



# STATE BUSHFIRE COORDINATION COMMITTEE

## Standard for the identification and risk assessment of South Australian environmental assets from bushfire

This document defines the methodology for the  
identification and risk assessment of environmental assets from  
bushfire within Bushfire Management Area Plans in South  
Australia

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This Standard has been prepared by the DEWNR for the Ecological Technical Reference Group (ETRG) on behalf of the South Australian State Bushfire Coordination Committee to form part of the State Bushfire Risk Plan.

This Standard is issued by the SA Country Fire Service on behalf of the South Australian State Bushfire Coordination Committee.

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Approval:

Name	Chair, SBCC	Signature	Date
Greg Nettleton	Chief Officer SA CFS		13/12/2017



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**Figure 1. An overview of the steps taken to assess risk to environmental assets from**

**Step 1a.** Community asked to nominate environmental assets to be registered on the BMAP Environmental assets register and risk assessed from bushfire

**Step 1b.** DEWNR to compile corporate datasets of environmental assets

**Step 2.** DEWNR use data sets from steps 1a and 1b to conduct a detailed, first draft assessment of the risk to the South Australian native environmental assets from the hazard of bushfire

**Step 3.** Environmental Assets and Risk Advisory Panel to review the first draft of the risk assessment:

- Undertake analysis of the risk assessment
- Consider appropriate risk treatment options and subsequently select risk treatments to reduce risk levels

**Step 4.** An Environmental Assets and Risk Advisory Panel member to present to the process and risk assessment outputs to the Bushfire Management Committee. The Bushfire Management Committee to review and endorse the Environmental Assets and Risk Advisory Panel's risk assessment

**Step 5.** Public consultation on the risk assessment output for 6 weeks

**Step 6.** Analysis of public submissions by Environmental Assets and Risk Advisory Panel and amendments made where appropriate to produce the final draft of the risk assessment

**Step 7.** Bushfire Management Committee to endorse analysis of submissions and the final draft of the risk assessment

**Step 8.** State Bushfire Coordination Committee to approve the final draft of the risk assessment. Bushfire Management Committee adopt risk assessment and implement treatments according to priority

**bushfire in South Australia**

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# 1. PURPOSE

Humans depend directly and indirectly upon living systems for their health and well-being. Bushfire has both a negative and positive influence on these living systems. The South Australian Country Fire Service (CFS) recognise their legislative obligations (Table 1), and the importance of protecting environmental assets negatively impacted by bushfire with a high-quality risk management approach.

Under the *Fire and Emergency Services Act 2005*, South Australia has a two-tiered structure of governance and planning for bushfires: the State Bushfire Coordination Committee (SBCC) which must prepare and keep under review the State Bushfire Management Plan; and Bushfire Management Committees (BMC) in each Bushfire Management Area (BMA), who must prepare and keep under review a Bushfire Management Area Plan (BMAP) for each area. This standard guides bushfire management planning for environmental assets at a regional level, for inclusion in the BMAPs.

This standard allows BMCs to conduct a detailed assessment of the risk to environmental assets in their BMA which may be negatively impacted by bushfire, whilst using a methodology which will be consistently applied in all BMAs across South Australia. The outputs of the risk assessment (7. Risk Register) will be included into BMAPs and allow for priority to be assigned to the identified risks. Treatment options for highest priority assets will be identified and prioritised to reduce risk. Effective risk treatments can eliminate or minimise the negative impacts of bushfire, in order to prevent the degradation or loss of environmental assets.

The standard is first generation and reflects current planning capabilities. Over time, standard for environmental risk-based planning will improve, and this approach will be expanded and connected across the spectrum of bushfire management actions: prevention, preparedness, response, recovery, and research.

**Table 1. Legislation influencing bushfire management planning for the conservation of environmental assets negatively impacted by fire**

Legislation	Sec.	Relevance to bushfire management
<i>Fire and Emergency Services Act 2005</i> (South Australia)	73 (3)	The primary objective of the State Bushfire Management Plan is to identify major bushfire risks in the State and recommend appropriate action that will provide protection of life, property and environment from the effects of bushfire.
<i>Environment Protection &amp; Biodiversity Conservation Act 1999</i> (Commonwealth)	18	To protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – defined in the Act as ‘matters of national environmental significance’. Matters of national environmental significance protected under the Act include: <ul style="list-style-type: none"> <li>• World Heritage properties</li> <li>• National Heritage places</li> <li>• wetlands of international importance (listed under the Ramsar Convention)</li> <li>• listed threatened species and ecological communities</li> <li>• migratory species protected under international agreements.</li> </ul>
<i>Native Vegetation Regulations 2017</i> (South Australia)	Schedule 1 Part 2 Division 1 & 2	Clarifies which fire hazard reduction actions can be undertaken to modify native vegetation without approval from the Native Vegetation Council.
<i>National Parks &amp; Wildlife Act 1972</i> (South Australia)	37	Defines overarching management objectives for proclaimed reserves managed by Department of Environment, Water and Natural Resources, which includes ‘the prevention and suppression of bushfires and other hazards’, and provides protection for threatened terrestrial flora and fauna.
<i>Wilderness Protection Act 1991</i> (South Australia)	12	Defines overarching management objectives to maximise the naturalness and remoteness of wilderness quality within Wilderness Protection Areas and Zones, including: <ul style="list-style-type: none"> <li>• the preservation of wildlife and ecosystems</li> <li>• the prevention and suppression of bushfires and other hazards.</li> </ul>

## 2. SCOPE

This standard should be used in the risk assessment of environmental assets, and subsequent identification of priorities and risk treatments for the environmental component of BMAPs. This includes members of:

- Bushfire Management Committees
- BMAP Environmental Assets and Risk Advisory Panels
- the CFS Bushfire Management Planning Unit
- the Department of Environment, Water and Natural Resources (DEWNR), Fire Management Program staff
- the State Bushfire Coordination Committee (SBCC).

