL, Tower FL and Warren CP. The White Beauty Spider-orchid occurs within Kaiserstuhl CP and Dewells FL. All of these orchids occupy eucalyptus forests or woodlands with a grassy or shrubby understorey (MVS 8 and MVS 9).

There are also a number of other threatened orchids in the plan area, including the Plum Leek-orchid (*Prasophyllum pruinosum*) and Hale Greenhood (*Pterostylis* sp. Hale) listed as Endangered under the EPBC Act, and the Pale Leek-orchid (*Prasophyllum pallidum*) and the Finniss Helmet-orchid (*Corybas dentatus*) listed as Vulnerable under the EPBC Act.

The Finniss Helmet-orchid is known from two locations in the Mount Lofty Ranges including Sandy Creek CP. The Hale Greenhood was previously only known from a single population in Hale CP. However, this population is possibly extinct and additional populations have since been located outside the planning area (Quarmby, J 2013, pers. comm.). Both of these

orchids occur in eucalyptus forests or woodlands with a grassy or shrubby understorey (MVS 8 and MVS 9).

Other threatened orchids listed under the NPW Act and included in the *Regional Recovery Plan for Threatened Species and Ecological Communities of Adelaide and Mouth Lofty Ranges* include the Behr's Cowslip-orchid (*Diuris behrii*), Self-pollinating Leek-orchid (*Prasophyllum fecundum*), Sweet Onion-orchid (*Microtis rara*), Yellow Onion-orchid (*Microtis atrata*) and the Dune Helmet-orchid (*Corybas expansus*) (Willson & Bignall 2009). The Fitzgerald's Leek-orchid (*Prasophyllum fitzgeraldii)* is under consideration to be listed as Endangered.

All of the above-mentioned orchids lie dormant during the summer months and resprout from underground tubers during April and May. Flowering and seed set occurs between July and December (refer to Appendix 2 – Fire Response of Rated, Significant and Introduced Flora Species). These orchids are pollinated by insects (thynnid wasps, native bees and fungus gnats) and produce thousands of minute seeds. Seedling recruitment and growth is dependent on the establishment of mycorrhizal fungi associations. Map 2 (Vegetation Communities & Significant Species; online) shows threatened orchid records for the planning area. To protect the species, data are buffered to prevent fine-scale identification of their exact location.

Flowering of some orchid species is known to be promoted by fire (e.g. *Caladenia rigida* and *C. behrii*), however, fire can at the same time promote dormancy, cause mortality, and increase the level of floral herbivory in these species (Quarmby, Joe 2012).

All of the above-mentioned orchids are considered to be at increased risk from burning during their growing season between April and November (Quarmby 2010). Furthermore, orchid populations that occur near fire access tracks are considered to be at risk of damage from track management and fire suppression operations (i.e. track grading, widening, slashing, herbicide use, and heavy vehicle use) (Quarmby 2010). The Hale Greenhood and Finniss Helmet-orchid are known to be fire sensitive species due to their shallow tubers and may be especially vulnerable to fires during their active growth season, April to October (Quarmby, J 2013, pers. comm.).

The recovery plan recommends that protocols for track management are developed and strategies to minimise potential impacts of prescribed burning and fire suppression operations on threatened orchids are also developed.

Specific information on how threatened orchids respond to fire is also included in Appendix 2 – Fire Response of Rated, Significant and Introduced Flora Species.

Management Strategies

Threatened Orchids

40. Refer to the *Recovery Plan for Twelve Threatened Orchids in the Lofty Block Region of South Australia* (Quarmby 2010) and draft *EFMS for Threatened Orchids* when planning prescribed burns within known habitat of threatened orchids.
41. Consult with the Lofty Block Threatened Orchid Recovery Team regarding prescribed burns in areas containing nationally listed orchid species.
42. Avoid prescribed burning or slashing within threatened orchid populations between April and October.
43. Avoid prescribed burning or slashing within threatened orchid populations more frequently than every 10 years (other than on designated firebreaks).
44. Minimise the likelihood of multiple populations of threatened orchid species and habitat burning in a single fire season.
45. Minimise the likelihood of vehicles or equipment impacting on threatened orchid populations during track management and fire suppression operations by referring to the relevant response plans.
46. Undertake ecological/experimental burns on threatened orchid populations to examine the response of these species to different disturbance regimes in consultation with the Lofty Block Threatened Orchid Recovery Team.
47. Prepare and implement an EFMS to improve fire management of threatened orchids.

Osborn's Eyebright

Osborn's Eyebright (*Euphrasia collina ssp. osbornii)* is listed as Endangered nationally under the EPBC Act and Endangered in South Australia under the NPW Act. A national recovery plan was prepared for this species in 2010 (Moritz & Bickerton 2010), along with an earlier recovery plan that was prepared for Tasmanian *Euphrasia* species (Potts 1999). Specific information on how Osborn's Eyebright responds to fire is included in Appendix 2 – Fire Response of Rated, Significant and Introduced Flora Species.

In the planning area, the species occurs in Montacute CP and Barossa Reservoir Reserve. Outside the planning area the species occurs on eastern Kangaroo Island, on Eyre Peninsula, in the state's south-east, across the Mount Lofty Ranges, and on Yorke Peninsula within government land, private land, and HA.

Osborn's Eyebright flowers from June through to August/September. *Euphrasia* species are known to prefer open habitats, characterised by patches of open ground, spaced low vegetation, and moist soils (Potts 1999).

The role of fire is not fully understood and has not yet been investigated for Osborn's Eyebright. Observations of the species in the Mount Lofty Ranges suggest that it may rely on fire events to promote regeneration and recruitment (Moritz & Bickerton 2010). Observations of other *Euphrasia* subspecies suggest that fire is the main disturbance involved in increasing the size of populations in Tasmania and that fire may offer germination cues as well as allowing exposure of seed to light (Moritz & Bickerton 2010). As *Euphrasia* species are seed

regenerators, frequent spring-summer burning is likely to reduce populations as plants are killed before they can mature and set seed. It is recommended that prescribed burns should only be undertaken after seed is released (Potts 1999) occurring from summer to autumn (Moritz & Bickerton 2010).

Management Strategies

Osborn's Eyebright

48. Minimise the likelihood of large areas of known habitat burning in a single fire event.
49. Undertake ecological/experimental burns within known habitat to examine the response of Osborn's Eyebright to different disturbance regimes.
50. Prescribed burning should occur after seed release in autumn.
51. Monitor the effects of fire on Osborn's Eyebright and use this information to update the DEWNR vital attributes database (Appendix 2 – Fire Response of Rated, Significant and Introduced Flora Species).

Clover Glycine

Clover Glycine (*Glycine latrobeana)* is listed as Vulnerable both nationally, under the EPBC Act, and in South Australia under the NPW Act. A national recovery plan has been developed for the species (Carter & Sutter 2010).

Clover Glycine occurs in Cudlee Creek, Mount Crawford, and Watts Gully Blocks in the planning area. It occurs mainly in grassland and grassy woodland habitats.

Clover Glycine flowers between September and May. Seed is likely to remain dormant and viable in the soil for many years, and is known to germinate in response to disturbances such as fire, as suggested by observations of high abundances of plants recorded shortly after fire (Carter & Sutter 2010).

The fire response of Clover Glycine is still generally unknown, and appropriate fire management is likely to vary between habitat types across the range of the species (Carter & Sutter 2010). Complete fire exclusion may be detrimental to the species as it may lead to a decrease in population viability due to competition, especially from grasses, weed invasion, and/or lack of recruitment opportunities. However, frequent spring-summer burning is likely to reduce populations as plants are killed before they can mature and set seed. Any prescribed burning should consider a weed management program (Carter & Sutter 2010).

Management Strategies

Clover Glycine

52. Prescribed burning should occur after plants have matured and set seed.
53. Where appropriate a weed management program will accompany prescribed burning activities when conducted where Clover Glycine is present.
54. Undertake ecological/experimental burns on Clover Glycine populations to examine the response of the species to different disturbance regimes.

Mount Lofty Speedwell

Mount Lofty Speedwell (*Veronica derwentiana* ssp. *homalodonta)* is listed as Endangered nationally under the EPBC Act and Endangered in South Australia under the NPW Act. This species is included in the regional recovery plan (Willson & Bignall 2009). Specific information on how Mount Lofty Speedwell responds to fire is included in Appendix 2 – Fire Response of Rated, Significant and Introduced Flora Species.

Mount Lofty Speedwell is endemic to South Australia where it occurs in the southern Mount Lofty Ranges and on Kangaroo Island. There is taxonomic confusion between Mount Lofty Speedwell and Kangaroo Island Speedwell (*Veronica derwentia* ssp. *anisodonta*) which are very similar in appearance and distribution. Both sub-species have been identified within the planning area, and are being managed synonymously as a precaution until the taxonomy is resolved. The two largest populations within the planning area occur at Devils Gully FL and Mount Gawler NFR, and a smaller population occurs in Warren CP. Outside the planning area the species occurs in a number of reserves and private properties in the central Mount Lofty Ranges, Fleurieu Peninsula, and Kangaroo Island.

Mount Lofty Speedwell is a large herbaceous shrub that re-shoots annually from a long-lived rootstock. Flowering occurs from October to January. It only grows in damp shaded gullies, usually along creek lines.

There is limited information about the fire response of Mount Lofty Speedwell, however, it has been known to re-sprout from rootstock after fire and there is some evidence that seedling regeneration may also be promoted by fire. However, because it only grows in damp protected gullies, it does not burn frequently and may therefore be sensitive to frequent fire. It is also possible that not all individuals will survive fire and this could have significant consequences for small populations such as those occurring in Warren CP.

Management Strategies

Mount Lofty Speedwell

55. Avoid burning Mount Lofty Speedwell populations more frequently than every 15 years.
56. Avoid burning entire populations of Mount Lofty Speedwell as a precaution until more is known about its fire response.
57. Minimise the likelihood of several populations burning in a single fire event or season.
58. Monitor the effects of fire on the Mount Lofty Speedwell and use this information to update the DEWNR vital attributes database (Appendix 2 – Fire Response of Rated, Significant and Introduced Flora Species).

Peppermint Box Grassy Woodlands

The Peppermint Box (*Eucalyptus odorata*) Grassy Woodland of South Australia is listed as a nationally Critically Endangered ecological community under the EPBC Act. A recovery plan has been adopted for this community (Turner 2012).

Currently South Australia has no official rating system for threatened ecological communities. However, the Peppermint Box with occasional South Australian Blue Gum (*E. leucoxylon*) Grassy Low Woodland ecosystem is recognised as Endangered in a provisional list of threatened ecosystems of South Australia (DEH 2005).

This community can be found in areas receiving 310 to 610 mm of rain per year, on gentle to moderate slopes, hilltops, and adjacent plains with sandy-loam to clay-loam soils. Peppermint Box Grassy Woodlands have been recorded within three reserves included in this plan – Sandy Creek CP, Para Wirra CP, and Para Woodlands proposed CP. The community is not known to occur on ForestrySA or SA Water land.

Peppermint Box is the dominant species of the tree canopy. The woodland tree form (a single main trunk at the base with low branches but may be multi-stemmed if it has been coppiced) of Peppermint Box characterises this ecological community. Other tree species present in the canopy but not as abundant as Peppermint Box include: Grey Box (*E. microcarpa*); South Australian Blue Gum; Sugar Gum (*E. cladocalyx*); Mallee Box (*E. porosa*); Drooping Sheoak (*Allocasuarina verticillata*); White Cypress Pine (*Callitris glaucophylla*); and Southern Cypress Pine (*C. gracilis*) (Hyde 2001).

The vegetation structure is an open to dense woodland. The tree canopy comprises low trees, generally 5 to 10 metres tall, but sometimes up to 15 metres tall, with a typical canopy cover of 5 to 40 percent, occasionally reaching 70 percent (Hyde 1996; Robertson 1998).

The ground layer mainly comprises grasses and herbs which can vary from a relatively dense and diverse layer, in more open sites, to a sparse layer under more densely wooded sites. The grasses and herbs that most often occur include Wallaby grasses (*Austrodanthonia* spp.), Spear grasses (*Austrostipa* spp.), Iron-grasses (*Lomandra* spp.) and Black-anther Flax Lily (*Dianella revoluta*). Shrubs are sparse in the understorey with cover up to 30 percent. The most common shrub species present are Sweet Bursaria (*Bursaria* spinosa) and Golden Wattle (*Acacia pycnantha*) (Hyde 1996).

Peppermint Box Grassy Woodlands have been heavily cleared across their range for cropping and cultivated pastures and grazing. In most of the areas that remain, grazing and pasture improvement have effectively removed the characteristic native, perennial tussock grasses, herbs, and shrubs, leaving many areas dominated by exotic weeds. Grazing has also prevented the regeneration of the overstorey species, to the extent that large areas of healthy, regenerating trees are rare.

Weed invasion is a major threatening process for Peppermint Box Grassy Woodlands. Patches have been heavily invaded by annual weeds such as Squirrel tail fescue and Rats tail fescue (*Vulpia* spp.), and Bearded oats (*Avena barbata*). Native species diversity and cover within these communities can be more apparent outside of spring. Annual weeds may be controlled through appropriate grazing and fire regimes (DEWR 2007).

However, inappropriate fire regimes are considered a threat to the community. The recovery plan recommends that the fire response of the community is investigated and best practice guidelines for managing fuel loads in remnants for ecological benefits and asset protection are developed (Turner 2012).

Management Strategies

Peppermint Box Grassy Woodland

59. Minimise the likelihood of large areas of the community burning in a single fire event.
60. Refer to the *National Recovery Plan for the Peppermint Box Grassy Woodland of South Australia ecological community* (Turner 2012) when planning fuel management strategies in areas supporting Peppermint Box Grassy Woodland.
61. Undertake ecological/experimental burns to examine the response of the community to different disturbance regimes and use this information to update the DEWNR fire response database (Appendix 4 – Ecological Communities of Conservation Significance).
62. Implement appropriate fire management strategies to reduce the likelihood of impact during prescribed burning (e.g. fire crew to rake hoe around mature trees, lighting patterns, controls on flame height).
63. A weed management program (including minimising soil disturbance) will accompany prescribed burning activities when conducted within Peppermint Box Grassy Woodlands community.

3.8 Abundant and Pest Species

3.8.1 Fauna

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

Within the planning area, a number of introduced fauna have been observed. These include: Eurasian Blackbird *(Turdus merula),* European Goldfinch *(Carduelis carduelis),* Red Fox

(Vulpes vulpes), Domestic/Feral Cat *(Felis catus),* Brown Hare *(Lepus capensis),* House Mouse *(Mus musculus),* Fallow Deer (*Dama dama*), Feral Goat (*Capra hircus*), Black Rat *(Rattus rattus)* and European Rabbit *(Oryctolagus cuniculus)*.

Prior to any prescribed burn, potential impacts will be considered to determine whether pre- and/or post-fire management is required. Pest fauna and abundant species management is implemented based on a risk assessment.

Abundant species can impact dramatically on the post-fire recruitment of flora species. Management across the landscape by different land managers may differ, an appropriate management strategy to address abundant species needs to be considered prior to undertaking prescribed burning activities. Such strategies should aim to minimise the negative ecological consequences of abundant species within C-zones. In A- and B-zones the overabundance of a species should not delay the implementation of bushfire mitigation works, however, consideration should still be given to managing the species in question to mitigate ecological impacts within the treated and surrounding areas.

The management of overabundant species should also be considered following bushfires to ensure that native flora and fauna populations are able to recover from the fire. This is likely to require a collaborative, cross-tenure management program. Such programs can be contentious with some sections of the community and need to be handled sensitively in areas where people are already distressed by bushfire events.

Kangaroo management is of particular concern across the South Para landscape, especially in areas such as Sandy Creek, and Kaiserstuhl. Any kangaroo control program on DEWNR-managed land will be assessed against the DEWNR *Kangaroos on reserves (population control) Policy* (DENR 2011c).

Further, prescribed burning can provide the opportunity to research and monitor how abundant fauna and flora respond to and impact on the environment post-fire. Section 5.4 provides more information on prescribed burn preparation and ecological fire management.

3.8.2 Flora

Weeds can have significant impacts on native vegetation and ecological communities (DPC 2003). Disturbance (e.g. grazing, nutrient inputs, erosion, fragmentation) is likely to promote weed invasion, and fire in areas already affected by one or more 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.

Some of the most significant weed species within the planning area include Boneseed *(Chrysanthemoides monilifera),* Bridal Creeper *(Asparagus asparagoides),* Blackberry *(Rubus* spp.*),* European Olive *(Olea europaea* ssp. *europaea),* Gorse *(Ulex europaeus),* English Broom (*Cytisus scoparius*), Cape Broom (*Genista monspessulana*), *Erica* spp.*,* Coolatai Grass *(Hypharrhenia hirta),* False Caper *(Euphorbia terracina)*, Horehound *(Marrubium vulgare)*, One-leaf Cape Tulip *(Moraea flaccida)*, Myrtle-leaf Milkwort *(Polygala myrtifolia),* Salvation

Jane *(Echium plantagineum),* Radiata Pine *(Pinus radiata*) and Aleppo Pine *(P. halapensis)*. Fire management guidelines for some of these species and other weeds of concern are included in Appendix 2 – Fire Response of Rated, Significant and Introduced Flora Species.

In relation to prescribed burning, priority will be given to managing fire responsive weed species to ensure existing weed management issues are not exacerbated. In A- or B-zones, non-fire responsive woody weeds contributing to fuel loads may also be targeted. Fire may provide opportunities to control non-fire responsive species owing to improved access or early emergence when off target damage will be reduced. Such opportunities should be identified in the planning phase.

Locally significant weeds within prescribed burn areas will be listed in the prescribed burn plan and mitigation actions identified consistent with the considerations outlined above (DEWNR 2013b). Weed control (pre- and/or post-fire) will be conducted where necessary and actions identified in relevant EFMS should be implemented.

Volunteers, community groups, and agency pest plant programs have completed significant weed management work on public land. Monitoring programs should ensure that vulnerable areas are evaluated pre- and post-fire to determine what post-fire weed control is required and to assess the effectiveness of control efforts.

3.8.3 Plant Pathogens

The EPBC Act identifies Phytophthora (*Phytophthora cinnamomi*) as a key threatening process, which means that it is a major threat to native vegetation and associated fauna, particularly threatened species. Phytophthora is a soil and waterborne mould that causes disease and death in a variety of native plant species (as well as introduced species). Areas that receive 400 mm or more of average annual rainfall are considered at risk from the mould, which can spread naturally through the soil and through mud carried on vehicle tyres, walking boots, and equipment. There is a risk of Phytophthora being introduced into new areas and of existing infestations spreading in the planning area. DEWNR has a Standard Operating Procedure, which addresses Phytophthora threat management (DEH 2002). This outlines hygiene procedures and guidelines to protect the integrity of natural areas by minimising the risk of Phytophthora infestation and spread across the state.

The rate of Phytophthora spread may be increased by fire but further monitoring is required to clarify the interaction between these two processes.

Management Strategies

Pest Species

64. Refer to EFMG (Table 6) and fire management guidelines for introduced flora species (Appendix 2 – Fire Response of Rated, Significant and Introduced Flora Species) during prescribed burn planning.
65. Implement pre- and post-fire management strategies identified in the EFMS that will minimise the risk of gorse and broom increasing post-fire (DENR 2011a).
66. Use fire as a tool that forms part of integrated weed management strategies.
67. Consider the likely post-fire responses and impacts of weed species and implement pre-, and post-fire weed control (subject to agency priorities).
68. Monitor the effect of fire on weed species to determine the need for pre- and/or post-fire management and use in future EFMG (subject to agency priorities).
69. Collect relevant information during prescribed burn planning on introduced or abundant fauna and undertake a risk assessment to determine the need for pre- and/or post-fire management.
70. Adhere to the Standard Operating Procedure – Phytophthora Threat Management (SOP-002) (DEH 2002) and conduct a risk assessment to determine whether fire management activities will exacerbate the spread of Phytophthora.
71. Ensure hygiene practices are implemented to reduce the spread of Phytophthora across the planning area. Refer to the *DEWNR Operating Procedure – Phytophthora Vehicle Disinfection Unit* (DEH 2003).
72. Monitor the interaction between Phytophthora and fire.

4 RISK

4.1 Risk Assessment

A risk assessment was conducted in line with the *DEWNR Risk Assessment in Fire Management Planning Procedure* (DEWNR 2015b), as a requirement for the compilation of the plan. The risk assessment is a tool used to gauge the risks arising from bushfire to life, property, and environmental values in the planning area (including the risk of no action). The risk assessment considered visitor use, assets (built, cultural, and natural values), and neighbouring properties for all reserves in the planning area. Risk assessment is a function of likelihood and consequence.

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

Where a risk rating of High or above has been identified, risk management strategies have been developed.

The *DEWNR Risk Assessment in Fire Management Planning Procedure* (DEWNR 2015b) provides more information on this process. Risk assessment is ongoing and continually reviewed to reflect the changing landscape. From the risk assessment, strategies and proposed works are identified and developed at a landscape level, irrespective of public land management boundaries. This provides a coordinated approach for all land management agencies in reducing the bushfire risk across the planning area.

4.2 Fuel Hazard

4.2.1 Overall Fuel Hazard

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

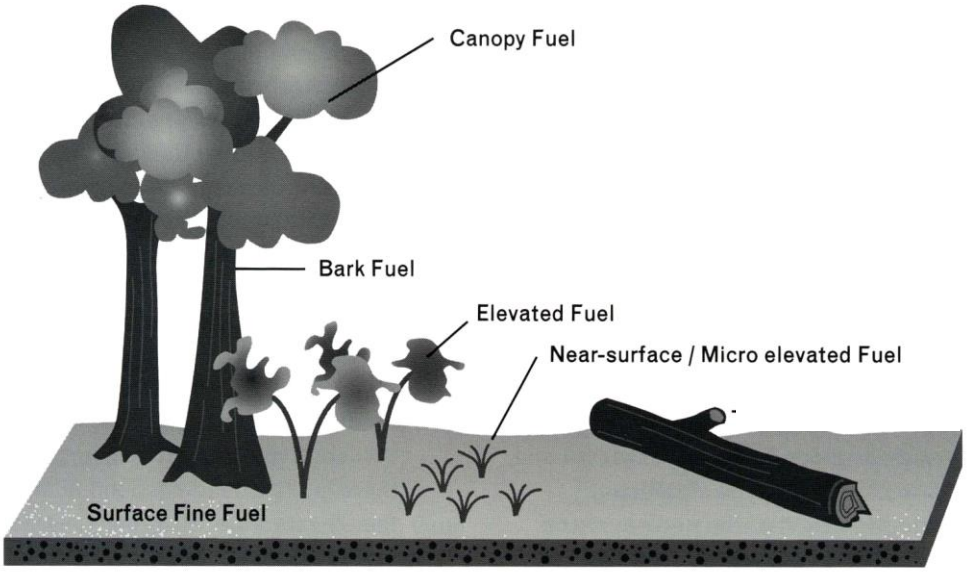

FIGURE 2 – COMPONENTS OF FUEL IN VEGETATION (Tolhurst & Cheney 1999)

Each fuel layer contributes to different aspects of fire behaviour: flame depth and height, surface fire combustion and rate of spread, spotting, and crown fire (DENR 2011e). Each layer, as well as the overall fuel hazard can be assessed as: Low, Moderate, High, Very High, or Extreme (DENR 2011e).

