Fire Management Plan

Flinders Chase Fire Management Plan

2009-2014

Incorporating Flinders Chase National Park, Ravine des Casoars Wilderness Protection Area, Cape Bouguer Wilderness Protection Area and Kelly Hill Conservation Park

Department
for Environment
and Heritage

Government
of South Australia

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Government of South Australia
Department for Environment and Heritage

EXECUTIVE SUMMARY

This Fire Management Plan for Flinders Chase includes four Department for Environment and Heritage (DEH) reserves: Flinders Chase National Park (NP), Ravine des Casoars Wilderness Protection Area (WPA), Cape Bouguer WPA and Kelly Hill Conservation Park (CP) as well as dedicated Crown land, Crown land under the care and control of the Minister for Environment and Conservation and participating Heritage Agreements. This plan has been developed to provide direction for fire management activities, through the inclusion of strategies for risk minimisation and bushfire suppression considerations within the planning area. 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 landscape. It is important to note that there will be a transitional stage where the management strategies and works proposed in the plan are implemented and this implementation will be dependant upon fire management priorities and the allocation of regional resources.

This plan is the outcome of an internal review process that was undertaken by the Department, after it was identified that a revision of the previous Flinders Chase Fire Management Plan (DEH, 2003b) was required due to the extensive bushfires in December 2007. The review has provided the opportunity to consider and address altered risks to life, property and the environment using recently developed policies, procedures and standards for fire management planning.

The reserves included within this Fire Management Plan were identified as a priority for fire management planning within the DEH Kangaroo Island (KI) Region in order to:

- provide for the protection of significant built and natural assets within and adjacent to DEH managed land
- provide for the protection of and to increase our knowledge of fire regimes required by species populations, fauna and flora communities and ecosystems of conservation significance (some of which are unique to the plan area)
- identify issues for visitor management
- minimise the potential for lightning caused fire ignitions, especially on the lateritic plateau, to build into landscape scale bushfires
- advocate for the pro-active management of ecosystems at a landscape level as well as individual species using fire as a management tool
- provide for landscape protection of the included lands, to reduce the likelihood of a whole reserve/block or multiple reserves and adjacent lands burning in a single fire event.

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

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

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

- Fuel reduction:
  - in Asset and Buffer Zones using a variety of methods, including prescribed burning and mechanical removal
  - in strategic areas within the Conservation-Land Management Zone to provide some landscape protection within the planning area and increase patchiness within the vegetation (to reduce the possibility of a block or reserve burning in a single fire event)
  - to complement strategies to manage species' habitats.
- Alteration and/or upgrade of fire access points and track classifications to increase the:
  - safety of firefighting personnel involved in a fire suppression effort
  - response time of fire suppression agencies
  - type of resources that can safely be deployed to assist in a fire suppression effort.
- Identification of suppression considerations that may assist bushfire suppression operations to contribute to improved fire management.

The Kangaroo Island community and Country Fire Service (CFS) volunteers have contributed an enormous amount of time, energy and resources to fire suppression on Kangaroo Island 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 risk mitigation works around their own assets to complement the work to be undertaken by DEH.

Public comment was invited during the initial stages of the internal review process, for four weeks over July and August 2008. The written submissions were evaluated and incorporated where considered appropriate. A major review of this plan will occur after five years of implementation (or earlier if required) when the Cape Forbin Integrated Fire Management Plan and this plan will be combined into a single DEH Fire Management Plan.

CONTENTS

List of Figures

List of Tables

List of Maps

1 SCOPE AND PURPOSE

A Fire Management Plan for Flinders Chase National Park and Ravine des Casoars Wilderness Protection Area was developed in 2003 and adopted for implementation over a period of five years, from 2004 to 2009. Following the extensive bushfires in 2007, the Department for Environment and Heritage and the community identified a need and opportunity to review the 2003 plan in order to evaluate its effectiveness, address altered risks and incorporate recently developed policies, procedures and standards.

This plan is the product of the internal review process which was completed in 2008. The intention of this plan is to provide a strategic framework for fire management activities in DEH Kangaroo Island Region reserves including: Flinders Chase NP, Ravine des Casoars WPA, Cape Bouguer WPA and Kelly Hill CP (Map 1). The plan defines objectives for ecological fire management and the protection of life and property, particularly in relation to visitors and adjacent landholders. Strategies and works are suggested, in order to allow 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.

These reserves were identified for fire management planning due to a number of factors.

- The existence of built and natural assets within and adjacent to the reserves.
- The occurrence of species populations, fauna and flora communities and ecosystems of conservation significance within the plan area.
- High visitor numbers, particularly during the fire season.
- The likelihood of lightning caused fire ignitions, especially on the lateritic plateau.
- The use of fire as a management tool.
- The high bushfire potential of the Flinders Chase area.

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 DEH managed land
- 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 Response Plans for DEH managed land, which provide specific operational information useful in the early stages of an incident.

Operational works outlined in this plan will be implemented in a staged manner depending on available resources. These works will be facilitated through the DEH Kangaroo Island Region in liaison with Regional Fire Management. Neighbouring lands including Crown land dedicated as a reserve to the Kangaroo Island Council, Crown land under the care and control of the Minister for Environment and Conservation and participating Heritage Agreements have been included in the plan. Other adjoining lands are considered, but only in the context of works required to minimise the threat from external fires and the risk to private assets from fires originating in the planning area. However, DEH will support and complement landscape scale fire planning for these adjoining lands. Fire management planning for these lands is the responsibility of the Kangaroo Island District Bushfire

Prevention Committee (DBPC), in accordance with the requirements of the *Fire and Emergency Services Act 2005*. DEH is represented on these committees, along with Local Government and the CFS.

In recent years DEH has reviewed and updated fire management planning to appropriately 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 DEH managed land are as follows.

General Objectives for Fire Management

- To provide for the protection of human life and property during bushfire events.
- To ensure that sound conservation and land management principles are applied to fire management activities (where information is available on species, habitat, cultural and built heritage, then it will be taken into account during fire suppression activities and when completing works for risk mitigation).
- To apply an adaptive management approach to fire management supported by contemporary research.
- To provide for the strategic containment of bushfires (e.g. to minimise the likelihood of a fire entering/exiting a DEH managed land).
- To complement Bushfire Prevention Plans.
- To undertake bushfire suppression activities in a safe and professional manner.
- To establish and maintain perimeter access.
- To manage fire regimes to ensure consistency with the fire management guidelines in Conservation-Land Management Zones (see Section 5.3.6).

The fire management objectives that apply specifically to the Flinders Chase planning area are as follows.

Objectives for Fire Management in the Flinders Chase Planning Area

- To reduce the impact of bushfire in the planning area by:
  - minimising the likelihood of a reserve burning in its entirety in a single fire event
  - minimising the likelihood of multiple reserves and adjacent lands burning in a landscape scale fire.
- To improve the defendability of significant built assets within the reserves including the Rocky River Visitor Centre precinct.
- To maintain wilderness quality within Ravine des Casoars and Cape Bouguer Wilderness Protection Areas by minimising impact of fire management activities.
- To maintain Flinders Chase National Park as an area of national significance by

Objectives for Fire Management in the Flinders Chase Planning Area

minimising the likelihood of bushfire impacting on the natural features of the reserve, wildlife and recreational values.

- To reduce the likelihood of bushfire impacting the natural and historic features of Kelly Hill Conservation Park.
- To improve knowledge of how species populations, flora and fauna communities and ecosystems respond to fire, by filling gaps in knowledge and contributing new information and concepts to the adaptive management process.
- To maintain or improve the viability of species populations, flora and fauna communities and ecosystems on DEH managed land by:
  - reducing the likelihood of fire suppression operations impacting upon the viability of species populations, flora and fauna communities and ecosystems
  - reducing the likelihood of contiguous remnants of significant ecological communities burning in their entirety during a single fire event
  - creating a mosaic of areas with a range of different times since last fire, to benefit a range of species populations, flora and fauna communities and ecosystems.
- 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:
  - preparing response actions that consider 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 DEH Policy
  - using the functions, roles and responsibilities of the Australasian Interagency Incident Management System (AIIMS) as per the Chief Officers Standing Orders (COSO) #1 (CFS, 2007a).

2 THE PLANNING FRAMEWORK

The policy and planning framework for fire management on DEH managed land is shown in Figure 1 (below). Reserve Management Plans provide the overarching strategy for all management activities on 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 DEH managed land in accordance with 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 5 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. Response Plans provide a greater level of detail in regards to fire suppression. Response Plans are used in the early stages of an incident and are reviewed annually to ensure currency.

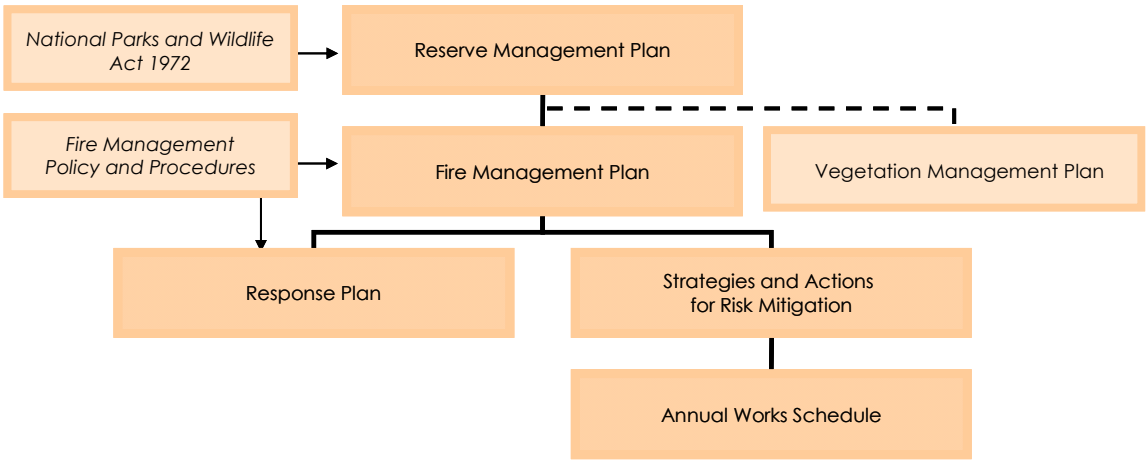

FIGURE 1 – THE PLANNING FRAMEWORK

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 the *Wilderness Protection Act 1992,* DEH 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.

Underlying the *Wilderness Protection Act 1992* is a Wilderness Code of Management (DEH, 2004a) (Appendix 2) that includes requirements for fire, emergency and essential management operations in wilderness areas. This plan has taken the Wilderness Code of Management into account in developing strategies for fire management for both Ravine des Casoars and Cape Bouguer Wilderness Protection Areas.

DEH 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 DEH by the Native Vegetation Council (NVC).

The *Crown Lands Management Act 2009* repeals the *Crown Lands Act 1929*. Under the *Crown Lands Management Act 2009* Crown land is described as either:

- dedicated Crown land (land that has been dedicated as a reserve for a specified purpose to a Minister, person or body (including local government or community groups)). For the purpose of this plan any dedicated Crown land will be known as a 'Crown land reserve'.
- Crown leasehold land
- Crown land owned by, or under the control of the Minister for Environment and Conservation
- unalienated Crown land (land that has not been alienated from the Crown, not including those as defined above).

DEH has responsibilities for fire management on unalienated Crown land and any Crown land owned by, dedicated as a reserve to 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 Crown land reserves dedicated to another government Minister, person or body.

The South Australian *Fire and Emergency Services Act 2005* outlines the responsibilities of DEH and other fire authorities in relation to fire management within proclaimed reserves. Under this Act, the Chief Officer (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.

All landholders are obliged to comply with the *Fire and Emergency Services Act 2005*, which outlines responsibilities for fire preparedness. DEH will implement works for fire management on DEH managed lands within the planning area; however adjoining landholders are also required to implement works on their own property to minimise the threat of fire. Note that the *Fire and Emergency Services Act 2005* is currently under review. Changes to the Act have been recommended within the Ministerial Review of Bushfire Management in South Australia (Monterola, 2007) report.

2.2 Policies and Procedures

2.2.1 DEH Fire Management Policy

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

Under this Policy, DEH is responsible for:

- fire management on reserves dedicated under the *National Parks and Wildlife Act 1972* or *Wilderness Protection Act 1992*
- fire management on any land under the *Crown Lands Management Act 2009* where the Minister for Environment and Conservation has fire management responsibilities (as defined within Section 2.1.2)

- fire suppression on other government lands where DEH have entered into a Memorandum of Understanding (MOU) or Heads of Agency Agreement (HOAA) with other government agencies.

The Policy states that DEH 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 DEH managed land for reducing fuel hazard to protect life, property and biodiversity values, and for ecological management.

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 ecological management and fuel reduction purposes.

2.2.2 Policies and Procedures for Fire Management Planning

DEH has a Policy that outlines the zoning standard that is used for fire management planning on DEH managed lands (DEH, 2008d). Zoning is derived from:

- the level of perceived risk, using the *Policy and Procedure for Risk Assessment in DEH Fire Planning* (DEH, 2008e)
- the overall fuel hazard, which is assessed using the *Overall Fuel Hazard Guide for South Australia* (DEH, 2006e), in accordance with the *Policy and Procedure for Fuel Hazard Assessment* (DEH, 2008f)
- 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-Land Management Zone (CLM-zone) and these are applied according to landscape objectives. A- and B-zones are determined by fuel management objectives whereas CLM-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 DEH Fire* Planning (DEH, 2008d).

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.

- *DEH Fire Management Policy* (DEH, 2009a)
- Those contained within the *DEH Fire Policy and Procedure Manual* (DEH, 2008k)
- CFS Chief Officer Standing Orders (COSOs)
- CFS Standard Operating Procedures (SOPs)
- CFS Operations Management Guidelines (OMGs)

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

2.3 Planning for DEH 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 principal 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 DEH responsibilities for managing fire in the reserve system in accordance with the *DEH Fire Management Policy*
- identify the requirement for a Fire Management Plan based on the nature of any fire-related issues.

A reserve management plan has been developed for all of the reserves in the Flinders Chase planning area (DEHAA, 1999). The plan outlines the following strategies for fire management.

- Fire management plans will be prepared for each reserve in consultation with the Kangaroo Island District Bushfire Prevention Committee and the CFS.
- Fire management plans will incorporate fire management zones, which identify and define areas of environmental significance, built assets and areas of high visitation, which require specific management objectives and prescriptions
- Research will be undertaken into the effects of fire on all ecosystems within the reserves including benchmark biological surveys and ongoing monitoring. Wherever possible research will be undertaken in a consultative manner on a regional basis. The results of this research will be used to guide future management planning.
- Fire management will be based on continuing research into the fire history of the area, the relationships between fire and the natural communities occurring within the area and consistent with the maintenance of biological diversity.
- Fire management will include the restoration and rehabilitation of areas adversely impacted as a result of fire or fire suppression activities.

The objectives and strategies in this Fire Management Plan are consistent with these five strategies from the reserve management plan.

2.3.2 Fire Management Plans

The *Cape Forbin Integrated Fire Management Plan* (DEH, 2009b) has been prepared by DEH in partnership with KI Council, KI District Bushfire Prevention Committee, KI NRM Board and the CFS for the north western section of Kangaroo Island. The integrated plan incorporates all land tenures to the north of the Flinders Chase planning area (i.e. north of the Playford Highway) and includes Cape Torrens and Western River Wilderness Protection Areas. The *Cape Forbin Integrated Fire Management Plan* supersedes the 'Western River Block' and the 'Cape Torrens Block' section of the previous Flinders Chase Fire Management Plan (DEH, 2003b); therefore these reserves will not be incorporated in this 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 DEH managed land depending on resource availability. Vegetation Management Plans have not been prepared for any of the reserves included in this Fire Management Plan.

Vegetation Management Plans prepared for any of the reserves in the planning area in the future should take the zoning and strategies within this Fire Management Plan into consideration when designating sites for revegetation. Any revegetation should be planned in conjunction with the relevant District Ranger and in consultation with the Regional Fire Management Officer.

2.4 Local and Regional Environmental Planning

The following documents provide management direction for the biodiversity of the Flinders Chase planning area and adjoining lands.

- *Biodiversity Plan for Kangaroo Island, South Australia* (Willoughby*, et al.*, 2001).
- *Draft Kangaroo Island Natural Resources Management Plan 2009* (KI NRM Board, 2008).

The fire management planning objectives, strategies and works outlined in this plan were developed with careful consideration given to providing for the maintenance of ecological integrity. This Fire Management Plan is consistent with the objectives outlined in these local and regional environmental plans. The recommendations of these plans are described in more detail below.

2.4.1 Biodiversity Plan

The *Biodiversity Plan for Kangaroo Island* is one of several biodiversity plans developed by DEH (Willoughby*, et al.*, 2001). The Biodiversity Plan was written to guide the conservation, management and rehabilitation or habitats at a regional level.

The plan identifies the Gosse Plateau at the western end of Kangaroo Island as a 'large remnant area of conservation significance' and lists 'inappropriate fire regime' as a major threat to biodiversity. It recommends working towards increasing fire management for biodiversity, through increasing understanding of the effects of fire on biodiversity and the preparation and implementation of district Fire Management Plans for large remnant areas.

2.4.2 Natural Resources Management Plan

The *Draft NRM Plan for Kangaroo Island* has been developed by the KI 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 and the natural resources within the region and identifies goals to improve NRM outcomes on KI. The plan identifies 'inappropriate fire regime' as a key threat to terrestrial diversity and also recognises 'increased fire frequency' as a potential future risk associated with a changing climate.

Landscape-scale fire management is specified as an objective within the NRM Plan for achievement in the next 5 to 10 years. Landscape-scale fire management planning has

already begun on KI, with the initiation of the *Kangaroo Island Bushfire Risk Management Plan* pilot project (see Section 2.5.1) by the DBPC after the December 2007 fires. DEH is contributing to this process to ensure that strategies and actions within DEH fire management planning are integrated into the Risk Management Plan.

The NRM Plan also advocates for the inclusion of biodiversity outcomes into fire management planning. DEH has incorporated biodiversity and ecological management into fire management planning for a number of years (see Section 5.3.6).

2.5 Adjoining Lands

Adjoining lands are considered in this Fire Management Plan, but only in the context of works required to minimise the risk to DEH managed land from external fires and the risk to private assets from fires originating in the planning area. However, DEH will support and complement landscape scale fire planning for adjoining lands. A number of documents exist that contribute to the effective management of bushfire risk for adjoining lands, including the:

- *KI Roadside Vegetation Management Plan* (KI Council, 2007)
- *KI Development Plan* (Planning SA, 2003)
- *Forest Owners Conference Plantation Design Guidelines* (FOC, 2003)
- *Plantation Design Guidelines for Farm Forestry* (CFS, 2006a)
- *Kangaroo Island District Bushfire Prevention Plan* (KI DBPC, 2000)
- *Kangaroo Island Bushfire Risk Management Plan* (KI DBPC, In prep.).

2.5.1 Bushfire Prevention Plan

Fire management planning for land not managed by DEH is addressed through the *Kangaroo Island District Bushfire Prevention Plan* (KI DBPC, 2000) prepared by the KI DBPC. Since the prevention plan was prepared there have been a number of changes to national and state policy and planning, changes to land use on Kangaroo Island (including land division), as well as reforms at the State Government level. These factors coupled with the heightened community concern as a result of the December 2007 fires on the Island provided a strategic opportunity to trial a unique and innovative approach to landscape planning using a model developed in New South Wales by the Rural Fire Service. The approach considers bushfire risk to life, property and the environment across the landscape, regardless of tenure or ownership and facilitates a risk assessment process to aid in the formulation and prioritisation of risk treatment strategies. The *Kangaroo Island Bushfire Risk Management Plan* (KI DBPC, In prep.) will ultimately build upon and replace the abovementioned prevention plan that was last updated eight years ago. DEH is working closely with the KI DPBC in order to ensure strategies, works and recommendations within this Fire Management Plan are reflected within the KI Risk Management Plan, with the interests of CFS and the KI DBPC being met through representation on the Flinders Chase Planning Team.