Bushfire impacts to environmental assets can be managed with a high-quality risk management approach. The environmental assets listed below will be assessed for impacts from bushfire, resulting in a risk rating being assigned to each asset. Selected environmental assets listed below will be assessed against several bushfire scenarios, which will result in the highest risk rating being assigned to these assets. All environmental assets assessed will be recorded in the BMAP risk register and Bushfire Risk Information Management System (BRIMS), with their risk rating and any identified risk treatments identified.

The minimum mandatory environmental assets to be risk assessed from the negative impacts from the hazard of bushfire, within a BMA are listed in Table 2.

**Table 2. Environmental asset categories and sub categories types**

Environmental asset category	Environmental asset category description
Community nominated environmental assets	<b>Threatened ecological community</b> <b>Flora</b> <b>Fauna</b> <b>Significant habitat</b> <b>Reserve system</b>
Threatened ecological community	<b>EPBC threatened ecological community</b> listed as threatened under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> <b>State threatened ecological community</b> listed under the <i>South Australian Provisional List of Threatened Ecosystems of South Australia</i> (DEH, in progress).
Flora Fauna	<b>Migratory species</b> protected under international agreements and the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> <b>EPBC native flora species</b> listed as threatened under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> <b>EPBC native fauna species</b> listed as threatened under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> <b>State native flora species</b> listed as threatened under the <i>South Australian National Parks and Wildlife Act 1972</i> <b>State native fauna species</b> listed as threatened under the <i>South Australian National Parks and Wildlife Act 1972</i>
Significant habitat	<b>Key species habitat</b> <b>High quality habitat</b>
Reserve system (native vegetation contained in South Australian terrestrial reserve systems)	<b>Wetlands of international importance</b> listed under the Ramsar Convention and the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> <b>Wetlands of national importance</b> listed under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> <b>Natural world heritage properties</b> listed under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> <b>Natural national heritage places</b> listed under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> <b>Wilderness protection areas</b> declared under the <i>South Australian</i>

Environmental asset category	Environmental asset category description
	<p><i>Wilderness Protection Act 1992</i></p> <p><b>Heritage agreements</b> declared under the South Australian <i>Native Vegetation Act 1991</i></p> <p><b>Reserves</b> declared under the South Australian <i>National Parks and Wildlife Act 1972</i></p> <p><b>Native forest reserves</b> declared under the South Australian <i>Forestry Act 1950</i></p> <p><b>Forest conservation areas</b> declared under the South Australian <i>Forestry Act 1950</i></p> <p><b>Reservoir reserves</b> under the care and control of SA Water</p> <p><b>Groundwater basins</b> under the care and control of SA Water</p> <p><b>Roadside reserves</b> identified under the Roadside Marker Scheme in accordance with the Native Vegetation Council's <i>Guidelines for Management of Roadside Vegetation</i></p>
<p><b>Environmental Assets and Risk Advisory Panel</b></p>	<p><b>Threatened ecological community</b></p> <p><b>Flora</b></p> <p><b>Fauna</b></p> <p><b>Significant habitat</b></p> <p><b>Reserve system</b></p>

This standard does not intend to address:

- cultural heritage, including Aboriginal heritage
- historic and indigenous world heritage properties and national heritage places listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
- South Australian marine protected areas
- maintenance or enhancement of natural ecosystems
- maintenance of temporal and spatial diversity of fire regimes through the application of ecological fire management guidelines
- traditional (Aboriginal) burning practices
- assessment of potential environmental impacts of risk treatments identified for life and property assets, in particular overlay of Asset Protection and Bushfire Buffer Zones
- assessment of potential environmental impacts of vegetation clearance, including prescribed burning. This environmental risk assessment will provide information to inform operational planning, however, it is not intended to be the sole source of policy directing these matters
- assessment of environmental impacts of bushfire suppression activities. This environmental risk assessment will provide bushfire hazard information to inform bushfire response planning, however, it is not intended to be the sole source of policy directing these matters
- assessment of environmental assets requiring post bushfire rehabilitation and recovery. This environmental risk assessment will provide information to inform bushfire recovery planning, however, it is not intended to be the sole source of policy directing these matters.

### 3. PROCESS

Risk assessment should be thought of as a dynamic, ongoing process, rather than as a one-time project. The process described here (see

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Approval:

Name	Chair, SBCC	Signature	Date
<name>	<position>	<signature>	<date>

Figure 1, above) is a set of steps that are repeated every four years, or earlier if required by the BMC or SBCC.

### **Step 1a: Community identification and nomination of environmental assets**

Community assign meaning to the landscape through the process of living in it. Engaging with the community and community groups for nominations of environmental assets ensures that the interests of the wider community are understood and considered. Furthermore, engagement with the community in this way encourages shared ownership of the responsibilities that lie with managing bushfire risks to protect not just human life and property, but also environmental assets.

During an eight-week period, community members and community groups are encouraged to nominate environmental assets to be assessed for risks from bushfire. Members of the Environmental Assets and Risk Advisory Panel (or their agencies) will promote awareness of the nomination process. Community members can volunteer location-based geographic information through an Atlas of Living Australia, 'Environmental assets at risk of bushfire', online survey project.

Once the public participation has concluded, DEWNR's Fire Management Program staff will extract the Environmental Asset Register survey data from the Atlas of Living Australia.

### **Step 1b: DEWNR Compilation of environmental assets from multiple sources**

DEWNR will gather information of environmental assets from corporate data sets that are identified within the environmental asset category types (Table 2).

### **Step 2: DEWNR produce first draft risk assessment**

Following the compilation of information, DEWNR will initiate the assessment of the risk to environmental assets from bushfire (see Section 4. Risk Analysis, for detailed discussion of methodology). The first draft will include a record of likelihood, consequence and overall risk rating for each environmental asset assessed. The first draft of the risk assessment will be provided to the Environmental Assets and Risk Advisory Panel for review.

### **Step 3: Environmental Assets and Risk Advisory Panel review first draft**

The Environmental Assets and Risk Advisory Panel is assembled to provide professional review of the first draft of the risk assessment produced by DEWNR and to identify potential risk treatments. Furthermore, the panel forms an important conduit to the BMC for information and feedback (Figure 2). The panel is comprised of people who have an interest and expertise of environmental assets, as well as knowledge of bushfire management.

