Fire Management Plan

Reserves of the Onkaparinga Valley

2011-2021

Incorporating: Aldinga Scrub, Charleston, Kenneth Stirling, Mark Oliphant, Moana Sands, Montacute, Mount George, Mylor, Porter Scrub and Scott Creek Conservation Parks, Totness and Onkaparinga River Recreation Parks, Onkaparinga River National Park, included Crown lands and participating Heritage Agreements

Department of Environment and Natural Resources

Government of South Australia

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Front Cover: Common Donkey-orchid (*Diuris maculata*) at Porter Scrub Conservation Park by Chantelle O'Brien

Government of South Australia
Department of Environment and Natural Resources

January 2011

EXECUTIVE SUMMARY

This Fire Management Plan for the Onkaparinga Valley includes Aldinga Scrub, Charleston, Kenneth Stirling, Mark Oliphant, Moana Sands, Montacute, Mount George, Mylor, Porter Scrub and Scott Creek Conservation Parks (CP), Totness and Onkaparinga River Recreation Parks (RP), Onkaparinga River National Park (NP), selected Crown land and participating Heritage Agreements.

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

The planning area was identified as a priority for fire management planning within the Department of Environment and Natural Resources (DENR) Adelaide Region to:

- enhance the protection of life, property and environmental values
- minimise the risk of fire threatening the community and significant infrastructure, including key water catchments and power facilities
- maintain or improve the viability of native species, populations, communities and habitats in reserves (some of which are unique to the plan area)
- reduce the likelihood of a reserve burning in its entirety in a single bushfire event
- decrease the potential for intentional and accidental fire ignitions to build into landscape scale bushfires
- advocate for the pro-active conservation management of habitats at a landscape level, as well as for individual species, by using fire as a management tool
- improve our knowledge of fire regimes required by species, populations, communities and habitats
- consider the implications of regeneration and revegetation processes changing fuel hazards.

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

- undertaking a risk assessment to identify life, property and environmental values that may be threatened by bushfires
- applying DENR Fire Management Zoning principles to guide the management of fuel in Asset and Buffer Zones and designating Conservation Zones
- applying DENR Ecological Fire Management Guidelines to determine appropriate fire regimes in Conservation Zones
- assessing track standards using the Government Agencies Fire Liaison Committee's (GAFLC) guidelines for firebreaks and fire access tracks in South Australia (GAFLC, 2008)

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

- Fuel reduction:

    - in Asset and Buffer Zones using a variety of methods, including but not limited to prescribed burning and mechanical removal
    - in strategic areas within the Conservation Zones to provide landscape protection within the reserves and increase patchiness of the vegetation across larger areas
    - to complement strategies to manage species or habitats.
- Operational works to improve fire preparedness, including changes to fire access and mitigation and suppression infrastructure.
- Coordinated fire management between DENR and neighbours (including other government agencies and private landholders).

The community and Country Fire Service (CFS) volunteers have contributed an enormous amount of time, energy and resources to fire suppression in the Adelaide Region and they are to be commended for this contribution. The cooperation of the local community will be critical to the successful implementation of the plan. Neighbours will need to implement fire management strategies around their own assets to complement the work undertaken by DENR.

This draft plan was released for public comment for a period of four weeks over June and July 2010. Comments were then evaluated and incorporated where considered appropriate. A major review of this plan will occur after ten years of implementation, or earlier if required.

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Fire Management Maps

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

The Fire Management Maps are designed to illustrate the text in plans using four standard thematic maps. Users can view maps referred to in the text by selecting the appropriate map. Data displayed on each map becomes more detailed at larger scales. Once zoomed to an area of interest, it is possible to move between map themes and also print A3 maps of areas of interest. Please note that data will be updated from time to time and the map is likely to be more current than this plan.

Map 1 – Terrain, Tenure and Infrastructure
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1 SCOPE AND PURPOSE

The intention of this plan is to provide a strategic framework for fire management activities in DENR reserves and other included land. This plan incorporates Aldinga Scrub, Charleston, Kenneth Stirling, Mark Oliphant, Moana Sands, Montacute, Mount George, Mylor, Porter Scrub and Scott Creek CPs, Totness and Onkaparinga River RPs, Onkaparinga River NP, selected Crown land and participating Heritage Agreements.

The plan defines objectives for the protection of life and property (particularly in relation to visitors and adjacent landholders), protection of the environment and for ecological fire management. Strategies and works are recommended in order to maximise the potential for the objectives to be met. Risk mitigation works and activities will increase the level of bushfire preparedness and guide management and suppression strategies during bushfire incidents.

The Onkaparinga Valley was identified for fire management planning to address the following issues.

- The general protection of life, property and the environment within and adjacent to the reserves.
- The positioning of the reserves within the urban interface and adjacent Adelaide Hills population centres.
- The proximity of the reserves to significant infrastructure, including key water catchments and power facilities.
- The occurrence of species, populations, communities and habitats of conservation significance within the plan area.
- The likelihood of intentional and accidental fire ignitions.
- The use of fire as a management tool for community protection and/or conservation management.
- The potential impacts to biodiversity as a result of a reserve burning in its entirety in a single fire event.
- The need for fire management planning to inform revegetation projects within reserves and consider existing revegetation assets.

This Fire Management Plan aims to:

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

Operational works outlined in this plan will be implemented in a staged manner depending on available resources. These works will be facilitated through Adelaide Region and prioritised by the respective District (in this case, Northern Lofty or Southern Lofty Districts) in liaison with the Region's Fire Management Unit. Adjoining lands are considered in the plan, but only in the context of works required to minimise the risk to assets from fires originating in

the included reserves. However, DENR will support and complement landscape scale fire planning for adjoining lands. Fire management planning for other lands is the responsibility of the Adelaide Mt Lofty Ranges Bushfire Management Committee (BMC), in accordance with the requirements of the *Fire and Emergency Services Act 2005*. DENR is represented on this committee, along with Local Government and the CFS.

In recent years DENR has reviewed and updated fire management planning to address issues such as safety, protection of life and property, ecological management and mitigation of fire risk. This approach has been carefully considered to ensure that the gap is bridged between planning, on-ground actions and outcomes. Mechanisms are in place to allow the plans to evolve and improve. Consultation with the community and stakeholders is seen as critical to successful planning and has been built into the planning process.

1.1 Objectives

The fire management objectives that apply to DENR managed land are as follows.

General Objectives for Fire Management

- To reduce the risk to life, property and the environment during bushfire events.
- To ensure that sound conservation and land management principles are applied to fire management activities.
- To apply an adaptive management approach to fire management on DENR 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 block or reserve).
- To complement Bushfire Risk Management Plans (formerly Bushfire Prevention Plans).
- To undertake bushfire suppression activities in a safe and professional manner.
- To prevent or inhibit the spread of fire through DENR managed land.
- To manage fire regimes in accordance with the fire management guidelines in conservation zones (refer to Table 5).

The fire management objectives that apply specifically to the Onkaparinga Valley are as follows.

General Objectives for Fire Management in the Onkaparinga Valley

- To reduce the impact of bushfire in the reserves by:
  - minimising the likelihood of a significant portion of a reserve burning in a single fire event
  - minimising the likelihood of a landscape scale fire occurring within the planning area or spreading into the adjacent planning area.
- To maintain or improve the viability of native species, populations, communities and habitats in reserves by:
  - reducing the likelihood of fire suppression operations impacting upon the viability of flora and fauna populations and ecosystems

General Objectives for Fire Management in the Onkaparinga Valley

- reducing the likelihood of contiguous remnants of significant bushland burning in their entirety during a single fire event
- reducing the likelihood of fire threatening flora and fauna species of conservation significance by ensuring key populations (or their habitats) are not burnt in their entirety during a single fire event
- creating variability in the fire regime across the landscape to benefit a range of flora and fauna populations and ecosystems.

- To work with universities or other research institutions to develop research programs that inform DENR prescribed burning where appropriate.
- To improve knowledge of flora and fauna populations' and ecosystems' response to fire by:
  - undertaking ecological/experimental burns in order to examine the response of a particular, or range of flora and fauna populations (including weeds) and ecosystems to various fire regimes
  - implementing ecological/experimental burns as part of integrated weed management, in order to reduce the abundance of environmental weeds posing a threat to the integrity of bushland.
- 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 preparedness in accordance with bushfire risk, including prevailing weather, topography, overall fuel hazard, available resources, fire location and the current situation
  - assessing each fire and determining strategies promptly
  - maintaining a safe working environment during fire operations, in compliance with the *Occupational Health Safety and Welfare Act 1986* and consistent with DENR policy
  - using the functions, roles and responsibilities of the Australasian Interagency Incident Management System (AIIMS).
- To reduce the impact of bushfire on community functioning by providing for the protection of significant community and recreational values/assets within and adjacent to DENR managed land.
- To minimise the likelihood of bushfire threatening juvenile revegetation assets representing a significant capital outlay.

2 THE PLANNING FRAMEWORK

The policy and planning framework for fire management on DENR managed land is shown in Figure 1 (below). Reserve Management Plans provide the overarching strategy for all management activities in reserves and are prepared as a requirement under the *National Parks and Wildlife Act 1972* (or *Wilderness Protection Act 1992* where relevant). Fire Management Plans are produced for reserves in accordance with DENR Fire Management Policy and Procedures. An outcome of the fire management planning process is the identification of strategies and operational works for risk mitigation over a 10 year period (as set out in Appendix 1). These works are prioritised and programmed into a works schedule, which is prepared on an annual basis. Bushfire Response Plans provide a greater level of detail in regards to fire suppression. These plans are used in the early stages of an incident and are reviewed annually to ensure currency.

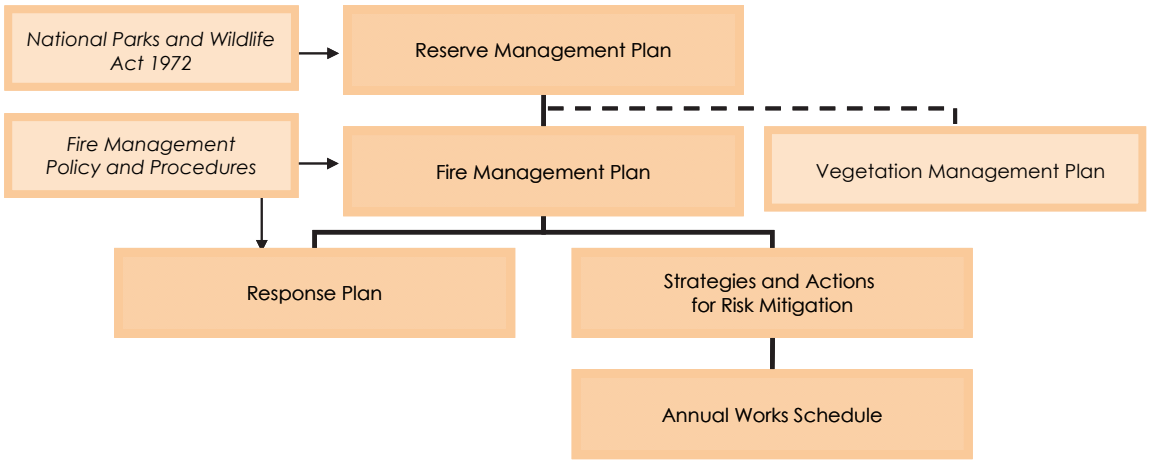

FIGURE 1 – THE PLANNING FRAMEWORK

2.1 Legislation

2.1.1 Federal Legislation

The Federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) describes the assessment and approval process required for actions likely to impact matters of national environmental significance (e.g. nationally listed species and ecological communities).

2.1.2 State Legislation

Under the provisions of the South Australian *National Parks and Wildlife Act 1972* (NPW Act) and *Wilderness Protection Act 1992*, DENR has responsibilities for fire management activities within reserves constituted under these Acts. The preparation of Fire Management Plans is not a statutory requirement under these Acts, but a Departmental Policy.

Under the *Crown Land Management Act 2009* DENR has responsibilities for fire management on unalienated Crown land and any Crown land dedicated to, owned by or under the care and control of the Minister for Environment and Conservation. The Minister for Environment and Conservation is not responsible for fire management on Crown leasehold land or land dedicated to another government Minister, person or body.

The South Australian *Fire and Emergency Services Act 2005* outlines the responsibilities of DENR and other fire authorities in relation to fire management within proclaimed reserves. Under this Act, the Chief Officer of the CFS must take steps to have any relevant provisions

of a management plan for a government reserve brought to the attention of members of CFS who might exercise powers under this section with respect to the reserve. Note that the *Fire and Emergency Services Act 2005* has recently undergone review.

DENR is required to meet the provisions under the *Native Vegetation Act 1991* when prescribing any works that involve the clearance of native vegetation, or the use of fire (note that fire is also defined as 'clearance' under the Act). All prescribed burns must be approved through the process delegated to DENR by the Native Vegetation Council (NVC).

Heritage Agreement areas are established under the provisions of the *Native Vegetation Act 1991* for conservation purposes. This is an agreement between the Minister for Environment and Conservation and the landholder, where the landholder remains ultimately responsible for fire management on the land. See Section 2.7 for more information.

2.2 Policies and Procedures

2.2.1 DENR Fire Management Policy

DENR has a *Fire Management Policy* (DEH, 2009b) which outlines the agency's fire management responsibilities and provides a framework for bushfire suppression, prescribed burning and fuel management on DENR managed land.

Under this Policy, DENR is responsible for:

- fire management on reserves dedicated under the NPW Act or *Wilderness Protection Act 1992*
- fire management on any land under the *Crown Land Management Act 2009* where the Minister for Environment and Conservation has fire management responsibilities (as defined within Section 2.1.2 of this plan)
- fire suppression on other government lands where DENR have entered into a Memorandum of Understanding (MOU) or Heads of Agency Agreement (HOAA) with other government land management agencies such as Forestry SA or SA Water.

The Policy states that DENR is will undertake fire management activities to protect life, property and environmental assets and to enhance the conservation of natural and cultural heritage values. Furthermore, it is recognised that fire is a natural component of the environment and the maintenance of biodiversity and ecosystem processes is dependent on appropriate fire regimes. Prescribed burning will be used as a management tool on DENR managed land for reducing fuel hazard to protect life, property and biodiversity values.

The Policy specifies that Fire Management Plans will provide the framework for:

- the management of bushfire suppression, including identification of strategic access and control lines
- prescribed burning for nature conservation and fuel reduction purposes.

2.2.2 Policies and Procedures for Fire Management Planning

DENR has a Policy that outlines the zoning standard that is used for fire management planning on DENR managed lands (DEH, 2009c). Zoning is derived from:

- the level of perceived risk, using the *Policy and Procedure for Risk Assessment in DENR Fire Planning* (DEH, 2009d)
- the overall fuel hazard, which is assessed using the *Overall Fuel Hazard Guide for South Australia* (DEH, 2006e), in accordance with the *Fire Policy and Procedure for Fuel Hazard Assessment* (DEH, 2009e)
- the activities considered appropriate to mitigate the threat that fire poses to life, property and environmental assets.

Three distinct zones exist: Asset zone (A-zone), Buffer zone (B-zone) or Conservation zone (C-zone) and these are applied according to landscape objectives. A- and B-zones are determined by fuel management objectives whereas C-zones are designated to assist in the conservation of biodiversity through the application of appropriate fire regimes. For more information on zoning, refer to Section 5.3.3 of this plan and the *Policy and Procedure for Fire Management Zoning in DENR Fire Planning* (DEH, 2009c).

2.2.3 Policies and Procedures for Fire Response

The following Policies and Procedures are to be used in conjunction with this Fire Management Plan during an incident.

- DENR Fire Management Policy and procedures contained within the *DENR Fire Policy and Procedure Manual* (DEH, 2009f)
- CFS Chief Officer Standing Orders (COSOs), Standard Operating Procedures (SOPs) and Operations Management Guidelines (OMGs).

Strategies implemented during an incident will be determined by the Incident Management Team (IMT), taking this plan into consideration in accordance with Section 97 of the *Fire and Emergency Services Act 2005.*

2.3 Planning For DENR Managed Lands

2.3.1 Reserve Management Plans

Reserve Management Plans are a statutory requirement under the NPW Act and the *Wilderness Protection Act 1992* (where relevant). Reserve Management Plans provide the overarching strategy for all management activities in reserves. In relation to fire, a Reserve Management Plan will:

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

Reserve Management Plans have been developed for eight of the 13 reserves included in this fire management plan:

- Aldinga Scrub CP (DEP, 1992)
- Mark Oliphant CP (DENR, 1996)
- Mount George CP (DEH, 2006d)
- Onkaparinga River NP and RP (DEH, 2004a)
- Porter Scrub CP (DEH, 2007)

- Scott Creek CP (DEHAA, 1999)
- Totness RP (DENR, 1994).

Each of these management plans recognises the fire risk and identifies the need for a fire management plan. However, many of these management plans refer to Bushfire Prevention or Protection Plans prepared by DENR prior to 2000, some of which do not promote active fire management practices. Since this time across Australia there has been increased community acceptance and evidence that fire management practices (including prescribed burning) are not only effective in asset protection, but can also contribute to nature conservation. Furthermore, DENR fire management planning has been updated to include risk analysis and a zoning approach which reflects recommendations contained in the Council of Australian Governments' (COAG) National Inquiry on Bushfire Mitigation and Management report (Ellis*, et al.*, 2004). It should be noted that the Reserves of the Onkaparinga Valley Fire Management Plan shall supersede these early DENR fire plans.

The Kenneth Stirling Conservation Park Group (Kenneth Stirling CP Group), Moana Sands CP, Montacute CP and Mylor CP do not have reserve management plans.

2.3.2 Fire Management Plans

Two other Fire Management Plans have been developed for groups of DENR reserves in the Mount Lofty Ranges: *Reserves of the Hills Face Zone* and *Reserves of the Southern Foothills*. These two plans were adopted in 2009. Both were developed using the same policies and procedures that were used during the development of this Fire Management Plan.

2.3.3 Vegetation Management Plans

Vegetation Management Plans are compiled as a means to identify a prioritised, strategic and sustainable approach to mitigating the impact of pest plants on natural ecosystems (Paul and Incoll, 2001). Unlike Reserve Management Plans, they are not a legislative requirement under the NPW Act or *Wilderness Protection Act 1992* and are completed on an ad hoc basis for selected DENR reserves depending on resource availability. Vegetation Management Plans have been prepared for six of the 13 reserves included in this Fire Management Plan:

- Aldinga Scrub CP (Kraehenbuehl and Holton, 2001)
- Charleston CP (Croft, 2008)
- Kenneth Stirling CP Group – Wotton Scrub (DEH, 2002b)
- Kenneth Stirling CP Group – Filsell Hill (under development)
- Onkaparinga River RP (EBS, 2008)
- Porter Scrub CP (Brewer, 2004)
- Scott Creek CP (ID&A Pty Ltd, 2000).

The *Aldinga Scrub CP Vegetation Management Plan* suggests that vegetation within the reserve may become senescent and some species may be disadvantaged or lost with the continued absence of fire. The plan identifies the requirement for post-fire monitoring of vegetation. The *Vegetation Management Plan for Onkaparinga River RP* was prepared to guide restoration works and the plan states that revegetation should not be carried out in fuel reduced areas or near boundary fences.

Future and current Vegetation Management Plans for reserves included in this plan should take fire management zoning and strategies into consideration. Any revegetation should be planned in conjunction with the relevant District Ranger and in consultation with the Region's Senior Fire Management Officer.

2.4 Local and Regional Environmental Planning

The following documents provide management direction for the biodiversity of the Onkaparinga Valley.

2.4.1 Regional Biodiversity Report

A regional biodiversity report, *Informing Biodiversity Conservation for the Adelaide and Mount Lofty Ranges Region – Priorities Strategies and Targets* has been prepared (DEH, 2009n). Recommendations from this report will be implemented in order to guide the conservation, management and rehabilitation of habitats at a regional level.

2.4.2 Natural Resources Management Plan

An Integrated Natural Resources Management (NRM) Plan has been developed by the Adelaide and Mount Lofty Ranges NRM Board (2008), as a requirement under the *Natural Resources Management Act 2004* (NRM Act), in consultation with the community and stakeholders. The plan, which is linked to the *State NRM Plan* (DWLBC, 2006a), describes the condition of the region, its natural resources and identifies goals to improve NRM outcomes. The plan identifies inappropriate fire regimes as a key threat to terrestrial biodiversity and also recognises 'increased fire frequency' as a potential future risk associated with a changing climate.

2.4.3 Local Government

Both the City of Onkaparinga and the District Council of Mount Barker have prepared environmental plans to guide the conservation of remnant vegetation under their care and control:

- *Biological Diversity Strategy and Action Plan* (City of Onkaparinga, 2005)
- *Community Land Management Plan for Natural Areas* (DC Mount Barker, 2004).

Each plan supports the use of fire as a management tool, if considered appropriate to meet both biodiversity and fire management objectives. These councils have also prepared fire management plans, which are discussed in Section 2.5 (below).

2.5 Bushfire Planning for Adjoining Lands

Adjoining lands are considered in this Fire Management Plan, but only in the context of works required to minimise the risk to DENR managed land from external fires and the risk to private assets from fires originating in the included reserves. However, a number of privately owned Heritage Agreements have been incorporated into fire management blocks due to the practicalities of implementing fire management works in conjunction with DENR (see Section 2.7). All landholders are obliged to comply with the *Fire and Emergency Services Act 2005*, which states that property owners are required to implement works on their own land to minimise the threat of fire. A number of documents exist that contribute to the effective management of bushfire risk for adjoining lands, including:

- *District Bushfire Prevention Plan* (City of Onkaparinga DBPC, 2006)

- *Adelaide Hills Council and District Council of Mount Barker Bushfire Mitigation Plan* (AHC & DCMB DBPC, 2008)

The City of Onkaparinga, Adelaide Hills Council and District Council of Mount Barker commend the approach that DENR have taken in developing fire management plans and support the adoption of DENR zoning principles in future bushfire prevention planning. These councils are prepared to work with DENR to achieve landscape scale fire management strategies and equally, DENR is committed to supporting and complementing landscape scale fire planning for adjoining lands.

A number of recommendations have been made in this fire management plan that will require the assistance and support of Bushfire Management Committees (formerly District Bushfire Prevention Committees) (Appendix 1).

2.6 Recovery Planning

Recovery Plans are prepared for nationally threatened species that are listed under the EPBC Act. In the Onkaparinga Valley area a number of species and communities of national conservation significance have been recorded. A Regional Recovery Plan has been developed for over 200 threatened species and 18 ecological communities in the Adelaide and Mount Lofty Ranges region (Willson and Bignall, 2009). This plan defines actions around improving and disseminating fire-related knowledge to reduce the likelihood of fire management activities impacting threatened species and ecological communities.

