GOLDFIELDS REGION
REGIONAL FUEL MANAGEMENT PLAN

GOVERNMENT OF WESTERN AUSTRALIA

Department of **Biodiversity, Conservation and Attractions**

Document history

Date of this version:	01/07/2025
Annual review due:	01/07/2026
Major review due	01/01/2031

Custodian

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Table of contents

1. Introduction

This regional fuel management plan (RFMP) assesses risks associated with bushfire in the Parks and Wildlife Service of the Department of Biodiversity, Conservation and Attractions' (the department) Goldfields Region to assist planning the department's fuel management program. It interprets the department's Bushfire Risk Management Framework into regional indicators of acceptable bushfire risk and recommends tactics by which these may be achieved. The annual comparison of the current landscape condition to the indicators will inform planning for fuel management in the region.

The RFMP addresses bushfire risk at a regional scale. Fire management requirements relating to Aboriginal sites, places and values, species, or populations of species are addressed separately in documents such as nature conservation strategies, local area management plans, species recovery plans, and individual burn prescriptions.

The RFMP considers the hazard posed by bushfire to people, communities, infrastructure, and the natural environment. It is underpinned by the principle that managing the fuel available to bushfire is the most efficient and effective way to reduce the impacts of unplanned bushfire. This plan should be read in conjunction with the department's Bushfire Risk Management Framework which further describes this principle and bushfire risk management criteria.

Targets in the RFMP apply to land managed by the department and the tactics proposed are restricted to prescribed burning and physical fuel management such as scrub rolling. Other key aspects of managing bushfire-related risk (including preparation for, response to and recovery from bushfire) are not within the RFMP scope.

The RFMP will be reviewed annually, and a comprehensive review undertaken at the end of its five-year life at the beginning of 2031. Any important new information that emerges between reviews will be incorporated immediately and the plan re-endorsed if those changes are significant.

2. Bushfire risk criteria

2.1. Bushfire risk management zones

A bushfire risk management zone (BRMZ) is an area with similar environmental variables, land use and cultural conditions and therefore a similar characteristic risk profile. It is an area within which fuel management activities are guided by a single set of bushfire risk indicators. Western Australia's BRMZs are defined and described in the department's Bushfire Risk Management Framework.

The department's Goldfields Region lies within the Desert, Central and Southern Rangelands BRMZ.

2.2. Fire management areas

The department divides the land it manages into six fire management areas (FMAs) to guide bushfire risk assessment and fuel management planning. These areas are defined according to the primary purpose of fuel management in the area and described relative to their proximity to assets.

The department's indicators of acceptable bushfire risk (defined in the department's Bushfire Risk Management Framework) allow fuel management activities to be tailored according to the risk profile and the management purpose of the land, including designating areas where there are no targets due to the limited capacity or requirement to manage fuels. The settlement-hazard separation (SHS), critical infrastructure buffer (CIB), critical transport corridor (CTC), agricultural interface (AgI), landscape risk reduction (LRR) and remote area management (RAM) categories are applied to the Goldfields Region.

Table 1: Fire management areas in the DBCA Goldfields Region. (Refer to the department's Bushfire Risk Management Framework for more information.)

Fire management area	Description
Settlement-hazard separation (SHS)	• An area of managed fuel adjacent to towns, subdivisions, and other areas of human settlement. • Management objective is to reduce the likelihood of direct flame contact, damaging intensities of radiant heat and ember attack from posing a threat to people. • Breadth of area considers the fuels, climate and topography of the area and the nature of the appropriate fuel management strategies. • Fuels are managed relatively intensively to minimise the likelihood of a bushfire being sustained and to facilitate fire suppression. • The use of fuel management to achieve other land management objectives is supported where it is complementary to the primary management intent.
Critical infrastructure buffer (CIB)	• An area of low fuel around items of critical infrastructure. • Management intent and intensity of fuel management is similar to SHS, however the CIB will generally be applied to a less extensive area than the SHS due to these assets having a higher level of resilience to ember attack. • Only applies in BRMZ where the most appropriate strategy to protect critical infrastructure from bushfire is localised, rather than landscape scale fuel management.
Critical transport corridor (CTC)	• An area of low fuel adjacent to critical transport corridors. • Management objective is minimising the potential for disruption of critical transport between WA and the eastern states of Australia. • Fuels are managed to increase the arrival time of an approaching bushfire, improve suppression effectiveness and limit landscape scale spread of a bushfire that may endanger people, damage infrastructure, cause financial or social disruption, or threaten SHS or CIB FMAs.
Landscape risk reduction (LRR)	• Encompasses areas where the density or significance of infrastructure, economic activity or environmental assets necessitates fuel management at a landscape scale. • Fuel management will achieve a range of outcomes, including preventing the occurrence of large bushfires that may threaten life, damage infrastructure, cause financial or social impacts, degrade the natural environment, or threaten SHS or CIB fire management areas. • This is usually achieved by creating a mosaic of fuel ages to reduce the likelihood of fires igniting and spreading and provides greater opportunity for suppression.
Remote area management (RAM)	• Areas where remoteness, inaccessibility, resource constraints and a lack of consequential assets make it impractical or unnecessary to intervene in the prevailing fire regimes. • Fuel management activities are a lower priority but may still occur where required to achieve land management outcomes.