The Environmental Assets and Risk Advisory Panel will be managed by and report to the BMC. A BMC member, nominated by the BMC, will Chair the panel. The Environmental Assets and Risk Advisory Panel will include, at a minimum:

- 1x BMC member as the Chair
- 1x DEWNR Fire Management Program representative. This person is the executive officer of the panel
- 1 x BMC conservation committee member (may also be the Chair) or 1x Conservation Council of South Australia Fire Management Policy Officer
- 1x BMC Executive Officer (may also be the Chair)
- 1x BMC DEWNR Regional Fire Management Officer (may also be the Chair)
- 1x CFS Bushfire Management Planning Unit representative
- 1x DEWNR Natural Resources conservation representative
- 1x DEWNR Fire Management Program, Fire Management Officer – Fire Planning.

Before the start of the risk assessment process, the Environmental Assets and Risk Advisory Panel members should appoint a proxy to provide input and attendance on their behalf if they are unable to attend themselves. Furthermore, the panel may seek and nominate additional panel members where specific expertise is required to support their decision making. Those additional members are to be approved by the BMC.

Once membership is approved by the BMC, the Environmental Assets and Risk Advisory Panel will commence analysis of the draft risk assessment. The analysis involves consideration of the nominated assets, the possible consequences of bushfire on those assets, the likelihood that those consequences may occur, and identification of existing controls that already modify the risk.

The panel may nominate additional environmental assets that have not already been included by the draft risk assessment. Examples of additional environmental assets to be considered for protection from the negative impacts of bushfire include native vegetation contained in private, local and state government and non-government organisations' terrestrial reserve systems.

During this phase the panel can amend the risk assessment for individual assets, where there is worthy justification. The proposed amendments are agreed upon by the panel and the justification is recorded for each environmental asset.

For any additional assets, the panel assigns an environmental asset category (Table 2), and proceeds to assess risk as per the particular methodology outlined in Section 4. Risk Analysis.

At the conclusion of this phase, all environmental assets assessed are recorded in an environmental assets and risk register (Section 7. Risk Register), with an assigned overall risk levels with associated confidence. Decisions are then made if further action is to be taken to reduce the risk. Treatment options are evaluated and the most appropriate treatment strategies are recommended by the panel.

#### **Step 4: Risk assessment presented to BMC**

Once the risk assessment has been reviewed, the Environmental Assets and Risk Advisory Panel convener presents the updated risk assessment outputs to the BMC for review and endorsement. The environmental risk assessment may then either be processed as part of an overall BMAP review, or as a separate unit of work to be added to an existing approved BMAP after public consultation and finalisation.

#### **Step 5: Public consultation**

A six-week public consultation period of the environmental risk register and identified treatments will be observed. The specifications of this will follow those of BMAP development which are legislated under the *Fire and Emergency Services Act 2005 s73A(7)(c)* and otherwise as endorsed by the SBCC.

Community members who have nominated environmental assets for consideration (in Step 1a) will be alerted to the public consultation period via email, along with other stakeholders otherwise known to the BMC.

#### **Step 6: Analysis of submissions and amendments to draft risk assessment**

On conclusion of the consultation period, the Environmental Assets and Risk Advisory Panel will review feedback received from the public, either at an additional meeting of the panel, or out-of-session. An Analysis of Submissions document will be developed by the panel, to address the issues raised in the public consultation. Amendments to the risk assessment outputs will be made to produce a final draft.

#### **Step 7: BMC endorsement of final draft**

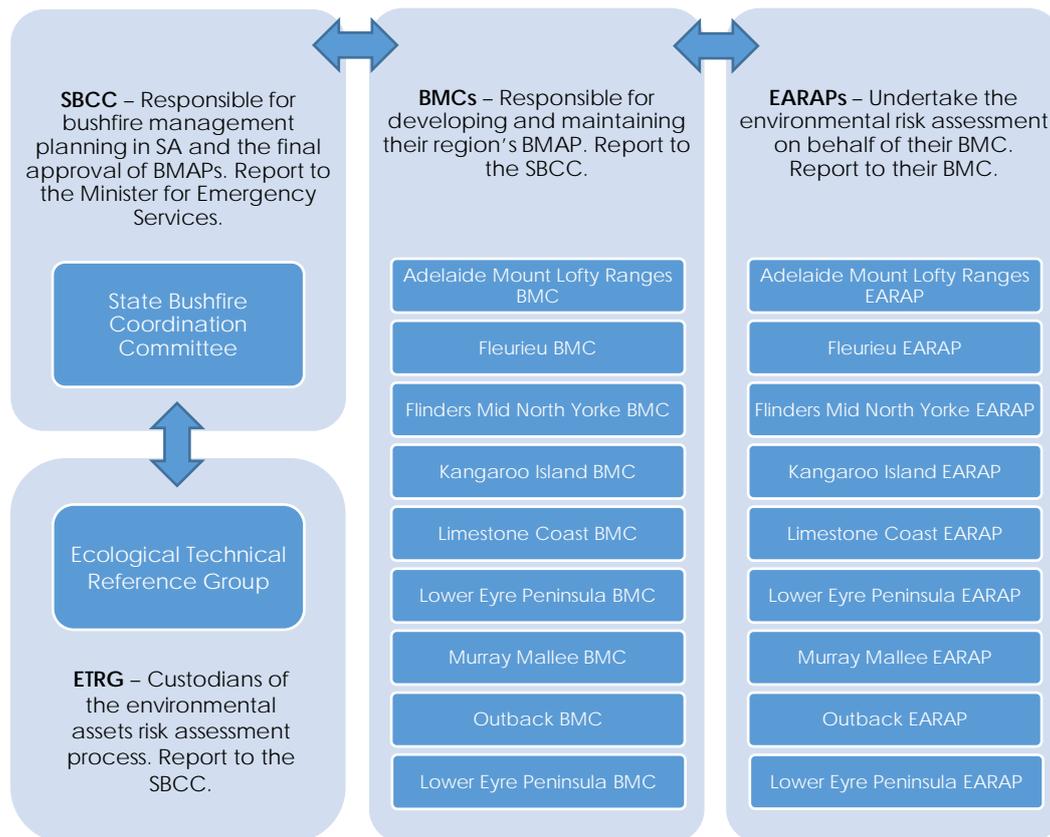
The convener of the Environmental Assets and Risk Advisory Panel will present the final draft risk assessment outputs and Analysis of Submissions to the BMC. The BMC is to review and endorse, if appropriate, the final draft risk assessment outputs based on the Analysis of Submissions.