The following species have been recorded in the planning area and have Recovery Plans that are either under development or in place:

- Osborn's Eyebright (*Euphrasia collina* ssp. *osbornii*) (Moritz and Bickerton, 2007)
- Pink-lipped Spider-orchid (*Caladenia behrii*) (Quarmby, 2009)
- Leafy Greenhood (*Pterostylis cucullata*) (Quarmby, 2009)
- Bayonet Spider-orchid (*Caladenia gladiolata*) (Quarmby, 2009)
- White Spider-orchid (*Caladenia rigida*) (Quarmby, 2009)
- Southern Brown Bandicoot (*Isoodon obesulus obesulus*) (Haby and Long, 2005)

A threatened species action statement has been developed for the Mount Lofty Ranges (MLR) Chestnut-rumped Heathwren (*Hylacola pyrrhopygia parkeri*) (Long and Bentley, 2010).

Recommendations for the Southern Brown Bandicoot, Chestnut-rumped Heathwren and threatened orchids are discussed in more detail in Section 3.7.4. Information on other species has been included in Appendix 2 and 3. Habitat data and sighting records of some significant species that occur within the planning area are shown on Map 2.

2.7 Fire Management in Heritage Agreements

The inclusion of private land held under Heritage Agreement in this fire management plan is appropriate when placed in the context of the landscape. Included Heritage Agreements are contiguous with DENR reserves and, in a fragmented landscape such as the Mount Lofty Ranges, it is considered that a holistic approach to fire management is necessary in order to maximise biodiversity in these remnants (See Map 1 and Section 3.1.2 for a list of included Heritage Agreements).

The inclusion of Heritage Agreements in a DENR plan does not change the fire management responsibilities of private landholders and the final decision to undertake any proposed activity still rests with the landholder in question. DENR will not contribute toward the implementation (through resources or financially) of any prescribed action on private land unless it is demonstrated that there is a benefit or shared risk to public land. However, DENR staff may provide technical support and expert advice to landholders where appropriate.

It should be noted that the inclusion of each Heritage Agreement in this fire management plan is subject to a change in the agreement between the Minister and the landholder, whereby the landholder must personally agree to the adoption of the fire management plan for their land. Therefore, any fire management works on Heritage Agreements listed in this fire management plan shall not proceed until this agreement is formally documented.

2.8 Partnership Agencies

The South Australian CFS is the lead combatant agency for bushfire suppression in rural South Australia. Responding to a fire in DENR reserves is undertaken jointly by DENR and other CFS Brigades (note DENR is a CFS Brigade under the *Fire and Emergency Services Act 2005*).

The Metropolitan Fire Service (MFS) only respond to bushfires occurring within DENR reserves in their response zone (Map 1). The MFS response zone does not cover any reserves included in this plan; however, the southern most extent of the response zone abuts the boundary of Onkaparinga River RP. Within reserves in the MFS response zone, MFS is the lead authority for bushfires. Coordination between the agencies is essential in maintaining fire management operations and implementing fire preparation, mitigation and suppression activities.

Local CFS Brigades from the Onkaparinga, Mawson, Heysen, Sturt, Mount Lofty and Kyeema Groups will form the initial response to fire incidents on DENR managed land, along with DENR appliances located at Black Hill CP and Cleland CP. As a fire escalates, DENR responds according to a staged District, Region and Statewide response with available resources.

Local brigades are heavily relied upon for fire suppression activities, particularly for first and second response to an incident. The cooperation, support and understanding between CFS, DENR brigades and the local community have been critical to successful fire suppression on DENR managed land and across the broader landscape in the past, and will be critical to the success of this plan.

The SA Government established the Mount Lofty Ranges Cooperative (MLRFC) in the latter part of 2009. Made up of CFS, DENR, SA Water and ForestrySA, the MLRFC is responsible for the planning and delivery of joint agency fire mitigation works, which includes prescribed burning, and the coordination of bushfire response arrangements on public lands in areas of shared risk. This arrangement is critical in complementing fire management works undertaken on DENR reserves, particularly where they are adjacent to other government land.

All fire management planning and works undertaken on DENR land are subject to consultation with local government to ensure that they are consistent with the objectives of

any Bushfire Risk Management Plans prepared by Bushfire Management Committees (see Section 2.5).

2.9 Consultation

DENR is committed to close cooperation and involvement with State and Commonwealth organisations, special interest groups and the broader community to achieve the goals of biodiversity conservation and protection of life and property. To achieve this, the CFS, other land management agencies, Local Government, Friends of Parks and the relevant NRM Board will be consulted during the development of the plan.

DENR fire management plans are prepared and adopted in accordance with the *Policy and Procedure for Fire Management Planning: Project Management and Consultation* (DEH, 2009v). Consultation is not a statutory requirement for Fire Management Plans, but is a Departmental Policy. The plan will be subject to DENR internal consultation for a period of four weeks prior to being released externally for public consultation (also for a period of four weeks). The finalised plan is reviewed and endorsed by the National Parks and Wildlife Council and NVC's Fire Sub-committee before it is adopted by DENR Executive.

2.10 Plan Review and Currency

This fire management plan will undergo a major review after ten years of implementation, or earlier if required. A works program will be derived from the recommendations listed in this fire management plan and reviewed on an annual basis.

3 BUSHFIRE ENVIRONMENT

The components of any landscape contributing to its bushfire potential include terrain, slope and aspect, climate and weather, vegetation and land use.

3.1 Description of the Planning Area

3.1.1 Location

The Onkaparinga Valley planning area spans across 70 km of the central hills of the Mount Lofty Ranges to the coastline south of Adelaide, where the Onkaparinga River meets the sea. This plan addresses fire management issues associated with 13 DENR reserves and other managed lands that fall within this zone. For the purpose of this plan, the 70 km length, extending from Porter Scrub CP in the north to Onkaparinga River NP and RP in the south and along the coast to Aldinga Scrub CP will be known as the 'planning area' (Map 1).

Three local government areas occur within the planning area. The Adelaide Hills Council and City of Onkaparinga areas meet within Scott Creek CP, with Adelaide Hills Council incorporating lands to the north-east of this divide and the City of Onkaparinga covering lands to the south-west. The District Council of Mount Barker area is located to the east of Scott Creek CP, with only Totness RP falling within its jurisdiction.

3.1.2 Included Lands

Thirteen DENR reserves (about 3 800 ha), nine Heritage Agreements (about 61 ha), four parcels of Crown land (about 30 ha) and two proposed reserve additions (less than 2 ha) have been incorporated into this plan. Included DENR reserves are Aldinga Scrub CP, Charleston CP, Kenneth Stirling CP Group, Mark Oliphant CP, Moana Sands CP, Montacute CP, Mount George CP, Mylor CP, Porter Scrub CP and Scott Creek CP, Totness RP and Onkaparinga River RP and Onkaparinga River NP. Details on other lands that have been included in this fire management plan are summarised in Table 1.

Proposed reserve additions have been included into this plan to ensure issues are identified and strategies for bushfire risk minimisation are established prior to dedication. Heritage Agreements abutting DENR reserves or included lands have been considered during the planning process; however, it is the responsibility of the individual owners to approve the adoption of the fire management plan for their land and undertake the proposed works (see Section 2.7).

Crown land dedicated to, owned by, or under the control of the Minister for Environment and Conservation was identified for inclusion into this plan through a risk assessment process considering existing and potential issues for fire management. The proximity to built assets, presence of native vegetation, location and size of the parcel were considered during this process.

TABLE 1 – OTHER LANDS INCLUDED IN THIS FIRE MANAGEMENT PLAN

Type	Dedication	Parcel Type and Number	Hundred	Size (ha)
Heritage Agreements	Private	Allotment 74, 78 (part) & 202 (part)	Noarlunga	22.6
Heritage Agreements	Private	Allotment 1 (part), 6 (part), 12 (part), 66, 101	Onkaparinga	38.4

Type	Dedication	Parcel Type and Number	Hundred	Size (ha)
		(part) & 102 (part)		
Unalienated Crown land	Minister for Environment and Conservation	Allotment 1 & 53	Willunga	28.2
Unspecified Reserve	The Crown	Section 70	Talunga	0.3
Unalienated Crown land	Minister for Environment and Conservation	Section 216	Onkaparinga	1.33
Proposed Addition to Onkaparinga River RP	Minister for Environment and Planning	Allotment 102	Willunga	1.5
Proposed Addition to Onkaparinga River NP	Minister for Environment and Conservation	Allotment 65	Noarlunga	0.2

3.1.3 Surrounding Land Use

Land use for areas adjoining the included reserves varies greatly across the planning area (Map 1). The rich, fertile soils and high rainfall of the Mount Lofty Ranges make it an ideal location for grazing, dryland agriculture and horticulture, especially the growing of apples, pears and cherries which are focused on the central hills area near Kenneth Stirling CP Group and Mylor CP. Viticulturists have also taken advantage of the productive environment and extensive areas of grape vines are grown across both the McLaren Vale (adjoining Onkaparinga River NP) and Adelaide Hills wine districts.

The urban sprawl of the Adelaide metropolitan area extends south to meet the northern boundary of the Onkaparinga River NP and RP and along the coast to Sellicks Beach incorporating Aldinga Scrub CP and Moana Sands CP. These reserves abut highly developed residential areas with housing generally positioned close to reserve boundaries without defendable space. Mount George CP and Mark Oliphant CP adjoin the hills settlements of Heathfield, Ironbank and Aldgate. Residential properties in these areas are often sited in dense native vegetation, frequently contiguous with DENR reserves. Reserves such as Porter Scrub CP, Charleston CP, Scott Creek CP, Mylor CP and Totness RP abut relatively low levels of residential development and exist in a landscape dominated by agricultural land and occasional areas of native vegetation, with scattered rural residential properties occurring some distance from DENR reserves.

Montacute CP, Kenneth Stirling CP Group and Mount George CP contribute to a large area of native vegetation that extends south from SA Water's Millbrook Reservoir Reserve and includes the Kangaroo Creek Reservoir Reserve and Cudlee Creek Forest managed by ForestrySA. This significant corridor of mature Stringybark forest (dominated by *Eucalyptus obliqua* and/or *E. baxteri*) continues as far south as Stirling. Similarly, a major remnant exists to the south, with 6 000 ha of protected native vegetation and plantation forest in the Scott

Creek CP and Mount Bold Reservoir area. Not only are these areas important in terms of biodiversity conservation but their management also should provide for the protection of drainage lines, and ultimately water quality flowing into SA Water reservoirs.

All of these features add to the complexity of fire management in the plan area.

3.1.4 Terrain

The Onkaparinga Valley planning area incorporates the 95 km long Onkaparinga River which originates at Mount Torrens in the Mount Lofty Ranges, at an elevation of about 650 m. This is the longest river in the Adelaide area, followed by the River Torrens. It flows from Mount Bold Reservoir, through Onkaparinga River NP and RP until it reaches St Vincent's Gulf at Port Noarlunga.

Reserves situated at the higher elevations of the Mount Lofty Ranges (such as the Kenneth Stirling CP Group, Scott Creek CP, Mark Oliphant CP, Montacute CP and Mt George CP) are characterised by steep and rugged topography. Some of the smaller reserves located further east (such as Charleston CP, Porter Scrub CP and Totness RP) have more gentle undulations. Coastal reserves in the south-western section of the planning area (Aldinga Scrub CP, Moana Sands CP and Onkaparinga River RP) have mainly sandy soils and flat terrain with coastal vegetation or mallee woodland. Onkaparinga River NP is characterised by rounded ridge tops and steep gorge slopes and incorporates a 12 km stretch of narrow river valley which located is some 80 to 100 m below the surrounding countryside.

3.1.5 Climate and Fire Weather

The reserves of the Onkaparinga Valley experience a Mediterranean maritime climate of mild, wet winters with dry, warm to hot summers. Average annual rainfall varies from approximately 500 mm in reserves on the coastal floodplain to over 1 000 mm in reserves situated on higher elevations of the Mount Lofty Ranges (see Figure 2).

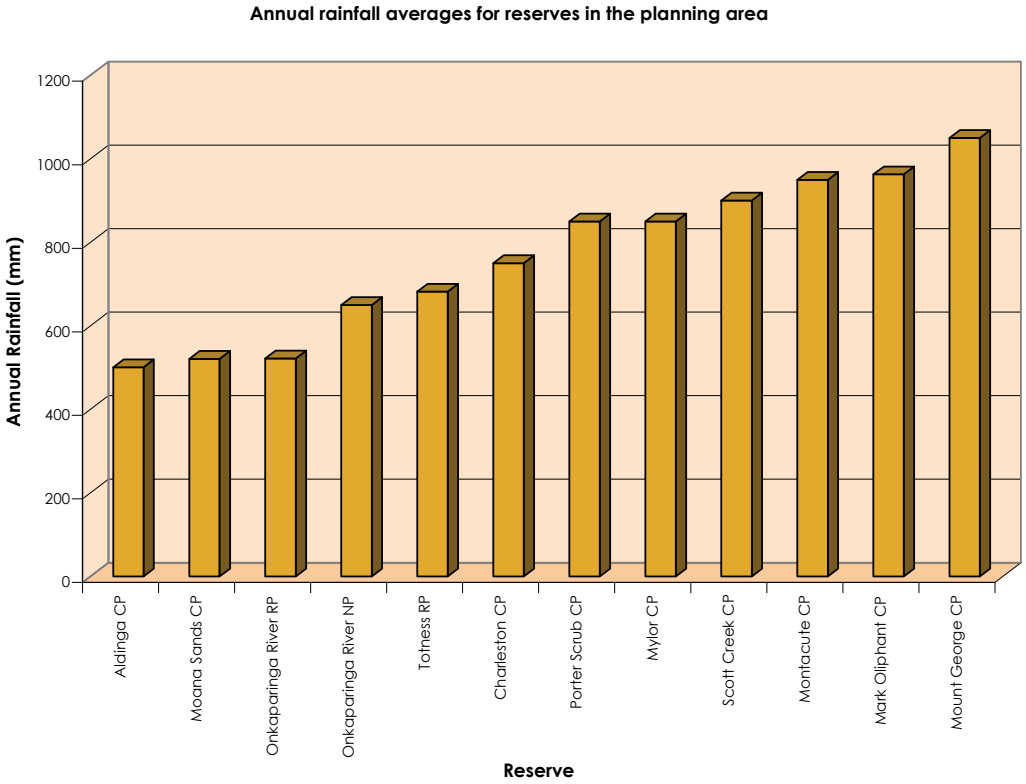

FIGURE 2 – ANNUAL RAINFALL AVERAGES FOR RESERVES IN THE PLANNING AREA

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 and McCaskill, 1986). This frontal activity is often associated with significant fire weather: strong northerly winds, high temperatures (high 30°C's or low 40°C's) 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 and McCaskill, 1986).

Two local wind systems influence the Adelaide area during the summer months. Gully winds, resulting from the funnelling of stronger easterly winds through the Mount Lofty Ranges, can be experienced at night from November through to March (Sha*, et al.*, 1996) along the foothills boundary of the Adelaide plains and the western side of the Mount Lofty Ranges (Schwerdtfeger, 1976). Sea breezes can also influence conditions, but effects are restricted to the coastal areas, as the presence of the Mount Lofty Ranges hinders the full inland development of the system (Schwerdtfeger, 1976).

3.2 Climate Change and Bushfire

South-eastern Australia is one of the most bushfire-prone areas in the world. Research is now suggesting that these risks are being compounded by the effects of climate change. Hennessy *et al.* (2005) have established that since 1950, rainfall has decreased in south-east Australia, droughts have become more severe and the number of extremely hot days has risen. Furthermore it is projected that the south-east of Australia is likely to become hotter and drier in the future. 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*, et al.*, 2001), which will potentially lead to longer fire danger season 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).

DENR acknowledges the significance of climate change and the potential impacts it will have on the management of fire regimes. As such DENR has developed a *Climate Change Strategy* (DEH, 2008) with a specific objective to address this: "*To play a lead role, in partnership with key groups, to develop and implement a landscape-based approach to fire management and planning that reduces impacts on life and property and maximises the resilience of natural systems to altered fire regimes caused by climate change.*" This fire management plan has been developed consistent with the objective and outcomes in the Strategy.

3.3 Extreme Fire Conditions

Strong winds, combined with high temperatures and low humidity increase the likelihood of extreme fire intensity and behaviour. As described by the CFS (2009a), 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 Australian Standard AS3959 will not necessarily survive a bushfire event on every occasion, but are intended to reduce the risk to occupants (Eadie and Herbert, 2009).

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

- *High* and above Fire Danger Indices
- *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 (especially westerly wind changes)
- Steep terrain.

3.4 Fire History

3.4.1 Mapping Fire Occurrences

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

The Fire History Map (Map 3) shows two representations of the same data: fire frequency and last fire. Fire frequency shows the number of times an area has been burnt, assuming only one fire per calendar year. The last fire map shows fire history grouped by year, which can also be viewed in 10 or 5 year classes. In combination, Map 3 shows that the planning area was subject to a number of larger fires that occurred over 20 years ago (Ash Wednesday fires) and in the last 10 years smaller fires (some of these prescribed) have burnt the included reserves.

3.4.2 Bushfires

Detailed records of recent fire incidents that have occurred within DENR managed land are stored within the Department's fire reporting database. This database along with spatial records and any other historical records were reviewed during the development of this fire management plan.

DENR has spatial fire history records from as early as 1931; however, the earliest mapped record on DENR managed land in the planning area is within Scott Creek CP in 1978/79 (Map 3).

Some of the more significant incidents that have occurred across the planning area within and adjacent to DENR managed lands include:

- The Black Sunday fires in 1955 that occurred in the Adelaide Hills area. The fires are known to have burnt the Cherryville, Montacute and Forest Range area, destroying the Governor's summer residence at Marble Hill.
- First Ash Wednesday fires in 1980. Part of Mark Oliphant CP was burnt after a fire started in Heathfield rubbish dump and moved in a south-easterly direction. The fire travelled as far as Mylor CP to the east and to the south almost reaching Echunga and Mount Bold Reservoir.
- Ash Wednesday II fires in 1983. Most of Montacute CP was burnt after an 885 ha fire that started at Anstey Hill RP travelled as far as the townships of Lobethal and Gumeracha. The fire burnt Kangaroo Creek and Millbrook Reservoir Reserves and Cudlee Creek Native Forest. Other fires further south burnt parts of Mylor CP and Totness RP.
- Part of Montacute CP was burnt in 1983 after a 147 ha fire that started at Black Hill CP travelled 6 km east to reach the reserve.
- A fire in 1994 that burnt over 168 ha of Mark Oliphant CP and the adjoining Heritage Agreements.

- Mt Bold fire in 2007. This was the most recent significant fire within the planning area which burnt a total of 1 493 ha of softwood plantation and native forest, however, this fire did not impact upon DENR managed land.

A significant number of bushfires within the Onkaparinga Valley have been attributed to human causes, with arson or suspected arson being the most frequent ignition source. Arson is especially an ongoing problem in Onkaparinga River NP and RP. Lightning caused ignitions are not common within the planning area; however, two fires that occurred in the Onkaparinga River area within the last 10 years are thought to have been due to lightning strikes.

3.5 Prescribed Burning

Prescribed burning has recently been undertaken within nine reserves included in this fire management plan and these areas are shown on Map 3: Kenneth Stirling CP Group (Filsell Hill and Wotton Scrub), Montacute CP, Mount George CP, Mylor CP, Mark Oliphant CP, Scott Creek CP and Aldinga Scrub CP, Totness RP and Onkaparinga River NP.

Prescribed burning and other fuel reduction methods will be carried out in the plan area to achieve fire management objectives within A-, B- and C-zones. Fuel reduction in A- and B-zones and C-zone burning is discussed in Section 5.3.

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

There are seven MVS within the planning area that have been mapped by DENR. Map 2 shows the distribution of MVS in the planning area. Table 2 (below) lists the dominant species composition for each MVS and the Ecological Fire Management Guidelines are outlined in Table 5.

TABLE 2 – DOMINANT SPECIES LAYERS FOR MAJOR VEGETATION SUB-GROUPS

MVS No.	MVS Name	Dominant Species Layers
4	*Eucalyptus* forests with a shrubby understorey	*Eucalyptus cosmophylla, E. fasciculosa, E. baxteri, Hakea rostrata, Hibbertia riparia, Leptospermum myrsinoides, Platylobium obtusangulum, Olearia ramulosa, Allocasuarina muelleriana* ssp. *muelleriana*

MVS No.	MVS Name	Dominant Species Layers
8	*Eucalyptus* woodlands with a shrubby understorey	*Eucalyptus baxteri, E. cosmophylla, E. dalrympleana* ssp. *dalrympleana, E. fasciculosa, E. leucoxylon, E. obliqua, E. viminalis* ssp. *cygnetensis, E. goniocalyx, Acacia pycnantha, Acrotriche serrulata, Allocasuarina muelleriana* ssp. *muelleriana, Astroloma conostephioides, Chrysanthemoides monilifera* ssp. *monilifera*, Hakea rostrata, Hibbertia exutiacies, H. sericea* var. *sericea, Lepidosperma semiteres, Leptospermum myrsinoides, Platylobium obtusangulum, Pultenaea daphnoides, Xanthorrhoea semiplana* ssp. *semiplana*
9	*Eucalyptus* woodlands with a grassy understorey	*Eucalyptus camaldulensis* var. *camaldulensis, E. fasciculosa, E. leucoxylon, E. microcarpa, E. porosa, E. viminalis* ssp. *cygnetensis, Acacia paradoxa, A. pycnantha, A. spinescens, Astroloma humifusum, Briza maxima*, Bromus diandrus*, Lepidosperma carphoides, Olea europaea* ssp. *europaea*, Olearia ramulosa, Pittosporum angustifolium, Vulpia* spp.*
26	*Casuarina* and *Allocasuarina* forests and woodlands	*Allocasuarina verticillata, , Acacia pycnantha, Chrysanthemoides monilifera* ssp. *monilifera*, Grevillea lavandulacea* var. *lavandulacea, Lomandra densiflora, Themeda triandra, Xanthorrhoea quadrangulata*
32	Other shrublands	*Acrotriche patula, Allocasuarina verticillata, Beyeria lechenaultii, Calytrix tetragona, Hakea* spp., *Lagurus ovatus*, Muehlenbeckia florulenta, Olearia ramulosa, Samolus repens, Senecio pinnatifolius ,Xanthorrhoea quadrangulata*
38	Wet tussock grassland, herbland, sedgeland or rushland	*Pteridium esculentum*
39	Mixed chenopod, samphire or forblands	*Muehlenbeckia gunnii, Olearia axillaris, Rhagodia candolleana* ssp. *candolleana, Tecticornia halocnemoides* ssp. *halocnemoides*

* denotes introduced species

3.7 Values and Assets

3.7.1 Visitor Use

Many of the reserves included in this plan are popular destinations for recreational activities. Bushwalking is the most common activity, however, only a few of the included reserves have an established walking trail network. Camping is not permitted in any of the reserves, however, overnight accommodation is provided within Mylor CP by the Youth Hostels Association. This facility cannot be used if there is a Total Fire Ban declared by the CFS.