The RFMP identifies where each FMA occurs in the region and details bushfire risk indicators for each fuel type within them. The effective management of bushfire risk in the Goldfields Region requires complementary activities in the FMAs including SHS, CIB, CTC and LRR. These areas have differing management intents, but do not represent a hierarchy of priorities for fuel management.

2.3. Asset value

The department's Bushfire Risk Management Framework applies the National Emergency Risk Analysis Guidelines (NERAG) and the State Emergency Management Prevention and Mitigation Procedure (SEMPMP) to group and prioritise assets at risk from bushfire. These priorities are used to define FMAs and guide the planning of mitigation activities.

Table 2: Asset class categorisation and prioritisation used when assessing bushfire risk.

Asset class	Priority	Description
Settlements	1	Areas of higher population density and low resilience to bushfire: • settlements, towns, and subdivisions • recreation and camping sites with high fire-season visitation.
Dispersed population	2	Areas of low or transient population density and low resilience to bushfire: • individual dwellings • roads with high usage in fire-vulnerable areas • recreation and camping sites with moderate fire-season visitation.
Critical infrastructure	2	Locations where there is a considerable threat to critical infrastructure with State-level significance and no redundancy: • major highways and other primary distributors • major rail routes • major infrastructure associated with electricity generation • gas transmission pipelines • water supply and pipelines and associated pumps and pumping stations • major optical TELCO cables • major wastewater treatment sites.
Protected species and communities	2	Areas that are critical to the survival of a legislatively protected species or threatened ecological communities (TEC) with low resilience to fire.
Economic assets	3	Locations where bushfires may have a significant effect on the livelihood of individuals or community financial sustainability, such as: • farmland • infrastructure of local and/or regional significance • major industry e.g. mine sites, refineries, manufacturing plants • native and plantation timber resources • water supply catchments.
Other assets	3	Other significant built, natural, or cultural assets, such as: • infrastructure of local significance • significant ecological communities or species habitat • areas with specific fire regime requirements • fire vulnerable Aboriginal or European heritage sites.

2.4. Asset resilience

The likelihood that the potential consequences of a bushfire will be realised depends partly on the resilience of the asset to fire. It is difficult to model resilience given there are many variables that affect the outcome of a fire, however some considerations for determining the resilience of an asset are shown in Table 3 (settlements) and Table 4 (biodiversity assets).

Table 3: Factors affecting the resilience of settlements to bushfire. Some of these factors are also applicable to other built assets and recreation sites.

More resilient to fire →	Less resilient to fire
Interface community[1]	Intermix community[2]
Hardened urban area without vegetation	Vegetation exists within developed area
Multiple access routes	One access route
Access routes highly trafficable	Access routes have limited trafficability
Access routes protected by low fuel buffers	Access routes have adjacent vegetation
Surrounding vegetation is fragmented	Surrounding vegetation is continuous
Adequate refuge available (oval, beach etc.)	Little refuge available
Most residents are capable of self-evacuation	Large population of elderly, infirm or children
Local population well prepared for fire	Population has low level of preparedness
Adequate water supply	Limited water available for fire fighting
Most dwellings constructed of brick	Dwellings constructed of timber or fibro
Building APZs[3] well maintained	Building APZs poorly maintained
Permanent resident population	Campsite or tourist/transient population

[1] An interface community is where a clear demarcation exists between urban areas and native vegetation and bushland does not continue into the developed area.
[2] An intermix community is where structures occur throughout a bushland area without a clear demarcation between urban and bushland areas.
[3] Asset protection zone: a low-fuel area maintained around a building to increase the likelihood that it will survive a bushfire.

Table 4: Factors affecting the resilience of species, communities, and ecosystems to bushfire.

More resilient to fire →	Less resilient to fire
Key plant species are resprouters	Key plant species are obligate seeders
No other threatening processes occurring	Fire may exacerbate other threatening process
Species have short juvenile periods	Species have long juvenile periods
Species have wide distributions	Species have restricted distributions
Species have multiple populations	Species have few populations
Connections exist between populations	Populations are isolated
Fauna is more mobile	Fauna is less mobile
Fauna is adapted to persistence in refugia	Fauna has limited ability to persist in refugia
Fauna can utilise a variety of habitats	Fauna has specialised habitat requirements
Habitat re-establishes rapidly post-fire	Habitat slow to re-establish post-fire
Fauna has a broad diet or can vary diet post-fire	Fauna has specific dietary requirements
Fire has little effect on predation rate	Fauna vulnerable to post-fire predation
Fauna has high rate of population increase	Fauna has low rate of population increase

Asset resilience is combined with the asset class priority rating (Table 2) to provide a regional priority for each asset. This is done using the matrix in Table 5. The regional priority is recorded in Table 8 of the RFMP and will guide the programming of works to mitigate bushfire risk.

Table 5: Matrix for determining the regional priority of assets in each class. The asset class priority is shown in Table 2, and the asset resilience is set with guidance from the criteria in Table 3 and Table 4.

