Fire Management Plan

Cape Gantheaume

2012-2022

Incorporating Cape Gantheaume Wilderness Protection Area and Cape Gantheaume, Seal Bay, Vivonne Bay, Nepean Bay and Beyeria Conservation Parks and included Heritage Agreements and Crown Lands

Government of South Australia

Department of Environment, Water and Natural Resources

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Front Cover: Graham McGregor

July 2012

Government of South Australia

Department of Environment, Water and Natural Resources

EXECUTIVE SUMMARY

This fire management plan for the Cape Gantheaume area on Kangaroo Island includes: Cape Gantheaume Wilderness Protection Area (WPA), Cape Gantheaume, Seal Bay, Vivonne Bay, Nepean Bay, and Beyeria Conservation Parks (CPs), selected Crown land, and participating Heritage Agreements.

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

The planning area was identified as a priority for fire management planning within the Department of Environment, Water and Natural Resources (DEWNR) Kangaroo Island Region to:

- enhance the protection of life, property and environmental values
- reduce the potential for a bushfire to impact upon townships and settlements adjacent to the reserves
- reduce the potential for bushfire to impact upon the Seal Bay Visitor Centre in Seal Bay CP
- enhance the protection of significant natural assets within and adjacent to the reserves
- maintain or improve the viability of native species, populations, ecological communities and habitats in reserves (some of which are unique to the plan area)
- provide for and increase our knowledge of appropriate fire regimes required by species, populations, ecological communities, and ecosystems of conservation significance (some of which are unique to the plan area)
- provide for the protection of ecological communities of conservation significance, such as the Kangaroo Island Narrow-leaved Mallee (*Eucalyptus cneorifolia*) ecological community
- reduce the likelihood of a reserve burning in its entirety in a single bushfire event, especially the Cape Gantheaume WPA
- minimise the potential for lightning-caused fire ignitions to build into landscape-scale bushfires
- identify visitor management issues.

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 DEWNR Fire Management Zoning principles to guide the management of fuel in Asset Protection and Bushfire Buffer Zones and designating Conservation-Land Management Zones
- applying DEWNR Ecological Fire Management Guidelines to determine appropriate fire regimes in Conservation-Land Management Zones

- assessing track standards using the Government Agencies Fire Liaison Committee's (GAFLC) guidelines for firebreaks and fire access tracks in South Australia (GAFLC, 2008).

Following the application of the processes identified above, the following strategies were identified.

- Fuel reduction:
    - in Asset Protection and Bushfire Buffer Zones using a variety of methods, including prescribed burning and mechanical works
    - in strategic areas within the Conservation-Land Management Zone to provide some landscape protection within the reserves and increase patchiness within the vegetation across larger areas
    - to complement environmental strategies to manage species or habitats.
- Operational works to increase fire readiness, including upgrades to fire access tracks and improvements to fire infrastructure.
- Coordinated fire management between DEWNR and adjacent landowners (including other government agencies and private landholders).

The community and Country Fire Service (CFS) volunteers have contributed an enormous amount of time, energy and resources to fire suppression 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 fire management strategies around their own assets to complement the work to be undertaken by DEWNR in this plan, and as recommended by the *Kangaroo Island Bushfire Risk Management Plan 2009-2014* (KI DBPC, 2009).

The draft plan was released for public comment for a period of four weeks over June and July 2011. Comments were then evaluated and incorporated where considered appropriate. A major review of this plan will occur after ten years of implementation, or earlier if required.

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Maps supporting this fire management plan are interactive and are provided via the web under four themes.
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1 SCOPE AND PURPOSE

This plan provides a strategic framework for fire management in DEWNR-managed reserves and other included land. The planning area incorporates Cape Gantheaume WPA and Cape Gantheaume, Seal Bay, Vivonne Bay, Nepean Bay, and Beyeria CPs, selected Crown land, and participating Heritage Agreements.

The plan defines objectives for the protection of life and property, particularly in regard to visitors and adjacent landholders, and also ecological fire management. Strategies are recommended to meet objectives, which will increase the level of bushfire readiness and guide management and suppression strategies during bushfire incidents.

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

- Enhance the protection of life, property and environmental values.
- Reduce the potential for a bushfire to impact upon townships and settlements adjacent to the reserves.
- Reduce the potential for bushfire to impact upon the Seal Bay Visitor Centre in Seal Bay CP.
- Enhance the protection of significant natural assets within and adjacent to the reserves.
- Maintain or improve the viability of native species, populations, ecological communities and habitats in reserves (some of which are unique to the plan area).
- Provide for and increase our knowledge of appropriate fire regimes required by species, populations, ecological communities, and ecosystems of conservation significance (some of which are unique to the plan area).
- Provide for the protection of ecological communities of conservation significance, such as the Kangaroo Island Narrow-leaved Mallee (*Eucalyptus cneorifolia*) ecological community.
- Reduce the likelihood of any reserve burning in its entirety in a single bushfire event, but especially the Cape Gantheaume WPA.
- Minimise the potential for lightning-caused fire ignitions to build into landscape-scale bushfires.
- Identify visitor management issues.

This fire management plan aims to:

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

Operational works outlined in this plan will be implemented in a staged manner depending on available resources. These works will be facilitated through the DEWNR Kangaroo Island Region with Regional Fire Management. Adjoining lands are considered in the plan, but

only in the context of works required to minimise the risk to assets from fires originating in the included reserves. However, DEWNR will support and complement landscape-scale fire planning for adjoining lands. Fire management planning for other lands is the responsibility of the Kangaroo Island Bushfire Management Committee, in accordance with the requirements of the *Fire and Emergency Services Act 2005* (FES Act). DEWNR is represented on this committee, along with local government and the Country Fire Service (CFS).

1.1 Objectives

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

General Objectives for Fire Management

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

The fire management objectives that apply specifically to the *Cape Gantheaume Fire Management Plan* are as follows.

General Objectives for Fire Management in the Cape Gantheaume area

- To reduce the impact of bushfire on reserves by:
  - minimising the likelihood of a substantial portion of a reserve burning in a single fire event
  - minimising the likelihood of a landscape-scale fire occurring within the planning area or spreading into an adjacent area.
- To optimise the protection of significant built assets within and immediately adjacent to DEWNR-managed lands.
- To maintain wilderness quality within Cape Gantheaume WPA by minimising the impact of fire management, and using fire to enhance the wilderness quality.
- To reduce the likelihood of a bushfire impacting on community and recreational values and assets.
- To improve knowledge of how species, populations, ecological communities and

General Objectives for Fire Management in the Cape Gantheaume area

ecosystems respond to fire (including native and introduced species).

- To maintain or improve biodiversity in reserves by:
  - reducing the likelihood of fire suppression operations impacting upon the viability of species, ecological communities, populations and ecosystems
  - reducing the likelihood of fire threatening species of conservation significance as a result of entire populations (or their habitats) being burnt in a single fire event
  - encouraging variability within the fire regime across the landscape to create a mosaic in habitats that benefit a range of populations and ecosystems
  - integrating the information generated by the Eastern Plains Fire Trial.
- To support readiness strategies that will enable rapid and effective response to bushfire.
- To minimise the likelihood of bushfire impacting on significant environmental restoration works.

2 THE PLANNING FRAMEWORK

2.1 Legislation

DEWNR fire management planning is influenced by several pieces of state and federal legislation.

The South Australian FES Act outlines the responsibilities of fire authorities in relation to fire management within proclaimed reserves. Under that Act, the Chief Officer of the CFS must take steps to have any relevant provisions of a management plan for a government reserve brought to the attention of CFS members who might exercise powers with respect to that reserve. In addition, all landholders are obliged to comply with section 105F-I of the FES Act, which states that property owners are required to implement works on their own land to minimise the threat of fire.

DEWNR is required to meet the provisions of the *Native Vegetation Act 1991* when prescribing any works that involve the modification of native vegetation, including the use of fire.

Heritage Agreements are established under the *Native Vegetation Act 1991* for conservation purposes. The inclusion of Heritage Agreements in a DEWNR fire management plan does not change the fire management responsibilities of private landholders and the final decision to undertake any proposed activity still rests with the landholder in question. DEWNR will provide support and advice to landholders where appropriate, and will contribute toward the implementation of any recommended action on private land where there is demonstrated benefit or shared risk to public land. See Section 3.1.1 for more information.

Through the provisions of the South Australian *National Parks and Wildlife Act 1972* (NPW Act) and the *Wilderness Protection Act 1992* (WP Act), DEWNR has responsibilities for fire management within reserves established under these Acts. The preparation of fire management plans is not a statutory requirement but a Departmental Policy.

The *Wilderness Code of Management* (DEH, 2004a) includes requirements for fire, and emergency and essential management operations in wilderness areas. The objectives and strategies contained in this plan for the Cape Gantheaume WPA are compliant with the Code (see Appendix 2).

DEWNR has responsibilities for fire management on unalienated Crown land and any Crown land dedicated to, owned by, or under the care and control of the Minister for Sustainability, Environment and Conservation through the *Crown Land Management Act 2009*.

The Federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) describes the assessment and approval process required for actions likely to impact nationally-listed species and ecological communities. In addition, Recovery Plans may be prepared for nationally-listed species and ecological communities (see Section 3.6.4).

2.2 DEWNR Fire Management Policy

The *DEWNR Fire Management Policy* (DENR, 2011b) outlines the agency's fire management responsibilities to protect life, property and the environment. The Policy states that DEWNR fire management plans will:

- identify fire related risks to natural and cultural heritage values and built assets

- define objectives for fire management in the planning area
- identify strategies to achieve these objectives.

DEWNR fire management plans are developed in accordance with DEWNR's fire management policies and procedures for project management, risk assessment, and zoning (DENR, 2011b).

2.3 Other influences and considerations

There are a number of statutory plans and non-statutory documents that were considered during the fire management planning process.

2.3.1 Land management

Reserve management plans are statutory requirements under the NPW Act and the WP Act (where relevant). They may identify the requirement for a fire management plan based on the nature of the fire-related issues within a reserve. In the planning area reserve management plans have been developed for Cape Gantheaume CP (DE 1977), Seal Bay CP (DE 1977), Vivonne Bay CP (DEP 1987), Beyeria CP (DEP 1992), and Nepean Bay CP (DEP 1987). The fire management strategies identified in this plan are consistent with the objectives of management set out in these reserve management plans.

While at present there is no management plan for the Cape Gantheaume WPA (declared under the WP Act in 1993), management of the WPA is guided by the WP Act and the *Wilderness Code of Management* (Appendix 2).

A plan of management for Seal Bay CP and the then Cape Gantheaume CP (now largely converted to WPA) was published in 1977 (DE, 1977) and subsequently amended in 1993 to allow for new visitor facilities (DENR, 1993). The 1977 management plan excludes prescribed burning in the area that is now Cape Gantheaume WPA. However, since that time there has been increased community acceptance of and evidence that fire management practices (including prescribed burning) can have a positive effect on biodiversity. Prescribed burning now includes the use of aircraft-based ignition and unbounded burning, thereby significantly reducing the damage to vegetation through track construction or ground-based operations.

Nepean Bay CP and Vivonne Bay CP are included in a multi-park plan of management for many of the island's reserves (DEP, 1987). For Nepean Bay CP this plan of management includes the impetus to protect the reserve from too frequent fire events, as this may negatively impact Drooping Sheoak (*Allocasuarina verticillata*), which is critical feeding habitat for the Glossy Black-Cockatoo *(Calyptorhynchus lathami halmaturinus*) (see Section 3.6.4 for more information on these species). Fire management actions listed for Vivonne Bay CP include the need to reduce fuels around the Point Ellen holiday shacks on the south-eastern boundary of the reserve and to construct a fire access track along the northern and western boundaries of the reserve (DEP, 1987).

The Beyeria CP plan of management (DEP, 1992) calls for fire to be managed to maintain or enhance the reserve's natural features, in line with contemporary ecological information and research.

A Biodiversity Plan has been developed for the region (Willoughby*, et al.*, 2001) to guide the conservation, management and rehabilitation of habitats at a regional level.

2.3.2 Bushfire planning

Fire management planning at a landscape scale, regardless of tenure, is addressed in Bushfire Management Area Plans (BMAPs) prepared by Bushfire Management Area Committees (BMCs) as a statutory requirement under the FES Act. Like DEWNR fire management plans, these are landscape-scale, risk-based, bushfire management plans, and include comprehensive risk treatments, including zoning. DEWNR fire management plans and BMC Bushfire Management Area Plans are complementary and both are developed in collaboration with each other. In the Kangaroo Island region, the *Kangaroo Island Bushfire Risk Management Plan 2009-2014* (KI DBPC, 2009) has been developed.

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

2.4 Partnership Agencies

An agreement exists between the state government public land management agencies (DEWNR, the South Australian Forestry Corporation and the South Australian Water Corporation) and the CFS to cooperatively manage fire in high fire risk areas. The *Code of Practice for Fire Management on Public Land in South Australia* (DENR*, et al.*, 2011) aims to improve public safety, reduce the risk to private and community assets, and to reduce the impacts of inappropriate fire regimes on the environment.

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

2.5 Consultation

DEWNR is committed to close cooperation and involvement with State and Commonwealth organisations, special interest groups and the broader community to achieve the goals of protection of life and property and biodiversity conservation.

Consultation is not a statutory requirement for fire management plans, but is Departmental Policy (DENR, 2011b). Before planning commences, the community are invited to submit their views on fire management in the planning area, to ensure that a wide-range of issues are considered over the course of the planning process. Once a plan is drafted it is subject to DEWNR internal consultation for a period of four weeks prior to being released externally for public consultation, also for a period of four weeks. The finalised plan is reviewed and endorsed by the National Parks and Wildlife Council and the Wilderness Advisory Committee, and the treatments are approved by the Native Vegetation Council's Fire Sub-committee before it is adopted by DEWNR Executive.

2.6 Plan Review and Currency

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

3 BUSHFIRE ENVIRONMENT

This section provides:

- an overview of the planning area, including its location, land use, terrain, vegetation, climate, and fire weather
- notes on potential impacts of climate change for the planning area
- a description of extreme fire conditions and their potential impacts in the planning area
- an overview of fire history in the planning area.

The physical components of a landscape contribute to its bushfire potential, including 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

The planning area is located on central Kangaroo Island, covering the central southern coast (lands to the south of the South Coast Road) and the lands of the Eastern Plains (west of the isthmus separating Dudley Peninsula from the rest of Kangaroo Island). It incorporates over 32 400 ha of DEWNR reserves: Cape Gantheaume WPA (20 099 ha) and CP (4 213 ha), Seal Bay CP (6 367 ha), Vivonne Bay CP (1 565 ha), Beyeria CP (188 ha), and Nepean Bay CP (32 ha).