Extreme bark hazard is likely in areas supporting Brown Stringybark (*Eucalyptus baxteri*) and/or Messmate Stringybark (*Eucalyptus obliqua*), where fire has not occurred for some time, or if fire has occurred it was of low intensity and did not burn the bark. In these areas, spot fires are likely to start ahead of the fire front, due to embers and firebrands blown in the wind. Stringybark occurs across the planning area predominantly along the ranges.

Introduced flora species such as gorse and broom are known to influence fire suppression across the planning area and these are assessed as part of overall fuel hazard where they occur. Gorse is characterised by ladder fuels that facilitate the transition of fire to the canopy. An EFMS has been produced for broom and gorse (DENR 2011a).

Revegetation activities have the potential to reach Very High and Extreme overall fuel hazard levels during establishment, however, in the longer term overall fuel hazard levels may reduce. Changes in the fuel arrangement over time occur when the canopy layer separates from the shrub layer and as some short lived species die out. Weed control during establishment will decrease the overall fuel hazard. It is important that the species selected to form the shrub layer are well considered in areas of revegetation where overall fuel hazard is important to be kept low, such as in A- or B-zones. Where revegetation exceeds the desired overall fuel hazard then selective removal of some species (shrubs) at varying densities may be required to achieve the desired overall fuel load and fuel arrangement levels. In the initial years of revegetation establishment, prescribed burning is not a desirable option; if fuel management is required, mechanical removal should be used.

Research conducted by McCarthy and Tolhurst (2004), who investigated the effectiveness of fuel reduction burning in Victoria, concluded that maintaining overall fuel hazard levels at High or less aids in slowing the rate of spread of a subsequent bushfire. To achieve long-term fuel reduction effects, the researchers recommended that the focus of fuel reduction should

be on the reduction of bark and elevated fuels, as these fuel layers are likely to contribute to the overall fuel hazard.

For more information on fuel hazard assessment methodology and evaluation refer to the *Overall Fuel Hazard Guide for South Australia* (DENR 2011e). DEWNR maintains a database containing fuel hazard assessment records. The process for recording and submitting fuel hazard data is explained in the *DEWNR Fuel Hazard Assessment Procedure* (DEWNR 2015b).

4.2.2 Likely Maximum Overall Fuel Hazard

Maximum overall fuel hazard levels have been estimated for MVS within the planning area in order to provide a guide for fire management (Table 4). The process used to derive MVS is described in Section 3.6 and the extent of each MVS within the planning area is shown on Map 2 (Vegetation Communities & Significant Species; online).

The likely maximum overall fuel hazard is based on on-ground sampling and vegetation mapping within the planning area, adjusted to account for the time since last fire. It can be used for planning and incident management, however, this estimate should be supported by on-ground inspection as areas of vegetation remain unmapped and it is likely that other factors (such as high weed density) will influence the overall fuel hazard.

TABLE 4 – LIKELY MAXIMUM OVERALL FUEL HAZARD FOR MVS IN THE PLANNING AREA

MVS No.	MVS Name	Likely Maximum Overall Fuel Hazard	Significant Fuel Layers
5	*Eucalyptus* forests with a grassy understorey	Very High	Bark Surface
8	*Eucalyptus* woodlands with a shrubby understorey	Extreme	Bark Surface Elevated
9	*Eucalyptus* woodlands with a grassy understorey	Very High	Surface Near-surface
12	*Callitris* forests and woodlands	Very High	Elevated
19	*Eucalyptus* low open woodlands with tussock grass	High	Surface Near-surface
21	Other *Acacia* tall open shrublands and shrublands	Extreme	Elevated Near-surface
26	*Casuarina* and *Allocasuarina* forests and woodlands	High	Elevated Near-surface
30	Heath	Extreme	Elevated
32	Other shrublands	Extreme	Elevated
48	*Eucalyptus* open woodlands with a grassy understorey	High	Surface

4.3 Potential for Fire Impact

The planning area can be broadly divided into two types of fuel and therefore fire types. The valleys, typically cleared for agriculture and settled first, are at risk of potentially fast moving grass fires. While these fires are fast moving they are more likely to be interrupted by low fuel areas, like orchards and vineyards, increasing the opportunities for suppression. Potential fire impacts are likely to be less in these areas in contrast to the ranges or steeper slopes. The Kersbrook Valley is an example of this.

The hilltops, which tend to have larger areas of remnant vegetation, have the potential to support slower but significantly more intense fires. These fires will also be characterised by extreme spotting due to the presence of stringybarks and Manna Gums. These areas have been settled more recently and are typically small rural living lifestyle blocks. Fire intensity, spotting, and poor access make fires in these areas far more difficult to suppress and therefore a more significant threat to people and their homes. This fuel type starts from the Sixth Creek catchment area around Montacute CP and Lenswood, extends north through Millbrook Reservoir Reserve and Mt Gawler NFR and terminates at the Barossa Reservoir Reserve and Para Wirra CP adjacent to Williamstown. Other smaller instances of this combination of fuel and typography also exist within the plan area, at Kaiserstuhl CP and NFR, for example.

The western slopes and southern end of the Sixth Creek catchment area falls in the south-west corner of the South Para planning area. This area is unique as it is part of a large 2 573 ha block of continuous vegetation (DELM 1993), starting at Para Wirra CP and Barossa Reservoir Reserves in the north through the township of Stirling in the south, incorporating Montacute CP, Kenneth Stirling CP group, and extending into the Onkaparinga Valley. Small settlements of Lenswood, Cudlee Creek, Inglewood, Paracombe, Kersbrook, and Williamstown are at significant risk if a fire were to occur in the ranges as there is little opportunity for fire suppression due to high fuels, poor access, and steep topography.

The Sixth Creek catchment area, north through Mount Gawler and South Para Reservoir Reserves, parts of which burnt during the 2015 Sampson Flat bushfire, contain important conservation, forestry, and community values. It is considered that there is a high potential for repeat events like the 2014 Cherryville and 2015 Sampson Flat bushfire to occur in this area and cause significant impact on these values (DELM 1993).

Bushfire also has the potential to threaten commercial plantation forests and Adelaide's drinking water supply. Current forestry plantations in the plan area are predominantly on the flatter areas, since plantation forests were not re-established after the 1983 Ash Wednesday bushfire in the steeper parts of Cudlee Creek FL. After the fire it was decided that pine regeneration in these areas would be managed to allow native vegetation to regenerate (ForestrySA 2006a) and only some small areas of pine plantation were re-established. ForestrySA have undertaken a variety of restoration works in the area since 1983. The fuels that currently exist in this area are a potential threat to the surrounding community (Lenswood).

During European settlement of the Mount Lofty Ranges, communities were concentrated along the valleys in small towns. In recent years there has been an increasing trend of building on bush blocks, with houses interspersed in areas dominated by native vegetation, with steeper terrain and limited access. This trend, combined with the largest continuous area of remnant vegetation in the Mount Lofty Ranges, creates a serious challenge for fire managers in the planning area.

4.3.1 Smoke

Smoke produced from bushfires can have short- and long-term health impacts and also impact on the seasonal viticulture yield. Smoke is made up of a range of particles and gases including carbon monoxide, carbon dioxide, nitrogen oxides, volatile organic compounds, and water vapour. These particles can impact on human health and influence the taste of

produce from smoke tainted grapes. The largest risk comes from the microscopic particles (SA Health 2009).

Health

Small particles from smoke can enter via the eyes, nose, and respiratory system (SA Health 2009), where they can cause irritation and inflammation, manifesting into a number of health effects. Children and the elderly are particularly susceptible to the health effects of smoke and pre-existing illnesses such as chronic obstructive pulmonary disease (COPD), asthma, and heart disease may deteriorate due to smoke inhalation (DOH 2012; SA Health 2009).

Under the CFS Standard Operating Procedures (5.1), advice will be provided to the public during a fire event (CFS 2013). Generally, the CFS advises that people affected by smoke should close all doors and windows and stay indoors. If outside, the use of a smoke mask that meets the Australian Standard AS1716 or P2 or P3 is recommended (SA Health 2009).

Smoke Taint

Grape vines are grown across the Barossa Valley and Adelaide Hills wine districts with extensive areas of vines abutting included lands within the planning area. Smoke as a result of bushfires or prescribed burning can have a notable impact on the taste and quality of grapes to be used in wine production. Smoke taint can lead to grapes displaying burnt, ashtray or charred flavours, leading to wine becoming unfit for sale or reduced in value. Smoke taint is a concern for wine growers especially during the veraison (ripening) period, with research suggesting that smoke uptake is the greatest from seven days post veraison to harvest (DPI 2012; Kennison, Wilkinson & Gibberd 2009; Richter 2006). Consultation with landowners on the timing of prescribed burning activities should be undertaken and considered during prescribed burn planning.

Management Strategies

Smoke

73. Assess smoke modelling projections from the Bureau of Meteorology and information from the Environmental Protection Agency (EPA) to consider smoke management prior to burning operations.

74. Refer to *Smoke Taint Fire Management Strategy* (DEWNR 2013c).

4.4 Influence of a Changing Climate

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

Management Strategies

Climate Change

75. Monitor species and ecosystems and the processes that support them to understand their resilience to a changing climate. Use fire as a tool that forms part of integrated weed management strategies.

76. Review and adapt fire management strategies in the planning area as the impacts of climate change become understood.

77. Monitor national and international fire management policies and best practice and partner with the research sector to increase our knowledge on altered fire regimes.

5 READINESS

5.1 Equipment

DEWNR, ForestrySA, and SA Water all maintain specialised fire suppression equipment and communications systems to optimise fire management and response capabilities. SA Water does this indirectly through arrangements with DEWNR and ForestrySA. These resources form part of the standard CFS response on public land and may be deployed to fires anywhere in South Australia or interstate.

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

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 agencies' policies and procedures.

5.2 Training

Firefighting is a specialised activity with a range of associated hazards. All firefighters shall be trained to carry out their duties safely and recognise hazardous situations. Staff involved, directly or indirectly, in the management of fire incidents are required to complete the Basic Firefighting 1 CFS course at a minimum. All staff involved in fire suppression are required to undertake annual pre-season training and health checks and meet fitness requirements to ensure that they are able to carry out assigned duties safely and competently. Agencies are committed to maintaining a safe working environment during fire operations in compliance with the *Work Health and Safety Act 2012*.

5.3 Risk Mitigation Strategies

5.3.1 Fire Access Tracks

The agencies are committed to maintaining a strategic network of fire access tracks on public land, in accordance with the Government Agencies Fire Management Working Group's (GAFMWG) standard (GAFMWG 2014). Tracks occurring within the planning area, as well as external private tracks and public roads considered important for fire suppression, have been reviewed as part of this plan and classified as a Major, Standard, or a Minor Track according to the standard. Tracks that are considered unsuitable for fire suppression have been classified as Service Tracks and should not be used during fire suppression operations, unless verified by on-ground inspection.

Tracks that have been identified as important for fire suppression are usually located in low fuel areas, supported by zoning, or may be positioned between significant assets (e.g. Fire Track 1, Bassnet Road, One Tree Hill-Kersbrook Road, Warren Road, Cricks Mill Road, Mount Road).

Map 4 (Fire Management & Access; online) shows fire access tracks according to their GAFMWG classification. Proposed changes to tracks are summarised within Appendix 1 – Recommended Works, other tracks will be maintained to their current GAFMWG standard shown on Map 4 (Fire Management & Access; online). Reserves that have been identified as requiring track upgrade works are Cromer Block, Cudlee Creek Block, Mount Gawler Block, Gawler Block, Kaiserstuhl Block, Millbrook Block, Para Block, Sandy Creek Block, and Watts Gully Block (Appendix 1 – Recommended Works).

Management Strategies

Tracks	78. Prioritise and implement actions regarding fire access as described in Appendix 1 – Recommended Works.
	79. Maintain tracks to the GAFMWG standards as shown on Map 4 (Fire Management & Access; online).
	80. Update and maintain track data on government mapping database.
	81. Install and maintain signs on fire access tracks and gates according to GAFMWG standards and name tracks as appropriate.

5.3.2 Fire Infrastructure

Various types of fire infrastructure are maintained for fire suppression activities within the South Para planning area; these have been mapped and are shown on Map 4 (Fire Management & Access; online). The Mount Crawford Fire Tower, located adjacent to the Tower NFR (operated and maintained by ForestrySA), was established for the rapid detection of smoke sightings to the CFS on days of increased fire danger. The Mount Crawford Airstrip, located near Mount Crawford Forest Headquarters, is a CFS approved airstrip used for filling and refuelling fire bombing aircraft. Numerous standpipes, hydrants, and static water supplies (tanks, dams, etc) are located across the planning area. The CFS AMLR primary response zone for the response of aerial bombers covers the central Mount Lofty Ranges; this includes all of the land in the Fire Management Plan except for Kaiserstuhl Block and the Gawler Buffer Crown land in Gawler Block.

Bushfire response plans for public land in the South Para area and the annual works schedule (that will be developed by the respective agency as part of this plan) will provide more information on fire infrastructure.

5.3.3 Forest Plantation Design

Commercial plantation forests managed by ForestrySA in the planning area are established in accordance with the ForestrySA Plantation Forest Manual (ForestrySA 2011). This document outlines the methods for plantation establishment, thinning, harvesting, and fire risk mitigation. Other factors to consider in plantation design are outlined within the *Forest Owners Conference Plantation Design Guidelines* (FOC 2003). Generally there is 20 metres of fuel reduction adjacent to plantations boundaries bordering private land, which includes a fire access track. Some of these fuel reduced zones have been mapped as part of the plan (Map 4 – Fire Management & Access; online).

5.3.4 Fire Management Zones

Fire management zones as detailed in the *DEWNR Zoning Procedure* (DEWNR 2015b) have been introduced into fire management planning to:

- ensure that appropriate management actions are implemented to meet the requirements for asset protection and ecological management on public land
- clarify the areas where different fire management activities will be undertaken on public land
- ensure a standard approach to the application of fire management zones on public land across South Australia.

Fire management zones are categorised according to the primary objective for fire management – Asset Protection Zone (A-zone), Bushfire Buffer Zone (B-zone) or Conservation-Land Management Zone (C-zone). Where A- or B-zones are not applied, C-zone is the default zone type. These zones are determined giving consideration to overall fuel hazard levels in different vegetation types and the level of risk to assets including life, property, and cultural heritage and biodiversity assets. The primary objective is fuel management within A- and B-zones; however, it is noted that carefully timed fuel management can benefit some species. The zones allocated to the reserves within the planning area are described in Appendix 1 – Recommended Works and shown on Map 4 (Fire Management & Access; online).

The following general objectives apply for fire management zoning across the reserves in the planning area.

A-zone Objectives

- To provide a reduced fuel area of at least 40 m in width to help protect life (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.

B-zone Objectives

- To minimise the likelihood of bushfire impacting on property, including essential infrastructure, Adelaide's drinking water catchment, commercial forestry plantations, and ecological assets.
- To assist in reducing bushfire intensity, ember attack, and spotting potential likely to impact on the assets within the surrounding areas or assets within public land.
- To provide a suppression advantage to assist in containing bushfires within defined areas, that is to minimise the likelihood of fires entering the public land from the wider landscape or exiting public land.
- To reduce the likelihood that significant areas of contiguous vegetation burn in a single fire event.
- To enhance safe access for firefighters.

C-zone Objectives

- To manage fire to meet the land management objectives as specified by the relevant agency.
- To assist in the conservation of species and populations such as the rated species listed in Appendix 2 – Fire Response of Rated, Significant and Introduced Flora Species, Appendix 3 – Fire Response of Rated and Significant Fauna Species, as well as Appendix 4 – Ecological Communities of Conservation Significance, through the application of appropriate fire regimes.

C-zone Objectives

- 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 reduce the likelihood of increased fragmentation of native vegetation through the planning and implementation of fire management strategies.

Major Strategies within the Planning Area

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

- A-zones have been applied to areas of public land where an adjacent asset is less than 40 m from the boundary of public land and not separated by a road.
- B-zones have been located to reduce the chance of a block burning in its entirety or the development of a large fire that may threaten the community.
- C-zone burning has been proposed to provide additional protection from landscape-scale fires by interrupting large contiguous areas of fuels, strengthening B-zones or supporting fuel reduction adjacent to public land.
- C-zone burning will be managed in accordance with EFMG as part of ecological maintenance, restoration, and research into fire as an ecological process.

These and other zones applied to the included lands in the plan are shown on Map 4 (Fire Management & Access; online) and detailed in Appendix 1 – Recommended Works. Note that the extent of these zones and proposed burns as displayed spatially is indicative, the widths and locations will be more clearly defined during prescribed burn planning depending on the method of implementation.

Prescriptions for Fuels in A- and B-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.

The overall fuel hazard is assessed via on-ground observations. The *Overall Fuel Hazard Guide for South Australia* (DENR 2011e) assists the agencies to identify the hazard posed by surface, near-surface, elevated, and bark fuels. The fuel hazard levels are then assessed against a table to determine the overall fuel hazard rating.

Fine fuels (less than 6 mm), particularly in the Near-surface and Surface layers, contribute the most to a fire's rate of spread and flame height (DSE 2010). The Elevated fuel layer significantly contributes to flame height and increases fire intensity (DSE 2010). Bark fuel (particularly stringy-bark) produces burning embers that can generate spotting (DENR 2011e), causing new fires or the ignition of other flammable objects (houses, sheds etc). These fuel layers are therefore targeted during prescribed burning operations as a means of providing the greatest reduction to the overall fuel hazard. Other fuel reduction activities such as selective vegetation thinning, woody weed removal, and slashing can also significantly reduce fuel hazards.

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.

Details on fuel reduction methods within A- and B-zones are provided as part of an EA process which is completed before the implementation of each prescribed burn and also before new fire management works are undertaken within publicly managed land (where native vegetation is being cleared and is not exempt under the *Native Vegetation Act 1991*). ForestrySA and SA Water have agreed to follow the EA process for prescribed burning as required in the Fire Information Management System. For more information refer to the *Fire Information Management System - User Guide* (DEWNR 2013b) and the *South Australian Prescribed Burning Code of Practice* (GAFLC 2009).

5.3.5 Prescribed Burning

Prescribed burning is the planned application of fire within prescribed environmental conditions and predefined boundaries, either for bushfire risk mitigation or to achieve ecological or research objectives. The agencies have developed and agreed to the *South Australian Prescribed Burning Code of Practice* (GAFLC 2009). This document guides the implementation of prescribed burning. DEWNR has developed operational prescriptions outlining the preferred range of weather variables and fuel moisture content for different vegetation types suitable for prescribed burning (DENR 2011d). ForestrySA adheres to these prescriptions (ForestrySA 2010a).

Individual prescribed burn plans are prepared and assessed for approval for every prescribed burn regardless of the objective (DEWNR 2015b; ForestrySA 2010a; GAFLC 2009). Operations plans are approved by the nominated Incident Controller (IC) for each burn.

Prescribed burn plans include:

- the objective of the prescribed burn, e.g. fuel reduction, ecological or research purposes, and the area to be treated
- an EA of potential impacts on threatened species and ecological communities, cultural heritage, significant recreation and amenity values, significant weeds, and vegetation age classes; for burns in C-zones, the application of the *Ecological Fire Management Guidelines for Native Vegetation in South Australia* (DEWNR 2013a). Mitigating actions are implemented where impacts are identified an operations plan detailing:
    - fuel hazard assessments
    - prescriptions for the burn based on strategic objectives
    - operational maps
    - site preparatory work required before the burn is conducted
    - forecasted weather
    - the strategies and tactics to achieve the desired objectives
    - the personnel required and their command
    - plant and equipment
    - site-specific safety considerations including control lines, fall-back lines, evacuation plans, and escape routes

  - permits required
  - notifications to other agencies and stakeholders
- a burn risk assessment assessing the risk of escapes, potential for off-target damage, effectiveness of mitigation strategies, and the potential for the burn to meet its objectives
- pre- and post-prescribed burn monitoring and follow-up works.

Approvals for prescribed burn plans vary depending on the level of complexity and risk. Where native vegetation is being treated an EA is undertaken. Depending on the level of impact a hierarchy of approvals must then be followed. This includes regional staff, including those with ecological expertise, IC, Regional Manager, and the Native Vegetation Council (NVC).

Where matters of national environmental significance are likely to be significantly impacted, approval is required from the Commonwealth Department of the Environment under the EPBC Act.

All C-zone burns require consultation with senior ecological staff. Operations plans are approved by the nominated IC for each burn within the agencies.

Prescribed burning in zones identified on Map 4 and Map 5 (Fire Management & Access and Implementation Strategy – Proposed Burns; online) may not be treated in their entirety at one point in time, as the area may be divided and treated over a number of seasons, or the treated area may be patchy for environmental purposes or due to conditions at the time of the prescribed burn.

Prescribed Burning in C-zones

Under agency policies, prescribed burning within C-zones may be implemented for the purpose of ecological management, cultural management, research, or for additional landscape protection. A clearly defined, strategic program of landscape protection C-zone burning may be an appropriate way to mitigate the risk of a whole block/reserve/area burning in a single bushfire event (DEWNR 2015b). All prescribed burning within C-zones will be in accordance with the EFMG described within the plan (see Section 5.4).