Asset class priority	Resilience		
	High	**Medium**	**Low**
1	3	2	1
2	4	3	2
3	5	4	3

2.5. Risk treatment strategies

The department applies two broad strategies for managing fuels to reduce bushfire risk:

1. Establishment and maintenance of low fuel areas close to assets or in strategic locations in order to interrupt a fire run. Low fuel areas may be established by prescribed burning or physical fuel modification.

2. Landscape scale fuel management using prescribed burning to create a mosaic of fuel availability within which there is reduced potential for the development of large bushfires and increased opportunities for successful fire suppression.

These strategies are applied individually or in combination to achieve the fuel conditions required by the indicators of acceptable bushfire risk.

2.6. Tolerable fuel age

The tolerable fuel age is the maximum age at which fuel in an FMA is deemed to be in a managed state. It is defined as the age at which the fuel will burn with an intensity that is double the upper limit at which machine and tanker attack on the head fire is possible under 95th percentile fire danger index (FDI) weather conditions[4] (see Section 2.7). This is determined by using fuel accumulation and fire behaviour models for the appropriate fuel type. Where this period is unknown, an alternative figure of 1.5 times the minimum period required post-fire before the vegetation will again sustain a bushfire is used.

Table 6: Maximum intensity and rate of spread thresholds for head fire attack on a bushfire.

Machine and tanker attack possible	Intensity < 2000kW/m and/or ROS < 400m/hr in forest
	Intensity < 2000kW/m and/or ROS < 1000m/hr in shrubland
	Intensity < 5000kW/m and/or ROS < 6500m/hr in grassland

2.7. Weather conditions

When defining the range of each FMA and the tolerable age of fuels within it, the department's bushfire risk management criteria require the application of the conditions that produce the 95th percentile FDI in the area. Worse fire conditions than this would only be expected to occur approximately seven times per year.

The 95th percentile weather conditions have not been applied to the Goldfields Region RFMP. Weather conditions derived from the Bureau of Meteorology weather reanalysis project were not considered to accurately reflect extreme fire conditions in the region. This is likely due to there being only five years' data currently available from the weather reanalysis project. Weather variables considered to represent extreme fire weather conditions have been contributed by experienced DBCA fire staff. This will be reviewed as more data becomes available.

[4] The intensity values for machine and tanker attack are doubled because the thresholds in Table 6 relate to head fire intensity, while the department's usual approach to a direct attack on a bushfire is to begin from the tail fire and work along the flank to the head. This means that most of the suppression effort is undertaken on parts of the fire exhibiting much lower fire intensity than the head fire. Flank fire intensity may be up to four times lower than head fire intensity, but a more conservative two-fold factor is used to set the risk indicators.

3. The Goldfields Region

The Goldfields Region covers about 34 per cent (84.2 million hectares) of Western Australia and incorporates the Shires of Coolgardie, Menzies, Wiluna, Ngaanyatjarraku, Leonora, Laverton, the City of Kalgoorlie-Boulder, and parts of Yilgarn and Sandstone. The major regional towns include Kalgoorlie-Boulder, Coolgardie, Kambalda, Menzies, Leonora, Laverton, Leinster, Wiluna, Sandstone and Warburton. There are a multitude of smaller Aboriginal communities and mine sites scattered throughout the region.

3.1. Tenure and management arrangements

The Goldfields Region includes about 8.6 million hectares of conservation estate (CALM Act land), including three national parks, 19 nature reserves, five conservation parks, 11 timber reserves, one State Forest, and an Arboretum. The region manages 11 former pastoral leases and nine parcels of 2015 pastoral lease exclusions, covering over 2 million hectares. There is also about 15 million hectares of unallocated Crown land (UCL) on which the department is responsible for fire mitigation.

3.2. Climate and vegetation

There is significant climate variation across the Goldfields Region. The southwest of the region is influenced by Mediterranean climate patterns (hot, dry summers and cool, wet winters) and receives relatively reliable winter rainfall averaging about 300mm per annum. The remainder of the region spans the arid and semi-arid climatic zones which experience hot, dry summers and cool, dry winters. Rainfall becomes increasingly unreliable in the east and north of the region, occurring primarily in unpredictable episodic events associated with spring and summer thunderstorms or decaying tropical lows. The lower rainfall areas of the region receive a mean annual rainfall of between 150 and 200mm. It is expected that climatic change will result in rainfall events in the Goldfields becoming rarer, but more intense when they do occur. Evaporation rates in the Goldfields Region range from about 2400mm per year in the south to over 3600mm per year at Matuwa in the north. The typical summer weather pattern in the Kalgoorlie area features a cycle of passages of high-pressure systems and troughs. This usually means hot easterly winds moving anticlockwise to north-westerly as the trough approaches, followed by a cooler south-westerly change as the trough moves past. A high-pressure system follows the passage of a trough, bringing fresh and often cooler south-easterly winds. Troughs that form in the north of the region often bring moist air down from the Kimberley and Pilbara coast, causing thunderstorms. The region's winter weather pattern is dominated by persistent high-pressure systems which lead to clear days and low winds. Cold fronts periodically pass through the south-west of the region, bringing rain and cold winds.