2.6 Recovery Plans

Recovery Plans are prepared for nationally threatened species (or subspecies) that are listed under the EPBC Act. In the Flinders Chase planning area a number of species (or subspecies) of national conservation significance have been recorded and the following have Recovery Plans in place.

- Glossy Black-Cockatoo *(Calyptorhynchus lathami halmaturinus)* (Mooney and Pedler, 2005)
- Several species of threatened plants including the Downy Star-bush *(Asterolasia phebalioides)*, Twining Finger Flower *(Cheiranthera volubilis),* Kangaroo Island Logania *(Logania insularis),* Ironestone Mulla Mulla *(Ptilotus beckerianus),* Splendid Bush-pea *(Pultenaea villifera var. glabrescens)* and Spiral Sun-orchid *(Thelymitra matthewsii)* (Taylor, 2003).

Recommendations from these Recovery Plans are discussed in more detail in Section 3.6.4. Habitat data for and sighting records of some significant species that occur within the planning area are shown on Map 2.

2.7 Partnership Agencies

The South Australian CFS is the lead combatant agency for bushfire suppression in rural South Australia. Responding to a fire on DEH managed land is undertaken jointly by DEH and other CFS Brigades (note DEH is a CFS Brigade under the *Fire and Emergency Services Act 2005*) working together under the Kangaroo Island CFS Group.

The remoteness of the western end of Kangaroo Island and the separation from the mainland means the local community are relied heavily upon for fire suppression activities, particularly in the early stages of an incident. The cooperation, support and understanding between CFS brigades, DEH and the local community at the western end of Kangaroo Island have been critical for successful fire suppression on all lands in the past and will be critical to the success of this plan.

Under Section 76 of the *Fire and Emergency Services Act 2005* local governments comprising a District Bushfire Prevention Committee are required to prepare Bushfire Prevention Plans. Kangaroo Island is considered a District and the KI Council, through its District Bushfire Prevention Committee, has identified the development of landscape scale Fire Management Plans as a priority. The Committee is currently in the process of preparing a whole of island Bushfire Risk Management Plan, as described in Section 2.5.1, in collaboration with KI Council, CFS, DEH and SA Water to meet part of this legislative requirement (KI DBPC, In prep.).

All fire management planning and works undertaken on DEH land are subject to consultation with local government to ensure that they are consistent with the objectives of the respective Regional and District Bushfire Prevention Plans.

2.8 Consultation

DEH 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 community, the CFS, local government, Friends of Parks and the Kangaroo Island Natural Resources Management (NRM) Board were consulted during the initial development and the review of this plan.

DEH Fire Management Plans are prepared and adopted in accordance with the *Policy and Procedure for Fire Management Planning: Project Management and Consultation* (DEH, 2008o). Consultation is not a statutory requirement for Fire Management Plans, but is a Departmental Policy. The community were invited to provide input during the review process and the reviewed plan was subject to DEH internal consultation for a period of four

weeks. The finalised plan was then adopted by the Executive Director, Regional Conservation Delivery and the Executive Director, Conservation Policy and Programs.

2.9 Plan Review and Currency

The revised Flinders Chase Fire Management Plan will remain current for five years, however may be revised earlier if required. After five years, it is intended that a major review will be conducted to combine the Cape Forbin Integrated (DEH, 2008p) and Flinders Chase Fire Management Plans. The review will incorporate the strategies of both plans into a single Fire Management Plan for all DEH managed land at the western end of Kangaroo Island. It is anticipated that the fire management for other lands included within the current Fire Management Plans will be addressed through the *Kangaroo Island Bushfire Risk Management Plan* (KI DBPC, In prep.) (see Section 2.5.1). A works program will be derived from the recommendations and works listed in this Fire Management Plan and reviewed on an annual basis.

3 BUSHFIRE ENVIRONMENT

Flinders Chase is an area with a high potential for bushfires. The components of the landscape contributing to the 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 and Included Lands

Situated at the western end of Kangaroo Island, the planning area incorporates over of 81 800 ha of DEH reserves: Flinders Chase NP (32 802 ha), Ravine des Casoars WPA (41 304 ha), Cape Bouguer WPA (5 530 ha) and Kelly Hill Conservation Park (2 176 ha) (Map 1). Approximately 312 hectares of land owned by the Minister for Environment and Conservation has been included in this fire management plan, as DEH have responsibilities for fire management on land owned by or under the care and control of the Minister.

A total of 2 333 hectares (five parcels) of private or Crown land reserves dedicated to the KI Council, have been incorporated into this plan (Table 1). DEH have consulted with the KI Council regarding any works or actions proposed in this Fire Management Plan for Crown land dedicated to the Council. Some of these other lands have been included in the plan to ensure issues are identified and strategies for risk minimisation are prepared should these areas be acquired by DEH in the future.

TABLE 1 – OTHER LANDS INCLUDED IN THIS FIRE MANAGEMENT PLAN

Type	Dedication/Owner	Parcel Type & Number	Hundred	Size (ha)
Crown land	Owned by the Minister for Environment and Conservation	Allotment 5	McDonald	312
Private	N/A	Allotment 8	McDonald	1 668
Crown land reserve	Dedicated to the Kangaroo Island Council	Section 41	Gosse	545
Crown land reserve	Dedicated to the Kangaroo Island Council	Section 62 & 63	Gosse	6
Crown land reserve	Dedicated to the Kangaroo Island Council	Section 38	Ritchie	17.5
Private	N/A	Section 30	Ritchie	96

3.1.2 Surrounding Land Use

Areas adjoining the DEH managed land included in this Plan have a mixture of land uses including conservation (some native vegetation is formally conserved under Heritage Agreements), grazing farmland, softwood and hardwood plantation forests, rural living, cropping and agriculture (Map 1). Although settlement is sparse at the western end of Kangaroo Island, there are numerous houses and smaller landholdings as well as tourist accommodation and facilities in the surrounding area (Map 1).

Importantly, land use has changed during last century. Forest plantations have increased and as a result have changed, and will continue to change, the fuel and flammability patterns in the immediate vicinity of DEH managed land depending on species and age. Native vegetation remaining after agricultural clearing is now confined to smaller isolated blocks, roadsides and creeklines. These areas often experience long periods without fire, which is contributing to changed fuel and flammability patterns. The extent of hardwood and softwood forestry plantations and native vegetation are shown on Map 1.

There has also been an increase in tourism and development during this time including the De Mole Estate subdivision to the north of Ravine des Casoars WPA and new tourism infrastructure such as bed and breakfast and resort accommodation at Hanson Bay. Tourist infrastructure has also increased on DEH managed land.

3.1.3 Terrain

The western end of Kangaroo Island is dominated by three main landforms (Map 1).

- The north coast comprising steep hilly country, with high cliffs along the coast. It is deeply dissected with moderate to steep slopes, predominantly westerly and easterly aspects reflecting the northerly drainage direction.
- The Gosse Plateau, or middle of the western end, being a lateritic plateau dissected by drainage lines running in a south-westerly direction to the coast, has steep valley slopes associated with major drainage lines, moderating toward the flat plateau areas and smaller drainage lines. The major drainage lines have noticeable north-west aspects, with the tributary minor drainage lines dominated by north-easterly aspects. The elevation is highest along the Playford Highway and slopes down toward the coastal cliffs.
- The south coast and west coast with limestone plains and cliffs. Sand dune systems in the southwest corner have undulations in many directions. This area also features a significant karst environment, with Kelly Hill Conservation Park protecting an extensive limestone cave system. Karst features are described in Section 3.6.4.

The landscape makes access to many areas difficult. Steep slopes, not only add significantly to the rate of spread of fires but increase risks to firefighters when undertaking suppression operations.

3.1.4 Climate

The climate is Mediterranean maritime, with over half of the total annual rainfall of approximately 800 mm occurring from April to October. The western end of Kangaroo Island has relatively mild winters and summers due to the moderating influence of the surrounding ocean and the low elevation of the island.

From October to December, Kangaroo Island can experience severe weather conditions with thunderstorm and associated lightning activity. The hottest months in the region are January and February, which coincide with grass curing and soil dryness. Prevailing winds are predominantly southeast in the summer, northwest in autumn and southeast during spring.

Frequent on-shore winds and afternoon sea breezes moderate the temperatures of the western end of Kangaroo Island during the summer. However, frontal activity can change, relatively quickly, the prevailing southeast summer wind direction to strong north to northwest winds with associated high temperatures (close to 40 degrees Celsius). This,

combined with generally low humidity (< 50%), can create extreme fire weather conditions. Subsequent frontal changes can then produce strong southwest winds. In addition, unpredicted localised wind effects can occur with coastal wind influences over the varying topography.

3.1.5 Fire Danger Ratings on Kangaroo Island

The local community suggest there are discrepancies associated with predicted fire danger ratings issued by the Bureau of Meteorology and the observed fire weather conditions at the western end of Kangaroo Island. This is likely due to the weather station data currently provided by Kangaroo Island's coastal weather stations used in predicting fire weather being significantly different from inland conditions at the western end where there is no weather station. The fire danger ratings are influenced by a range of variables including soil dryness and grass curing. This may underestimate the fire behaviour in thick shrubland fuels like those found at the western end of Kangaroo Island.

3.2 Extreme Fire Conditions

It is broadly understood that strong winds, combined with high temperatures and lowered humidity increases the likelihood of extreme fire intensity and behaviour. Under such conditions, suppression activities are unlikely to be effective in areas supporting *Very High* and above overall fuel hazard levels (DEH, 2006e) and suppression activities will be confined to the protection of life and property. Within Flinders Chase NP and Ravine des Casoars WPA recently burnt vegetation can burn under extreme conditions.

On the western end of Kangaroo Island there is a dramatic increase in the likelihood of major bushfire events when the following conditions are experienced:

- *Very High* to *Extreme* overall fuel hazard levels;
- low humidity, decreased soil and fuel moisture, particularly during drought years;
- strong winds shifting direction during the course of a fire;
- lightning strikes on the lateritic plateau as a result of increased thunderstorm activity between October and December; and
- steep terrain.

The large complex of fires in December 2007 is an example of a fire that occurred during a period of extended drought. On the 6th December, lightning ignited a series of fires that burnt over 72 000 hectares of DEH land on Kangaroo Island under predominantly *Moderate* conditions. The largest fire burnt approximately 60 000 hectares of Flinders Chase NP and Ravine des Casoars WPA. Rugged terrain, dense native vegetation and erratic weather conditions made the fire difficult to contain. Over 1 200 volunteer firefighters and support crews worked for over 10 days to bring the fires under control. It is therefore imperative that the development and implementation of objectives, strategies and on-ground actions reflect the conditions possible and resultant risk. The potential of bushfires must be recognised along with the likely impacts on both DEH and private land.

The effect of climate change on fire frequency and intensity is the subject of much speculation, however modelling indicates that the incidence of extreme bushfires may increase 25% by the year 2050 (Lucas*, et al.*, 2007). The potential impact of increased fire frequency and intensity as a result of climate change may require more active measures to be adopted to limit the impact of fire on the community (Lucas*, et al.*, 2007).

3.3 Fire History

3.3.1 Mapping Fire Occurrences

Fire History mapping has been compiled from a combination of the latest DEH fire incident reports, records documented in the *Fire History of Western Kangaroo Island* report (Overton, 1994) and aerial photography from 1945 onwards (Map 3). The quality of the firescar mapping varies, depending on the method of capture. Fire scar boundaries produced from these sources have been added to the DEH EGIS spatial database. Many smaller fires associated with land clearing operations, recorded by Overton (1994) have not been captured spatially and are not represented on Map 3. Consequently, the mapped fires should be regarded as a minimum estimate of fire occurrences.

The Fire History Map (Map 3) shows the landscape is dominated by the December 2007 fire that burnt a large proportion of the planning area. The fire frequency of the planning area reflects the fire potential of the lateritic plateau, with areas in Ravine des Casoars WPA being burnt up to eight times since records have been kept. The map also shows that Cape Bouguer and Kelly Hill CP have not been subject to fire for 25 years or more and that Hanson Bay Block has been threatened by fires potentially crossing Sanderson Track in the past.

3.3.2 Natural and Human-caused Fires

Detailed records of recent fire incidents that either occurred on DEH managed land or were attended by DEH staff are stored within the Department's fire reporting database. This database along with spatial records and any other historical records was reviewed during the development of this Fire Management Plan. Fire-cause of incidents over 1 ha recorded by DEH since 1985 within and adjacent to DEH managed land are summarised in Table 2.

TABLE 2 – FIRE CAUSE OF INCIDENTS OVER 1 HA SINCE 1985

Source: DEH records

Fire Cause	No.	%
Lightning	13	65
Burn-off/prescribed burn escape	4	20
Re-kindle	2	10
Other	1	5

On the western end of Kangaroo Island, landscape scale bushfires have occurred regularly. Since 1931, a total of eight fires over 10 000 ha have burnt the planning area (Table 3) with five of these attributed to ignition by lightning.

TABLE 3 – FIRES OVER 10 000 HA SINCE 1931

Source: Overton (1994) and DEH records

		Year							
		1931	1953	1954	1958	1968	1970	1991	2007
Cause	Lightning	✓			✓			✓	✓
	Burn-off		✓	✓		✓	✓		

The most recent large fire was caused by lightning in December 2007 where 90 000 ha of land was burnt on Kangaroo Island in a series of bushfires. The largest fire was in Flinders Chase NP/Ravine des Casoars WPA, which burnt over 60 000 hectares (Map 3). Cape Bouguer WPA and Kelly Hill CP were not affected by this fire and are essentially long unburnt, with the most recent fire in 1983 burning only a small section in the north-eastern corner. This fire was a result of a burn-off that escaped from private land to the north of the reserves (Overton, 1994).

3.3.3 Historical Fire Regimes

The concept of high intensity fires occurring on Kangaroo Island over the last several thousand years is consistent with Kangaroo Island being a lightning-prone area, particularly the western end on the lateritic plateau. In most years lightning strikes have caused fires at this end of the island (Table 2). Local people suggest that many such fires have gone undetected because they only burn in the immediate vicinity of the strike, before naturally extinguishing, due to unfavourable fuel or weather conditions.

During the post-war years on Kangaroo Island, fire was used in conjunction with felling and chaining to clear 'soldier settler' blocks of native vegetation. These fires sometimes burnt unchecked, burning much larger areas than originally intended.

3.3.4 Present and Future Fire Regimes

Land use changes have increased the economic, political and community pressure on CFS and DEH to suppress bushfires when they occur. At the same time, the relative operational capacity to suppress fires has increased through several mechanisms including improved access, well-equipped and trained firefighters, aerial suppression and improved management of incidents. The suppression strategies and tactics adopted, such as backburning, can also maximise the capacity to suppress fires, but may result in a different pattern of burning, patchiness and extent from that which may have occurred naturally in the past. The combination of pressure to suppress all fires, along with the increased capacity to control fires of low to moderate intensity, means that such fires may be extinguished sooner than they might have without any suppression. This in turn means the natural path, size, intensity and patchiness of bushfires, the fire regime, is affected, as are the fuel and flammability patterns across the landscape.

Quantifying the degree of change to natural fire regimes, and to what degree humans have contributed to that change is very difficult. Fire management within the Flinders Chase plan area must influence fire regimes responsibly, given the existing landscape, current fire patterns and surrounding land use.

Opportunities to create a mosaic of fire severity and interval at an appropriate scale within Flinders Chase NP and Ravine des Casoars WPA have been constrained in the past by the nature of continuous high fuel loads across the landscape and topography. The current mosaic has largely been established by trying to contain bushfires to management blocks. Recent attempts to establish relatively small fuel reduced buffers and in one instance an alternative within block mosaic (at Yacca Flat) have been largely successful. However, managing a prescribed burn within a boundary surrounded by high fuel loads has been extremely difficult and reliant upon operating within a very narrow window of fuel moisture and weather conditions. These restrictions have inturn greatly restricted the area that has been able to be treated with the resources available.

The widespread fires of 2007 have created an opportunity to establish an appropriate mosaic. This has arisen from a lowering of fuel loads across the landscape, thereby providing conditions in which the intensity and spread of prescribed fires can be managed through both fuel and weather conditions. This will broaden the window of opportunity for prescribed burning within Flinders Chase NP and Ravine des Casoars WPA and give land managers the confidence to treat larger areas.

3.4 Prescribed Burning

Prescribed burning has been undertaken since 2001 within Flinders Chase NP chiefly for asset protection, totalling approximately 1 000 ha. Prescribed burning has not been undertaken within Ravine des Casoars WPA, Kelly Hill CP or Cape Bouguer WPA.

Prescribed burning will be carried out in the plan area in the future to achieve fire management objectives within A-, B- and CLM-zones. Fuel reduction in A- and B-zones and CLM-zone burning is discussed in Section 5.3.3. The use of aerial incendiary for prescribed burning will be investigated to assist in the implementation of these zones without establishing additional control lines.

3.5 Vegetation Communities

Floristic mapping for this plan uses a compilation of regional vegetation mapping data that has been reclassified to comply with the National Vegetation Information System (NVIS) classification for Australia. 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 (Section 4.3).

There are eight MVS within the planning area that have been mapped by DEH. Map 2 shows the distribution of MVS in the planning area. Table 4 lists the dominant species composition for each MVS and the Ecological Fire Management Guidelines are outlined in Table 7.

TABLE 4 – DOMINANT SPECIES LAYERS FOR MAJOR VEGETATION SUB-GROUPS (MVS)

MVS No.	MVS Name	Dominant Species Layers
8	*Eucalyptus* woodlands with a shrubby understorey	*Eucalyptus cladocalyx, E. baxteri, E. fasciculosa, E. arenacea, E. obliqua, E. ovata* var. *ovata, E. viminalis* ssp. *cygnetensis, Melaleuca lanceolata, Allocasuarina striata, A. verticillata, Xanthorrhoea semiplana* ssp. *tateana, Daviesia asperula* ssp. *asperula, Prostanthera spinosa, Bursaria spinosa* ssp. *spinosa, Orthrosanthus multiflorus, Pteridium esculentum*
21	Other *Acacia* tall open shrublands and shrublands	*Acacia retinodes, Leucopogon parviflorus*
26	*Casuarina* and *Allocasuarina* forests and woodlands	*Allocasuarina verticillata, Acacia paradoxa, A. spinescens, Banksia marginata, B. ornata, Goodenia ovata*
28	Low closed forest or tall closed shrublands (including *Acacia*, *Melaleuca* and *Banksia*)	*Callistemon rugulosus*
29	Mallee heath and shrublands	*E. remota, E. cosmophylla, E. diversifolia* ssp. *diversifolia, E. rugosa, E. albopurpurea, E. cladocalyx, E. ovata* var. *ovata, Acacia retinodes* var. uncifolia, *Banksia ornata, B. marginata, Allocasuarina muelleriana, A. striata, Melaleuca lanceolata, M. uncinata, M. gibbosa, Pultenaea rigida* var. *rigida, Pomaderris paniculosa* spp. *paniculosa, Lasiopetalum schulzenii, Correa eburnea, Beyeria lechenaultii, Phyllota pleurandroides, Daviesia asperula* ssp. *asperula, Acrotriche patula, Leptospermum continentale, Gahnia sieberiana, Hakea mitchelli, Leucopogon parviflorus*
30	Heath	*Leptospermum myrsinoides, Hakea mitchelli*
47	*Eucalyptus* open woodlands with a shrubby understorey	*Eucalyptus cosmophylla, E. baxteri, E. arenacea, E. cladocalyx, E. leucoxylon* ssp. *leucoxylon, E. fasciculosa, E. obliqua, Acacia paradoxa, Allocasuarina muelleriana, A. striata, Melaleuca gibbosa, Banksia marginata, Daviesia asperula* ssp. *asperula, Leptospermum continentale, Gahnia sieberiana, Pteridium esculentum*
49	*Melaleuca* shrublands and open shrublands	*Melaleuca gibbosa, M. uncinata, M. brevifolia, Allocasuarina verticillata, Acacia paradoxa, Prostanthera spinosa*

3.6 Values and Assets

3.6.1 Visitor Use

Western Kangaroo Island is recognised as one of South Australia's foremost areas for nature-based tourism. This is centred on the included DEH reserves and is greatest during the fire danger season, particularly the high fire danger months. The hub of visitor activity is the Rocky River precinct in Flinders Chase NP, with about 100 000 people visiting this site each year, originating from South Australia, interstate and overseas, from a wide variety of

backgrounds and interests. The following is a summary of areas within the included DEH reserves that are popular with visitors.