Proposed prescribed burn areas in C-zones are shown on Map 4 and Map 5 (Fire Management & Access and Implementation Strategy – Proposed Burns; online). These burn areas may be added, altered, relocated, or may be withdrawn at the discretion of the agencies at any time. Generally this would be as a result of unplanned fires or other factors that may have occurred since the time of writing. The implementation of any proposed burn is subject to resource availability and agency priorities.

All prescribed burning in A-, B-, and C-zones (regardless of the objective or tenure) will meet fire management planning requirements by applying an EA process as part of a prescribed burn plan and consistent with the GAFLC *Code of Practice for Prescribed Burning* (GAFLC 2009). Within A- and B-zones burning is undertaken for the purpose of fuel reduction (as described above).

Ecological Prescribed Burns

Prescribed burns within C-zones may be carried out for specific ecological purposes, including the management of vegetation age classes, weed management, and management of threatened species or ecological communities, as well as non-threatened

fauna and flora. Ecological prescribed burns are conducted in accordance with the *Ecological Fire Management Guidelines for Native Vegetation in South Australia* (DEWNR 2013a), which are described in Section 5.4 of this plan. Where a proposed prescribed burn is not included in an approved management plan or other statutory document that outlines the requirements for the application of fire regimes, an Ecological Burn Rationale must be prepared and approved as per the *Ecological Burning Procedure* (DEWNR 2015b).

The *Native Vegetation Council Guidelines, Ecological Prescribed Burning under Regulation 5(1)(zi)* (Native Vegetation Council 2014) under the *Native Vegetation Act 1991* (NV Act) also apply to these prescribed burns. All ecological burns on DEWNR-managed land are either, approved by the NVC under *Native Vegetation Regulation 5(1)(zi)* or are in line with the *DEWNR Fire Management Standard Operating Procedure Under the Native Vegetation Act* (Native Vegetation Council In Prep). ForestrySA has NVC authority to carry out prescribed burning on ForestrySA-managed land for fire mitigation and ecological purposes. SA Water has NVC authority to carry out prescribed burning on SA Water-managed land for fire mitigation purposes under Native Vegetation Regulation 5A, whilst ecological burns on SA Water-managed land are approved by the NVC under Native Vegetation Regulation 5(1)(zi).

Landscape Protection Prescribed Burns

Prescribed burns within C-zones may be carried out for landscape protection purposes, where the reduction of fuel in a particular area reduces the likelihood of a whole reserve or large contiguous block of vegetation burning in a single fire event. Unlike prescribed burns in A- or B-zones, return application of fire in landscapes protection burns is not determined by set fuel hazards thresholds. Instead they are guided by fire regimes described in the *Ecological Fire Management Guidelines for Native Vegetation in South Australia* (DEWNR 2013a).

5.3.6 Fire Management Blocks

The planning area has been divided into 12 fire management blocks to ensure that information and issues unique to a particular area have been addressed (Table 5). Block boundaries are based on access and the practicalities of implementing fire management objectives.

TABLE 5 – FIRE MANAGEMENT BLOCK INFORMATION

Block	FSA FL	FSA NFR	SAW land	DEWNR land	Other land	Size (ha)
Kaiserstuhl		Kaiserstuhl Pewsey Vale		Kaiserstuhl CP	HA 900.1 HA 900.2 HA 1211	961
Sandy Creek				Sandy Creek CP		158
Murrays	Roselers Hicks Londons Murrays Gilberts					840
Mount Crawford	Forbes Big Hill Mt Crawford Dewells Cromer Mt Pleasant Goat Farm Mc Beans Big Flat	Little Mt Crawford	Warren RR (east)			3 118
Watts Gully	Forties Scotts Charcoal Pits Yatala Tower Watts Gully Waterholes Dickers	Tower Hill Watts Gully	Warren RR (west)	Warren CP Hale CP	HA 1467 HA 490 HA 1297	3 520
Cromer	Kennedys Muellers			Cromer CP	Cromer CP (addition)	300
Para	Old Kersbrook Colemans	Kersbrook	South Para RR Barossa RR	Para Wirra CP		4 801
Gawler					Gawler Buffer Crown land Para Woodlands	733
Mount Gawler	Mount Gawler Devils Gully	Mount Gawler			HA 56	1 603
Little Para			Little Para RR			1 268
Millbrook	Bennetts Symonds Haarsmas Hatchlands		Millbrook RR Gumeracha Weir Reserve	Cudlee Creek CP		1 853
Cudlee Creek	Baldy Foxes Ramseys Mount Misery Hornes	Cudlee Creek Coralinga	Kangaroo Creek RR	Kenneth Stirling CP (Burdetts Block) Montacute CP	HA 512	2 573

5.4 Ecological Fire Management

The management of fire to maintain or enhance biodiversity is based on knowledge of the vital attributes (Noble & Slatyer 1980) of flora and fauna species, populations, and communities exposed to different fire regimes. Vital attributes are a functional approach to

fire response based on groups of species that share critical life history characteristics. Consideration is given to the method of persistence after fire (e.g. seeding or resprouting), the environmental requirements for successful re-establishment (e.g. competition or some form of preconditioning), and the lifespan of the different stages within the lifecycle (e.g. time to become reproductive). A functional approach such as this can provide a means of both understanding and predicting species' response to a particular fire regime, with the specific objective of being able to predict the changes in plant communities subject to recurrent disturbance. There is 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. The agencies collect and record vital attributes data for flora and fauna. This approach is being used as a sound basis for the management of fire for biodiversity across Australia (Andersen, Cook & Williams 2003; FEWG 2004; Hopkins & Saunders 1987; Whelan *et al.* 2002) and is used to assist in achieving management objectives in C-zones within all DEWNR fire management plans and across agencies.

5.4.1 Methodology

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

- **TPC1** describes the lower threshold for fire interval (years between fires) for a particular MVS. That is, vegetation within this MVS will be represented predominantly by early successional species if the inter-fire interval is less than the time specified, and those species that require longer to flower and set seed can disappear from a community. The KFRS that typically determine TPC1 are those species with the longest juvenile period (i.e. time to adequately set seed or reproduce)
- **TPC2** describes the upper threshold for fire interval (years between fires) for a particular MVS. That is, populations of some species (e.g. obligate seeders) are likely to reduce within this MVS if fire is absent for more than the time specified. The KFRS that typically determine TPC2 are those species with the shortest extinction period (i.e. time until regeneration from seed or reproduction is no longer possible).

Fire intervals between TPC1 and TPC2 (Table 6) are predicted to maintain the species complement, whereas intervals shorter than TPC1 or longer than TPC2 are predicted to lead to the decline of the 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 TPCs of fire regime (fire interval, intensity, scale 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).
- EFMG are reviewed periodically as new information becomes available.

Figure 3 illustrates this process.

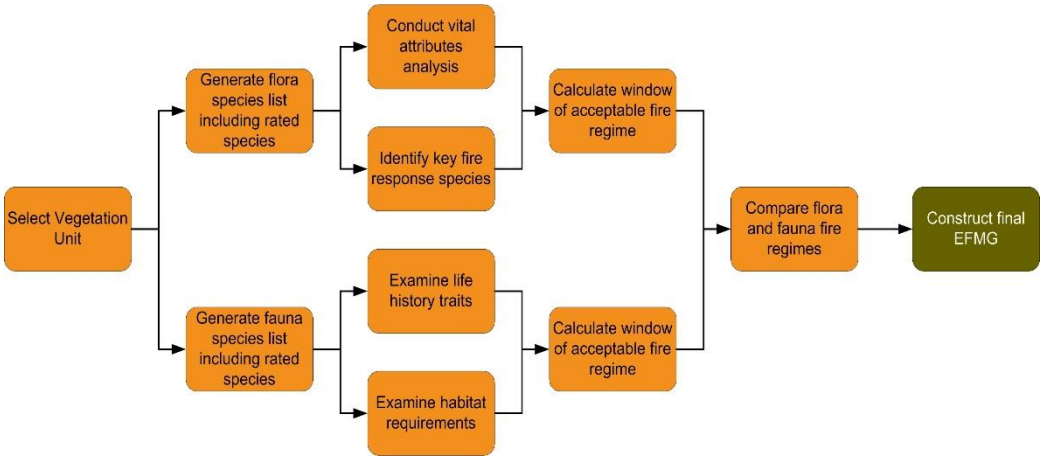

FIGURE 3 – APPROACH FOR DETERMINING ECOLOGICAL FIRE MANAGEMENT GUIDELINES

5.4.2 Interpreting Ecological Fire Management Guidelines

EFMG have been defined for MVS within the planning area (refer Table 6) to assist strategic planning and management of fire within the reserves in the planning area in a way that will support the maintenance and enhancement of biodiversity.

Guidelines for five aspects of fire regime (interval, frequency, spatial, intensity, and season) have been determined for all MVS within the planning area (where data are available). The upper and lower 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 PLANNING AREA

		ECOLOGICAL FIRE REGIME							
		Interval		Spatial Criteria		Frequency	Intensity		Season
MVS No	MVS NAME	TPC1: Lower threshold in years	TPC2: Upper threshold in years	Inter-fire intervals within TPC1 & TPC2 across more than X% of the extent of this MVS within the planning area	% > TPC2	Avoid more than 2 fires within a period of X years	Avoid more than 2 successive fires of low intensity (Yes/No)	Some medium to high intensity fire needed to regenerate some species (Yes/No)	Avoid more than 1 successive fires in season
5	*Eucalyptus* forests with a grassy understorey	5	50	40	30	60	N	N	Spring/during & following drought
8	*Eucalyptus* woodlands with a shrubby understorey	20	50	40	30	60	Y	Y	Spring/during & following drought
9	*Eucalyptus* woodlands with a grassy understorey	5	50	40	30	60	Y	Y	Spring/during & following drought
12	*Callitris* forests and woodlands	15	60	40	30	70	Y	Y	During & following drought
19	*Eucalyptus* low open woodlands with tussock grass	5	50	40	30	60	Y	Y	Spring/during & following drought
21	Other *acacia* tall open shrublands and shrublands	20	40	40	30	50	Y	Y	Drought
26	*Casuarina* and *Allocasuarina* forests and woodlands	20	50	40	30	60	N	N	During & following drought
30	Heath	15	40	40	30	50	Y	Y	Same season
32	Other shrublands	20	35	40	30	40	N	N	Spring
48	*Eucalyptus* open woodlands with a grassy understorey	10	50	40	30	60	Y	Y	Spring/during & following drought

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

6 RESPONSE

6.1 Response Plans

Response plans exist for public land in the planning area and these are reviewed on an annual basis through the MLRFC. Response plans provide reserve-specific information in relation to fire suppression including water points, equipment and access, as well as levels of preparedness.

The response plan is for initial response only and the plan should be referred to by an IC for more detailed fire management information, in conjunction with the land manager.

6.2 Suppression Considerations

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

General principles:

- All suppression efforts are to be in accordance with the FES Act and the CFS Operational Tri-Manual (CFS 2013).
- Bushfires should be kept to the smallest possible area in commercial plantations to minimise economic loss.
- The use of fire suppression chemicals in catchment areas will be in accordance with the *Memorandum of Understanding on Aerial Application of Chemical Fire Retardants between the SA Country Fire Service and South Australian Water Corporation* (CFS 2015).
- The use of fire suppression chemicals on DEWNR-managed public land will be in accordance with the *DEWNR Fire Suppression Chemicals Procedure* (DEWNR 2015b).
- Only chemicals qualified and approved by the United States Department of Agriculture Forest Service (USDA Forest Service 2008) and endorsed by AFAC (AFAC 2013a) will be used on public land.
- Implement precautionary hygiene measures to reduce the risk of Phytophthora infestation (see Section 3.8.3) and spread of weeds. Weed hygiene measures may incorporate cleaning by water (wash-down), solvent based cleaning, and/or air jets.
- Minimum Impact Suppression Techniques (MIST) and specialised equipment that reduces impacts to the landscape shall be used wherever possible and control methods will not be greater than the potential or actual impact of the fire.

The agencies have an obligation to maximise safety for fire suppression activities. For this plan, standards for firebreaks are in accordance with the GAFMWG Guidelines (GAFMWG

2014). Where the combination of vegetation, fuel loads, and terrain is likely to reduce the effectiveness of these firebreaks, they may be widened using techniques such as chaining or rolling, or perimeter burns in their immediate vicinity. This will minimise the likelihood of bushfires crossing control lines.

Utilising existing firebreaks and the strategic use of previous fire scars and fuel patterns, will reduce the need to undertake other high impact suppression measures, such as chaining or constructing mineral earth breaks during a running fire.

In some situations, where plantations or water quality might be impacted, it may be more appropriate for control lines to be constructed in neighbouring lands off-reserve, and this will be negotiated with neighbours and the CFS on a case-by-case basis.

6.2.1 Firefighters

Hazards to firefighters within the reserves have been identified as:

- steep terrain, rocky cliffs and gorges
- historical mine shafts, covered and uncovered, exist across the planning area
- heavy, wooded areas with minimal opportunity to escape in the event of a fire event
- agencies depots are located across the planning area and may contain chemicals and other hazards.

In regards to fire access within the planning area:

- public roads and access tracks considered important for fire management on public land have been classified to GAFMWG standards and are shown on Map 4 (Fire Management & Access; online)
- gates providing access to publically-managed lands are illustrated on Map 4 (Fire Management & Access; online)
- public roads and access tracks classified as Service Tracks should not be used during fire suppression operations unless verified by on ground inspection and approved by the IMT
- there is a high likelihood that public roads may be blocked due to traffic, falling trees, track conditions, or fire behaviour during an incident and as a result there is a risk of entrapment.

Water for fire suppression can be sourced from standpipes and static water supplies as shown on Map 4 (Fire Management and Access; online). Alternatively bulk water carriers may be deployed to the incident.

6.2.2 Machinery Use

Machinery for bushfire suppression may be used. The decision to deploy machinery for direct attack should be made by the IMT at the earliest point in time, given:

- the fire weather and associated fire behaviour conditions under which the machinery will be operating
- the response time and anticipated time of work commencement is acceptable and achievable (e.g. to minimise the overall area cleared in the establishment of control lines and increase the likelihood of success)
- that the actions are authorised by the IMT

- where known environmental and cultural values and/or assets occur, machinery is to be excluded, particularly from significant areas such as threatened or reintroduced fauna and flora habitat, or sites of Ngadjuri, Peramangk, or Kaurna cultural heritage
- where possible, machinery use is strategically located to minimise the impact on native vegetation and the environment
- steep terrain/cliffs will often considerably reduce the effectiveness of, and pose risks to, machinery operators.

Machinery use and deployment during fire suppression is to be in accordance with the *CFS Supervision of Machinery Guidelines* (CFS 2007) and the *DEWNR Earthmoving Equipment Procedure* (DEWNR 2015b).

6.2.3 Aerial Suppression

There are opportunities for aerial fire operations within and adjacent the South Para planning area. The Mount Crawford Airstrip is the main airstrip within the planning area available for use.

The use of retardant should be restricted to critical situations, such as the protection of built assets, both within the reserve and off reserve. The dye added to retardants to make it easy for pilots to identify previous drops can cause damage to cultural assets such as petroglyphs and the weight of the water disturbs the soil surface, potentially affecting cultural values.

All aerial suppression operations across the planning area will:

- be in accordance with the *CFS* Operational Tri-Manual (CFS 2013)
- be in accordance with the *Memorandum of Understanding on Aerial Application of Chemical Fire Retardants* between the CFS and SA Water when the use of fire suppression chemicals is required in catchment areas (CFS 2015)
- be in accordance with the *DEWNR Fire Suppression Chemicals Procedure* (DEWNR 2015b) when the use of fire suppression chemicals is required on DEWNR-managed public land
- only use chemicals qualified and approved by the USDA Forest Service (USDA Forest Service 2008) and endorsed by AFAC (AFAC 2013a) on public land.

6.3 Access to Public Land

The safety of residents and lessees within public land is managed in accordance with the 'Prepare Act Survive' principle, which advocates for the preparation of Bushfire Survival Plans ahead of time and explains the responsibility of individuals to stay well informed to assist in decision making to improve safety (CFS 2009b). Agency policies allow for the temporary closure of publicly-managed lands on days declared a Total Fire Ban (TFB) (DENR 2010d; Government of South Australia 2013; SA Water 2008). Reserves may also be closed in the event of a bushfire within or threatening a reserve or during other fire management operations, such as prescribed burning.

ForestrySA-managed lands and SA Water Reservoir Reserves are closed to the public on days of TFB as declared by the CFS (Fire Danger Index >50) (CFS 2013) and work bans may also be put in place. DEWNR reserve closures will be implemented on days declared a TFB where there is a catastrophic risk of bushfire. The decision to close reserves should be considered on declared TFB days.

The CFS has an Evacuation Policy (CFS 2009c), which explains that as far as is possible, members of the community should decide for themselves whether to stay or go when threatened by an emergency. Directed evacuation will only be undertaken by the South Australia Police and Emergency Services when it is safe to do so and adequate resources are available. Agencies will comply with all requests from these authorities in evacuating visitors, lessees, and residents from reserves during an emergency.

7 RECOVERY, RESEARCH AND MONITORING

7.1 Post-fire Rehabilitation and Recovery

Post-fire rehabilitation plans are prepared by each agency as necessary to ensure that requirements for the rehabilitation and recovery of areas affected by bushfire are considered. A post-fire rehabilitation plan shall discuss:

- impacts to infrastructure, built assets, plantation forests, water quality, and natural and cultural heritage
- potential threats to biodiversity conservation, natural heritage, and potable water quality
- actions, responsibilities, and costs associated with the rehabilitation effort.

Plantation areas will be assessed for damage by ForestrySA post-fire and salvage of standing pine will be attempted to minimise the commercial impact of the fire on the forest industry.

The *DEWNR Post-fire Rehabilitation Procedure* (DEWNR 2015b) was developed to ensure that this is carried out to mitigate the impact on natural and cultural values, address pest or abundant species issues, as well as to control access for public safety purposes and re-instate damaged property as necessary on or adjacent to DEWNR-managed land.

SA Water has a procedure to address water quality post-fire (SA Water 2010b). This is a step-by-step guide for managing water quality risks associated with a bushfire incident. A *Fire Recovery Strategy* (SA Water 2010c) has been developed for the Mount Lofty Ranges, which gives an overview of each reservoir reserve, identifies the potential risks to raw water quality post-fire and defines the various options available to SA Water from an operational perspective if water quality is compromised.

Under the *Emergency Management Act 2004*, the State Emergency Management Plan for South Australia outlines the process for recovery of incidents and disasters. The State Recovery Office is responsible for major post-bushfire recovery. South Australia is divided into Emergency Management Zones, and each zone is managed by a Zone Emergency Management Committee that is responsible for planning and implementing Zone-level actions in support of the State Emergency Management Plan (South Australian Fire and Emergency Services Commission 2015). This plan is found across three zones, being the Adelaide Hills, Northern Adelaide and the Barossa, Light and Lower North.

7.2 Research

DEWNR has prepared a Science Directions document (DENR 2010c) that outlines some key questions for research in fire science and fire management. The following research proposed will contribute to improving the knowledge required to answer these priority research questions. ForestrySA and SA Water will collaborate with DEWNR in achieving research objectives. The following management strategies summarise recommended research that may be undertaken on public land in the planning area.

Management Strategies	
Research	82. Determine the suitability of flora based thresholds for meeting fauna conservation objectives.
	83. Continue to collect and collate vital attributes for fauna and flora and incorporate into future EFMG and EFMS.
	84. Assess whether the chosen KFRS are appropriately sensitive as community-wide indicators of inappropriate fire regimes in the plan area.
	85. Support the ongoing research into use of fire for the management of weeds.
	86. Investigate the effect of fire on the following species and ecological communities: Southern Brown Bandicoot, Mount Lofty Ranges Chestnut-rumped Heathwren, Osborn's Eyebright, Clover Glycine, Mount Lofty Speedwell, threatened orchids and Peppermint Box Grassy Woodlands.
	87. Investigate the social attitudes, values, and drivers that are impacting on or having the greatest influence on decision making.

7.3 Monitoring

Monitoring will be established in conjunction with prescribed burns to assess issues raised during prescribed burn planning, in accordance with individual agencies' policies and procedures. Implementation will depend upon state and regional priorities and available resources.

Monitoring will also be conducted in areas impacted by bushfire to improve knowledge about the response of species, communities, and habitats to fire within the planning area. The Sampson Flat bushfire provides an opportunity to monitor fire response and accordingly, the agencies will work collaboratively to identify and undertake monitoring projects to build upon the existing knowledge base.

The results from post-fire monitoring will be used to further refine fire management, consistent with an adaptive management approach. Refer to Section 5.3.4 of this plan for general information on zoning, burning, and the planning requirements.

7.3.1 ForestrySA Fire Exclusion Areas

A number of forest reserve compartments within the plan area are designated as scientific benchmark areas, where prescribed burning is excluded. These compartments have native vegetation that is long unburnt and serve as baseline reference areas.

Management Strategies

Monitoring

88. Investigate the fuel accumulation rates of the various MVS that occur within the planning area (Table 4). These data will help determine if and when fuel reduction works are required, ultimately assisting in the scheduling of operational works and activities in B-zones.
89. Undertake monitoring to assess the effectiveness of implemented weed control measures and refine the weed management information for the control of introduced species following fire accordingly.
90. Continue to monitor existing survey sites of flora and fauna species pre- and post-fire to determine their fire response and to assess habitat preferences and requirements in relation to the TPCs. Where strategically needed, establish new monitoring sites.
91. Establish permanent monitoring plots in long unburnt areas as reference points for comparison with burnt areas in relation to habitat condition, flora species composition, and fuel loading.
92. Promote data sharing between agencies to increase quality and quantity.

8 SUMMARY OF MANAGEMENT STRATEGIES

Visitor Use

1. Consider closures of DEWNR reserves when significant fire weather is forecast.
2. Prepare visitor Bushfire Survival Plans as required and review annually. Plans for individual visitor facilities should be developed by the lessee, owner, or manager.
3. Educate and encourage visitors to reconsider travel into and through areas of high bushfire risk on days of heightened fire danger.
4. Implement appropriate fire management strategies as shown on Map 4 (Fire Management & Access; online) to increase visitor safety.

Forestry Assets

5. Implement appropriate fire management strategies for the protection of forestry assets as shown on Map 4 (Fire Management & Access; online).
6. Ensure that Forest Reserves are managed in accordance with the *ForestrySA Plantation Forestry Manual* (ForestrySA 2011) and the *ForestrySA Fire Management Plan* (ForestrySA 2012).