The Goldfields Region can be broadly divided into four zones of vegetation. In the south-west of the region, Eucalyptus woodlands dominate, interspersed with broad sandplains of primarily *Acacia*-dominated shrublands. This area, known as the Great Western Woodlands, is recognised as a significant biodiversity hotspot, being the largest intact temperate woodland remaining on Earth. It is an area of largely contiguous vegetation, with salt lake chains representing the only significant breaks in vegetation cover. The north-western portion of the region is largely *Acacia* shrubland and woodland (mulga), with areas of spinifex. This area is utilised for pastoralism and large areas have been significantly degraded. Vegetation is still continuous but, in many places, has been simplified and reduced in biomass by heavy grazing. The north-east of the region is desert. Spinifex grasslands are the most common vegetation with a sparse overstorey of low Eucalyptus trees or *Acacia* shrubs

and mallee. The south-east of the region covers the Nullarbor Plain, which is dominated by salt bush, blue bush, and annual grasses with scattered fringing *Acacia* woodland.

3.3. Fire management considerations

The Goldfields Region is relatively sparsely developed with most fires unlikely to impact on the built environment. Because of this, and a limited budget, fire management activities are therefore focussed in areas which will provide the most valuable outcomes. These include critically important, fire-vulnerable assets, most notably:

- Recreation and camping sites such as Burra Rock Nature Reserve, Cave Hill Conservation Park and Wallaroo Conservation Park. These sites have dams which are relatively popular with the local community on hot weekends and some have previously been impacted by bushfires.
- The critical transport corridor and associated critical infrastructure between Norseman, Coolgardie and Southern Cross, which includes: the Great Eastern Highway, the Coolgardie-Esperance Highway, the Transcontinental Railway line, the Perth to Kalgoorlie 220kVA powerline, the Mundaring to Kalgoorlie water pipeline, and various telecommunication towers. Damage to any of this infrastructure, or interruption of their operation due to fire, has significant impacts on Kalgoorlie, surrounding towns and mine sites.
- The Matuwa Kurrara Kurrara (MKK) native fauna compound. MKK continues to be the target of a significant program of reintroduction of critical weight range mammals to the rangelands. It is situated in a highly fire-prone environment and requires careful management.
- A variety of lodged, registered and unregistered Aboriginal heritage sites and cultural landscapes exist in the region which can be adversely impacted by bushfire and prescribed burning activities. To achieve appropriate fire management planning and operational outcomes the department undertakes thorough assessment of Aboriginal cultural values in its burn planning process and where possible aims to develop and implement strategies to protect cultural values.
- The Great Western Woodlands (GWW). A highly biodiverse area of national and international significance. The GWW has been the focus of a major campaign by non-government organisations (NGO) and Traditional Owner groups for better protection and management. Large, intense bushfires are recognised as the greatest threat facing this system.
- Mine sites and camps located on or near DBCA-managed lands and UCL e.g., Sandy Ridge, Carina and Tropicana.
- *Santalum spicatum* (sandalwood) is a fire vulnerable asset in the landscape which provides an opportunity for economic development for Traditional Owners in the region. Complexities relating to the protection of sandalwood communities may be addressed through prescribed fire plans.

3.4. Key fuel management strategies

The primary objective of the department's fire management in the Goldfields Region is to protect human life (people and communities) and important community infrastructure. The department also aims to manage fire in a way that promotes ecosystem health and avoids compounding the effects of other threatening processes.

To achieve these objectives, the department:

- uses prescribed burning to maintain a landscape scale mosaic of fuel age and structure to inhibit the spread of bushfires, create opportunities for successful fire suppression, and maintain adequate habitat linkages to support biota
- uses prescribed burning to maintain a mosaic of fuel age and structure within reserves to reduce bushfire risk to and from surrounding lands and to support ecosystem resilience
- uses prescribed burning or other forms of fuel management to maintain areas of low-fuel adjacent to private property and important infrastructure
- applies prescribed fire to the landscape with consideration of ecosystems and the requirements of important species and ecological communities.

Fuel management strategies applied across the Goldfields Region vary depending on location within the region and fuel type. The highest priority for fuel management, is the application of CTC and CIB treatments along the Great Eastern Highway (GEH) and other proximate critical infrastructure. Sandplain vegetation, which is one of the dominant vegetation types along the GEH through the Goldfields Woodlands National Park/Conservation Park and the Boorabbin National Park, is generally difficult to burn as standing fuel, under cooler conditions (i.e., safe prescribed burning conditions), without modification of the fuel ladder. With sparse surface fuels, hot, dry, windy conditions are required to sustain ignitions and adequate spread, but these weather parameters are not always conducive to prescribed burning, because of the elevated risk of ignitions escaping targeted areas. Therefore, modification of the available fuels is generally carried out in proximity to critical infrastructure, to provide more control over fire behaviour when prescribed burning is applied.

A fire break rotation system has been designed for the GEH. This comprises two parallel fire breaks of 50m width each (100m total), north and south of the GEH in the more fire-prone vegetation along this route, e.g., sandplain communities. These breaks are treated on an approximate seven-year rotation program. Both breaks are subjected to an initial treatment at year one, comprising of a mechanical treatment (e.g., chopper-rolled, or scrub-rolled), followed shortly afterwards by a prescribed burn once the fuels have adequately cured. The breaks then receive a first follow-up mechanical treatment – one break at year seven, and the adjacent break at year 14. The second follow-up treatments occur at year 21 for the first fire break, and year 28 for the second fire break, respectively, and are applied by prescribed burning, when sufficient fuel loads have built up on the breaks. The 7-year rotation is a guideline and may vary depending on fuel accumulation.