#### **Step 8: SBCC approval**

Following endorsement by the BMC, the risk assessment outputs are tabled at the SBCC for approval, either as part of an overall BMAP review, or as a separate unit of work to be added to an existing approved BMAP.

The approved risk assessment outputs are integrated into the BMAP, and the BMC are to make the risk assessment outputs publically available.

**Figure 2. Governance arrangements for environmental asset elements of Bushfire Management Area Plans**



## 4. RISK ANALYSIS

This Standard has been developed to assess risk associated with bushfires, and is consistent with the Australian Standard *AS/NZS ISO 31000:2009 Risk Management – principles and guidelines*. The *National Emergency Risk Assessment Guidelines* (2<sup>nd</sup> edition, CoA, 2015) has been used to guide standardised environmental consequence levels, likelihood ratings, and a risk matrix to derive an overall risk rating for environmental assets.

Consequence assessments will consider the likely impacts to the species, ecological community, or their habitats within the BMA, rather than the local environment or individuals within a population.

### 4.1 Assessment of consequence – Community nominated or Environmental Assets and Risk Advisory Panel nominated environmental assets

Community nominated or Environmental Assets and Risk Advisory Panel nominated environmental assets will be assigned an environmental asset category (Table 2). Consequence will be determined by the category methodology outlined in Section 4. Risk Analysis. Any nomination that cannot be assigned a relevant environmental asset category will be assessed by the methodology outlined in Section 4.6. Assessment of consequence – Other environmental assets.

### 4.2 Assessment of consequence – Threatened ecological communities

The consequence level for a threatened ecological community asset is determined by its degree of permanent or long term damage from bushfire, and the conservation status of the asset. Degree of damage is the amount to which the ecological community is likely to experience degradation or damage due to exposure to a bushfire. Degree of damage is a 3 step process that considers the:

1. ecological community's extent of occurrence within the BMA

2. ecological community's response to fire (Table 4)
3. conservation status of the ecological community (Table 7).

A bushfire that burns the entire extent of occurrence of the ecological community has the potential to cause the greatest degradation. Four bushfire extent scenarios are used to assist in determining a degree of damage. The scenarios are based on set percentages of the environmental asset burnt by bushfire (Table 3). The percentage of the area burnt is calculated from the environmental asset's extent of occurrence. The required bushfire extents to burn the specific percentages of the extent of occurrence is calculated in Section 4.7 Likelihood.

**Table 3. Bushfire extent scenarios**

The percentage of the environmental asset's extent of occurrence burnt by bushfire
100%
75%
50%
25%

The second step in determining the degree of damage is assigning a fire response to the environmental asset. Fire response describes the long-term effect a fire regime may have on ecological community assets. Each ecological community asset is assigned a fire response category (Table 4).

**Table 4. Fire response categories for environmental assets (Kennedy & Jamieson 2007; Pyke & Marsden-Smedley 2005)**

Fire response category	Fire ecology characteristics
Fire sensitive	Fire sensitive environmental assets have not evolved with fire as a significant recurring process. The ecological communities, flora and fauna species lack adaptations to positively respond to fire and species mortality is high. Fire will cause irreversible or very long term damage and change the community or population more permanently.
Fire influenced	Fire can regenerate and maintain ecological communities and flora and fauna species, however, regeneration can occur in the absence of fire. Fire generally occurs at long intervals. The ecological community, flora and fauna species can tolerate fire and will recover.
Fire dependent	Fire is essential for the maintenance of ecological community, flora and fauna species. Species have evolved adaptations that are reliant on fire, such as fire dependent germination.

The degree of damage matrix (Table 5), is used to determine the overall degree of damage a bushfire will cause to the ecological communities and to flora and fauna species is based on the categories selected for extent and fire response. Table 6 describes the degree of damage categories.

Table 5. Environmental assets degree of damage matrix (CoA 2015)

		Fire Response		
		Fire dependent	Fire influenced	Fire sensitive
Bushfire extent scenarios	100%	Minor damage	Significant damage or loss	Permanent destruction
	75%	Insignificant damage	Significant damage or loss	Severe damage or loss
	50%	Insignificant damage	Minor damage	Severe damage or loss
	25%	Insignificant damage	Minor damage	Significant damage or loss

Table 6. Degree of damage categories and description (CoA 2015)

Degree of damage category	Degree of damage description
Permanent destruction	The permanent loss of an environmental asset, or the potential for ongoing impacts leading to permanent loss. Although some degree of restoration may be possible, the condition pre bushfire cannot be restored.
Severe damage or loss	The environmental asset has been or is likely to be permanently altered from its original state by the bushfire. Requires a major program of interventions and recovery for the asset to return to a stable state. A return to the original state is unlikely, given that single or multiple thresholds or irreversibility have been transgressed.
Significant damage or loss	The environmental asset has been or is likely to be significantly altered from its original state by the bushfire. A diversion of existing resources to manage recovery and/or restoration of ecological assets in the short term would create a high likelihood of a return to a pre-existing condition. Areas of significant impairment may include cases described as minor, but where longer timeframes for recovery are required; where significant areas of the environmental asset are affected; or where there is a level of uncertainty about full recovery.
Minor damage	No permanent loss likely of environmental asset. Unassisted recovery to a pre-existing condition is likely within a short time frame, and without the assistance of current programs and resources that manage the environmental asset. Typically the scale of impact would be insufficient to disrupt the environmental asset with a high degree of <i>ex situ</i> and <i>in situ</i> resilience evident.
Insignificant damage	No damage. The environmental asset is able to fully recover to its pre-existing condition, with no intervention.