Crown land dedicated to, owned by, or under the control of the Minister for Sustainability, Environment and Conservation was identified for inclusion into this plan through a risk assessment process considering existing and potential issues for fire management. The proximity to built assets, presence of native vegetation, and location and size of each parcel was considered during this process. One hundred and seventeen parcels (574.4 ha) of Crown land have been included in this fire management plan (Table 1). Of these:

- 17 parcels (294 ha) are unalienated Crown land on the coast (not otherwise earmarked for addition to reserves)
- 3 parcels (42.4 ha) are unalienated Crown land along the Harriet River corridor (to the north-east of Vivonne Bay CP)
- 46 parcels (4.2 ha) are reserves dedicated to the Coast Protection Board
- 44 parcels (8.2 ha) are proposed additions to Vivonne Bay CP
- 3 parcels (100.8 ha) are proposed additions to Cape Gantheaume WPA
- 4 parcels (125.2 ha) are proposed additions to Cape Gantheaume CP.

These proposed reserve additions have been included in this plan to ensure fire management issues are identified and strategies for bushfire risk minimisation are established prior to dedication.

Heritage Agreements abutting DEWNR reserves or included lands have been considered during the planning process. The inclusion of a Heritage Agreement in this fire management plan is subject to a change in the agreement between the Minister and the landholder. However, it is the responsibility of the individual owner to approve the adoption of the fire management plan for their land and undertake the proposed works.

TABLE 1 – OTHER LANDS INCLUDED IN THIS FIRE MANAGEMENT PLAN

Type	Dedication	Parcel & Hundred	Number of parcels	Total Size (ha)
Unallotted Crown land on coast	Minister for Sustainability, Environment & Conservation	Hundred of Haines: Allotments 1, 2, 10 &104, Sections 394, 395, 397, 408, 416 & 417	10	76.1
Unallotted Crown land on coast	Minister for Sustainability, Environment & Conservation	Hundred of Newland: Sections 110, 111, 113, 123 & 124	5	178.3
Unallotted Crown land on coast	Minister for Sustainability, Environment & Conservation	Hundred of Ritchie: Section 49	1	16.0
Unallotted Crown land on coast	Minister for Sustainability, Environment & Conservation	Hundred of Seddon: Section 85	1	23.1
Unallotted Crown land (Harriet River corridor)	Minister for Sustainability, Environment & Conservation	Hundred of Newland: Section 115, 120 & 121	3	42.4
Proposed addition to Vivonne Bay CP	Minister for Sustainability, Environment & Conservation	Hundred of Newland: Allotments 1-8, 10-15, 19-28, 30-48, Section 112	44	8.2
Proposed addition to Cape Gantheaume WPA	Minister for Sustainability, Environment & Conservation	Hundred of Macgillivray: Allotments 1 & 2 Hundred of Haines: Allotment 3	3	100.8
Proposed addition to Cape Gantheaume CP	Minister for Sustainability, Environment & Conservation	Hundred of Haines: Allotments 10 & 104, and Sections 394 & 395	4	125.2
Reserve	Coast Protection Board	Hundred of Newland: Allotments 112-122, 134, 148-179, 197 & 198	46	4.2
Heritage Agreement	Private	Hundred of Haines: Sections 148 (part), 153 (part), 155 (part), 156 (part), 157 (part) & 158 (part)	6	178.1
Heritage Agreement	Private	Hundred of Macgillivray: Allotments 1 & 4 (part)	2	1 360.8
Heritage Agreement	Private	Hundred of Newland: Allotments 1 (part), 6 (part), 7 (part), 102 (part), 103 (part) & 104 (part), Pieces 8 & 9 (part)	8	888.0
Heritage Agreement	Private	Hundred of Seddon: Allotments 1 (part), 10 (part), 11 & 101 (part), & Section 50	5	2 298.3

3.1.2 Surrounding Land Use

Lands adjoining the planning area have a variety of uses, including livestock grazing, cropping, quarrying, tourist accommodation and facilities, and rural and coastal living (Map 1).

On farmlands, particularly following spring and summer rains, grass and pasture can create a significant fire hazard, resulting in quick-moving grass fires that may impact on native vegetation. The remaining native vegetation on farm properties in the planning area is confined to small isolated blocks, roadsides and creek lines. Such areas of native vegetation often experience long periods without fire. As a result, these areas can create 'wicks' for high intensity bushfires that can travel through the landscape, and enter larger areas of native vegetation.

3.1.3 Terrain

The majority of the planning area is located within the South Coast Regional Ecological Area (Willoughby*, et al.*, 2001). It consists of largely undulating, calcrete-capped dune limestone landform with pockets of shallow sandy soils. Drifting sand dunes are present in Seal Bay CP and Cape Gantheaume WPA. Coastal areas vary between rugged cliffs of dune limestone (such as Vivonne Bay CP and Cape Gantheaume WPA) and sloping sandy beaches (Vivonne Bay township, parts of Seal Bay CP, and eastern parts of Cape Gantheaume CP).

The soils in Nepean Bay CP and Beyeria CP are predominantly duplex soils consisting of neutral to acidic sand to sandy loam over alkaline clays and shallow to deep calcareous sands near the coast.

The saline wetlands of Murray Lagoon and Lake Ada are considered wetlands of national environmental significance, while D'Estrees Bay tidal lagoon is considered important (Willoughby*, et al.*, 2001).

3.1.4 Climate and Fire Weather

Kangaroo Island has a Mediterranean climate with distinct winter rainfall (Davies*, et al.*, 2002). It experiences relatively mild winters and summers due to the moderating influence of the surrounding ocean and the overall low elevation of the island.

From October to December, Kangaroo Island may experience severe weather conditions with thunderstorms 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 south-east in spring and summer and north-west in autumn.

Frequent on-shore winds and afternoon sea breezes moderate the temperatures of coastal Kangaroo Island during the summer. However, frontal activity can cause rapid changes to the prevailing south-east summer wind direction, swinging around to strong north to north-west winds with associated high temperatures (up to 40 degrees Celsius). Such wind changes, which generally occur with low humidity (< 50%), can create extreme fire weather conditions. Subsequent frontal changes can then produce strong south-west winds. In addition, significant localised wind effects can occur with coastal and inland wind influences over the island's varying topography.

On the south coast the prevailing summer winds are predominantly south-east to easterly, and north-westerly in autumn. In spring the prevailing winds tend to shift to the south-east (DEP, 1985a; b).

Average annual rainfall across the planning area ranges between 500 and 600 mm (Davies*, et al.*, 2002).

3.2 Climate Change and Bushfire

South-eastern Australia is one of the most bushfire-prone areas in the world. Research is now suggesting that these risks are being compounded by the effects of climate change. Hennessy et al. (2005) have established that since 1950, rainfall has decreased in south-east Australia, droughts have become more severe and the number of extremely hot days has risen. Furthermore, it is projected that the south-east of Australia is likely to become hotter and drier in future. The impacts of these changes on fire management are discussed below.

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

DEWNR acknowledges the significance of climate change and the potential impacts it will have on the management of fire regimes. As such DEWNR has developed a *Climate Change Strategy* (DEH, 2008a), which includes a specific objective to address fire management.

> *To play a lead role, in partnership with key groups, to develop and implement a landscape-based approach to fire management and planning that reduces impacts on life and property and maximises the resilience of natural systems to altered fire regimes caused by climate change.*

This fire management plan is consistent with the objective and outcomes in that strategy.

3.3 Extreme Fire Conditions

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

Buildings constructed to the requirements of *Australian Standard for Construction of buildings in bushfire-prone areas AS3959-2009* will not necessarily survive a bushfire event under all conditions, but will reduce the risk to occupants (Eadie and Herbert, 2009).

There are numerous factors that will contribute to a dramatic increase in fire behaviour.

- Fire Danger Indices of *Very High* or greater.
- *Very High* to *Extreme* Overall Fuel Hazard levels in native vegetation.
- High levels of cured grass, pasture or stubble in agricultural areas in summer following good spring rains.

- Broad areas of continuous *Very High* to *Extreme* fuel hazard levels, making fire suppression less effective.
- The presence of raised bark fuel hazard levels, increasing the chance of spot fires and crown fires.
- Low humidity, decreased soil and fuel moisture, particularly during drought years.
- Strong winds shifting direction during the course of a fire, typically blowing from the north, then shifting to west or south-westerly.
- Lightning strikes as a result of increased thunderstorm activity between October and December.

3.4 Fire History

3.4.1 Mapping Fire Occurrences

Fire history mapping has been compiled from a combination of the latest DEWNR fire incident reports, records documented in the *Fire History of Eastern Kangaroo Island* report (Overton, 1994) and aerial photography from 1945 onwards. The quality of the fire scar mapping varies, depending on the method of capture. Fire scar boundaries produced from these sources have been added to the DEWNR EGIS spatial database. Many smaller fires recorded by Overton (1994) associated with land clearing operations were unable to be mapped due to the lack of complete data. Consequently, the mapped fires should be regarded as a minimum estimate of fire occurrences.

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

3.4.2 Bushfires

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

Since 1950 a total of 207 bushfire incidents have been recorded in the area of Kangaroo Island covered by this plan. Of those, 66 have occurred within or in close proximity to DEWNR-managed land in the planning area. There have been large fires (> 5 000 ha annual cumulative total) within the planning area on average every 13 years since 1950 (Table 2).

TABLE 2 – LARGE FIRES (> 5 000 HA) IN THE VICINITY OF THE PLANNING AREA

Fire year	Area (ha)
1954	22 797
1955	8 664
1964	8 678
1978	11 504
1996	24 280
2007	21 317

Some of the more significant recent incidents are listed below.

- 1978: 8 380 ha burnt by bushfires in Cape Gantheaume CP and WPA (collectively) over 24 days. These fires are the source of the age class for the long unburnt vegetation in the Cape Gantheaume area.
- 1996: 24 272 ha burnt in a large fire in Cape Gantheaume WPA and CP, and the eastern portion of Seal Bay CP. Started by lightning north-west of Seal Bay CP, this fire developed and impacted the D'Estrees Bay community 25 km to the east, within a 12 hour timeframe. This fire burnt predominantly over 16 days and affected 89% of Cape Gantheaume WPA.
- 2007: 16 285 ha burnt in one of five fires burning across the island. The second largest fire affected Cape Gantheaume WPA and CP, and the eastern portion on Seal Bay CP. This bushfire travelled from the Seal Bay Road to the D'Estrees Bay community, a distance of approximately 20 km, in a 12 hour period. The 2007 fires on Kangaroo Island are discussed in more detail below.

In December 2007 a large complex of fires on Kangaroo Island burnt around 85 000 ha, or 19% of the whole island. Lightning ignited the fires on 6 December, and over 1 200 firefighters and support crew worked for 10 days to bring the fires under control. There were five separate fires.

- The Chase Fire burnt 60 455 ha, affecting Flinders Chase NP and Ravine des Casoars WPA.
- The D'Estrees Fire burnt 16 285 ha, affecting Cape Gantheaume WPA and CP, and Seal Bay CP.
- The Central Fire burnt 5 032 ha; the Solly Fire burnt 2 948 ha, affecting Western River WPA.
- The smaller Riverleas Fire burnt 235 ha.

The D'Estrees Fire burnt 41% of the Cape Gantheaume WPA (8 341 ha burnt), 30% of the Cape Gantheaume CP (1 280 ha) and 45% of Seal Bay CP (2 841 ha). Importantly, a large portion of land in the Cape Gantheaume area that was burned in the 1996 fire was burnt again in 2007. Of the total area of both fire scars (27 676 ha), 47% (12 881 ha) of that land was burnt twice in 11 years.

While the Central Fire only burnt a small portion of DEWNR-managed Crown land to the north-west of the Vivonne Bay Township, it came close to impacting on Vivonne Bay CP and adjacent Heritage Agreements.

3.4.3 Prescribed Burning

The Department has not undertaken prescribed burning within any of the reserves in the plan area since their proclamation. Prescribed burning will be carried out in the plan area in the future to achieve fire management objectives within Asset Protection Zones (A-zones), Bushfire Buffer Zones (B-zones) and Conservation-Land Management Zones (C-zones). Fuel reduction in A- and B-zones, and C-zone burning is discussed in Section 5.3.

A total of 36 prescribed burns covering 98.07 hectares have been conducted within the Hundreds of Haines and Macgillivray (within the plan area) as part of the Eastern Plains Fire Trial (Taylor, 2011a). This included one burn within a Heritage Agreement that forms part of this plan. The remaining burns have been conducted in remnant vegetation on both

private land and land under the care and control of local government (including areas of roadside vegetation).

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) classifications for Australia. The Major Vegetation Sub-group (MVS) level of the NVIS classification emphasises the structural and floristic composition of the dominant stratum but with additional types identified according to typical shrub or ground layers occurring with a dominant tree or shrub stratum. Within this fire management plan MVS have been used as these groupings are accepted by fire managers for predicting maximum Overall Fuel Hazard levels (see Section 4.2.2).

There are five MVS that have been mapped by DEWNR within the planning area. Map 2 shows the distribution of MVS in the planning area. Table 3 lists the dominant species composition for each MVS and the Ecological Fire Management Guidelines are outlined in Table 6.

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

MVS No.	MVS Name	Dominant Species Layers
8	Eucalyptus woodlands with a shrubby understorey	*Eucalyptus cosmophylla, E. albopurpurea, E. diversifolia* ssp. *diversifolia* +/- *E. fasciculosa* +/- *E. cneorifolia* low open woodland; and *E. viminalis* ssp. *cygnetensis, E. oleosa* ssp. *ampliata, E. rugosa, E. diversifolia* ssp. *diversifolia* low open woodland.
26	Casuarina and Allocasuarina forests and woodlands	*Allocasuarina verticillata* (mixed) low open woodland over *Acacia paradoxa* (mixed) shrubs.
29	Mallee heath and shrublands	Various mid mallee woodlands of *E. diversifolia* ssp. *diversifolia, E. rugosa, E. albopurpurea,* or *E. cneorifolia* over mixtures of shrubs including *Acacia uncifolia, Banksia marginata, Calytrix glaberrima, Correa eburnea, Lasiopetalum schulzenii, Leptospermum myrsinoides, Melaleuca uncinata, M. lanceolata, Orthrosanthus multiflorus,* and *Thryptomene ericaea.* Also, mid open shrublands of *Beyeria lechenaultii, Hakea mitchellii* or *Melaleuca lanceolata* over single or mixed shrub combinations of *Correa eburnea, Leucopogon parviflorus, M. acuminata* ssp. *acuminata, M. gibbosa, Microcybe pauciflora* ssp. *pauciflora,* and *Pultenaea acerosa.*
47	Eucalyptus open woodlands with shrubby understorey	*E. fasciculosa* mid open woodland over *Banksia marginata* (mixed) shrubs; *E. leucoxylon* ssp. *leucoxylon* mid open woodland over *Melaleuca lanceolata* and *Acacia paradoxa* shrubs.
49	Melaleuca shrublands and open shrublands	*Melaleuca brevifolia* mid shrubland; *Melaleuca gibbosa* (mixed) mid shrubland over *M. uncinata* (mixed) shrubs; and *Melaleuca halmaturorum* tall open shrubland.