In addition to bushwalking, visitors to Onkaparinga River RP can pursue fishing, cycling, canoeing and kayaking in and around the estuary area. Rock climbing and abseiling are popular at Onkaparinga River NP. Statistics for Onkaparinga River NP and RP indicate that up to 100 000 people visit these reserves each year.

Management Strategies	
Visitor Use	1. Consider reserve closures when significant fire weather is forecast to ensure visitor safety (at the discretion of the Director, National Parks and Wildlife).
	2. Prepare visitor bushfire survival plans as required and review these annually. Plans for visitor facilities should be developed by the lessee, owner or manager.
	3. Implement appropriate fuel management strategies as shown Map 4 to increase visitor safety.

3.7.2 Built Assets

There are a number of assets at risk from bushfires including:

- Hardwood and softwood forestry plantations adjacent to Montacute CP and to the south of Scott Creek CP at Mount Bold representing significant forestry asset value.
- Many homes, sheds and outbuildings within the urban fringe, rural settlements and larger townships across the planning area.
- Community facilities such as the pistol club south-west of Porter Scrub CP, rifle range south of Onkaparinga River NP, Port Noarlunga Football Club north of Onkaparinga River RP, Noarlunga Football Club to the west of Onkaparinga River NP, Heathfield High/Primary Schools and football club north of Mark Oliphant CP, Seeonee Hills Scout Camp adjacent to Mount George CP, Mount Lofty Golf Club west of Mount George CP and the Moana Surf Life Saving Club north of Moana Sands CP.
- Agricultural assets such as grape vines, fruit trees, livestock and crops surrounding many of the reserves in the plan area.
- Industrial assets such as the Boral Quarry south of Onkaparinga River NP, SA Water treatment facility and Heathfield waste depot north of Mark Oliphant CP and power station south-west of Scott Creek CP.
- Tourist facilities such as Aldinga Beach Holiday Park to the east of Aldinga Scrub CP and the Moana Beach Tourist Park to the north of Moana Sands CP.
- Leased assets and other non-DENR infrastructure within reserves such as the Noarlunga Model Aerosports Club, Scouting Association and South Coast Flying Club assets at Onkaparinga River RP, the YHA Hostel on Whitehead Road at Mylor CP and the SA Water pumping station within Mark Oliphant CP.
- DENR built assets including two houses at Scott Creek CP and general infrastructure such as tanks, fences, signs, picnic tables, bridges, sheds, bores and a boardwalk.
- Revegetation sites within Onkaparinga River NP representing a significant investment by DENR and the community.

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

Appendix 1 details significant assets within and adjacent to DENR managed land and the corresponding fire management strategies. Map 1 shows the location of assets within the planning area.

Management Strategies	
Built Assets	4. Implement fuel management strategies appropriate to asset protection as shown on Map 4.
	5. Encourage adjacent property owners to work with CFS and local government to implement appropriate and coordinated fire management works on their own land to minimise the threat of fire.
	6. Undertake fire management works and activities on DENR reserves to minimise the impact that fire may pose to adjacent public assets.
	7. Work with the Adelaide Mt Lofty Ranges Bushfire Management Committee to improve safety at Heathfield High/Primary Schools through coordinated fuel reduction (see Appendix 1).
	8. Encourage volunteer participation in undertaking approved fuel reduction activities on reserves.
	9. Ensure revegetation is consistent with fire management zoning and fire is excluded from juvenile revegetation sites.

3.7.3 Cultural Heritage

Information on Aboriginal and European heritage is collected during prescribed burn planning as part of the Environmental Assessment Table (EAT) (refer to Section 5.3.4) (DEH, 2004b). Any fire operations must be in accordance with the *Fire Policy and Procedure for the Protection of Cultural Heritage* (DEH, 2009m).

Aboriginal Heritage

The land comprising the Onkaparinga Valley forms part of the 'country' of the Peramangk and Kaurna people as described by Tindale (1974). Peramangk country extends from Sandy Creek in the north and follows the western ridge line of the Mount Lofty Ranges south to Myponga and Currency Creek. Kaurna country incorporates the Adelaide plains and coastline extending as far as Crystal Brook in the north and to Cape Jervis in the south. The boundary between Peramangk and Kaurna country has been described as the high ridges and Stringybark forests of the Mount Lofty Ranges (Ellis, 1976). Areas of cultural significance within the planning area include the Onkaparinga River and estuary, which is featured in Kaurna Dreaming. As described in the *Onkaparinga River Reserve Management Plan* (DEH, 2004a), the mouth of the Onkaparinga River is a mythological site and the area is highly significant to Kaurna Women.

Aboriginal heritage sites have been recorded throughout the Onkaparinga Valley. Four reserves are known to contain recorded sites:

- Burial sites and campsites at Onkaparinga River RP.
- Rock and stone artefacts at Mark Oliphant CP scattered across the sandy flats and the lower, flatter margins of hill slopes along gullies and stream channels.
- Burial sites, hearths, shell middens and other artefacts at Moana Sands CP and a campsite within the Pedlar Creek reedbeds.
- Campsites and a workshop site at the southern end of Aldinga Scrub CP and stone artefacts.

It is recognised that many other sites and objects may occur throughout the planning area that have not been recorded. When implementing this plan, DENR will comply with the *Aboriginal Heritage Handbook and Strategy* (DEH, 2006b), to facilitate the protection of sites during bushfire suppression and prescribed burns, including procedures for the protection of newly discovered sites.

European Heritage

European settlers arrived in South Australia in 1836 and evidence of this early occupation still exists today within some of the reserves included in this fire management plan. Two sites have been listed on the State Heritage Register and one site on a local heritage register:

- Pingle Farm Ruins at Onkaparinga River RP (listed on the state heritage register)
- Mackereth Cottage within Scott Creek CP on Matthews Road, Dorset Vale (listed on the state heritage register)
- Almanda Silver Mine ruins within Scott Creek CP on Dorset Vale Road (listed on a local heritage register)
- Remnants of an engine house, a stone chimney ('twisted chimney'), a mine office, dairy, several mining shafts and Eys Tunnel at Scott Creek CP
- Railway dam at Totness RP
- Mine diggings at Porter Scrub CP.

Management Strategies

Cultural Heritage

10. Implement fuel management strategies appropriate for the protection of cultural assets as shown on Map 4.
11. 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.
12. Ensure suppression strategies take into account significant cultural assets in order to minimise impacts from these activities and undertake post-fire rehabilitation.

3.7.4 Natural Values

Flora, Fauna and Ecological Communities

The Biological Database of South Australia (BDBSA) 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. Records of significant flora and fauna were extracted from BDBSA, and additional information was also provided by experts, for the purposes of this plan.

Fire response information, where known, is included for species and communities of conservation significance in Appendix 2, Appendix 3 and Appendix 4.

In this plan 'of conservation significance' is used to describe species that are:

- nationally listed as Threatened (with a rating of Extinct, Critically Endangered, Endangered or Vulnerable) under the federal EPBC Act

- listed as Threatened in South Australia (with a rating of Endangered, Vulnerable or Rare) under the NPW Act, Revised Schedules 7, 8 and 9)
- provisionally listed as Threatened (with a rating of Endangered or Vulnerable) in South Australia, that is, included on the unpublished DENR Provisional List of Threatened Ecosystems of South Australia (DEH, 2005a).
- regionally threatened (with a rating of Endangered, Vulnerable or Rare) in the Adelaide and Mount Lofty Ranges as determined by the Regional Recovery Plan (Willson and Bignall, 2009).

There are a number of flora species, fauna species and ecological communities considered to be of conservation significance within the planning area. Appendix 2 and Appendix 3 contains a list of flora and fauna of conservation significance as well as species that are considered important in terms of fire management. Note that this is not intended to be an exhaustive list of rated species within the plan area as it does not include species that are regionally threatened and it excludes rated species that are considered to be functionally extinct or unlikely to be affected by fire management activities. Appendix 2 and 3 attempt to summarise the current level of fire response knowledge for these species. Appendix 4 summarises information on threatened ecological communities.

In addition to the information provided within the appendices, species response and ecological information for selected significant flora, fauna and ecological communities have been detailed in the following section. These are species listed as threatened at a National or State level for which appropriate fire management is regarded as being critically important for their long term conservation. These species include the **Southern Brown Bandicoot** (*Isoodon obesulus obesulus*), **MLR Chestnut-rumped Heathwren** (*Hylacola pyrrhopygia parkeri*), **Aldinga Dampiera** (*Dampiera lanceolata* var. *intermedia*), **Swamp Mazus** (*Mazus pumilio*), **White-flower Matted Pratia** (*Pratia puberula*), **Tall Daisy** (*Brachyscome diversifolia*), **Mount Lofty Speedwell** (*Derwentia derwentiana* ssp. *homalodonta*), twelve **threatened orchid species** and two provisionally listed **threatened ecological communities**.

DENR is committed to increasing its capacity to incorporate species' requirements into improved ecological fire management. The actions in this plan relate specifically to fire management actions within reserves; nevertheless DENR will work with the community on landscape scale biodiversity 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 (Haby and Long, 2005). A National Recovery Plan is currently under development for the species. Specific information on how the Southern Brown Bandicoot responds to fire is included in Appendix 3. An Ecological Fire Management Strategy for the Southern Brown Bandicoot in the Mount Lofty Ranges is in preparation. This document should be referred to as the primary source of information for this species when implementing the below 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, 2006c).

The Southern Brown Bandicoot is known to occur in Scott Creek CP, Mark Oliphant CP, Mount George CP, Kenneth Stirling CP Group and Mylor CP. Bandicoots have either been recorded in these reserves by DENR or suitable habitat has been identified. Map 2 shows Southern Brown Bandicoot records for the planning area.

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 (Haby and Long, 2005). Providing a mosaic of successional stages is considered desirable. Furthermore, current knowledge suggests that fire regimes that simplify habitat structure (in the medium and long term) are 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

13. Implement pre-fire management actions that will minimise the risk of local extinctions in the event of a bushfire. .
14. Conduct prescribed burning to improve habitat suitability where necessary.
15. During extensive bushfires, attempt to retain unburnt patches as refuge areas to minimise the risk of local extinctions.
16. Finalise and implement the Bandicoot Ecological Fire Management Strategy.
17. Monitor the effects of fire on the Southern Brown Bandicoot populations and preferred habitat and use this information to inform the DENR flora and fauna vital attributes database for use in Ecological Fire Management Guidelines (Appendix 2).

Chestnut-rumped Heathwren

The MLR Chestnut-rumped Heathwren is endemic to the Mount Lofty Ranges in South Australia (TSSC, 2005), and is listed as Endangered at the National level and Endangered at the State level. Within the planning area, there are records of occurrence within Mark Oliphant CP, Scott Creek CP, Kenneth Stirling CP Group and Montacute CP. A Threatened Species Action Statement (Long and Bentley, 2010) has been developed to provide a detailed overview of the MLR subspecies. Refer to Map 2 for records of MLR Chestnut-rumped Heathwren occurrence in the planning area. Specific information on how the MLR Chestnut-rumped Heathwren responds to fire is listed in Appendix 3.

In the MLR the subspecies inhabits dense heathlands and sclerophyllous *Eucalyptus* woodlands with a dense heathy understorey (MVS No. 4 and 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 MLR 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 MLR Chestnut-rumped Heathwren appears to occur at low densities and therefore reductions in the availability of suitable habitat may affect population viability.

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.

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 (Pickett, 2008). The effects of fire on the MLR Chestnut-rumped Heathwren will be monitored to improve knowledge of the species response to fire.

Management Strategies	
MLR Chestnut-rumped Heathwren	18. Implement pre-fire management actions that will minimise the risk of local extinctions in the event of a bushfire.
	19. If necessary, conduct prescribed burning to improve habitat suitability.
	20. During extensive bushfires, attempt to retain unburnt patches as refuge areas to minimise the risk of local extinctions.
	21. Develop and implement an Ecological Fire Management Strategy for the MLR Chestnut-rumped Heathwren.
	22. Monitor the effect of fire on MLR Chestnut-rumped Heathwren populations and preferred habitat and use this information to update the DENR flora and fauna vital attributes database for use in future Ecological Fire Management Guidelines (Appendix 2).

Aldinga Dampiera

The Aldinga Dampiera is only found in Aldinga Scrub CP and on adjacent private property. It is listed as Endangered in South Australia under the NPW Act. The species is thought to be fire responsive and a lack of fire may be a threat to the remaining population (Willson and Bignall, 2009). Monitoring of the species' fire response has commenced and is ongoing. Weed competition is a threat to the Aldinga Dampiera population and, if uncontrolled, weeds are likely to proliferate post-fire exacerbating this threat.

Management Strategies	
Aldinga Dampiera	23. Continue to monitor the effect of fire on Aldinga Dampiera populations and preferred habitat and use this information to update the DENR vital attributes database for use in future Ecological Fire Management Guidelines (Appendix 2).
	24. Based on monitoring results, implement an ecological burning program, if required, to increase the health and abundance of the Aldinga Dampiera population.
	25. Undertake targeted post-fire weed control following prescribed burns and bushfires in the vicinity of the Aldinga Dampiera population and monitor the effectiveness of this control.

Scott Creek CP Threatened Flora

Scott Creek CP contains a large number of threatened flora species. Four species, the Swamp Mazus (State Listing: Vulnerable), White-flower Matted Pratia (State listing: Vulnerable), Tall Daisy (State listing: Endangered) and the Bayonet Spider-orchid (*Caladenia gladiolata*) (discussed in detail below) occur nowhere else in the Mount Lofty Ranges. A fifth species, the Mount Lofty Speedwell (National listing: Critically Endangered; State listing: Endangered), has a highly restricted distribution in the Mount Lofty Ranges. Known records for each of these species are shown on Map 2.

The fire responses of these species are not known but, given their highly restricted distributions, care should be taken to minimise risks to these populations. In most cases this will mean excluding these populations from prescribed burning and minimising the risk of them burning during bushfires. Where opportunities exist to examine the fire response of a small section of a population, monitoring should be conducted.

The Swamp Mazus and White-flower Matted Pratia occur in swampy areas and the Mount Lofty Speedwell occurs in moist gullies and near streams. These habitats are typically at low risk of burning; however, the risk will increase during drought years, extended dry periods, and extreme fire weather. Population increase of the Mount Lofty Speedwell on Kangaroo Island may have been due to post-fire recruitment (DEH, 2005b), but this response hasn't been observed with other populations (K. Brewer pers. comm.).

The Tall Daisy occurs in Eucalypt Woodlands with grassy or shrubby understoreys. This species is known to be sensitive to off-target herbicide spray-drift and grazing (Willson and Bignall, 2009). The potential impacts of post-fire grazing and non-specialised weed control must be considered following bushfires or if prescribed burns are conducted in the vicinity of this species.

Management Strategies

Scott Creek Threatened Flora

26. Exclude populations of the Swamp Mazus, White-flower Matted Pratia, Tall Daisy and Mount Lofty Speedwell from prescribed burning in C-zones unless experimental burning of small sections of these populations is recommended by the Biodiversity Conservation Unit, Adelaide Region. Monitoring results should be used to update the DENR vital attributes database for use in future Ecological Fire Management Guidelines (Appendix 2).

27. Undertake strategic fuel reduction activities as required to minimise the risk of populations of these species burning in a single fire event.

28. Undertake pre-fire population monitoring so that in the event of a bushfire, the post-fire response of these species can be documented.

29. Ensure that the risk of weed proliferation, off-target damage due to weed control and overabundant species are considered and planned for following a fire within or adjacent to threatened plant populations.

Threatened Orchids

The Pink-lipped Spider-orchid (*Caladenia behrii*), White Spider-orchid (*Caladenia rigida*) and Bayonet Spider-orchid are listed as Endangered at the national level under the EPBC Act and Endangered in South Australia under the NPW Act. A draft recovery plan covering these species has been developed (Quarmby, 2009). A national recovery plan was also prepared in 1999 for the Pink-lipped Spider-orchid (Bickerton, 1999).

There are also a number of other threatened orchids in the plan area, including the Pale Leek-orchid (*Prasophyllum pallidum*) (listed as vulnerable under the EPBC Act) and the Copper Beard-orchid (*Calochilus cupreus*), Little Stony Rufous-hood (*Pterostylis* sp. Sand plain), Contorted Leek-orchid (*Prasophyllum goldsackii* var. *aenigmum*), Fitzgerald's Leek-orchid (*Prasophyllum fitzgeraldii*), Dune Helmet-orchid (*Corybas expansus*), Short-leaf Donkey-orchid (*Diuris brevifolia*), Large Duck-orchid (*Caleana major*) and Behr's Cowslip Orchid (*Diuris behrii*), all listed as Endangered or Vulnerable under the NPW Act. Specific information on how threatened orchids respond to fire is included in Appendix 2.

The Pink-lipped Spider-orchid, White Spider-orchid, Bayonet Spider-orchid, Pale Leek-orchid, Little Stony Rufous-hood, Fitzgerald's Leek-orchid, Short-leaf Donkey-orchid and Behr's Cowslip Orchid all occur within Scott Creek CP. For the Bayonet Spider-orchid, this is the only population known in the Mount Lofty Ranges. The Copper Beard-orchid and Dune Helmet-orchid occur within Aldinga Scrub CP. Onkaparinga River NP contains populations of the Pale Leek-orchid, Contorted Leek-orchid and Fitzgerald's Leek-orchid. Behr's Cowslip Orchid also occurs in Charleston CP and the Large Duck-orchid is found in Mark Oliphant CP. All of these orchids occupy *Eucalyptus* forests and woodlands with a grassy or shrubby understorey (MVS 8 and MVS 9). Map 2 shows threatened orchid records for the planning area.

All of above-mentioned orchids lie dormant during summer months and resprout from underground tuberoids during April and May. Flowering and seed set occurs between July and December (refer to Appendix 2). These orchids are pollinated by insects (thynnid

wasps and fungus gnats) and produce thousands of minute seeds. Seedling recruitment and growth is dependent on the establishment of mycorrhizal fungi associations.

The impact of fire on each of these threatened orchids is poorly understood (Quarmby, 2009). The White Spider-orchid has been recorded flowering profusely in the years following fire but conversely the Pink-lipped Spider-orchid and Bayonet Spider-orchid are not known to increase post-fire and decreases have been recorded (Quarmby, 2009). The response of the Copper Beard-orchid is unknown. All of the orchids are considered to be at risk of fire during the growing season between May and November (Quarmby, 2009). Furthermore, orchid populations that occur near fire access tracks are considered to be at risk of damage from track management and fire suppression activities (i.e. track grading, widening, slashing, herbicide use and heavy vehicle use) (Quarmby, 2009).

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

Management Strategies		
Threatened Orchids	30.	Minimise the likelihood of vehicles or equipment impacting on threatened orchid populations during track management and fire suppression operations.
	31.	Avoid prescribed burning or slashing within threatened orchid populations between May and November.
	32.	Avoid prescribed burning or slashing within threatened orchid populations more frequently than every 5 years.
	33.	Minimise the likelihood of large areas of threatened orchid habitat burning in a single fire event.
	34.	Liaise with the South Lofty Block Orchid Recovery Team when planning prescribed burns within known habitat of threatened orchids.
	35.	Undertake ecological/experimental burns on threatened orchid populations to examine the response of these species to different disturbance regimes.

Grey Box Woodland

Status

Grey Box (*Eucalyptus microcarpa*) Woodland is a significantly depleted community of conservation significance listed as Endangered under the commonwealth EPBC Act. The status of the community was initially identified by Neagle (1996) and rated *Conservation Priority 4;* that is, much depleted, poorly conserved within SA, with only a few large examples remaining across the state. It was also recommended by Neagle (1996) that any good representations of the community be protected under Heritage Agreements or acquired by the then SA National Parks and Wildlife Service "as a matter of urgency".

Grey Box Grassy Low Woodland is recorded as Endangered on the DENR unpublished provisional list of threatened South Australian ecosystems developed in 2005 (DEH, 2005a) and the status of the community is considered to be declining (DEH, 2005a). The community has been nominated for national listing under the EPBC Act.

Components

The overstorey of this community is dominated by Grey Box trees. Other overstorey species include SA Blue Gum (*E. leucoxylon*), River Red Gum (*E. camaldulensis*) and Drooping Sheoak (*Allocasuarina verticillata*). Understorey species typically represented within the community include Golden Wattle (*Acacia pycnantha*), Twiggy Daisy-bush (*Olearia ramulosa*), Mount Lofty Grass-tree (*Xanthorrhoea quadrangulata*), Yacca (*X. semiplana*), Kangaroo Thorn (*Acacia paradoxa*), Narrow-leaf Hop-bush (*Dodonaea viscosa* ssp. *angustissima*), Rock Fern (*Cheilanthes austrotenuifolia*) and Soft Tussock Mat-rush (*Lomandra densiflora*).

Introduced species including Boneseed (*Chrysanthemoides monilifera*), African Daisy (*Senecio pterophorus*), European Olive (*Olea europaea* ssp. *europaea*), Soursob (*Oxalis pes-caprae*), Broad-leaf Cotton-bush (*Asclepias rotundifolia*), Fennel (*Foeniculum vulgare*) and other exotic shrubs, grasses and herbs are commonly associated with Grey Box woodland within the plan area.

Location

Grey Box Woodland originally had a wide distribution throughout the foothills, slopes and plains of the Mount Lofty Ranges, however, recent surveys indicate that only an estimated 1 250 ha remains within the region (Quarmby, 2003). The community occurs predominantly in heavy clay soils across the south-western slopes of the Mount Lofty Ranges from Mount Osmond to McLaren Vale (Armstrong*, et al.*, 2003). Within the plan area remnant patches of Grey Box Woodland exist in Onkaparinga River NP. Other remnants outside the plan area occur in Shepherds Hill RP, Sturt Gorge RP and adjacent to Scott Creek CP in SA Water land. The largest remnant on DENR land (163 ha) is found in Belair NP (Quarmby, 2003; Turner, 2001).