- Rocky River Visitor Centre and precinct including the BBQ area, picnic shelters and Rocky River Campground.
- Kelly Hill Visitor Centre and Caves.
- Remarkable Rocks.
- Admirals Arch and Weirs Cove at Cape du Couedic.
- Snake Lagoon and West Bay Campgrounds.
- Grassdale Cottage at Kelly Hill CP.
- Cape Borda precinct including the lighthouse, museum, picnic areas and accommodation.
- Harvey's Return Campground, landing site and cemetery.

Additionally, surfers and fishermen frequent many coastal locations along the southern and western coastlines and there are numerous walking trails throughout the reserves. These include the Hanson Bay Hike through Kelly Hill CP and Cape Bouguer WPA, and the Ravine des Casoars Hike in Ravine des Casoars WPA.

3.6.2 Built Assets

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

- hardwood and softwood forestry plantations adjacent to DEH managed land representing a significant capital outlay
- many homes, sheds and outbuildings scattered throughout the area, although there are no major towns in the vicinity of DEH managed land
- community facilities such as the Karatta Outdoor Education Centre adjacent to Kelly Hill CP and the Western Districts Community and Sports Centre adjacent to the Gosselands of Flinders Chase NP
- tourist facilities adjacent to DEH managed land such as the KI Wilderness Retreat, Southern Ocean Lodge, Western KI Caravan Park, Hanson Bay Holiday Accommodation and Wildlife Sanctuary, Wilderness Valley Studio Accommodation and Flinders Chase Farm
- smaller landholdings in native vegetation on the eastern side of Cape Bouguer WPA and within the De Mole Estate area north of Ravine des Casoars WPA . The buildings are often nestled in native vegetation at the end of no-through roads and present emergency services personnel and occupants with significant life and property risks
- numerous DEH built assets including homes, offices and buildings, tourist infrastructure such as visitor centres, accommodation, ablution blocks, campground facilities, interpretative information, boardwalks, lookouts, barriers and signs, etc.

DEH 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 the planning area and the corresponding fire management strategies. Map 1 shows the location of assets within the planning area.

Management Strategies

Built Assets

1. Implement fuel management strategies on DEH managed land appropriate to asset protection as shown on Map 4 and other risk mitigation works as detailed in Appendix 1.
2. Encourage adjacent property owners to work with CFS to implement appropriate and coordinated fire management works on their own land to minimise the threat of fire.
3. Implement fuel management strategies on DEH managed land to minimise the impact that fire may pose to adjacent public assets as shown on Map 4 and other risk mitigation works as detailed in Appendix 1.

3.6.3 Cultural Heritage

Aboriginal Heritage

Kangaroo Island is an area of cultural significance for both the Kaurna and Ngarrindjeri people. Aboriginal heritage sites have been identified at Cape du Couedic, Rocky River, West Bay and Ravine des Casoars. It is likely that evidence of Aboriginal occupation may also be found in unexplored caves.

The Aboriginal Affairs and Reconciliation Division of the Department of Premier and Cabinet maintains the Central Archive, which includes the Register of Aboriginal Sites and Objects (the Register). It should be noted that the Register is not a comprehensive record of all Aboriginal sites and objects in South Australia, therefore sites or objects may exist in the planning area, even though the Register does not identify them. Nevertheless, the *Aboriginal Heritage Act 1988* affords protection to any Aboriginal site regardless of whether it is on the Register. When implementing this plan, DEH will comply with the *Aboriginal Heritage Handbook and Strategy* (DEH, 2006f), to facilitate the protection of sites during bushfire suppression and prescribed burns. Information on Aboriginal 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, 2008s).

European Heritage

Throughout the planning area there are many structures and remains that are of special cultural and heritage value, providing examples of European history on the island. Many of these sites are recorded on the State Heritage Register and are located on the coastline or around the Rocky River area. The majority of the heritage structures are built of stone, and therefore are not generally fire prone. Many are sited in cleared areas offering some protection from bushfire. Where this is not considered adequate, further strategies for protection are outlined in the plan. Any fire management activities must be in accordance with the *Fire Policy and Procedure for the Protection of Cultural Heritage* (DEH, 2008s). The following is a summary of European heritage sites within the planning area.

- Rocky River (May's) Homestead and Postman's Hut.
- Lighthouse, stables and three lighthouse keeper's cottages at Cape du Couedic.
- Storehouse ruins, jetty and flying fox remains at Weirs Cove.
- Wallaby trappers hut remains and the unknown sailor's grave at West Bay.

- Loch Vennechar Historic Reserve and anchor at West Bay.
- Lighthouse and the associated residences and structures at Cape Borda.
- Cemetery and relics at Harvey's Return Landing.
- David Kirkpatrick's gravesite at Maupertuis Bay.
- Grassdale Homestead, remnant farming implements and sealer's sites at Kelly Hill CP.

Management Strategies

Cultural Heritage

4. Implement fuel management strategies appropriate for the protection of cultural assets as shown on Map 4.

5. 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.

6. Ensure suppression strategies take into account significant cultural assets in order to minimise impacts from these activities and undertake post-fire rehabilitation.

3.6.4 Natural Values

Karst Systems

Kelly Hill CP and Cape Bouguer WPA protect an extensive cave system due to the significant aeolianite karst landscape. Calcarenite karst systems extend approximately 1 km inland along the west coast of Ravine des Casoars WPA and the south coast of Flinders Chase NP where a number of coastal and inland caves occur.

The effect of fire on karst landscapes is largely unpredictable; however is somewhat related to geology, soil type, surface vegetation, and fire interval and intensity. Eberhard (2004) linked altered fire regimes to changes in hydrology in Jewel Cave, Western Australia. Over 1978 to 2002 a reduction in fire frequency within the Jewel Cave catchment contributed to an increase in understorey vegetation density and groundcover. The dense vegetation and groundcover influenced surface flows through rainfall interception resulting in decreased groundwater recharge, which lead to a lowered watertable in the cave.

Impacts to the karst system from smoke and altered hydrology due to fire and fire management activities were considered during the risk assessment as part of the development of this Fire Management Plan. There is a *Moderate* risk that fire may impact groundwater quality or lead to long term drying of the karst system. There is a *Moderate* risk that smoke could enter the karst system and reduce air quality for both cave fauna and visitors and also impact delicate cave formations.

In order to maintain the natural values of the karst system, DEH shall aim to minimise degradation of water quality within the catchment area by reducing the incidence of erosion and subsequent runoff that may occur as a result of fire management operations. DEH will also consider the hydrological implications of fire management actions within the karst catchment. Smoke management should be considered during prescribed burn planning (see Section 5.3.4) and steps should be taken in order to minimise potential impacts on the karst system.

Management Strategies

Karst Systems

7. Consider weather conditions during prescribed burn planning to minimise the likelihood of smoke impact to the karst system.
8. Minimise the likelihood of fire management operations impacting groundwater quality by restricting the use of fire suppression chemicals and reducing the erosion potential in significant karst areas.
9. Ensure appropriate liaison at bushfires occurs to identify karst values. Once the fire has passed evaluate sites to establish if any damage has occurred.
10. Ensure suppression strategies take into account significant karst values in order to minimise impacts from fire management activities and undertake post-fire rehabilitation.

Flora, Fauna and Ecological Communities

Kangaroo Island supports a high number of endemic species and subspecies (Willoughby, *et al.*, 2001). Fauna that occur on Kangaroo Island are known to utilise a wider range of habitats than on the mainland however the diversity of fauna on the island is lower than that on the mainland (Willoughby, *et al.*, 2001).

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

Fire response information is maintained within the DEH Vital Attributes database and where known, is included for species and communities of conservation significance in Appendix 3, 4 and 5.

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

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

There are a number of species and ecological communities considered to be of conservation significance within the planning area. These include the following nationally rated species.

- Glossy Black-Cockatoo *(Calyptorhynchus lathami halmaturinus)* – nationally Endangered.
- Kangaroo Island Dunnart *(Sminthopsis aitkeni)* – nationally Endangered.
- Southern Brown Bandicoot *(Isodon obesulus obesulus)* – nationally Endangered.
- Heath Rat *(Pseudomys shortridgei)* – nationally Vulnerable.

- Mount Compass Swamp Gum *(Eucalyptus paludicola)* – nationally Endangered.
- Splendid Bush-pea *(Pultenaea villifera var. glabrescens)* – nationally Vulnerable.
- Spiral Sun-orchid *(Thelymitra matthewsii)* – nationally Vulnerable.
- Downy Star-bush *(Asterolasia phebalioides)* – nationally Vulnerable.
- Twining Finger Flower *(Cheiranthera volubilis)* – nationally Vulnerable.
- Kangaroo Island Logania *(Logania insularis)* – nationally Vulnerable.
- Ironstone Mulla Mulla *(Ptilotus beckerianus)* – nationally Vulnerable.

The ecological communities of conservation significance include one that is provisionally listed and three considered regionally significant.

- Swamp Honey-myrtle *(Melaleuca squamea)* closed shrubland on peaty soils, provisionally listed as Vulnerable in SA.
- Kangaroo Island Mallee Ash *(Eucalyptus remota)* Mallee, no current rating.
- Drooping Sheoak *(Allocasuarina verticillata)* community, no current rating.
- Manna Gum *(Eucalyptus cygnetensis)* community, no current rating.

Flora and fauna of conservation significance are listed in Appendix 3 and 4. Note that this is not intended to be an exhaustive list of rated species as it does not consider species that are regionally significant, but attempts to summarise the current level of fire response knowledge for particular species. Information on threatened ecological communities are summarised in Appendix 5.

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

Glossy Black-Cockatoo

The SA subspecies of the Glossy Black-Cockatoo (GBC) is listed as Endangered under the federal EPBC Act and the South Australian NPW Act. The subspecies once occurred on the South Australian mainland however, now is restricted to Kangaroo Island. It occurs mainly along the north coast and hinterland where food resources are available, and breeds on the western two-thirds of Kangaroo Island, utilising large hollow bearing eucalypts for nesting (Mooney and Pedler, 2005). Potential GBC critical nesting and feeding habitat are shown on Map 2.

Bushfire has the potential to impact on the availability of GBC food resources, at least in the short to medium term, as mature Drooping Sheoak trees produce the best seed crops. For example, GBC have not returned to Drooping Sheoak feeding and nesting habitat that was burnt in 1991 at West Bay, Flinders Chase NP (Mooney and Pedler, 2005). Specific information on how the GBC responds to fire is included in Appendix 4.

The Recovery Plan for the subspecies identifies that some fire is required to regenerate habitat, however, this is poorly understood (Mooney and Pedler (2005). Further research is necessary to determine appropriate fire regimes. Managers should aim to minimise the loss of Glossy Black-Cockatoo feeding and nesting habitat by ensuring that these key habitat components are not severely impacted during a bushfire.

Management Strategies

Glossy Black-Cockatoo

11. Monitor the effect of fire on Glossy Black-Cockatoo populations and preferred habitat and use this information to update the DEH vital attributes database for use in future Ecological Fire Management Guidelines (Appendix 4)
12. Consult the Glossy Black-Cockatoo Recovery Team when planning burns in known habitat.
13. Minimise the negative impact of fire management activities on feeding and nesting habitat of the Glossy Black-Cockatoo (refer to (Mooney and Pedler, 2005) and Appendix 4.
14. Information on Glossy Black-Cockatoo nesting sites to be made available to Incident Management Teams during a bushfire.
15. Develop an Ecological Fire Management Strategy for the subspecies in collaboration with the Glossy Black-Cockatoo Recovery Team.

Kangaroo Island Small Mammal Fauna

Two species of small mammals that occur on Kangaroo Island are listed as threatened. The Kangaroo Island Dunnart is listed as Endangered both nationally and in South Australia and is the only species of Dunnart occurring on Kangaroo Island. The Southern Brown Bandicoot is the last remaining species of bandicoot occurring naturally in South Australia and is listed as Endangered at the National level and Vulnerable in South Australia.

The KI Dunnart has been recorded within the Ravine des Casoars WPA and in the Gosselands at Flinders Chase NP. Dunnart surveys in 1999 and 2001 identified six sites with KI Dunnarts and provided information for a recovery plan (Gates, 2001). Bushfires may be a major threat to the population viability of the Dunnart due to its potential to reduce available habitat. Bushfire could cause the extirpation of some populations in the short-term. Extensive bushfires of high severity, resulting in few remaining unburnt patches may impact on the recovery of the species, as the potential for re-colonisation would decrease (Gates, 2001). Managers should aim to reduce the severity and extent of bushfires. A mosaic of post-fire ages in vegetation may be of benefit to the KI Dunnart but this requires verification.

The Recovery Plan for the Southern Brown Bandicoot focuses on the Mount Lofty Ranges. 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 (DEH, 2006b). These requirements are best matched by MVS 8.

The Bandicoot is known to occur in Flinders Chase NP and Ravine des Casoars WPA. Map 2 shows records for the planning area. It is thought that fire management should aim to minimise the likelihood of bushfires burning entire habitat patches, thus providing a mosaic of successional stages (Haby and Long, 2005). Furthermore, fire regimes that simplify habitat structure (in the medium and long term) or allow habitats to become excessively dense may be undesirable. Historically on Kangaroo Island large scale fires have burnt the

reserves at high intensity and recently Bandicoots have been observed to survive these events in unburnt patches.

Management Strategies

Small Mammal Species

16. Monitor the effect of fire on KI small mammal populations and preferred habitat and use this information to update the DEH vital attributes database for use in future Ecological Fire Management Guidelines (Appendix 4).
17. Consult the Kangaroo Island Conservation Programs Unit when planning burns in known habitat of the KI Dunnart and Southern Brown Bandicoot.
18. Develop an Ecological Fire Management Strategy for small mammal species.

Threatened Plants

Several species of threatened plants occur within the planning area, including the Downy Star-bush, Twining Finger Flower, Kangaroo Island Logania, Ironestone Mulla Mulla, Splendid Bush-pea and Spiral Sun-orchid. Specific information on how these species respond to fire is included in Appendix 3. Nationally threatened plant habitat is displayed on Map 2.

A recovery plan has been prepared for these species (Taylor, 2003) which advocates for research to determine appropriate fire regimes and management actions to promote these fire regimes for effective reproduction, recruitment and recovery of these species and associated critical habitat on Kangaroo Island. The plan supports the use of fire for ecological management (where supported by research) and also the implementation of works to protect critical habitat from bushfire, including fire breaks and fire access.

Management Strategies

Threatened Plants

19. Monitor the effect of fire on threatened plant populations and preferred habitat and use this information to update databases (including the DEH vital attributes database) for use in future Ecological Fire Management Guidelines (Appendix 3).
20. Consult the KI Conservation Programs Unit and KI Threatened Plants Recovery Team when planning burns in known habitat of threatened plants.

3.7 Pest Species

3.7.1 Fauna

The conditions that result following a fire can be favourable to some fauna, but for other species these conditions may result in population decline. There is evidence that pest fauna can flourish in the conditions existing after a fire. The degree of impact by pest fauna post-fire depends on a number of factors, including the pre-fire abundance of the species and characteristics of the fire (e.g. fire size, shape, season, intensity and location).

Within the planning area, a number of pest fauna have been recorded. These include Goats *(Capra hircus)*, Pigs *(Sus scrofa)*, Cats *(Felis catus)*, Eurasian Blackbirds *(Turdus*

merula), Starlings *(Sturnus vulgaris),* Honey Bees *(Apis mellifera)* and Marron *(Cherax tenuimanus)*.

It is important that the information collected on pest fauna pre-fire is used to determine appropriate management post-fire. There is the opportunity to increase the rate of eradication programs for pest fauna after fire, to take advantage of the reduced vegetation cover and/or possible concentration of fauna in a smaller area. Prescribed burning provides opportunities for research and monitoring into how pest fauna respond to fire. Management of pest fauna post-fire is more likely to be implemented if it is expected that pest fauna will impact species of conservation significance. Information on pest fauna may be collected during prescribed burn planning as part of the Environmental Assessment Table (EAT), to determine appropriate management post-fire (DEH, 2004b; 2008c). Section 5.3.4 provides more information on burn preparation.

3.7.2 Flora

Weeds can have significant impacts on native vegetation and ecological communities within reserves (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). It is well known that fire is an important source of disturbance in natural systems (Hobbs and Huenneke, 1992).

Some of the most significant weed species within the planning area include Bridal Creeper *(Asparagus asparagoides),* Salvation Jane *(Echium plantagineum),* Variegated Thistle *(Silybum marianum),* Stinging Nettles *(Urtica urens),* Cape Tulip *(Moraea* species), Cape Weed *(Arctotheca calendula),* Blue-bell Creeper *(Billardiera heterophylla)* and various pasture weeds including Clover *(Trifolium* species) and Mignonette *(Reseda luteola)*. Fire management guidelines for these species are included in Appendix 3.

All prescribed burns conducted by DEH assess weed control measures in the EAT completed as a requirement of the prescribed burn planning process (DEH, 2004b; 2008c). The EAT will recommend the weed control to be implemented post-burn, however investment will be based on the areas overall habitat quality and management priorities within the region.

Monitoring programs should ensure that vulnerable areas are evaluated pre and post-fire to determine what post-fire weed control is required.

3.7.3 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 fungus that causes disease and death to a variety of native plant species (as well as introduced species). It occurs in areas of high rainfall and has been introduced into a number of areas, particularly Kangaroo Island and the Mount Lofty Ranges. The fungus can spread through mud carried on vehicle tyres, walking boots and equipment, thriving when soils are warm and moist. Infestation is permanent and there is no known method for successfully eradicating the disease once it has established. There is significant risk of Phytophthora spread within the planning area as its presence has been confirmed across the western end of Kangaroo Island.

To reduce the spread of Phytophthora, hygiene procedures are implemented, including vehicle wash down and the restriction of vehicles and personnel to tracks at minimum levels during wet periods. DEH has a Standard Operating Procedure, which addresses Phytophthora threat management (DEH, 2002). This outlines the hygiene procedures adopted by DEH and guidelines to protect the integrity of natural areas by minimising the risk of Phytophthora infestation and spread on DEH managed land.

Management Strategies

Pest Species

21. Refer to Ecological Fire Management Guidelines (Table 7) and fire management guidelines for introduced flora species (Appendix 3) during prescribed burn planning.
22. Consider the use of fire as part of an integrated biodiversity management strategy.
23. Conduct post-fire weed control subject to Regional priorities.
24. Identify the potential impact of weed species as part of the EAT during prescribed burn planning, this will identify any priority weed species and recommend post-fire actions to mitigate the impact of weeds.
25. Collect relevant information on introduced fauna as part of the EAT, during prescribed burn planning to determine appropriate management post-fire.
26. Ensure the *Standard Operating Procedure – Phytophthora Threat Management* (SOP-002) (DEH, 2002) is adhered to in Phytophthora risk areas.
27. Ensure hygiene practices are implemented to reduce the spread of Phytophthora across the planning area. In Phytophthora free areas consider the risks of machinery use and implement hygiene measures if machinery and vehicle access is necessary. Refer to the *DEH Operating Procedure - Phytophthora Vehicle Disinfection Unit* (DEH, 2003a).