Conservation status describes the relative risk of extinction. Since this risk assessment is used to document the degradation or loss of an environmental asset from bushfire, the conservation status of the asset is based on the most significant level at which the asset is classified (Table 7).

Table 7. Environmental assets ranked according to the level of their conservation status (CoA 2015)

Ranking of conservation status	Conservation status
1	Commonwealth <i>Environment Protection &amp; Biodiversity Conservation Act 1999</i> , including migratory species protected under international agreements.
2	South Australian <i>National Parks and Wildlife Act 1972</i>
3	Regional level, Regional Species Conservation Assessments

Finally, the conservation status of the ecological community is combined with the degree of damage to identify the consequence level. The starting point for these tables is the conservation status ranking. Table 8 for an environmental asset assigned a Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* conservation status, Table 9 for South Australian *National Parks and Wildlife Act 1972* conservation status and Table 10 for a regional conservation status.

Table 8. Regional consequence levels for an environmental asset with a Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* conservation status, conservation status rank 1 (CoA 2015)

Regional degree of damage	Regional consequence level
Permanent destruction	Catastrophic
Severe damage or loss	
Significant damage or loss	Major
Minor damage	Moderate
Insignificant damage	Insignificant

Table 9. Regional consequence levels for an environmental asset with a South Australian *National Parks and Wildlife Act 1972* conservation status, conservation status rank 2 (CoA 2015)

Regional degree of damage	Regional consequence level
Permanent destruction	Catastrophic
Severe damage or loss	Major
Significant damage or loss	Moderate
Minor damage	Minor
Insignificant damage	Insignificant

**Table 10. Regional consequence levels for an environmental asset with a regional conservation status, conservation status rank 3 (CoA 2015)**

Regional degree of damage	Regional consequence level
Permanent destruction	Major
Severe damage or loss	Moderate
Significant damage or loss	Minor
Minor damage	
Insignificant damage	Insignificant

### 4.3 Assessment of consequence – Flora and fauna

The consequence level for flora and fauna assets, is determined by its degree of permanent or long term damage from bushfire, and the conservation status of the asset. Degree of damage is the amount to which the species is likely to experience degradation or damage due to exposure from a bushfire. Degree of damage is a 3 step process that considers the:

1. species' extent of occurrence
2. species' response to fire
3. conservation status of the species.

As such, the assessment of consequence for flora and fauna follows the same process as for native ecological communities, applying Table 3 through to Table 10.

### 4.4 Assessment of consequence – Significant habitat

Significant habitats are defined by:

- areas of habitat that are critically important for meeting a specific need of key species (generally a threatened species) e.g. core nesting or feeding habitat for a large proportion of the population
- areas of habitat that are poorly represented in the broader landscape and provide habitat for a wide range of species. Protecting these high-value ecosystem areas is critical to conserving a broad range of species.

Examples of significant habitat within the landscape include, but are not limited to:

- regenerating habitat that is limited within the landscape
- rare intact habitat that provides an environmental niche that supports species
- important long unburnt habitat that is limited within the landscape
- core, high quality nesting, feeding, roosting and/or breeding sites for significant species
- sites identified as future threatened species reintroduction sites
- the best remaining rare, intact, or high quality habitat
- under-represented habitat
- a landscape with high connectivity, where species can move freely between suitable habitats. Alternatively, a landscape with low connectivity, where species are severely constrained from moving between suitable habitat patches
- corridors linking fragmented habitats

- biodiversity hotspots (areas that contain a disproportionately high number of native species for their area).

DEWNR will identify significant habitat from corporate datasets and regional workshops. Subsequently, the regional workshops will determine the consequence level for significant habitat assets by applying the relevant conservation status consequence table (Table 8 to Table 10), to each significant habitat identified. The consequence level will be determined by its degree of permanent or long term damage from bushfire (Table 6) and the conservation status of the significant habitat asset (Table 7). The species or ecological communities supported by the habitat determine the degree of damage rating given, rather than the habitat elements themselves.

#### 4.5 Assessment of consequence – Native vegetation contained in SA terrestrial reserve systems

Degree of permanent or long term damage to reserve system environmental assets from bushfire is based on a scenario of 100% of the reserve burning in a single bushfire event. Consequence levels have been assigned to the reserve system types based on the management objective of the reserve system (Table 11).

**Table 11. Consequence level of the reserve system asset burning in a single bushfire event**

Reserve system type	Consequence level
<b>Wetlands of international importance</b> (listed under the Ramsar Convention and the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> ) <b>Wetlands of national importance</b> (listed under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> ) <b>Natural world heritage properties</b> (listed under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> ) <b>Natural national heritage places</b> (listed under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> ) <b>Wilderness protection areas</b> (declared under the South Australian <i>Wilderness Protection Act 1992</i> )	Major
<b>Heritage agreements</b> (declared under the South Australian <i>Native Vegetation Act 1991</i> ) <b>Reserves</b> (declared under the South Australian <i>National Parks and Wildlife Act 1972</i> ) <b>Native forest reserves</b> and <b>forest conservation areas</b> (declared under the South Australian <i>Forestry Act 1950</i> ) <b>Reservoir reserves</b> and <b>groundwater basins</b> (under the care and control of SA Water)	Moderate
<b>Roadside reserves</b> (identified under the Roadside Marker Scheme in accordance with the Native Vegetation Councils, <i>Guidelines for Management of Roadside Vegetation</i> )	Minor

#### 4.6 Assessment of consequence – Other environmental assets

Some environmental assets, potentially those nominated by the community in Step 1a, may not be easily classified into an environmental asset category. In these situations, the environmental asset will be assessed by assigning the most appropriate degree of damage (Table 5) and subsequently the consequence level based on the assets highest ranked conservation status (Table 8 to Table 10).