3.6 Values and Assets

3.6.1 Visitor Use

Kangaroo Island is South Australia's primary nature-based tourism destination, and one of the top four such destinations in Australia (URPS, 2006). Around 162 000 overnight visitors holiday on the island each year (of those 35 000 are from overseas) and an additional 58 000 visit on a day trip (SATC, 2009).

Within the planning area, the Seal Bay Visitor Centre in Seal Bay CP is the most significant tourist site. On average 105 000 people visit the site annually, with more people visiting during summer than at other times of the year (DENR unpubl.).

Management Strategies	
Visitor Use	1. Close reserves when significant fire weather is forecast to ensure visitor safety.
	2. Prepare emergency management plans for Seal Bay and D'Estrees Bay visitor areas and review these biennially.
	3. Implement appropriate fuel management strategies consistent with the zoning shown on Map 4 to improve visitor safety.
	4. Implement approved recommendations of the CFS Building Fire Safety Unit recommendations for the existing Seal Bay Visitor Centre (CFS Building Fire Safety Unit, 2011). Any new development should be built to the *Australian Standard for Construction of buildings in bushfire-prone areas AS3959-2009*.
	5. Install safety signs at Bales Bay picnic area (Seal Bay CP), identifying it as being unsuitable as a fire refuge.
	6. Develop a visitor interpretation strategy for bushfire issues in the planning area.

3.6.2 Built Assets

There are a number of built assets at risk from bushfires within and immediately adjacent to the lands included in the planning area.

- Seal Bay Visitor Centre in Seal Bay CP, including the boardwalk to access the beach and viewing platform.
- Bales Bay Picnic area (in Seal Bay CP).
- Private residences to the south of the South Coast Road (adjacent Vivonne Bay CP, Seal Bay CP).
- Sand mining lease plant and equipment (in Seal Bay CP).
- Private shacks at Point Ellen (adjacent Vivonne Bay CP).
- Various assets in the vicinity of the Harriet River Crown lands (adjacent Vivonne Bay township), including private shacks, a private golf course, and a Council campground.
- Murray Lagoon Ranger Station, including office, sheds and campsite (in Cape Gantheaume CP).
- Shacks on the coast near D'Estrees Bay (adjacent to Cape Gantheaume CP).

- D'Estrees Bay settlement (adjacent to Cape Gantheaume CP).
- Nepean Bay settlement to the west of Nepean Bay CP.

DEWNR 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 DEWNR-managed land and the corresponding fire management strategies. Map 1 shows the location of assets within the planning area.

Management Strategies	
Built Assets	7. Implement fuel management strategies for asset protection consistent with the zoning shown on Map 4 and other risk mitigation works as detailed in Appendix 1.
	8. Encourage adjacent property owners to work with DEWNR, CFS and local government to implement relevant actions from the *Kangaroo Island Bushfire Risk Management Plan 2009-2014*.
	9. Ensure revegetation including post-fire recovery works is consistent with fire management zoning.

3.6.3 Cultural Heritage

Information on Aboriginal and European heritage is collected as part of prescribed burn planning during preparation of the Environmental Assessment Table (refer to Section 5.3.4) (DEH, 2004b). Any fire operations must be undertaken in accordance with the *Fire Policy and Procedure for the Protection of Cultural Heritage* (DENR, 2011b).

Aboriginal Heritage

Kangaroo Island is an area of cultural significance for Aboriginal people within South Australia. Aboriginal heritage sites have been identified around Murray Lagoon in Cape Gantheaume CP and at Bales Beach in Seal Bay CP.

The Aboriginal Affairs and Reconciliation Division of the Department of Premier and Cabinet maintain the Central Archive, which includes the Register of Aboriginal Sites and Objects (the Register). It should be noted that the Register is not a comprehensive record of all Aboriginal sites and objects in South Australia. Therefore, sites or objects may exist in the planning area without being identified in the Register. When implementing this plan, DEWNR will comply with the *Aboriginal Heritage Handbook and Strategy* (DEH, 2006), to facilitate the protection of Aboriginal Heritage sites during bushfire suppression and prescribed burns.

European Heritage

Throughout the planning area there are many structures and remains of structures that are of special cultural and heritage value, providing examples of European history on the island. Many of these sites are recorded on the South Australian Heritage Register. The majority of the heritage structures are built of stone, and therefore are not generally fire prone. Many are sited in cleared areas offering some protection from bushfire. Any fire management activities must be in accordance with the *Fire Policy and Procedure for the Protection of*

Cultural Heritage (DENR, 2011b). The following is a summary of European heritage sites within the planning area.

- Huts, shed and grave sites to the north-west of Six Mile Lagoon.
- Bales Hut ruin, Seal Bay CP.
- Hawks Nest homestead ruin near Murray Lagoon, Cape Gantheaume CP.
- Stone hut ruin on western side of Murray Lagoon, Cape Gantheaume CP.
- Former site of the Point Tinline Whaling Station, Cape Gantheaume CP.
- Threshing floor near Point Tinline, Cape Gantheaume CP.
- Ship's mast from the wreck of the *SS You Yangs* (wrecked 1890), at the base of coastal cliffs, Cape Gantheaume WPA.

Management Strategies

Cultural Heritage

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

3.6.4 Natural Values

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, where known, is maintained within the DEWNR Vital Attributes database and is included for species and ecological communities of conservation significance in Appendices 3, 4 and 5.

In this plan 'of conservation significance' is used to describe rated species, populations and ecological communities. These may be:

- nationally rated, that is, listed as Threatened (with a rating of Extinct, Critically Endangered, Endangered or Vulnerable) under the 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 *Provisional List of Threatened Ecosystems of South Australia* (DEH, 2005b)
- otherwise considered locally important.

There are a number of species and ecological communities considered to be of conservation significance within the planning area. Appendices 3 and 4 contain a list of flora and fauna of conservation significance as well as species that are considered

important in terms of fire management. Note that this is not intended to be an exhaustive list of rated species within the plan area as it does not include species that are regionally threatened and it excludes rated species that are considered to be functionally extinct or unlikely to be affected by fire management activities. Appendices 3 and 4 summarise the current level of fire response knowledge for these species.

Appendix 5 summarises information on threatened ecological communities.

In addition to the information provided within the appendices, species response and ecological information for selected significant species and ecological communities have been detailed in the following paragraphs. 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.
- Southern Brown Bandicoot (*Isoodon obesulus obesulus*), nationally Endangered.
- Australian Sea-lion (*Neophoca cinerea*), nationally Vulnerable.
- Kangaroo Island Phebalium (*Leionema equestre*), nationally Endangered.
- Kangaroo Island Turpentine Bush (*Beyeria subtecta*), nationally Vulnerable.
- Macgillivray Spyridium (*Spyridium eriocephalum* var. *glabrisepalum*), nationally Vulnerable.
- Ironstone Mulla Mulla (*Ptilotus beckerianus*), nationally Vulnerable.
- Kangaroo Island Spider-orchid (*Caladenia ovata*), nationally Vulnerable.

The ecological communities of conservation significance include:

- Drooping Sheoak (*Allocasuarina verticillata*) community, provisionally listed as Vulnerable at a state level (DEH, 2005b)
- Kangaroo Island Narrow-leaved Mallee (*Eucalyptus cneorifolia*) community, provisionally listed as Endangered (endemic) at a state level (DEH, 2005b). The Eastern Plains Complex has been included in the *2010 Finalised Priority Assessment List* to be assessed for listing under the EPBC Act.

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

Glossy Black-Cockatoo

The South Australian subspecies of the Glossy Black-Cockatoo is listed as Endangered under both the federal EPBC Act and the South Australian NPW Act. The subspecies once occurred on the South Australian mainland, however, is now restricted to Kangaroo Island. It occurs mainly along the north coast and hinterland, and along inland river systems where food and nesting resources are available. Current breeding sites occur west of American River where large hollow-bearing eucalypts are used for nesting (Mooney and Pedler, 2005). Glossy Black-Cockatoo critical nesting and feeding habitats are shown on Map 2.

Fire will impact both the availability of suitable nesting hollows (in old Sugar Gum (*Eucalyptus cladocalyx*), Manna Gum (*E. viminalis* ssp.) and Blue Gum (*E. leucoxylon* ssp. *leucoxylon*) trees) and the primary food source, Drooping Sheoak (Mooney and Pedler, 2005). Fire regime may have a negative effect on populations of Glossy Black-Cockatoo when fires are too frequent. Conversely, complete lack of fire will also reduce the viability of the feeding and nesting habitats in the long term. Specific information on how the Glossy Black-Cockatoo 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 process 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 bushfire or prescribed burning.

Management Strategies

Glossy Black-Cockatoo

12. Monitor the effect of fire on Glossy Black-Cockatoo habitat use, and use this information to manage the fire regime for this species in the future, through Ecological Fire Management Guidelines (Appendix 4) and Ecological Fire Management Strategies.
13. When planning burns in known Glossy Black-Cockatoo habitat, consultation will include relevant specialists.
14. 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).
15. Information and interpretation on Glossy Black-Cockatoo critical nesting and feeding habitat to be made available to Incident Management Teams during a bushfire.
16. Develop an Ecological Fire Management Strategy in collaboration with the Glossy Black-Cockatoo Recovery Program.

Southern Brown Bandicoot

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. A draft National Recovery Plan is being developed for this species (DSE, 2010).

Bandicoots occur in a wide range of vegetation communities. Vegetation structure is a more important determinant than vegetation age class, with the animal preferring a dense understorey (50-80% average foliage density, at 0.2-1 m height) (Jones*, et al.*, 2010).

The Southern Brown Bandicoot has been recorded in Seal Bay CP, Cape Gantheaume CP and WPA, Nepean Bay CP, and in the area of Vivonne Bay township. Map 2 shows records for the planning area. Moreover, the *Draft EPBC Act Southern Brown Bandicoot Policy Statement 3.29* defines most of the planning area as either likely or known Southern Brown Bandicoot habitat (DSEWPC, unpubl.).

The *Ecological Fire Management Strategy for Southern Brown Bandicoot* recommends that for C-zones, no more than 20% of bandicoot habitat within a reserve or group of reserves should be burnt within four years of a previous burn (DENR, 2011a).

The strategy recommends that fire managers should aim to minimise the likelihood of bushfires burning entire habitat patches, and trial small scale prescribed burns in order to encourage habitat regeneration in areas where habitat quality is perceived to have declined (DENR, 2011a). Unburnt patches of vegetation may be important in allowing the species to persist; following the 2007 bushfire in Flinders Chase NP, a population of Southern Brown Bandicoots survived in an unburnt remnant of around 35 ha in size (T. Mooney, pers comm).

Management Strategies	
Southern Brown Bandicoot	17. Monitor the effect of fire on Southern Brown Bandicoot distribution and habitat use, and use this information to manage the fire regime for this species in the future, through Ecological Fire Management Guidelines (Appendix 4) and Ecological Fire Management Strategies.
	18. When planning burns in known Southern Brown Bandicoot habitat, consultation will include the Kangaroo Island Conservation Programs Unit, and other relevant specialists.
	19. Finalise an Ecological Fire Management Strategy for the Southern Brown Bandicoot.

Coastal Raptors

White-bellied Sea-Eagle (*Haliaeetus leucogaster*) and Eastern Osprey (*Pandion cristatus*), both listed as endangered under the NPW Act and Marine and Migratory under the EPBC Act, are present in the planning area, and are likely to have nesting sites at many locations along the southern coastline of the island. Both species are sensitive to nest disturbance. In areas of high human disturbance, White-bellied Sea-Eagle nests are linked to lower breeding success compared to areas with less disturbance (Dennis, *et al.*, In press). Consideration should be given to minimising disturbance to known nesting sites from fire management activities, particularly during the breeding season.

Specific information on how these coastal raptors respond to fire is included in Appendix 4.

Management Strategies	
Coastal Raptors	20. When planning burns in known nesting habitat for coastal raptors, consultation will include the Kangaroo Island Conservation Programs Unit, and other relevant specialists.

Australian Sea-lion

The Australian Sea-lion (*Neophoca cinerea*) is listed as Vulnerable under both the EPBC Act and NPW Act. A large proportion of the Australian population is found in South Australia, and 39 breeding sites are located in the state. There are two main colonies on Kangaroo Island; Seal Bay in Seal Bay CP, and the Seal Slide in Cape Gantheaume WPA (Goldsworthy,

et al., 2008). At both of these sites, Australian Sea-lions are known to use inland vegetated habitat above the beach for resting, particularly during inclement weather.

The draft national recovery plan lists the threats to the species, which include human disturbance and other activities in areas adjacent to breeding (DEWHA, 2010). Fire is not considered a major threatening process for this species. Nevertheless, care will be taken to minimise disturbance to known Sea-lion habitat, including inland resting sites.

Specific information on how Australian Sea-lions respond to fire is included in Appendix 4.

Management Strategies

Australian Sea-lion

21. When planning burns in known Australian Sea-lion habitat, consultation will include the Kangaroo Island Conservation Programs Unit, and other relevant specialists.

Threatened Plants

Several species of threatened plants occur within the planning area, including the Kangaroo Island Turpentine Bush (*Beyeria subtecta*), Macgillivray Spyridium (*Spyridium eriocephalum* var. *glabrisepalum*), Kangaroo Island Phebalium (*Leionema equestre*), Small-flower Daisy-bush (*Olearia microdisca*), and Ironstone Mulla Mulla (*Ptilotus beckerianus*). Specific information on how these species respond to fire is included in Appendix 3. Nationally threatened plant habitat is displayed on Map 2.

The recovery plan for these species calls for research to determine appropriate fire regimes, and management actions to promote appropriate fire regimes for effective reproduction, recruitment and recovery of these species and associated critical habitat on Kangaroo Island (Taylor, 2003). 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 firebreaks and fire access.

The Eastern Plains Fire Trial (EPFT) was designed to provide a research framework for the recovery plan in order to support "increased knowledge of fire ecology of eastern Kangaroo Island, and improvement in bushland condition" (Taylor, 2011b). The preliminary findings of the EPFT have confirmed that under the right conditions "burning small areas of long unburnt KI Narrow-leaved Mallee *(Eucalyptus cneorifolia)* can promote a regeneration event that greatly increases the above ground diversity of these plant communities" (Taylor, 2011b). Factors being closely examined by the trial that appear to have an influence on post burn regeneration include the intensity of the burn, the native herbivore grazing regime and the pre-burn condition of each site. A recommendation by Taylor (2011b) based on the preliminary findings of the EPFT burns undertaken to date proposed that:

> *A series of formalised guidelines [be developed] for the future use of prescribed fire to stimulate regeneration of long unburnt plant communities in eastern Kangaroo Island. These guidelines should be based upon a thorough analysis of the field data collected as part of the monitoring of phase 1 sites of the EPFT (completion by 2014).*

The Trial Progress Report also recommended that "the preliminary findings and observations from monitoring of burns undertaken to date be used to guide the development and

implementation of future fire management projects on Kangaroo Island until a more rigorous analysis of scientific data has been completed" (Taylor, 2011b). The Trial is a significant applied research project in areas of fragmented vegetation containing threatened species, and the preliminary findings an observations based upon monitoring undertaken to date can inform prescribed burn planning on the island.