4 RISK

4.1 Risk Assessment

A risk assessment was conducted in line with the *Policy and Procedure for Risk Assessment in DEH Fire Planning* (DEH, 2008e), 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, within and adjacent to the planning area. The risk assessment considered visitor use, assets (built, cultural and natural values) and neighbouring properties for all lands included within 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 on a basis of Rare to Almost Certain (Rare, Unlikely, Possible, Likely, Almost Certain).
- Consequence considers bushfire risk based on impacts to life, property and environmental values and is ranked from Insignificant to Critical (Insignificant, Minor, Moderate, Major, Critical).
- Based on the derived likelihood and consequence ratings, the overall risk for each scenario is determined using a Risk Matrix and ranked from Low to Extreme (Low, Moderate, High, Extreme).

The Policy and Procedure for Risk Assessment in DEH Fire Planning (DEH, 2008e) 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 Potential for Fire Ignitions

Lightning has been the primary cause of bushfires at the western end of Kangaroo Island in the past, with a high number of lightning strikes occurring on the lateritic plateau due to the increased thunderstorm activity between October and December (see Section 3.1.4). The frequency of human-caused ignitions is relatively low; however the increase in land divisions and construction of dwellings over the last 20 years has increased the potential for human caused fires (Elllis, 2007, pers comm.). There is also a risk of human caused ignitions at campgrounds and other tourist sites within the planning area.

4.3 Fuel Hazard

4.3.1 Overall Fuel Hazard

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

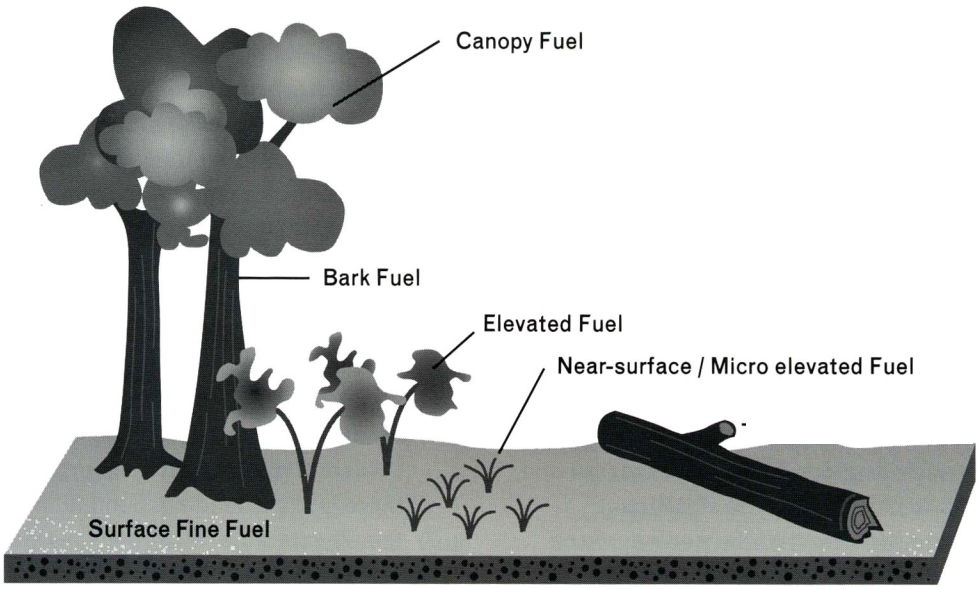

FIGURE 2 – COMPONENTS OF FUEL IN VEGETATION

(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). Fire behaviour affects the response of biota to fire, the degree of difficulty in suppressing bushfires and managing prescribed burns and the threat to assets. In order to undertake effective fire management it is necessary to have an understanding of the characteristics and distribution of fuels in the planning area.

The majority of vegetation communities in the planning area have an understorey dominated by shrubs, with a corresponding *Very High* to *Extreme* overall fuel hazard for litter and shrub fuels in mature vegetation. This helps explain the high intensity of bushfires, further exacerbated by terrain and the weather conditions experienced at the western end of Kangaroo Island.

Spotting is a common feature of the vegetation, particularly in the Brown Stringybark *(E. baxteri)* and *(E. obliqua)* areas where fire has not occurred for some time, or if fire has occurred it was of low intensity and did not reduce the bark fuel hazard. In these areas, spot fires are likely to start several kilometres ahead of the fire front, due to embers and firebrands blown in the wind.

The fuel hazard outside of the planning area varies with different land use patterns ranging from dense native vegetation in steep gullies to open flat grasslands and pine and blue gum plantations.

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). DEH 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, 2008f).

4.3.2 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. Dowie (2006) used the *Victorian Overall Fuel Hazard* Guide to carry out extensive fuel hazard assessments on Kangaroo Island in 18 vegetation groups (based on the dominant overstorey species and structural formation) and eight post-fire age classes. The results of this study and supplementary fuel hazard sampling in the planning area have been used to generate the likely maximum overall fuel hazard values for MVS in the planning area (Table 5).

The process used to derive MVS is described in Section 3.5 and the extent of each MVS within the planning area is shown on Map 2.

The likely maximum overall fuel hazard 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 5 – LIKELY MAXIMUM OVERALL FUEL HAZARD FOR MVS IN THE PLANNING AREA

MVS No.	MVS Name	Likely Maximum Overall Fuel Hazard	Significant Fuel Layers
8	*Eucalyptus* woodlands with a shrubby understorey	Extreme	Surface Elevated Bark[1]
21	Other *Acacia* tall open shrublands and shrublands	Extreme	Surface Elevated
26	*Casuarina* and *Allocasuarina* forests and woodlands	Extreme	Elevated
28	Low closed forest or tall closed shrublands (including *Acacia*, *Melaleuca* and *Banksia*)	Very High	Elevated
29	Mallee heath and shrublands	Extreme	Near-surface Elevated Bark[1]
30	Heath	Extreme	Elevated
47	*Eucalyptus* open woodlands with a shrubby understorey	Extreme	Surface Elevated Bark[1]
49	Melaleuca shrublands and open shrublands	Extreme	Elevated

* denotes introduced species
[1] if Stringybark present

5 READINESS

5.1 Equipment

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

DEH issues personal protective equipment (PPE) to all firefighting staff, designed to protect their safety and welfare and to improve fire suppression effectiveness. DEH 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, 2008y). PPE shall also be consistent with the DEH *Occupational Health, Safety and Welfare Policy* (DEH, 2006a).

DEH firefighting resources include a variety of firefighting vehicles and equipment, which may be deployed to fires anywhere in South Australia or interstate. DEH ensures that all firefighting equipment meets Australian Standards (where they exist) and complies with CFS standards, unless specified otherwise in DEH environmental policies and standards (including the *Policy and Procedure for Fire Appliance Equipment Standards* (DEH, 2008t) and the *Policy and Procedure for Earthmoving Equipment* (DEH, 2008x)).

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 DEH 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. DEH 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 DEH personnel engaged in fire management operations are trained in accordance with the DEH *Policy and Procedure for Fire Training* (DEH, 2008w) 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 *Policy and Procedure for Fire Personnel Health and Fitness (Fighting Fit)* (DEH, 2008v) for details).

DEH 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 DEH Occupational Health, Safety and Welfare Policy (DEH, 2006a) and the *Fire Policy and Procedure for Safety, Health and Welfare* (DEH, 2008u).

5.3 Risk Mitigation Strategies

5.3.1 Fire Access Tracks

DEH is committed to managing a strategic network of fire access tracks on DEH managed land, in accordance with the GAFLC standard (GAFLC, 2008) and the *Fire Policy and Procedure for Fire Access Tracks* (DEH, 2008r). Tracks occurring on DEH managed land, as well as external tracks/public roads considered important for fire suppression have been classified as a 'Major', 'Standard' or a 'Minor' Track according to the standard. Tracks that are considered unsuitable for fire suppression have been classified as 'Service Tracks' and

should not be used during fire suppression operations, unless verified by on-ground inspection. Map 4 shows fire access tracks according to their GAFLC classification.

Tracks that are 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. Sanderson Track, Douglas-Hill Boundary Track, East and West Melrose Tracks, Hanson Bay Road, Shackle Road, West End Highway and Playford Highway).

Design and location of new fire access tracks will take into consideration slopes and low fuel hazard areas to provide for the safety of firefighters during suppression. There are no new fire access tracks proposed within the planning area.

Fire access points and tracks have been reviewed as part of this plan and proposed changes are summarised within Appendix 1. If track closures or upgrades are not recommended in the plan, tracks will be maintained to the GAFLC standards shown on Map 4. In order to maintain tracks to GAFLC standards works will be implemented on an annual basis, subject to resources, fuel hazard and other factors.

Management Strategies

Fire Access

28. Implement changes to fire access as described in Appendix 1.
29. Maintain tracks to the GAFLC standards as shown on Map 4.
30. Implement signs on fire access tracks according to GAFLC standards.
31. Encourage adjacent landowners through the DBPC to maintain their tracks to the GAFLC standards and adopt GAFLC signs.

5.3.2 Fire Infrastructure

Utilities and facilities in the planning area that are important during a firefighting effort include water sources and airstrips (Map 4). Access to privately owned water sources for firefighting purposes should be negotiated directly with neighbours, through the CFS group. The *Response Plan for the Kangaroo Island Region* (DEH, 2008q) as well as the Kangaroo Island Region annual works schedule will provide up to date information on fire infrastructure as these documents are updated annually.

5.3.3 Fire Management Zones

Fire management zones, as detailed in the *Policy and Procedure for Fire Management Zoning in DEH Fire Planning* (DEH, 2008d) have been introduced into DEH fire management planning to:

- ensure that appropriate management actions are implemented to meet the requirements for asset protection and ecological management on all DEH managed land
- clarify the areas where different fire management activities will be undertaken on all DEH managed land
- ensure a standard approach to the application of fire management zones on DEH 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-Land Management Zone (CLM-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 (DEH, 2008d).

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

A-zone Objectives

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

CLM-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 populations, communities and ecosystems such as the rated species listed in Appendix 3 and 4, as well as threatened ecological communities listed in Appendix 5, through the application of appropriate fire regimes.
- To assist in the conservation of wilderness areas and cultural heritage values through the application of appropriate fire regimes.
- To reduce the likelihood that significant areas of contiguous vegetation burns in a single fire event.
- To reduce the likelihood of fragmentation of native vegetation through fire

[i] *Note: All A-zones within the planning area are a minimum of 50 m due to fuels, expected fire behaviour and topography to ensure sufficient protection from bushfires is provided to built assets*

CLM-zone Objectives

management strategies.

- To minimise the impact of suppression activities on wilderness quality.
- To minimise the impact of bushfire on catchment water quality and aquatic fauna.
- To manage fire within the ecological fire management guidelines for MVS as detailed in Table 7.

Major Strategies within Flinders Chase

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

- Wide B-zones have been placed on the perimeter of the most significant blocks in order to form an effective fuel break to reduce the likelihood of fire moving across the landscape or exiting DEH land. Strategic areas where escapes have occurred in the past have been targeted (such as along Shackle Road, Sanderson Track, West End Highway and Playford Highway).
- A large northeast/southwest B-zone 'corridor' to be established along East and West Melrose Tracks to the coast in order to minimise the likelihood of the historical northwest to southeast movement of fires from Ravine des Casoars WPA into Flinders Chase NP.
- B-zones to be applied to drainage lines where escapes have occurred in the past or are likely to occur in the future once fuel loads increase.

These and other zones applied to the planning area 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; and
- should not exceed High for the areas designated as B-zones (DEH, 2008d).

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 CLM-zones management is not dictated by overall fuel hazard levels, rather zoning allows for fire management to meet ecological and conservation management objectives.

Details on fuel reduction methods within A- and B-zones are provided within the EAT (as part of prescribed burn planning), which is prepared before the implementation of each prescribed burn (see Section 5.3.4 for details) and also before fire management works are undertaken on DEH managed land (where native vegetation is being cleared and is not exempt under the *Native Vegetation Act 1991*). However, fuel management within B-zones will primarily be undertaken through prescribed burning and A-zones are likely to be established through slashing, mowing, selective fuel removal, trail or fire break construction and/or prescribed burning.

Strategies for prescribed burning within B-zones include either bounded burning (where the burn is contained within control lines) or open-ended burning (where the burn is not contained on one or more sides by a control line). Open-ended burning allows the fire to move around depending upon the existing fuel loads and conditions and could be achieved through aerial incendiary or using ground crews for ignition. Where a control line needs to be implemented for a prescribed burn in a B-zone, a hydro-axe line or a rolled control line must first be established. Refer to Section 6.2.2 for guidelines on the use of heavy machinery in the planning area.

Proposed Burning

Under DEH policy proposed burning within CLM-zones in the planning area may be implemented for the purpose of ecological management, cultural management, research or for landscape protection (DEH, 2008d). All proposed burning within CLM-zones in the planning area should be in accordance with the ecological fire management guidelines described within this Fire Management Plan (see Section 5.3.6). Potential burn areas may be added, altered, relocated or may be withdrawn at the discretion of DEH as a result of unplanned fires or other factors that may have occurred since time of writing. Any 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. Proposed burns are subject to the planning process described in Section 5.3.4. The implementation of any proposed burn is subject to resource availability and regional priorities.

Within the 2007 firescar it is believed that within 7 to 10 years time (NB: outside the life of this plan) there will be opportunities to create a mosaic of fire severity and interval at the fine scale but also within blocks and between blocks through the application of fire with varying intensity under specific conditions. This would involve:

- maintaining a diversity of burnt and unburnt patches to create a series of seral stages in vegetation at the fine scale or maintaining key habitat features within burnt areas;
- the establishment of a variety of fire severities and intervals within each of the designated management blocks; and
- maintaining whole blocks at one fire interval and managing to some extent severity by preventing the movement of bushfire from one block to the other (NB this has been the approach considered in the past).

As part of the planning process, one area within the CLM-zone was identified for prescribed burning within the life of this Fire Management Plan (Map 4). This area has been selected due to its suitability for an aerial incendiary trial. It is recognised that burning this area is not consistent with the ecological fire management guidelines for MVS (see Section 5.3.6), however undertaking will allow DEH to develop techniques that can be applied not only across Kangaroo Island, but throughout the state. The trial will also give DEH the opportunity to investigate a number of operational, social and ecological questions.

5.3.4 Burn Preparation

All prescribed burning in A-, B- and CLM-zones (regardless of the objective or tenure) carried out by DEH will adhere to the planning process utilising the *Interim Environmental Assessment Table Guidelines* (DEH, 2004b), as detailed in Figure 3 and in the *Fire Policy and*

Procedure for Prescribed Burning (DEH, 2008c). Ecological burns are also subject to the planning process as detailed in the *Fire Policy and Procedure for Ecological Burning* (DEH, 2008n).

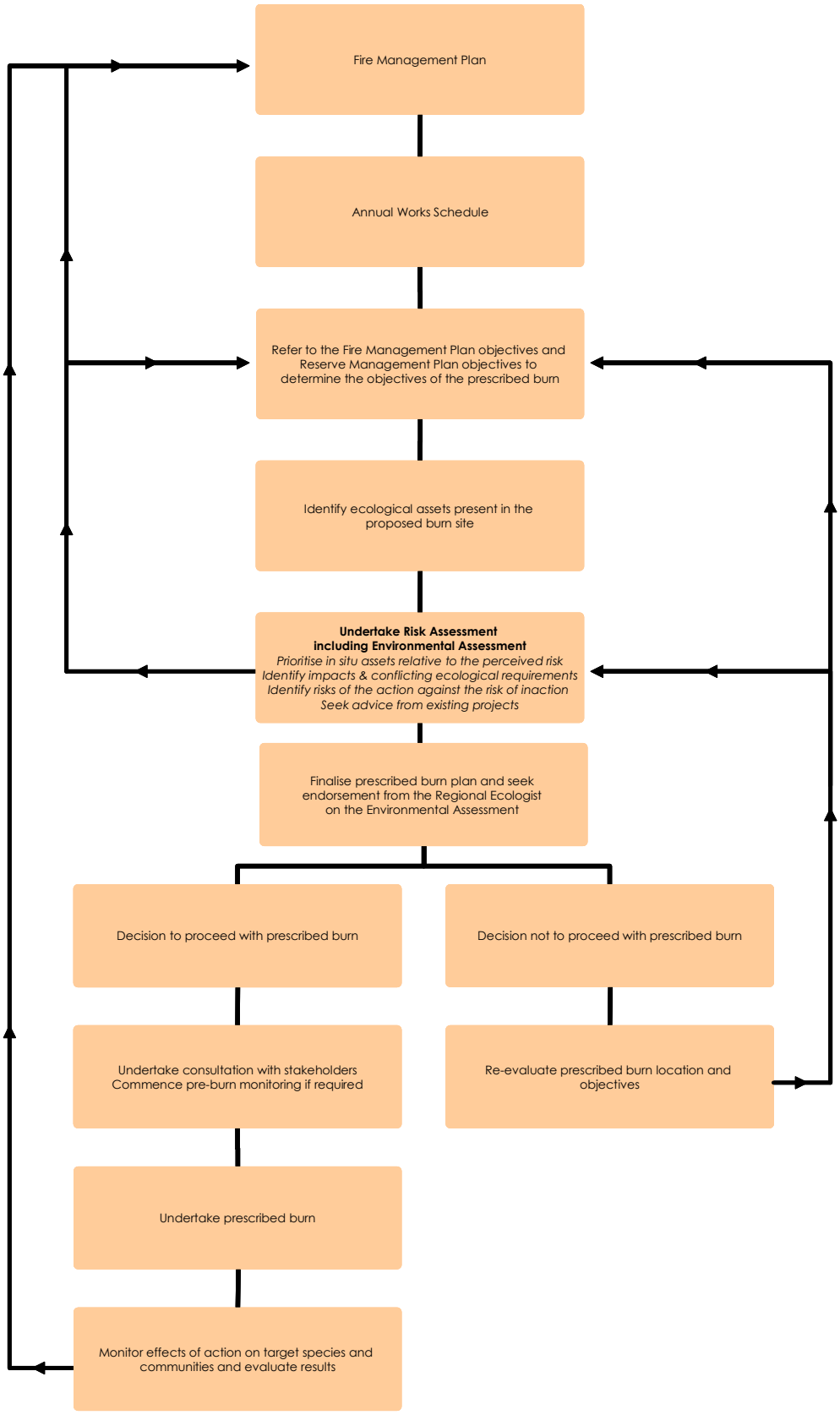

FIGURE 3 – FLOW CHART DETAILING THE BURN PLANNING PROCESS

5.3.5 Fire Management Blocks

The planning area has been divided into 16 fire management blocks to ensure that information and issues unique to a particular area have been addressed (Table 6). Block boundaries are based on access and the practicalities of implementing fire management objectives.

Baxter Block is entirely private land, including 18 Heritage Agreements, numerous forestry plantations and grazing/pastureland. For the purpose of this plan, Baxter Block appears wholly as a CLM-zone to address the ecological fire management of Heritage Agreements and significant Glossy Black-Cockatoo habitat that occurs in the area. The block has not had A- or B-zones applied, as this is outside the Departments area of authority. Strategies for minimising risk to life and property within Baxter Block are the responsibility of the KI DBPC and landowners.

Hanson Bay Block includes private land identified as significant as it connects DEH reserves and includes land owned by the Minister for Environment and Conservation. Zoning has been applied should this land be incorporated into the reserve system in the future.