Additional breaks along north-south alignments have also been developed, to reduce the potential spread of bushfires over the broader environment, and others around along or around other infrastructure (e.g., power lines to pump stations) which will be retreated as required. These are not dual fire breaks and may only be utilised for short term fire protection. Landscape-scale prescribed burning will also be applied across the broader GEH LRR FMA (see also 6.1), to reduce the spread and size of bushfires, with the target of 30 per cent of the more flammable fuels in this FMA kept under the 95th percentile FDI. This will be achieved by a combination of aerial burning and open-edge ground burning, targeting mature stands of sandplain vegetation (including thicket and mallee heath) >15 years old.

Fuel modification and prescribed burning has only previously been undertaken in the sandplain vegetation adjacent to the GEH. However, because extensive areas of woodlands burnt during the 2018/2019 and 2019/2020 bushfire seasons, including long runs at night, when these stands would have in the past either slowed the rate of spread, or even stopped fires, it is imperative that prescribed

burning methodology be developed for and implemented in the woodlands and associated communities (e.g., mallee-over-spinifex, and *Melaleuca* spp. ecotones) during the period of this plan.

Another key area in the region is the threatened native fauna compound at MKK. This compound covers 1100 hectares and represents a multimillion-dollar investment in the long-term conservation of critical mammal species by the department. The protection of the compound is provided by a series of buffers and low fuel mosaic outside the fenced compound area; and a system of small mosaic burns inside the compound aiming to treat five per cent of the area each year over 10 years.

For the conservation reserves and ex-pastoral leases in the southern rangelands, the fuel management strategy is to use boundaries and internal tracks as alignments to edge off from, to reduce the frequency of fires starting on DBCA-managed lands and spreading onto adjacent active pastoral leases. "Mineral-earth" fire breaks (of up to five metres in width), which also serve as access tracks, will be maintained along the boundary fences around all reserves and ex-pastoral leases adjacent to active pastoral leases, to reduce the spread of bushfires from these lands, mitigate damage to fences, and provide appropriate access for bushfire preparedness and suppression.

For conservation reserves in the desert zone, an adaptive fire interference strategy (an appropriate combination of bushfires and prescribed burning), will be used to establish and maintain, from an ecological perspective, appropriate spatial and temporal configurations of post-fire successional stages, i.e., for habitat diversity, and as a surrogate for maintenance of biodiversity. This will be implemented through aerial ignition operations (funding-dependent) and using internal tracks to edge off from.

Specific to the Southern Rangelands BRMZ, the following objectives and strategies were developed to help inform the identification of FMAs in this zone.

Objectives:

1. Protect life and property
2. Prevent the occurrence of landscape-scale bushfires (>30,000ha)
3. Mitigate the likelihood of bushfires crossing the agricultural interface in either direction.
4. Mitigate the likelihood of bushfires impacting critical transport corridors and critical infrastructure
5. Protect regenerating fire-sensitive eucalypt woodlands from bushfire prior to reaching reproductive maturity (25-30 years old)
6. Protect mature fire-sensitive eucalypt woodlands from bushfire (which may burn under extreme fire conditions)
7. Protect other fire-sensitive species and communities if necessary, from bushfires.

Strategies (in indicative priority order):

1. Mitigate risk along the agricultural interface, major infrastructure corridors and the major transport corridors of the Great Eastern Highway, Hyden Norseman Road and Great Northern Highway through the creation of low fuel buffers (up to 100m deep) in non-woodland fuels using mechanical treatments—chaining every 7-12 years, chopper-rolling 5-7 years and mulching 4-6 years.
2. Application of prescribed burning to achieve 45 per cent of the landscape within 10km of the agricultural interface will be less than tolerable fuel age to all non-woodland fuels.

3. Create and maintain landscape barriers to prevent spread of bushfires by joining areas of low fuel (e.g. lake systems and fire scars) with additional prescribed burning. Treatment target is 60 per cent of fuel below tolerable age threshold and applies to all non-woodland fuels.
4. At a landscape scale create a mosaic of fuel ages. This could include open-edged prescribed burns and bushfires. Treatment target is 30 per cent of fuel below tolerable age threshold and applies to all non-woodland fuel types.
5. Within the context of the strategies 2-4 above, consider the treatment of fuel types that exceed their tolerable fuel age threshold where these occur within 500 metres of woodlands. prioritising i) regenerating and ii) mature woodlands, and iii) any other communities identified as bushfire sensitive. Treatment target is 60 per cent of fuel below threshold age and applies to all non-woodland fuel types.

3.5. Plan implementation

During the period of this RFMP, the Goldfields Region has set an ambitious works program which treats four key areas but does not address all assets identified in Table 8. The four key areas of attention are:

1. All SHS FMAs
2. The Great Eastern Highway CTC FMA
3. The MKK threatened species compound LRR FMA
4. Great Western Woodlands LRR FMA.