Management Strategies

Threatened Plants

22. Consider the preliminary findings and observations of the Eastern Plains Fire Trial when developing and implementing fire management activities on Kangaroo Island.
23. Integrate the results of the Eastern Plains Fire Trial and monitor the effect of fire on threatened plant populations and preferred habitat and use this information to update databases (including the DEWNR vital attributes database) for use in future Ecological Fire Management Guidelines (Appendix 3).
24. When planning burns in known habitat of threatened plants, consultation will include the Kangaroo Island Conservation Programs Unit, the Kangaroo Island Threatened Plants Recovery Team, and relevant specialists.

3.7 Abundant and Pest Species Management

3.7.1 Fauna

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

Within the planning area, a number of introduced fauna have been recorded. These include: Cat (*Felis catus*), House Mouse (*Mus musculus*), Pig (*Sus scrofa*), Common Blackbird (*Turdus merula*), Common Starling (*Sturnus vulgaris*), Eurasian Skylark (*Alauda arvensis*), European Goldfinch (*Carduelis carduelis*), House Sparrow (*Passer domesticus*), Indian Peafowl (*Pavo cristatus*), and Northern Mallard (*Anas platyrhynchos*).

Prior to any prescribed burn, potential impacts will be considered to determine whether post-fire management is required. Pest fauna and abundant species management is implemented based on a risk assessment. Any kangaroo control program will be assessed against the *DEWNR Kangaroos on reserves (population control) policy* (DENR, 2011c). Prescribed burning provides opportunities for research and monitoring into how fauna respond to and impact on the environment post-fire. Section 5.3.6 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: Sallow Wattle (*Acacia longifolia* ssp. *longifolia*), Bridal Creeper (*Asparagus declinatus*), Bridal Veil (*Asparagus declinatus*), Blue Bell Creeper (*Billardiera heterophylla*), Salvation Jane (*Echium plantagineum*), and One-Leaf Cape Tulip (*Moraea flaccida*). Fire management guidelines for these species are included in Appendix 3.

Significant weeds within prescribed burn areas will be listed in the prescribed burn plan and mitigation actions identified. Post-fire weed control will be conducted where necessary. However, investment in weed control will be based on the reserves' overall habitat quality and overall weed management priorities within the region.

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

3.7.3 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 mould that causes disease and death in a variety of native plant species (as well as introduced species). Areas that receive average annual rainfall of 400 mm or more are considered at risk from the mould, which can spread naturally through the soil and through mud carried on vehicle tyres, walking boots and equipment. There is significant risk of *Phytophthora* being introduced into new areas and of existing infestations spreading in the planning area. The presence of *Phytophthora* has been confirmed by soil testing within Seal Bay CP.

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

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

Management Strategies

Abundant and Pest Species

25. Refer to Ecological Fire Management Guidelines (Table 6) and fire management guidelines for introduced flora species (Appendix 3) during prescribed burn planning.
26. Use fire as a tool that forms part of integrated weed management strategies where appropriate.
27. Consider the likely post-fire responses and impacts of weed species and implement post-fire weed control and monitoring accordingly (subject to regional priorities).
28. Collect relevant information during prescribed burn planning on introduced fauna and undertake a risk assessment to determine the need for post-fire management.
29. Adhere to the *Standard Operating Procedure – Phytophthora Threat Management (SOP-002)* (DEH, 2002) and conduct a risk assessment to determine whether fire management activities will exacerbate the spread of *Phytophthora*.
30. Ensure hygiene practices are implemented to reduce the spread of *Phytophthora* across the planning area. Refer to the *DEWNR Operating Procedure – Phytophthora Vehicle Disinfection Unit* (DEH, 2003).

4 RISK

4.1 Risk Assessment

A risk assessment was conducted in line with the *Policy and Procedure for Risk Assessment in DEWNR Fire Planning* (DENR, 2011b), as a requirement for the compilation of this fire management plan. The risk assessment is a tool used to gauge the risks arising from bushfire to life, property and environmental values in the planning area. The risk assessment considered visitor use, assets (built, cultural and natural values) and neighbouring properties for all reserves in the planning area. Risk assessment is a function of likelihood and consequence.

- Likelihood considers the possibility that a fire-related risk will occur and is assessed 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 DEWNR Fire Planning* provides more information on this process. Risk assessment is ongoing and continually reviewed to reflect the changing landscape. The application of fire management zones as well as recommended actions and works in this plan are derived from the risk assessment process.

4.2 Fuel Hazard

4.2.1 Overall Fuel Hazard

As assessment of 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 1). Canopy Fuel is not measured as part of Overall Fuel Hazard.

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

Fuel loads within a particular area will be influenced by the types of vegetation (floristics) found in the landscape. The majority of vegetation communities within the planning area are dominated by mallee communities with a relatively intact understorey, which corresponds with *Very High* to *Extreme* elevated fuels. This helps to explain the history of high intensity bushfires in this area (see Section 3.4.2). The vegetation is relatively dense on sandy soils, grading to less dense on fragmented limestone areas (aeolianite calcrete) through to a low shrub layer in heath along the coastal margin.

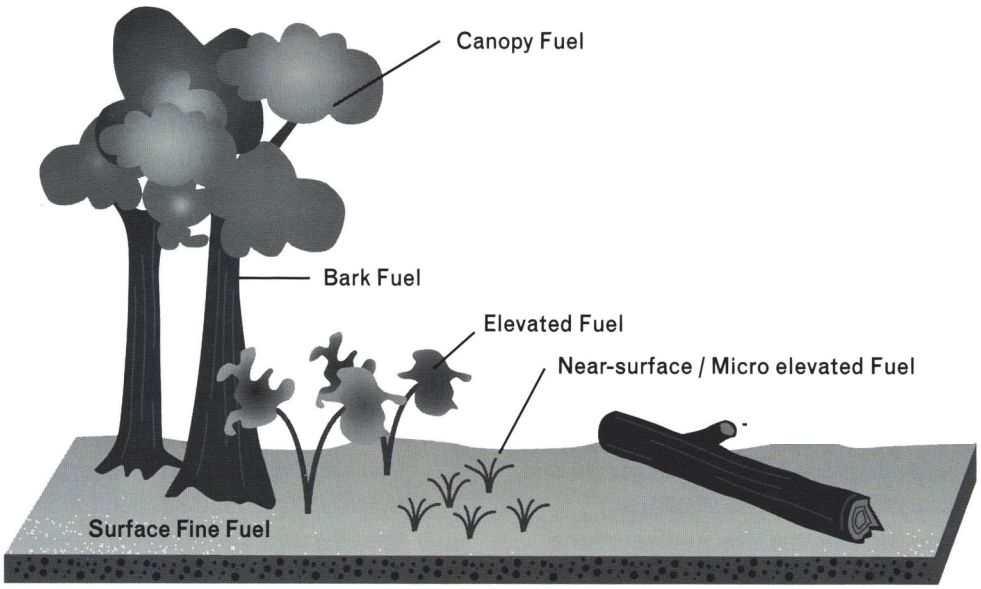

FIGURE 1 – COMPONENTS OF FUEL IN VEGETATION

(Tolhurst and Cheney, 1999)

Along the south coast of Kangaroo Island, the vegetation is mostly continuous from the Stunsail Boom River in the west to D'Estrees Bay in the east. Due to the lack of north-south control lines along the extent of this vegetation, there are very few opportunities to undertake fire suppression strategies in the event of a large bushfire. The potential exists for a high intensity bushfire to be driven for many kilometres in an easterly direction under severe weather conditions, including strong gusty westerly winds. This would result in large tracts of vegetation burning in a single fire event.

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.

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

4.2.2 Likely Maximum Overall Fuel Hazard

Maximum Overall Fuel Hazard levels have been estimated for MVS within the planning area in order to provide a guide for fire management (Table 4). The process used to derive MVS is described in Section 3.5 and the extent of each MVS within the planning area is shown on Map 2.

The likely maximum Overall Fuel Hazard is based on on-ground sampling and vegetation mapping within the planning area. It can be used for planning and incident management. However, this estimate should be supported by on-ground inspection as areas of vegetation remain unmapped, and it is likely that other factors (such as high weed density) will influence the Overall Fuel Hazard.

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

MVS No.	MVS Name	Likely Maximum Overall Fuel Hazard	Significant Fuel Layers
8	*Eucalyptus* woodlands with a shrubby understorey	Extreme	Surface, elevated & bark[1]
26	*Casuarina* and *Allocasuarina* forests and woodlands	Extreme	Elevated
29	Mallee heath and shrublands	Extreme	Near surface, elevated & bark
47	*Eucalyptus* open woodlands with shrubby understorey	Extreme	Surface, elevated & bark
49	*Melaleuca* shrublands and open shrublands	Extreme	Elevated

[1] if Stringybark present

4.2.3 Potential for Fire Impact

Seal Bay

There are several locations in the planning area where life and property may be threatened by bushfire. The Seal Bay Visitor Centre is a premier tourist destination for the island, with up to 470 visitors each day (based on monthly averages). The site is accessed via a dead-end, 11 km road (the Seal Bay Road) off the South Coast Road. In 1996 the Cape Gantheaume fire came within 1 km of the visitor centre (see Section 3.4.2). While a fire protection sprinkler system is installed at the site, the building itself is considered highly vulnerable to bushfire, and not suitable as a refuge during a bushfire event in its current design (CFS Building Fire Safety Unit, 2011). In addition to the risk to life at this location, the site is a highly valuable economic asset for DEWNR and tourism.

Vivonne Bay and D'Estrees Bay

The township of Vivonne Bay and the settlement of D'Estrees Bay are also considered to be at risk of bushfire. Their location on the north-eastern side of large blocks of continuous vegetation place them at significant risk of bushfire, especially under strong south-west winds that occur with frontal activity during bushfires. The private shacks at Point Ellen and Harriet River, and several community assets at Vivonne Bay (including the jetty, campground, golf course, fishing depot, and tourist sites) are at risk of bushfire. While only some of these assets are likely to be utilised for shelter during a bushfire, others are important built assets that are necessary for the community to function. Shacks and campgrounds along the D'Estrees Bay Road (Cape Gantheaume CP) are also susceptible due to their location, as evidenced by the 2007 fires (see Section 3.4.2).

Other sites

Private buildings and assets are located adjacent to most reserves in the planning area, but those next to Seal Bay CP and Cape Gantheaume WPA and CP are at particular risk of bushfire, especially those surrounded or almost surrounded by reserve and/or native vegetation. There are non-DEWNR tourist sites adjacent to Seal Bay CP (Little Sahara to the west, and several others along the South Coast Road to the north) and these would be at risk if a bushfire occurred in the reserve, or travelled south from private lands further north.

In addition to those mentioned in Section 3.6.4 and Appendices 3, 4 and 5, the large areas of intact vegetation in the planning area, including the Cape Gantheaume WPA, are themselves environmental assets.

4.2.4 Influence of a Changing Climate

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

Management Strategies	
Changing Climate	31. Monitor national and international fire management policy and best practice and partner with the research sector to increase our knowledge on altered fire regimes.
	32. Monitor species and ecosystems and the processes that support them to understand their resilience to a changing climate.
	33. Review and adapt fire management strategies in the planning area as the impacts of climate change become understood.

5 READINESS

5.1 Equipment

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

DEWNR issues personal protective equipment (PPE) to all firefighting staff, designed to protect their safety and welfare and to improve fire suppression effectiveness. DEWNR ensures that PPE issued to firefighters meets recognised Australian Standards (where they exist), CFS requirements, and Schedules as set out in the *Policy and Procedure for Personal Firefighting Equipment* (DENR, 2011b). PPE is also required to be consistent with the *DEWNR Occupational Health, Safety and Welfare Policy* (DEH, 2008b).

DEWNR firefighting resources include a variety of firefighting vehicles and equipment, which may be deployed to fires anywhere in South Australia or interstate. DEWNR ensures that all firefighting equipment meets Australian Standards (where they exist) and complies with CFS standards, unless otherwise specified in DEWNR policies and standards (including the *Policy and Procedure for Fire Appliance Equipment Standards* and the *Policy and Procedure for Earthmoving Equipment* (DENR, 2011b)).

All firefighting equipment is inspected prior to the commencement of the fire season and after use at fires to ensure that minimum requirements are met as prescribed in DEWNR policies and standards.

5.2 Training

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

All DEWNR personnel engaged in fire management operations are trained in accordance with the *Policy and Procedure for Fire Training* (DENR, 2011b) and CFS standards. All staff involved in fire suppression are required to undertake annual pre-season training and health checks and meet fitness requirements to ensure that they are able to carry out assigned duties safely and competently (see the *Fire Personnel Health and Fitness (Fighting Fit Program) Policy and Procedure* (DENR, 2011b) for details).

DEWNR 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 *DEWNR Occupational Health, Safety and Welfare Policy* (DEH, 2008b) and the *Fire Policy and Procedure for Safety, Health and Welfare* (DENR, 2011b).

5.3 Risk Mitigation Strategies

5.3.1 Fire Access Tracks

DEWNR is committed to managing a strategic network of fire access tracks on DEWNR-managed land, in accordance with the GAFLC standard (GAFLC, 2008) and the *Fire Policy and Procedure for Fire Access Tracks* (DENR, 2011b). Tracks occurring within the planning area, as well as external tracks or public roads considered important for fire suppression have been classified as a 'major', 'standard' or a 'minor' fire access 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 with

absolute caution and with the approval of the Incident Controller. 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, and supported by zoning or may be positioned between significant assets (e.g. Seal Bay Road leading to Seal Bay Visitor Centre).

In Seal Bay CP there is a mobile sand dune located on the western side of Nicks Track that requires ongoing maintenance to realign the track and allow passage of fire vehicles.

There are dead-end tracks throughout the planning area, which are a safety issue for both the general public and fire crew during incidents. These include: Nicks Track, Seal Bay Road and Bales Bay Road in Seal Bay CP, D'Estrees Bay Road in Cape Gantheaume CP and WPA, Vivonne Bay Road adjacent Vivonne Bay CP, Murray Lagoon Track south of the Murray Lagoon Ranger Station in Cape Gantheaume CP, and Osmali Road in the Crown lands adjacent to D'Estrees Bay community. Of a particular safety concern is the Cape Gantheaume WPA coastal walking track from the southern end of the formed D'Estrees Bay Road. Vehicle access to this track is currently unrestricted. Due to the risk of entrapment of visitors travelling along this walking track during bushfires, movements should be controlled.