Built Assets

7. Implement appropriate fire management strategies to protect assets as shown on Map 4 (Fire Management & Access; online).
8. Encourage adjacent property owners to work with the CFS and local government to implement appropriate and coordinated fire management works on their own land to minimise the threat of fire.
9. Ensure that infrastructure critical to Adelaide's water supply is protected against the threat of fire.
10. Ensure that fuel reduction of any native vegetation adjacent to or surrounding reservoirs is managed appropriately to minimise detrimental effect on water quality.
11. Ensure revegetation is consistent with fire management zoning and fire is excluded from juvenile revegetation sites.

Cultural Heritage

12. Implement appropriate fire management strategies for the protection of cultural assets as shown on Map 4 (Fire Management & Access; online).
13. Ensure liaison at bushfires occurs to identify cultural assets, where time allows. Once the fire has passed evaluate sites to establish if any damage has occurred.
14. Ensure suppression strategies take into account significant cultural assets to minimise impacts from these activities and where necessary undertake post-fire rehabilitation.

Southern Brown Bandicoot

15. Implement appropriate fire management strategies identified in the EFMS that will minimise the risk of local extinctions in the event of a bushfire.
16. Conduct prescribed burning to improve habitat suitability as identified in the Recovery Plan.
17. During bushfires, attempt to retain unburnt patches as refuge areas to minimise the risk of local extinctions.
18. Monitor the effects of fire on the Southern Brown Bandicoot populations and preferred habitat and structure. Use this information to inform the DEWNR vital

attributes database (Appendix 2 – Fire Response of Rated, Significant and Introduced Flora Species & Appendix 3 – Fire Response of Rated and Significant Fauna Species).

Chestnut-rumped Heathwren

19. If extant populations are confirmed to still occur in the area, implement appropriate fire management strategies that will minimise the risk of a whole population's habitat burning in a single bushfire event.
20. If necessary, conduct prescribed burning to improve habitat suitability.
21. During bushfires, attempt to retain unburnt patches of land as refuge areas to minimise the risk of local extinctions.
22. Develop and implement an EFMS for the Mount Lofty Ranges Chestnut-rumped Heathwren.
23. Monitor the effect of fire on Mount Lofty Ranges Chestnut-rumped Heathwren populations and preferred habitat and use this information in future EFMG (Appendix 2 – Fire Response of Rated, Significant and Introduced Flora Species & Appendix 3 – Fire Response of Rated and Significant Fauna Species).

Bassian Thrush

24. Implement appropriate fire management strategies that will minimise the risk of local extinctions in the event of a bushfire.
25. During bushfires, attempt to retain unburnt patches of land as refuge areas to minimise the risk of local extinctions.
26. Undertake post-burn weed management to avoid altering habitat structure.
27. Where possible, burning in known Bassian Thrush habitat should be avoided. Where prescribed burning is necessary, consultation with the Threatened Fauna Ecologist should occur.
28. Monitor the effect of fire on Bassian Thrush populations and preferred habitat and use this information in future EFMG (Appendix 2 – Fire Response of Rated, Significant and Introduced Flora Species & Appendix 3 – Fire Response of Rated and Significant Fauna Species).

Declining Woodland Birds

29. Implement appropriate fire management strategies that will minimise the risk of local extinctions in the event of a bushfire.
30. Identify and implement strategies for minimising the collapse of significant habitat and hollow bearing trees during prescribed burn operations and develop a process to facilitate the appropriate assessment and possible removal of potentially hazardous trees as part of bushfire operations.
31. During bushfires, attempt to retain unburnt patches of land as refuge areas to minimise the risk of local extinctions.
32. To ensure that adequate habitat resources are available for Square-tailed Kites, fire planners to ensure that >50% of remnant vegetation in planning area is >15 years age since last fire.
33. Undertake post-burn weed management to avoid altering habitat structure.
34. Where prescribed burning is necessary in known declining woodland bird habitat, consultation with the Threatened Fauna Ecologist should occur.

Diamond Firetail

35. Implement appropriate fire management strategies that will minimise the risk of local extinctions in the event of a bushfire.

36. If necessary, conduct prescribed burning to improve habitat suitability.
37. During bushfires, attempt to retain unburnt patches of land as refuge areas to minimise the risk of local extinctions.
38. Develop and implement an EFMS for the Diamond Firetail.
39. Encourage research into the ecology of the species to help inform future fire management activities in species' habitat.

Threatened Orchids

40. Refer to the *Recovery Plan for Twelve Threatened Orchids in the Lofty Block Region of South Australia* (Quarmby 2010) and draft *EFMS for Threatened Orchids* when planning prescribed burns within known habitat of threatened orchids.
41. Consult with the Lofty Block Threatened Orchid Recovery Team regarding prescribed burns in areas containing nationally listed orchid species.
42. Avoid prescribed burning or slashing within threatened orchid populations between April and October.
43. Avoid prescribed burning or slashing within threatened orchid populations more frequently than every 10 years (other than on designated firebreaks).
44. Minimise the likelihood of multiple populations of threatened orchid species and habitat burning in a single fire season.
45. Minimise the likelihood of vehicles or equipment impacting on threatened orchid populations during track management and fire suppression operations by referring to the relevant response plans.
46. Undertake ecological/experimental burns on threatened orchid populations to examine the response of these species to different disturbance regimes in consultation with the Lofty Block Threatened Orchid Recovery Team.
47. Prepare and implement an EFMS to improve fire management of threatened orchids.

Osborn's Eyebright

48. Minimise the likelihood of large areas of known habitat burning in a single fire event.
49. Undertake ecological/experimental burns within known habitat to examine the response of Osborn's Eyebright to different disturbance regimes.
50. Prescribed burning should occur after seed release in autumn.
51. Monitor the effects of fire on Osborn's Eyebright and use this information to update the DEWNR vital attributes database (Appendix 2 – Fire Response of Rated, Significant and Introduced Flora Species).

Clover Glycine

52. Prescribed burning should occur after plants have matured and set seed.
53. Where appropriate a weed management program will accompany prescribed burning activities when conducted where Clover Glycine is present.
54. Undertake ecological/experimental burns on Clover Glycine populations to examine the response of the species to different disturbance regimes.

Mount Lofty Speedwell

55. Avoid burning Mount Lofty Speedwell populations more frequently than every 15 years.
56. Avoid burning entire populations of Mount Lofty Speedwell as a precaution until more is known about its fire response.

57. Minimise the likelihood of several populations burning in a single fire event or season.
58. Monitor the effects of fire on the Mount Lofty Speedwell and use this information to update the DEWNR vital attributes database (Appendix 2 – Fire Response of Rated, Significant and Introduced Flora Species).

Peppermint Box Grassy Woodland

59. Minimise the likelihood of large areas of the community burning in a single fire event.
60. Refer to the *National Recovery Plan for the Peppermint Box Grassy Woodland of South Australia ecological community* (Turner 2012) when planning fuel management strategies in areas supporting Peppermint Box Grassy Woodland.
61. Undertake ecological/experimental burns to examine the response of the community to different disturbance regimes and use this information to update the DEWNR fire response database (Appendix 4 – Ecological Communities of Conservation Significance).
62. Implement appropriate fire management strategies to reduce the likelihood of impact during prescribed burning (e.g. fire crew to rake hoe around mature trees, lighting patterns, controls on flame height).
63. A weed management program (including minimising soil disturbance) will accompany prescribed burning activities when conducted within Peppermint Box Grassy Woodlands community.

Pest Species

64. Refer to EFMG (Table 6) and fire management guidelines for introduced flora species (Appendix 2 – Fire Response of Rated, Significant and Introduced Flora Species) during prescribed burn planning.
65. Implement pre- and post-fire management strategies identified in the EFMS that will minimise the risk of gorse and broom increasing post-fire (DENR 2011a).
66. Use fire as a tool that forms part of integrated weed management strategies.
67. Consider the likely post-fire responses and impacts of weed species and implement pre-, and post-fire weed control (subject to agency priorities).
68. Monitor the effect of fire on weed species to determine the need for pre- and/or post-fire management and use in future EFMG (subject to agency priorities).
69. Collect relevant information during prescribed burn planning on introduced or abundant fauna and undertake a risk assessment to determine the need for pre- and/or post-fire management.
70. Adhere to the Standard Operating Procedure – Phytophthora Threat Management (SOP-002) (DEH 2002) and conduct a risk assessment to determine whether fire management activities will exacerbate the spread of Phytophthora.
71. Ensure hygiene practices are implemented to reduce the spread of Phytophthora across the planning area. Refer to the *DEWNR Operating Procedure – Phytophthora Vehicle Disinfection Unit* (DEH 2003).
72. Monitor the interaction between Phytophthora and fire.

Smoke

73. Assess smoke modelling projections from the Bureau of Meteorology and information from the Environmental Protection Agency (EPA) to consider smoke management prior to burning operations.
74. Refer to *Smoke Taint Fire Management Strategy* (DEWNR 2013c).

Climate Change

75. Monitor species and ecosystems and the processes that support them to understand their resilience to a changing climate. Use fire as a tool that forms part of integrated weed management strategies.
76. Review and adapt fire management strategies in the planning area as the impacts of climate change become understood.
77. Monitor national and international fire management policies and best practice and partner with the research sector to increase our knowledge on altered fire regimes.

Tracks

78. Prioritise and implement actions regarding fire access as described in Appendix 1 – Recommended Works.
79. Maintain tracks to the GAFMWG standards as shown on Map 4 (Fire Management & Access; online).
80. Update and maintain track data on government mapping database.
81. Install and maintain signs on fire access tracks and gates according to GAFMWG standards and name tracks as appropriate.

Research

82. Determine the suitability of flora based thresholds for meeting fauna conservation objectives.
83. Continue to collect and collate vital attributes for fauna and flora and incorporate into future EFMG and EFMS.
84. Assess whether the chosen KFRS are appropriately sensitive as community-wide indicators of inappropriate fire regimes in the plan area.
85. Support the ongoing research into use of fire for the management of weeds.
86. Investigate the effect of fire on the following species and ecological communities: Southern Brown Bandicoot, Mount Lofty Ranges Chestnut-rumped Heathwren, Osborn's Eyebright, Clover Glycine, Mount Lofty Speedwell, threatened orchids and Peppermint Box Grassy Woodlands.
87. Investigate the social attitudes, values, and drivers that are impacting on or having the greatest influence on decision making.

Monitoring

88. Investigate the fuel accumulation rates of the various MVS that occur within the planning area (Table 4). These data will help determine if and when fuel reduction works are required, ultimately assisting in the scheduling of operational works and activities in B-zones.
89. Undertake monitoring to assess the effectiveness of implemented weed control measures and refine the weed management information for the control of introduced species following fire accordingly.
90. Continue to monitor existing survey sites of flora and fauna species pre- and post-fire to determine their fire response and to assess habitat preferences and requirements in relation to the TPCs. Where strategically needed, establish new monitoring sites.
91. Establish permanent monitoring plots in long unburnt areas as reference points for comparison with burnt areas in relation to habitat condition, flora species composition, and fuel loading.
92. Promote data sharing between agencies to increase quality and quantity.

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10 APPENDICES

Appendix 1 – Recommended Works

	Land Manager	Location	Risk	Recommended Works
Cromer Block	DEWNR	Southern boundary of Cromer CP	Diminished firefighter safety	**DEWNR 1.** Upgrade the Service Track running along the southern boundary of Cromer CP to Minor.
	FSA	Kennedys & Muellers FL	Asset damage/loss	**FSA 1.** A-zones (minimum 40 m) surrounding houses adjacent Cromer Road, Black Snake Road, Running Postman Road and Blackwood Road within Kennedys and Muellers. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.
Cudlee Creek Block	DEWNR	South-western corner of Montacute CP	Loss of block in a single fire event and fire building into a landscape-scale event Loss of ecological integrity	**DEWNR 2.** Implement C-zone (Montacute S13) burn for landscape protection.
	DEWNR	Montacute CP	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**DEWNR 3.** Maintain Track 15 and 1D running north-south from Stone Hut Road via Gate 15 to Valley Road to a Standard Track.
	DEWNR	Montacute CP	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**DEWNR 4.** Investigate the potential for the upgrade of the Service Track running north-south in the western section of Montacute CP (linking Valley Road and Big Range Road) to a Minor Track.
	DEWNR/FSA	Coralinga, western end of B-zone	Asset damage/loss	**DEWNR 5.** A-zones to a minimum 40 m width surrounding adjacent houses. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.

	Land Manager	Location	Risk	Recommended Works
Cudlee Creek Block	DEWNR/FSA	Montacute CP through Coralinga	Diminished firefighter safety	**DEWNR 6.** Maintain a fuel reduced strip (A-zone) to a maximum 10 m width along both sides of Big Range Road (including Track 2 and 1C) extending from Valley Road to Mawson Road (refer to **AMLR BMC 6**).
	DEWNR/FSA/SAW	Stone Hut Road, adjacent Montacute CP, Coralinga and Kangaroo Creek Reservoir Reserve	Limited access for fire response vehicles during a fire event Diminished public safety Diminished firefighter safety	**DEWNR 7.** Implement an A-zone to a minimum 20 m width along the northern side of Stone Hut Road (Fire Track 1).
	DEWNR/AMLR BMC	Montacute CP	Loss of block in a single fire event and fire building into a landscape-scale event	**DEWNR 8.** Consider cross-tenure prescribed burning between Fernhurst Road, Big Range Road and Fire Track 2b in conjunction with private landholders.
	FSA	Southern edge of Coralinga	Asset damage/loss	**FSA 2.** A-zones to a minimum 40 m width surrounding adjacent houses. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.
	FSA	Mount Misery & Cudlee Creek (Thomas Hill Study Centre)	Asset damage/loss	**FSA 3.** A-zones to a minimum 40 m width surrounding Thomas Hill Study Centre.
	FSA/DEWNR	Coralinga	Diminished firefighter safety	**FSA 4.** Maintain a fuel reduced strip (A-zone) to a maximum 10 m width along both sides of Big Range Road, extending Track 2 in Montacute (refer to **DEWNR 6** and **AMLR BMC 6**)
	FSA	Ramseys, western edge of Fox Creek Road, to the right of the Guts Trail.	Asset damage/loss	**FSA 5.** A-zones to a minimum 40 m width surrounding car park and any associated structures.

	Land Manager	Location	Risk	Recommended Works
Cudlee Creek Block	FSA	Ramseys, adjacent Croft Road	Asset damage/loss	**FSA 6.** A-zones to a minimum 40 m width along northern edge of Croft Road and surrounding adjacent dwellings/structures. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.
	FSA	Corner of Fox Creek Road and Croft Road within Foxs	Asset damage/loss	**FSA 7.** A-zones to a minimum 40 m width surrounding adjacent dwellings/structures. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.
	FSA	Coralinga, southern boundary within Cpt CO4	Loss of block in a single fire event and fire building into a landscape-scale event	**FSA 8.** Implement a B-zone to a maximum 300 m width along north side of Track 3.
	FSA	Northern edge of the southern boundary of Coralinga NFR	Loss of block in a single fire event and fire building into a landscape-scale event	**FSA 9.** Implement a B-zone to a maximum 350 m width within in Coralinga Native Forest Reserve, adjacent Kenneth Stirling Conservation Park along Track 4.
	FSA	East of the SA Water B-zone north of Stone Hut Road	Loss of block in a single fire event and fire building into a landscape-scale event	**FSA 10.** Implement a B-zone to a maximum width of 850 m and minimum width of 300 m (refer **SAW 5**).
	FSA	Eastern side of Fox Creek Road, all of Baldy and Foxs	Loss of block in a single fire event and fire building into a landscape-scale event	**FSA 11.** Implement a B-zone to a maximum 1000 m width.

	Land Manager	Location	Risk	Recommended Works
Cudlee Creek Block	FSA	Ramseys	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**FSA 12.** Upgrade Lone Gum Trail and The Big End Trail within Ramseys to a Standard Track. HA 512 abuts The Big End Trail on the eastern boundary.
	FSA	Ramseys	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**FSA 13.** Implement Standard Track to link Croft Road and Snake Gully Road.
	FSA	Coralinga	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**FSA 14.** Upgrade tracks 1C & 1B running north south, through Coralinga NFR from Stone Hut Road to Mawson Road to Standard Track.
	SAW	Western end of Stone Hut Road within the Kangaroo Creek Reservoir Reserve	Asset damage/loss	**SAW 1.** A-zones to a minimum 40 m width surrounding adjacent houses. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.
	SAW	Number of Locations along Gorge Road, Lookout Track and SA Water Track 1 within the Kangaroo Creek Reservoir Reserve including helipad and disused pump station	Asset damage/loss	**SAW 2.** A-zones to a minimum 40 m width surrounding adjacent houses. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.
	SAW	A number of locations in the north-western corner of Kangaroo Creek Reservoir Reserve, including adjacent Paracombe and adjacent the Millbrook Block	Asset damage/loss	**SAW 3.** A-zones to a minimum 40 m width surrounding adjacent houses. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.

	Land Manager	Location	Risk	Recommended Works
Cudlee Creek Block	SAW	Stone Hut Road, north of Montacute Conservation Park.	Loss of block in a single fire event and fire building into a landscape-scale event	**SAW 4.** A-zone to a minimum 20 m width along Stone Hut Road.
	SAW	Starting from the southern edge of Kangaroo Creek Reservoir Reserve and running south-east towards Coalinga NFR along Stone Hut Road	Loss of block in a single fire event and fire building into a landscape-scale event	**SAW 5.** Implement a B-zone to a maximum 850 m width to a minimum of 350 m width (refer to **FSA 10**).
	SAW	North-western corner of Kangaroo Creek Reservoir Reserve, adjacent Paracombe, abutting the Millbrook Block	Loss of block in a single fire event and fire building into a landscape-scale event	**SAW 6.** Implement a B-zone to a maximum 150 m width.
	AMLR BMC	Montacute CP	Asset damage/loss and risk to life	**AMLR BMC 1.** Recommend that owners of Allotment 51 and 52, Hundred of Onkaparinga, maintain an A-zone to a minimum 40 m adjacent assets and a B-zone to the reserve boundary.
	AMLR BMC	Kenneth Stirling CP - Burdetts Block	Limited access for fire response vehicles during a fire event	**AMLR BMC 2.** Recommend to the AMLR BMC that the Adelaide Hills Council consider upgrading the bridge on Merchants Road to allow for the track to meet GAFMWG standards.
	AMLR BMC	Montacute CP	Limited access for fire response vehicles during a fire event	**AMLR BMC 3.** Liaise with the AMLR BMC, CFS and landowners to upgrade Valley Road to a Standard Track, with a turnaround point to the entrance to Montacute CP.
	AMLR BMC	Private Land	Limited access for fire response vehicles during a fire event	**AMLR BMC 4.** Recommend to the AMLR BMC to investigate the upgrade of Fernhurst Road to Standard.

	Land Manager	Location	Risk	Recommended Works
Cudlee Creek Block	AMLR BMC	Private Land	Limited access for fire response vehicles during a fire event	**AMLR BMC 5.** Recommend to the AMLR BMC to investigate the extension of Big Range Track across private land to connect with the western side of Montacute CP and Valley Road, including the switchback section. This should be upgraded to Major for the entire length (refer to **DEWNR 6** & **AMLR BMC 6**).
	AMLR BMC	Big Range Road		**AMLR BMC 6.** Recommend to the AMLR BMC that track work along Big Range Road (including any extension) be supported by a fuel reduced strip (A-zone) to a maximum 10 m width along both sides (refer to **DEWNR 6** and **FSA 4**).
	AMLR BMC	Gorge Road	Diminished firefighter safety	**AMLR BMC 7.** Recommend to the AMLR BMC that fuels along Gorge Road should be treated as a strategic break and maintained at B-zone level where possible.
	AMLR BMC	Private land	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**AMLR BMC 8.** Recommend to the AMLR BMC that Snake Gully Road be upgraded to a Standard Track to support access to the upgraded Standard Track within Ramseys.
Mount Gawler Block	FSA	Eastern boundary of Mt Gawler Block – intersection of Tracks DG16 & DG10	Asset damage/loss and risk to life	**FSA 15.** A-zones to a minimum 40 m width surrounding adjacent houses. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.
	FSA	Eastern boundary of Mt Gawler Block – intersection of Tracks DG16 & DG10	Asset damage/loss and risk to life	**FSA 16.** Implement to a minimum a 40 m wide B-zone supporting the A-zone identified in **FSA 15** (above). Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.

	Land Manager	Location	Risk	Recommended Works
Mount Gawler Block	FSA	Adjacent Mt Gawler Road – north of the intersections with Track MG28	Asset damage/loss and risk to life	**FSA 17.** A-zones to a minimum 40 m width surrounding adjacent houses. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.
	FSA	Centre of Mt Gawler Block	Loss of block in a single fire event	**FSA 18.** Implement a B-zone to a maximum 1000 m width including parts of Cpt DG1, DG11, DG 17, DG18, and DG 19.
	FSA	Kersbrook Road and Mount Gawler Road	Public road users safety	**FSA 19.** B-zone to a maximum 80 m width along Kersbrook Road until joining up with **FSA 18**.
	FSA	Airstrip Road, south-western boundary of Mt Gawler Block	Diminished firefighter safety Loss of block in a single fire event	**FSA 20.** Implement a B-zone to a maximum of 250 m width along Airstrip Road.
	FSA	North-eastern corner of Mount Gawler Block (Ridge Road, KE1 Track and KE30 Track)	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**FSA 21.** Implement a slashed break (A-zone) to a minimum 10 m width along the northern edge of Ridge Road and DG1 Track (continuing on to KE1 Track and KE30 Track to Kersbrook Forest Road), supporting access to and from Devils Gully, Mount Gawler Block to Old Kersbrook, Para Block, improving west-east access and egress. Support works identified in **FSA 22** and **FSA 23** below. Refer to Recommend Work **FSA 60** in Para Block.