Treatment of the GEH corridor will require broadscale aircraft burning practices which have not yet been routinely conducted in the Goldfields Region. The region intends to approach this using a continual learning process initially starting with lower risk burns and progressing to larger landscape scale burns under a broader window of environmental conditions (outside of winter).

4. Goldfields Region risk criteria

The Goldfields Region lies within the Desert, Central and Southern Rangelands BRMZs. The indicators of acceptable bushfire risk are based upon the fuel and fire behaviour characteristics of *Acacia* woodland, semi-arid woodland, thicket, mallee heath, hummock grassland and chenopod grasslands which have been broadly grouped across the region.

Table 7: Summary of bushfire risk criteria for the Goldfields Region.

Fuel type	Thicket	Semi-arid woodland	Hummock grassland	Acacia woodland	Mallee heath	Chenopod shrublands
Fuel accumulation and fire behaviour models	Expert judgement Anderson shrubland model	Expert judgement McArthur Mk 5 Forest Fire Behaviour Meter. Forest fire behaviour tables (Redbook) & Dry eucalypt forest fire model (VESTA)	Expert judgement Burrows Spinifex Model	Expert judgement Cruz mallee-heath model	Expert judgement Cruz mallee-heath model	No model, as area is rainfall reliant. Only an issue in 'boom' rainfall years.
Weather parameters applied	Location: Ninghan weather district (likely Southern Cross is closest) Temperature: 35°C Relative humidity: 8% Wind speed: 40km/h	Location: Ninghan weather district (likely Southern Cross is closest) Temperature: >35°C Relative humidity: <8% Wind speed: >35km/h	Location: South interior weather district (possibly Laverton is a good average) Temperature: >30°C Relative humidity: <5% Wind speed: >40km/h	Location: Goldfields weather district (possibly Leonora is a good average) Temperature: 42°C Relative humidity: <5% Wind speed: >35km/h	Location: Ninghan weather district (likely Southern Cross is closest) Temperature: >35°C Relative humidity: <8% Wind speed: >40km/h	Location: Forrest Temperature: 42°C Relative humidity: <5% Wind speed >35km/h
Tolerable fuel age	15 years	Particularly fire prone generally the 4-10 years immediately post bushfire due to increased grass component and sapling regrowth	10 years in general – highly dependent on accumulated rainfall. Variation between the north of the region and the south.	Most of the mulga woodlands occur in an area impacted by pastoralism. Ground fuels are sparse and often the fuel type is only impacted when understorey is dominated by spinifex	18 years	N/A – fuels can be available one year and not the next. Based on very intermittent rainfall, usually every 6-10 years, but can occur over a two-year period.
Settlement hazard separation (SHS)	1km surrounding settlements	N/A	500m surrounding settlements	N/A	500m surrounding settlements	N/A
Critical infrastructure buffer (CIB)	100m surrounding critical infrastructure	N/A	50m surrounding critical infrastructure	N/A	100m surrounding critical infrastructure	N/A
Landscape risk reduction (LRR)	As defined in Table 8	Manage as required	As defined in Table 8	N/A	As defined in Table 8	N/A
Critical transport corridor (CTC)	15km each side of National Highway 94 and the Trans Australian Railway	N/A	15km each side of National Highway 94 and the Trans Australian Railway	N/A	15km each side of National Highway 94 and the Trans Australian Railway	N/A

Fuel type	Thicket	Semi-arid woodland	Hummock grassland	Acacia woodland	Mallee heath	Chenopod shrublands
Remote area management (RAM)	Managed as required	Managed as required	Managed as required	Managed as required	Managed as required	N/A

5. Asset categorisation and prioritisation

The following table applies the department's bushfire risk criteria to identify and prioritise assets in the Goldfields Region, establishing where each FMA applies. Table 9 then provides the indicators of acceptable bushfire risk for these areas.

Table 8: Asset categorisation and prioritisation for the Goldfields Region.