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

Management Strategies

Fire Access Tracks

34. Unless identified for upgrade, maintain tracks to GAFLC standards as shown on Map 4.

35. Install signs on fire access tracks and gates according to GAFLC standards and name tracks as appropriate.

5.3.2 Fire Infrastructure

The following fire infrastructure is maintained for fire suppression activities within the Cape Gantheaume Fire area.

- Fire standpipes at Murray Lagoon Ranger Station (Cape Gantheaume CP), and fire water tanks at Seal Bay Visitor Centre (Seal Bay CP).
- Fire protection sprinkler system at the Seal Bay Visitor Centre (Seal Bay CP).
- Numerous static water supplies (tanks, dams, watercourses, etc.) across the planning area.

Map 4, the *Response Plan for the Kangaroo Island Region* (DENR, 2011e), as well as the Kangaroo Island Region annual works schedule will provide more information on fire infrastructure.

5.3.3 Fire Management Zones

Fire management zones as detailed in the *Policy and Procedure for Fire Management Zoning in DEWNR Fire Planning* (DENR, 2011b) have been introduced into DEWNR fire management planning to:

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

Fire management zones are categorised according to the primary objective for fire management: A-zone, B-zone, or C-zone. These zones were determined through consideration of Overall Fuel Hazard levels in different habitat types and the level of risk to assets including life, property and cultural heritage and biodiversity assets. The primary objective within A- and B-zones is fuel management. However, some native species may benefit from such disturbance (e.g. orchids are often found on slashed fuel breaks). The zones allocated to the reserves within the planning area are described in Appendix 1 and shown on Map 4.

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

A-zone Objectives

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

C-zone Objectives

- To assist in the conservation of species and populations such as the species listed in Appendices 3 and 4, as well as threatened ecological communities listed in Appendix 5, through the application of appropriate fire regimes.
- To reduce the likelihood of contiguous vegetation burning in a single fire event.
- To promote heterogeneity within the environment through the creation of variability in the fire regime.
- To reduce the likelihood of fragmentation of native vegetation through fire management strategies.
- To maintain and, where possible, enhance wilderness quality through the maintenance of fire as a natural ecosystem process, where supported by best available knowledge.
- 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.

Major Strategies within the Planning Area

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

- A-zones have been applied to areas of reserves where an adjacent asset is less than 40 m from the reserve boundary and not separated by a formed road.
- Wide B-zones have been placed to reduce the likelihood of fire moving across the landscape or exiting DEWNR-managed land. Strategic areas where bushfire escapes have occurred in the past or could occur in the future have been targeted (such as throughout Seal Bay CP, Six Mile Lagoon, and Cape Gantheaume WPA and CP).
- B-zones have also been located to reduce the chance of a reserve burning in its entirety, such as within Seal Bay CP.
- B-zones have been placed to complement the zoning from the Kangaroo Island BMAP (KI DBPC, 2009).

These and other zones applied to the lands included in the fire management plan are shown on Map 4 and detailed in Appendix 1. Note that the extent of these B-zones as displayed spatially is indicative and the widths will be more clearly defined during prescribed burn planning (for those where fuel management will be achieved by prescribed burning).

Prescriptions for Fuels in A- and B-zones

The Overall Fuel Hazard:

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

In A- and B-zones, fuel management will be undertaken to achieve the desired level of Overall Fuel Hazard. Fuels in A- and B-zones will be managed by a variety of treatment techniques and will not necessarily be managed by prescribed burning alone. Note that

within C-zones management is not dictated by Overall Fuel Hazard levels, rather the C-zones allow for fire management to meet ecological and conservation management objectives.

Details on fuel reduction methods within A- and B-zones are provided as part of an environmental assessment process, which is completed before the implementation of each action (where native vegetation is being cleared and is not exempt under the *Native Vegetation Act 1991*). Refer to the *Interim Environmental Assessment Table Guidelines* (DEH, 2004b) and the *Fire Policy and Procedure for Prescribed Burning* (DENR, 2011b) for more information.

The fuel reduction works in some A- and B-zones may require the construction of firebreaks and control lines. Such works will be incorporated as part of the operation plan for the implementation of the zoning at the discretion of DEWNR regional staff.

5.3.4 Implementation of Fire Management Works

Under DEWNR policy, prescribed burning within C-zones may be implemented for the purpose of ecological management, cultural management, research, or for landscape protection. All prescribed burning within C-zones should be in accordance with the ecological fire management guidelines described within this fire management plan, unless the biodiversity benefits of such a burn would outweigh the risks (see Section 5.3.6).

Proposed prescribed burn areas in C-zones are shown on Map 4. These burn areas may be added, altered, relocated or may be withdrawn at the discretion of DEWNR at anytime. Generally this would be as a result of unplanned fires or other factors that may have occurred since time of writing. The implementation of any proposed burn is subject to resource availability and regional priorities; however, where fuel reduction burns are required to achieve the desired fuel levels in a B-zone, these burns will be implemented as a matter of priority to reduce the risk. Any proposed burn area identified on Map 4 may not be burnt in its entirety at one point in time, as the area may be divided and burnt over a number of seasons or the burn itself may be patchy for environmental purposes or due to prevailing climatic conditions.

All prescribed burning and other fire management works carried out by DEWNR (regardless of the objective or tenure) will meet fire management planning requirements by applying an environmental assessment process as part of a prescribed burn plan, as detailed in Figure 2 and in *the Fire Policy and Procedure for Prescribed Burning* (DENR, 2011b). Within A- and B-zones, burning may be undertaken for the purpose of fuel reduction (as described above). Ecological burns within C-zones are also subject to the planning process as detailed in the *Fire Policy and Procedure for Ecological Burning* (DENR, 2011b).

Under DEWNR policy, environmental assessments are also required for any other fire prevention works or activities where native vegetation is being modified (DEH, 2004b). The assessment considers aspects such as vegetation condition, threatened species, erosion potential, the potential to introduce or increase pest plants, animals or diseases, fire regime, bushfire risk, hydrology, and Aboriginal and European heritage.

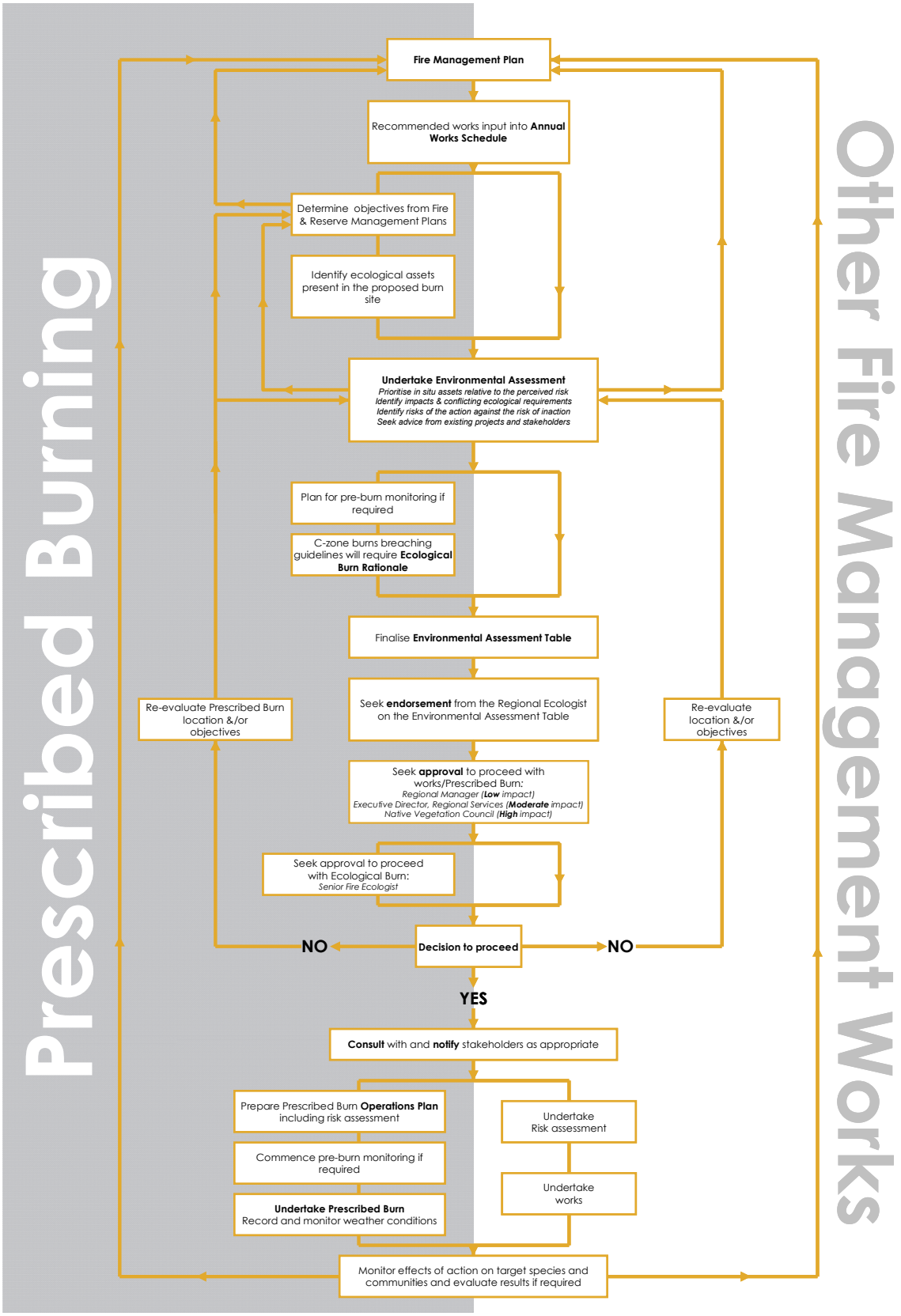

FIGURE 2 – FLOW CHART DETAILING THE BURN PLANNING PROCESS

5.3.5 *Fire Management Blocks*

The planning area has been divided into 10 fire management blocks to ensure that information and issues unique to each area have been addressed (Table 5). Block boundaries are based on access and the practicalities of implementing fire management objectives.

TABLE 5 – FIRE MANAGEMENT BLOCK INFORMATION

Reserve	Block Name	Block Size (ha)
Beyeria CP & Heritage Agreements	Beyeria Block	370.3
Cape Gantheaume CP	Murray Block	4 386.9
	D'Estrees Block	1 304.6
Cape Gantheaume WPA	Gantheaume Block	20 182.9
Heritage Agreement & Crown land	Six Mile Lagoon Block	543.8
Nepean Bay CP & Crown land	Nepean Block	53.4
Seal Bay CP	Ada Block	3 790.5
	Seal Bay Block	4 778.8
Vivonne Bay CP	Vivonne Block	2 076.5
Vivonne township Crown land	Vivonne Bay Township Block	57.5

5.3.6 *Ecological Fire Management*

The management of fire to maintain biodiversity is discussed in more detail in the *Ecological Fire Management Guidelines – DRAFT* (DENR, 2010b). 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 ecological communities and their response to fire regimes, and then applying this knowledge to fire management practices to maximise biodiversity outcomes. Ecological Fire Management Guidelines are used to assist in achieving management objectives in C-zones within all DEWNR 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 DEWNR 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 summarised below, and illustrated in Figure 3.

- Vital attribute data of species and ecological communities is gathered and assessed.
- This knowledge is used to identify the Thresholds of Potential Concern (TPC) within the fire regime (fire interval, intensity, season and type) where species significantly decrease.

- Ecological Fire Management Guidelines are formed from these thresholds and are then used to guide the fire management practices to ensure that adequate habitat is available to maintain biodiversity (i.e. species, populations and ecological communities).

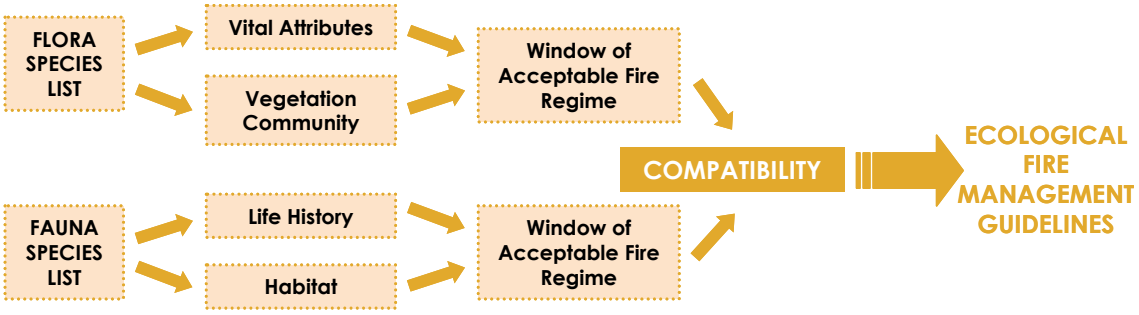

FIGURE 3 – APPROACH FOR DETERMINING ECOLOGICAL FIRE MANAGEMENT GUIDELINES

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 reserves in the planning area in a way that will ensure the maintenance and enhancement of biodiversity (Table 6). Guidelines for five aspects of fire regime (interval, spatial criteria, frequency, 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 promotes the conservation of existing species.

The Ecological Fire Management Guidelines are based on the best available information and they will be refined as new research and monitoring data become available for Key Fire Response Species. The outcomes of the Eastern Plains Fire Trial will provide such new information for Kangaroo Island Narrow-leaved Mallee (*E. cneorifolia*) communities and a range of threatened plants that occur within the plan area.

Thresholds of Potential Concern

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

- TPC1 demonstrates the lower threshold for fire interval (in years) for a particular MVS. That is, vegetation within this MVS will be represented predominantly by early successional species if the inter-fire interval is less than the time specified, and those species that require longer to flower and set seed can disappear from a vegetation 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 threshold is breached, species of sensitive functional types are likely to significantly decline. Fire intervals between the upper and the lower threshold (Table 6) are predicted to maintain the species diversity, whereas intervals shorter than the lower threshold or longer

than the upper threshold are predicted to lead to the decline of the Key Fire Response Species (Kenny, *et al.*, 2004).