Risk

The decline of this woodland community is thought to have occurred as a direct result of land clearing, invasion of exotic species and urbanisation (DEH, 2005a). Evidence of historic timber cutting is apparent from the coppice regrowth of Grey Box trees within Sturt Gorge RP (Quarmby, 2003). The remnant stands of this community are severely degraded due to weed infestation, particularly by European Olive, Boneseed and herbaceous weeds and annual grasses (Armstrong*, et al.*, 2003). Many of these weeds are responsive to fire and the risk posed by post-fire weed invasion is likely to be a greater issue than fire itself. Also, the increased fuels created by weedy shrub layers are likely to increase the intensity of bushfires in Grey Box Woodlands and this may kill large adult trees that would otherwise survive under bushfire conditions. The timing of prescribed burns should be considered to minimise any effects on understorey species such as orchids that have fire-sensitive life stages. Onkaparinga River NP protects the only remnants of Grey Box woodland in the plan area (DEH, 2005a; Quarmby, 2003) and the risk of this reserve burning in its entirety during a single fire event has been assessed as *Low* due to terrain, shape of the reserve and landscape features. The loss or degradation of this community due to inappropriate fire regime is considered *Moderate* to *High*.

Management Strategies	
Grey Box Woodland	36. Refer to the fire management guidelines for Grey Box in Appendix 4 when implementing prescribed burns and aim to manage within these guidelines.
	37. Minimise the risk of large contiguous remnants of Grey Box woodland burning in their entirety during a single fire event.
	38. Implement ecological/experimental burns as part of an integrated weed management strategy in order to reduce the abundance of environmental weeds posing a threat to the integrity of Grey Box woodland.
	39. Ensure the planning of prescribed burning takes into consideration the responses of understorey species with fire-sensitive life stages.
	40. Monitor the response of the community to different fuel management regimes through the application of ecological/experimental burns and/or mechanical fuel reduction.

Silver Banksia Woodland

Status

Silver Banksia (*Banksia marginata*) Grassy Low Woodland is listed as Endangered on the DENR unpublished provisional list of threatened South Australian ecosystems (DEH, 2005a) and the status of the community is considered to be rapidly declining (DEH, 2005a). The community is also recognised as being one of four *Very High Priority* communities in the Adelaide Region (Willson and Bignall, 2009).

Location

Silver Banksia Grassy Low Woodland occurs on sandy loam plains in higher rainfall areas and is poorly represented in reserves (DEH, 2005a). Within the Onkaparinga Valley Fire Management Plan area it is only known to occur in Charleston CP, although small remnants may exist in other parks.

Risks

The community has been highly modified by clearance and grazing (DEH, 2005a) . Low recruitment appears to be threatening Banksia populations, possibly due to lack of viable seed production. The most significant threat to Silver Banksia Grassy Low Woodland is post-fire weed invasion, rather than fire itself.

Fire stimulates the germination of Banksia seed and, at the right time (late spring and probably through to early autumn), fire may also benefit native grasses and may assist in the control of introduced annual grasses. Fire is therefore an important process that should be maintained within this community. However, while adult Banksias generally regenerate after a fire by re-sprouting or suckering, some adult plants may be killed by fire (particularly high intensity fire). In general, there needs to be a fire-free period of at least 8 years to allow plants to replenish the seed stored in the canopy, while at least a 10 to 20 year fire-free period is required to allow a substantial soil seed bank to accumulate.

Management Strategies	
Silver Banksia Woodland	41. Use fire to achieve restoration goals and monitor the effect of fire on Silver Banksia Grassy Low Woodland, particularly on Banksia regeneration and germination.
	42. Minimise the risk of remnants of Silver Banksia Grassy Low Woodland burning in their entirety during a single fire event.

3.8 Pest Species

3.8.1 Fauna

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

Within the planning area, a number of pest fauna have been observed. These include the Fox (*Vulpes vulpes*), Cat (*Felis catus*), Brown Hare (*Lepus capensis*), House Mouse (*Mus musculus*), Fallow Deer (*Dama dama*), Goats (*Capra hircus*), Black Rat (*Rattus rattus*) and European Rabbit (*Oryctolagus cuniculus*).

Prior to any prescribed burn potential pest-fauna impacts are considered to determine whether post-fire management is required. Management of pest fauna is implemented based on a risk assessment. Prescribed burning provides opportunities for research and monitoring into how pest fauna respond to and impact on native species post-fire Section 5.3.4 provides more information on burn preparation.

3.8.2 Flora

Weeds can have significant impacts on ecological communities within remnants (Saunders, *et al.*, 1991). Disturbance (e.g. grazing, nutrient inputs, erosion, fragmentation) is likely to promote weed invasion, and fire in areas already affected by one or more of these disturbance mechanisms is likely to lead to weed proliferation (Hobbs, 1991; Hobbs, 2002; Hobbs and Huenneke, 1992). However, it is also well known that fire is an important source of disturbance in natural systems (Hobbs and 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, Bridal Creeper (*Asparagus asparagoides*), Blackberry (*Rubus* spp.), European Olive, Gorse (*Ulex europaeus*), False Caper (*Euphorbia terracina*), Horehound (*Marrubium vulgare*), One-leaf Cape Tulip (*Moraea flaccida*), Perennial Veldt Grass (*Ehrharta calycina*), Salvation

Jane (*Echium plantagineum*), African Daisy, Aleppo Pine (*Pinus halepensis*), Bulbil Watsonia (*Watsonia bulbillifera*), Radiata Pine (*Pinus radiata*), English Broom (*Cytisus scoparius*), Montpellier Broom (*Genista monspessulana*), Tree Heath (*Erica arborea*), Sallow Wattle (*Acacia longifolia* var. *longifolia*), Monadenia (*Disa bracteata*), Phalaris (*Phalaris* spp.) and Texas Needle Grass (*Nassella leucotricha*). Fire management guidelines for these species and other weeds of concern are included in Appendix 2.

Significant weeds within prescribed burn areas will be listed in the prescribed burn plan and mitigation actions identified (DEH, 2004b; 2009k). Post-fire weed control will be conducted where necessary, however, investment in weed control will be based on the reserves' overall habitat quality, the relative fire responses of weeds at the site and also weed management priorities within the region.

Volunteers, community groups and DENR pest plant programs have completed significant weed management work within the reserves. 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 significant risk of Phytophthora being introduced into new areas and of existing infestations spreading in the Mount Lofty Ranges. The presence of Phytophthora has been confirmed by soil testing within Filsell Hill (Kenneth Stirling CP Group), Scott Creek CP and Mark Oliphant CP and is also suspected to occur in Mount George CP, Wotton Scrub (Kenneth Stirling CP Group), Totness RP, Charleston CP, Onkaparinga River NP and Aldinga Scrub CP.

DENR has a Standard Operating Procedure that addresses Phytophthora threat management (DEH, 2002a). This outlines hygiene procedures and guidelines to protect the integrity of natural areas by minimising the risk of Phytophthora infestation and spread in DENR reserves.

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

43. Refer to Ecological Fire Management Guidelines (Table 5) and fire management guidelines for introduced flora species (Appendix 2) during prescribed burn planning.

44. Consider the use of fire as tool that forms part of integrated pest management strategies.

45. Consider the likely post-fire responses and impacts of weed species and implement post-fire weed control and monitoring accordingly (subject to regional priorities).

46. Collect relevant information during prescribed burn planning on introduced fauna and undertake a risk assessment to determine the need for post-fire management.

47. Adhere to the *Standard Operating Procedure – Phytophthora Threat Management (SOP-002)* (DEH, 2002a) and conduct a risk assessment to determine whether fire management activities will exacerbate the spread of Phytophthora.

48. Ensure hygiene practices are implemented to reduce the spread of weeds and Phytophthora across the planning area. Refer to the *DENR Operating Procedure – Phytophthora Vehicle Disinfection Unit* (DEH, 2003).

49. Undertake monitoring to determine the interaction between Phytophthora and fire.

4 RISK

4.1 Risk Assessment

A risk assessment was conducted in line with the *Policy and Procedure for Risk Assessment in DENR Fire Planning* (DEH, 2009d), as a requirement for the compilation of this Fire Management Plan. The risk assessment is a tool used to gauge the risks arising from bushfire to life, property and environmental values in the planning area. 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 or Extreme.

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

4.2 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 3). Canopy Fuel is not measured as part of overall fuel hazard.

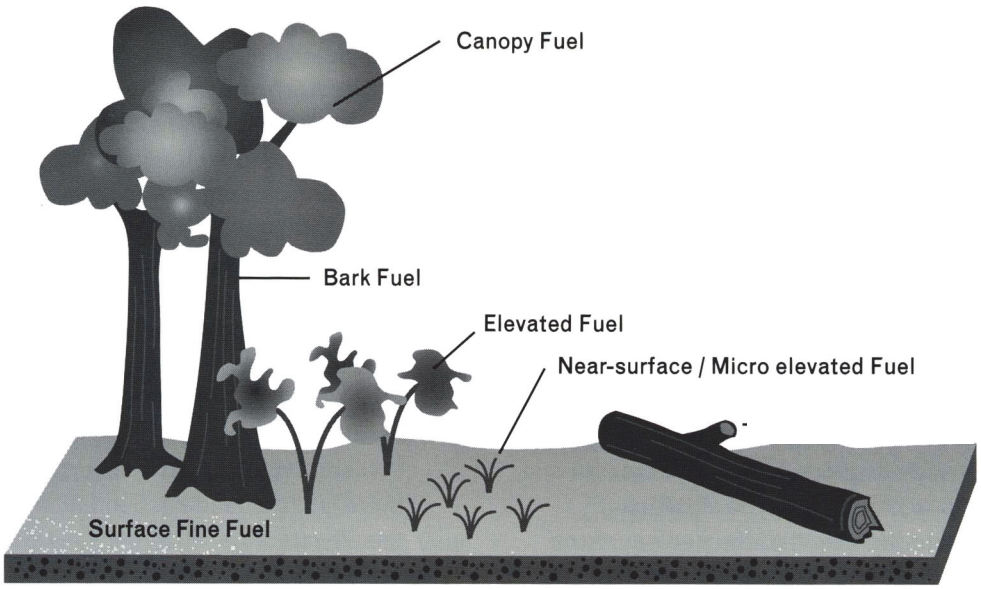

FIGURE 3 – COMPONENTS OF FUEL IN VEGETATION

(Tolhurst and 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 (DEH, 2006e). Each layer, as well as the overall fuel hazard can be assessed as: Low, Moderate, High, Very High or Extreme (DEH, 2006e).

Extreme bark hazard is likely in areas supporting Brown Stringybark (*Eucalyptus baxteri*) and/or Messmate Stringybark (*E. 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. Within the planning area, areas dominated by Stringybark occur from Montacute CP in the north, extending south to Scott Creek CP.

Vegetation in the Onkaparinga Gorge is dominated by smooth barked Eucalypt species such as River Red Gum, Pink Gum (*E. fasciculosa*), SA Blue Gum and Manna Gum (*E. viminalis*) supporting a Moderate to High overall fuel hazard (depending on the quality of the understorey) with some Grey Box in the eastern area. Within these areas, spotting would be less than what would occur in Stringybark areas due to the reduced bark hazard.

Within areas of dry schlerophyll woodland and heath at Aldinga Scrub CP, Perennial Veldt Grass contributes significantly to the overall fuel hazard, which is generally High to Very High across the reserve. The fuel hazard may also exacerbated by an absence of fire.

Important samphire flats occur within the floodplain and estuary area of Onkaparinga River RP, supporting communities of samphire, chenopods, saltbush and sedges. Fuels within these samphire flat and estuary areas are generally Moderate to Low.

Research completed by McCarthy and Tolhurst (2004) investigated the effectiveness of fuel reduction burning in Victoria. It was concluded that maintaining overall fuel hazard levels at High or less aids in slowing the rate of spread of a subsequent bushfire. It was determined that to achieve long-term fuel reduction effects the focus should be on the reduction of bark and elevated fuels as these fuel layers are likely to contribute 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 (DEH, 2006e). DENR maintains a database containing fuel hazard assessment records. The process for recording and submitting fuel hazard data is explained in the *Fire Policy and Procedure for Fuel Hazard Assessment* (DEH, 2009e).

4.2.2 Likely Maximum Overall Fuel Hazard

Maximum overall fuel hazard levels have been estimated for Major Vegetation Sub-groups (MVS) within the planning area in order to provide a guide for fire management (Table 3). 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.

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

MVS No.	MVS Name	Likely Maximum Overall Fuel Hazard	Significant Fuel Layers
4	Eucalyptus forests with a shrubby understorey	Extreme	Surface Elevated Bark[1]
8	Eucalyptus woodlands with a shrubby understorey	Extreme	Surface Elevated Bark[1]
9	Eucalyptus woodlands with a grassy understorey	Very High	Surface Near-surface
26	Casuarina and Allocasuarina forests and woodlands	High	
32	Other shrublands	High	
38	Wet tussock grassland, herbland, sedgeland or rushland	High	
39	Mixed chenopod, samphire or forblands	Moderate	

[1] if Stringybark present

4.2.3 Potential for Fire Impact

The Sixth Creek catchment area, Heathfield and surrounds, Mount Bold, Onkaparinga Hills and Aldinga Beach are considered to be at a higher risk of fire impacting on conservation and community values within the planning area.

The western slopes and southern end of the Sixth Creek catchment area falls in the north-west corner of the planning area. This area is unique as it is part of a large corridor of vegetation, starting at Millbrook Reservoir in the north through the township of Stirling in the south, incorporating Montacute CP, Kenneth Stirling CP Group and Mount George CP. Small settlements of Cherryville, Montacute, Basket Range and Carey Gully are at significant risk if a fire were to occur as there is little opportunity for fire suppression due to high fuels, accessibility issues and steep topography of the area.

It has been recognised that a bushfire within Mark Oliphant CP would pose a risk to the residents of Heathfield, Longwood, Ironbank and Cherry Gardens due to the steep terrain, high overall fuel hazard and vegetation supporting the movement of fire out of the reserve and into private property. Properties along Walker Avenue at Heathfield and Nioka Drive at Ironbank were identified as particularly vulnerable to bushfire impact and risk is further amplified by accessibility issues and lack of defendable space.

Scott Creek CP was also identified as an area with high bushfire potential. The reserve is part of a larger remnant including Mount Bold Reservoir and Kuitpo Forest, extending north to Mylor CP. A fire in this area has the potential to not only impact on water catchments and softwood plantations, but fire could build and threaten the surrounding hills settlements of Bradbury, Mylor, Echunga and Kangarilla.

Onkaparinga River NP, particularly Hardy's Scrub is an area with a high potential for bushfire to occur and this is supported by the fire history of the area. In the past the reserve has been a target of arsonists, with fires occurring regularly during the summer months. Of particular concern is the risk to residents of Blewitt Springs to the south of Hardy's Scrub and also to residents of Clarendon to the south-east of the reserve.

Residents of Aldinga Beach, particularly those properties positioned between the beach and Aldinga Scrub CP are considered to be at risk of bushfire impact. Some properties lack defendable space and many are not constructed to the Australian Standard AS3959. Holiday makers may also be threatened by a fire in the reserve and visitors may not fully realise the potential for bushfire to occur. A future risk is the new residential development to the north of the reserve.

4.2.4 Influence of a Changing Climate

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

Management Strategies

Changing Climate

50. Monitor species and ecosystems and the processes that support them to understand their resilience to a changing climate.

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

52. Monitor national and international fire management policy and best practice and partner with the research sector to increase our knowledge of altered fire regimes.

5 READINESS

5.1 Equipment

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

DENR issues personal protective equipment (PPE) to all firefighting staff, designed to protect their safety and welfare and to improve fire suppression effectiveness. DENR ensures that PPE issued to firefighters meets recognised Australian Standards (where they exist), CFS requirements and Schedules as set out in the *Policy and Procedure for Personal Firefighting Equipment* (DEH, 2009x). PPE shall also be consistent with the *DENR Occupational Health, Safety and Welfare Policy* (DEH, 2006f).

DENR firefighting resources include a variety of firefighting vehicles and equipment, which may be deployed to fires anywhere in South Australia or interstate. DENR ensures that all firefighting equipment meets Australian Standards (where they exist) and complies with CFS standards, unless specified otherwise in DENR environmental policies and standards (including the *Policy and Procedure for Fire Appliance Equipment Standards* (DEH, 2009y) and the *Policy and Procedure for Earthmoving Equipment* (DEH, 2009z)).

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 DENR policies and standards.

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. DENR staff involved, directly or indirectly, in the management of fire incidents are required to complete the Basic Firefighting Level 1 CFS course at a minimum.

All DENR personnel engaged in fire management operations are trained in accordance with the *Policy and Procedure for Fire Training* (DEH, 2009l) and CFS standards. 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 (see the *Fire Personnel Health and Fitness (Fighting Fit Program) Policy and Procedure* (DEH, 2009w) for details).

DENR is committed to maintaining a safe working environment during fire operations in compliance with the *Occupational Safety, Health and Welfare Act 1986,* consistent with the *DENR Occupational Health, Safety and Welfare Policy* (DEH, 2006f) and the *Fire Policy and Procedure for Safety, Health and Welfare* (DEH, 2009h).

5.3 Risk Mitigation Strategies

5.3.1 Fire Access Tracks

DENR is committed to managing a strategic network of fire access tracks on DENR managed land, in accordance with the GAFLC standard (GAFLC, 2008) and the *Fire Policy and Procedure for Fire Access Tracks* (DEH, 2009i). Tracks occurring within the planning area, as well as external tracks/public roads considered important for fire suppression, have been classified as 'Major', 'Standard' or 'Minor' Tracks 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. Map 4 shows fire access tracks according to their GAFLC classification. Slashed areas (unmapped) may be used for access during an incident subject to consultation with relevant DENR District staff.

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. Mount Bold Road, Piggot Range Road, Chapel Hill Road, South Eastern Freeway, Stone Hut Road (Fire Track 1), Frith Road and Evans Drive). Within the planning area, fire suppression is generally best attempted from surrounding lower fuel areas and/or the adjoining public road network (such as at Aldinga Scrub CP, Kenneth Stirling CP Group, Mt George CP, Charleston CP, Totness CP).

Fire access points and tracks have been reviewed as part of this plan and proposed changes are summarised within Appendix 1, other tracks will be maintained to their current GAFLC standard shown on Map 4 (Fire Management and Access). Works will be implemented on a priority needs basis, subject to resources, fuel hazard and risk.

Design and location of new fire access tracks will take into consideration gentle slopes and low fuel hazard areas to provide for the safety of firefighters during suppression. Reserves that have been identified as requiring track establishment works are Montacute CP, Mount George CP, Aldinga Scrub CP, Onkaparinga River RP, Porter Scrub CP and Kenneth Stirling CP Group (Burdett Scrub) (Appendix 1).

Management Strategies	
Fire Access Tracks	53. Implement changes to fire access as described in Appendix 1.
	54. Maintain tracks to the GAFLC standards as shown on Map 4.
	55. Install signs on fire access tracks and gates according to GAFLC standards and name tracks as appropriate.

5.3.2 Fire Infrastructure

The following fire infrastructure is maintained for fire suppression activities within the Onkaparinga Valley planning area.

- Mount Lofty Fire Tower (operated and maintained by CFS).
- Numerous CFS approved airstrips across the planning area, including Woodside Airstrip, Cherry Gardens Airstrip (located on Thorley Road, adjacent to Scott Creek CP) and Aldinga Airstrip (located on Plains Road/Collville Road) (Map 4).
- Fire protection systems on assets, such as the DENR owned housing at Scott Creek CP.
- Fire hydrants within Onkaparinga River NP, Mount George CP, Mark Oliphant CP and Montacute CP (Map 4).
- Standpipes and static water supplies (tanks, dams, etc.) across the planning area (Map 4).

Map 4, the Response Plan for the Adelaide Region (DEH, 2009j) as well as the Adelaide Region annual works schedule will provide more information on fire infrastructure.

5.3.3 Fire Management Zones

Fire management zones as detailed in the *Policy and Procedure for Fire Management Zoning in DENR Fire Planning* (DEH, 2009c) have been introduced into DENR fire management planning to:

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

Fire management zones are categorised according to the primary objective for fire management – Asset Zone (A-zone), Buffer Zone (B-zone) or Conservation Zone (C-zone). These zones were determined, giving consideration to overall fuel hazard levels in different habitat 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, some native species may benefit from disturbance (e.g. orchids are often found on slashed fuel breaks). Efforts are made to locate A- and B-zones in areas where they do not conflict with biodiversity values, where it does not compromise the effectiveness of the zone. The zones allocated to the reserves within the planning area are described in Appendix 1 and shown on Map 4.

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

A-zone Objectives

- To provide a low fuel area of at least 40 m 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 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 the included lands.
- To provide a suppression advantage to assist in containing bushfires within defined areas, that is to minimise the likelihood of fires entering the reserve from the wider landscape or exiting the reserve.
- To reduce the likelihood that significant areas of contiguous vegetation burns in a single fire event.
- To enhance safe access for firefighters.

C-zone Objectives

- To manage fire to meet the reserve management objectives as specified within the Reserve Management Plans listed in Section 2.3.1 of this document.
- To assist in the conservation of species and populations such as the rated species listed in Appendix 2 and Appendix 3, as well as threatened ecological communities listed in Appendix 4, through the application of appropriate fire regimes.
- To reduce the likelihood of contiguous vegetation burning in a single fire event.
- To promote heterogeneity within the environment through the creation of variability in the fire regime.
- To use fire as part of an integrated weed management program to improve bushland quality.
- To manage fire to minimise the impact to tree hollows.

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 reserves where an adjacent asset is less than 40 m from the reserve boundary and not separated by a road.
- B-zones have been placed along strategic tracks to provide a suppression opportunity, such as along Chapel Hill Road in Onkaparinga River NP, Evans Drive and Scott Creek Road in Mark Oliphant CP and along Mount Bold Road in Scott Creek CP.
- B-zones have been positioned to reduce the chance of fire threatening residential assets, specifically within Mark Oliphant CP to provide protection to residents of Heathfield and Ironbank, Mylor CP to provide protection to residents of Mylor, Mount George CP to provide protection to residents of Stirling and within Aldinga Scrub CP to provide protection to residents of Aldinga Beach.
- B-zones have also been located to reduce the chance of a reserve burning in its entirety, such as within Onkaparinga River NP, Aldinga Scrub CP, Mark Oliphant CP and Scott Creek CP.
- C-zone burning has been proposed to provide protection from landscape-scale fires by interrupting large contiguous areas of fuels, strengthening B-zones or supporting off-reserve fuel reduction, such as within Montacute CP and Scott Creek CP.
- C-zone burning managed in accordance with ecological guidelines as part of ecological restoration and research into fire as an ecological process.