TABLE 6 – FIRE MANAGEMENT BLOCK INFORMATION

Block	Reserve	Other Lands	Size (ha)
Black Swamp Block	Flinders Chase NP	-	486
Bunker Hill Block	Flinders Chase NP	-	4 718
Cape Borda Block	Flinders Chase NP	-	224
East Gosselands Block	Flinders Chase NP	-	2 248
East Melrose Block	Flinders Chase NP	-	2 414
Gosselands Block	Flinders Chase NP	• Section 30 Hundred of Ritchie • Sections 41, 62 & 63 Hundred of Gosse	12 577
Maupertuis Bay Block	Flinders Chase NP	-	5 386
Rocky River Precinct Block	Flinders Chase NP	-	31
Sandy Creek Block	Flinders Chase NP	-	3 180
West Melrose Block	Flinders Chase NP	-	2 174
Breakneck River Block	Ravine des Casoars WPA	-	21 876
Ravine des Casoars Block	Ravine des Casoars WPA	-	5 816
Upper Rocky River Block	Ravine des Casoars WPA	-	13 670
Cape Bouguer/Kelly Hill Block	Cape Bouguer WPA Kelly Hill CP	• Section 38 Hundred of Ritchie	7 398
Hanson Bay Block	-	• Allotment 5 & 8 Hundred of McDonald	2 039
Baxter Block	-	• Various	24 149

5.3.6 Ecological Fire Management

The management of fire to maintain biodiversity is discussed in more detail in the *Draft DEH Guidelines for Ecological Fire Management* (DEH, 2006d). This approach is being used as a sound basis for the management of fire for biodiversity across Australia (Andersen, *et al.*, 2003; FEWG, 2004; Hopkins and Saunders, 1987; Whelan, *et al.*, 2002). It is based on accumulating knowledge of species, populations and communities and their response to fire regimes, and then applying this knowledge to fire management practices to maximise biodiversity outcomes. Ecological Fire Management Guidelines are used to assist in achieving management objectives in CLM-zones within all DEH 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 DEH to define the Ecological Fire Management Guidelines involves the identification of fire regime thresholds using flora and the assessment of the potential impacts of these thresholds against known faunal requirements, particularly the requirements of species of conservation significance. The steps taken in the development of the Ecological Fire Management Guidelines are as follows.

- Vital attributes data of flora and fauna, and ecological communities are gathered and assessed.
- This knowledge is used to identify the window of acceptable of fire regime (fire interval, intensity, season and type) where species significantly decrease.
- Ecological Fire Management Guidelines are formed from these windows 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 4 (below) illustrates this process.

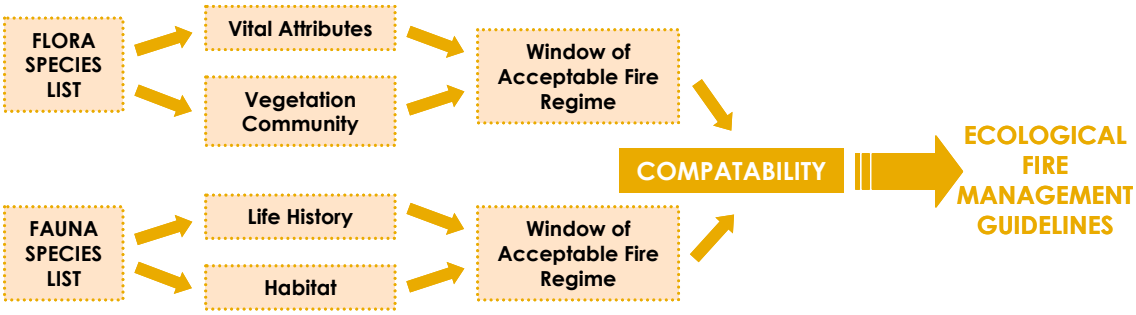

FIGURE 4 – APPROACH FOR DETERMINING ECOLOGICAL FIRE MANAGEMENT GUIDELINES

Interpreting Ecological Fire Management Guidelines

Ecological Fire Management Guidelines have been defined for MVS, enabling fire management to strategically plan and manage fire within the planning area in a way that will ensure the maintenance and enhancement of biodiversity (Table 7) Guidelines for five aspects of fire regime (interval, frequency, spatial criteria, 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 a window of "acceptable" fire regime that ensures the conservation of existing species.

Thresholds of Potential Concern

Thresholds of Potential Concern (TPC) are defined as 'the limits of tolerance to a particular fire regime' (Kenny*, et al.*, 2003).

- 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 7) 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.*, 2003).

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

		FIRE REGIME						
		Thresholds of Potential Concern		Spatial Criteria	Frequency		Intensity	Season
		TPC 1 – Lower threshold in years	TPC 2 – Upper threshold in years	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 a period of X years	Avoid more than 2 successive fires of low intensity	Some medium to high intensity fire needed to regenerate some species	Avoid 2 or more successive fires in season[1]
8	*Eucalyptus* woodlands with a shrubby understorey	17	40	50	17	Y	Y	Same Season
21	Other *Acacia* tall open shrublands and shrublands	10	20	50	10	Y	Y	Same season
26	*Casuarina* and *Allocasuarina* forests and woodlands	17	40	50	17	Y	Y	Same Season
28	Low closed forest or tall closed shrublands (including *Acacia*, *Melaleuca* and *Banksia*)	17	40	50	17	Y	Y	Same season
29	Mallee heath and shrublands	17	40	50	17	Y	Y	Same Season
30	Heath	17	40	50	17	Y	Y	Same Season
47	*Eucalyptus* open woodlands with a shrubby understorey	17	40	50	17	Y	Y	Same Season
49	Melaleuca shrublands and open shrublands	17	40	50	17	Y	Y	Same season

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

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

6 RESPONSE

6.1 Response Plans

A Response Plan exists for the Kangaroo Island Region (DEH, 2008q), which is reviewed on an annual basis in accordance with the *Fire Policy and Procedure for Response Planning* (DEH, 2008m). The response plan provides specific information in relation to fire suppression including water points, equipment and access, as well as levels of preparedness.

Note that these plans are for initial response only and this Fire Management Plan should be referred to for more detailed fire management information, in conjunction with DEH 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 DEH managed land it is likely that DEH staff will be the best source of this information, as such they should be consulted during the development of any incident prediction. A DEH Liaison Officer will be assigned to most incidents attended by DEH crews, in accordance with the *DEH Fire Policy and Procedure for Fire Response* (DEH, 2008l) and the *DEH Fire Policy and Procedure for Coordinated Fire Management* (DEH, 2008z). The role of the DEH Liaison Officer is to coordinate and work with Incident Control, to give advice on DEH policy and procedures, organise the supply of DEH resources and provide logistical and planning support. Consideration for firefighter safety and the protection of life are paramount during all suppression operations.

6.2.1 Ground Crews

Considerations.

- Water for fire suppression can be sourced from dams (shown on Map 4) and creeks. Alternatively Bulk Water Carriers may be deployed to the incident.
- Public roads and access tracks classified to GAFLC standards are shown on Map 4.
- Public roads and access tracks classified as 'Service Tracks' on Map 4 should not be used for fire suppression unless verified by inspection and approved by the IMT.
- All maps should be checked carefully to determine escape routes and reduce the likelihood of entrapment.
- Adhere to the Phytophthora hygiene procedures as described in Section 3.7.3.
- Coastal/sea breezes may influence fire behaviour.

6.2.2 Machinery Use

Considerations.

- Machinery use and deployment during fire suppression is to be in accordance with:
  - the DEH *Fire Policy and Procedure for Earthmoving Equipment* (DEH, 2008x);
  - the *CFS Supervision of Machinery Guidelines* (CFS, 2007b);
  - the *SA Wilderness Code of Management* (DEH, 2004a); and (Appendix 2)
  - Phytophthora hygiene procedures, as described in Section 3.7.3.

- The decision to deploy heavy 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; and
  - that the actions are authorised by the IMT, following liaison with the DEH Liaison Officer or the relevant landholder/s.
- All practical options, effectiveness, the likelihood of success and likely positive and negative impacts on environmental, social, economic and cultural values must be considered by the IMT when planning the use of earthmoving equipment. Specifically, heavy machinery is only to be used where the IMT has determined that:
  - the topography is suitable and/or safe for heavy machinery;
  - the risk of spreading Phytophthora has been minimised;
  - the line will be trafficable by fire appliances to support supervision, implementation and mop-up;
  - the measures are necessary to minimise the threat of the fire to life and property;
  - there is likely to be irreversible or an unacceptable level of environmental impact on significant species populations, flora and fauna communities and/or ecosystems if the action is not taken;
  - known areas of cultural significance can be avoided.
- Bulldozers should only be used with the blade raised to a height that will achieve a clean sweep of vegetation, minimising soil disturbance.
- To minimise environmental and operational risk, any spot over being tracked should be:
  - less than 5 ha in size; and/or
  - within 1 km of an existing control line or boundary and able to be contained within one 12 hour shift.

6.2.3 Aerial Suppression

Considerations.

- Implementation of aerial suppression is to be in accordance with the *Fire Policy and Procedure for Aerial Operations* (DEH, 2008j).
- DEH supports the use of retardant and foam products that meet Australian Standards. The use of retardant should be in accordance with the *Fire Policy and Procedure for Fire Suppression Chemicals* (DEH, 2008i).
- 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, 2006b).
- The use of retardant should be restricted to critical situations, such as the protection of built assets. Retardant should not be dropped in creeklines or in close proximity to

standing water, due to the increase in nutrients and resultant potential weed proliferation and/or impacts to nutrient sensitive native species.

- The use of foams should be minimised in catchment areas and creek lines.
- Sea water should only be used where no other water source is available.
- Aerial suppression should only be undertaken where the operation is supported by ground crew.
- Aerial ignition should be considered for the implementation of large scale prescription burns. During bushfires aerial ignition should be considered 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

Emergency information is provided to all visitors and accommodation guests on permit application to ensure their safety. This includes information on general personal protection and rules for visitors in vehicles or on foot should a fire threaten. This information is available within published material such as the *Parks of Kangaroo Island: Visitor Information* brochure (DEH, 2007). Furthermore, visitors are provided with an information sheet on days declared a total fire ban by the CFS (FFDI > 50). DEH also discourages visitors from bushwalking on days of extreme fire danger.

Buildings and sites within the DEH reserves have emergency procedures, which include evacuation from a limited space. The Flinders Chase Visitor Centre has an emergency plan which is reviewed and practiced on a regular basis.

Visitor safety on DEH managed land is managed in accordance with the 'Plan Now to Stay and Defend – or Go Early' principle, which advocates for the preparation of Bushfire Action Plans and explains why trying to escape a fire at the last moment could be fatal (CFS, 2006c). DEH has prepared a Bushfire Action Plan for the Flinders Chase area for this purpose. An extract from this plan is available to visitors at all rental accommodation. See the *Fire Policy and Procedure for Visitor Safety* for more information (DEH, 2008h).

Management Strategies

Visitor Management

32. Implement appropriate fuel management strategies as shown on Map 4 to increase visitor safety.
33. Consider partial or total reserve closures on extreme fire weather days to ensure visitor safety (at the discretion of the Executive Director, Conservation Policy and Programs).
34. Continue to provide visitors with an information handout on days declared a total fire ban by the CFS (FFDI >50). Review this and other emergency information provided to visitors on an annual basis and update as required.
35. Emergency Response Plans for visitor facilities, including campgrounds (where they exist) to be reviewed and practiced on a regular basis.
36. An extract from the KI West Bushfire Action Plan to be available to visitors at all accommodation premises. Review and update the plan as required.

6.4 DEH Staff and Residents

Permanent or long-term residents living in Departmental accommodation on DEH reserves, such as those at Rocky River, Kelly Hill and Cape Borda are encouraged to prepare their own Bushfire Action Plan and rehearse it regularly.

During the risk assessment process it was identified that there is a High risk to residents living at Rocky River if a fire threatens. Further to the fire management works proposed in Appendix 1 it has been recommended that the installation of fire protection systems be investigated in order to minimise the likelihood of fire impacting property and residents.

To ensure safety, DEH staff and contractors working on DEH managed land during the fire season are required to maintain communications with the Flinders Chase NP office at Rocky River.

Management Strategies

DEH Residents

37. Implement fuel management strategies as shown on Map 4 to increase the safety of residents.

38. Ensure all permanent/long-term residents living on DEH reserves have prepared their own Bushfire Action Plan and investigate the installation of fire protection systems on residences at Rocky River.

7 RECOVERY, RESEARCH AND MONITORING

7.1 Post-fire Rehabilitation and Recovery

DEH has a *Policy and Procedure for Post-fire Rehabilitation* (DEH, 2008b) 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 to infrastructure, built assets and natural and cultural heritage
- potential threats to biodiversity conservation, natural heritage and catchment protection
- actions, responsibilities and costs associated with the rehabilitation effort.

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

Areas at Flinders Chase adversely impacted as a result of previous fires or fire suppression activities have been restored and rehabilitated. After the recent bushfires in December 2007 the Department established a recovery program to assess the impact to biodiversity, tourism and built assets, establish priorities for rehabilitation and undertake recovery actions.

7.2 Research

Further investigation via research and monitoring is critical to refine future fire management. Some research is already happening and DEH needs to ensure that research is tailored to specific questions, is relevant to land managers and can be readily incorporated into improved ecological fire management through the refinement of the proposed ecological fire management guidelines (see Section 5.3.6). To ensure that this occurs, any fire-related research that is proposed within the planning area shall be discussed with the Senior Fire Research Scientist (Bioknowledge SA, DEH) and be in accordance with fire research policy (DEH, 2008a).

The research questions that could be asked in the Flinders Chase planning area are numerous. Testing the underlying assumptions of the fire management model used for this landscape is critical to informing future iterations of this plan. Some simple ecological and operational research questions that require further exploration include:

- the fire requirements of flora and flora;
- the role of unburnt patches;
- the role of fire severity and inter-fire interval mosaics; and
- the influence of prescribed burning effectiveness on bushfire behaviour and suppression success.

Following the December 2007 bushfires DEH initiated a fire severity mapping project to evaluate the impact of the fires within Flinders Chase NP and Ravine des Casoars WPA. The severity map that has been produced will be used to identify areas that may be slower to recover and for use in future planning of fire management activities within the planning area. Further research to take advantage of the mapping exercise is being considered to investigate the ecological consequences of varying fire severity on species populations, flora and fauna communities and ecosystems.

The following table summaries recommended research that may be undertaken in the planning area.

Research

39. Investigate the suitability of the Ecological Fire Management Guidelines (Table 7) for MVS by:
    - quantifying the existing status of MVS within the planning area, to assist fire managers with burn planning and suppression activities
    - the on-ground assessment of historical fire regimes in similar communities across the state.
40. Explore the effects of fire regime on threatened flora and fauna, species populations and ecosystems and use this information to propose Ecological Fire Management Guidelines (Appendix 3, 4 and 5) where they do not exist.
41. Develop specific research questions aimed at investigating the ecological consequences of varying fire severity using the fire severity map produced after the 2007 fires.
42. Research the effects of fire on Southern Brown Bandicoot populations and habitat and use this information to update the Ecological Fire Management guidelines (Appendix 4).
43. Improve knowledge of the post-fire response of rare and threatened flora and fauna.
44. Regional Conservation Delivery (Kangaroo Island), Bioknowledge SA and Fire Management Branch to investigate the development of a research and monitoring plan to inform fire management and the implementation of burning in CLM-zones across the planning area.

7.3 Monitoring

Monitoring will be established in conjunction with any prescribed burns conducted within the the planning area, in accordance with DEH policy and procedures. This includes the *Policy and Procedure for Prescribed Burning* (DEH, 2008c), incorporating the Environmental Assessment Table and monitoring procedures. Refer to Section 5.3.3 and 5.3.4 of this plan for general information on zoning, burning and the planning requirements.

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 DEH policy (DEH, 2008g). The results from post-fire monitoring will be used to further refine fire management, consistent with an adaptive management approach.

Within Flinders Chase NP, a research and monitoring program (*Kangaroo Island Monitoring Biodiversity Assets* (or KIMBA)) is currently underway in order to investigate community scale responses to fire (Gates and Moss, 2002). Specifically, the KIMBA program aimed to assess the effects of fire on the flora and fauna species and fuel loads across 25 sites with a range of vegetation communities and post-fire ages. The project was designed to yield detailed information on the life histories, species richness and abundance of a range of flora, structural changes to vegetation, and rates of fuel accumulation post-fire, and the impact of fire on bird species richness (Dowie, 2005). The original KIMBA design assumed that only a proportion of sites in a given vegetation type would burn in a single fire event, thus allowing comparisons with unburnt sites as controls. This assumption was not met during December 2007 when all monitoring sites were burnt in one event. As a result, a new approach to

monitoring is being developed that will incorporate the KIMBA sites and add additional monitoring in burnt and unburnt locations.

Recently investment into new fire projects has seen the development of 'Fahrenheit 451' and 'Island Refuge' programs by the DEH KI Conservation Programs Unit. Outputs from the Fahrenheit 451 program include:

- ongoing monitoring in priority vegetation communities to provide important data for the development ecologically sustainable fire regimes and management actions; and
- the collection of fuel, weather and fire behaviour data from bushfires and prescribed burns to contribute to the development of suitable burning prescriptions for KI.

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

It is recommended that monitoring is undertaken to:

Monitoring	
	45. Investigate the fuel accumulation rates of the various MVS that occur within the planning area (Table 5). These data will help DEH staff determine if and when fuel reduction works are required, ultimately assisting in the scheduling of operational works and activities in B-zones.
	46. Assess the suitability of the proposed weed management guidelines for the control of introduced species following fire (Appendix 3)
	47. Assess the suitability of the proposed Ecological Fire Management Guidelines on threatened flora and fauna, species populations and ecosystems and use this information to update Appendix 3, 4 and 5 as required.

8 SUMMARY OF MANAGEMENT STRATEGIES

Built Assets

1. Implement fuel management strategies on DEH managed land appropriate to asset protection as shown on Map 4 and other risk mitigation works as detailed in Appendix 1.
2. Encourage adjacent property owners to work with CFS to implement appropriate and coordinated fire management works on their own land to minimise the threat of fire.
3. Implement fuel management strategies on DEH managed land to minimise the impact that fire may pose to adjacent public assets as shown on Map 4 and other risk mitigation works as detailed in Appendix 1.

Cultural Heritage

4. Implement fuel management strategies appropriate for the protection of cultural assets as shown on Map 4.
5. 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.
6. Ensure suppression strategies take into account significant cultural assets in order to minimise impacts from these activities and undertake post-fire rehabilitation.

Karst Systems

7. Consider weather conditions during prescribed burn planning to minimise the likelihood of smoke impact to the karst system.
8. Minimise the likelihood of fire management operations impacting groundwater quality by restricting the use of fire suppression chemicals and reducing the erosion potential in significant karst areas.
9. Ensure appropriate liaison at bushfires occurs to identify karst values. Once the fire has passed evaluate sites to establish if any damage has occurred.
10. Ensure suppression strategies take into account significant karst values in order to minimise impacts from fire management activities and undertake post-fire rehabilitation.

Glossy Black-Cockatoo

11. Monitor the effect of fire on Glossy Black-Cockatoo populations and preferred habitat and use this information to update the DEH vital attributes database for use in future Ecological Fire Management Guidelines (Appendix 4)
12. Consult the Glossy Black-Cockatoo Recovery Team when planning burns in known habitat.
13. Minimise the negative impact of fire management activities on feeding and nesting habitat of the Glossy Black-Cockatoo (refer to (Mooney and Pedler, 2005) and Appendix 4.
14. Information on Glossy Black-Cockatoo nesting sites to be made available to Incident Management Teams during a bushfire.
15. Develop an Ecological Fire Management Strategy for the subspecies in collaboration with the Glossy Black-Cockatoo Recovery Team.

Small Mammal Species

16. Monitor the effect of fire on KI small mammal populations and preferred habitat and use this information to update the DEH vital attributes database for use in future Ecological Fire Management Guidelines (Appendix 4).

17. Consult the Kangaroo Island Conservation Programs Unit when planning burns in known habitat of the KI Dunnart and Southern Brown Bandicoot.
18. Develop an Ecological Fire Management Strategy for small mammal species.

Threatened Plants

19. Monitor the effect of fire on threatened plant populations and preferred habitat and use this information to update databases (including the DEH vital attributes database) for use in future Ecological Fire Management Guidelines (Appendix 3).
20. Consult the KI Conservation Programs Unit and KI Threatened Plants Recovery Team when planning burns in known habitat of threatened plants.