TABLE 6 – ECOLOGICAL FIRE MANAGEMENT GUIDELINES FOR MVS IN THE PLANNING AREA

MVS No. and MVS Name		Interval		Spatial Criteria		Frequ-ency	Intensity		Season
		TPC 1 – Lower threshold in years	**TPC 2** – Upper threshold in years[1]	Inter-fire intervals within TPC1 and TPC2 across more than X% of the extent of this MVS within the planning area	% > TPC2	Avoid more than 2 fires within a period of **X** years	Avoid more than 2 successive fires of low intensity	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	40	30	40	Y	Y	Spring or during & following drought
26	*Casuarina* and *Allocasuarina* forests and woodlands	17	40	40	30	60	Y	Y	Spring or during & following drought
29	Mallee heath and shrublands	17	40	40	30	40	Y	Y	Spring or during & following drought
47	*Eucalyptus* open woodlands with shrubby understorey	17	40	40	30	60	Y	Y	Spring or during & following drought
49	*Melaleuca* shrublands and open shrublands	17	40	40	30	70	Y	Y	Spring or during & following drought

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

6 RESPONSE

6.1 Response Plans

A Response Plan exists for the Kangaroo Island Region (DENR, 2011e), which is reviewed on an annual basis in accordance with the *Fire Policy and Procedure for Response Planning* (DENR, 2011b). The response plan provides reserve-specific information in relation to fire suppression including water points, equipment and access, as well as levels of readiness.

It should be noted that the Response Plan is for initial response only and this fire management plan should be referred to, in conjunction with DEWNR staff, for more detailed fire management information during an incident.

6.2 Suppression Considerations

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

General principles:

- Bushfires should be kept to the smallest possible area in commercial plantations to minimise economic loss.
- The use of retardant in catchment areas should be in accordance with the *Memorandum of Understanding on Aerial Application of Chemical Fire Retardants* between SA Water and CFS (CFS, 2006).
- Only chemicals qualified and approved by the United States Department of Agriculture (USDA) Forest Service and endorsed by AFAC will be used on public land (see USDA Forest Service (2008) document).
- Implement precautionary hygiene measures to reduce the risk of Phytophthora infestation (see Section 0) and spread of weeds. Weed hygiene measures may incorporate cleaning by water (washdown), solvent based cleaning, and/or air jets.
- Minimum Impact Suppression Techniques (MIST) and specialised equipment that reduces impacts to the landscape shall be used wherever possible and control methods will not be greater than the potential or actual impact of the fire.

6.3 Visitor Management during Bushfire

Visitor and tourism issues in the planning area and associated management strategies are detailed in Section 3.6.1.

Visitors within reserves are managed according to the *Fire Policy and Procedure for Visitor Safety* (DENR, 2011b), which allows for the temporary closure of reserves or cancellation of

activities due to an actual emergency, imminent threat or extreme threat of a bushfire. The *DEWNR Temporary Closure of Reserves Policy* (DENR, 2010a) and *Fire Policy and Procedure for Reserve Closures* (DENR, 2011b) allow for reserves to be closed on days of 'significant fire danger' forecast *Catastrophic* (FFDI 100+ or GFDI 150+), however also allows for closures if forecast *Severe* or *Extreme* at the discretion of the DEWNR Chief Executive. Closures may also be implemented due to bushfires or prescribed burns within or adjacent to a reserve.

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

To maximise safety, DEWNR staff and contractors working within the reserves during high fire danger days are required to maintain communications with the relevant District Duty Officer.

7 RECOVERY, RESEARCH AND MONITORING

7.1 Post-fire Rehabilitation and Recovery

DEWNR has a *Policy and Procedure for Post-fire Rehabilitation* (DENR, 2011b) to support the identification of requirements for the rehabilitation and recovery of areas affected by bushfire 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.

7.2 Research

Eastern Plains Fire Trial

At present, research is being conducted within the Hundreds of Haines, Macgillivray and Menzies in eastern Kangaroo Island as part of the Eastern Plains Fire Trial (EPFT). Beyeria CP and adjacent native vegetation is included in the EPFT study area. The EPFT was established in 2008 to investigate a number of fire-related questions within the remnant native vegetation of the area. This part of Kangaroo Island was extensively cleared for agriculture in the 1950's and 1960's and less than 16% (15 198 ha) of the original vegetation remains and most of this is in a highly fragmented state. Roughly a quarter of this remnant native vegetation (4 064 ha) consists of the Kangaroo Island Narrow-leaved Mallee (*Eucalyptus cneorifolia*) community, a vegetation type restricted to eastern Kangaroo Island that supports a range of unique species, including five nationally threatened plants.

The senescence of plant communities in the study area has been identified as a key cause of decline for both nationally threatened plant species and associated habitat. A key component of this vegetation senescence has been the exclusion of fire from this landscape, with many vegetation fragments in this area not burning for more than 30 years. Anecdotal observations, botanical surveys and small-scale scientific trials suggest that carefully planned burning in long unburnt habitat is an effective means of encouraging the regeneration of a large number of declining 'fire dependent' plant species.

The broad objective of the EPFT is to develop a better understanding of the role of fire for maintaining ecosystem diversity and health. This is being investigated through a number of experiments to manipulate patches of remnant native vegetation. A series of prescribed burns are planned, with long term monitoring occurring pre- and post-burn to measure changes in flora and fauna communities. Expected outcomes include improved knowledge of significant plant species regeneration following fire, and the importance of landscape metrics (such as shape and connectivity), spring versus autumn burns, fire intensity, and fuel structure in the outcomes of prescribed burning. An overall improvement in bushland condition at each site is expected, along with an improvement in fire management practices, a strengthening of partnerships between land managers and heightened public involvement in bushland and fire management on Kangaroo Island. Ultimately this information will be used to revise ecological fire management guidelines (Table 6) and inform future fire management plans.

Any further fire-related research proposed within the reserves in the planning area should be discussed with the DEWNR Fire Management Branch and be in accordance with *Policy and Procedures for Fire Research* (DENR, 2011b) and in consultation with the Kangaroo Island Region. DEWNR has prepared a Science Directions document (DEH, 2010) that outlines some key questions for research in fire science and fire management. The recommended research areas proposed below will contribute to improving the knowledge required to answer these priority research questions. It is important that research projects have stated goals that are measurable and incorporate performance indicators and a monitoring and reporting framework that feeds back into the adaptive management process.

It is recommended that research is undertaken to:

Research	36. Continue to collect and collate vital attributes for fauna and flora, including continuing support for the Eastern Plains Fire Trial, and incorporate into future ecological fire management guidelines revisions.
	37. Determine the suitability of flora-based thresholds for meeting both flora and fauna conservation objectives.
	38. Assess whether the chosen Key Fire Response Species are appropriately sensitive as community-wide indicators of inappropriate fire regimes in the plan area.
	39. Investigate the effect of fire on the species and ecological communities identified in Appendices 3 and 4.
	40. Investigate the use of fire for the management of weeds (e.g. Bridal Veil, Blue-Bell creeper).

7.3 Monitoring

A range of situations are likely to provide opportunities for measuring the response of biota to fire, including planned fire, bushfire, and fire management activities that impact on natural systems. Monitoring will be established in conjunction with prescribed burns to assess issues raised during prescribed burn planning, in accordance with DEWNR policy and procedures. Implementation will depend upon state and regional priorities and available resources. This includes the *DEWNR Policy and Procedure for Prescribed Burning* and the *Policy and Procedure for Ecological Burning* (DENR, 2011b). Monitoring of the impacts of reintroduced fire as part of the EPFT (see Section 7.2) in order to gain an understanding of the longer term effects of this management action will conclude during the life of this plan.

Opportunities for monitoring will also be considered in areas impacted by bushfire to improve knowledge about the response of species, ecological communities and habitats to fire within the planning area, as per DEWNR policy (DENR, 2011b). Post-bushfire monitoring of established sites is currently underway as part of the Kangaroo Island Monitoring of Biodiversity Assets project (Gates and Moss, 2002) in western Kangaroo Island. These sites are outside the current planning area but occur in the same MVS, so findings from this study should assist with the revision of the ecological fire management in the Cape Gantheaume area. The results from all post-fire monitoring, including that of the EPFT, will be used to further refine fire management, consistent with an adaptive management approach.

It is recommended that monitoring is undertaken to:

Monitoring

41. Investigate the fuel accumulation rates of the various MVS that occur within the planning area (Table 4). These data will help DEWNR staff determine if and when fuel reduction works are required, ultimately assisting in the scheduling of operational works and activities in B-zones.
42. Undertake monitoring to assess the effectiveness of implemented weed control measures and refine the weed management information for the control of introduced species following fire accordingly (Appendix 3).
43. Establish monitoring of flora and fauna pre- and post-fire to determine their fire response and to assess habitat preferences and requirements in relation to the Thresholds of Potential Concern (TPC).

8 SUMMARY OF MANAGEMENT STRATEGIES

Visitor Use

1. Close reserves when significant fire weather is forecast to ensure visitor safety.
2. Prepare emergency management plans for Seal Bay and D'Estrees Bay visitor areas and review these biennially.
3. Implement appropriate fuel management strategies consistent with the zoning shown on Map 4 to improve visitor safety.
4. Implement approved recommendations of the CFS Building Fire Safety Unit recommendations for the existing Seal Bay Visitor Centre (CFS Building Fire Safety Unit, 2011). Any new development should be built to the *Australian Standard for Construction of buildings in bushfire-prone areas AS3959-2009*.
5. Install safety signs at Bales Bay picnic area (Seal Bay CP), identifying it as being unsuitable as a fire refuge.
6. Develop a visitor interpretation strategy for bushfire issues in the planning area.

Built Assets

7. Implement fuel management strategies for asset protection consistent with the zoning shown on Map 4 and other risk mitigation works as detailed in Appendix 1.
8. Encourage adjacent property owners to work with DEWNR, CFS and local government to implement relevant actions from the *Kangaroo Island Bushfire Risk Management Plan 2009-2014*.
9. Ensure revegetation including post-fire recovery works is consistent with fire management zoning.

Cultural Heritage

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

Glossy Black-Cockatoo

12. Monitor the effect of fire on Glossy Black-Cockatoo habitat use, and use this information to manage the fire regime for this species in the future, through Ecological Fire Management Guidelines (Appendix 4) and Ecological Fire Management Strategies.
13. When planning burns in known Glossy Black-Cockatoo habitat, consultation will include relevant specialists.
14. 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).
15. Information and interpretation on Glossy Black-Cockatoo critical nesting and feeding habitat to be made available to Incident Management Teams during a bushfire.
16. Develop an Ecological Fire Management Strategy in collaboration with the Glossy Black-Cockatoo Recovery Program.

Southern Brown Bandicoot

17. Monitor the effect of fire on Southern Brown Bandicoot distribution and habitat use, and use this information to manage the fire regime for this species in the

future, through Ecological Fire Management Guidelines (Appendix 4) and Ecological Fire Management Strategies.

18. When planning burns in known Southern Brown Bandicoot habitat, consultation will include the Kangaroo Island Conservation Programs Unit, and other relevant specialists.
19. Finalise an Ecological Fire Management Strategy for the Southern Brown Bandicoot.

Coastal Raptors

20. When planning burns in known nesting habitat for coastal raptors, consultation will include the Kangaroo Island Conservation Programs Unit, and other relevant specialists.

Australian Sea-lion

21. When planning burns in known Australian Sea-lion habitat, consultation will include the Kangaroo Island Conservation Programs Unit, and other relevant specialists.

Threatened Plants

22. Consider the preliminary findings and observations of the Eastern Plains Fire Trial when developing and implementing fire management activities on Kangaroo Island.
23. Integrate the results of the Eastern Plains Fire Trial and monitor the effect of fire on threatened plant populations and preferred habitat and use this information to update databases (including the DEWNR vital attributes database) for use in future Ecological Fire Management Guidelines (Appendix 3).
24. When planning burns in known habitat of threatened plants, consultation will include the Kangaroo Island Conservation Programs Unit, the Kangaroo Island Threatened Plants Recovery Team, and relevant specialists.

Abundant and Pest Species

25. Refer to Ecological Fire Management Guidelines (Table 6) and fire management guidelines for introduced flora species (Appendix 3) during prescribed burn planning.
26. Use fire as a tool that forms part of integrated weed management strategies where appropriate.
27. Consider the likely post-fire responses and impacts of weed species and implement post-fire weed control and monitoring accordingly (subject to regional priorities).
28. Collect relevant information during prescribed burn planning on introduced fauna and undertake a risk assessment to determine the need for post-fire management.
29. Adhere to the *Standard Operating Procedure – Phytophthora Threat Management (SOP-002)* (DEH, 2002) and conduct a risk assessment to determine whether fire management activities will exacerbate the spread of *Phytophthora*.
30. Ensure hygiene practices are implemented to reduce the spread of *Phytophthora* across the planning area. Refer to the *DEWNR Operating Procedure – Phytophthora Vehicle Disinfection Unit* (DEH, 2003).

Changing Climate

31. Monitor national and international fire management policy and best practice and partner with the research sector to increase our knowledge on altered fire regimes.
32. Monitor species and ecosystems and the processes that support them to understand their resilience to a changing climate.
33. Review and adapt fire management strategies in the planning area as the impacts of climate change become understood.

Fire Access Tracks

34. Unless identified for upgrade, maintain tracks to GAFLC standards as shown on Map 4.
35. Install signs on fire access tracks and gates according to GAFLC standards and name tracks as appropriate.

Research

36. Continue to collect and collate vital attributes for fauna and flora, including continuing support for the Eastern Plains Fire Trial, and incorporate into future ecological fire management guidelines revisions.
37. Determine the suitability of flora-based thresholds for meeting both flora and fauna conservation objectives.
38. Assess whether the chosen Key Fire Response Species are appropriately sensitive as community-wide indicators of inappropriate fire regimes in the plan area.
39. Investigate the effect of fire on the species and ecological communities identified in Appendices 3 and 4.
40. Investigate the use of fire for the management of weeds (e.g. Bridal Veil, Blue-Bell creeper).

Monitoring

41. Investigate the fuel accumulation rates of the various MVS that occur within the planning area (Table 4). These data will help DEWNR staff determine if and when fuel reduction works are required, ultimately assisting in the scheduling of operational works and activities in B-zones.
42. Undertake monitoring to assess the effectiveness of implemented weed control measures and refine the weed management information for the control of introduced species following fire accordingly (Appendix 3).
43. Establish monitoring of flora and fauna pre- and post-fire to determine their fire response and to assess habitat preferences and requirements in relation to the Thresholds of Potential Concern (TPC).

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10 APPENDICES

Appendix 1 – Assets and Strategies for Risk Mitigation

	Values and Assets	Location/Block	Recommended Works
Six Mile Lagoon	Heritage Agreement Large tract of continuous vegetation Private residences to the north	Six Mile Lagoon	• B-zone (500 to 800 m) running north-south along western boundary of Heritage Agreement. May include maintenance of control line on the western border of the B-zone.
Vivonne Bay CP	Shacks at Point Ellen Vivonne Bay CP	Vivonne Block	• Recommend that DEWNR acquire road reserves (namely Heggaton, Blacker, Weir, McDonald, and Pethick Roads) and parcel of Commonwealth Land (Allotment 29, Hundred of Newland) adjacent Vivonne Bay CP for inclusion in the reserve, to allow for coordinated management of bushfire risk. • A-zone (40 to 170 m) surrounding the private shacks at Point Ellen. • B-zone (200 m) along north-eastern boundary of the reserve, to reduce the likelihood of fire travelling from the reserve in a north-easterly direction towards Vivonne Bay township.
Vivonne Bay township	All structures in the vicinity of the Harriet River Vivonne Bay township, including jetty & transfer station, fuel storage	Vivonne Township Block	• B-zone (120 to 180 m) running north-south along the western boundary of the Crown land. • Upgrade the service track running north-south on Vivonne Township Block (on Crown land), which connects to Vivonne Bay Road at its southern point, to minor standard (minimum 4 m wide).