	Land Manager	Location	Risk	Recommended Works
Mount Gawler Block	FSA	North-eastern corner of Mount Gawler Block (Ridge Road)	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**FSA 22.** Develop access / intersection to connect Ridge Road and KE1 Track, allowing through access, east-west, to and from Devils Gully in Mount Gawler Block to Old Kersbrook, in Para Block. Upgrade to Standard criteria at a minimum. Work with Council to implement this strategy. Refer to Recommend Work **FSA 61**in Para Block. **FSA 23.** Upgrade sections of Ridge Road, KE1 Track and KE30 Track to Standard criteria at a minimum, where this is not already met to improved east-west access and egress. Refer to Recommend Work **FSA 62** in Para Block.
	FSA	Devils Gully Mount Gawler Native Forest Reserve adjacent to Bagshaw Road	Diminished firefighter safety, loss of life/injury due to smoke inhalation Loss of block in a single fire event and fire building into a landscape-scale event	**FSA 24.** Upgrade sections of tracks DG18, DG1, DG15 and DG16 running west – east from Mt Gawler Road (Gate DG11) through to the eastern boundary of Devils Gully (Gate DG7) to a Standard Track (noting that some sections of this track already meet or exceed this criteria). **FSA 25.** Upgrade Track MG39 on the eastern edge of Cpt MG32, 33 and 28 to a Standard Track.
	AMLR BMC	Devils Gully	Limited access for fire response vehicles during a fire event Diminished suppression opportunities Diminished firefighter safety	**AMLR BMC 9.** Recommend that works be implemented to support Recommended Works **FSA 21**, **FSA 22** & **FSA 23** to improve access between Old Kersbrook and Devil's Gully. Refer to Recommended Works **AMLR BMC 19**.

	Land Manager	Location	Risk	Recommended Works
Mount Gawler Block	HA 56 Owner	HA 56	Asset damage/loss and risk to life	Implement an A-zone to a minimum 40 m width surrounding structure.
	HA 56 Owner	HA 56	Limited access for fire response vehicles during a fire event Diminished firefighter safety	Upgrade the track from Sheoak Road to the asset within the centre of HA 56 to a Standard Track at a minimum.
Gawler Block	DEWNR	Parcel (D29986 A1) located at the corner of Alexander Avenue & Gawler-One Tree Hill Road	Asset damage/loss	**DEWNR 9.** Implement A-zones to a minimum of 40 m width surrounding adjacent dwellings/structures. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.
	DEWNR	Gawler Buffer project site	Loss of block in a single fire event and diminished firefighter safety Loss of ecological integrity	**DEWNR 10.** Create new track linking the Standard and Minor Fire Tracks in the eastern section of the site and create access (Standard Tracks) north-south supported by B-zones.
	DEWNR	Para Woodlands	Loss of block in a single fire event and diminished Fire fighter safety	**DEWNR 11.** Implement 40 m B-zones along Balmoral Track and Mallee Track. Upgrade key fire access along the eastern boundary of Yaringa to Standard (refer to **DEWNR 16**).
	DEWNR	Gawler Buffer project site	Loss of block in a single fire event and diminished firefighter safety	**DEWNR 12.** Implement a B-zone to a maximum of 40 m in width where roads separate housing from the reserve, and where new development is scheduled to occur. A-zones to a minimum 40 m width should be implemented where no road/track separates assets from the reserve.

	Land Manager	Location	Risk	Recommended Works
Gawler Block	DEWNR	Para Woodlands	Loss of block in a single fire event, property, life and diminished Fire fighter safety	**DEWNR 13.** Implement a B-zone to a maximum of 100 m along the northern boundary where new development is occurring. This should be integrated as much as possible into the development. This zone should be managed as a grassy woodland, consistent with habitat types within the proposed CP.
	DEWNR	Para Woodlands sections along Allendale Road and further east through the block	Loss of block in a single fire event and fire building into a landscape-scale event	**DEWNR 14.** Implement a B-zone to a maximum of 40 m width within the Barossa Block where Allendale Road abuts the boundary.
	DEWNR	Para Woodlands	Limited access for fire response vehicles during a fire event Loss of ecological integrity	**DEWNR 15.** Implement C-zone burning to assist in the re-establishment of native vegetation as identified by the rehabilitation program in the Yaringa.
	DEWNR	Para Woodlands	Loss of block in a single fire event and diminished firefighter safety Asset damage/loss	**DEWNR 16.** Investigate and upgrade where necessary to Standard Tracks Central, Balmoral, Mallee, Eagle, Gauge Station, Riggs and Allendale Track in Yaringa to allow access along and across the South Para River (refer to **DEWNR 11**). *Central Crossing, Eagle Crossing, Horse Shoe Crossing and Shale Crossing require upgrade to allow access for 34 Appliances.*
	DEWNR	Para Woodlands	Loss of block in a single fire event and diminished firefighter safety	**DEWNR 17.** Negotiate with quarry operators access arrangements and the maintenance of a Standard track along Allendale Road and Allendale Track to provide access to the eastern boundary of Yaringa block. Liaise with Rocla to formalise access arrangements.

	Land Manager	Location	Risk	Recommended Works
Gawler Block	DEWNR	Para Woodlands	Loss of block in a single fire event, property and diminished firefighter safety	**DEWNR 18.** Access between houses and fuel reduced zone within the development needs to be created (Major Track).
	DEWNR	Para Woodlands	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**DEWNR 19.** Establish new Minor Track from the gate in the northern parcel of Barossa Block.
	DEWNR/Council	Gawler Buffer project site	Loss of block in a single fire event and diminished firefighter safety	**DEWNR 20.** Recommend to the AMLR BMC that council implement A- and B-zones along Smith and Dalkeith Road to at least 40 m, consistent with B-zones implemented by DEWNR.
	ALMR BMC	Para Woodlands	Limited access for fire response vehicles during a fire event Diminished firefighter safety Asset damage/loss	**AMLR BMC 10.** Recommend that the AMLR BMC create and maintain a strategic fire management track from Eagle Crossing through private land to the One Tree Hill Road.
	ALMR BMC	Para Woodlands	Limited access for fire response vehicles during a fire event Diminished firefighter safety Asset damage/loss	**AMLR BMC 11.** Recommend that the AMLR BMC liaise with landowners to upgrade track linking Allendale Rd and Woodlands Rd to a Standard Track.
	ALMR BMC	Para Woodlands	Limited access for fire response vehicles during a fire event Diminished firefighter safety Asset damage/loss	**AMLR BMC 12.** Recommend that the AMLR BMC upgrade Valley Road (from Corkscrew Road to Montacute CP) to meet Standard Track criteria at a minimum.

	Land Manager	Location	Risk	Recommended Works
Gawler Block	ALMR BMC	Para Woodlands	Limited access for fire response vehicles during a fire event Diminished firefighter safety Asset damage/loss	**AMLR BMC 13.** Recommend that the AMLR BMC investigate and formalise a track, to Standard criteria at a minimum, from the eastern boundary of the southern Gawler Block gate (unnamed) at E300031 N6164363, through private land to Woodlands Road to provide strategic access from the east.
Kaiserstuhl Block	DEWNR	Kaisterstuhl CP	Loss of block in a single fire event and fire building into a landscape-scale event Landscape protection Loss of ecological integrity	**DEWNR 21.** Implement C-zone burning for landscape protection.
	DEWNR	Kaisterstuhl CP	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**DEWNR 22.** Upgrade the Wollowa Track within Kaiserstuhl CP from Gate PV2 (Granite Track) to Tanunda Creek Road to a Standard Track to complement track upgrade within Pewsey Vale (refer to **DEWNR 23** & **FSA 27**).
	DEWNR	Kaisterstuhl CP	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**DEWNR 23.** Investigate feasibility of relocating Granite Track to the western boundary on private land as part of strategic north-south access (refer to **AMLR BMC 17**). If not feasible upgrade the Granite Track within Kaiserstuhl CP from Gate PV1 to Rifle Range Road to Standard criteria at a minimum to complement track upgrades within Pewsey Vale and on private land (refer to **DEWNR 22**, **FSA 27**, and **AMLR BMC 15**).
	FSA	Pewsey Vale – southern boundary	Loss of block in a single fire event and diminished firefighter safety	**FSA 26.** Implement a B-zone to a maximum of 40 m width adjacent Brownes Road.

	Land Manager	Location	Risk	Recommended Works
Kaiserstuhl Block	FSA	Pewsey Vale along Granite Track	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**FSA 27.** Upgrade/maintain Granite Track along the eastern boundary of Pewsey Vale, from Gate PV5 to PV1 to at least a Standard Track (some sections already Major) to complement track upgrade within Kaiserstuhl CP (refer to **DEWNR 22**).
	FSA	Pewsey Vale	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**FSA 28.** Upgrade/maintain PV1 Track from Gate PV12 to Kaiserstuhl Track to Standard criteria at a minimum, continuing PV1 Track on from **HA 900.1** & **900.2**.
	AMLR BMC	Little Kaiserstuhl Road	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**AMLR BMC 14.** Recommend to the AMLR BMC that Little Kaiserstuhl Road be upgraded to a Standard Track to improve access for fire vehicles to Pewsey Vale through Gate PV12 (refer to **FSA 28, HA 900.1** & **900.2**).
	AMLR BMC	Rifle Range Road	Limited access for fire response vehicles during a fire event Diminished public and firefighter safety	**AMLR BMC 15.** Recommend to the AMLR BMC that Rifle Range Road be maintained to Standard Track classification (refer to **DEWNR 23**).
	AMLR BMC	Goodchild Road	Limited access for fire response vehicles during a fire event Diminished public and firefighter safety	**AMLR BMC 16.** Recommend to the AMLR BMC that Goodchild Road be maintained as a Standard Track to ensure access for fire vehicles to Pewsey Vale.
	AMLR BMC	Goodchild Road	Limited access for fire response vehicles during a fire event Diminished public and firefighter safety	**AMLR BMC 17.** Investigate access to northern boundary of Kaiserstuhl CP along private land, ideally linking to Tanunda Creek Rd or Gravel Pit Rd.

	Land Manager	Location	Risk	Recommended Works
Kaiserstuhl Block	HA 1211 Owner	HA 1211	Loss of block in a single fire event and fire building into a landscape-scale event Loss of ecological integrity	Implement a C-zone burn within the central region of the HA for landscape protection.
	HA 900.1 Owner	HA 900.1	Loss of block in a single fire event and fire building into a landscape-scale event Loss of ecological integrity	Investigate opportunities to implement a C-zone burn within the HA for landscape protection. Work with AMLR BMC, FSA and HA 900.2 to upgrade Track PV1 from Little Kaiserstuhl Road to Kaiserstuhl Track to Standard criteria at a minimum, to improve access and egress (refer to **AMLR BMC 14** & **FSA 28**).
	HA 900.2 Owner	HA 900.2	Loss of block in a single fire event and fire building into a landscape-scale event Loss of ecological integrity	Investigate opportunities to implement a C-zone burn within the HA for landscape protection. Work with AMLR BMC, FSA and HA 900.1 to upgrade Track PV1 from Little Kaiserstuhl Road to Kaiserstuhl Track to Standard criteria at a minimum, to improve access and egress (refer to **AMLR BMC 14** & **FSA 28**.
Little Para Block	DEWNR	Little Para Reservoir Reserve	Loss of ecological integrity Loss of block in a single fire event and fire building into a landscape-scale event	**DEWNR 24.** Implement C-zone burning for Coolatai Grass management (refer to **SAW 15**).
	SAW	South-western corner of Little Para Reservoir Reserve – Little Para Water Treatment Plant	Asset damage/loss and risk to life	**SAW 7.** Implement an A-zone to a minimum of 40 m width surrounding Little Para Water Treatment Plant.
	SAW	Properties located at the end of Kurrajong Road adjacent Little Para Reservoir Reserve	Asset damage/loss and risk to life	**SAW 8.** Implement an A-zone to a minimum of 40 m width surrounding adjacent dwellings/structures. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.

	Land Manager	Location	Risk	Recommended Works
Little Para Block	SAW	Within Little Para Reservoir Reserve, western boundary adjacent Black Top Road and the ETSA Para Substation	Diminished public and firefighter safety Asset damage/loss and risk to life	**SAW 9.** Implement an A-zone to a minimum of 30 m width and to maximum 550 m length running adjacent to Black Top Road from Track 1D to Track 1E (refer to **SAW 13** & **SAW 14**).
	SAW	Corner of Track 1, 4 & 4A within Little Para Reservoir Reserve	Asset damage/loss and risk to life	**SAW 10.** Implement an A-zone to a minimum of 40 m width surrounding adjacent dwellings/structures. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.
	SAW	Land adjacent properties located at the end of Goulds Creek Road on the eastern boundary of Little Para Reservoir Reserve	Asset damage/loss and risk to life	**SAW 11.** Implement an A-zone to a minimum of 40 m width surrounding adjacent dwellings/structures. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.
	SAW	Southern boundary of Little Para Reservoir Reserve	Loss of block in a single fire event and fire building into a landscape-scale event	**SAW 12.** Implement a B-zone to a maximum of 700 m width to minimum of 100 m depth.
	SAW	Within Little Para Reservoir Reserve, western boundary, adjacent Black Top Road	Diminished public and firefighter safety Asset damage/loss and risk to life	**SAW 13.** Implement a B-zone, maximum of 500 m width to maximum of 30 m depth running adjacent to Black Top Road from Gate 1 to Track 1D, then and from Track 1E to Gate 4 (refer to **SAW 9** & **SAW 14**).

	Land Manager	Location	Risk	Recommended Works
Little Para Block	SAW	Within Little Para Reservoir Reserve, north-western adjacent Black Top Road	Diminished public and firefighter safety Asset damage/loss and risk to life	**SAW 14.** Implement a B-zone to a maximum length of 2100 m to maximum of 30 m depth running adjacent to Black Top Road and continuing from above recommended work (refer to **SAW 9** & **SAW 13**).
	SAW	Little Para Reserve, southern boundary	Loss of block in a single fire event and fire building into a landscape-scale event Asset damage/loss and risk to life Loss of ecological integrity	**SAW 15.** Implement joint C-zone burning for Coolatai Grass management with DEWNR (refer to **DEWNR 24**).
	SAW	Little Para Reservoir Reserve	Diminished firefighter safety	**SAW 16.** Implement a slashing program along Track 2, 4, 5, 7, 10, 11. A B-zone to a maximum 40 m width implemented along Track 4 and 7.
Millbrook Block	FSA	Bennetts	Asset damage/loss and risk to life	**FSA 29.** Implement A-zones a minimum of 40 m width surrounding adjacent houses/dwellings.
	FSA	Adelaide to Mannum Pipeline running through Haarsmas	Asset damage/loss and risk to life	**FSA 30.** Implement an A-zone to a minimum 10 m width along Adelaide to Mannum Pipeline.
	FSA	Adelaide to Mannum Pipeline running through the south-eastern corner of Symonds	Asset damage/loss and risk to life	**FSA 31.** Implement an A-zone to a minimum 10 m width along Adelaide to Mannum Pipeline.

	Land Manager	Location	Risk	Recommended Works
Millbrook Block	FSA	North-east corner of Bennetts	Loss of block in a single fire event and fire building into a landscape-scale event Diminished public and firefighter safety	**FSA 32.** Implement a B-zone to a maximum of 50 m width along the boundary.
	FSA	Haarsmas – to the eastern side of Gorge Road	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**FSA 33.** Implement B-zones to a maximum 100 m width along identified Tracks.
	FSA/SAW	Bennetts	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**FSA 34.** Upgrade the two unnamed tracks (currently Standard/Minor): • from Gate BN1 (Torrens Valley Road) to near Gate BN17 through private land to Standard (where is does not meet this criteria already), and; • from Gate BN9 (South Para Rd) to Simmonds Hill to a Major Track where it connects with the above works.
	SAW/FSA	Mannum to Adelaide Pipeline running east west cross the Millbrook Block	Asset damage/loss and risk to life	**SAW 17.** Implement an A-zone to a minimum 10 m width running along Adelaide to Mannum Pipeline.
	SAW	South-western corner of Millbrook Block within the Kangaroo Creek Reservoir Reserve, north of Torrens Hill Road	Asset damage/loss and risk to life	**SAW 18.** Implement an A-zone to a minimum 40 m width surrounding adjacent houses. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.

	Land Manager	Location	Risk	Recommended Works
Millbrook Block	SAW	West of HA 128 (Millbrook EL, 1,2&3 tank)	Loss of block in a single fire event and fire building into a landscape-scale event Damage/loss to assets and life	**SAW 19.** Implement an A-zone to a minimum 20 m width around tanks and pump shed.
	SAW	Millbrook Reserve Depot north of Pipeline Track and east of Track 1F	Asset damage/loss and risk to life	**SAW 20.** Implement an A-zone to a minimum 40 m width surrounding the Millbrook Depot compound (from buildings).
	SAW	Millbrook Reservoir Reserve ETSA Substation.	Asset damage/loss and risk to life	**SAW 21.** Implement an A-zone to a minimum 40 m width surrounding ETSA Substation (refer to **SAW 28)**.
	SAW	Along Tracks 2 and 2A along eastern boundary adjacent B-Zone	Asset damage/loss and risk to life	**SAW 22.** Implement A-zones to a minimum 40 m width surrounding adjacent houses/dwellings (refer to **SAW 30**).
	SAW	Millbrook Reservoir Reserve, intersection between Track 1F and the Boat Ramp Track	Asset damage/loss and risk to life	**SAW 23.** Implement an A-zone to a minimum 40 m width surrounding sheds.
	SAW	South-east of the Sunninghill Road and Tippett Road intersections	Asset damage/loss and risk to life	**SAW 24.** Implement an A-zone to a minimum 40 m width surrounding adjacent houses/dwellings. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.
	SAW	North-west of section of Millbrook Reservoir Reserve at the end of Ballans Road	Asset damage/loss and risk to life	**SAW 25.** Implement an A-zone to a minimum 40 m width surrounding adjacent houses/dwellings. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.

	Land Manager	Location	Risk	Recommended Works
Millbrook Block	SAW	Southern border of Gumeracha Weir Reserve abutting Torrens Valley Road	Asset damage/loss and risk to life	**SAW 26.** Implement an A-zone to a minimum 80 m width along Torrens Valley Road.
	SAW	Millbrook Block, intersections of Boundary Track and 44A Track	Asset damage/loss and risk to life	**SAW 27.** Implement an A-zone to a minimum 40 m width surrounding adjacent houses/dwellings. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.
	SAW	Located west of dam wall to creek line, surrounding ETSA Substation and pump house	Loss of block in a single fire event and fire building into a landscape-scale event Asset damage/loss and risk to life	**SAW 28.** Implement a B-zone to a maximum 300 m width west of dam wall to creek line, surrounding the ETSA Substation and pump house (refer to **SAW 21**).
	SAW	Between the boundaries of where Millbrook Block and Cudlee Creek Block meet, north of Torrens Hill Road within Kangaroo Creek Reservoir Reserve	Loss of block in a single fire event and fire building into a landscape-scale event Associated Impacts of fire events to water quality	**SAW 29.** Implement a B-zone to a maximum 250 m width running adjacent Torrens Hill Road.
	SAW	Millbrook Reservoir Reserve, located between Pipeline Track and Gorge Road, west of the Tippett Road & Gorge Road intersection	Loss of block in a single fire event and fire building into a landscape-scale event Diminished public and firefighter safety	**SAW 30.** Implement a B-zone to a maximum 400 m width between Track 2, 2A and 2F, 2C (refer to **SAW 22**).

	Land Manager	Location	Risk	Recommended Works
Millbrook Block	SAW	Millbrook Reservoir Reserve, following Tippett Road north until meeting Track 16, abutting the above A-zone	Loss of block in a single fire event and fire building into a landscape-scale event Diminished public and firefighter safety	**SAW 31.** Implement a B-zone to a maximum 300 m width, then reducing to 40 m width from Track 3A to Track 16 along Track 10A.
	SAW/FSA	North East Road, running east west through Millbrook Reservoir Reserve *Connecting to* South Para Road running north-south through Millbrook Reservoir Reserve	Loss of block in a single fire event and fire building into a landscape-scale event Diminished public and firefighter safety	**SAW 32.** Implement a B-zone to a maximum 300 m width and minimum 40 m width running along North East Road. *Note – excluding a section along Millbrook Reservoir, from the eastern end of peninsula to the intersection of North East Road and Tippet Road.* **SAW 33.** Implement a B-zone to a maximum of 350 m width and minimum 100 m width running along South Para Road.
	SAW	Millbrook Block	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**SAW 34.** Implement B-zones (SAW slashing program) along Boundary Track and Tilmouth Road, and sections of the northern and southern Millbrook Reservoir boundary.
	SAW/FSA	Gumeracha Weir	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**SAW 35.** Upgrade Track 6B and the track connecting Track 6 to Gate 7 to a Major Track.
	ALMR BMC	Cudlee Creek CP	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**AMLR BMC 18.** Access to the west of the reserve needs to be investigated.

	Land Manager	Location	Risk	Recommended Works
Mount Crawford Block	FSA	Forbes	Asset damage/loss and risk to life	**FSA 35.** Maintain identified A-zones to a minimum 40 m width around Mt Crawford HQ.
	FSA	Dewells	Asset damage/loss and risk to life	**FSA 36.** Implement identified A-zones to a minimum 40 m width around Fromms Farm.
	FSA	Cromer	Asset damage/loss and risk to life	**FSA 37.** Implement identified A-zones to a minimum 40 m width around Cromer Shed.
	FSA	Forbes– Mt Crawford Airstrip	Diminished firefighter safety	**FSA 38.** Implement identified A-zones to a minimum 70 m width surrounding Mt Crawford Airstrip.
	FSA	Mount Road between Mount Crawford, Little Mount Crawford and Forbes	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**FSA 39.** Implement identified B-zones to a maximum 40 m width along Mount Road.
	FSA	Dewells	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**FSA 40.** Maintain identified B-zones to a maximum 80 m width along tracks.
	FSA	South-east corner of Cromer	Diminished suppression opportunities Diminished firefighter safety	**FSA 41.** Maintain identified B-zones to a maximum 180 m width along track.
	FSA	Between Cromer & Mount Pleasant	Diminished suppression opportunities Diminished firefighter safety	**FSA 42.** Maintain identified B-zones to a maximum 40 m width along track.