Pest Species

21. Refer to Ecological Fire Management Guidelines (Table 7) and fire management guidelines for introduced flora species (Appendix 3) during prescribed burn planning.
22. Consider the use of fire as part of an integrated biodiversity management strategy.
23. Conduct post-fire weed control subject to Regional priorities.
24. Identify the potential impact of weed species as part of the EAT during prescribed burn planning, this will identify any priority weed species and recommend post-fire actions to mitigate the impact of weeds.
25. Collect relevant information on introduced fauna as part of the EAT, during prescribed burn planning to determine appropriate management post-fire.
26. Ensure the *Standard Operating Procedure – Phytophthora Threat Management* (SOP-002) (DEH, 2002) is adhered to in Phytophthora risk areas.
27. Ensure hygiene practices are implemented to reduce the spread of Phytophthora across the planning area. In Phytophthora free areas consider the risks of machinery use and implement hygiene measures if machinery and vehicle access is necessary. Refer to the *DEH Operating Procedure - Phytophthora Vehicle Disinfection Unit* (DEH, 2003a).

Fire Access

28. Implement changes to fire access as described in Appendix 1.
29. Maintain tracks to the GAFLC standards as shown on Map 4.
30. Implement signs on fire access tracks according to GAFLC standards.
31. Encourage adjacent landowners through the DBPC to maintain their tracks to the GAFLC standards and adopt GAFLC signs.

Visitor Management

32. Implement appropriate fuel management strategies as shown on Map 4 to increase visitor safety.
33. Consider partial or total reserve closures on extreme fire weather days to ensure visitor safety (at the discretion of the Executive Director, Conservation Policy and Programs).
34. Continue to provide visitors with an information handout on days declared a total fire ban by the CFS (FFDI >50). Review this and other emergency information provided to visitors on an annual basis and update as required.
35. Emergency Response Plans for visitor facilities, including campgrounds (where they exist) to be reviewed and practiced on a regular basis.
36. An extract from the KI West Bushfire Action Plan to be available to visitors at all accommodation premises. Review and update the plan as required.

DEH Residents

37. Implement fuel management strategies as shown on Map 4 to increase the safety of residents.
38. Ensure all permanent/long-term residents living on DEH reserves have prepared their own Bushfire Action Plan and investigate the installation of fire protection systems on residences at Rocky River.

Research

39. Investigate the suitability of the Ecological Fire Management Guidelines (Table 7) for MVS by:
40. Explore the effects of fire regime on threatened flora and fauna, species populations and ecosystems and use this information to propose Ecological Fire Management Guidelines (Appendix 3, 4 and 5) where they do not exist.
41. Develop specific research questions aimed at investigating the ecological consequences of varying fire severity using the fire severity map produced after the 2007 fires.
42. Research the effects of fire on Southern Brown Bandicoot populations and habitat and use this information to update the Ecological Fire Management guidelines (Appendix 4).
43. Improve knowledge of the post-fire response of rare and threatened flora and fauna.
44. Regional Conservation Delivery (Kangaroo Island), Bioknowledge SA and Fire Management Branch to investigate the development of a research and monitoring plan to inform fire management and the implementation of burning in CLM-zones across the planning area.

Monitoring

45. Investigate the fuel accumulation rates of the various MVS that occur within the planning area (Table 5). These data will help DEH staff determine if and when fuel reduction works are required, ultimately assisting in the scheduling of operational works and activities in B-zones.
46. Assess the suitability of the proposed weed management guidelines for the control of introduced species following fire (Appendix 3)
47. Assess the suitability of the proposed Ecological Fire Management Guidelines on threatened flora and fauna, species populations and ecosystems and use this information to update Appendix 3, 4 and 5 as required.

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10 APPENDICES

Appendix 1 – Assets and Strategies for Risk Mitigation

	Values and Assets	Location/Block	Recommended Works
Flinders Chase NP (Southern Block)	Flinders Chase NP Visitor Centre Park residences Flinders-Baudin Research Centre May's Homestead Postman's Cottage Rocky River Campground Picnic shelters BBQ areas DEH workshop DEH sheds	Rocky River – Rocky River Precinct Block	• A-zones (50 m) surrounding visitor accommodation, park residences, workshop, sheds, visitor centre, research centre, campground infrastructure, BBQ & picnic areas. • B-zone (350 to 1000 m) to buffer the Rocky River Precinct predominantly through prescribed burning, using the existing track network & low fuel areas as control lines. Note that the area immediately south of the park residences is to be maintained mechanically. • Track running from the park residences to the SWER Track on the Entrance Road to be widened to a width of 17 m for its entire length, to reduce the likelihood of fire threatening park residences. • B-zone (500 m) either side of Shackle Road to reduce the likelihood of fire threatening from the north, north-west or west & impacting the Rocky River precinct. Burning shall be scheduled to minimise the negative impact on visitor experience, whilst still achieving burn program requirements. • B-zone (40 m) to the south of Entrance Road between SWER Track & road to reduce the risk to road users & improve access for firefighters. • Track network to be maintained on an annual basis. • Regular maintenance on water infrastructure is required to ensure adequate supply during fire operations. • Visitor Centre Emergency Response Plan to be reviewed & practiced on a regular basis. • Fire protection system to be installed on park residences. • Park residents are encouraged to implement their own Bushfire Action Plan as per CFS guidelines. • Emergency information to continue to be provided to visitors & accommodation guests. • An extract from the KI West Bushfire Action Plan to be available to visitors at all accommodation premises. • Provide visitors an information handout on days declared a total fire ban by the CFS (FFDI >50).

	Values and Assets	Location/Block	Recommended Works
Flinders Chase NP (Southern Block)	Troubridge Lodge Karatta Lodge Parndana Lodge Cape du Couedic Lighthouse Stable & Store ruins Admiral's Arch Boardwalk Interpretive signs	Cape du Couedic – Bunker Hill Block	• A-zones (50 m) surrounding visitor accommodation, lighthouse, stable & store ruins, however implementation should not impact on aesthetics or heritage values. • Emergency information to continue to be provided to visitors & accommodation guests. • Emergency telephone connection to be maintained within Troubridge Lodge. • An extract from the KI West Bushfire Action Plan to be available to visitors at all accommodation premises.
	Boardwalk Interpretive signs Toilet	Remarkable Rocks –Bunker Hill Block	• B-zone (200 m width) to the north/north-west of Remarkable Rocks to be maintained through prescribed burning. Zone to be set back from the visitor area but put in place so as to not impact the aesthetic qualities but to provide strategic protection from fires threatening from the north/north-west.
	Jetty Funnelway Store ruin	Weir's Cove – Bunker Hill Block	• A-zone (50 m) surrounding assets, however implementation should not impact on aesthetics or heritage values.
	West Bay Campground Toilet	West Bay – Sandy Creek /Ravine des Casoars Block	• A-zone (50 m) surrounding campground infrastructure. • Provide visitors an information handout on days declared a total fire ban by the CFS (FFDI >50).
	Snake Lagoon Campground Toilet	Sandy Creek Block	• A-zone (50 m) surrounding campground infrastructure. • B-zone (1 000 m) along the northern side of West & East Melrose Track to the ocean to reduce the likelihood of fire impacting campground. • Provide visitors an information handout on days declared a total fire ban by the CFS (FFDI >50).
	Walking trails: Sandy Creek & Breakneck Creek trails	Sandy Creek Block	• Provide visitors an information handout on days declared a total fire ban by the CFS (FFDI >50).
	Power & communications infrastructure	Along Cape du Couedic SWER line – Maupertuis Bay Block South of Entrance Road – Bunker Hill Block	• SWER lines to be maintained to Major Track standard. • ETSA to continue to maintain agreed 18 m clearance under powerlines.

	Values and Assets	Location/Block	Recommended Works
Flinders Chase NP (Southern Block)	Western KI Caravan Park Wildlife Sanctuary KI Wilderness Retreat Southern Ocean Lodge Agricultural land Forest plantations Rural living Heritage Agreements GRN tower	To the east of the reserve	• Residents & property owners are encouraged to prepare & implement a Bushfire Action Plan as per the CFS guidelines. • Recommend neighbours implement fuel reduction on their own land through asset protection zones (in accordance with the KI District Bushfire Prevention Plan (KI DBPC, 2000) & any subsequent approved plans) & install fire protection systems. • Recommend facilities providing visitor accommodation prepare an emergency response plan & ensure that all staff are trained in emergency procedures. • B-zone (1 km width) along Sanderson Track & West End Highway. Burning shall be scheduled to minimise the negative impact on visitor experience, whilst still achieving burn program requirements. • Maintain Sanderson Track to 5 m width plus 12 m clearance (strategic fire break). • Fire breaks (20 m width) should continue to be maintained around plantations by owners in accordance with Development Approval conditions.
	Flinders Chase NP – whole of reserve (south of East & West Melrose Tracks)	Sandy Creek Block Rocky River Precinct Block Bunker Hill Block Maupertuis Bay Block East Melrose Block West Melrose Block Black Swamp Block	• East-west landscape B-zone (1 000 m) from immediately north of East Melrose Track north of Sandy Creek to the west coast of Flinders Chase NP. • B-zone (40 m) between Entrance Road & SWER line to reduce the risk to road users, improve access for firefighters & to provide a suppression advantage in which to undertake backburning providing protection to assets at Rocky River. • B-zone (1 km) along Sanderson Track & (500 m to 1 km) along the extent of the West End Highway through to Playford Highway. • Burning outside of A- and B-zones will be considered & implemented once outcomes from specific research & the application of the adaptive management process are defined.
Ravine des Casoars WPA	Harvey's Return Cemetery	Breakneck River Block	• A-zone (20 m) to be maintained around the Harvey's Return Cemetery. • B-zone (500 m width) on the southern side of Playford Highway through to Ravine Rd & then north along Scott's Cove Lookout Rd to reduce the likelihood of fire impacting the cemetery under a south westerly. Burning shall be scheduled to minimise the negative impact on visitor experience, whilst still achieving burn program requirements.
	Harvey's Return Campground Toilet Harvey's Return Landing Site (storage hut & capstan site ruins)	Breakneck River Block	• A-zone (40 m) around the assets at Harvey's Return campground. • B-zone (500 m width) on the southern side of Playford Highway through to Ravine Rd & then north along Scott's Cove Lookout Rd to reduce the likelihood of fire impacting the campground. Burning shall be scheduled to minimise the negative impact on visitor experience, whilst still achieving burn program requirements. • Provide visitors an information handout total fire ban days (FFDI >50).

	Values and Assets	Location/Block	Recommended Works
Ravine des Casoars WPA	Agricultural land Forest plantations Rural living Heritage Agreements Flinders Chase Farm	To the east of the reserve	• B-zone (up to 1000 m width) along the western side of West End Highway where private land abuts the reserve to reduce the likelihood of fire exiting the reserve & impacting adjacent assets. Burning shall be scheduled to minimise the negative impact on visitor experience, whilst still achieving burn program requirements. • B-zone (up to 1 km) to buffer the 3 km of the Rocky River adjacent West End Highway & East Melrose Track. This will maintain the overall fuel hazard at *High* or less within the Rocky River to minimise the likelihood of an escape to the east where continuous fuels exist through private land. • Residents & property owners are encouraged to prepare & implement a Bushfire Action Plan as per the CFS guidelines. • Recommend neighbours implement fuel reduction on their own land through asset protection zones (in accordance with the KI District Bushfire Prevention Plan (KI DBPC, 2000) & any subsequent approved plans) & install fire protection systems. • Fire breaks (20 m width) should continue to be maintained around plantations by owners in accordance with Development Approval conditions. • Recommend that facilities providing visitor accommodation prepare an emergency response plan & ensure that all staff are trained in emergency procedures.
	Agricultural land Forest plantations Rural living Heritage Agreements	To the north of the reserve	• B-zone (500 m) along the southern side of Playford Highway from Ravine Road through to West End Highway) to reduce the likelihood of fire crossing the reserve boundary. Burning shall be scheduled to minimise the negative impact on visitor experience, whilst still achieving burn program requirements. • B-zone (500 m) to buffer the Ravine des Casoars River at the river crossing on the Playford Highway to approximately 1.5km to the east. This will maintain the overall fuel hazard at High or less within the river system adjacent to the Playford Highway & minimise the likelihood of an escape to the north where continuous fuels exist. • B-zone (1 km) to buffer the headwaters of the Rocky River (at the junction of West End & Playford Highway) to minimise the likelihood of bushfire escape. • Residents are encouraged to prepare & implement a Bushfire Action Plan as per CFS guidelines. • Refer to the *Cape Forbin Integrated Fire Management Plan* for risk mitigation works & strategies for assets to the north of the reserve (DEH, 2008p). • Fire breaks (20 m width) should continue to be maintained around plantations by owners in accordance with Development Approval conditions.

	Values and Assets	Location/Block	Recommended Works
Ravine des Casoars WPA	Power & communications infrastructure	Along Playford Highway – Breakneck River, Ravine des Casoars & Upper Rocky River Block	• B-zone (500 m width) along Playford Highway will reduce the likelihood of impact to infrastructure (which either fall within the zone or across Playford Highway on other lands). Burning shall be scheduled to minimise the negative impact on visitor experience, whilst still achieving burn program requirements.
	Ravine des Casoars WPA – whole of reserve	Breakneck River Block Upper Rocky River Block Ravine des Casoars Block	• Equipment use in Wilderness Areas must comply with the SA Code of Management for Wilderness Areas (DEH, 2004a) (see Appendix 2) & DEH policy. • B-zone (500 m) along the western side of West End Highway to reduce the likelihood of fire moving into Gosselands Block. • B-zone (500 m) either side of Shackle Road in order to reduce the likelihood of fire crossing Shackle Road. • B-zone (500 m) to be implemented along the southern side of Playford Highway (northern boundary of the reserve) from Ravine Road through to West End Highway)to reduce the likelihood of fire exiting & entering the reserve by crossing the Playford Highway. • B-zone (1 km) to buffer the creek system north of Scotch Thistle Flat along Shackle Road for a 3 km length to reduce fuels in an area where the risk of fire escape is extreme. • B-zone (500 m) to buffer the upper reaches of the Breakneck River (where it crosses Shackle Road) for 3 km of its length to reduce fuels in an area where the risk of fire escape is extreme. • B-zone (1 km) along the northern side of West & East Melrose Track to the ocean to reduce the likelihood of fire entering Flinders Chase NP. • Burning outside of A- and B-zones will be considered & implemented once outcomes from specific research & the application of the adaptive management process are defined. • Any burning shall be scheduled to minimise the negative impact on visitor experience, whilst still achieving burn program requirements.
Flinders Chase NP (Cape Borda)	Cape Borda Lighthouse Museum Store Flinders Light Lodge Hartley Hut Woodward Hut Toilet Picnic shelters BOM tower	Cape Borda Block	• A-zone (50 m) surrounding assets. • Park residents need to implement their own Bushfire Action Plan as per CFS guidelines. • Emergency information to continue to be provided to visitors & accommodation guests. • An extract from the KI West Bushfire Action Plan to be available to visitors at all accommodation premises. • Provide visitors an information handout on days declared a total fire ban by the CFS (FFDI >50).

	Values and Assets	Location/Block	Recommended Works
Flinders Chase NP (Gosselands)	Agricultural land Forest plantations Rural living Heritage Agreements	To the north of the reserve	• B-zone (500 m) to be implemented along the northern boundary to reduce the likelihood of fire escaping reserve. • B-zone (1 km) to buffer the headwaters of the Rocky River (at the junction of West End Highway & Playford Highway) to minimise the likelihood of bushfire escape. • Refer to the *Cape Forbin Integrated Fire Management Plan* for risk mitigation works & strategies for assets to the north of the reserve (DEH, 2008p). • Recommend that neighbours implement fuel reduction on their own land through the establishment of asset protection zones (in accordance with the KI District Bushfire Prevention Plan) & install fire protection systems. • Fire breaks (20 m width) should continue to be maintained around forest plantations by owners in accordance with Development Approval conditions..
	Agricultural land Forest plantations Rural living Heritage Agreements GRN Tower Native vegetation	To the south & east of the reserve	• B-zone (500 m) along the entire eastern boundary to minimise the risk of fire escaping the reserve. • B-zone along Walsh & Warner Track (500 m width) to reduce the likelihood of fire impacting private lands or entering the reserve. • B-zone (100 m) along the southern boundary - Church Rd (to Walsh Track), Riggs Heritage Track & Hammatt Boundary Track) to reduce the risk of fire entering/exiting the reserve. • Maintain perimeter access – liaise with neighbours/DBPC if preferred access if off-reserve. • Upgrade Yabby Track & the northern & east boundary track to a Standard Track. • Residents are encouraged to prepare & implement a Bushfire Action Plan as per the CFS guidelines. • Recommend neighbours implement fuel reduction on their own land through asset protection zones (in accordance with the KI District Prevention Plan) & install fire protection systems • Fire breaks (20 m width) should continue to be maintained around forest plantations by owners in accordance with Development Approval conditions.
	Western Districts Community & Sports Centre	To the north east of Gosselands Block (within Baxter Block)	• B-zone (1 km) to the south west of the Western Districts Community & Sports Centre (along the reserve boundary, within Gosselands Block) to reduce the likelihood of fire threat. • Recommend to DBPC that a 50 m A-zone is implemented by the owner to reduce the likelihood of direct flame contact & radiant heat should a bushfire threaten. • Recommend that fire preparedness measures should be reviewed & assessed by the owner.

	Values and Assets	Location/Block	Recommended Works
Flinders Chase NP (Gosselands)	Gosselands – whole of reserve	Gosselands Block East Gosselands Block	• B-zone along North-South Track (100 m either side of track) to reduce the likelihood of the Gosselands burning in one fire event & increase safe access for firefighters & provide prescribed burning opportunities. • 3 km of the B-zone along North-South Track (north of Walsh Track) to be increased to a width of 1 km to provide a fuel reduced area along the creekline to minimise the likelihood of a bushfire escaping this block. • B-zone (1 km) to buffer the creek system along North-South Track (immediately north of Reedy Track) to provide a fuel reduced area along the creekline to minimise the likelihood of a bushfire escaping this block. • B-zone along Warner Track & Walsh Track through to the West End Highway (500 m width) to reduce the likelihood of fire impacting the southern section of the Gosselands • B-zone (100 m width) along the eastern side of Gosse Richie Road. • Recommend to DBPC that Gosse Richie Rd continue to be maintained as a Major Track. • Burning outside of A- and B-zones will be considered & implemented once outcomes from specific research & the application of the adaptive management process are defined. • Implement burn to the west of Snake Track within the East Gosselands Block • Upgrade Yabby Track & the northern & east boundary track to a Standard Track. • Birdsville Creek Crossing to be upgraded & apron extended. • Reedy Track to be re-routed to improve alignment (west of Reedy Creek).
Kelly Hill CP/Cape Bouguer WPA	Kelly Hill Visitor Centre Show Cave Entrance Picnic shelters BBQ areas Toilet Kelly Lodge Homestead	Kelly Hill/Cape Bouguer Block	• A-zones (50 m) surrounding reserve assets. • Encourage park residents to prepare & implement their own Bushfire Action Plan as per CFS guidelines. • Emergency information to continue to be provided to visitors & accommodation guests. • An extract from the KI West Bushfire Action Plan to be available to residents & visitors at all accommodation premises. • Provide an information handout to visitors intending to undertake the 9 km Hanson Bay Hike on days declared a total fire ban by the CFS (FFDI >50).
	Grassdale Cottage	Kelly Hill/Cape Bouguer Block	• A-zone (50 m) around cottage. • Emergency information to continue to be provided to visitors & accommodation guests. • An extract from the KI West Bushfire Action Plan to be available to visitors at all accommodation premises.