	Values and Assets	Location/Block	Recommended Works
Seal Bay CP	Seal Bay Visitor Centre Large tract of continuous vegetation Bales Bay picnic area Little Sahara tourist site (non-DEWNR)	Seal Bay Block	• B-zone (500 to 800 m) running along the northern and western boundaries of the reserve. • B-zone (200 m) running along the northern side of Morcom Track, extending to the west to connect with the 500 m B-zone on the western boundary of the reserve. • B-zone (500 m) running the length of Seal Bay Road, from the South Coast Road to the Seal Bay Track (may occur on either side of the Seal Bay Road). Recommend to the Kangaroo Island BMC that neighbours surrounded by Seal Bay CP (to the west of the Seal Bay Road) implement a 250 m B-zone along the length of the Seal Bay Road to complement a 250 m B-zone on reserve. If neighbour does not implement 250 m B-zone, full 500 m B-zone will be constructed on reserve. • B-zone (200 m) running along the southern side of Seal Bay Track, extending from the sand dunes to the north of the Seal Bay Visitor Centre in the east, to the walking track to the west. The B-zone to continue down the western side of the walking track extending to the coast. • A-zone (100 m) to the north and west of the Seal Bay Visitor Centre, the inner ring of which will be modified landscaped vegetation to reduce available fuels and to ensure the maintenance of aesthetic values for visitors attending the centre. • Upgrade static water supply infrastructure at western end of Hammatt Track (at existing dam) in northern part of Seal Bay CP.
Seal Bay CP	Private residences Wetland habitat	Ada Block	• B-zone (500 m) along the southern and eastern side of Emmet Track and Lake Ada Track. • Implement C-zone burn for landscape protection (Map 4).
Cape Gantheaume CP	Murray Lagoon Ranger Station Wetland habitat	Murray Block	• A-zone (20 to 150 m) surrounding the Murray Lagoon Ranger Station and depot, to reduce the likelihood of bushfire threatening the built assets. • Signpost Murray Lagoon Track as 'No Through Road'.

	Values and Assets	Location/Block	Recommended Works
Cape Gantheaume CP	D'Estrees Bay settlement Shack sites and campsites along D'Estrees Bay Road	D'Estrees Block	• Recommend to the Kangaroo Island BMC that residents and property owners at D'Estrees Bay settlement consider their bushfire readiness, including suitability of access and egress routes. • B-zone (1000 m) in northern section of block, to reduce likelihood of fire travelling to the D'Estrees Bay settlement from the reserve. • A-zone (40 m) around the three shacks located between D'Estrees Bay Road and the coast. • Install gate at Cape Gantheaume coastal walking track to manage visitor access.
Cape Gantheaume WPA	Neighbours to the north Wilderness Protection Area Large tract of continuous vegetation	Gantheaume Block	• B-zone (500 to 1 000 m) along the northern boundary where the reserve abuts private land. • Recommend to the Kangaroo Island BMC that neighbours on the northern boundary of Cape Gantheaume WPA implement fuel management on private land to complement the B-zone on the reserve. • Implement C-zone burns for landscape protection (Map 4).
Beyeria CP	Intact vegetation with significant flora Heritage Agreements to the north	Beyeria Block	• Conduct C-zone burning in Beyeria CP and adjacent Heritage Agreements to implement a fire regime beneficial to threatened plant species and ecological communities. • Establish a west to east hydro axe line dividing the block in two for the purposes of undertaking C-zone burns.
Nepean Bay CP	Nepean Bay township to the west	Nepean Block	

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 (2004a) *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 *DEWNR Fire Policy and Procedure for Wilderness Fire Management* (DENR, 2011b).

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

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Life Form	Species Ecology & Fire Response	Considerations for Management	Source
Acacia longifolia ssp. *longifolia*	Sallow Wattle					Shrub	• Seed germination responds to disturbance including fire, but not a requirement • Can form dense thickets	• Weed control may be required post-fire	
*Asparagus asparagoides**	Bridal Creeper					Herb	• Flowers Aug - Sept • *Weed of National Significance* • Declared under the *Natural Resource Management 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* (Wilson, 2006)	• Weed control may be required post-fire	SA ^
*Asparagus declinatus**	Bridal Veil				VB	Vine	• Shoots annually from perennial tubers in autumn • Flowers Jul – Aug • Seeds are short lived with few remaining viable for > 3 years • Will re-sprout from underground tubers after fire	• Surveys required prior to prescribed burns • Weed control likely to be required post-fire	
Beyeria subtecta	Kangaroo Island Turpentine Bush	VU	E	29	B	Small shrub	• Regenerates from the soil seedbank • Disturbance (inc. fire) plays an important role in regeneration and recruitment • Associated with open-scrub and tall shrubland with an overstorey dominated by *E. cneorifolia*	• Avoid interfire interval <20 years or >40 years	KI ^ (Taylor, 2003)

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Life Form	Species Ecology & Fire Response	Considerations for Management	Source
*Billardiera heterophylla**	Blue-bell Creeper					Shrubby climber	• Flowers Spring – Summer • Occurs in areas receiving > 550 mm of annual rainfall, but known to occur in lower rainfall areas on eastern KI. • Can survive extended dry periods • Only reproduces from seed • Prolific seedling regeneration after fire or soil disturbance	• Consider weed control post-fire	SA ^
Caladenia ovata	Kangaroo Island Spider-orchid	VU	E	29	B	Orchid	• Deciduous herb, emerging annually in response to soaking rains in early autumn. Flowers in October. Dormant over the summer months. • Observed flowering at burnt sites 1 - 2 years after fire • Observed growing in open areas (often subjected to disturbance) such as open mallee heath	• Timing of fire is important, with the best time for orchids during dormancy (late spring to early autumn) prior to new shoot growth • Avoid interfire intervals <20 years or >40 years	(Todd, 2000)
Caladenia valida	Robust Spider-orchid		E		CG	Orchid	• Deciduous herb, emerging annually in response to soaking rains in early autumn. Flowers in September. Dormant over the summer months • Tubers re-sprout after fire, seedlings may be killed • Seed destroying by fire	• Timing of fire is important, with the best time for orchids during dormancy (late spring to early autumn) prior to new shoot growth	(Todd, 2000)
Corybas expansus	Dune Helmut-orchid		V	29	CG	Orchid	• Deciduous herb, emerging annually in response to soaking rains in early autumn. Flowers in August. Dormant over the summer months. • Fire likely to kill tubers. Unburnt patches important for recolonisation.	• Timing of fire is important, with the best time for orchids during dormancy (late spring to early autumn) prior to new shoot growth • Avoid interfire frequencies <20 years	
*Echium plantagineum**	Salvation Jane					Perennial herb	• Erect annual herb to 60 (rarely to 150) cm high • Flowers all year but mainly May – Nov • Spread by seed • Seed may remain dormant in the soil for up to 6 years but most will germinate within 2 years	•	

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Life Form	Species Ecology & Fire Response	Considerations for Management	Source
Grevillea muricata	Rough Spider-flower		V	29	B	Small Shrub	• Re-sprouts after fire • Also regenerates from the soil seedbank • Grows in open mallee heath with limited overstorey	• Avoid interfire intervals <20 years or >40 years	SA ^
Hibbertia obtusibracteata	Prickly Guinea-flower		V	29	HA (SB)	Small Shrub	• Unknown but has been observed growing in open mallee heath (often subjected to disturbance through roadside maintenance)and presumably has the same fire ecological requirements as the mallee heath species	• Avoid interfire intervals <20 years or >40 years	KI ^
Leionema equestre	Kangaroo Island Phebalium	EN	E	29	B	Small shrub	• Endemic to KI. • Grows from seed, requires 6 years to seed set. • Lifespan > 20 years • Adult plants intolerant of fire (mature individuals die if burnt) • Observed regenerating prolifically in response to disturbance (fire and/or vegetation clearance)	• Avoid interfire intervals <20 years or >40 years	KI ^
Microtis orbicularis	Swamp Onion-orchid		V	8 29	VB, B	Orchid	• Deciduous herb, emerging annually. Flowers in Oct-Nov. Dormant over the summer months. • Occurs in areas which are inundated for up to 6 months of the year, such as waterholes, lake margins & shallow lagoons. • Re-sprouts after fire. Can flower profusely after fire.	• Timing of fire is important, with the best time for orchids during dormancy (summer to early autumn) prior to new shoot growth • Avoid inter-fire intervals < 10 years	KI ^, SA ^
*Moraea flaccida**	One-Leaf Cape Tulip					Perennial herb	• Flowers Aug – Oct • Cormous, perennial, herb, to 0.75 m high • Active growth May – Oct • Reproduces primarily by seed, occasionally corm offsets • Seeds viable < 2years • Flowers after 2-3 years	• Generally survives fire • Following fire is a particularly important time as fire can bring corms out of dormancy and stimulate flowering	Aus ^

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Life Form	Species Ecology & Fire Response	Considerations for Management	Source
Olearia microdisca	Small-flowered Daisy-bush	EN	C E	29	B	Woody shrub	• Endemic to KI • Regrows from seed. Requires 6 years to set seed. Lifespan + seedbank at least 50 years. Intolerant. Lifespan 15 to 20 years • Seedbank is viable for 60 years+ • Early successional species • Responds extremely prolifically to fire events of medium to high intensity (100% canopy scorch)	• Avoid interfire intervals <20 years or >40 years	KI <
Prasophyllum calcicola	Limestone Leek-orchid		V	29	CG	Orchid	• Deciduous herb, emerging annually in response to soaking rains in early autumn. Flowers in September. Dormant over the summer months. • Grows in coastal mallee and heath in calcareous soils. • Fire is known to kill tubers.	• Timing of fire is important, with the best time for orchids during dormancy (late spring to early autumn) prior to new shoot growth • Avoid interfire frequencies <20 years	Aus <
Ptilotus beckerianus	Ironstone Mulla Mulla	VU	V	8 29 47	VB SB	Perennial herb	• Flowers Sept - Jan • Occurs on KI and 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, for example this species has been observed growing in roadside gravel • Known to proliferate after fire until mid to upperstorey species outcompete • Appear to thrive on disturbance & set seed quickly	• Avoid interfire intervals <10 years or >40 years	KI <
Pultenaea insularis	Beyeria Bush-pea		C E		B	small shrub	• Endemic to KI • Thought to be tolerant of fire and other disturbance • Observed regenerating from soil seedbank after fire at one location	• Avoid interfire intervals <20 years or >40 years	KI <

Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Life Form	Species Ecology & Fire Response	Considerations for Management	Source
Spyridium eriocephalum var. *glabrisepalum*	Macgillivray Spyridium	VU	E	29	B	Small shrub	• Endemic to KI • Regrows from seed. Lifespan at least 20 years. • Intolerant of fire • Observed regenerating prolifically from the soil seedbank after fire at a number of locations in eastern KI	• Avoid interfire intervals <20 years or >40 years	KI ^
Thysanotus nudicaulis			E	29	SB	Perennial herb	• < 0.5m high • Flowers Nov-Dec • Resprouts from tuberous roots		Aus ^

Appendix 4 – Fire Response of Rated and Significant Fauna Species

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Diet	Breeding	Species Ecology & Fire Response	Considerations for Management	Source
Bird	*Calyptorhynchus funereus*	Yellow-tailed Black-Cockatoo		V	8 26 29 47	VB, SB	G	• Sites: Sugar Gum and Blue Gum hollows, high in trees • Material: chewed woodchips • Season: Nov-Mar	• Inhabits woodland and mallee & often seen in pine plantations feeding 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 than 20% of nesting patches in a single fire event • Avoid 2 or more successive fires in summer • Avoid high intensity fires in nesting habitat	SA ^
Bird	*Calyptorhynchus lathami halmaturinus*	Glossy Black-Cockatoo	EN	E	8 26 29 47		G	• Sites: Old Sugar Gum, Blue Gum & Manna Gum hollows • Material: chewed woodchips • Season: Jan-Oct	• Some mobility within flock areas • Potential long term loss of breeding habitat from extensive high intensity fires • Fire exclusion may inhibit hollow development & feeding habitat regeneration	• Nepean Bay block important feeding area in the planning area • Avoid burning >5% of feeding and nesting habitat in any 5 year period • Avoid high intensity fires in nesting habitat • Avoid late summer to early winter burns in habitat; also early spring	SA ^
Bird	*Haliaeetus leucogaster*	White-bellied Sea-Eagle		E		C G, SB, VB	C	• Sites: High in tree, on ground or on rocks • Material: sticks, leaves • Season: nesting May-mid Dec, critical sensitivity period May-Sept	• Often found in coastal areas on KI; also inland along rivers and on larger lagoons and dams • High mobility • Fire may disrupt breeding and/or destroy nest sites	• Minimise impact to nest sites, such as smoke, machinery use, ground crew, aerial suppression • Avoid prescribed burning in spring, as this is more likely to disturb nesting and/or breeding • Avoid successive, extensive fires	Aus ^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Diet	Breeding	Species Ecology & Fire Response	Considerations for Management	Source
Bird	*Pandion cristatus*	Eastern Osprey		E		SB, VB, C G	C	• Sites: coastal locations - high in trees, rocky headlands, artificial towers, etc. • Material: Sticks/twigs • Season: laying Jul-Sept, hatching Aug-Oct, fledging Oct-Dec	• Mostly found in coastal areas • Highly mobile, large breeding territories • The same nesting site may be used for many years • Fire may impact on nesting locations	• Minimise impact to nest sites, such as smoke, machinery use, ground crew, aerial suppression • Avoid prescribed burning in spring, as this is more likely to disturb nesting and/or breeding • Avoid successive, extensive fires	SA ^
Bird	*Psophodes nigrogularis leucogaster*	Western Whipbird (eastern subspecies)	VU	E	8 29 47	C G		• Sites: dense understorey • Season: late winter/spring	• Prefers dense scrub and undergrowth in mallee and heathland • Favours coastal environments on KI • Prefers 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 patched in a single fire event • Avoid 2 or more successive fires in late winter/spring	SA ^
Bird	*Sternula nereis*	Fairy Tern	VU	E		C G, VB		• Site: sand, rocky flats • Material: sand, pebbles, shell • Season: Sept-Jan	• Prefers coastal areas • High mobility • Fire may disturb breeding cycle	• Avoid burning near nesting locations in spring-early summer • Breeding records at Nepean Bay CP (Baxter, 1995)	Aus ^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Diet	Breeding	Species Ecology & Fire Response	Considerations for Management	Source
Bird	*Stictonetta naevosa*	Freckled Duck		V		C G		• Sites: At or near water level • Material: twigs • Season: Sept-Dec	• Occupies wetland areas • Not likely to be affected by fire	• Not likely to be affected by fire	Aus ^
Bird	*Stipiturus malachurus halmaturinus*	Southern Emu-wren (Kangaroo Island subspecies)		R	8 29 47	SB, C G, VB	I	• Sites: near ground in a grass tussock or dense shrub • Material: grasses • Season: Aug-Dec	• Prefers low coastal mallee scrub & coastal heath on limestone and lime sand, low open mallee on laterite soils inland • Moderate mobility • High potential for significant impact on populations from extensive fires	• Avoid burning more than 50% of nesting patches in a single fire event • Avoid 2 or more successive fires in spring/early summer	SA^
Bird	*Thinornis rubricollis*	Hooded Plover		V		C G, VB, SB		• Sites: Above high water mark on beaches and dunes • Material: shallow scrape in sand • Season: Aug-Feb	• Found on most beaches in the planning area • Moderate mobility • Fire may disrupt breeding, flushing birds away from nests and leaving eggs/chicks exposed	• Avoid burning near nesting areas in early spring and late summer • Avoid 2 or more successive fires in early spring-late summer	E