These and other zones applied to the lands included in the fire management plan are shown on Map 4 and detailed in Appendix 1. Note that the extent of these B-zones as displayed spatially is indicative and the widths 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.

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 (see Section 5.3.4).

Details on fuel reduction methods (i.e. burning, mechanical removal, weed control, etc.) within A- and B-zones are provided as part of an environmental assessment process which is completed before the implementation of each prescribed burn and also before new fire management works are undertaken within DENR managed land (where native vegetation is being cleared and is not exempt under the *Native Vegetation Act 1991*). Refer to the *Interim Environmental Assessment Table Guidelines* (DEH, 2004b) and the *Fire Policy and Procedure for Prescribed Burning* (DEH, 2009k) for more information.

5.3.4 Prescribed Burning in C-zones

Under DENR policy, prescribed burning within C-zones may be implemented for the purpose of ecological management, cultural management, research or for landscape protection. All prescribed burning within C-zones should be in accordance with the ecological fire management guidelines described within this Fire Management Plan (see Section 5.3.6).

Proposed prescribed burn areas in C-zones are shown on Map 4. These burn areas may be added, altered, relocated or may be withdrawn at the discretion of DENR at anytime. Generally this would be as a result of unplanned fires or other factors that may have occurred since time of writing. The implementation of any proposed burn is subject to resource availability and regional priorities. Any proposed burn area identified on Map 4 may not be burnt in its entirety at one point in time, as the area may be divided and burnt over a number of seasons or the burn itself may be patchy for environmental purposes or due to conditions. Long unburnt areas may also be identified in C-zones.

All prescribed burning in A-, B- and C-zones (regardless of the objective or tenure) will meet fire management planning requirements by applying an environmental assessment process as part of a prescribed burn plan, as detailed in Figure 4 and in *the Fire Policy and Procedure for Prescribed Burning* (DEH, 2009k). Within A- and B-zones, burning is undertaken for the purpose of fuel reduction (as described above). Ecological burns within C-zones are also subject to the planning process as detailed in the *Fire Policy and Procedure for Ecological Burning* (DEH, 2009p).

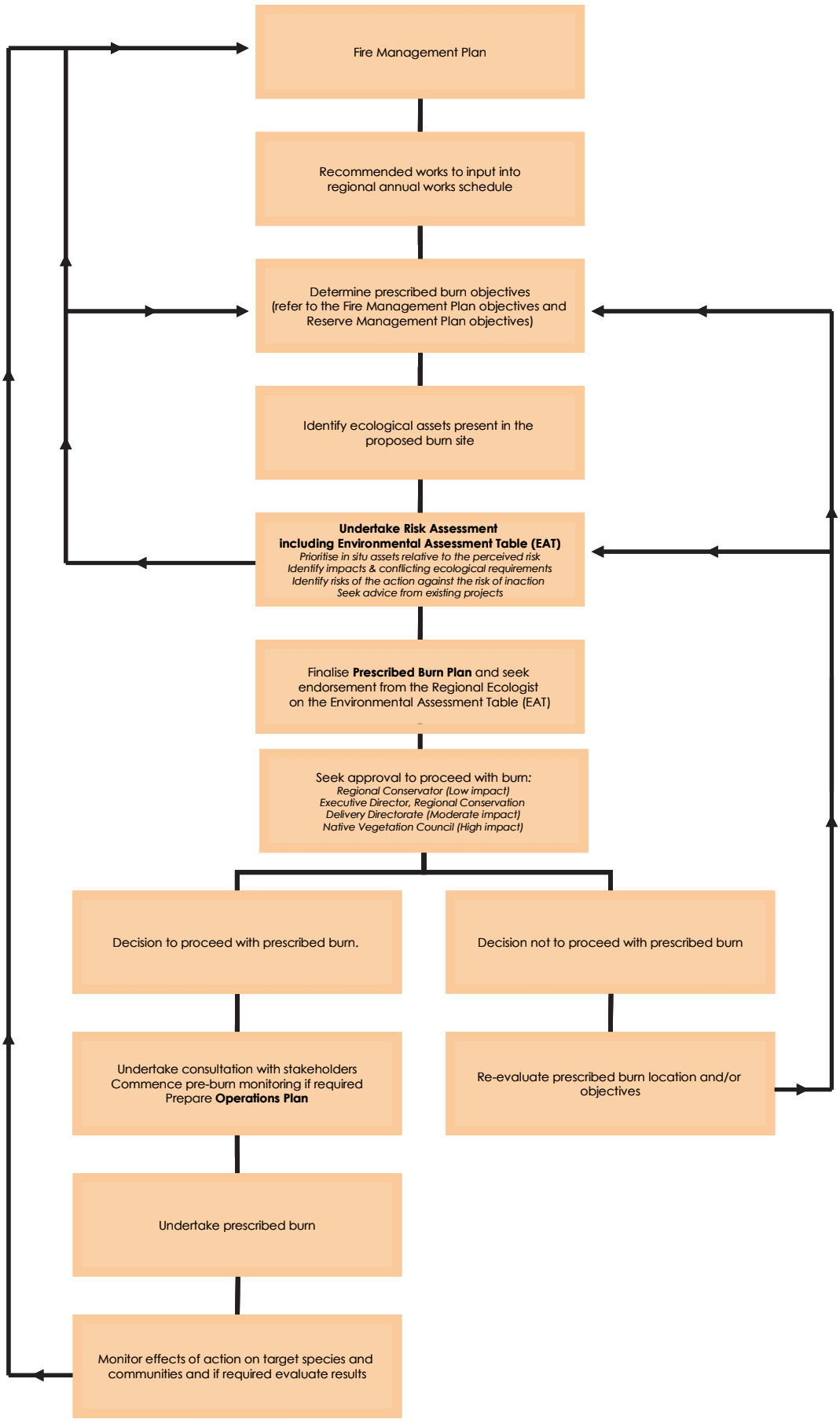

FIGURE 4 – FLOW CHART DETAILING THE BURN PLANNING PROCESS

5.3.5 *Fire Management Blocks*

The planning area has been divided into 15 fire management blocks to ensure that information and issues unique to a particular area have been addressed (Table 4). Block boundaries are based on access and the practicalities of implementing fire management objectives.

TABLE 4 – FIRE MANAGEMENT BLOCK INFORMATION

Reserve	Block	Size (ha)
Aldinga Scrub CP	Aldinga Block	265.7
Aldinga Crown Land	Aldinga Block	28.1
Charleston CP	Charleston Block	54.1
Kenneth Stirling CP Group	Filsell Hill Block Wotton Block Burdetts Block Whites Block	138.4 103.2 19.4 14.5
Marble Hill Crown Land	Burdetts Block	13.3
Mark Oliphant CP	Mark Oliphant Block	215.0
Moana Sands CP	Moana Block	21.7
Montacute CP	Montacute Block	199.9
Mount George CP	Mount George Block	89.7
Mylor CP	Mylor Block	45.7
Onkaparinga River NP Onkaparinga River RP	Onkaparinga Block	1544.6 290.5
Porter Scrub CP	Porter Scrub Block	54.1
Scott Creek CP	Scott Creek Block	718.2
Totness RP	Totness Block	40.9

5.3.6 *Ecological Fire Management*

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

Methodology

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

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

Figure 5 (below) illustrates this process.

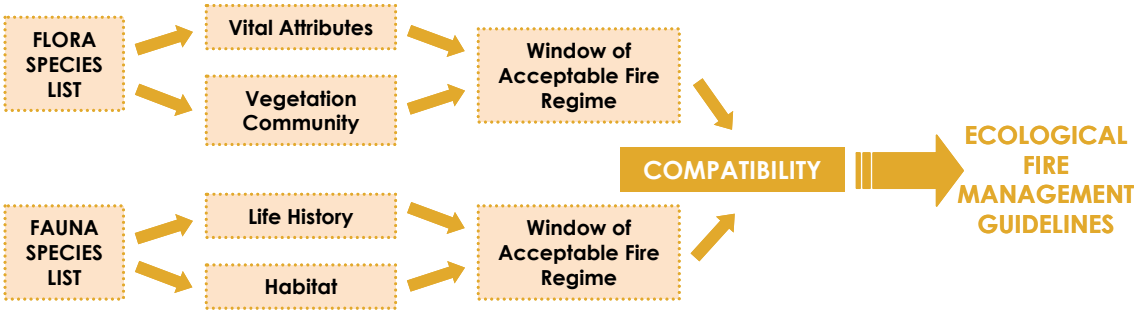

FIGURE 5 – APPROACH FOR DETERMINING ECOLOGICAL FIRE MANAGEMENT GUIDELINES

Interpreting Ecological Fire Management Guidelines

Ecological Fire Management Guidelines have been defined for MVS, enabling fire managers to strategically plan and manage fire within the reserves in the planning area in a way that will ensure the maintenance and enhancement of biodiversity (Table 5). Guidelines for five aspects of fire regime (interval, frequency, spatial, intensity and season) have been determined for all MVS within the planning area (where data are available). The upper and lower thresholds of potential concern for a particular MVS have been proposed, as well as recommendations on the management of fire frequency. Fire intensity requirements for species regeneration and undesired seasonal burning patterns have also been identified. Ecological Fire Management Guidelines should not be used as prescriptions; instead they define windows of "acceptable" fire regimes that should ensure the conservation of existing species. The Ecological Fire Management Guidelines are based on the best available information and they will be refined as new research and monitoring data become available for Key Fire Response Species.

Thresholds of Potential Concern

TPC are defined as 'the limits of tolerance to a particular fire regime' (Kenny, *et al.*, 2004).

- TPC1 demonstrates the lower threshold for fire interval (in years) for a particular MVS. That is, vegetation within this MVS will be represented predominantly by early successional species if the inter-fire interval is less than the time specified, and those species that require longer to flower and set seed can disappear from a community.
- TPC2 demonstrates the upper threshold for fire interval (in years) 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.

If either of the thresholds are breached, species of sensitive functional types are likely to significantly decline. Fire intervals between the upper and the lower threshold (Table 5) are predicted to maintain the species complement, whereas intervals shorter than the lower threshold or longer than the upper threshold are predicted to lead to the decline of the Key Fire Response Species (Kenny*, et al.*, 2004).

TABLE 5 – ECOLOGICAL FIRE MANAGEMENT GUIDELINES FOR MVS IN THE PLANNING AREA

		FIRE REGIME						
		Thresholds of Potential Concern		Spatial Criteria	Frequency	Intensity		Season
MVS No.	MVS Name	**TPC 1** – Inter-fire interval greater than X years	**TPC 2** – Inter-fire interval less than X years[1]	Inter-fire intervals within **TPC1** and **TPC2** across more than X% of the extent of this MVS within the planning area	Avoid more than 2 fires within X years	Avoid more than 2 successive fires of low intensity	Some medium to high intensity fire needed to regenerate some species	Avoid 2 or more successive fires in season[2]
4	Eucalyptus forests with a shrubby understorey	20	50	40%	60	Y	Y	Spring or during and following drought
8	Eucalyptus woodlands with a shrubby understorey	20	50	40%	60	Y	Y	Spring or during and following drought
9	Eucalyptus woodlands with a grassy understorey	5	50	40%	60	Y	Y	Spring or during and following drought
26	Casuarina and Allocasuarina forests and woodlands	20	50	40%	60	N	N	During and following drought
32	Other shrublands	20	35	40%	40	N	N	Spring
38	Wet tussock grassland, herbland, sedgeland or rushland	20	35	40%	40	N	N	Spring or during and following drought
39	Mixed chenopod, samphire or forblands	20	35	40%	40	N	N	During and following drought

[1] 30% of the extent of each MVS within the planning area is to have inter-fire intervals above TPC2

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

6 RESPONSE

6.1 Response Plans

A Response Plan exists for the Adelaide Region (DEH, 2009j), which is reviewed on an annual basis in accordance with the *Fire Policy and Procedure for Response Planning* (DEH, 2009q). The response plan provides reserve-specific information in relation to fire suppression including water points, equipment and access, as well as levels of preparedness.

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

6.2 Suppression Considerations

Initial efforts to contain bushfires should be made using existing access tracks, previously burnt areas and natural low fuel areas. If unsuccessful, alternative strategies may be considered providing the impact can be justified, and ecological consequences considered. The best available fire prediction should be used before decisions on strategies are taken to ensure all agencies are working to a common goal. For DENR managed land it is likely that DENR staff will be the best source of this information, as such 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. A DENR Liaison Officer will be assigned to most incidents attended by DENR crews. The role of the DENR Liaison Officer is to coordinate and work with Incident Control, to provide Policy advice as well as resources and other logistical and planning support.

6.2.1 Ground Crews

Considerations.

- Hazards such as the presence of mineshafts (such as in Scott Creek CP and Porter Scrub CP), quarries, steep slopes and cliffs.
- Likelihood of extreme fire conditions as a result of:
  - wind funnelling up east/west drainage lines
  - westerly wind changes.
- *Extreme* fuels in vegetation dominated by Stringybarks.
- Likelihood of spotting and ember attack on assets within the Sixth Creek catchment area, Heathfield and surrounds, Mount Bold, Onkaparinga Hills and Aldinga Beach.
- Consider safety overhead, aerial suppression is likely and falling trees/limbs are common.
- Use anchor points to maintain safe access for firefighters.
- Reliance on ground crews and aerial suppression due to difficulty of machinery deployment.
- DENR role in fire suppression and the role of other fire suppression agencies during an incident (i.e. CFS and MFS may focus on asset protection and ForestrySA, DENR and CFS are likely to implement hose lays and carry out more remote area firefighting).

- Water for fire suppression can be sourced from DENR standpipes and static water supplies as shown on Map 4. Alternatively Bulk Water Carriers may be deployed to the incident and there may be mains water points in the surrounding urban area.
- In regards to fire access within the planning area:
  - public roads and access tracks considered important for fire management have been classified to GAFLC standards and are shown on Map 4
  - gates providing access to DENR managed lands are illustrated on Map 4
  - 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 during an incident, as a result there is a risk of entrapment
  - through access may not be possible in many reserves (e.g. Whitehead Road, Merchants Road, Ostigh Road, Sharps Road, etc.).
- Backburning operations should only be implemented in accordance with the *DENR Fire Policy and Procedure for Backburning* (DEH, 2009t) at the discretion of the Incident Controller.
- 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 (washdown), solvent based cleaning, and/or air jets.

6.2.2 Machinery Use

Considerations.

- Machinery use and deployment during fire suppression is to be in accordance with:
  - the DENR *Fire Policy and Procedure for Earthmoving Equipment* (DEH, 2009z)
  - the *CFS Supervision of Machinery Guidelines* (CFS, 2007).
- Steep terrain/cliffs will often considerably reduce the effectiveness of, and pose risks to machinery operators.
- 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 (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, following liaison with the DENR Liaison Officer or the relevant landholder/s
  - environmental and cultural impacts have been assessed.
- The construction of new tracks should not be necessary during an incident as the existing track network is sufficient and the topography may be unsuitable.
- Machinery use should avoid significant swamp areas, such as Fox Bog, Bush Rat Creek and Almanda and Derwentia Valleys in Scott Creek CP, the swamp off the western side of Thornbill Track in Mark Oliphant CP and Aldinga Scrub CP (Map 2).

- 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.
- Standards for control lines are to be accordance with the *Fire Policy and Procedure for Control Lines* (DEH, 2009u).
- 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.

6.2.3 Aerial Suppression

Considerations.

- The CFS Mount Lofty Ranges Primary Response Zone for the automatic dispatch of aerial bombers extends across all reserves in the planning area except Aldinga Scrub CP.
- Only chemicals qualified and approved by the United States Department of Agriculture (USDA) Forest Service and endorsed by the Australasian Fire and Emergency Services Authorities Council (AFAC) will be used on DENR managed land and on DENR fire appliances (see *USDA Forest Service* (2008) document).
- The use of retardant and foams should be in accordance with the *Fire Policy and Procedure for Fire Suppression Chemicals* (DEH, 2009s).
- Implementation of aerial suppression is to be in accordance with the *Fire Policy and Procedure for Aerial Operations* (DEH, 2009r).
- The use of retardant in catchment areas should be in accordance with the *Memorandum of Understanding on Aerial Application of Chemical Fire Retardants between SA Water and CFS* (CFS, 2006).
- Aerial suppression should only be undertaken where the operation is supported by ground crew.
- Aerial ignition may be used for prescribed burning. During bushfires, aerial ignition may be used to reduce the impact of head fires on control lines and increase the probability of success in limiting the propagation of bushfire within the landscape.

6.3 Visitor Management during Bushfire

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

Visitors within reserves are managed according to the *Fire Policy and Procedure for Visitor Safety* (DEH, 2009o), which allows for the temporary closure of reserves or cancellation of activities due to an actual emergency, imminent threat or extreme threat of a bushfire.

CFS has an Evacuation Policy (CFS, 2009b), 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. These nominated authorities will only direct evacuation when it is evident

that loss of life or injury is imminent and almost certain. DENR 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

DENR has a *Policy and Procedure for Post-fire Rehabilitation* (DEH, 2009a) to ensure that requirements for the rehabilitation and recovery of areas affected by bushfire is identified during an incident. A post-fire rehabilitation plan shall consider:

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

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

7.2 Research

Any fire-related research that is proposed within the reserves in the planning area should be discussed with the Senior Fire Research Scientist and be in accordance with *Policy and Procedures for Fire Research* (DEH, 2009g) and in consultation with the Adelaide Region. DENR is currently working on an adaptive management framework, incorporating research and monitoring to ensure new knowledge is incorporated into future fire planning. DENR has prepared a Science Directions document (DEH, 2010) that outlines some key questions for research in fire science and fire management. The research proposed below will contribute to improving the knowledge required to answer these priority research questions.

It is recommended that research should be undertaken to:

Research	56.	Determine the suitability of flora based thresholds for meeting fauna conservation objectives
	57.	Continue to collect and collate vital attributes for fauna and incorporate into future ecological fire management guidelines
	58.	Assess whether the chosen Key Fire Response Species are appropriately sensitive as community-wide indicators of inappropriate fire regimes in the plan area.
	59.	Investigate the effect of fire on the following species and ecological communities: Southern Brown Bandicoot, Chestnut-rumped Heathwren, threatened orchids, Aldinga Dampiera, Mount Lofty Speedwell, Swamp Mazus, Tall Daisy, White-flower Matted Pratia, Grey Box Grassy Woodland and Silver Banksia Low Woodland.
	60.	Investigate the use of fire for the management of weeds (e.g. Perennial Veldt Grass).
	61.	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 DENR policy and procedures.

Implementation will depend upon state and regional priorities and available resources. This includes the *DENR Policy and Procedure for Prescribed Burning* and the *Policy and Procedure for Ecological Burning* (DEH, 2009p).

Opportunities for monitoring will also be considered in areas impacted by bushfire to improve knowledge about the response of species, communities and habitats to fire within the planning area, as per DENR policy (DEH, 2009k). The results from post-fire monitoring will be used to further refine fire management, consistent with an adaptive management approach. Refer to Section 5.3.3 and 5.3.4 of this plan for general information on zoning, burning and the planning requirements.

It is recommended that monitoring is undertaken to:

Monitoring	62.	Investigate the fuel accumulation rates of the various MVS that occur within the planning area (Table 3). These data will help DENR staff determine if and when fuel reduction works are required, ultimately assisting in the scheduling of operational works and activities in B-zones.
	63.	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 (Appendix 2).
	64.	Establish monitoring 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 Thresholds of Potential Concern (TPC).
	65.	Monitor the effect of fire on Silver Banksia Grassy Low Woodland, particularly on Banksia regeneration and germination.

8 SUMMARY OF MANAGEMENT STRATEGIES

Visitor Use

1. Consider reserve closures when significant fire weather is forecast to ensure visitor safety (at the discretion of the Director, National Parks and Wildlife).
2. Prepare visitor bushfire survival plans as required and review these annually. Plans for visitor facilities should be developed by the lessee, owner or manager.
3. Implement appropriate fuel management strategies as shown Map 4 to increase visitor safety.

Built Assets

4. Implement fuel management strategies appropriate to asset protection as shown on Map 4.
5. Encourage adjacent property owners to work with CFS and local government to implement appropriate and coordinated fire management works on their own land to minimise the threat of fire.
6. Undertake fire management works and activities on DENR reserves to minimise the impact that fire may pose to adjacent public assets.
7. Work with the Adelaide Mt Lofty Ranges Bushfire Management Committee to improve safety at Heathfield High/Primary Schools through coordinated fuel reduction (see Appendix 1).
8. Encourage volunteer participation in undertaking approved fuel reduction activities on reserves.
9. Ensure revegetation is consistent with fire management zoning and fire is excluded from juvenile revegetation sites.

Cultural Heritage

10. Implement fuel management strategies appropriate for the protection of cultural assets as shown on Map 4.
11. 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.
12. Ensure suppression strategies take into account significant cultural assets in order to minimise impacts from these activities and undertake post-fire rehabilitation.

Southern Brown Bandicoot

13. Implement pre-fire management actions that will minimise the risk of local extinctions in the event of a bushfire. .
14. Conduct prescribed burning to improve habitat suitability where necessary.
15. During extensive bushfires, attempt to retain unburnt patches as refuge areas to minimise the risk of local extinctions.
16. Finalise and implement the Bandicoot Ecological Fire Management Strategy.
17. Monitor the effects of fire on the Southern Brown Bandicoot populations and preferred habitat and use this information to inform the DENR flora and fauna vital attributes database for use in Ecological Fire Management Guidelines (Appendix 2).

MLR Chestnut-rumped Heathwren

18. Implement pre-fire management actions that will minimise the risk of local extinctions in the event of a bushfire.

19. If necessary, conduct prescribed burning to improve habitat suitability.
20. During extensive bushfires, attempt to retain unburnt patches as refuge areas to minimise the risk of local extinctions.
21. Develop and implement an Ecological Fire Management Strategy for the MLR Chestnut-rumped Heathwren.
22. Monitor the effect of fire on MLR Chestnut-rumped Heathwren populations and preferred habitat and use this information to update the DENR flora and fauna vital attributes database for use in future Ecological Fire Management Guidelines (Appendix 2).