	Values and Assets	Location/Block	Recommended Works
Kelly Hill CP/Cape Bouguer WPA	Karatta Outdoor Education Centre Telecommunication Exchange	Adjacent northern boundary	• This Crown land reserve is dedicated to the Minister for Education & Children's Services. Therefore they are responsible for all management activities on this Crown land reserve. • Encourage Minister to manage fuels to reduce fire risk to centre & implement a Bushfire Action Plan. • DEH to implement an access track around the Crown land reserve. • B-zone (200 m width) along Crown land reserve boundary to reduce the likelihood of fire entering the Crown land reserve • from DEH land or vice versa.
	Forestry assets Rural living Agricultural land Heritage Agreements	To the north of Kelly Hill CP	• B-zone (300 m width) along the northern boundary of Kelly Hill CP from Hanson Bay Rd to Grassdale Track. • B-zone (40 m) along the northern boundary of Kelly Hill CP where the other B-zone does not occur. • Fire breaks (20 m width) should continue to be maintained around plantations by owners in accordance with Development Approval conditions.
	Hanson Bay cabins & shacks Southern Ocean Lodge	To the west of the reserves	• Residents & property owners are encouraged to prepare & implement a Bushfire Action Plan as per the CFS guidelines. • Recommend neighbours implement fuel reduction on their own land through asset protection zones (in accordance with the KI District Bushfire Prevention Plan (KI DBPC, 2000) & any subsequent approved plans) & install fire protection systems. • Recommend that facilities providing visitor accommodation prepare an emergency response plan & ensure that all staff are trained in emergency procedures. • Encourage KI Council to continue to maintain Hanson Bay Road as a Major Track. • Recommend that DBPC work with landowners to implement a 200 m B-zone on the western side of Hanson Bay Road for its entire length.
	Rural living	To the east of the reserves	• B-zone (500 m to 1 km width) along Douglas Hill Boundary Track (strategic break) to reduce the likelihood of fire exiting reserve • Create a Minor Track running north-south 100m east of Douglas-Hill Boundary Track & implement B-zone between the two tracks before attempting to implement larger B-zone described above. • Maintain Douglas-Hill Boundary Track to Major standard. • Further track upgrades off-reserve need to be considered by the DBPC.

	Values and Assets	Location/Block	Recommended Works
Kelly Hill CP/ Cape Bouguer WPA	Cape Bouguer WPA & Kelly Hill CP – whole of reserve	Kelly Hill/Cape Bouguer Block	• Equipment use in Wilderness Areas must comply with the SA Code of Management for Wilderness Areas (DEH, 2004a) (see Appendix 2)& DEH policy. • Burning outside of A- and B-zones will be considered & implemented once outcomes from specific research & the application of the adaptive management process are defined. • B-zone (500 m to 1 km width) along Douglas Hill Boundary Track (strategic break) to reduce the likelihood of fire moving through native vegetation to the east. • Recommend that DBPC work with landowners to implement a 200 m B-zone on the western side of Hanson Bay Road for its entire length.
Baxter Block	Heritage Agreements Native Vegetation	Baxter Block	• DEH will minimise the likelihood that a fire will escape DEH managed land & impact the significant Glossy Black-Cockatoo habitat within the creeklines & Heritage Agreements of Baxter Block. See other blocks for strategies & works & Appendix 3 & 4 for information on the fire response of the Glossy Black-Cockatoo & other significant & introduced species.
	Agricultural land Rural living Forest plantations Western KI Caravan Park Flinders Chase Farm GRN tower	Baxter Block	• Residents & property owners are encouraged to prepare & implement a Bushfire Action Plan as per the CFS guidelines. • Recommend neighbours undertake fuel reduction on their own land through asset protection zones (in accordance with the *KI District Bushfire Prevention Plan* (KI DBPC, 2000) & any subsequent approved plans) & install fire protection systems. • Recommend that facilities providing visitor accommodation prepare an emergency response plan & ensure that all staff are trained in emergency procedures. • Fire breaks (20 m width) should continue to be maintained around plantations by owners in accordance with Development Approval conditions. • DEH will implement fuel reduction on adjacent DEH managed land to minimise the likelihood of fire escape into Baxter Block. See other blocks for strategies & works.
Hanson Bay Block	Adjacent Native Vegetation Cape Bouguer WPA & Kelly Hill CP	To the east of the block	• Recommend that DBPC work with landowners to implement a 200 m B-zone on the western side of Hanson Bay Road for its entire length. • DEH will implement fuel reduction on adjacent DEH managed land to minimise the likelihood of fire escape into Hanson Bay Block. See other blocks for strategies & works.
	Adjacent Native Vegetation Flinders Chase FMP	To the west of the block	• B-zone (1 km width) along Sanderson Track (within Flinders Chase NP) • Sanderson Track to be maintained as a strategic fire break. Track to be maintained to 5 m width plus 12 m clearance.

	Values and Assets	Location/Block	Recommended Works
Hanson Bay Block	Native Vegetation	Hanson Bay Block - Allotment 8 Hundred of McDonald	• If DEH purchases Allotment 8 consider prescribed burning for ecological management or landscape protection & implement once outcomes from specific research & the application of the adaptive management process are defined. • Liaise with DBPC to upgrade Sanctuary Track to a Standard Track. • DEH will implement fuel reduction on adjacent DEH managed land to minimise the likelihood of fire escape into Hanson Bay Block. See other blocks for strategies & works.
	Hanson Bay cabins & shacks Southern Ocean Lodge	To the south of the block	• Encourage KI Council to continue to maintain Hanson Bay Rd as a Major Track & work with landholders to implement a 200 m B-zone along the western side of the road. • Residents & property owners are encouraged to prepare & implement a Bushfire Action Plan as per the CFS guidelines. • Recommend that neighbours implement fuel reduction on their own land through asset protection zones (in accordance with the KI District Bushfire Prevention Plan (KI DBPC, 2000) & any subsequent approved plans) & install fire protection systems. • Recommend that facilities providing visitor accommodation prepare an emergency response plan & ensure that all staff are trained in emergency procedures.
	Western KI Caravan Park Wildlife Sanctuary KI Wilderness Retreat Agricultural land Forest plantations Rural living Heritage Agreements	To the north of the block	• Residents & property owners are encouraged to prepare & implement a Bushfire Action Plan as per the CFS guidelines. • Recommend that neighbours implement fuel reduction on their own land through asset protection zones (in accordance with the KI District Bushfire Prevention Plan (KI DBPC, 2000) & any subsequent approved plans) & install fire protection systems. • Recommend that facilities providing visitor accommodation prepare an emergency response plan & ensure that all staff are trained in emergency procedures. • If DEH purchases Allotment 8 consider prescribed burning for ecological management or landscape protection & implement once outcomes from specific research & the application of the adaptive management process are defined. • Liaise with DBPC to upgrade Sanctuary Track to a Standard Track. • Fire breaks (20 m width) should continue to be maintained around plantations by owners in accordance with Development Approval conditions.

Appendix 2 – Wilderness Code of Management

Section 3.6 'Fire'

(i) Fire management will be based on continuing research into the fire history of the area, the relationships between fire and the natural communities occurring within the area, and on the maintenance of wilderness quality.

(ii) Deliberately lit fires will be used only in emergency situations, and in essential management operations as listed in 3.10 and subject to (i) above.

(iii) Other human caused fires should, where practicable, be extinguished consistent with maintenance of wilderness quality.

(iv) Naturally caused fires will be extinguished when, in view of the direction, intensity and extent of the fire and the fire suppression techniques available, they pose a threat to human life and property, and to habitats requiring protection.

(v) Where fire suppression action is required, the methods utilised will be, wherever possible, those which will have the least long-term impact on wilderness quality.

(vi) The use of heavy machinery for fire suppression within a wilderness area will be prohibited except:

a) where it is considered to be the only way of preventing greater long-term loss of wilderness quality
b) where specific machinery use techniques, that do not result in significant disturbance to the landscape or create a new access network, are considered the only feasible method of preventing long-term loss of wilderness quality
c) to mitigate hazard to human life, where alternative measures which do not impact on the wilderness quality of the area are unavailable.

(vii) Wherever possible, fire management practices designed to protect land adjacent to or within a wilderness area will be conducted outside the wilderness area.

Section 3.10 'Emergency and Essential Management Operations'

(i) All emergency and essential management operations will be carried out with the least possible impact on wilderness quality.

(ii) Actions that cause short-term degradation of wilderness quality but are necessary for emergency and/or essential management operations will be permitted. The only specific situations acknowledged in this Code as possibly requiring such actions are:

- control or eradication of non-indigenous species
- conservation of threatened species, communities and habitats
- protection of fire-sensitive species and communities
- management of visitor use
- management action or use of devices to mitigate hazard to human life
- restoration of natural processes, communities and habitats
- research

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

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

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

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

Species	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
*Arctotheca calendula**	Cape Weed				KH FC	Annual herb to 30 cm	• Flowers: Sept – Nov • Seeder • Risk of introduction/spread by machinery	• #	Aus^
*Asparagus asparagoides**	Bridal Creeper				KH FC	Herb	• Flowers: Aug - Sept • *Weed of National Significance* • Declared under the SA NRM Act 2004 • Mature plants resprout following fire • Seeds are short lived with few remaining viable for > 2 years • Seedlings take 3 to 5 years to set seed • Refer to the *Bridal Creeper Management Strategy for KI 2006-2010* report (Wilson, 2006)	• Weed control may be required post-fire	SA^
Asperula euryphylla var. *tetraphylla*	Broad-leaf Woodruff		V	29	FC	Wiry branched shrub	• Flowers: Nov – Dec • Little is known about the ecology of this species.	• #	
Asterolasia phebalioides	Downy Star-bush	VU	V	29	FC	Small shrub to 1.5m	• Flowers: Jun - Oct • Regenerates from seed • Requires 6 years to set seed, however may require up to 10 years between disturbances to set seed • Found in heathlands, with a sparse overstorey & occasionally in KI Mallee Ash • Long lived early coloniser following fire or soil disturbance	• Avoid inter-fire intervals of < 9 years & > lifespan + seedbank	KI^ SA^
*Billardiera heterophylla**	Blue-bell Creeper					Shrubby climber	• Flowers: Spring – Summer • Occurs in areas receiving over 550 mm of rainfall annually • Can survive extended dry periods • Only reproduces from seed • Prolific seeding regeneration after fire or soil disturbance	• Consider weed control post-fire	SA^

Species	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
Cheiranthera volubilis	Twining Hand-flower	VU	V	2629	FC	Climbing twiner	• Flowers: Sept - Feb • Grows on the upper slopes of dissected plateau • May depend on fire at regular intervals for survival • Threatened by road & fire break maintenance activities	• #	KI^ SA^
Correa eburnea	Deep Creek Correa		V	8 26 29 47		Shrub	• Little is known about the biology & ecology of this species	• #	
Derwentia derwentiana ssp. homalodonta	Mt Lofty Speedwell		E		FC	Herbaceous clumping shrub	• Seed regenerator, 1 year to set seed • Does not tolerate shade or strong competition from shrubs • Prefers moist areas with excellent drainage • Some indication that the species may increase in abundance after fire	• Avoid inter-fire intervals < 5 years • Avoid 3 or more successive fires of low intensity	SA^
Deyeuxia minor	Small Bent-grass		V	29	FC	Tufted perennial grass	• Flowers: Nov - Dec • Resprouting species • Requires 1 year to reach maturity • Fire tolerant	• Avoid inter-fire intervals < 4 years	KI^
Diuris brevifolia	Short-leaf Donkey-orchid		E	8 29 47		Herb to 40cm	• Flowers: Sept - Dec • Resprouts & disperses seeds • Intolerant of fire	• Avoid inter-fire intervals < secondary juvenile period + 3 years • Avoid inter-fire intervals > lifespan + seedbank	KI^
*Echium plantagineum**	Salvation Jane					Herb	• Declared under the SA NRM Act 2004 • Mature plants killed by fire • Seedlings readily recruit post-fire • Some seeds are killed by fire	• Weed control may be required post-fire	SA^

Species	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
Eucalyptus paludicola	Mount Compass Swamp Gum	EN	E		CB	Small tree to 5 – 10 m	• Endemic to SA, also occurs on the Fleurieu Peninsula • Known from a 1 km^2 area within Cape Bouguer WPA • Prefers seasonally swampy areas, depressions & broad gullies, or hillsides near permanent creeks where the soil is waterlogged over winter	• #	Aus^
Eurychorda complanata	Flat Cord-rush		V			Herb	• Flowers: Oct – Nov • Little is known about the biology & ecology of this species	• #	
Hakea aenigma	Enigma Hakea		R	8 29 47	FC RC	Rounded bushy shrub	• Flowers Sept - Nov • Grows in dense mallee heath in sandy to clayey loam soils • Endemic to KI, confined to the lateritic plateau at the western end • Resprouting species, reproduces by suckering • Intolerant of fire	• Avoid inter-fire intervals > than life span • Avoid 2 or more fires at short intervals	KI^
Isolepis producta	Nutty Club-rush		V			Aquatic herb	• Flowers: Nov – Jan • Found in muddy swampy areas & rock pools	• #	
Logania insularis	Kangaroo Island Logania	VU	V	29	FC	Low growing shrub	• Flowers: Sept - Nov • Endemic to KI, entire population occurs at Cape Borda • Grows in sand deposits in between calcrete outcrops on northern & western facing mid & upper slopes • Re-grows from seed & requires 6 years to set seed • Fire tolerant	• Avoid inter-fire intervals < 9 years	KI^
*Marrubium vulgare**	Horehound				FC	Bushy perennial to 1 m	• Flowers: Spring & Summer • Fire kills mature plants & may reduce the soil seed bank by up to 80%, however seedlings readily recruit post-fire • Seeder • Drought tolerant	• Weed control required post-fire, either through spraying or burning at a short inter-fire interval	Aus^

Species	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
Microtis orbicularis	Swamp Onion-orchid		V	8 29 47	KH	Perennial herb	• Flowers: Sept – Nov • Occurs in areas which are inundated for up to 6 months of the year, such as waterholes, lake margins & shallow lagoons where very large populations may form • Resprouts & re-grows from dispersed seed • Fire intolerant	• Avoid inter-fire intervals < primary juvenile period + 3 years	KI^ SA^
*Moraea flaccida**	One-leaf Cape Tulip					Perennial herb with annual leaves & flowers	• Flowers: early Spring • Seed regenerator, seeds are only viable for 1 year • Plant requires 2 to 3 years to set seed & flower • Plants reproduce vegetatively through root corms that go dormant over summer & stay dormant in the soil until conditions are favourable • Fire can play a role in bringing corms out of dormancy – after fire a light rain can stimulate the sprouting of corms	• #	Aus^
*Moraea miniata**	Two-leaf Cape Tulip					Perennial herb with annual leaves & flowers	• Flowers: early Spring • Does not produce viable seed but instead produces cormils • Cormils separate from the parent plant in early Spring & remain viable in the soil for over 8 years • Plants reproduce vegetatively through root corms that go dormant over summer & stay dormant in the soil until conditions are favourable • Fire can play a role in bringing corms out of dormancy – after fire a light rain can stimulate the sprouting of corms	• #	Aus^ SA^
Nymphoides geminata	Entire Marshwort		V	29		Tufted aquatic perennial	• Flowers: chiefly Oct - May • Found in shallow fresh water to 40cm deep & saturated soil	• #	SA^
Pterostylis furcata	Forked Greenhood		E	8 29 47		Terrestrial herb	• Flowers: Dec – Mar • Grows in wet situations such as seepage areas or near streams.	• #	Aus^

Species	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
Ptilotus beckerianus	Ironstone Mulla Mulla	VU	V	8 29 47	KH FC	Herb	• Flowers: Sept - Jan • Occurs on KI & the Eyre Peninsula, on gently sloping terrain associated with low ridges • The majority of known populations appear to be in areas disturbed within the last 10 years or in naturally open habitat • Known to proliferate after fire until mid to upperstorey species outcompete • Appear to thrive on disturbance & set seed quickly	• #	KI^
Pultenaea villifera var. *glabrescens*	Splendid Bush-pea	VU	V	8 29 47	FC	Low spreading or tall shrub	• Flowers: Sept - Oct • Endemic to KI , occurs in areas ranging from seaside cliffs to the upper slopes of ridge systems • Most of the preferred habitat occurs across the north coast of KI however one population occurs at Harvey's Return	• #	KI^
*Reseda luteola**	Mignonette					Erect herb	• Flowers: May/Nov - Jan	• #	
Restio complanatus	Flat Cord-rush		V			Tufted rush	• Flowers Nov – Dec • Found in wet areas in heath & shrubland	• #	
Schizaea bifida	Forked Comb-fern		V	29		Clustered erect fern to 35 cm	• Found in swampy areas or on moist soils • Resprouting species • Requires 2 years to produce viable spores • Lifespan of plant + spores = 100 years • Tolerant of fire	• Avoid inter-fire intervals < 5 years	KI^
Schizaea fistulosa	Narrow Comb-fern		V	29		Clustered erect fern to 30 cm	• Usually found on raised soil mounds in swamps or under scrub in moist situations • Resprouting species • Requires 2 years to produce viable spores • Tolerant of fire	• Avoid inter-fire intervals < 5 years	KI^

Species	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Life Form	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines/ Post-fire Mgt	Source
*Silybum marianum**	Variegated Thistle					Herb	• Flowers: Spring – Summer • Declared under the SA NRM Act 2004 • Seeds may remain viable in the soil for at least 9 years • Can form dense impenetrable stands	• #	Aus^
Thelymitra matthewsii	Spiral Sun-orchid	VU	E	29	RC	Ground orchid to 20 cm	• Flowers: Aug - Sept • Occurs in SA, Victoria & Western Australia • Occurs on gentle sloping plateaus in lateritic podsols within *Eucalypt* tall open shrubland • Resprouting species • Requires 1 year to set seed • Tolerant of fire	• Avoid inter-fire intervals < 4 years	KI^
Trifolium species*	Clover				FC KH	Low growing herb	• Six *Trifolium* species have been recorded in the plan area • Native to the Mediterranean • Prefers well-drained soils	• #	Aus^
*Urtica urens**	Small Nettle				FC	Annual herb to 60 cm	• Flowers: July - Nov • Re-grows from seed post-fire	• #	Aus^
*Watsonia bulbillifera**	Bulbil Watsonia					Erect herb	• Flowers: Oct – Dec • Declared under the SA NRM Act 2004 • Fire stimulated flowering has been recorded in *Watsonia* sp.	• #	SA^

Appendix 4 – Fire Response of Rated and Significant Fauna Species

Type	Species	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Amphibian	*Pseudophryne bibronii*	Brown Toadlet		R			I	• Sites: damp sites beside swamps, creeks & ditches • Material: moist soil • Season: males call from Feb - Jun esp. after heavy rain	• Ground dwelling frog • Inhabits forests, heathlands & grasslands, usually found under leaf litter, logs & rocks in moist soaks & depressions in areas likely to be inundated after rain • Low mobility • Fire likely to kill individuals & destroy preferred habitat	• Reduce the likelihood of extensive bushfires	Aus^
Bird	*Biziura lobata*	Musk Duck		R	29		I G	• Sites: around brackish Tea-tree swamps & freshwater lagoons • Season: spring/summer	• Moderate mobility • Inhabits non-fire dependant habitat • Long-lived species	• Avoid burning areas surrounding brackish Tea-tree swamps & freshwater lagoons • Avoid 2 or more successive fires in spring/summer	KI^
Bird	*Burhinus grallarius*	Bush Stone Curlew		V	8 29 47		I	• Sites: ground, within shallow scrape or bare patch • Material: soil • Season: Aug-Jan	• Prefers a farmland/bush interface & coastal mallee, mallee/open scrub & forest (e.g. to the area east of Flinders Chase NP) • Require fallen timber & debris for foraging, shelter & camouflage • Moderate mobility • High risk of significant impact on populations from extensive fires	• Avoid burning more than 50% of individual habitat patches in a single fire event. • Avoid 2 or more successive fires in spring/summer.	KI^