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Diet	Breeding	Species Ecology & Fire Response	Considerations for Management	Source
Mammal	*Isodon obesulus obesulus*	Southern Brown Bandicoot	EN	V	8 29 47	C G, SB	I	• Sites: within dense vegetation • Material: Grass, dead leaves • Season: Jun-Feb, however, wetter areas may sustain breeding year round	• On KI known to occur in a wide range of vegetation communities, mallee, woodland and shrubland. No soil type within KI defines their habitat; often in long unburnt vegetation • Moderate mobility , high dispersal rates of young • Can survive in the short term in areas burnt by high intensity fires where unburnt patches of sufficient size occur • Increased exposure to predation following fires • Appear to prefer early to mid-successional stages (5-20 years) which provide dense understorey cover; but also found in long unburnt patches where understorey vegetation density is > 50%, i.e. the vegetations structure is the driver, not post-fire age	• Maintain a mosaic of post-fire ages and long unburnt habitat (> 20 years) • Avoid burning more than 20% habitat in C-zone (within a reserve/group of reserves) within 4 years of previous burn • Avoid burning habitat more often than every 15 years	KI ^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Diet	Breeding	Species Ecology & Fire Response	Considerations for Management	Source
Mammal	*Neophoca cinerea*	Australian Sea-lion	VU	V		SB, C G	C	• Sites: Coastal beaches & rocks • Material: sand, rock • Season: Every 17.5 months (for a 5 month period)	• Found on beaches and rock coastal shelf • Adults are highly mobile (swim in ocean) • Fire may flush colony due to smoke, heat & disturbance • Fire could disrupt breeding season • Fire could have an impact on juveniles not yet capable of swimming at sea • Fire could impact vegetated inland resting sites (used by both adults and young during inclement weather)	• Avoid burning near colonies • Avoid burning around breeding season (every 17.5 months) • Avoid burning vegetation that is used for inland resting sites	E
Mammal	*Sminthopsis aitkeni*	Kangaroo Island Dunnart	EN	E	8 29 47	SB	I	• Likely to be capable of breeding several times per year • Site: ground • Material: leaves • Season: late winter/spring	• Endemic to KI • Prefers open low mallee with sparse understorey and deep leaf litter under *Banksia* and *Xanthorrhoea* species • Unburnt remnants likely to provide refuge • Individuals may move into burnt areas to take advantage of resources available • Appear to prefer area that have been unburnt for 11+ years	• Minimise likelihood of bushfires burning large tracts of continuous vegetation • Maintain a mosaic of post-fire ages • Avoid burning more frequently than 1 in 17 years, retain areas long-unburnt (>30 years)	SA ^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	MVS No	Reserve	Diet	Breeding	Species Ecology & Fire Response	Considerations for Management	Source
Reptile	*Varanus rosenbergi*	Heath Goanna		R		C G, SB, B	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 and low intensity fires in burrows	• Avoid burning more than 50% of nesting patches in a single fire event • Avoid two or more successive fires in spring	KI ^
Bird	*Puffinus tenuirostris*	Short-tailed Shearwater				C G, SB		• Dig nesting burrows on bare or vegetated ground • Sept-May • Single egg per breeding season	• Fully migratory throughout Pacific Ocean • Feed on fish and crustaceans, plunging into water	• Avoid burning near breeding colony at Cape Gantheaume	E

Appendix 5 – Ecological Communities of Conservation Significance

Ecological Community	SA Status (DEH, 2005b)	Other Status comments	Occurrence	Components	Fire Response	Considerations for Management	Source
Kangaroo Island Narrow-leaved Mallee (*Eucalyptus cneorifolia)*	E	• EPBC nominated, nationally threatened	• Endemic to SA, primarily found on KI. A small isolated patch occurs on Fleurieu Peninsula • 4 064 ha, on eastern KI	• Five separate sub-communities have been identified based on variation in sub-dominant canopy species occurring in association with *E. cneorifolia* • Supports a diverse suite of understorey plant species, many of which are nationally, state or regionally listed	• Components of the plant communities have been shown to regenerate (either soil seedbank or resprouting) in response to fire • The exclusion of fire is considered to be a significant cause of decline in understorey plant species on eastern KI	• Avoid burning sites that have long history of intense stock grazing, are dominated by exceptionally large adult mallee individuals, or have extensive pasture grass or weed understorey • Undertake prescribed burning only when fire intensity will achieve canopy scorch, and use fuel manipulations (cutting) to increase fuel loads where necessary • Control grazing pressure post fire (fencing, culling) • Fire frequency should be greater than 20 years, but less than 40 years	KI A
Drooping Sheoak (*Allocasuarina verticillata*)	V	• Fruit is primary food source for Glossy Black-Cockatoo	• On sandstone or basalt slopes along the northern coastline in a narrow discontinuous belt • Along slopes of major watercourses	• Drooping Sheoak, *Eucalyptus* spp., *Melaleuca* spp., or *Allocasuarina muelleriama*	• May be negatively impacted if fire too frequent or not frequent enough • Depending on fire intensity, regenerates both vegetatively and from seed post-fire • Takes 5-7 years post-fire for plant to produce seed-bearing cones	• Avoid burning >5% of feeding habitat in any 5 year period • Consult with Recovery Program staff on case by case basis prior to burning	E

Summary of Codes Used in Appendices

Reserve Codes

CODE	RESERVE
B	Beyeria CP
CG	Cape Gantheaume WPA and/or CP
HA	Heritage Agreement (brackets indicate nearest reserve)
SB	Seal Bay CP
VB	Vivonne Bay CP

Other Codes Used

NPW ACT STATUS	
E	Endangered
V	Vulnerable
R	Rare

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

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

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

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

11 GLOSSARY OF ACRONYMS AND FIRE MANAGEMENT TERMINOLOGY

TERM	DEFINITION
Adaptive management	Continually improving management policies and practices by learning from the outcomes of operational programs and incorporating new information (Victorian Coastal Council, 2008).
Age class	The age of an area of vegetation, time since last fire.
A-zone	Asset Protection zone. One of the three types of zones applied in fire management planning. A-zones aim to provide the highest level of protection to human life and highly valued built assets, by implementing the most intensive fuel management strategies. The Overall Fuel Hazard should not exceed Moderate unless otherwise specified (DENR, 2011b).
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.
Biodiversity	Biological diversity. The diversity of life in all its forms (i.e. plants, animals and micro-organisms) and at all its levels of organisation (i.e. genetic, species and ecosystem levels).
BMAP	Bushfire Management Area Plans. Risk-based, landscape-scale fire management plans developed by Bushfire Management Committees within a defined Bushfire Management Area, as required under the *Fire and Emergency Services Act 2005*.
BMC	Bushfire Management Committee(s), formed under the *Fire and Emergency Services Act 2005*. Responsible for the governance, planning and coordination of fire management within a Bushfire Management Area, and development and implementation of Bushfire Management Area Plans. Nine Bushfire Management Committees exist across the state, and report to the State Bushfire Coordination Committee.
Bulk Water Carrier	A large tanker used for replenishing firefighting appliances with water.
Bushfire	An unplanned fire. A generic term that includes grass fires, forest fires and scrub fires.
Bushfire Survival Plan	Also known as a Bushfire Action Plan. A pre-prepared plan developed by people who live, visit or work in a bushfire prone area encompassing the decision to either "Leave Early" or to "Stay and Defend" to ensure that they are prepared and know what to do in the event of a bushfire (CFS, 2009a).
B-zone	Bushfire Buffer zone. One of the three types of zones applied in fire management planning. B-zones aim to provide a buffer area in bushland at the urban fringe or close to rural assets. The Overall Fuel Hazard should not exceed High unless otherwise specified (DENR, 2011b).
Canopy fuel	The crowns (leaves and fine twigs) of the tallest layer of trees in a forest or woodland. Not measured as part of the Overall Fuel Hazard assessment (DENR, 2011d).
CFS	The South Australian Country Fire Service.
Control line	A natural or constructed barrier, or treated fire edge, used in fire suppression and prescribed burning to limit the spread of fire.
Cormous	A plant that has a swollen underground stem with a terminal bud (Collin, 2004).
CP	Conservation Park.

TERM	DEFINITION
C-zone	Conservation-Land Management zone. One of the three types of zones applied in fire management planning. C-zones are the default zone for all natural areas and allows for fire management activities to meet ecological and conservation management objectives (DENR, 2011b).
DEWNR	The South Australian Department of Environment, Water and Natural Resources.
Direct attack	A method of bushfire attack where wet or dry firefighting techniques are used. It involves suppression action right on the fire edge, which becomes the control line.
Ecological Burn Rationale	A document prepared to justify prescribed burning for ecological purposes in the absence of a plan, or where ecological guidelines don't exist or may be breached through the implementation of the burn.
Elevated Fuel	Shrubs and juvenile understorey plants up to 3 m in height (DENR, 2011d).
Environmental Assessment Table	Completed for all DEWNR 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).
EPBC Act	The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
Fire access track	A track designed, constructed and maintained for the safe passage of fire fighting vehicles undertaking fire suppression activities (GAFLC, 2008). In summary: major – at least 7 m wide, clear of vegetation overhead. standard – 4 to 5 m wide, passing bays at least every 400 m. minor – 4 to 5 m wide. All lesser tracks are service.
Fire behaviour	The manner in which a fire reacts to the variables of fuel, weather and topography.
Fire danger	The combination of all factors, which determine whether fires start, spread and do damage, and whether and to what extent they can be controlled.
Fire frequency	The number of fires that have occurred on the same area over a time period.
Fire intensity	The rate of energy release per unit length of fire front usually expressed in kilowatts per metre (Kw/m).
Fire interval	The length of time between successive fires.
Fire management	All activities associated with the management of fire-prone land, including the use of fire to meet land management goals and objectives.
Fire regime	The history of fire in a particular vegetation type or area including the fire frequency, interval, intensity, extent and seasonality of burning (Brooks, *et al.*, 2004).
Fire season	The period(s) of the year during which fires are likely to occur, spread and do sufficient damage to warrant organised fire control.
Fire suppression	The activities connected with restricting the spread of bushfire following its detection and making it safe.
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).
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 (DENR, 2011d)
Fuel management	Modification of fuels by prescribed burning, or other means.
GAFLC	South Australian Government Agencies Fire Liaison Committee.
Heritage Agreement	A private conservation area established through an agreement between the SA Minister for Sustainability, Environment and Conservation and the landholder under the *Native Vegetation Act 1991*.
Incident Controller	The individual responsible for the management of all incident operations and Incident Management Team.
Incident Management Team	The group of incident management personnel comprising the Incident Controller and the people he/she appoints to be responsible for the functions of Operations, Planning and Logistics.
Key Fire Response Species	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.
Landscape Protection	Strategic fuel management activities implemented to reduce the likelihood of contiguous of continuous vegetation burning in a single fire event.
Life history	The combination of attributes with respect to growth, shelter, food/nutrients and reproduction which determine species' requirements for existence (FEWG, 2004).
Minimum Impact Suppression Techniques	Achieving fire management objectives using methods that are consistent with land and resource management objectives. When determining an appropriate suppression response, consideration will be given to undertaking suppression with greater sensitivity and the long-term effects (WFLLC, 2003).
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, 2006).
NPW Act	The South Australian *National Parks and Wildlife Act 1972*.
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 *Provisional List of Threatened Ecosystems of South Australia* (DEH, 2005b).
Prescribed Burn Plan	A plan which is approved for the conduct of prescribed burning. It contains a map identifying the area to be burnt and incorporates the specifications and conditions under which the operation is to be conducted.
Prescribed burning	The controlled application of fire under specified environmental conditions to a predetermined area and at the time, intensity, and rate of spread required to attain planned resource management objectives.
Response plan	A plan detailing the response for a risk or an area including the type and number of resources.
Retardant	A chemical generally mixed with water, designed to retard combustion by chemical or physical action. It is usually applied by aircraft but may be applied from tankers at the fire edge.

TERM	DEFINITION
Risk assessment	Used in DEWNR fire planning to assist in evaluating the threat to life, property and environmental assets posed by bushfire and also to aid in developing strategies and works for risk mitigation. Considers Likelihood and Consequence to determine an overall risk rating through a matrix (DENR, 2011b).
RP	Recreation Park.
SA Water	South Australian Water Corporation.
SBCC	State Bushfire Coordination Committee constituted under s 71 of the *Fire and Emergency Services Act 2005* (SA) with the primary function of coordinating and integrating bushfire management in South Australia.
Senescence	The decline of plant vigour due to physiological change associated with age related reduction in cell division and reproduction, environmental stress or pathogenic attack, eventually leading to plant death.
Service track	See fire access track.
Spotting	The ignition of spot fires from sparks or embers.
spp.	Species (plural).
ssp.	Subspecies.
TPC	A Threshold of Potential Concern is defined as a limit of tolerance to the different aspects of fire regime, beyond which, Key Fire Response Species are likely to be negatively affected.
Vital Attributes	Vital attributes are the key life history features which determine how a species lives and reproduces. With respect to fire, these attributes govern how a species responds to fire and/or persists within a particular fire regime (FEWG, 2004).
Weed of national significance	Twenty 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).
WP Act	The South Australian *Wilderness Protection Act 1992*.
WPA	Wilderness Protection Area, declared under the *Wilderness Protection Act 1992*.

Unless otherwise indicated, definitions have been sourced from the *DEH Fire Glossary* (2005a) or the *AFAC Wildfire Glossary* (2010)

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