Aldinga Dampiera

23. Continue to monitor the effect of fire on Aldinga Dampiera populations and preferred habitat and use this information to update the DENR vital attributes database for use in future Ecological Fire Management Guidelines (Appendix 2).
24. Based on monitoring results, implement an ecological burning program, if required, to increase the health and abundance of the Aldinga Dampiera population.
25. Undertake targeted post-fire weed control following prescribed burns and bushfires in the vicinity of the Aldinga Dampiera population and monitor the effectiveness of this control.

Scott Creek Threatened Flora

26. Exclude populations of the Swamp Mazus, White-flower Matted Pratia, Tall Daisy and Mount Lofty Speedwell from prescribed burning in C-zones unless experimental burning of small sections of these populations is recommended by the Biodiversity Conservation Unit, Adelaide Region. Monitoring results should be used to update the DENR vital attributes database for use in future Ecological Fire Management Guidelines (Appendix 2).
27. Undertake strategic fuel reduction activities as required to minimise the risk of populations of these species burning in a single fire event.
28. Undertake pre-fire population monitoring so that in the event of a bushfire, the post-fire response of these species can be documented.
29. Ensure that the risk of weed proliferation, off-target damage due to weed control and overabundant species are considered and planned for following a fire within or adjacent to threatened plant populations.

Threatened Orchids

30. Minimise the likelihood of vehicles or equipment impacting on threatened orchid populations during track management and fire suppression operations.
31. Avoid prescribed burning or slashing within threatened orchid populations between May and November.
32. Avoid prescribed burning or slashing within threatened orchid populations more frequently than every 5 years.
33. Minimise the likelihood of large areas of threatened orchid habitat burning in a single fire event.
34. Liaise with the South Lofty Block Orchid Recovery Team when planning prescribed burns within known habitat of threatened orchids.
35. Undertake ecological/experimental burns on threatened orchid populations to examine the response of these species to different disturbance regimes.

Grey Box Woodland

36. Refer to the fire management guidelines for Grey Box in Appendix 4 when implementing prescribed burns and aim to manage within these guidelines.
37. Minimise the risk of large contiguous remnants of Grey Box woodland burning in their entirety during a single fire event.
38. Implement ecological/experimental burns as part of an integrated weed management strategy in order to reduce the abundance of environmental weeds posing a threat to the integrity of Grey Box woodland.
39. Ensure the planning of prescribed burning takes into consideration the responses of understorey species with fire-sensitive life stages.
40. Monitor the response of the community to different fuel management regimes through the application of ecological/experimental burns and/or mechanical fuel reduction.

Silver Banksia Woodland

41. Use fire to achieve restoration goals and monitor the effect of fire on Silver Banksia Grassy Low Woodland, particularly on Banksia regeneration and germination.
42. Minimise the risk of remnants of Silver Banksia Grassy Low Woodland burning in their entirety during a single fire event.

Pest Species

43. Refer to Ecological Fire Management Guidelines (Table 5) and fire management guidelines for introduced flora species (Appendix 2) during prescribed burn planning.
44. Consider the use of fire as tool that forms part of integrated pest management strategies.
45. Consider the likely post-fire responses and impacts of weed species and implement post-fire weed control and monitoring accordingly (subject to regional priorities).
46. Collect relevant information during prescribed burn planning on introduced fauna and undertake a risk assessment to determine the need for post-fire management.
47. Adhere to the *Standard Operating Procedure – Phytophthora Threat Management (SOP-002)* (DEH, 2002a) and conduct a risk assessment to determine whether fire management activities will exacerbate the spread of Phytophthora.
48. Ensure hygiene practices are implemented to reduce the spread of weeds and Phytophthora across the planning area. Refer to the *DENR Operating Procedure – Phytophthora Vehicle Disinfection Unit* (DEH, 2003).
49. Undertake monitoring to determine the interaction between Phytophthora and fire.

Changing Climate

50. Monitor species and ecosystems and the processes that support them to understand their resilience to a changing climate.
51. Review and adapt fire management strategies in the plan area as the impacts of climate change become understood.

52. Monitor national and international fire management policy and best practice and partner with the research sector to increase our knowledge of altered fire regimes.

Fire Access Tracks

53. Implement changes to fire access as described in Appendix 1.
54. Maintain tracks to the GAFLC standards as shown on Map 4.
55. Install signs on fire access tracks and gates according to GAFLC standards and name tracks as appropriate.

Research

56. Determine the suitability of flora based thresholds for meeting fauna conservation objectives
57. Continue to collect and collate vital attributes for fauna and incorporate into future ecological fire management guidelines
58. Assess whether the chosen Key Fire Response Species are appropriately sensitive as community-wide indicators of inappropriate fire regimes in the plan area.
59. Investigate the effect of fire on the following species and ecological communities: Southern Brown Bandicoot, Chestnut-rumped Heathwren, threatened orchids, Aldinga Dampiera, Mount Lofty Speedwell, Swamp Mazus, Tall Daisy, White-flower Matted Pratia, Grey Box Grassy Woodland and Silver Banksia Low Woodland.
60. Investigate the use of fire for the management of weeds (e.g. Perennial Veldt Grass).
61. Investigate the social attitudes, values and drivers that are impacting on or having the greatest influence on decision making.

Monitoring

62. Investigate the fuel accumulation rates of the various MVS that occur within the planning area (Table 3). These data will help DENR staff determine if and when fuel reduction works are required, ultimately assisting in the scheduling of operational works and activities in B-zones.
63. 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 (Appendix 2).
64. Establish monitoring 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 Thresholds of Potential Concern (TPC).
65. Monitor the effect of fire on Silver Banksia Grassy Low Woodland, particularly on Banksia regeneration and germination.

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10 APPENDICES

Appendix 1 – Assets and Strategies for Bushfire Risk Mitigation

	Values and Assets	Location	Recommended Works
Aldinga Block	**Adjoining Properties** Aldinga Arts EcoVillage, Port Road, Aldinga	To the south of Willunga Creek	• Liaise with staff from the Urban Forest Biodiversity Unit, Adelaide Region to maintain B-zone between the southern boundary and Willunga Creek to reduce the likelihood of fire threatening residents and properties in the EcoVillage • Recommend to the Adelaide Mt Lofty Ranges BMC that residents of the EcoVillage maintain defendable space around their assets as per CFS guidelines and consider whether their house is designed to withstand a bushfire
Aldinga Scrub CP	**Adjoining Properties** Aldinga Beach	To the west and north of the reserve	• B-zone (50 m from boundary) along the western boundary of the reserve to reduce the risk to residents and properties on Dover and Fraser Street • A-zone (40 m from asset) along the western boundary of the reserve where housing abuts the reserve to reduce the risk to residents and properties on Maurice Street and The Esplanade • A-zone (40 m from assets) along the western boundary of the reserve where housing abuts the reserve to reduce the risk to residents and properties on Mallee Avenue, Emu Road, The Esplanade and Kestral Terrace • B-zone (40 m from boundary) along the northern boundary of the reserve where new housing is being developed. An A-zone may be implemented in the future if assets are constructed less than 40 m from the reserve • B-zone (50 m width) north of Quandong Avenue, east of Acacia Terrace, south of Sheoak Avenue, north of Wattle Avenue and east of Kestral Terrace to reduce the likelihood of fire threatening • Recommend to the Adelaide Mt Lofty Ranges BMC that residents of Aldinga Beach maintain defendable space around their assets as per CFS guidelines and consider whether their house is designed to withstand a bushfire • Maintain Kestrel Terrace track (on-reserve) as a Minor Track

	Values and Assets	Location	Recommended Works
Aldinga Scrub CP	**Adjoining Properties** Aldinga Beach	To the east of the reserve	• A-zones (40 m from assets) abutting the eastern boundary to reduce the risk to properties accessed off of Norman and Cox Roads • Recommend to the Adelaide Mt Lofty Ranges BMC that residents of Aldinga Beach maintain defendable space around their assets as per CFS guidelines and consider whether their house is designed to withstand a bushfire
	Adjoining Community Assets Aldinga Beach Holiday Park, Cox Road, Aldinga Beach	To the east of the reserve	• Implement a A-zone (5 m) between Gate 2 and 3 • Implement a B-zone (150 m) north and west of the holiday park to reduce the risk to assets and holidaymakers • Recommend to the Adelaide Mt Lofty Ranges BMC that holiday park owners maintain defendable space around their assets as per CFS guidelines and consider whether these assets are designed to withstand a bushfire
	Aldinga Scrub CP – whole of reserve		• Maintain Kestral Terrace track as a Minor Track (on reserve) • Implement a B-zone (150 m) south of Boomerang Track to provide a suppression opportunity
Charleston CP	Charleston CP – whole of reserve	Charleston Block	• Upgrade the eastern, southern and western tracks to Minor if appropriate • Block has been designated as a C-zone for ecological fire management purposes • Undertake C-zone burning along the eastern edge of reserve to promote the regeneration of the Silver Banksia community (Map 4)
Kenneth Stirling CP Group	**Adjoining Properties** Sharps Road, Carey Gully	To the north of White Block	• Implement an A-zone (40 m from asset) around property to the north and recommend that owners maintain defendable space
	Adjoining Properties Mount George Balhannah	To the east and west of Wotton Block	• A-zones (40 m) from assets that are less than 40 m from the reserve and Heritage Agreement 186 • Recommend that residents maintain defendable space as per CFS guidelines around their assets and should consider whether their house is designed to withstand a bushfire

	Values and Assets	Location	Recommended Works
Kenneth Stirling CP Group	**Adjoining Properties** Heritage Agreement (HA 186)	To the west of Wotton Scrub (within Wotton Block)	• Recommend to the Adelaide Mt Lofty Ranges BMC to upgrade the track running along the southern boundary of the Heritage Agreement to a Minor Track and implement a turnaround point at the end
	Adjoining Properties Within Heritage Agreement 260, Swamp Road, Balhannah	To the east of Filsell Hill Block	• Recommend to the Adelaide Mt Lofty Ranges BMC that the track to the property within Heritage Agreement 260 to be upgraded to a Standard Track from Swamp Road to the asset. • Recommend that owner of Heritage Agreement 260 implements an A-zone (40 m) around their assets and a 40 m B-zone to strengthen this • Work with Heritage Agreement 260 owner to implement cross-tenure prescribed burning as appropriate
	White Scrub – whole of reserve	White Block	• Recommend to the Adelaide Mt Lofty Ranges BMC that Adelaide Hills Council maintain low fuels on the road verge between the reserve and Greenhill Road • Liaise with the Adelaide Mt Lofty Ranges BMC, CFS and landowners to improve access from reserve to Greenhill Road by establishing a link track through private land to the east • Implement a turnaround point at the end of the Minor Track in the reserve • Erect a sign indicating the western boundary track is to be used during dry weather only, with a possible turn around point to be developed at the end
	Burdett Scrub – whole of reserve	Burdett Block	• Liaise with ForestrySA with the aim to undertake cooperative fire management activities • Investigate access to the reserve and a combined track network with ForestrySA across the broader landscape • Recommend to the Adelaide Mt Lofty Ranges BMC that the Adelaide Hills Council consider upgrading the bridge on Merchants Road to allow for the track to meet GAFLC standards

	Values and Assets	Location	Recommended Works
Kenneth Stirling CP Group	Filsell Hill – whole of reserve	Filsell Hill Block	• Upgrade Proberts Track to a Standard Track, from Deviation Road through to Ostigh Road. Liaise with the Adelaide Mt Lofty Ranges BMC, CFS and landholders in regards to the off-reserve component. • Upgrade the Service Track running east from Proberts Track along the northern boundary of the 2009 prescribed burn to the orchard to Minor. Liaise with the Adelaide Mt Lofty Ranges BMC, CFS and landholders in regards to the off-reserve component. • Upgrade the Service Track providing access to the western boundary of Heritage Agreement 260 to Minor and construct a turnaround point at the end. • Upgrade Hidden Valley Track to Minor. Liaise with the Adelaide Mt Lofty Ranges BMC, CFS and landholders in regards to the off-reserve component. • Upgrade the track linking Proberts Track to Deviation Road near 'Hillstowe' to a Minor Track. Liaise with the Adelaide Mt Lofty Ranges BMC, CFS and landholders in regards to the off-reserve component. • Upgrade Filsells Track through to Swamp Road to Standard. Liaise with the Adelaide Mt Lofty Ranges BMC, CFS and landholders in regards to the off-reserve component. • Recent C-zone burning in the reserve has provided a significant fuel reduced zone, therefore B-zones are not planned to be implemented during the life of this plan.
	Wotton Scrub – whole of reserve	Wotton Block	• Implement C-zone burn along the southern boundary of the reserve (Map 4) • Upgrade the main north-south track that runs from Gate 2 south to the southern boundary (south-east exit) to a Standard Track. Ensure this track is all weather with turnarounds • Liaise with the Adelaide Mt Lofty Ranges BMC, CFS and landowners to improve access from the main north-south track south-east exit through private land • Upgrade track with turnaround running south from Gate 1 to a Minor Track

	Values and Assets	Location	Recommended Works
Marble Hill	Marble Hill – whole of block	Burdett Block	• Implement C-zone burning and consider asset protection of the historic Marble Hill mansion in liaison with owner of Heritage Agreement 1129 and the new owners • Investigate cost and requirement to upgrade the track to DENR managed land to provide access to the bottom of the gully and what standard it would become
Mark Oliphant CP	**Adjoining Properties** Upper Sturt	To the north and north-west of the reserve	• Recommend that residents maintain defendable space as per CFS guidelines around their assets and should consider whether their house is designed to withstand a bushfire • C-zone burning between the northern reserve boundary and creek for landscape protection, note that the creekline should be avoided (Map 4)
	Adjoining Properties Ironbank	To the south and south-west of the reserve	• B-zone behind houses on Nioka Drive and A-zones where houses are less than 40m from reserve. Recommend that residents maintain defendable space as per CFS guidelines around their assets and should consider whether their house is designed to withstand a bushfire • Houses along Ironbank Road to comply with setback distances, recommend C-zone burning in the area to complement fuel reduction within the reserve • Investigate access to the reserve from Allumba Drive and Morgan Road

	Values and Assets	Location	Recommended Works
	Adjoining Properties Heathfield Longwood	To the north-east, east and south-east of the reserve	• Walker Avenue, Heathfield residents should maintain defendable space as per CFS guidelines around their assets and should consider whether their house is designed to withstand a bushfire • B-zone (200 m width) between Thornbill Track and Scott Creek Road • C-zone burning at the corner of Evans Drive and Scott Creek Road adjacent to the B-zone (Map 4) • Recommend to the Adelaide Mt Lofty Ranges BMC that an A-zone (40 m from the asset) be maintained to reduce the risk to the residence surrounded by the Heritage Agreement on Scott Creek Road • Recommend to the Adelaide Mt Lofty Ranges BMC that within the Heritage Agreement (HA 83) and to the southeast of this in private land, C-zone burning should be undertaken at a minimum and ideally the eastern most portion of the Heritage Agreement should be maintained as a B-zone
Mark Oliphant CP	**Adjoining Infrastructure** Council Reserve SA Water Treatment Plant Heathfield dump	To the north of the reserve	• Recommend to the Adelaide Mt Lofty Ranges BMC that a B-zone (125 m) be maintained to the north of Evans Drive on council land extending to the west to capture the low fuel area (refer to previous fire history) • Recommend to the Adelaide Mt Lofty Ranges BMC that access throughout Adelaide Hills Council land should be maintained as Standard • Recommend to the Adelaide Mt Lofty Ranges BMC that an A-zone (minimum 40 m) be placed around the SA Water treatment plant • Recommend to the Adelaide Mt Lofty Ranges BMC that fuel reduction be completed between the reserve boundary and SA Water treatment plant on SA Water land and private property north of the treatment plant to reduce the risk of fire threatening Heathfield
	Adjoining Infrastructure SA Water Pumping Station	Surrounded by the reserve (adjacent Thornbill Track)	• A-zone (40 m from the asset) to reduce the risk to the SA Water pumping station
	Adjoining Community Assets Heathfield School	To the north-east of the reserve	• Liaise with the Adelaide Mt Lofty Ranges BMC, CFS and landowners to coordinate fuel reduction work at the northern end of Mark Oliphant CP and east to Longwood Road to reduce the risk to Heathfield school

	Values and Assets	Location	Recommended Works
	Mark Oliphant CP – whole of reserve		• Recommend to Adelaide Mt Lofty Ranges BMC that Evans Drive should be upgraded to a Standard Track, with 2 m of verge work each side (shrub/elevated fuel removal) • Implement a B-zone (230 m width) along Evans Drive to reduce the likelihood of bushfire burning the reserve in its entirety • Thornbill and Loftia Tracks to be maintained as Standard Tracks • Maintain A-zone in south-eastern corner of the reserve in order to retain the low fuel area that currently exists
Moana Sands CP	**Adjoining Properties** Moana	To the south of the reserve	• A-zone (40 m from asset) along southern boundary of the reserve to reduce the likelihood of fire threatening residential properties on Macquarie Street/Bathurst Avenue. • Recommend to the Adelaide Mt Lofty Ranges BMC that the owner of Allotment 10, Hundred of Willunga continue the proposed A-zone along the southern parcel boundary to reduce risk to properties on Macquarie Street.
	Moana Sands CP – whole of reserve		• Maintain Service Tracks within the reserve and delineate to reduce the likelihood of vehicles driving off-track and threatening cultural heritage values
Montacute CP	**Adjoining Assets** Kangaroo Creek Reservoir Coralinga & Cudlee Creek Forests	To the north, east and south of the reserve	• Work with SA Water and ForestrySA to implement cross tenure C-zone burning
	Adjoining Properties Montacute	Adjacent Montacute CP	• Recommend that owners of Allotment 51 and 52, Hundred of Onkaparinga maintain a 40 m A-zone adjacent assets and B-zone to the reserve boundary

	Values and Assets	Location	Recommended Works
	Montacute CP - whole of reserve	Montacute Block	• Upgrade track running north-south from Stone Hut Road via Gate 15 to Valley Road to a Standard Track • Liaise with the Adelaide Mt Lofty Ranges BMC, CFS and landowners to upgrade Valley Road to a Standard Track, with a turnaround point at the entrance gate in the reserve. • Investigate the potential upgrade of service track running north-south in the western section of the reserve (linking Valley Road and Big Range Road) to a Minor Track if appropriate • Upgrade track across reserve to Stone Hut Road to Standard. Liaise with ForestrySA for works to be completed within Coralinga Native Forest • Recommend that the Adelaide Mt Lofty Ranges BMC investigates the upgrade of Fernhurst Road to Standard • Recommend to the BMC to investigate the extension of Big Range Track across private land to connect to the western side of the reserve and Valley Road, including the switchback section. This should be upgraded to a Major Track for the entire length if possible. • Liaise with SA Water and ForestrySA to maintain a fuel reduced strip 10 m either side of the entire length of Fire Track 1 (Stone Hut Road), Big Range Road and the new extension • Tank at the end of Valley Road to be assessed for upgrade (including access) • Consider cross tenure C-zone burning between Fernhurst Road, Big Range Track and Fire Track 2b in conjunction with private landholders (Map 4)

	Values and Assets	Location	Recommended Works
Mount George CP	**Adjoining Community Assets** Seeonee Hills Scout Camp	Adjacent Mount George Road and Muller Road	• Recommend to the Adelaide Mt Lofty Ranges BMC that all of the Seeonee Hills Scout Camp land on Muller Road is maintained as an A-zone. • DENR to maintain an A-zone (40 m) around the sleeping quarters and recreation shed at Seeonee Hills for any part of DENR land that falls into this zone except across Muller Road where this will be maintained as a B-zone. • Implement a B-zone (100 m maximum) around Seeonee Hills A-zone to buffer
	Road users on the South Eastern Freeway	To the south of the reserve	• Recommend to the Adelaide Mt Lofty Ranges BMC that Transport SA maintain a B-zone within the roadside vegetation along the freeway to the reserve boundary to assist in reducing the risk of fire threatening road users and ultimately Bridgewater from a fire moving to the south east. This area has been revegetated by the Friends of Mount George to suppress exotic grasses and should be managed appropriately.
	Adjoining Properties Golflinks Road, Stirling	To the south-west of the reserve	• A-zone (40 m) along the reserve boundary behind assets on Golflinks Road • B-zone (280 m maximum)out to Leah Fire Track continuing along the north-eastern boundary of the reserve for 60 m to strengthen the A-zone
	Adjoining Properties Fox Hill Road, Mount George	To the south-east of the reserve	• Upgrade Lewis Fire Track to Standard Track from Worden Road through to Gate 6 where it connects with Mount George Road. Liaise with the Adelaide Mt Lofty Ranges BMC, CFS and landowners to upgrade the off-reserve section. • B-zone (110 m maximum) between Lewis Fire Track and south-eastern reserve boundary (between Gate 7 and 8) • Recommend to the Adelaide Mt Lofty Ranges BMC that a B-zone be maintained behind assets on private land on Fox Hill Road to extend the B-zone on reserve to the Freeway.

	Values and Assets	Location	Recommended Works
	Mount George CP – whole of reserve	Mount George Block	• Investigate with neighbouring landowner fire access from Davenport Road through western section of reserve east from Foreman Track along the edge of the pine plantation through to Mount George Road. This should be a Standard Track • Upgrade Foreman Track as a Standard Track if possible • Access from Gate 12 and 13 to the Freeway (south) must be established through negotiation with Transport SA • Recommend to the Adelaide Mt Lofty Ranges BMC that vehicle access along the Heysen Trail track through the tunnel to the Council reserve south of the Freeway be maintained as Minor Track (excluding the tunnel section). Ensure a turnaround point on the northern side is up to standard. • Recommend to the Adelaide Mt Lofty Ranges BMC that B-zone be maintained as a corridor along Mount George Road south to freeway as a strategic fuel reduced area to reduce the likelihood of fire moving through the landscape. DENR to maintain any parts of this zone that falls on reserve.