	Land Manager	Location	Risk	Recommended Works
Mount Crawford Block	FSA	Between Big Flat & Mount Pleasant	Diminished suppression opportunities Diminished firefighter safety	**FSA 43.** Maintain identified B-zones to a maximum 40 m width along track.
	FSA	Glen Devon Road between Big Flat and Goat Farm	Diminished suppression opportunities Diminished firefighter safety	**FSA 44.** Maintain identified B-zones to a maximum 40 m width along Glen Devon Road.
	FSA	Between Goat Farm and McBeans	Diminished suppression opportunities Diminished firefighter safety	**FSA 45.** Maintain identified B-zones to a maximum 40 m width along McBean Road.
	FSA	Little Mount Crawford, abutted by Dewells on the east and west	Loss of block in a single fire event and fire building into a landscape-scale event Loss of ecological integrity	**FSA 46.** Implement C-zone burn in Cpt LM2 for landscape protection.
Murrays Block	FSA	Western boundary Londons	Asset damage/loss and risk to life	**FSA 47.** Implement identified A-zones to a minimum 40 m widths around assets/structures. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.

	Land Manager	Location	Risk	Recommended Works
Murrays Block	FSA	Murrays	Asset damage/loss and risk to life	**FSA 48.** Implement identified A-zones to a minimum 40 m width around Old School House and private dwelling. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.
	FSA	Wirra Wirra Road, Murrays	Diminished suppression opportunities Diminished firefighter safety	**FSA 49.** Implement two identified B-zones to a maximum 20 m width on either side of Wirra Wirra Road.
	FSA	South-eastern boundary of Murrays	Diminished suppression opportunities Diminished firefighter safety	**FSA 50.** Implement identified B-zones to a maximum 30 m width.
	FSA	North-western boundary of Gilberts	Diminished suppression opportunities Diminished firefighter safety	**FSA 51.** Implement identified B-zones to a maximum 20 m width along north-western boundary of Gilberts.
Para Block	DEWNR	Abutting Para Wirra Road within the Para Wirra CP (northern boundary)	Asset damage/loss and risk to life	**DEWNR 25.** Implement identified A-zones to a minimum 40 m width around assets/structures.
	DEWNR	Throughout Para Wirra CP	Asset damage/loss and risk to life	**DEWNR 26.** Implement number of identified A-zones to a minimum 40 m width around assets/structures.

	Land Manager	Location	Risk	Recommended Works
Para Block	DEWNR	Southern boundary of Para Wirra CP	Asset damage/loss and risk to life	**DEWNR 27.** Implement identified B-zones to a maximum 40 m width along southern boundary of Para Wirra CP.
	DEWNR	Para Wirra CP	Loss of block in a single fire event and fire building into a landscape-scale event Loss of ecological integrity	**DEWNR 28.** Implement the 3 C-zone burns for landscape protection.
	DEWNR	Para Wirra CP	Access for fire response vehicles during a fire event Diminished firefighter safety	**DEWNR 29.** Maintain Para Wirra Drive and Wirra Road to the eastern gate within Para Wirra CP to Major criteria at a minimum.
	DEWNR	Para Wirra CP	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**DEWNR 30.** Upgrade Scenic Drive to meet Major Track criteria at a minimum.
	DEWNR	Para Wirra CP	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**DEWNR 31.** Upgrade Mine Track to meet Standard Track criteria at a minimum.
	DEWNR	Para Wirra CP	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**DEWNR 32.** Upgrade Tipperary Tanks Track to Standard Track criteria at a minimum.
	DEWNR	Para Wirra CP	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**DEWNR 33.** Upgrade Orchid Dam and Sanctuary Tracks to Standard Track criteria at a minimum.
	DEWNR	Para Wirra CP	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**DEWNR 34.** Upgrade Devils Nose and Bagshaw, Quarry, Bowdens Cottage and Ruins Track to meet Standard Track criteria at a minimum.

	Land Manager	Location	Risk	Recommended Works
Para Block	DEWNR/FSA	Within Para Wirra CP, running from west to east from the western Para Wirra CP boundary, above and abutting the private land and moving in to Kersbrook	Diminished suppression opportunities Diminished firefighter safety Loss of block in a single fire event and fire building into a landscape-scale event	**DEWNR 35.** Implement identified B-zones to a maximum 1000 m width.
	DEWNR/FSA	Humbug Scrub Road running between Para Wirra CP and Kersbrook NFR	Diminished suppression opportunities Diminished firefighter safety	**DEWNR 36.** Implement identified B-zones to a maximum 40 m width along Humbug Scrub Road.
	FSA	Kersbrook NFR, adjacent Kersbrook Forest Road and Sires Road	Asset damage/loss and risk to life	**FSA 52.** Implement number of identified A-zones to a minimum 40 m width around assets/structures. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.
	FSA	Kersbrook NFR, south-west corner adjacent Gate KE8	Asset damage/loss and risk to life	**FSA 53.** Implement identified A-zones to a minimum 40 m width around assets/structures. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.
	FSA	Kersbrook NFR, southern point, adjacent Gate KE5 at the corner of Sires and Kersbrook Forest Road	Asset damage/loss and risk to life	**FSA 54.** Implement identified A-zones to a minimum 40 m width around assets/structures. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.

	Land Manager	Location	Risk	Recommended Works
Para Block	FSA	Along the western, southern and eastern boundary of Old Kersbrook and Kersbrook NFR, Tracks KE1, Mary Gully, KE16 and Purdies	Diminished suppression opportunities Diminished firefighter safety Loss of block in a single fire event and fire building into a landscape-scale event	**FSA 55.** Implement identified B-zones to a maximum 150 m width along identified tracks.
	FSA	Southern boundary of Para Block and Kersbrook	Diminished suppression opportunities Diminished firefighter safety Loss of block in a single fire event and fire building into a landscape-scale event	**FSA 56.** Implement a B-zone to a maximum 700 m width at the southern point of Cpt KE26 (including Cpt KE29).
	FSA	Kersbrook NFR	Limited access for fire response vehicles during a fire event Diminished suppression opportunities Diminished firefighter safety	**FSA 57.** Upgrade Track KE1, Purdies Track and Track KE16 from Gate KE9 to Gate KE2 to a Major Track where it does not already meet or exceed this criteria.
	FSA	Old Kersbrook	Limited access for fire response vehicles during a fire event Diminished suppression opportunities Diminished firefighter safety	**FSA 58.** Upgrade Track KE30 along south-eastern boundary adjacent Gate KE5 to a Standard Track where it does not already meet or exceed this criteria.
	FSA	Kersbrook NFR	Limited access for fire response vehicles during a fire event Diminished suppression opportunities Diminished firefighter safety	**FSA 59.** Upgrade Track KE26 to a Standard Track where it does not already meet or exceed this criteria.

	Land Manager	Location	Risk	Recommended Works
Para Block	FSA	South-western corner of Para Block (KE1 Track, KE30 Track and Kersbrook Road)	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**FSA 60.** Implement a slashed break (B-zone) to a minimum 10 m width from Kersbrook Forest Road, KE30 Track and KE1 Track, meeting up with Ridge Road, supporting access from Old Kersbrook, Para Block to and from Devils Gully, Mount Gawler Block, improving east-west access and egress. Support works identified in **FSA 61** and **FSA 62** below. Refer to Recommend Work **FSA 21** in Mount Gawler Block.
	FSA	South-western corner of Para Block (Kersbrook Road)	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**FSA 61.** Develop access / intersection to connect KE1 Track and Ridge Road, allowing through access, east-west, to and from Old Kersbrook, Para Block to Devils Gully, Mount Gawler Block. Upgrade to Standard criteria at a minimum. Work with Council to implement this strategy. Refer to Recommend Work **FSA 22** in Mount Gawler Block. **FSA 62.** Upgrade sections of KE1 Track and KE30 Track (through to Ridge Road) to Standard criteria at a minimum where this is not already met to improved east-west access and egress. Refer to Recommend Work **FSA 23** in Mount Gawler Block.
	FSA	Kersbrook NFR	Loss of block in a single fire event and fire building into a landscape-scale event Loss of ecological integrity	**FSA 63.** Implement the C-zone burn located in Cpt KE4 and KE5 for landscape protection.

	Land Manager	Location	Risk	Recommended Works
Para Block	FSA/SAW	Old Kersbrook & South Para Reservoir Reserve	Limited access for fire response vehicles during a fire event Diminished suppression opportunities Diminished firefighter safety	**FSA 64.** Upgrade Malcolm Ridge Track and Mary Gully Track to Standard Track. **FSA 65.** Upgrade Cattleyard Track (Track 17) to a Standard Track from Gate KE14 on Bassnet Road to Gate 17 on South Para Road.
	SAW	Northern boundary of the Barossa Reservoir Reserve at water treatment plant and Whispering Wall	Asset damage/loss and risk to life	**SAW 36.** Implement identified A-zone to a minimum 300 m width around water treatment plant. **SAW 37.** Implement identified A-zones to a minimum 40 m width around tanks and public access area (reservoir keeper's house and toilets).
	SAW	South-eastern corner of the Barossa Reservoir Reserve	Asset damage/loss and risk to life	**SAW 38.** Implement identified A-zones to a minimum 40 m width around assets/structures along Boundary Track. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.
	SAW	North-eastern corner of the South Para Reservoir Reserve	Asset damage/loss and risk to life Diminished suppression opportunities Diminished firefighter safety	**SAW 39.** Implement identified A-zones to a minimum 40 m width, adjacent Whiteman Road. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.
	SAW	South Para and Barossa Reservoir Reserve	Asset damage/loss and risk to life	**SAW 40.** Implement identified A-zones to a minimum 20 m width around workshop, nursery, depot and toilet block.

	Land Manager	Location	Risk	Recommended Works
Para Block	SAW	South-eastern corner of the Barossa Reservoir Reserve moving into the South Para Reservoir Reserve along Boundary Track	Diminished suppression opportunities Diminished firefighter safety Loss of block in a single fire event and fire building into a landscape-scale event	**SAW 41.** Implement identified B-zones to a maximum 950 m width.
	SAW	South Para Reservoir	Limited access for fire response vehicles during a fire event Diminished firefighter safety	**SAW 42.** Implement B-zone (SAW slashing program) along South Para Road, Para Wirra Road and adjacent sections.
	SAW/DEWNR	Para Wirra Road on the western boundary of the Barossa Reservoir Reserve	Diminished suppression opportunities Diminished firefighter safety Loss of block in a single fire event and fire building into a landscape-scale event	**SAW 43.** Implement identified B-zones to a maximum 40 m width along Para Wirra Road. Joins up with the above recommended B-zone (**SAW 42**).
	SAW/FSA	Track which is the southern extension of Wild Street	Diminished suppression opportunities Diminished firefighter safety Loss of block in a single fire event and fire building into a landscape-scale event	**SAW 44.** Maintain identified B-zones to a maximum 40 m width along track.
	AMLR BMC	Old Kersbrook	Limited access for fire response vehicles during a fire event Diminished suppression opportunities Diminished firefighter safety	**AMLR BMC 19.** Recommend that works be implemented to support Recommended Works **FSA 60**, **FSA 61** & **FSA 62** to improve access between Old Kersbrook and Devil's Gully. Refer to Recommended Works **AMLR BMC 9**.

	Land Manager	Location	Risk	Recommended Works
Para Block	AMLR BMC	Humbug Scrub (Private Land)	Limited access for fire response vehicles during a fire event Diminished suppression opportunities Diminished firefighter safety	**AMLR BMC 20.** Recommend to the AMLR BMC that any tracks to assets within Humbug Scrub are upgraded to Major Tracks where possible.
Sandy Creek Block	DEWNR	Sandy Creek Conservation Park	Asset damage/loss and risk to life	**DEWNR 37.** Implement number of identified A-zones to a minimum 40 m width around assets/structures. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.
	DEWNR	Sandy Creek Conservation Park – western boundary	Loss of ecological integrity (senescent flora population)	**DEWNR 38.** Implement C-zone burn in the south-west section of the reserve to stimulating plant recruitment.
	DEWNR	Sandy Creek Conservation Park	Asset damage/loss and risk to life Limited access for fire response vehicles during a fire event Diminished suppression opportunities Diminished firefighter safety	**DEWNR 39.** Upgrade Boundary Tracks in Sandy Creek CP to meet Standard Track criteria at a minimum.

	Land Manager	Location	Risk	Recommended Works
Watts Gully Block	DEWNR	Northern boundary of Hale Conservation Park	Asset damage/loss and risk to life Loss of block in a single fire event and fire building into a landscape-scale event	**DEWNR 40.** Implement A-zone to a minimum 40 m around assets/structures adjacent the northern park boundary. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.
	DEWNR	Warren Conservation Park, extension of Watts Gully Road extending into HA 1359	Asset damage/loss and risk to life	**DEWNR 41.** Implement identified A-zones to a minimum 40 m width around assets/structures. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.
	DEWNR	Western boundary of Hale Conservation Park	Asset damage/loss and risk to life	**DEWNR 42.** Implement number of identified A-zones to a minimum 40 m width around assets/structures. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.
	DEWNR	Eastern boundary of Hale Conservation Park	Loss of block in a single fire event and fire building into a landscape-scale event Loss of ecological integrity	**DEWNR 43.** Implement C-zone burning for landscape protection.
	DEWNR	Warren Conservation Park	Limited access for fire response vehicles during a fire event Diminished suppression opportunities Diminished firefighter safety	**DEWNR 44.** Investigate the potential for an east-west track extension along southern edge of Warren CP from Mt Crawford, exiting at Gate 1 on Watts Gully Road.
	DEWNR	Hale Conservation Park	Limited access for fire response vehicles during a fire event Diminished suppression opportunities Diminished firefighter safety	**DEWNR 45.** Upgrade Hale Track from the main gate off Warren Road to SAW gate to Minor criteria at a minimum.

	Land Manager	Location	Risk	Recommended Works
Watts Gully Block	DEWNR/SAW	Eastern and south-eastern boundary of Hale Conservation Park along Track 15 and Warren Road	Loss of block in a single fire event and fire building into a landscape-scale event	**DEWNR 46.** Implement identified B-zone to a maximum 200 m width.
	FSA/SAW	North-eastern boundary of Warren Conservation Park extending into Warren Reservoir Reserve	Loss of block in a single fire event and fire building into a landscape-scale event Diminished suppression opportunities	**FSA 66.** Implement identified B-zone to a maximum 800 m width. Including B-zone between Track 1 and 1D on Warren Reservoir Reserve.
	FSA	Scotts	Asset damage/loss and risk to life	**FSA 67.** Implement identified A-zones to a minimum 40 m width around assets/structures (Scotts Hut).
	FSA	Tower, Charcoal Pits and Watts Gully	Loss of block in a single fire event and fire building into a landscape-scale event Diminished suppression opportunities Diminished firefighter safety	**FSA 68.** Implement identified B-zone to a maximum 900 m width.
	FSA	Adjacent and along sections of Rocky Creek Road, Ironstone Road, Forreston Road, Warren Road and others, throughout Charcoal Pits, Forties, Watts Gully and Camp Paddock	Limited access for fire response vehicles during a fire event Diminished suppression opportunities Diminished firefighter safety	**FSA 69.** Implement identified B-zone to a maximum 40 m width along roads/tracks.
	FSA	Central and western section of Watts Gully NFR	Loss of block in a single fire event and fire building into a landscape-scale event Diminished suppression opportunities	**FSA 70.** Implement B-zone burn in Cpt WG3.

	Land Manager	Location	Risk	Recommended Works
Watts Gully Block	FSA	Central and western section of Watts Gully NFR	Loss of block in a single fire event and fire building into a landscape-scale event Diminished suppression opportunities	**FSA 71.** Implement B-zone burn in Cpt WG4.
	FSA	Central and western section of Watts Gully NFR	Loss of block in a single fire event and fire building into a landscape-scale event Loss of ecological integrity	**FSA 72.** Implement C-zone burn in Cpt WG6 for landscape protection.
	FSA	Central and western section of Watts Gully NFR	Loss of block in a single fire event and fire building into a landscape-scale event Loss of ecological integrity	**FSA 73.** Implement C-zone burn in Cpt WG7 for landscape protection.
	FSA	Central and western section of Watts Gully NFR	Loss of block in a single fire event and fire building into a landscape-scale event Loss of ecological integrity	**FSA 74.** Implement C-zone burn in Cpt WG13 for landscape protection.
	FSA	Central and western section of Watts Gully NFR	Loss of block in a single fire event and fire building into a landscape-scale event Loss of ecological integrity	**FSA 75.** Implement C-zone burn in Cpt WG15 for landscape protection.
	FSA	Charcoal Pits	Limited access for fire response vehicles during a fire event Diminished suppression opportunities Diminished firefighter safety	**FSA 76.** Upgrade and maintain track along the western boundary of Charcoal Pits (abutting HA 1467) to a Major Track.

	Land Manager	Location	Risk	Recommended Works
Watts Gully Block	FSA	Watts Gully	Limited access for fire response vehicles during a fire event Diminished suppression opportunities Diminished firefighter safety	**FSA 77.** Upgrade and maintain The Nugget Road to Standard criteria at a minimum. Refer to Recommend Work **AMLR BMC 21**.
	FSA/SAW	Mt Crawford Fire Tower, Tower and Warren Reservoir Reserve (Track 11 and Track 10)	Limited access for fire response vehicles during a fire event Diminished suppression opportunities Diminished firefighter safety	**FSA 78.** Upgrade the track from Gate CP17 to Mt Crawford Fire Tower, through Tower and Warren Reservoir Reserve (Track 11 and Track 10) to Gordon Road to a Standard where it does not already meet these criteria.
	SAW	Warren Reservoir Reserve	Asset damage/loss and risk to life	**SAW 45.** Implement identified A-zones to a minimum 20 m width around chlorine station and structures associated with dam wall.
	SAW	Along the north-eastern boundary of Watts Gully Block and along Track 1, 15 and Warren	Loss of block in a single fire event and fire building into a landscape-scale event Diminished suppression opportunities	**SAW 46.** Implement identified B-zone to a maximum 250 m width. *Note: not required adjacent the Warren Reservoir.*
	SAW	Western boundary of Warren Reservoir Reserve along Tack 1		**SAW 47.** Continue maintenance of Track 1 and adjacent vegetation to a maximum width of 10 m.
	AMLR BMC/FSA	Watts Gully	Limited access for fire response vehicles during a fire event Diminished suppression opportunities Diminished firefighter safety	**AMLR BMC 21.** Recommend to the AMLR BMC that Rocky Creek Road and Watts Gully Road are maintained at Standard criteria at a minimum. Refer to Recommend Work **FSA 77**.

	Land Manager	Location	Risk	Recommended Works
Watts Gully Block	HA 490 Owner	HA 490	Asset damage/loss and risk to life	Implement identified A-zones to a minimum 40 m width around assets/structures. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land.
	HA 1359 Owner	HA 1359	Asset damage/loss and risk to life	Implement an A-zone to a minimum 40 m width surrounding structure, consistent with **DEWNR 41**.
	HA 1467 Owners	HA 1467 to north of Watts Gully Native Forest Reserve	Asset damage/loss and risk to life Limited access for fire response vehicles during a fire event Diminished suppression opportunities Diminished firefighter safety Loss of ecological integrity	Implement identified A-zones to a minimum 40 m width around assets/structures. Recommend to the AMLR BMC that land owners manage the part of the zone that falls on their land. Recommend that track be upgraded to Standard FA Track. Implement C-zone burn to the south of the fire access track for landscape protection.
Private Lands	AMLR BMC	South of Montacute Conservation Park		**AMLR BMC 22.** Construct new track off Old Cherryville Road (adjacent Marble Hill Road intersection), due to water affecting activity and vegetation clearance issues.