Fire management area	Asset class	Asset description and occurrences	Resilience	Rationale
Regional priority 1				
SHS	Settlement	Nil identified	Low	
Regional priority 2				
SHS	Settlement	Tjuntjuntjara Remote Aboriginal Community in the Great Victoria Desert Nature Reserve	Medium	Situated within grass and spinifex fuels. Community is protected by cultural burning practices for the most part.
	Settlement	Tellus Holdings Sandy Ridge mine site	Medium	Site being developed in UCL in ~20-year-old (as at 2021) sandplain vegetation.
	Settlement	Tropicana Mine site and camp	Medium	Large mine site embedded in spinifex fuels – camp needs fire protection but mine operations well protected from fire impact. Company has good response capabilities.
	Settlement	Carina Mine camp	Medium	Mine camp situated in sandplain fuels. Mostly steel buildings and has gone into care & maintenance late 2018.
	Settlement	Recreation and camping sites - Burra Rock Nature Reserve, Cave Hill Conservation Park, and Wallaroo Conservation Park: camping and day use areas	Medium	All have dams which are relatively popular with the local community on hot weekends. Sites have previously been impacted by bushfires. Wallaroo Rock has a single access/egress route.
	Settlement	Recreation and camping sites - Boondi camping and day use area in the Boorabbin National Park	Medium	Relatively popular stop for travellers all year round as a designated camping area with water. Only one entry/exit.
	Settlement	Recreation and camping sites - Victoria Rock	Medium	Low visitation, but in fire prone area. No attraction to visitors in summer as no dam.
	Settlement	Kurrawang Aboriginal Community	Low	Located near the north-western boundary of the Kurrawang Nature Reserve, between Kalgoorlie and Coolgardie.
	Settlement	Kalgoorlie Arboretum	Low	Kalgoorlie Arboretum is located on the western edge of the Kalgoorlie urban fringe. The vegetation is mainly kikuyu grass (which is cut on a regular basis) and scattered groups of typical Goldfields Eucalyptus species and Red River Gums.
CIB	Critical infrastructure	Infrastructure with State-level significance, no redundancy Powerlines supplying pipeline pump stations and pump stations, in the Boorabbin National Park, the Goldfields Woodlands National Park and the Goldfields Woodlands Conservation Park	Medium	Powerlines that supply power to pump stations are still wooden poles. Some clearing underneath but vulnerable to bushfire.
CTC	Critical infrastructure Dispersed population Economic assets	Transport corridors with National-level significance and no redundancy. National Highway 94 (Great Eastern Highway) through the Boorabbin National Park, the Goldfields Woodlands National Park, and the Goldfields Woodlands Conservation Park	Low	Applied to protect of the flow of people, goods and services between Western Australia and the eastern states with only a few detour options available, which significantly increase travel distances and times for road users. During road closures, traffic from the east will need to be diverted at Norseman, and from the west at Merredin. Vehicle control points (VCP) will need to be established at Coolgardie and Southern Cross, almost 200km

Fire management area	Asset class	Asset description and occurrences	Resilience	Rationale
	Protected species and communities			apart. Significant traffic volume and exposed on both sides with extensive stands of Sandplain vegetation and Mallee-over-spinifex.
	Critical infrastructure Dispersed population Economic assets Protected species and communities	Transport corridors with National-level significance and no redundancy. Transcontinental Railway in proximity to the Boorabbin National Park, the Goldfields Woodlands National Park and the Goldfields Woodlands Conservation Park	High	Applied to protect of the flow of people, goods and services between Western Australia and the eastern states. Timber sleepers replaced with concrete so should be no damage issues. May require trains to be stopped in large incidents.
LRR	Dispersed population Economic assets Protected species and communities Other assets	Great Western Woodlands as defined by the "Great Western Woodlands" shapefile within DBCA's Corporate Data Distribution Program	Medium	The Great Western Woodlands is an internationally significant area containing an accumulation of important assets including threatened species, cultural heritage, mining, recreation and tourism. It also contains critical and regionally significant transport corridors and areas of agricultural interface.
	Protected species and communities	Areas that are critical to the survival of a protected species or ecological community - Matuwa threatened native fauna compound	Low	The dominant vegetation in, and surrounding the compound, is spinifex vegetation. Bushfires therefore carry a significant risk to this asset.
	Dispersed population	Koorarawalyee Retreat on the Great Eastern Highway on the western boundary of Boorabbin National Park	Low	Old timber buildings and train carriages surrounded by old sandplain fuels. Some mitigation done by owners but is vulnerable to bushfires.
Regional priority 3				
SHS	Settlements	Recreation and camping sites with moderate fire-season visitation – Goongarrie, Credo, Jaurdi, Yeo Lake, and Lake Mason	Medium	Pastoral era homestead precincts surrounded by low fuel loads which are a legacy of grazing pressure. Mostly timber and steel buildings. Water supply and various entry/exit points. Low visitation in summer but can be utilised by large groups on occasion.
CIB	Critical infrastructure	Infrastructure with State-level significance - 220kVA Supply line to Kalgoorlie adjacent to or intersecting the Boorabbin National Park, the Goldfields Woodlands National Park, and the Goldfields Woodlands Conservation Park	Medium	Steel frames of significant height – may be susceptible to shorting out in intense fires with thick smoke, but unlikely to be damaged.
	Critical infrastructure	Infrastructure with State-level significance - communications towers (phone and radio) in the Boorabbin National Park, the Goldfields Woodlands National Park, and the Goldfields Woodlands Conservation Park	Medium	Several radio and mobile phone towers in the sandplain and woodland fuels. Unlikely to be directly impacted but power supplies could be disrupted.
LRR	Dispersed population	Areas of smaller or transient population – Matuwa homestead precinct	Medium	Wooden buildings (accommodation and storage sheds) with medium resilience to bushfires.
RAM	Other assets	Areas where fuels may be managed to achieve other outcomes – Matuwa landscape (excluding the compound)	Medium	Western half of Matuwa has fire prone fuels. With potential future expansion of animal compound and broad area release, fire management in the landscape is of high importance.
Regional priority 4				
CIB	Critical infrastructure	Infrastructure with State-level significance - Mundaring to Kalgoorlie Water Pipeline (Water supply to Goldfields)	High	Pipeline itself unlikely to be damaged by direct fire impact, though an intense fire (e.g., the 2009/10 Boorabbin fire), may cause leaks.