	Values and Assets	Location	Recommended Works
Mylor CP	**Adjoining Community Assets** Adelaide Hills Wilderness Lodge, Whitehead Road, Mylor	To the south-east of the reserve	• B-zone (110 m) behind Wilderness Lodge to reduce the risk of fire threatening • Recommend to the Adelaide Mt Lofty Ranges BMC that owners of the Wilderness Lodge maintain defendable space around their assets as per CFS guidelines and consider whether these assets are designed to withstand a bushfire
	Community Assets YHA Hostel	Whitehead Road (within the reserve)	• A-zone (40 m) around asset • Recommend to the Adelaide Mt Lofty Ranges BMC that owners should consider whether the hostel has been designed to withstand a bushfire
	Adjoining Properties Mylor	To the east of the reserve	• A-zone (40 m from asset) around house adjacent to reserve boundary which is accessed off River Road
	Mylor CP – whole of reserve		• Upgrade Whitehead Road to a Standard Track, with the fuel reduced area to complement the powerlines, with the western end of the road to connect back to the reserve entrance. • Upgrade track along south-western boundary to Standard and link this through to River Road. Negotiate the upgrade through the Adelaide Mt Lofty Ranges BMC, CFS and landowners as this track is potentially privately owned
Onkaparinga River NP	**Adjoining Properties** Onkaparinga Hills Hackham Clarendon	To the north and east of the NP	• Recommend to the Adelaide Mt Lofty Ranges BMC that adjacent property owners maintain defendable space around their assets as per CFS guidelines and consider whether these assets are designed to withstand a bushfire
	Adjoining Properties Old Noarlunga	To the west of the NP	• 30 m B-zone behind properties along Church Hill Rd (part) and river to be complemented by work on church land • Recommend to the Adelaide Mt Lofty Ranges BMC that adjacent property owners maintain defendable space around their assets as per CFS guidelines and consider whether these assets are designed to withstand a bushfire

	Values and Assets	Location	Recommended Works
	Adjoining Properties McLaren Vale Chapel Hill Winery	To the south of the NP	• A-zone (40 m) from Gate 25 to the next gate to the north (near Chaffeys Road) supported by a B-zone (200 m) to reduce risk to Chapel Hill Winery • Recommend to the Adelaide Mt Lofty Ranges BMC that adjacent property owners maintain defendable space around their assets as per CFS guidelines and consider whether these assets are designed to withstand a bushfire
Onkaparinga River NP	**Adjoining Properties** Blewitt Springs	To the south-east of the NP	• B-zone (800 m) east of Old Quarry Track to reserve boundary and implement A-zones where houses are closer than 40 m • Old Quarry Track and Wine Dam Track to be upgraded to Standard Tracks and Wine Dam Track to be built up from the dam • Recommend to the Adelaide Mt Lofty Ranges BMC that adjacent property owners maintain defendable space around their assets as per CFS guidelines and consider whether these assets are designed to withstand a bushfire
	Onkaparinga River NP – whole of reserve		• Maintain existing water supplies within the reserve • Implement B-zone (800 m width) to the west of Porosa Track • Implement B-zone (1 km width) to the west of Baker Gully Track • C-zone burning to the east of the Baker Gully Track B-zone (Map 4) • Porosa and Sundew Tracks to be upgraded to Standard • Porosa Track requires delineation on private land near the Quarry • Baker Gully Track to be upgraded to Major with a 20 m slashed break • Implement B-zone (40 m) north of Chapel Hill Road incorporating a slashed zone up to 15 m wide abutting the internal track. Regular fuel reduction in the area adjacent to this track dominated by Rock Wattle (*Acacia rupicola*) is recommended to reduce the chance of fire impacting Hardy's Scrub. • Implement a B-zone (500 m maximum) between Gate 10 and 11, extending south to the creekline along the walking trail and Sundew Track • Revegetation adjacent to Gate 20 should be closely monitored and managed to avoid this area becoming a fire risk

	Values and Assets	Location	Recommended Works
Onkaparinga River RP	**Adjoining Properties** Seaford Meadows Old Noarlunga	To the south of the RP	• B-zone (40 m) along Pingle Farm Track and continuing south along the reserve boundary • B-zone (400 m) to the south of the airstrip • A-zones (40 m) behind houses on Railway Road where they are located less than 40 m from the reserve boundary • Recommend to the Adelaide Mt Lofty Ranges BMC that adjacent property owners maintain defendable space around their assets as per CFS guidelines and consider whether these assets are designed to withstand a bushfire
Onkaparinga River RP	**Adjoining Properties** Noarlunga Downs	To the east of the RP	• Implement A-zone (40 m from asset) where residences are less than 40 m from the reserve boundary • Recommend to the Adelaide Mt Lofty Ranges BMC that adjacent property owners maintain defendable space around their assets as per CFS guidelines and consider whether these assets are designed to withstand a bushfire
	Community Assets Noarlunga Model Aerosports Club South Coast Flying Club Pingle Farm ruins	Within the RP	• Implement A-zone (40 m) around buildings/ruins • Lessees should consider whether these assets are designed to withstand a bushfire
	Onkaparinga River RP – whole of reserve		• Liaise with Transport SA regarding access along and across the train line (due to Sauerbiers Road closure). This should be a Standard Track • Implement C-zone burn to the west of Sauerbiers Road (Map 4)
Porter Scrub CP	**Adjoining Community Assets** Pistol Club Maidment Road, Gumeracha	To the south-west of Porter Scrub Block	• Recommend to the Adelaide Mt Lofty Ranges BMC that the Pistol Club establish a minimum 40m A-zone to reduce risk to assets

	Values and Assets	Location	Recommended Works
	Porter Scrub CP – whole of reserve	Porter Scrub Block	• C-zone burning in the southern section of the reserve as shown on Map 4. • Upgrade north-south track to minor, closing one section. Investigate constructing a track along the northern boundary to meet Burfords Hill Road or formalise an agreement to access the reserve through private land. • Recommend to the Adelaide Mt Lofty Ranges BMC that council undertake reciprocal work along Maidment Road - maintain the roadside as A-zone.
Scott Creek CP	**Adjoining Properties** Bradbury Cherry Gardens Scott Creek	To the north of the reserve	• Implement A-zones (40 m from asset) where houses are closer than 40 m from the reserve boundary • B-zone (40 m) along part of the northern boundary (across Scott Creek Road) • Recommend to the Adelaide Mt Lofty Ranges BMC that adjacent property owners maintain defendable space around their assets as per CFS guidelines and consider whether these assets are designed to withstand a bushfire

	Values and Assets	Location	Recommended Works
	Adjoining Assets SA Water land (Mount Bold Reservoir Reserve) ForestrySA land Electranet land	To the south of the reserve	• B-zone (40 m) to be maintained north of Mount Bold Road • Recommend to SA Water that the B-zone (40 m) is reciprocated south of Mount Bold Road • Liaise with the Adelaide Mt Lofty Ranges BMC to encourage local government to fuel reduce roadside vegetation to meet Standard Track classification at a minimum and complement SA Water and DENR zoning along Mt Bold Road as well as Dorset Vale Road • C-zone burning for landscape protection between Shingleback Track, Neville Road and Mount Bold Road B-zone (Map 4) • Recommend to SA Water to implement burning for landscape protection from Mount Bold Road south to the powerline • Recommend to SA Water and Electranet via the Adelaide Mt Lofty Ranges BMC to maintain a B-zone (40 m) south of Frith Road • Investigate options with SA Water to maintain a B-zone west or east of Dorset Vale Road on SA Water land • Recommend to SA Water and Onkaparinga Council via the Adelaide Mt Lofty Ranges BMC to maintain Thorley Road as a Standard Track supported by a B-zone that continues along Track 14 to Dorset Vale Road.

	Values and Assets	Location	Recommended Works
Scott Creek CP	Scott Creek CP – whole of reserve		• Implement A-zone (40 m) around significant reserve assets • Maintain low fuel area to the west of Frith Road as a B-zone (300 m width) • Maintain low fuel area west of Scott Creek Road as B-zone (250 m width) and continue along Matthews Road to Gate 17 (80 m width) • C-zone burning between Bandicoot Track, Neville Road, Matthews Road and Stringybark Track (Map 4) • C-zone burning north of Almanda Track and east of Echidna Track (Map 4) • Bandicoot and Currawong Ridge Tracks to be upgraded to Standard Tracks (Currawong through to Neville Road) • Upgrade Neville Road to a Standard Track between Dorset Vale Road and Frith Road • Matthews Road to be maintained as Major Track • Upgrade Almanda Track to Standard from Gate 18 to 21 • Upgrade Greenhood Track to Standard from Thorley Road and continue this through to Almanda Track via the Quarry Ridge Track extension (unnamed) • Upgrade Quarry Ridge Track to Standard and liaise with SA Water to ensure access is maintained through their land
Totness RP	Totness RP – whole of reserve		• Recommend to Transport SA that fuels between reserve boundary and freeway maintained as a B-zone • Maintain southern boundary track (in southern section) to a Standard Track • Maintain dam as a fire water supply and investigate provision of water to southern parcel from dam

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

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	AMLR Status (Willson and Bignall, 2009)	MVS No	Reserve	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
Acacia longifolia var. *longifolia**	Sallow Wattle					FH MY MOL MG	Shrub	• Native to the eastern states • Disturbance, including fire, usually stimulates mass germination • Flowers: spring	• Post fire control works may be required	Aus^
Adiantum capillus-veneris	Dainty Maiden-hair		V	V			Fern	• Root suckering, resprouting species • Found growing among rocks, on ledges or cliffs close to water • Fire response is unknown • Observed regenerating after Ash Wednesday fire at Anstey Hill RP		SA^
*Asparagus asparagoides**	Bridal Creeper				26		Herb	• Weed of National Significance • Adults resprout following fire • Seeds viable for up to three years • Flowers: Aug to Sep		Aus^
Brachyscome diversifolia	Tall Daisy		E	E	8 9	SC	Herb	• Scott Creek CP supports the only known population in the MLR • Grows in dry, well drained soil • Flowers Oct to Feb • Fire response unknown		SA^
Caladenia behrii	Pink-lipped Spider-orchid	EN	E	E	8 9	SC	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	• Avoid inter-fire intervals < 5 years • Avoid burning from Apr to Nov	SA^

See Page 100 for a summary of codes used in Appendices

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	AMLR Status (Willson and Bignall, 2009)	MVS No	Reserve	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
Caladenia gladiolata	Bayonet Spider-orchid	EN	E	E	89	SC	Orchid	• The only known population in the MLR occurs in Scott Creek CP • Resprouting species • Emerges from tuber in Apr to Nov • Dormant over summer, likely to survive summer fires • Flowers freely without fire	• Avoid burning from Apr to Oct • Avoid burning only known population in Scott Creek CP	SA^
Caladenia rigida	White Spider-orchid	EN	E	E	89	SC	Orchid	• Resprouting species • Resprouts from underground tubers in Apr • Flowering & seed set occurs between Aug & Nov • Flowers profusely after summer fires • Flowering reduced by dense vegetation	• Avoid inter-fire intervals < 5 years • Avoid burning from Apr to Oct	SA^
Caleana major	Large Duck-orchid		V	V	89	MOL	Orchid	• Flowers: Sep to Oct • Known to regenerate after summer fires • Suppressed by dense understorey • Fire during May to Dec likely to be detrimental	• Avoid burning late Autumn through to early Summer	SA^
Calochilus cupreus	Copper Beard-orchid		E	E	89	AL	Orchid	• Resprouting species • Flowers: Sep to Nov • Dormant over summer, summer fires may increase flowering • Fires from Apr to Oct likely to be detrimental	• Avoid burning Autumn through to Spring • Avoid prescribed burning where populations are known to exist.	SA^
*Chrysanthemoides monilifera**	Boneseed					WS	Shrub	• Weed of National Significance • Lifespan: 10 to 20 years • Flowers: Jul to Oct • Fire kills adult plants • Seedlings readily recruit post-fire	• Post fire control works likely to be required • Refer to Brougham *et al.* (2006)	Aus^ SA^
Corybas expansus	Dune Helmet-orchid		V	E	89	AL FH	Orchid	• Resprouting species • Flowers in Jul to Aug • Fires in Apr to Sep likely to be detrimental	• Avoid inter-fire intervals less than 4 years • Avoid frequent & intense fire	SA^

See Page 100 for a summary of codes used in Appendices

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	AMLR Status (Willson and Bignall, 2009)	MVS No	Reserve	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
*Cytisus scoparius**	English Broom					WS	Shrub	• Establishes readily on disturbed sites • Seed regenerator • Germination is encouraged by fire • Primary juvenile period: 2 years • 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)) • Flowers: Oct to Dec	• Post fire control works likely to be required	SA^
Dampiera lanceolata var. *intermedia*	Aldinga Dampiera		E	E		AL	Shrub	• Found in Aldinga Scrub CP & on adjacent private land • Resprouts from rhizomes • Known to regenerate immediately post-fire • Limited seed set observed		SA^
Derwentia derwentiana ssp. *homalodonta*	Mt Lofty Speedwell	CE	E	E		SC	Shrub	• Highly restricted distribution in the MLR • Occurs in damp gullies & creeklines • Known to survive infrequent fires • Resprouter		SA^
Deyeuxia minor	Small Bent-grass		V			SC FH	Grass	• Little is known about the biology & ecology of this species		
Diuris behrii	Behr's Cowslip Orchid		V	V	89	SC CH WA	Orchid	• Flowers in September • Flowers freely without fire • Fires during Apr to Oct	• Avoid burning late Autumn through to early Spring	SA^
Diuris brevifolia	Short-leaf Donkey-orchid		E	E	89	SC	Orchid	• Prefers Summer to early Autumn burning • Intolerant of competition • Flowers & sets seed in Nov to Dec	• Avoid burning late Autumn through to early Spring	SA^
*Echium plantagineum**	Salvation Jane				826	AL MOL MY FH	Herb	• Declared under the SA *Natural Resources Management Act 2004* • Adults killed by fire • Seedlings readily recruit post-fire • Some seeds are killed by fire	• Post fire control works likely to be required	Aus^

See Page 100 for a summary of codes used in Appendices

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	AMLR Status (Willson and Bignall, 2009)	MVS No	Reserve	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
*Ehrharta calycina**	Perennial Veldt Grass					AL	Grass	• Commonly invades highly disturbed ecosystems • Often rhizomatous • Established plants re-sprout vigorously from the base of the tussock after drought and may provide some tolerance to fire • Reproduce both by seed and vegetatively • Regular burning may reduce invasiveness • Flowers: mainly Oct to Nov	• Post fire control works may be required • Effects if regular burning and the use of fire as part of integrated control programs requires further research	Aus^
*Erica arborea**	Tree Heath					WS	Shrub	• Well developed rootstock which reshoots after fire • Possible seedbank germination post-fire • Flowers: Jul to Oct	• Post fire control works may be required	Aus^ (Blood, 2001)
*Euphorbia terracina**	False Caper					AL	Herb	• Able to invade relatively undisturbed vegetation, although greatly enhanced by disturbance such as fire • Declared under the SA *Natural Resources Management Act 2004* • Plants are generally killed by fire, however some Resprouting following bushfire has been observed • Fire can cause mass germination of soil-stored seed • Flowering: Aug to Nov	• Post fire control works may be required	Aus^
Euphrasia collina ssp. *osbornii*	Osborn's Eyebright	EN	E	V		MON FH	Herb	• Known to regenerate post-fire		SA^
*Genista monspessulana**	Montpellier Broom					WS	Shrub	• Fire stimulates germination by breaking the dormancy of soil-stored seed • Declared under the SA *Natural Resources Management Act 2004* • Flowers: Spring	• Post fire control works may be required	

See Page 100 for a summary of codes used in Appendices

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	AMLR Status (Willson and Bignall, 2009)	MVS No	Reserve	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
Glycine latrobeana	Clover Glycine	VU	V	V		MG FH PO SC	Herb	• Flowers: Sep to May • Seed regenerator but also may spread from rhizomes • Known to germinate post-fire & have a strong fire response		SA^
Isolepis producta	Nutty Club-rush		V			SC MY	Rush	• Little is known about the biology & ecology of this species		
Juncus amabilis	Austral Rush		V	V		SC	Rush	• Little is known about the biology & ecology of this species		
Lagenophora gracilis	Slender Bottle-daisy		V	V		SC FH	Herb	• Little is known about the biology & ecology of this species		
Lazula flaccida	Pale Wood-rush		V	T		PO FH SC	Rush	• Little is known about the biology & ecology of this species		
*Marrubium vulgare**	Horehound					AL	Herb	• Declared under the SA *Natural Resources Management Act 2004* • Flowers: Sep to Mar • Adults killed by fire • Fire may reduce up to 80% of the seedbank • Seedlings readily recruit post-fire	• Post fire control works likely	Aus^
Mazus pumilio	Swamp Mazus		V	E		SC	Herb	• The only known population in the MLR occurs in Scott Creek CP • Occurs in swampy areas		
Montia fontana ssp. *chondrosperma*	Waterblinks		V	V		SC MY	Herb	• Little is known about the biology & ecology of this species		

See Page 100 for a summary of codes used in Appendices

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	AMLR Status (Willson and Bignall, 2009)	MVS No	Reserve	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
*Moraea flaccida**	One-leaf Cape Tulip						Herb	• Declared under the SA *Natural Resources Management Act 2004* • Reproduce through root corms that stay dormant in the soil until conditions are favourable • Requires 2 to 3 years to set seed • Seeds viable for 1 year • Fire can bring corms out of dormancy and stimulate flowering – after fire rain can stimulate corms • Flowering: Aug to Sep	• Post fire control works likely	SA^ Aus^
*Nassella leucotricha**	Texas Needle Grass					OR	Grass	• Declared under the SA *Natural Resources Management Act 2004* • Flowers Oct to Jan	• Post fire control works may be required • Investigation into the use of fire as part of an integrated control program may be warranted	(Davies, 2006)
Olea europaea ssp. *europaea**	European Olive				9	WS	Tree	• Declared under the SA *Natural Resources Management Act 2004* • Adults resprout following fire. • Juveniles < 1 m high are killed by low intensity fire • Flowers late spring • Seeds germinate in autumn. • Fruit: Berry - dispersed by birds	• Fire unlikely to increase spread. However control may be undertaken to reduce fuel loads	Aus^ SA^
Olearia pannosa ssp. *pannosa*	Silver Daisy-bush	VU	V	V		SC	Shrub	• Little is known about the biology & ecology of this species		
*Oxalis pes-caprae**	Soursob					WS	Herb	• Declared under the SA *Natural Resources Management Act 2004* • Spreads through bulbs in the soil • Generally survives fire • Flowers: Jun to Oct	• Fire not known to increase spread	Aus^
Phalaris spp.*	Phalaris					AL FH	Grass	• Flowers: Sep to Nov • Burning will stimulate germination	• Post fire control works may be required	Aus ^

See Page 100 for a summary of codes used in Appendices

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	AMLR Status (Willson and Bignall, 2009)	MVS No	Reserve	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
*Pinus halepensis**	Aleppo Pine					AL	Tree	• Seed regenerator • 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	• Post fire control works likely to be required	(Daskalakou and Thanos, 1996) SA^
*Pinus radiata**	Radiata Pine					WS	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 suppressing native plants	• 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 fitzgeraldii	Fitzgerald's Leek-orchid			E	89	SC OR	Orchid	• Little is known about the biology & ecology of this species		
Prasophyllum pallidum	Pale Leek-orchid	VU	R	V	89	SC OR	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 late Autumn through to late Spring	SA^
Prasophyllum sp. Enigma (*Prasophyllum goldsackii* var. *aenigmum*)	Contorted Leek-orchid		E		89	OR	Orchid	• Little is known about the biology & ecology of this species		
Pratia puberula	White-flower Matted Pratia		V	E		SC FH	Herb	• The only known population in the MLR occurs in Scott Creek CP • Occurs in swampy areas	• Avoid burning Scott Creek population	SA^

See Page 100 for a summary of codes used in Appendices

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	AMLR Status (Willson and Bignall, 2009)	MVS No	Reserve	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
Pterostylis cucullata	Leafy Greenhood	VU	E	E		SC FH	Orchid	• Resprouter • Flowers in Sep to Dec • Known to be fire sensitive with fires during Apr to Nov likely to be most detrimental • Occurred historically in Scott Creek CP. Likely to be extinct	• Avoid burning late Autumn through to late Spring	SA^
Pterostylis falcata			E			SC	Orchid	• Wetland species • Resprouter • Flowers in summer, requires open habitat to flower • Historical record in Scott Creek CP. Likely to be extinct.		SA^
Pterostylis sp. Sand plain	Little Stony Rufous-hood (Rufous Greenhood)		E		89	SC	Orchid	• Little is known about the biology & ecology of this species		
Rubus spp.*	Blackberry				89	WS	Shrub	• *Weed of National Significance* • 1 year to seed set • Readily resprouts following fire • Seeds distributed by birds	• Spread unlikely to be increased by fire	Aus^ SA^
*Senecio pterophorus**	African Daisy					WS	Herb	• Flowers: Dec to Feb • Burning will stimulate germination • Density of plants usually decreases naturally with time since fire		Aus^ SA^
Thelymitra ixiodes	Spotted Sun-orchid		E*			SC KS PO MY FH	Orchid	• Little is known about the biology & ecology of this species		

See Page 100 for a summary of codes used in Appendices

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	AMLR Status (Willson and Bignall, 2009)	MVS No	Reserve	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
*Ulex europaeus**	Gorse				8	WS	Shrub	• *Weed of National Significance* • 1 year to set seed • Soil stored seed, remains viable for up to 30 years • Germination of soil stored seed stimulated following fire • Plants long-lived to at least 29 years • Adult plants burn readily, but are not killed	• Post fire control works likely to be required	(Blood, 2001) (National Gorse Taskforce, 2006)
Veronica gracilis	Slender Speedwell		V			SC	Shrub	• Little is known about the biology & ecology of this species		
*Watsonia bulbillifera**	Bulbil Watsonia					WS	Herb	• Fire stimulated flowering • Flowers Oct-Dec • Seed and vegetative propagules	• Post fire control may be required	Aus^ (Robertson , 1994)

See Page 100 for a summary of codes used in Appendices

Appendix 3 – Fire Response of Rated and Significant Fauna Species

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	AMLR Status (Willson and Bignall, 2009)	MVS No	Reserve	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Amphibian	*Pseudophryne bibronii*	Brown Toadlet		R	V		MOL SC	I	• Site: beneath leaf litter in ephemeral streams or areas that are seasonally inundated with water • Season: Autumn	• Found in damp sites, sometimes in ephemeral streams, swamps or on the margins of dams & seasonally inundated waterways. • Occur beneath leaf litter, rocks & woody debris - may survive low intensity fires if sufficiently sheltered • Typically occur at low densities • Can occupy heavily modified habitats.	• Avoid fires that cause erosion & sedimentation of watercourses (including small, ephemeral watercourses).	SA^
Bird	*Botaurus poiciloptilus*	Australasian Bittern		V	V		OR AL			• Occurs in wetlands so unlikely to be impacted	• Avoid burning wetlands	SA^
Bird	*Cacomantis flabelliformis*	Fan-tailed Cuckoo			V		AL CH MOL MON MY OR SC TO FH	I	• Breeding linked to abundance of hosts (fairy-wrens & scrub-wrens)	• Impacts related to affects of fire on hosts (possible short term decline)	• Avoid burning in spring when hosts are nesting	SA^