Type	Species	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Bird	*Callocephalon fimbriatum*	Gang Gang Cockatoo		R		FC	G	• Sites: tree hollows at great height • Material: lined with woodchips & dust • Season: Oct-Jan	• Introduced into planning area • Rely on mature tall trees for breeding & have a high fidelity to selected hollows • Feed on seeds from Eucalypts, Wattles & introduced Hawthorns • Will also eat berries, insects & their larvae • Low intensity fire is unlikely to impact key habitat requirements • Threatened by frequent fire impacting the availability of hollows	• Avoid 2 or more successive fires in spring-summer	Aus^
Bird	*Calyptorhynchus funereus*	Yellow-tailed Black-Cockatoo		V	8 26 29 47		G	• Sites: Sugar Gum hollows, high in trees • Material: woodchips • Season: Summer	• Inhabits woodland & often seen in pine plantations where it feeds on seeds • High mobility • Potential long-term loss of breeding habitat from extensive, high intensity fires. • Fire exclusion may inhibit hollow development	• Avoid burning more that 20% of nesting patches in a single fire event. • Avoid 2 or more successive fires in summer • Avoid high intensity fires in nesting habitat	KI^
Bird	*Calyptorhynchus lathami halmaturinus*	Glossy Black-Cockatoo	EN	E	8 26 29 47		G	• Sites: Sugar Gum, Blue Gum & Manna Gum hollows • Material: decayed wood • Season: Jan-Jul	• High mobility within flock areas. • Potential long-term loss of feeding & breeding habitat from extensive high intensity fires • Fire exclusion may inhibit hollow development & feeding habitat regeneration • Important nesting area in Baxter Block	• Avoid burning > 5% of feeding & nesting habitat in any individual flock area in any 5 year period • Avoid high intensity fires in nesting habitat • Avoid late summer to early winter burns	KI^

Type	Species	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Bird	*Cereopsis novaehollandiae*	Cape Barren Goose		R	8 29 47		H	• Sites: on fresh & brackish lagoon edges • Season: winter/spring	• Introduced to KI • High mobility • Found within pasture, tussock grassland or low heathy shrubland	• Avoid burning more than 50% of individual habitat patches in a single fire event • Avoid 2 or more fires in winter/spring	KI^
Bird	*Chrysococcyx lucidus*	Shining Bronze-Cuckoo		R	8 29 47		I	• Sites: brood parasite • Material: variable • Season: Aug - Jan	• Found in tall *Eucalypt* & *Melaleuca* belts around lagoons • Moderate mobility • Home range size unknown, but it is likely to be large • Driven by host response • Fire likely to increase parasitism by exposing nests • May benefit from exposed sites, to feed on insects • High risk of significant impact on populations from extensive fires	• Avoid burning more than 50% of individual habitat patches in a single fire event. • Avoid 2 or more successive fires in spring/summer.	SA^
Bird	*Falco peregrinus*	Peregrine Falcon		R	8 29 47		C	• Sites: rock crevices, cliffs • Material: rock • Season: Aug - Dec	• Preferred habitat includes rocky cliffs (usually coastal) & lagoons • The same nesting sites may be used for many years • High mobility - pairs will maintain a home range of approximately 20-30km^2 • Unlikely to be adversely affected by fire • Fire will influence the availability of prey species within home ranges	• Reduce the likelihood of extensive bushfires	SA^

Type	Species	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Bird	*Hylacola cauta halmaturina*	Shy Heathwren		R			I	• Sites: on or near the ground. • Material: bark & grasses & lined with finer grasses/soft material • Season: Jul-Nov	• Subspecies endemic to KI • Low mobility • Prefers mallee & coastal thickets with dense, low cover, grass tussocks & sand plain • In NSW the species occupies vegetation with a post fire age of 4 to 40 years, but is most abundant 4 to 8 years post-fire.	• #	Aus^
Bird	*Melithreptus lunatus* subspecies	White-naped Honeyeater			8 47		I N	• Sites: high in tree/sapling • Material: grass, bark & spider webs • Season: Jul - Dec	• Subspecies is regionally Rare on KI • Prefers dry open forests & woodlands	• #	(Willoughby, *et al.*, 2001)
Bird	*Psophodes nigrogularis lashamri*	Western Whipbird		R	8 29 47		I	• Sites: dense understorey • Material: • Season: Late winter/spring	• Prefers dense scrub & undergrowth in mallee & heathland • Favours coastal environments on KI • Preferred areas 10 to 30 years post fire • Moderate mobility • High potential for significant mortality & loss of habitat as a result of extensive high intensity fires	• Avoid burning more than 50% of individual habitat patches in a single fire event • Avoid 2 or more successive fires in late winter/spring	KI^
Bird	*Stagonopleura bella*	Beautiful Firetail		R	8 26 29 47		G	• Sites: within thick foliage of a bush or tree • Material: bottle shaped nest of grass & leaves • Season: Sep-Jan	• Sedentary to moderately mobile • High potential for significant impact on populations due to extensive fires • Prefers habitat dominated by Sheoak & Tea-tree & swampy/marshy areas not far from water • Forages on the ground	• >50% of a habitat patch should not burn in a single fire event • Avoid 2 or more successive fires in spring/early summer	SA^

Type	Species	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Bird	*Stipiturus malachurus halmaturinus*	Southern Emu-wren		R	8 29 47		I	• Sites: near the ground in a grass tussock or dense shrubbery • Material: grasses • Season: Aug-Dec	• Prefers low coastal mallee scrub & coastal heath, low open mallee over laterite soils • Moderate mobility • High potential for significant impact on populations from extensive fires	• Avoid burning more that 50% of nesting patches in a single fire event. • Avoid 2 or more successive fires in spring/early summer	KI^
Bird	*Turnix varia*	Painted Button-quail		R	8 29 47		I H G	• Sites: terrestrial under some vegetation, within a depression • Material: grass acting as a hood & lined with fine grass • Season: Spring-Summer	• Found within open forests & heaths with abundant leaf litter but prefers mallee, as it requires dense cover • Numbers may be temporarily reduced due to fire &/or exposure to predators • May invade or become abundant in recently burnt areas • Ground feeding species – generally become abundant after fire • Low mobility	• >50% of a habitat patch should not burn in a single fire event • Avoid 2 or more successive fires in spring/summer	SA^
Bird	*Zoothera lunulata*	Bassian Thrush		R	8 26 29 47		I F	• Sites: tree stump or fork to 13 m • Material: cup shaped of bark strips, leaves, grasses, moss & rootlets • Season: Jul-Dec	• Prefers thick, dense vegetation, damp forested river margins, taller coastal mallee & around lagoons & in gullies • Low to moderate mobility • High potential for significant impact on populations from extensive fires • Forages for insects on the ground • Frequent fire disrupts foraging sites	• Avoid burning more than 50% of individual habitat patches in a single fire event • Avoid 2 or more successive fires in late winter-summer	KI^

Type	Species	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Fish	*Galaxias brevipinnis*	Climbing Galaxias					I	• Spawning in Autumn & winter • Aquatic	• Listed as 'Rare' in the *Action Plan for SA Freshwater Fishes* (Hammer, *et al.*, 2007) • Population on KI considered secure - found in the Breakneck & Rocky Rivers • Occur in mid to upper reaches in deeper, cool pools with high levels of cover & a good buffer of vegetation • Able to move through streams, waterfalls & in-steam structures • Threatened by altered catchment hydrology & loss of stream side vegetation	• Reduce the likelihood of fire impact on catchment quality	(Hammer, *et al.*, 2007)
Mammal	*Isodon obesulus obesulus*	Southern Brown Bandicoot	EN	V	8 29 47		O	• Sites: within dense vegetation • Material: Grass, dead leaves • Season: Jun-Dec	• Prefers heathland, shrubland, dry sclerophyll forest with a heathy understorey, sedgeland & woodland (often sites that are regularly burnt) • Moderate mobility • Can survive in areas burnt by high intensity fires where unburnt patches occur • Increased exposure to predation following fires • Appear to prefer early to mid-successional stages (5-20 years) which provide dense understorey cover	• Maintain a mosaic of post-fire ages. • Avoid burning more than 50% of individual habitat patches in a single fire event • Avoid 2 or more successive fires in winter/early summer • Some long unburnt areas are probably desirable	R^
Mammal	*Ornithorhynchus anatinus*	Platypus		E			I	• Sites: multiple burrows in earth banks around rivers & creeks • Season: spring/summer	• Prefers slow flowing rivers • Inhabits the Rocky & Breakneck Rivers • Poor mobility • High potential for impact on populations from extensive fires due to decline in water quality	• Avoid burning more than 50% of catchments of the Rocky & Breakneck Rivers in any single fire event	KI^

Type	Species	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Mammal	*Phascolarctos cinereus*	Koala		R	8 29 47		H	• Sites: pouch • Season: summer	• Prefers forest, woodland & mallee – but predominantly riparian • Low mobility, sedentary • High potential for significant mortality & loss of feeding habitat as a result of extensive high intensity fires • High frequency fire can reduce the regeneration of preferred food trees & lead to a change in floristics	• Avoid burning more that 50% of individual habitat patches in a single fire event. • Avoid 2 or more successive fires in summer	KI^
Mammal	*Pseudomys shortridgei*	Heath Rat	VU	E	8 47		H	• Sites: shallow burrows or on the ground amongst thick vegetation • Season: Sept-Dec	• Poor mobility • Found in heathland, shrubland, dry schlerophyll forest with a heathy understorey, sedgeland & woodland • In Victoria that this species prefers recently burnt, species-rich, treeless heath communities. • Presence is linked to pyrogenic plant species.	• Maintain a mosaic of post-fire age classes • Avoid burning more than 50% of individual habitat patches in a single fire event • Avoid 2 or more successive fires in spring/summer	(Willoughby, *et al.*, 2001) KI^
Mammal	*Rattus lutreolus*	Swamp Rat		R		FC	I F H	• Sites: burrows up to 1m deep in dense grass, sedge or heath • Season: spring & autumn	• Prefers dense grassland, sedgeland or heathland near swamps • Cryptic species	• #	(Willoughby, *et al.*, 2001)

Type	Species	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Mammal	*Sminthopsis aitkeni*	Kangaroo Island Dunnart	EN	E	8 29 47		I	• Sites: ground • Material: leaves • Season: late winter/spring	• Endemic to KI – thought to be restricted to the planning area • Prefers open low mallee with a sparse understorey & deep leaf litter under *Banksia* & *Xanthorrhoea* species. • Thought to have a preference for early to middle seral stages • Extensive fires with few unburnt patches are likely to impact on populations • Requires unburnt patches for post fire recolonisation (<10ha) (Gates, 2001) • Appears to prefer areas that have been unburnt for > 11 years	• Maintain a mosaic of post-fire ages • Avoid burning more than 50% of individual habitat patches in a single fire event • Avoid 2 or more successive fires in spring	(Willoughby, *et al.*, 2001) (Gates, 2001)
Mammal	*Trichosurus vulpecula*	Common Brushtail Possum		R			H	• Sites: hollows • Season: autumn	• Fire reduces suitable habitat & displaces animals • Possum density is known to increase rapidly with increasing time since fire • In Tasmania the species prefers areas that are between 6 & 40 years post-fire	• Reduce the likelihood of extensive bushfires	Aus^
Mammal	*Cercatetus concinnus*	Western Pygmy Possum					I N	• Sites: hollows, stumps, lignotubers, disused birds nests, under shrubs, etc. • Material: nest of leaves • Season: all	• Nocturnal • Inhabits mallee and dry forest, particularly where *Banksia* sp., *Grevillea* sp. and *Melaleuca* sp. dominate. • Threatened by frequent fires that remove the shrub layer and mallee providing food and shelter	• Reduce the likelihood of extensive bushfires	Aus^

Type	Species	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Diet	Breeding	Species Ecology & Fire Response	Ecological Fire Mgt Guidelines	Source
Mammal	*Cercartetus lepidus*	Little Pygmy Possum					I N	• Sites: hollows, disused birds nests, under shrubs, etc. • Material: nest of leaves • Season: all	• Nocturnal • Dry forest with a dense shrub layer • Threatened by frequent fires that remove the shrub layer and mallee providing food and shelter	• Reduce the likelihood of extensive bushfires	Aus^
Reptile	*Varanus rosenbergi*	Heath Goanna		R	8 26 29 47		C I	• Sites: burrows in sandy soil • Season: egg laying in summer, hatching in early spring	• Occurs throughout KI • Moderate mobility • Will probably survive moderate & low intensity fires in burrows	• Avoid burning more that 50% of nesting patches in a single fire event. • Avoid 2 or more successive fires in spring	KI^

Appendix 5 – Ecological Communities of Conservation Significance

Ecological Community	SA Status (DEH, 2005)	EPBC Act Status	Reserve	Occurrence	Components	Fire Response	Ecological Fire Mgt Guidelines	Source
Swamp Honey-myrtle +/- Prickly Tea-tree Closed Shrubland on Peaty Soils "Hanging Swamps"	V		FC RC	• Associated with hanging swamps in the upper reaches of creeks in Flinders Chase NP & Ravine des Casoars WPA	• Community is declining in SA • Threatened by Phytophthora, increasing salinity & altered drainage. • It is recommended that field work should be undertaken in order to accurately map the extent of Hanging Swamps in the planning area	• Unknown	• #	

Summary of Codes Used in Appendices

Reserve/Block Codes

CODE	RESERVE/BLOCK	CODE	RESERVE/BLOCK
FC	Flinders Chase National Park	RC	Ravine des Casoars Wilderness Protection Area
KH	Kelly Hill Conservation Park	CB	Cape Bouguer Wilderness Protection Area
HB	Hanson Bay Block	BB	Baxter Block

Other Codes Used

NPW ACT STATUS		EPBC ACT STATUS		DIET OF RATED FAUNA SPECIES	
E	Endangered	EX	Extinct	C	Carnivore or scavenger. Mainly vertebrates
V	Vulnerable	CE	Critically Endangered	H	Herbivore. Includes folivores, grazers & browsers
R	Rare	EN	Endangered	N	Nectar feeder
		VU	Vulnerable	I	Insectivore/"arthropodivore"/omnivore
				G	Granivore. Typically peak in abundance after a fire event in fire adapted vegetation, due to the stimulation of flowering & 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	
KI	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).
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.
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.
Containment	A fire is considered contained once a control line has been completed around the fire, and around any associated spot fires, which can reasonably be expected to stop the fire's spread, but it may still be burning freely within the control lines.
Control line	A natural or constructed barrier, or treated fire edge, used in fire suppression and prescribed burning to limit the spread of fire.
DEH	The South Australian Department for Environment and Heritage.
DEH (Cwlth)	The Commonwealth Department of Environment and Heritage.
Direct attack	A method of bushfire attack where wet or dry firefighting techniques are used. It involves suppression action right on the fire edge, which becomes the control line.
Discontinuous fuels	Significant gaps between clumps or patches of fuel (DEH, 2006e).
DBPC	District Bushfire Prevention Committee.
EAT	DEH Environmental Assessment Table. Completed for all prescribed burns (as part of the Prescribed Burn Plan) and other fire management works where native vegetation is being cleared and is not exempt under the Native Vegetation Act 1991 (DEH, 2004b).
Elevated Fuel	Shrubs and juvenile understorey plants up to 3 m in height (DEH, 2006e)
EPBC Act	The Federal *Environment Protection and Biodiversity Conservation Act 1999.*
Extreme fire behaviour	A level of bushfire behaviour characteristics that ordinarily precludes methods of direct suppression action. One or more of the following is usually involved: high rates of spread; prolific crowning and/or spotting; presence of fire whirls and/or a strong convective column. Predictability is difficult because such

TERM	DEFINITION
	fires often exercise some degree of influence on their environment and behave erratically, sometimes dangerously.
Fine fuels	Grass, leaves, bark and twigs less than 6mm in diameter.
Fire access track	A track constructed and maintained expressly for fire management purposes.
Fire behaviour	The manner in which a fire reacts to the variables of fuel, weather and topography.
Fire brand	A piece of burning material, commonly bark from Eucalypts.
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, 2008).
Fire crew	A general term for two or more firefighters organised to work as a unit.
Fire danger	The combination of all factors, which determine whether fires start, spread and do damage, and whether and to what extent they can be controlled.
Fire danger rating	An evaluation of fire rate of spread, or suppression difficulty for specific combinations of fuel, fuel moisture, temperature, humidity and wind speed. The rating can be Low, Moderate, High, Very High or Extreme.
Fire frequency	The number of fires that have occurred on the same area over a time period.
Fire intensity	The rate of energy or heat release per unit time per unit length of fire front, usually expressed in kilowatts per metre (kw/m) (Pausas, *et al.*, 2003)
Fire 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 scar	A destructive mark left on a landscape by fire.
Fire season	The period(s) of the year during which fires are likely to occur, spread and do sufficient damage to warrant organised fire control.
Fire severity	The effect of fire on an ecosystem, that is, on living plants, as well as on the amount and location of organic matter consumed during a fire (Pausas, *et al.*, 2003)
Fire suppression	The activities connected with restricting the spread of bushfire following its detection and making it safe.
Fuel	Any material such as grass, leaf litter and live vegetation, which can be ignited and sustains a fire. Fuel is usually measured in tonnes per hectare.

TERM	DEFINITION
Fuel hazard	The overall fuel hazard is defined as the sum of the influences of bark fuel, elevated fuel and surface fine fuel (DEH, 2006e).
Fuel management	Modification of fuels by prescribed burning, or other means.
GAFLC	South Australian Government Agencies Fire Liaison Committee.
Hot spot	A particularly active part of a fire.
Incident Controller (IC)	The individual responsible for the management of all incident operations and IMT.
IMT	Incident Management Team. The group of incident management personnel comprising the IC and the people he/she appoints to be responsible for the functions of Operations, Planning and Logistics.
Indirect attack	The use of backburning as a method of suppression to confine the fire within a defined area bounded by existing or prepared control lines. Control lines may be a considerable distance ahead of the fire.
Key Fire Response Species	These are the species most susceptible to decline due to inappropriate fire regimes: either too frequent or too infrequent fire, low or very high intensity fire, or fire in a particular season.
Ladder fuels	Fuels that provide vertical continuity between strata. Fire is able to carry surface fuels into the crowns of trees with relative ease.
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).
Near-surface fuel	Grasses, low shrubs and heath, sometimes containing suspended components (leaves, bark and/or twigs).
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. These may be: • Nationally rated, that is, listed as Threatened (with a rating of Extinct, Critically Endangered, Endangered, Vulnerable or Conservation Dependent) under the federal EPBC Act. • South Australian rated, listed as Threatened (with a rating of Endangered, Vulnerable or Rare) under the NPW Act, Revised Schedules 7, 8 and 9. • Provisionally listed as Threatened (with a rating of Endangered or Vulnerable) in South Australia, that is, included on the unpublished

TERM	DEFINITION
	DEH Provisional List of Threatened Ecosystems of South Australia (DEH, 2005).
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.
Rate of spread	The forward progress per unit time of the head fire or another specified part of the fire perimeter.
Relative humidity	The amount of water vapour in a given volume of air, expressed as a percentage of the maximum amount of water vapour the air can hold at that temperature.
Response plan	A plan detailing the response for a risk or an area including the type and number of resources.
Retardant	A chemical generally mixed with water, designed to retard combustion by chemical or physical action. It is usually applied by aircraft but may be applied from tankers at the fire edge.
Risk assessment	Used in DEH fire planning to assist in evaluating the threat to life, property and environmental assets posed by bushfire and 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, 2008e).
Spot over (spot fires)	Isolated fires started ahead of the main fire by sparks, embers or other ignited material, sometimes to a distance of several kilometres.
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.
Weed of national significance	20 priority weeds that pose future threats to primary industries, land management, human or animal welfare, biodiversity and conservation values at a national level. These weeds were identified and ranked through the assessment of invasiveness, impacts, potential for spread and socioeconomic and environmental aspects (Australian Weeds Committee, 1999).

Unless otherwise identified, definitions have been sourced from: (DEH, 2006c)

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