## 4.7 Likelihood

The assessment of likelihood is statistically measured by calculating an annual exceedance probability (AEP) for the BMA in question. To calculate AEP, a characterisation of bushfire annual recurrence intervals (ARI) and burnt area is required. ARI is a statistical estimate of the average period of time between occurrences of a bushfire of a given extent. This is determined by analysing the statistical properties of bushfire within each BMA, based on the DEWNR fire history layer, as per the detailed analysis in Malamud et al. 2005.

The steps below summarise Malamud et al. 2005 methodology.

1. Calculate the fire size:
  - for ecological communities and native flora and fauna species which would result in the set percentages of the environmental asset extent of occurrence being burnt by bushfire, according to Table 3.
  - for significant habitat, native vegetation contained in reserve systems and other environmental assets which would result in the entire area of the asset being burnt by bushfire.
2. Calculate the frequency density of bushfires within each BMA. This is the number of bushfires of various sizes that occur within a geographic area. This reflects the estimated consequences occurring as a result of the bushfire events.
3. Based on frequency density distributions of bushfires within each BMA, calculate the ARI for fire sizes derived in step 1 for an area 100 km<sup>2</sup> within each BMA.
4. Assign likelihood level based on Table 12.

**Table 12. Likelihood level (CoA 2015)**

Likelihood	Annual exceedance probability (AEP)	Average recurrence interval (ARI) (indicative)	Frequency (indicative)
<b>Almost certain</b>	63% per year or more	Less than 1 year	Once or more per year
<b>Likely</b>	10% to <63% per year	1 to <10 years	Once per 10 years
<b>Unlikely</b>	1 to <10% per year	10 to <100 years	Once per 100 years
<b>Rare</b>	0.1 to <1% per year	100 to <1,000 years	Once per 1,000 years
<b>Very rare</b>	0.01 to <0.1 per year	1,000 to <10,000 years	Once per 10,000 years
<b>Extremely rare</b>	Less than 0.01% per year	10,000 years or more	Once per 100,000 years

## 4.8 Risk rating

The risk rating (Table 13) for the environmental asset is determined by combining the consequence and likelihood levels, following the preceding steps assigning likelihood and consequence to each environmental asset.

The highest risk rating is assigned to the environmental asset where there has been a range of consequence and likelihood levels assigned for particular bushfire scenarios.

**Table 13. Risk rating matrix (CoA 2015)**

Consequence level
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		Consequence level				
		Insignificant	Minor	Moderate	Major	Catastrophic
Likelihood	Almost certain	Medium	Medium	High	Extreme	Extreme
	Likely	Low	Medium	High	Extreme	Extreme
	Unlikely	Low	Low	Medium	High	Extreme
	Rare	Very low	Low	Medium	High	High
	Very rare	Very low	Very low	Low	Medium	High
	Extremely rare	Very low	Very low	Low	Medium	High

#### 4.9 Confidence

The asset register, along with consequence and likelihood levels and risk ratings generated by the risk assessment are used to determine possible action. The Environmental Assets and Risk Advisory Panel assigns a level of confidence to the risk assessment process to identify and communicate uncertainty. A level of confidence is assigned to the risk rating of each environmental asset (Table 14).

Table 14. Confidence level descriptions (CoA 2015)

Confidence level	Descriptor	Justification	
		Supporting evidence	Expertise
<b>Highest</b>	Assessed likelihood, consequence or risk is easily assessed to one level, with almost no uncertainty	Recent historical event of similar magnitude to that being assessed in the community of interest or Quantitative modelling and analysis of highest quality and length of data relating directly to the affected community, used to derive results of direct relevance to the scenario being assessed	Risk assessment team contains relevant and demonstrated technical expertise in the field being assessed, and experience in data and/or modelling of direct relevance to the scenario being assessed and Technical expertise is highly influential in the decisions of the risk assessment team
<b>High</b>	Assessed likelihood, consequence or risk has only one level, but with some uncertainty in the assessment	Recent historical event of similar magnitude to that being assessed in a directly comparable community of interest or Quantitative modelling and analysis uses sufficient quality and length of data to derive results of direct relevance to the event being assessed	Risk assessment team contains relevant technical expertise in the field being assessed, and experience with data and/or modelling relating to the event being assessed and Technical expertise is highly influential in the decisions of the risk assessment team

Confidence level	Descriptor	Justification	
		Supporting evidence	Expertise
<b>Moderate</b>	Assessed likelihood, consequence or risk could be one of two levels, with significant uncertainty	Historical event of similar magnitude to that being assessed in a comparable community of interest or Quantitative modelling and analysis with reasonable extrapolation of data required to derive results of direct relevance to the event being assessed	Risk assessment team contains relevant technical expertise in the field being assessed, and experience in data and/or modelling of relevance to the event being assessed and Technical expertise is used by the risk assessment team
<b>Low</b>	Assessed likelihood, consequence or risk could be one of three or more levels, with major uncertainty	Some comparable historical events through anecdotal information or Quantitative modelling and analysis with extensive extrapolation of data required to derive results of relevance to the event being assessed	Risk assessment team contains technical expertise related to the field being assessed and Technical expertise is taken into account by the risk assessment team
<b>Lowest</b>	Assessed likelihood, consequence or risk could be one of four or more levels, with fundamental uncertainty	No historical events or quantitative modelled results to support the levels	No relevant technical expertise is available to the team for analysis

## 5. RISK EVALUATION

Risk evaluation assists in deciding which risks may require further detailed assessment or treatment, and to prioritise measures to reduce risk levels.

### 5.1 Risk priority

The outcome of the risk evaluation process is to assign a priority to each risk, based on the risk level and confidence associated with that risk. Risk prioritisation guides asset managers to the order in which the risks need to be addressed, with the highest priority risks being treated first. Asset managers may respond to a priority level by:

- improving the confidence level of the risk rating, if possible, through research or by further expert opinion
- treating the risk by taking action to reduce the likelihood or consequence of the risk, or
- monitoring and reviewing the risk as part of the ongoing risk management process.

Priority levels range from 1, highest priority, to 5, lowest priority. Table 15 to Table 19 are used to determine the level of priority, based on the overall confidence for the risk, and the likelihood and consequence levels.