See Page 100 for a summary of codes used in Appendices

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	AMLR Status (Willson and Bignall, 2009)	MVS No	Reserve	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Bird	*Calyptorhynchus funereus*	Yellow-tailed Black-Cockatoo		V	V	489	WS	G	• Sites: hollows high in canopy • Material: woodchips • Season: Nov-Mar	• Nomadic or locally migratory • Higher intensity fire can increase hollow loss • Favours Eucalypt woodland & pine plantations (Aleppo Pine) • Fire likely to impact the availability of food sources	• Minimise loss of hollows (avoid high intensity fire) • Minimise the loss of important feeding sites & critical habitat (including Aleppo Pine stands)	SA^
Bird	*Corcorax melanorhamphos*	White-winged Chough		R	V		CH KS MOL MG PO TO SC	IG	• Sites: horizontal branches • Material: mud & plant fibre • Season: Aug-Jan	• Feeds in open ground • Generally increases abundance post-fire		SA^
Bird	*Hylacola pyrrhopygia parkeri*	MLR Chestnut-rumped Heathwren	EN	E	V	49	KS MON SC FH	I	• 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	• >50% of habitat where populations are known to occur should not burn in a single fire event • Avoid fire regimes likely to permanently alter habitat structure	SA^
Bird	*Ixobrychus dubius*	Australian Little Bittern		E						• Occurs in wetlands so unlikely to be impacted	• Avoid burning wetlands	SA^

See Page 100 for a summary of codes used in Appendices

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	AMLR Status (Willson and Bignall, 2009)	MVS No	Reserve	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Bird	*Lathamus discolor*	Swift Parrot	EN	E						• Now vagrant to listed reserves		
Bird	*Melithreptus gularis*	Black-chinned Honeyeater		V	E		CH KS SC FH PO	I N	• Sites: high in canopy • Material: fragile cup of bark, hair, fur & wool • Season: Mainly Jul-Dec	• Prefers drier woodlands dominated by box Eucalypts, often with little understorey • Local movements associated with the flowering of food plants • Forages in the upper canopy • High intensity fire likely to impact nesting sites & food availability	• Avoid high intensity fire resulting in crown fire or canopy scorch	SA^
Bird	*Neophema chrysogaster*	Orange-bellied Parrot	CE	E	E			G	• Breeds in Tasmania	• Now vagrant to listed reserves		
Bird	*Neophema chrysostoma*	Blue-winged Parrot		V			OR AL	G	• Breeds south-east Australia and Tasmania	• Now vagrant to listed reserves		
Bird	*Petroica phoenicea*	Flame Robin		V			AL OR FH			• Now vagrant to listed reserves		
Bird	*Rallus pectoralis*	Lewin's Rail		V	V					• Occurs in wetlands so unlikely to be impacted		

See Page 100 for a summary of codes used in Appendices

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	AMLR Status (Willson and Bignall, 2009)	MVS No	Reserve	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Bird	*Stagonopleura bella*	Beautiful Firetail		R	E		SC AL OR	G	• Sites: within thick foliage of a bush or tree • Material: bottle shaped nest of grass and leaves • Season: Sept-Jan	• Considered *Locally Extinct* in the metropolitan area • Prefers habitat dominated by Sheoak and Tea-tree species • Sedentary to moderately mobile • High risk of population loss due to bushfire • Prefers swampy, marshy areas not far from water • Impacted by habitat fragmentation • Forages on the ground	• >50% of habitat patch should not burn in a single fire event	(Turner, 2001) Aus^
Bird	*Stagonopleura guttata*	Diamond Firetail		V	V		AL CH FH PO	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	• >50% of habitat where populations are known to occur should not burn in a single fire event	SA^

See Page 100 for a summary of codes used in Appendices

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	AMLR Status (Willson and Bignall, 2009)	MVS No	Reserve	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Bird	*Zoothera lunulata*	Bassian Thrush		R	V	4 8 26	KS MG TO FH SC PO	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	• Avoid extensive bushfires • Undertake patchy burns in riparian areas • Ensure post-fire weed control is undertaken to avoid habitat degradation • Avoid burning areas of *Callitris* spp.& *Exocarpos* spp.	SA^

See Page 100 for a summary of codes used in Appendices

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	AMLR Status (Willson and Bignall, 2009)	MVS No	Reserve	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Butterfly	*Hesperilla flavescens flavia*	Yellow Sedge-skipper						H	• Sites: Eggs laid on the underside of a Thatching Grass leaf, close to the ground. • Material: Thatching Grass • Season: Spring & Autumn	• Considered Endangered by CCSA • Local extinction of a population could occur if a fire impacts on preferred food species • Younger Thatching Grass (*Gahnia filum*) growth is preferred by the butterflies	• Avoid burning habitat where populations are known to occur • Avoid backburning, machinery use & the use of retardants in potential habitat • Small fires promote regeneration of Thatching Grass. • Prescribed burning to occur between Apr to Aug. • >50% of a potential habitat patch should not be burnt in one year & ensure a >5 year interval before burning remaining area.	(Coleman and Coleman, 2000) SA^
Fish	*Galaxias brevipinnis*	Climbing Galaxias			V		OR SC	I	• Aquatic	• Occur in mid to upper catchments in deeper, cool pools that are often spring fed & have high levels of cover (rock) surrounded by riparian vegetation. • Migratory		(Hammer, *et al.*, 2007)

See Page 100 for a summary of codes used in Appendices

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	AMLR Status (Willson and Bignall, 2009)	MVS No	Reserve	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Fish	*Galaxias olidus*	Mountain Galaxias			V		OR MON SC	I	• Aquatic	• Threatened by increased silt loads & reduced shade.		(Hammer, *et al.*, 2007)
Mammal	*Antechinus flavipes*	Yellow-footed Antechinus		V			KS MOL MON SC MG FH	C I N	• Highly restricted seasonal breeding season (late Spring) • Often nest in tree hollows & in *Xanthorrhoea* skirts	• 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.	• Reduce the likelihood of extensive bushfires • Conduct patchy burns where possible to provide shelter & reduce post-fire predation • Minimise the loss of large woody debris	SA^
Mammal	*Cercartetus concinnus*	Western Pygmy-possum			V		FH	I N	• Sites: leaf lined nests often in tree hollows or *Xanthorrhoea* • Season: year round.	• Occurs in heathlands, shrublands & dry forests with a heathy understorey • Forages on the ground & in trees • High intensity fire may result in hollow loss (particularly hollows in dead wood which are often utilised) • Fire is likely to reduce the availability of nectar & pollen resources • Occupy small home ranges	• Minimise the risk of extensive bushfire • Avoid fire regimes that reduce tree hollow availability • In critical habitat consider patchy burns or restricting the size of prescribed burns	SA^

See Page 100 for a summary of codes used in Appendices

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	AMLR Status (Willson and Bignall, 2009)	MVS No	Reserve	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Mammal	*Isoodon obesulus obesulus*	Southern Brown Bandicoot	EN	V	V	89	MOL SC MG WA	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 per se	• Mosaic of post-fire vegetation is desirable (diversity & structure) • Avoid inter-fire intervals< 7 years • Some inter-fire intervals > 15 years desirable	SA^
Reptile	*Austrelaps labialis*	Pygmy Copperhead			V		FH MG	C I	• Season: mating probably occurs in Autumn	• Requires moist habitats (but not necessarily standing water) with a combination of dense vegetation cover & open areas. • Distribution probably climatically restricted by net precipitation • Forages primarily on small skinks • Will shelter under rocks & woody debris	• Reduce the likelihood of extensive bushfires • Conduct patchy burns where possible to provide shelter & reduce post-fire predation • Minimise the loss of large woody debris • Undertake burns under mild to warm conditions when snakes are active & may avoid fire	SA^

See Page 100 for a summary of codes used in Appendices

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	AMLR Status (Willson and Bignall, 2009)	MVS No	Reserve	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Reptile	*Egernia cunninghami*	Cunningham's Skink		E	V	89	OR	IH	• 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				• 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 extensive bushfires • Avoid Spring burns in known habitat where possible to prevent exacerbating predation pressure on hatchlings • Patchy burns may reduce post-fire predation	SA^

See Page 100 for a summary of codes used in Appendices

Appendix 4 – Ecological Communities of Conservation Significance

Ecological Community	SA Status (DEH, 2005a)	Other Status comments	Occurrence	Components	Fire Response	Ecological Fire Mgt Guidelines	Source
Grey Box (*Eucalyptus microcarpa*) **Grassy Woodland**	E	• Listed as *Endangered* under the EPBC Act • *Very High Priority* threatened community in the AMLR (Willson and Bignall, 2009)	• Occurs on the southern foothills & hill slopes of the Mount Lofty Ranges • Eastern end of the gorge in Onkaparinga River NP	• Over Drooping Sheoak (*Allocasuarina verticillata*) & Dryland Tea-tree (*Melaleuca lanceolata*)	• Considered to be *Highly* threatened by inappropriate fire regimes (Willson and Bignall, 2009) • Most remnants are infested with woody weeds contributing to fire risk	• Avoid burning entire remnants during a single fire event • Aim to increase patchiness within the remnants • Implement ecological /experimental burns as part of an integrated weed management strategy • Implement ecological/ experimental burns to determine the response of the community to various fire regimes	SA^ (Turner, 2001)
Kangaroo Grass (*Themeda triandra*) +/- *Danthonia* spp. **Tussock Grassland**	E	• *Very High Priority* threatened community in the AMLR (Willson and Bignall, 2009)	• Occurs on heavy, fertile soils of plains & hill slopes		• Considered to be *Highly* threatened by inappropriate fire regimes (Willson and Bignall, 2009) • Inappropriate fire regime may stimulate weed invasion • May be threatened by a lack of fire	• Burning established populations every 2-3 years strengthens sward and depletes soil nitrogen levels, allowing Themeda to outcompete introduced pasture species.	SA^
Mallee Box (*E. porosa*) **Woodland**	"Of Conservation Concern"		• Usually found on heavy soils over limestone in large shallow depressions • 16 ha in Aldinga Scrub CP	• Over Golden Wattle (*Acacia pycnantha*), Wreath Wattle (*A. acinacea*), Umbrella Bush (*A. ligulata*), Kangaroo Thorn (*Acacia paradoxa*) & smaller shrubs. • Sometimes in association with Native Apricot (*Pittosporum phylliraeoides*)	• Considered to be *Highly* threatened by inappropriate fire regimes (Willson and Bignall, 2009)	• Avoid burning entire remnants during a single fire event	SA^ (Turner, 2001)

See Page 100 for a summary of codes used in Appendices

Ecological Community	SA Status (DEH, 2005a)	Other Status comments	Occurrence	Components	Fire Response	Ecological Fire Mgt Guidelines	Source
Mountain (Candlebark) Gum (*Eucalyptus dalrympleana* ssp. *dalrympleana*) **Open Forest**	E	• *Very High Priority* threatened community in the AMLR (Willson and Bignall, 2009)	• Occurs in the wetter, colder valleys on fertile soils between Mylor & Gumeracha • Charleston, Mark Oliphant, Montacute, Mt George, Mylor , Kenneth Stirling & Porter Scrub CPs & Totness RP	• Over Bracken (*Pteridium esculentum*), Myrtle Wattle (*Acacia myrtifolia*), Prickly Tea-tree (*Leptospermum continentale*), Wallaby Grass (*Danthonia* spp.), Kangaroo Grass (*Themeda triandra*) & exotics	• Inappropriate fire regimes considered a *Low* threat to this community (Willson and Bignall, 2009) • Remnants are infested with weeds contributing to fire risk • Potential changes in fire regimes may be restricting natural regeneration	• Avoid burning entire remnants during a single fire event • Avoid burning remnants at intervals of less than 10 years	SA^ (Turner, 2001)
Silky Tea-tree (*Leptospermum lanigerum*) **Prickly Tea-tree** (*L. continentale*) **Closed Heath**	E		• In swamps & creeklines with permanent water • Onkaparinga River NP & Scott Creek CP		• Considered to be *Moderately* threatened by inappropriate fire regimes (Willson and Bignall, 2009) • Some remnants are infested with weedy species such as Blackberry contributing to fire risk • Silky Tea-tree known to resprout after fire in Victoria; no records of response in SA.	• Avoid burning remnants during a single fire event • Avoid burning remnants at intervals of less than 10 years	SA^

See Page 100 for a summary of codes used in Appendices

Ecological Community	SA Status (DEH, 2005a)	Other Status comments	Occurrence	Components	Fire Response	Ecological Fire Mgt Guidelines	Source
Silver Banksia (*Banksia marginata*) **Grassy Low Woodland**	E	• *Very High Priority* threatened community in the AMLR (Willson and 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 • Charleston CP	• In the Mount Lofty Ranges it is found in association with Hop Bush (*Dodonaea viscosa*) or Drooping Sheoak (*Allocasuarina verticillata*)	• Considered to be *Highly* threatened by inappropriate fire regimes (Willson and Bignall, 2009) • Remnants are small & 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	• Avoid burning entire remnants during a single fire event • Avoid burning remnants at intervals of less than 10 years • Determine fire response at MLR sites	SA^ (Turner, 2001)

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10.1 Summary of Codes Used in Appendices

Reserve Codes

CODE	BLOCK	CODE	BLOCK
AL	Aldinga Block	MY	Mylor Block
BU	Burdett Scrub Block	OR	Onkaparinga River Block
CH	Charleston Block	PO	Porter Scrub
FH	Filsell Hill Block	SC	Scott Creek Block
KS	Kenneth Stirling CP (Filsell Hill, Burdett, Wotton and Whites Scrub Blocks)	TO	Totness Block
MOL	Mark Oliphant Block	WA	Wotton Scrub Block
MS	Moana Sands Block	WH	Whites Scrub Block
MON	Montacute Block	WS	Species is widespread
MG	Mount George Block		

Other Codes Used

NPW ACT STATUS	
E	Endangered
V	Vulnerable
R	Rare

EPBC ACT STATUS	
EX	Extinct
CE	Critically Endangered
EN	Endangered
VU	Vulnerable

DIET OF RATED FAUNA SPECIES	
C	Carnivore or scavenger. Mainly vertebrates
H	Herbivore. Includes folivores, grazers & browsers
N	Nectar feeder
I	Insectivore/"arthropodivore"/omnivore
G	Granivore. Typically peak in abundance after a fire event in fire adapted vegetation, due to the stimulation of flowering and subsequent seed set.

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

FIRE RESPONSE SOURCE	
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 ACRONYMS AND FIRE MANAGEMENT TERMINOLOGY

TERM	DEFINITION
Backburn(ing)	A fire started intentionally along the inner edge of a control line to consume the fuel in the path of a bushfire.
Bark fuel	The flammable bark on tree trunks and upper branches (DEH, 2006e).
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)
Bulk Water Carrier	A large tanker used for replenishing firefighting appliances with water.
Bushfire	An unplanned fire. A generic term that includes grass fires, forest fires and scrub fires.
Bushfire Management Committee (BMC)	Bushfire Management Committees are responsible for the governance, planning and coordination of fire prevention work for Bushfire Management Areas. Responsible for the development of Bushfire Risk Management Plans. A total of 9 Bushfire Management Committees exist across the state, reporting to a central State Bushfire Coordination Committee.
Bushfire Risk Management Plan	Replaces a Bushfire Prevention Plan. Developed by Bushfire Management Committees as a requirement under the *Fire and Emergency Services Act 2005*.
Bushfire Survival Plan	Also known as a Bushfire Action Plan. A pre-prepared plan developed by people who live, visit or work in a bushfire prone area encompassing the decision to either "Leave Early" or to "Stay and Defend" to ensure that they are prepared and know what to do in the event of a bushfire (CFS, 2009c).
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 (DEH, 2006e).
CFS	The South Australian Country Fire Service.
Control line	A natural or constructed barrier, or treated fire edge, used in fire suppression and prescribed burning to limit the spread of fire.
CP	Conservation Park
DEH	The South Australian Department for Environment and Heritage. Recently renamed as the Department of Environment and Natural Resources
DENR	The South Australian Department of Environment and Natural Resources. Former Department for Environment and Heritage.
Direct attack	A method of bushfire attack where wet or dry firefighting techniques are used. It involves suppression action right on the fire edge, which becomes the control line.
DBPC	District Bushfire Prevention Committee. These Committees have been replaced by Bushfire Management Committees due to recent changes to the

TERM	DEFINITION
	Fire and Emergency Services Act 2005.
EAT	DENR Environmental Assessment Table. Completed for all prescribed burns (as part of the Prescribed Burn Plan) and other fire management works where native vegetation is being cleared and is not exempt under the *Native Vegetation Act 1991* (DEH, 2004b).
Ecological Fire Management	The active use of fire in nominated areas to achieve specified ecological objectives.
Elevated fuel	Shrubs and juvenile understorey plants up to 3 m in height (DEH, 2006e)
EPBC Act	The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
FDI	Fire Danger Index. Calculated using a combination of temperature, relative humidity, wind speed, vegetation and drought factors (CFS, 2009a)
Fire behaviour	The manner in which a fire reacts to the variables of fuel, weather and topography.
Firebreak	An area or strip of land where vegetation has been removed or modified to reduce the risk of fires starting and reduce the intensity and rate of spread of fires that may occur (GAFLC, 2005).
Fire danger	The combination of all factors, which determine whether fires start, spread and do damage, and whether and to what extent they can be controlled.
Fire 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 is determined using the Fire Danger Index (FDI) (CFS, 2009a)
Fire frequency	The number of fires that have occurred on the same area over a time period.
Fire intensity	The rate of energy or heat release per unit time per unit length of fire front, usually expressed in kilowatts per metre (kw/m) (Pausas, et al., 2003)
Fire interval	The interval between successive fires.
Fire management	All activities associated with the management of fire-prone land, including the use of fire to meet land management goals and objectives.
Fire regime	The history of fire in a particular vegetation type or area including the fire frequency, interval, intensity, extent and seasonality of burning (Brooks, et al., 2004).
Fire season	The period(s) of the year during which fires are likely to occur, spread and do sufficient damage to warrant organised fire control.
Fire severity	The effect of fire on an ecosystem, that is, on living plants, as well as on the amount and location of organic matter consumed during a fire (Pausas, et al., 2003)
Fire suppression	The activities connected with restricting the spread of bushfire following its detection and making it safe.

TERM	DEFINITION
ForestrySA	The South Australian Government's forest management agency.
Fuel	Any material such as grass, leaf litter and live vegetation, which can be ignited and sustains a fire. Fuel is usually measured in tonnes per hectare.
Fuel hazard	The overall fuel hazard is defined as the sum of the influences of bark fuel, elevated fuel and surface fine fuel (DEH, 2006e).
Fuel management	Modification of fuels by prescribed burning, or other means.
GAFLC	South Australian Government Agencies Fire Liaison Committee.
Heritage Agreement	Private conservation areas established through an agreement between the SA Minister for Environment and Conservation and the landholder under the *Native Vegetation Act 1991*.
Incident Controller (IC)	The individual responsible for the management of all incident operations and IMT.
Incident Management Team (IMT)	Incident Management Team. The group of incident management personnel comprising the IC and the people he/she appoints to be responsible for the functions of Operations, Planning and Logistics.
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.
Life history	The combination of attributes with respect to growth, shelter, food/nutrients and reproduction which determine species' requirements for existence (FEWG, 2004).
Major Track	A track designed, constructed and maintained for the safe passage of firefighting vehicles undertaking fire management activities. Track shall be a minimum of 7 metres wide and sufficiently clear of vegetation both sides and overhead to allow ready two-way access (GAFLC, 2008).
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.
MFS	South Australian Metropolitan Fire Service.
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 (GAFLC, 2008).
MIST	Minimum Impact Suppression Techniques. Achieving fire management objectives using methods that are consistent with land and resource management objectives. When determining an appropriate suppression response, consideration will be given to undertaking suppression with greater sensitivity and the long-term effects (WFLLC, 2003).
MLR	Mount Lofty Ranges.

TERM	DEFINITION
Near-surface fuel	Grasses, low shrubs and heath, sometimes containing suspended components (leaves, bark and/or twigs).
NP	National Park
NPW Act	The South Australian National Parks and Wildlife Act 1972.
NVC	Native Vegetation Council. Established under the provisions of the Native Vegetation Act 1991, responsible for making decisions on a wide range of matters concerning native vegetation in SA (DWLBC, 2006b).
Of conservation significance	In this plan, used to describe important or rated populations or species of flora and fauna as well as vegetation communities. See Section 3.7.4
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 Burn Plan	The plan, which is approved for the conduct of prescribed burning. It contains a map identifying the area to be burnt and incorporates the specifications and conditions under which the operation is to be conducted.
Prescribed burning	The controlled application of fire under specified environmental conditions to a predetermined area and at the time, intensity, and rate of spread required to attain planned resource management objectives.
Response plan	A plan detailing the response for a risk or an area including the type and number of resources.
Retardant	A chemical generally mixed with water, designed to retard combustion by chemical or physical action. It is usually applied by aircraft but may be applied from tankers at the fire edge.
Risk assessment	Used in DENR fire planning to assist in evaluating the threat to life, property and environmental assets posed by bushfire and also to aid in developing strategies and works for risk mitigation. Considers Likelihood and Consequence to determine an overall risk rating through a matrix (DEH, 2009d)
RP	Recreation Park
SA Water	South Australian Water Corporation.
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 (GAFLC, 2008).
sp.	Species
Spotting	The ignition of spot fires from sparks or embers.
spp.	Species (plural)

TERM	DEFINITION
ssp.	Subspecies
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 (GAFLC, 2008).
Surface fuel	Otherwise known as 'litter'. Comprised of leaves, twigs and bark on the ground (DEH, 2006e)
Total Fire Ban	A ban on lighting and maintaining of a fire in the open, which can be invoked at any time during the year. When invoked, the Total Fire Ban is imposed for a period of 24 hours (from midnight to midnight) but may also be imposed for part of a day or days (Country Fire Service Regulations, 2003).
TPC	The Threshold of Potential Concern is defined as a point in time where Key Fire Response Species are likely to be affected by an aspect of fire regime.
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 *DENR Fire Glossary* (2005c) or the *AFAC Knowledge Web Wildfire Glossary* (2010)

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