Fire management area	Asset class	Asset description and occurrences	Resilience	Rationale
	Dispersed populations	Widgiemooltha and Roadhouse	High	Small community of older timber houses in woodland fuels. Not likely to be susceptible to fire in general but may be an accumulation area for travellers if highway to Norseman closed.
RAM	Other assets	Areas where fuels may be managed to achieve other outcomes - Wanjarri Nature Reserve	Medium	Spinifex-dominated vegetation. Active pastoral leases on the southern, eastern, and northern boundaries. Mt Keith mine site, camp, and associated infrastructure on the western boundary.
	Other assets	Areas where fuels may be managed to achieve other outcomes - Lake Mason/Black Range ex-pastoral leases	Medium	Mainly boundary protection issues (with neighbouring pastoral leases). Some work required on the boundaries, but in general, no significant internal risks except for the homestead precinct mentioned above.
	Protected species and communities Other assets	Areas where fuels may be managed to achieve other outcomes – Pila Desert Nature Reserve	High	Low threats even to landscape function. Area has been significantly impacted by large fire events in last 15 years. Most at threat would be the large number of Aboriginal sites scattered throughout the reserve.
	Protected species and communities Other assets	Areas where fuels may be managed to achieve other outcomes – Great Victoria Desert Bioregion reserves	High	The reserves in the Great Victoria Desert Bioregion area (Neale Junction, Plumridge, Queen Victoria Spring, Yeo Lake and Great Victoria Desert) have had significant impacts from large scale bushfires in the last 15 years.
Regional priority 5				
LRR	Nil identified			
RAM	Nil identified			

6. Indicators of acceptable bushfire risk

Bushfire risk is maintained at an acceptable level in the Goldfields Region if fuels are managed to the condition described in the below table. The current landscape condition will be compared to these indicators at least annually and the outcomes of that comparison used to inform the development of the annual fuel management program.

Table 9: Summary of indicators of acceptable bushfire risk in the Goldfields Region.

Fire management area	Fuel type	Location	Target
Settlement hazard separation (SHS)	Thicket	1km surrounding settlements	60% of fuel less than threshold intensity
	Mallee-heath Hummock grassland	500m surrounding settlements	
	Acacia woodland Semi-arid woodland Chenopod shrubland	N/A	No targets apply
Critical infrastructure buffer (CIB)	Thicket, mallee-heath	100m surrounding critical infrastructure	50% of fuel less than threshold intensity
	Hummock grassland	50m surrounding critical infrastructure	
	Acacia woodland Semi-arid woodland Chenopod shrubland	N/A	No targets apply
Critical transport corridor (CTC)	Thicket, mallee-heath & hummock grassland	15km adjacent to National Highway 94 from Yellowdine to Norseman and National Highway 1 from Norseman to Eucla	45% of fuel less than threshold intensity
	Acacia woodland, semi-arid woodland, chenopod shrubland	N/A	No targets apply
Landscape risk reduction (LRR)	Mallee-heath Thicket Hummock grassland	As defined in Table 8	30% of fuel less than threshold intensity
	Acacia woodland Semi-arid woodland Chenopod shrubland	N/A	No targets apply. Managed as required to meet land management objectives

Fire management area	Fuel type	Location	Target
Remote area management (RAM)	Acacia woodland Thicket, mallee-heath Semi-arid woodland Chenopod shrubland	All other Parks and Wildlife Service managed lands	No targets apply. Managed as required to meet land management objectives

7. Spatial data

The descriptions of asset locations and FMA extents in Table 8 and Table 9 are depicted spatially in a geodatabase that supports this RFMP. These data form the basis for comparison of the current landscape condition against the department's indicators of acceptable bushfire risk. This comparison will be conducted annually, at a minimum, and used to inform the fuel management program planning process. The master copy of the geodatabase is maintained in-house by the department's Regional Leader, Fire Management, with a copy provided to Fire Management Services Branch (FMSB) information officers to facilitate corporate reporting.

8. Monitoring and review

This plan will be regularly monitored and reviewed to ensure content remains accurate and up to date. The plan will be endorsed annually by the content custodian prior to being used in the burn program planning process.

FMSB will advise the Goldfields Regional Manager of any changes to the department's Bushfire Risk Management Framework that will need to be reflected in the RFMP.

The Regional Manager, or their delegate, will review the regional context statement, regional risk criteria and asset categorisation and prioritisation annually (at a minimum). The most important aspect of this review is confirmation that Table 8 continues to represent a comprehensive and accurate catalogue of the assets in the region requiring protection from bushfire. Any changes to Table 8 will also be reflected in the accompanying spatial data, including the mapping of FMA extents.

The spatial data that supports the RFMP will be reviewed at least annually to capture any changes in the distribution of assets, fuel, or department-managed tenure. Updated datasets will be provided to FMSB whenever any changes are made.

9. Knowledge gaps

The department's risk criteria and indicators of acceptable risk were developed using the best available science, practitioner judgement and supporting data. These inputs will be monitored by the department to ensure that the RFMP continues to reflect industry best-practice. It is expected that ongoing adjustment to the settings will be required as the State's social, political and natural environments change; better data become available, or knowledge of bushfire risk management is refined or improved. The framework will also be updated to incorporate the findings of any relevant research or adaptive management, and as new models are developed and refined.

Department of **Biodiversity, Conservation and Attractions**

2025_547_1025