Table 15. Priority levels at highest confidence (CoA 2015)

		Consequence level				
		Insignificant	Minor	Moderate	Major	Catastrophic
Likelihood	Almost certain	4	4	3	2	1
	Likely	5	4	4	2	2
	Unlikely	5	5	4	3	2
	Rare	5	5	5	3	3
	Very rare	5	5	5	4	3
	Extremely rare	5	5	5	4	4

Table 16. Priority levels at high confidence (CoA 2015)

		Consequence level				
		Insignificant	Minor	Moderate	Major	Catastrophic
Likelihood	Almost certain	4	3	2	1	1
	Likely	4	4	3	2	1
	Unlikely	5	4	3	2	2
	Rare	5	5	4	3	2
	Very rare	5	5	4	3	3
	Extremely rare	5	5	5	4	3

Table 17. Priority levels at moderate confidence (CoA 2015)

		Consequence level				
		Insignificant	Minor	Moderate	Major	Catastrophic
Likelihood	Almost certain	3	3	2	1	1
	Likely	4	3	2	1	1
	Unlikely	4	4	3	2	1
	Rare	5	4	3	2	2
	Very rare	5	5	4	3	2
	Extremely rare	5	5	4	3	3

Table 18. Priority levels at low confidence (CoA 2015)

Consequence level				
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		Consequence level				
		Insignificant	Minor	Moderate	Major	Catastrophic
Likelihood	Almost certain	3	2	1	1	1
	Likely	3	3	2	1	1
	Unlikely	4	3	2	1	1
	Rare	4	4	3	2	1
	Very rare	5	4	3	2	2
	Extremely rare	5	5	4	3	2

Table 19. Priority levels at lowest confidence (CoA 2015)

		Consequence level				
		Insignificant	Minor	Moderate	Major	Catastrophic
Likelihood	Almost certain	2	2	1	1	1
	Likely	3	2	1	1	1
	Unlikely	3	3	2	1	1
	Rare	4	3	2	1	1
	Very rare	4	4	3	2	1
	Extremely rare	5	4	3	2	2

## 5.1 Decision point

A decision is now required on whether any further action is to be taken for each risk. A decision point category included in Table 20, is assigned to each evaluated risk. Where an *Extreme* risk rating is identified, the decision point will be assigned a category 1, the risk requires treatment. The panel will assign decision point categories to all remaining environmental assets (with risks below Extreme) as either 1, 2 or 3.

Table 20. Decision point categories (CoA 2015)

Decision point category	Decision point category description
1	<b>Risks requiring treatment.</b> For these risks, the risk assessment is completed because they are required to be treated and the information contained in the risk register provides guidance to determine treatment objectives.
2	<b>Risks requiring further analysis and subsequent re-evaluation.</b> For these risks, the risk assessment continues in the form of a revised baseline assessment or a detailed assessment, which will then lead to re-analysis and re-evaluation of the risk.

Decision point category	Decision point category description
3	<b>Risks currently requiring monitoring and maintenance of existing controls.</b> These risks will be subject to monitoring and review during the ongoing risk management process.

## 6. RISK TREATMENT

Once the risk analysis and evaluation is complete, recommendations for risk treatment can be made. Risk treatment aims to determine the most appropriate mitigating action in response to the identified need to treat risk. Treating risks should result in eliminating or reducing bushfire impact on the environmental asset.

To determine an appropriate risk treatment the following steps are applied.

1. Establish a suitable risk based objective of the treatment. For example, to reduce the risk to a certain level.
2. Identify and develop treatment options as listed in Section 12 Risk treatment strategies, to meet the set objective. Options to be considered include:
  - changing the likelihood of:
    - a bushfire igniting and building
    - a bushfire affecting the environmental asset at risk
  - sharing the risk
  - accepting the risk by informed decision.
3. Evaluate the risk treatment options. Consider treatment effectiveness and impacts on bushfire behaviour. Evaluation should consider the adverse impacts on the environmental asset and surrounding environmental assets. Treatments may result in the need for trade-offs or redesign of risk treatments.
4. Select and record the most appropriate treatment.

## 7. RISK REGISTER

The completed risk register is the output of the risk assessment process and gives a summary of all the decisions taken during the risk assessment process. The completed risk register for environmental asset following endorsement from the BMC will include:

- environmental asset name
- an environmental asset category type
- an environmental asset sub-category type
- a consequence level
- a likelihood level
- a risk level
- an overall confidence level for the risk
- a priority for the risk
- a decision point that recommends next steps
- risk treatments for those risks requiring treatment
- identification of the asset owner/s.

## 8. GUIDING PRINCIPLES

Risk assessments for environmental assets are based on the best available current scientific knowledge of the biology of the species or threatened ecological community, and, where available, their fire ecology. In situations where the required information is absent or uncertain, the precautionary principle will be applied. The assessments will be dynamic and will be updated as new information becomes available.

Communicating and consulting with external and internal stakeholders should take place during all phases of the risk management process. Effective external and internal communication and consultation are essential to ensure that stakeholders, including those accountable for implementing risk treatment strategies, understand the basis on which decisions are made and the reasons why particular actions are required.

Perceptions of risk can vary due to difference in experience and assumptions of stakeholders. Thus, stakeholders' perceptions should be considered in the decision making process. Communication and consultation should facilitate respectful, truthful, relevant, accurate and understandable exchanges of information, taking into account information validity, confidentiality and integrity.

## 9. RESPONSIBILITIES

The SBCC is responsible for the development and approval of this standard.

The Ecological Technical Reference Group (ETRG), on behalf of the SBCC, is to review this standard and update as necessary. The ETRG will review this standard at a minimum of four years from adoption, or earlier if required by the SBCC.

The BMC is responsible for ensuring that their BMAP assesses the risk to South Australian native environmental assets from the hazard of bushfire through the use of this standard.

The CFS Bushfire Management Planning Unit are responsible for the support of resource needs of the risk assessment.