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

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
*Asparagus asparagoides**	Bridal Creeper				9		Herb	• Weed of National Significance • Adults resprout following fire • Flowers: August-September	• Burning for weed control preferably in autumn after the annual shoot cohort emerges • Plants likely to be more conspicuous post-fire facilitating control • Spot spray any post-fire regrowth	Aus^
Austrostipa oligostachya	Fine-head Spear-grass		E	E		C WG	Grass	• Flowering occurs between Oct to Mar • Fire response is unknown		SA^
Caladenia argocalla	White Beauty Spider-orchid	EN	E	E		K MC MG P	Orchid	• Resprouts from underground tubers in Apr • Flowering occurs between Sept & Oct • Seed set occurs late October to November • Likely to be fire sensitive during growth season (April-Nov)	• Avoid burning from Apr to Nov • Avoid inter-fire intervals <10years	SA^

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
Caladenia behrii	Pink-lip Spider-orchid	EN	E	E		C M MG P WG	Orchid	• Resprouting species • Grows on the upper slopes & crests of moderate to steep hills • Resprouts from underground tubers in Apr & May • Flowering & seed set occurs between Aug & Dec • Fire can induce dormancy and possibly cause mortality • Likely to be more fire sensitive during growth season (April-Nov) • Flowering can be stimulated by late spring/summer fires, but risk of browsing can also increase	• Avoid inter-fire intervals < 10 years • Avoid burning from Apr to Nov • Protection/management of browsing should be considered post-fire especially in small populations	SA^
Caladenia rigida	Stiff White Spider-orchid	EN	E	E		M MG P WG	Orchid	• Resprouting species • Resprouts from underground tubers in Apr • Flowering & seed set occurs between Aug & Nov • Can be fire sensitive during growth season, especially in autumn-winter • Flowering can be stimulated by late spring/summer fires, but risk of browsing can also increase	• Avoid inter-fire intervals < 10 years • Avoid burning from Apr to Sept • Protection/management of browsing should be considered post-fire especially in small populations	SA^
*Chrysanthemoides monilifera**	Boneseed				9		Perennial Shrub	• *Weed of National Significance* • Lifespan 10-20 years • Flowers: July-October • Fire kills seedlings and adult plants • Seedlings readily recruit post-fire	• Post fire weed control likely to be required since burning stimulates mass germination of the seed bank	Aus^

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
Corybas dentatus	Finniss Helmet-orchid (Toothed Helmet-orchid)	VU	E	E		M SC	Orchid	• Resporuts from underground tuber in Apr • Flowers Jul to Aug • Colony forming species which reproduces vegetatively and more occasionally by seed • Species is fire sensitive due to shallow tubers	• Where possible, avoid use of suppressants	SA^
Corybas expansus	Dune Helmet-orchid		V		8 9		Orchid	• Deciduous herb, emerging annually in response to soaking rains in early autumn. Flowers in August. Dormant over the summer months. • Colony forming species which reproduces vegetatively and more occasionally by seed • Species is fire sensitive due to shallow tubers	• Where possible, avoid use of suppressants • Avoid inter-fire intervals < 10 years	SA^
*Cytisus scoparius**	English Broom						Shrub	• Seed regenerator • Primary juvenile period: 2 years • Flowers: Oct to Dec • Plants may live for 10 years • Seeds may remain dormant in the soil for > 10 years(evidence for up to 80 years in Turner (1933)) • Fire stimulates germination by breaking the dormancy of soil-stored seed	• Post fire weed control likely to be required since burning stimulates mass germination of the seed bank	SA^
Diuris behrii	Behr's Cowslip-orchid		V	V		C K M MC WG	Orchid	• Reprouts from tuber in Apr • Flowers in September • Flowers freely without fire • Likely to be sensitive to fire during growth season April-Oct	• Avoid burning in April-Oct • Avoid fire intervals <10 years	SA^

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
*Echium Plantagineum**	Salvation Jane						Herb	• Declared under the SA *Natural Resource Management Act 2004* • Adults killed by fire • Seedlings readily recruit post-fire • Some seeds are killed by fire	• Weed control may be required post-fire	Aus^
Eryngium ovinum	Blue Devil		V			C K MC WG	Herb	• Resprouts from rhizome • Flowers: Nov to Jan • Likely to resprout post-fire		SA^
Euphrasia collina ssp. *osbornii*	Osborn's Eyebright	EN	E	E		CC P	Herb	• Flowers: June to September • Known to regenerate from seed post-fire • Fire likely to stimulate seedling recruitment	• Fire should be considered to stimulate seedling regeneration if recruitment is poor/absent	SA^
*Genista monspessulana**	Cape Broom						Shrub	• Declared under the SA *Natural Resources Management Act 2004* • Flowers: Spring • Reach productive maturity after three years • Fire stimulates germination by breaking the dormancy of soil-stored seed	• Post fire weed control likely to be required since burning stimulates mass germination of the seed bank	SA^
Glycine latrobeana	Clover Glycine	VU	V	V		CC M MC WG	Herb	• Flowers: Sep to May • Seed regenerator but also may spread from rhizomes • Known to germinate post-fire & have a strong fire response	• Fire should be considered to stimulate seedling regeneration if recruitment is poor/absent • Prescribed burning should occur after plants have matured and set seed	SA^

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
Glycine tabacina	Variable Glycine		V	E	9	CC	Herb	• Flowers from November to June • Abundant seedlings noted in burnt areas following rain • Plants can resprout from the base after fire	• Fire should be considered to stimulate seedling regeneration if recruitment is poor/absent • Prescribed burning should occur after plants have matured and set seed	SA^
*Hypharrhenia hirta**	Coolatai Grass						Perennial	• Declared under the SA *Natural Resource Management Act 2004* • Can survive high intensity fires and regular burning has been shown to have no negative impact on plant numbers.	• Weed control may be required following fire	R
Juncus homalocaulis	Wiry Rush		V				Herb	• Found in moist habitats • Flowers: spring-summer • Resprouts from rhizome		Aus^
Luzula flaccida	Pale Wood-rush		V	T		CC M P	Rush	• Little is known about the biology & ecology of this species		
Microtis atrata	Yellow onion-Orchid		R			K	Orchid	• Flowers from late September to early December • Forms small, dense colonies • Flowering can be greatly increased in the season following a summer fire • Likely to be sensitive to fire during growth season (April-Nov)	• Avoid burning from Apr-Oct • Avoid inter-fire intervals ≤ 10 years	SA^

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
Microtis rara	Sweet Onion-orchid		R				Orchid	• Species occurs in small colonies around permanent swamp margins often in deeply shaded places. • Flowers from late October to early January • Flowering often stimulated by summer fire • Likely to be sensitive to fire during growth season (April-Nov)	• Avoid burning from Apr-Oct • Avoid inter-fire intervals ≤ 10 years	Aus^
Montia fontana ssp. *chondrosperma*	Waterblinks		V	V		C K M WG	Herb	• Ephemeral in water holes after the water has receded • Fire response is unknown.		SA^
*Olea europaea**	European Olive				9		Tree	• Declared under the SA *Natural Resource Management Act 2004* • Adults resprout following fire • Seedlings are killed by fire • Flowers late spring • Seeds germinate in autumn • Fruit: Berry - dispersed by birds	• Pre-fire control will help weed biomass to burn and may facilitate post-fire access for follow-up control • Drill and fill to kill adults • Hand pull or grub seedlings	SA^
Olearia pannosa ssp. *pannosa*	Silver Daisy-bush	VU	V			P	Shrub	• Flowers August-October • Resprouts from lignotuber		SA^
*Pinus halapensis**	Aleppo Pine						Tree	• Reseeder • Burning will stimulate germination • Forms a short-lived soil seed bank, which is particularly abundant after a fire • Seedling recruitment takes place up to 1 year post-fire • Cones are produced 4 years from germination	• Weed control may be required following fire	(Daskalakou & Thanos 1996)

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
*Pinus radiata**	Radiata Pine						Tree	• Female cones produce large numbers of winged seed • Seeds spread by wind are also carried by Yellow-tailed Black-Cockatoos into native vegetation • Mature trees create dense shade and needles carpet the ground often suppressing plant germination. • Fire will kill pine wildlings • High intensity fire will kill larger pine trees	• Fire can be used in conjunction with manual methods of control	Aus^
Prasophyllum fecundum	Self-pollinating Leek-orchid		R		8 9 12	MG SC	Orchid	• Flowers from mid-September for about four weeks. • Self-pollinating • Flowering likely to be stimulated by summer fire • Likely to be sensitive to fire during growth season Apr-Sept	• Avoid burning from Apr-Oct • Avoid inter-fire intervals ≤ 10 years	SA^
Prasophyllum fitzgeraldii[1]	Fitzgerald's Leek-orchid				9 26		Orchid	• Flowers between September and November • Resprouter • Flowers freely without fire • Fire during Apr to Oct likely to be detrimental	• Avoid burning from Apr-Oct • Avoid inter-fire intervals ≤ 10 years	SA^

[1] The Fitzgerald's Leek-orchid (*Prasophyllum fitzgeraldii*) is under consideration to be listed as Rare under the NPW Act.

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
Prasophyllum pallidum	Pale Leek-orchid	VU	R	V		C CC K MC MG P SC WG	Orchid	• Has been observed occurring at higher densities in recently burnt areas • Flowers Sep to Oct • Resprouter • Flowers freely without fire • Fire during Apr to Oct likely to be detrimental	• Avoid burning from Apr-Oct • Avoid inter-fire intervals ≤ 10 years	SA^
Prasophyllum pruinosum	Plum Leek-orchid		V	E		P SC	Orchid	• Flowers late Sept to early Nov • Resprouter • Likely to sensitive to fire during growth season Apr-Oct	• Avoid burning from Apr-Oct	Aus^
Pterostylis sp. Hale (R.J. Bates 59781)[2]	Hale Greenhood	EN	V			WG	Orchid	• Colony forming species which reproduces vegetatively and by seed • Flowers Aug to Sept • Fire sensitive due to shallow tubers		SA^
Pterostylis ferruginea	Bangham Rustyhood		E			SC	Orchid	• Flowers Sept-Oct • Resprouter • Fire response unknown		SA^

[2] *Pterostylis* sp. Hale (R.J. Bates 59781) is listed as Vulnerable under NPW Act as *Pterostylis* sp. Veined leaf (R.J. Bates 59781).

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
Rubus spp.*	Blackberry						Scrambling Semi-deciduous Shrub	• *Weed of National Significance* • 1 year to seed set • Readily resprouts following fire • Seeds distributed by birds	• Pre-fire control will help weed biomass to burn and may facilitate post-fire access for follow-up control	Aus^
Schoenus latelaminatus	Medusa Bog-rush		V	T		K M MC P	Rush	• Grows in temporary damp places • Flowering occurs from Oct to Jan • Fire response is unknown.		SA^
Swainsona behriana	Behr's Swainson-pea		V			MC	Herb	• Congeners killed by fire • Seed germination likely to be stimulated by fire • Flowers: July-October		Aus^
*Ulex europaeus**	Gorse				8		Shrub	• *Weed of National Significance* • 1 year to set seed • Soil stored seed • Germination of soil stored seed stimulated following fire • Fire kills adult plants	• Post fire weed control likely to be required since burning stimulates mass germination of the seed bank	SA^

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
Veronica derwentiana ssp. homalodonta	Mount Lofty Speedwell	CE	E	E		MG WG	Shrub	• Emerge annually from a long-lived rootstock, forming a large clump. • Commonly found in moist gullies and near creeklines. • Flowering occurs from Oct to Jan • Resprouts after fire	• Avoid frequent fires <5 years	Aus^
Veronica derwentiana ssp. anisodonta	Kangaroo Island Speedwell		R	E		MG WG	Shrub	• Grows beside streams and waterfalls • Flowers from October to January • Plants tend to reshoot from the root system	• Avoid frequent fires <5 years	SA^

Appendix 3 – Fire Response of Rated and Significant Fauna Species

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Bird	Aphelocephala leucopsis	Southern Whiteface			V	9		I	• Site: Tree stumps, hollow limbs, fence posts, low trees and shrubs • Material: Untidy domed nest of grass, bark and roots. • Season: Jun to Dec	• Usually foraging at ground level, which is often bare or with little cover, or in sparse litter around the base of vegetation • Favours habitat where dead trees or stumps result from previous fire • Prefers habitat recovering from fire less than 10 years but not present in mature mallee last burnt 25 years or more	• >25% of habitat where populations are known to occur should not burn in a single fire event • Protect known nesting sites from the impact of prescribed burns • Post-fire woody weed control may be required to prevent habitat becoming more dense	(Higgins & Peter 2002) SA^
Bird	*Botaurus poiciloptilus*	Australasian Bittern		V	V		LP	I	• Site: nests in reeds	• Listed on the IUCN Red List as globally vulnerable • Inhabits dense reedbeds, fringing rivers & swamps • Specialised habitat requirements – so are more sensitive to overall habitat loss than many other wetland species	• Reduce the likelihood of frequent fires	(Marchant & Higgins 1993)

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Bird	*Calyptorhynchus funereus*	Yellow-tailed Black-cockatoo		V	V	489	C CC G M MC MG P SC WG	G	• Sites: hollows high in canopy • Material: woodchips • Season: Nov-Mar	• Inhabits woodland & often seen in pine plantations where it feeds on seeds • High mobility • Potential long-term loss of breeding habitat from extensive, high intensity fires • High intensity fire can increase hollow loss. However, fire exclusion may inhibit hollow development	• Protect known nesting sites from the impact of prescribed burns • Minimise the loss of important feeding sites & critical habitat (including Aleppo Pine stands) • Maximise the potential for *Hakea carinata* recovery from prescribed burn operations by ensuring the habitats containing this species are burned at high intensity at a time when good amounts of ripe seed are present on the plants.	SA^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Bird	*Ceyx azureus*	Azure Kingfisher		E			LP	C I	• Sites: The nest is at the end of a burrow dug out of soil in a riverbank • Season: October – March • Form monogamous pairs that defend a breeding territory	• Inhabits vegetated banks of freshwater rivers, creeks and reservoirs • Prefers the simple structure of trees and grass. Considerably less abundant in areas of long unburnt dense vegetation • Attracted to carrion immediately post burn	• Maintain a mosaic of different times since last fire	Aus^
Bird	*Climacteris picumnus*	Brown Treecreeper			V			I	• Sites: tree hollows • Material: grass, feathers & lose bark • Season: June-Dec	• Higher abundance in burnt (8 yrs post-fire) than unburnt vegetation	• Protect known nesting sites from the impact of prescribed burns. • Consider mechanical means of reducing fuel loads (such as thinning of shrubs) in grassy woodland systems (where appropriate).	SA^
Bird	*Coturnix ypsilophora*	Brown Quail		V	V		G LP P	I G	• Site: depression on the ground under dense cover	• Lives in grassland, marshes & scrub • Numbers may be temporarily reduced post-burn due to fire &/or exposure to predators	• Aim to provide unburnt areas for refuge	Aus^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Bird	*Hylacola pyrrhopygius parkeri*	Chestnut-rumped Heathwren (Mount Lofty Ranges ssp.)	EN	E	V	4 9	CC MG WG	G	• Sites: on ground or in a low bush or tussock • Material: dome shaped - grasses, fine bark & feathers • Season: Jul-Nov	• Prefers heaths & low dense thickets in forests & woodlands • In pairs or small groups • Sedentary • High risk to population loss due to bushfire • May be an early successional coloniser of burnt woodland • Colonises burnt areas within 5 yrs if unburnt areas nearby	• > 20% of habitat where populations are known to occur should not burn in single fire event • Avoid fire regimes likely to permanently alter habitat structure	SA^
Bird	*Lophoictinia isura*	Square-tailed Kite		E			MC P SC WG	C I	• Sites: high in tree forks and large horizontal limbs • Material: Platform of sticks • Season: Jul - Feb	• Prefers open eucalypt forest and woodlands with mature trees • Home range 10 000 ha • Nests are usually located along or near watercourses • Specialist predator of the canopy, feeding primarily on nestling birds, eggs, insects and reptiles • Fire may temporarily increase food availability as prey is flushed from habitats. However, if fire is intense and canopy scorch prevalent, foraging opportunities may be reduced for this species in the short term	• To ensure that >50% of remnant vegetation in planning area is >15 years age since last fire • Protect known nesting sites from the impact of prescribed burns • Minimise canopy scorch within 100 m of known nesting site	Aus^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Bird	*Melanodryas cucullata*	Hooded Robin				9 19 26	C K M MC MG P SC WG	I	• Sites: 1-5 m high in a tree fork or crevice. Sometimes in the hollow top of a stump • Material: A cup shaped nest of rootlets, grass and bark bound with spider's web • Season: Jul-Nov	• Prefers lightly timbered open eucalypt woodland, mallee and acacia shrubland. Often in or near clearings or open areas • Often perches on low dead stumps and fallen timber or on low-hanging branches for foraging • Territorial, occupying the same area over a year or several years • Territories range from around 10 ha during the breeding season, to 30 ha in the non-breeding season • KFRS • Bird may increase in abundance 1-10 yrs post-fire, but is prevalent in mallee 40+ yrs post-fire suggesting a preference for longer fire intervals	• >25% of habitat where populations are known to occur should not burn in a single fire event • Protect known nesting sites from the impact of prescribed burns • Post-fire woody weed control may be required to prevent habitat becoming more dense • Post-fire grazing pressure management may be required • Ensure that grassy woodland systems are managed to retain open structures (e.g. mass eucalypt regeneration may need to be managed in box grassy woodland systems)	Aus^ SA^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Bird	*Microeca fascinans*	Jacky Winter				8 12	C K M P SC WG	I	• Sites: Usually on the fork of a dead branch and always in an exposed position and clear of leaves • Material: Cup-shaped nest, made from grass and strips of bark, bound with spider's web • Season: Aug-Jan	• Prefer open woodland (eucalypt and mallee) with an open shrub layer and bare ground • Ground and aerial forager	• >25% of habitat where populations are known to occur should not burn in a single fire event • Protect known nesting sites from the impact of prescribed burns. • Post-fire woody weed control may be required to prevent habitat becoming more dense • Post-fire grazing pressure management may be required • Ensure that grassy woodland systems are managed to retain open structures (e.g. mass eucalypt regeneration may need to be managed in box grassy woodland systems)	Aus^ SA^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Bird	*Myiagra cyanoleuca*	Satin Flycatcher		E			SC	I	• Site: 3-25m in a bare, horizontal branch, with overhanging foliage • Material: Cup shaped nest of shredded bark and grass, bound with spider's web • Season: Nov-Feb	• Found in eucalypt forests, preferring moister gullies often near wetlands or watercourses. They are also found in eucalypt woodlands with open understorey and grass ground cover • Arboreal foragers, feeding high in the canopy and subcanopy of trees • Migratory species, moving northwards in autumn to northern Queensland and Papua New Guinea, returning south to breed in spring	• Protect known nesting sites from the impact of prescribed burns	Aus^
Bird	*Myiagra inquieta*	Restless Flycatcher		R	E	8 9 12	C CC G K M P SC WG	I	• Site: Exposed branches of trees • Material: small cup-shaped nest of bark and grass bound with spider's web • Season: Jul to Jan	• Found in open forests and woodlands • Usually foraging at ground level, which is often bare or with little cover, or in sparse litter around the base of vegetation	• Protect known nesting sites from the impact of prescribed burns • Post-fire woody weed control may be required to prevent habitat becoming more dense	(Higgins & Peter 2002) SA^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Bird	*Petroica boodang boodang*	Scarlet Robin		R	V		C CC G K M MC MG MU P SC W WG	I	• Sites: low tree forks • Material: fine vegetation • Season: Aug-Dec	• Ground feeding • Colonises open burnt areas until regrowth becomes too dense (up to 3 years) • Generally increases in abundance post-fire	• Avoid burning >50% of known habitat in a single event	SA^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Bird	*Stagonopleura guttata*	Diamond Firetail		V	V		C CC G K M P SC	G	• Sites: shrub & tree canopy • Material: grass • Season: Oct-Jan	• Inhabits grassy eucalypt communities • Feeds exclusively on the ground on grasses & forbs • Requires ground cover, including fallen timber • Local movements • Strong fliers likely to evade fire • Habitat likely to be temporarily impacted by fire	• >25% of habitat where populations are known to occur should not burn in a single fire event • Protect known nesting sites from the impact of prescribed burns • Post-fire woody weed control may be required to prevent habitat becoming more dense • Post-fire grazing pressure management may be required • Ensure that grassy woodland systems are managed to retain open structures (e.g. mass eucalypt regeneration may need to be managed in box grassy woodland systems)	SA^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Bird	*Stictonetta naevosa*	Freckled Duck		V			K M WG	I	• Site: nests in bushes at water level • Season: Sep-Nov (can breed out of season when conditions are favourable)	• Regarded as one of the rarest waterfowl in the world • Is dependent on dense vegetation in large shallow swamps for breeding, & on permanent waters for refuge during drought		Aus^
Bird	*Taeniopygia guttata*	Zebra Finch			U	8 9	K SC WG	S	• Site: loose domed nest in a low dense shrub or tree • Season: Oct to Nov	• Found mainly dry wooded grasslands, bordering watercourses • Feed in large flocks on fallen or ripening grass seeds	• Protect known nesting sites from the impact of prescribed burns • Post-fire woody weed control may be required to prevent habitat becoming more dense	((Higgins & Peter 2002) SA^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Bird	*Turnix varius*	Painted button-Quail		R	V		C CC G K MC P SC WG	G I	• Sites: terrestrial under some vegetation within a depression • Material: grass acting as a hood and lined with finer grass • Season: Sept-May	• Found within open forests and heaths with abundant leaf litter • Numbers may be temporarily reduced due to fire and/or exposure to predators • Low mobility • Will enter farmlands for food • May invade or become abundant in recently burnt areas • Ground feeding species which generally increase in abundance post-fire	• >50% of habitat patch should not burn in a single fire event	Aus^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Bird	*Zoothera lunulata halmaturina*	Bassian Thrush	V	R	V	4 8 26	C K M MC M P WG	I	• Sites: tree forks or tree stumps • Material: cup shaped of bark strips, leaves, grasses, moss & rootlets • Season: Jul-Dec • Also frequents *Callitris rhomboidea* & *Exocarpos cuprressiformis* areas	• Prefers dense vegetation & moist gullies but will utilise nearby open areas for foraging • Sedentary but dispersive • Risk of population decline due to bushfire • Forages for insects on the ground beneath leaf litter • Frequent fire & intensive fires that remove leaf litter & cover are likely to impact species	• > 50% of habitat patch should not burn in single fire event for > 50% of patches • Undertake patchy burns in riparian areas • Ensure post-fire weed control is undertaken to avoid habitat degradation • Where stands of Callistris and Exocarpus comprise significant habitat, ensure sufficient areas of this habitat remain unburnt	SA^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Fish	*Galaxias brevipinnis*	Climbing Galaxias			V		CC LP M P WG	I	• Sites: Streamside vegetation above the normal water levels • Season: Spawning in autumn and winter	• Occur in mid to upper catchments in deeper, cool pools that are often spring fed & have high levels of cover (Friedel *et al.* 2007) surrounded by riparian vegetation • Prefers clear, flowing water in shaded streams with rocky substrates	• Where possible, avoid the use of fire suppression chemicals in and surrounding watercourses • Sediment traps may be required to minimise the amount of mobilised sediment reaching the watercourse following a bushfire	(Hammer, Wedderburn & van Weenen 2007)
Mammal	*Antechinus flavipes*	Yellow-footed Antechinus		V		8 30	CC M MG P WG	C I N	• Sites: eucalypt forest and dense understorey • Materail: In tree hollows & in Xanthorrhoea skirts • Season: Late spring, highly restricted breeding season	• Capable of surviving low intensity fires, however, variable responses noted between studies (from population increases to long-term declines) • Availability of refuge/nesting sites likely to decline following intensive fires	• Aim to provide unburnt areas for refuge to facilitate recolonisation • Minimise loss of woody debris and hollows (avoid high intensity fire)	SA^ Aus^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Mammal	*Isoodon obesulus obesulus*	Southern Brown Bandicoot	EN	V	V	8 9	CC M MC P WG	I H G	• Sites: dense understorey vegetation • Material: soil & leaves • Season: late winter to summer	• Home range 1 ha - 6 ha • Inhabits heathland, shrubland, dry sclerophyll forest with heathy understorey, sedgeland or woodland • At least some individuals capable of surviving low intensity fire • Some indication that species prefers early seral stages, however, this is not conclusive & habitat preference is more likely to be related to habitat structure rather than time since fire	• Mosaic of post-fire vegetation is desirable (diversity & structure) • Avoid inter-fire intervals< 7 years • Some inter-fire intervals > 15 years desirable	SA^
Reptile	*Aprasia pseudopulchella*	Flinders Worm Lizard	VU		U	9 19 48	LP P	I	• Site: Open woodland, native tussock grassland, riparian habitats and rocky isolates • Material: Borrows in loose sand with vegetation litter below. Also found under rocks, logs and in termite nests • Season: unknown	• Diet consists almost entirely of the larvae and pupae of ants • Fire response is unknown	• Aim to provide unburnt areas for refuge to facilitate recolonisation • Where possible, avoid the use of fire suppression chemicals in known habitat	SA^ Aus^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	MVS No	Block	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Reptile	*Egernia cunninghami*	Cunningham's Skink		E	V	8 9	CC M	I H C	• Season: late summer	• Normally found in crevices & rock formations • Likely to find refuge in these areas during a fire • Juveniles omnivorous & adults are herbivorous - fire may impact the short-term availability of food sources	• Conduct patchy burns, where possible, around rock outcrops	SA^
Reptile	*Varanus rosenbergi*	Heath Goanna		V	E		CC MG WC	C	• Sites: termite mounds • Season: eggs laid in Feb, young hatch in Spring	• Wide ranging, terrestrial predator • Likely to survive fire by taking refuge in burrows • May benefit in the short-term from scavenging opportunities post-fire • Extensive fires may decrease prey resources (in the medium to long-term) & increase exposure • May be more vulnerable to fox & cat predation post-fire while vegetation is reduced	• Avoid Spring burns in known habitat where possible, particularly if burns are large-scale • Patchy burns may reduce post-fire predation	SA^