## 10. REFERENCES

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## 11. AUTHORITIES

This Standard has been endorsed by:

Chair Ecological Technical Reference Group  
(Attach appropriate and dated signature block)

And approved by:

Chair State Bushfire Coordination Committee  
(Attach appropriate and dated signature block)

## 12. GLOSSARY

### Key terminology

<b>Annual Exceedance Probability (AEP)</b>	'The likelihood of an emergency event of a given size or larger occurring in a given year, usually expressed as a percentage' (CoA 2015).
<b>Bushfire Management Area (BMA)</b>	The area in which the strategic bushfire management plan is conducted. South Australia is divided into nine CFS bushfire management areas as defined by the <i>Fire and Emergency Services Act 2005</i> .
<b>Bushfire Management Area Plan (BMAP)</b>	An all tenure, strategic bushfire approach aimed at prevention and preparedness planning. The plan outlines information, risk ratings and treatment strategies to prevent or minimise the impact of major bushfire on people, property and the environment. Legislated requirement under the <i>Fire and Emergency Services Act 2005</i> .
<b>Bushfire Management Committee (BMC)</b>	Bushfire Management Committees across South Australia help to identify assets at risk of bushfire within the BMA. They then develop strategies to protect those assets. Each Bushfire Management Committee develops and maintains a BMAP. The Bushfire Management Committee is represented by the: Conservation Council of South Australia, Local and State Government land managers and State Government emergency response agencies. Legislated under the <i>Fire and Emergency Services Act 2005</i> .
<b>Bushfire management planning</b>	The planning activities conducted to assess and manage bushfire risk, including deriving bushfire management strategies and actions.
<b>Bushfire Risk Information Management System</b>	A database system embedded with geospatial records of assets, risk ratings and identified risk treatments. Provides a set of map-based tools.
<b>Community nominated environmental assets</b>	Environmental assets nominated by the community and interested stakeholders during planning.
<b>Confidence</b>	'The trustworthiness or reliability of the evidence that supports risk assessments' (NERG 2015).
<b>Consequence</b>	'The outcome of an event that affects objectives', (CoA 2015).
<b>Ecological community</b>	'A naturally occurring group of native plants, animals and other organisms that are interacting in a unique habitat. Its structure, composition and distribution are determined by environmental factors such as soil type, position in the landscape, altitude, climate and water availability'. Australian Government, Department of the Environment and Energy, <a href="http://www.environment.gov.au/biodiversity/threatened/communities">http://www.environment.gov.au/biodiversity/threatened/communities</a>
<b>Ecological Technical Reference Group (ETRG)</b>	The Ecological Technical Reference Group (ETRG) provides technical and scientific advice on environmental matters to the State Bushfire Coordination Committee (SBCC) as part of the Bushfire Management Area Planning (BMAP) process.

<b>Environmental asset</b>	'Naturally occurring entities that provide environmental "functions" or services. Environmental assets include those which have no economic values. This is not to suggest they are of no value, but bring indirect uses benefits, options and bequest benefits or simply existence benefits which cannot be translated into a present day monetary value' (OECD 2005).
<b>Environmental Assets and Risk Advisory Panel</b>	A panel of subject matter experts and interested parties, assembled to provide technical input into the environmental risk assessment process, on behalf of the BMC.
<b>Extent of occurrence</b>	The area encompassing the present known, inferred or projected extent of occurrence of a taxon, excluding vagrancy. This measure may exclude discontinuities or disjunctions within the overall distributions of taxa (e.g. large areas of obviously unsuitable habitat). Extent of occurrence is measured by a minimum convex polygon (the smallest polygon in which no internal angle exceeds 180 degrees and which contains all the sites of occurrence). Atlas of Living Australia, <a href="http://www.ala.org.au/spatial-portal-help/aoo/">http://www.ala.org.au/spatial-portal-help/aoo/</a>
<b>Hazard</b>	'A source of potential harm or a situation with a potential to cause loss' (CoA 2015).
<b>Impact</b>	'To have noticeable or marked effect on' (CoA 2015).
<b>Likelihood</b>	'Chance of something happening' (CoA 2015).
<b>Mitigation</b>	'Measures taken in advance of a disaster that aim to decrease or eliminate the disaster's impact on society and the environment' (CoA 2015).
<b>Monitoring</b>	'Continual checking, supervising, critically observing or determining the status to identify change from the performance level required or expected' (CoA 2015).
<b>Preparedness</b>	'Regulatory and physical measures to ensure that emergencies are prevented or their effects mitigated' (CoA 2015).
<b>Prevention</b>	'Arrangements to ensure that, should an emergency occur, all the resources and services that are needed to cope with the effects can be efficiently mobilised and deployed' (CoA 2015).
<b>Response</b>	'Actions taken in anticipation of, during and immediately after an emergency to ensure that its effects are minimised, and that people affected are given immediate relief and support' (CoA 2015).
<b>Risk</b>	'The effect of uncertainty on objectives' (CoA 2015).
<b>Risk analysis</b>	'Process to comprehend the nature of risk and determine the level of risk' (CoA 2015).
<b>Risk evaluation</b>	'Process of comparing the results of risk analysis with risk criteria to determine whether the risk and/or its magnitude is acceptable or tolerable' (CoA 2015).
<b>Risk identification</b>	'Process of finding, recognising and describing risks' (CoA 2015).
<b>Risk management</b>	'Coordinated activities of an organisation or a government to direct and control risk' (CoA 2015).
<b>Risk rating (level of risk)</b>	Magnitude of a risk or a combination of risks, expressed in terms of the combination of consequences and their likelihood (CoA 2015).

<b>Risk treatment</b>	'Process to modify risk' (CoA 2105).
<b>Species</b>	The basic unit of biological classification and a taxonomic rank.
<b>State Bushfire Coordination Committee (SBCC)</b>	Responsible for bushfire management planning in SA and the final approval of BMAPs.
<b>Taxon</b>	A group of one or more populations of an organism or organisms to from a unit.
<b>Vagrancy</b>	Individual animals appear well outside their normal range.
<b>Vulnerability</b>	Vulnerability is the degree to which a system, subsystem, or system component is likely to experience harm due to exposure to a hazard, either a perturbation of stress/stressor. (White, 1974).