Appendix 4 – Ecological Communities of Conservation Significance

Ecological Community	SA Status (DEH 2005)	Other Status comments	Occurrence	Components	Fire Response	Ecological Fire Mgt Guidelines	Source
Peppermint Box *(Eucalyptus odorata)* **Grassy Woodland of South Australia**	CE (Aus)		• Occurs on plains to low ranges on sandy-loam to clay-loam • Sandy Creek CP • Para Woodlands	• Over Golden Wattle (*Acacia pycnantha*), Sweet Bursaria (*Bursaria spinosa*), Spear- grasses (*Austrostipa* spp.), Wallaby-grasses (*Austrodanthonia* spp.), Black-anther Flax Lily (*Dianella revoluta*), Iron-grasses (*Lomandra* spp.) & Native Primrose (*Goodenia blackiana*) • Sometimes in association with Drooping Sheoak (*Allocasuarina verticillata*), Southern Cypress Pine (*Callitris gracilis*), Grey Box (*E. macrocarpa*) & Mallee Box (*E. porosa*).	• Grassy understorey species regenerate well following low-moderate intensity fire • Some shrub species regenerate following moderate-high intensity fire • Hollows & coarse woody debris are important fauna habitat elements & can be adversely affected by moderate-high intensity fire • Where grassy/herbaceous understorey of this community is already moderately to highly degraded, fire may significantly increase weed cover and extent	**Fire Interval** • Inter-fire interval greater than 10 years • Inter-fire interval less than 40 years • Some intervals greater than 40 years are desirable **Fire Frequency** Avoid 2 or more successive fires less than 15 years apart **Fire Intensity** • Avoid 3 or more successive fires of low intensity • Some medium – high intensity fire needed to regenerate some species **Fire Season** Avoid 2 or more successive fires in spring (breeding season for significant species) **Fire Regime Extent** More than 50% of Peppermint Box Woodland across the plan area to meet Guidelines **Weeds** Consider other fuel reduction methods in situations where fire may exacerbate the spread of significant weed infestations causing a decline in habitat quality	Aus^

Ecological Community	SA Status (DEH 2005)	Other Status comments	Occurrence	Components	Fire Response	Ecological Fire Mgt Guidelines	Source
• **Iron-Grass** *(Lomandra* spp.*)* **Natural Temperate Grassland of South Australia**	CE (Aus)		• Occurs on plains, foothills and low ranges on gentle slopes. Usually found on loams to clay-loams where surface pebbles, shale and sandstone rocky outcrops are common • May occur in Gawler Block	• Over Spear- grasses (*Austrostipa* spp.), Wallaby-grasses (*Austrodanthonia* spp.), Yellow-wash Bluebell (*Wahlenbergia luteola*), Cut Leaf Goodenia (*Goodenia pinnatifida*), Woolly New Holland Daisy (*Vittadinia gracilis*), Vanilla Lily (*Arthropodium strictum*), Hairy Tails (*Ptilotus spathulatus*), & Black-anther Flax Lily (*Dianella revoluta*)	• Grassy species regenerate well following low-moderate intensity fire • Where grassy/herbaceous understorey of this community is already moderately to highly degraded, fire may significantly increase weed cover and extent	• Avoid burning entire remnants during a single fire event • Consider other fuel reduction methods in situations where fire may exacerbate the spread of significant weed infestations causing a decline in habitat quality	Aus^

Ecological Community	SA Status (DEH 2005)	Other Status comments	Occurrence	Components	Fire Response	Ecological Fire Mgt Guidelines	Source
Mallee Box *(Eucalyptus porosa)* **Woodland**	"Of Conservation Concern" (SA)		• Usually found on heavy soils over limestone in large shallow depressions • Para Woodlands • Gawler Buffer Site	• Over Golden Wattle (*Acacia pycnantha*), Wreath Wattle (*A. acinacea*), Umbrella Bush (*A. ligulata*), Kangaroo Thorn (*A. paradoxa*), Silver Daisy Bush (*Olearia pannosa*), Pink Garland Lily (*Calostemma purpureum*) , Spear-grasses (*Austrostipa* spp.) • Sometimes in association with Native Apricot (*Pittosporum phylliraeoides*)	• Inappropriate fire regimes considered a High threat to this community (Willson & Bignall 2009) • Remnants are infested with weeds contributing to fire risk • Potential changes in fire regimes may be restricting natural regeneration • Where grassy/herbaceous understorey of this community is already moderately to highly degraded, fire may significantly increase weed cover and extent	• Avoid burning entire remnants during a single fire event • Consider other fuel reduction methods in situations where fire may exacerbate the spread of significant weed infestations causing a decline in habitat quality	SA^ (Turner, M 2001)

Ecological Community	SA Status (DEH 2005)	Other Status comments	Occurrence	Components	Fire Response	Ecological Fire Mgt Guidelines	Source
Silver Banksia *(Banksia marginata)* **Grassy Low Woodland**	E (SA)	• Very High Priority threatened community in the Mount Lofty Ranges (Willson & Bignall 2009)	• Occurs along the foothills of the Mount Lofty Ranges on the poor sandy soils, in areas receiving more than 550 mm of annual rainfall • Cromer CP • Gumeracha Woodland • Kaiserstuhl CP • Little Mount Crawford NFR • Sandy Creek CP	• Over Yakka (*Xanthorrhoea semiplana*), Sticky Hop-bush *(Dodonaea viscosa* spp. Spatulata), Flame Heath (*Astroloma conostephioides*), Common Fringe-myrtle (*Calytrix tetragona*), Myrtle Wattle (*Acacia myrtifolia*), Bulbine Lily (*Bulbine bulbosa*), Milkmaids (*Burchardia umbellata*), Rock Fern (*Cheilanthes austrotenuifolia*), Sundew (*Drosera* spp.), Vanilla Lily (*Arthropodium strictum*), Spear- grasses (*Austrostipa* spp.), & Wallaby-grasses (*Austrodanthonia* spp.).	• Remnants are small and highly fragmented contributing to fire risk • Some of the dominant species will reseed following fire • Plants will need to reach reproductive maturity before fire • *B. marginata* appears to act as obligate seeder in some regions, but species is known to resprout from the base and root suckers in the Mount Lofty Ranges • Seed mortality of some banksia species over summer has been found to be high following Spring burns (Cowling & Lamont 1987; Enright & Lamont 1989) • Where grassy/herbaceous understorey of this community is already moderately to highly degraded, fire may significantly increase weed cover and extent • Inappropriate fire regimes considered a High threat to this community (Willson & Bignall 2009)	• Avoid burning entire remnants during a single fire event • Avoid burning remnants at intervals of less than 10 year • Avoid burning this community during periods of drought • Determine fire response at Mount Lofty Ranges sites • Undertake moderate intensity burns in Autumn to ensure canopy seed drop occurs and seed mortality is minimised • Consider other fuel reduction methods in situations where fire may exacerbate the spread of significant weed infestations causing a decline in habitat quality	(Turner, M 2001)

Ecological Community	SA Status (DEH 2005)	Other Status comments	Occurrence	Components	Fire Response	Ecological Fire Mgt Guidelines	Source
Pink Gum *(Eucalyptus fasciculosa)* **+/- Blue Gum** *(E. leucoxylon)* **Heathy Woodland**	V (SA)	• High Priority threatened community in the Mount Lofty Ranges (Willson & Bignall 2009)	• Occurs on sandy loams of flats and slopes • Sandy Creek CP • Warren CP • Hale CP • Para Wirra CP	• Over Silver Banksia (*Banksia marginata*), Sticky Hop-bush *(Dodonaea viscosa* spp. *spatulata*), Ground-berries (*Acrotriche* spp.), Spider-flower (*Grevillea lavandulacea*), Muntries (*Kunzea pomifera*), Iron-grasses (*Lomandra* spp.), & Milkmaids (*Burchardia umbellata*)	• It is thought that prescribed burning is not likely to have a major impact on this community • High intensity burns have been known to cause pink gums to be killed or resprout basally (rather than epicormically). This effect is likely to be exacerbated if the trees are already stressed • To ensure good regeneration of the heathy understorey, a moderate intensity burns may be required • Where grassy/herbaceous understorey of this community is already moderately to highly degraded, fire may significantly increase weed cover and extent • Inappropriate fire regimes considered a Moderate threat to this community (Willson & Bignall 2009)	• Avoid burning entire remnants during a single fire event • Undertake burns in late Spring or early Autumn to reduce potential impacts on geophytes • Manage fire intensity based on the floristic composition, fuel loads and health of the community to ensure good regeneration of pink gums and heathy understorey • Avoid burning this community in drought conditions to maintain health of Pink gums • Consider other fuel reduction methods in situations where fire may exacerbate the spread of significant weed infestations causing a decline in habitat quality	SA^

Ecological Community	SA Status (DEH 2005)	Other Status comments	Occurrence	Components	Fire Response	Ecological Fire Mgt Guidelines	Source
Silky Tea-tree *(Leptospermum lanigerum)* **Prickly Tea-tree** *(L. continentale)* **Closed Heath**	E (SA)	• Very High Priority threatened community in the Mount Lofty Ranges (Willson & Bignall 2009)	• Scotts FL • Kaiserstuhl CP • South Para RR • Warren CP	• Over Swamp Wattle *(Acacia retinodes),* Hop Goodenia (*Goodenia ovata*), Saw Sedge (*Gahnia sieberiana*), Fishbone Water Fern *(Blechnum nudum),* Soft Water Fern *(B. minus),* Maindenhair Fern (*Adiantum aethiopicum*), Coral Fern *(Gleichenia microphylla),* & Bracken Fern (*Pteridium esculentum*)	• Burning may promote increased structural and floristic richness. Swamp vegetation regenerates quickly following a controlled burn, with increases in both biomass and plant species richness • Inappropriate fire regimes considered a Moderate threat to this community (Willson & Bignall 2009)	• Avoid burning entire remnants during a single fire event • Moderate to high intensity fire is likely to result in the best regeneration of this community • Consider other fuel reduction methods in situations where fire may exacerbate the spread of significant weed infestations causing a decline in habitat quality	SA^
Mount Lofty Ranges Candlebark *(Eucalyptus dalrympleana* ssp. *dalrympleana)* **Open Forest**	E (SA)	• Very High Priority threatened community in the Mount Lofty Ranges (Willson & Bignall 2009)	• Occurs in the wetter, colder valleys on fertile soils between Mylor and Gumeracha (Nicolle 1997)	• Over Bracken Fern (*Pteridium esculentum*), Myrtle Wattle (*Acacia myrtifolia*), Prickly Tea-tree (*Leptospermum continentale*), Wallaby-grasses (*Danthonia* spp.), Kangaroo Grass (*Themeda triandra*) & exotics	• Inappropriate fire regimes considered a Low threat to this community (Willson & Bignall 2009) • Potential changes in fire regimes may be restricting natural regeneration • Where grassy/herbaceous understorey of this community is already moderately to highly degraded, fire may significantly increase weed cover and extent	• Avoid burning entire remnants during a single fire event • Avoid burning remnants at intervals of less than 10 years • Consider other fuel reduction methods in situations where fire may exacerbate the spread of significant weed infestations causing a decline in habitat quality.	SA^

Ecological Community	SA Status (DEH 2005)	Other Status comments	Occurrence	Components	Fire Response	Ecological Fire Mgt Guidelines	Source
Manna Gum *(Eucalyptus viminalis* ssp. *cygnetensis* and/or *E. viminalis* ssp. *viminalis)* **Woodland**	V (SA)	• Moderate Priority threatened community in the Mount Lofty Ranges (Willson & Bignall 2009)	• Cudlee Creek NFR • Coralinga NFR	• Over Native Cherry (*Exocarpos cupressiformis*), Golden Wattle (*Acacia pycnantha*), Spear-grasses (*Austrostipa* spp.), Wallaby-grasses (*Austrodanthonia* spp.), Old Man's Beard (*Clematis microphylla*), & Groundsel's (*Senecio* spp.)	• High intensity burns have been known to cause Manna Gums to be killed or resprout basally (rather than epicormically). This effect is likely to be exacerbated if the trees are already stressed • Where grassy/herbaceous understorey of this community is already moderately to highly degraded, fire may significantly increase weed cover and extent	• Avoid burning entire remnants during a single fire event • Consider other fuel reduction methods in situations where fire may exacerbate the spread of significant weed infestations causing a decline in habitat quality	SA^

Ecological Community	SA Status (DEH 2005)	Other Status comments	Occurrence	Components	Fire Response	Ecological Fire Mgt Guidelines	Source
Red Gum *(Eucalyptus camaldulensis var. camaldulensis)* **Grassy woodland**	V (SA)		• Kaiserstuhl CP • Para Woodlands • Pewsey Vale • Para Wirra CP	• Over Sticky Hop-bush (*Dodonaea viscosa* spp. spatulata), Myrtle Wattle (*Acacia myrtifolia*), Spear- grasses (*Austrostipa* spp.), Wallaby-grasses (*Austrodanthonia* spp.) and Old Man's Beard (*Clematis microphylla*)	• Red Gum trees are vulnerable to fire, however, the impact of fire on individual trees is likely to vary substantially in response to fire intensity, as well as tree age, with juvenile tree stages expected to be more vulnerable • The response of understorey species is determined by the component species characteristics • Where grassy/herbaceous understorey of this community is already moderately to highly degraded, fire may significantly increase weed cover and extent • Inappropriate fire regimes are considered a Moderate threat to this community	• Avoid burning entire remnants during a single fire event • Consider other fuel reduction methods in situations where fire may exacerbate the spread of significant weed infestations causing a decline in habitat quality	SA^

Summary of Codes Used in Appendices

Block Codes

CODE	BLOCK	CODE	BLOCK
C	Cromer Block	MC	Mount Crawford Block
CC	Cudlee Creek Block	MG	Mount Gawler Block
G	Gawler Block	MU	Murrays Block
K	Kaiserstuhl Block	P	Para Block
LP	Little Para Block	SC	Sandy Creek Block
M	Millbrook Block	WG	Watts Gully Block

Other Codes Used

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

MISCELLANEOUS CODES	
#	Fire response is unknown or ambiguous, thus the required data are not available to propose Ecological Fire Management Guidelines. When data becomes 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 Branch, has inferred based on other species genera).

11 GLOSSARY OF FIRE MANAGEMENT TERMINOLOGY

TERM	DEFINITION
Adelaide and Mount Lofty Ranges (AMLR)	The Adelaide Mount Lofty Ranges, for the purpose of this plan, includes metropolitan Adelaide, Willunga Basin, the Mount Lofty Ranges (including the foothills, hills-face and eastern flanks), the Fleurieu Peninsula, the Northern Adelaide Plains to the Light River, and the Barossa Valley (DEH 2010).
Bark fuel	The flammable bark on tree trunks and upper branches (DENR 2011e).
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).
Block	A management area defined during the fire management planning process. It is based on similar management requirement, geographically, ecologically and practically, to improve the implementation and delivery of fire management activities.
Bushfire	An unplanned fire. A generic term that includes grass fires, forest fires and scrub fires.
Bushfire Management Area Plan (BMAP)	Developed by Bushfire Management Committees as a requirement under the *Fire and Emergency Services Act 2005*.
Bushfire Management Committee (BMC)	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 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 2009b).
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 2011e).
Cultural values	Aboriginal and non-aboriginal sites and objects of significance.
Ecological burning	A form of prescribed burning. Treatment of vegetation in nominated areas to achieve specified ecological objectives.
Elevated fuel	Shrubs and juvenile understorey plants up to 3 m in height (DENR 2011e).
Environmental Assessment (EA)	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). The Environmental Assessment process considers cultural sites and objects (scar trees, middens), heritage sites (state listed buildings), significant recreational and amenity values, environmental values, landscapes and the recent fire regime.

TERM	DEFINITION
Environmental values	Non-built assets and values including threatened species, ecological communities, significant habitat elements (such as tree hollows), soil, water and other values which are valued for non-monetary reasons.
EPBC Act	The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*
Fine fuels	Grass, leaves, bark and twigs less than 6 mm in diameter.
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 (GAFMWG 2014).
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.
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 Index (FDI)	Calculated using a combination of temperature, relative humidity, wind speed, vegetation and drought factors (CFS 2009a).
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, Severe, Extreme, or Catastrophic.
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 suppression	The activities connected with restricting the spread of bushfire following its detection and making it safe.
Fire suppression chemicals	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.
Fuel	Any material such as grass, leaf litter and live vegetation, which can be ignited and sustains a fire. Fuel is usually measured in tonnes per hectare.

TERM	DEFINITION
Fuel arrangement	A general term referring to the spacing and arrangement of fuel in a given area.
Fuel hazard	The overall fuel hazard is defined as the sum of the influences of bark fuel, elevated fuel and surface fine fuel (DENR 2011e).
Fuel management	Modification of fuels by prescribed burning, or other means.
Heads of Agencies Committee	A committee formed to direct fire management activities across public land in South Australia. Membership includes the CFS, DEWNR, ForestrySA and SA Water.
Heritage Agreement (HA)	Private conservation areas established through an agreement between the MSEC and the landholder under the *Native Vegetation Act 1991*.
Incident Controller (IC)	The individual responsible for the management of all incident operations and the decisions of the Incident Management Team.
Incident Management Team (IMT)	The group of incident management personnel comprising the Incident Controller and the people he/she appoints to be responsible for the functions of Operations, Planning and Logistics.
Key Fire Response Species (KFRS)	These are the species most susceptible to decline due to inappropriate fire regimes: either too frequent or too infrequent fire, low or very high intensity fire, or fire in a particular season.
Ladder fuels	Fuels that provide vertical continuity between strata. Fire is able to carry surface fuels into the crowns of trees with relative ease.
Landscape protection (prescribed burns)	A strategic and adaptive program of prescribed burns applied to the landscape in order to reduce the risk of a whole block/reserve/area/significant habitat burning in a single bushfire event (DEWNR 2015b). While not constrained by them, fire regimes within landscape protection programs need to have regard for the Ecological Fire Management Guidelines.
Major Track	A track designed, constructed and maintained for the safe passage of firefighting vehicles undertaking fire management activities. Track shall be a minimum of 7 metres wide and sufficiently clear of vegetation both sides and overhead to allow ready two-way access (GAFMWG 2014).
Major Vegetation Groups (MVG)	A broad, upper level classification of native vegetation within the Native Vegetation Information System. Major Vegetation Groups are based on aggregations of 'like' vegetation types, principally in terms of structure, growth form and floristic composition in the dominant stratum. Each Major Vegetation Group has different mixes of plant species within the canopy, shrub and ground layers, but vegetation within each is structurally similar and often dominated by a single genus. There are currently 33 Major Vegetation Groups nationally (Department of the Environment 2014).
Major Vegetation Sub-groups (MVS)	A finer scale classification of native vegetation types within the Native Vegetation Information System that sit within the Major Vegetation Groups. Defined for the purposes of finer scale mapping and regional analyses. There are currently 85 Major Vegetation Sub-groups nationally (Department of the Environment 2014).

TERM	DEFINITION
Mechanical removal	Physical modification of flammable material to reduce fuel hazard levels through selective logging, thinning, clearing, slashing, mowing and trimming of vegetation using machinery or equipment.
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).
Minor Track	A track designed, constructed and maintained for the safe passage of firefighting vehicles undertaking fire management activities. Track shall be 4 to 5 metres wide and sufficiently clear of vegetation both sides and overhead to permit single lane access (GAFMWG 2014).
Mount Lofty Ranges Fire Cooperative (MLRFC)	A group formed by the Heads of Agencies Committee to coordinate cooperative fire management activities on public land in the Mount Lofty Ranges of SA. Membership includes the CFS, DEWNR, ForestrySA, and SA Water.
Native Vegetation Council (NVC)	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 2006).
Native Vegetation Information System (NVIS)	The Native Vegetation Information System (NVIS) is a comprehensive data system that provides information on the extent and distribution of vegetation types in Australian landscapes. The NVIS database contains over 9000 distinct vegetation types (Department of the Environment 2014).
NPW Act	The South Australian *National Parks and Wildlife Act 1972* (NPW Act).
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.
Preparedness	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.
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.
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.
Public land	Land managed by the Department of Environment, Water and Natural Resources (DEWNR), ForestrySA and/or SA Water within the planning area.
Response plan	A plan detailing the response for a risk or an area including the type and number of resources.

TERM	DEFINITION
Risk assessment	Used 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 2015b).
Service Track	All other access tracks which are not maintained to the Major, Standard or Minor Track requirements and therefore may not be trafficable or appropriate to use these for fire management purposes (GAFMWG 2014).
Spotting	The ignition of spot fires from sparks or embers.
Standard Track	A track designed, constructed and maintained for the safe passage of firefighting vehicles undertaking fire management activities. Track shall be 4 to 5 metres wide, sufficiently clear of vegetation both sides and overhead and incorporate passing bays (a minimum of 17 metres long and up to 6 metres wide) every 400 metres or less (GAFMWG 2014).
Threshold of Potential Concern (TPC)	Defined as a point in time where Key Fire Response Species are likely to be affected by an aspect of fire regime.
Total Fire Ban	A ban on lighting and maintaining of a fire in the open, which can be invoked at any time during the year. When invoked, the Total fire Ban is imposed for a period of 24 hours (from midnight to midnight) but may also be imposed for part of a day or days (CFS 2013).
Vital attributes	Vital attributes are the key life history features which determine how a species lives and reproduces. With respect to fire, these attributes govern how a species responds to fire and/or persists within a particular fire regime (FEWG 2004).

Unless otherwise indicated, definitions have been sourced from the *AFAC Bushfire Glossary* (AFAC 2012) or the *DEWNR Fire Management Glossary* (DEWNR 2015b).

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