

# Fire Procedures for Biodiversity

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**Direct all inquiries to:**  
**Ecoscape (Australia) Pty Ltd**  
**Lvl 1 38 Adelaide Street Fremantle (Walyalup) WA 6160**  
**Whadjuk Boodja**  
**Ph: (08) 9430 8955**  
**Prepared for City of Kalamunda**

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# EXECUTIVE SUMMARY

The City of Kalamunda ('the City', CoK) is responsible for the management of 201 Local Natural Areas (LNAs) ranging in size from 0.04 ha to 124.89 ha. Most are composed wholly or partly of natural vegetation, however, some are considered as LNAs where they protect a natural feature or are a mixture of land uses including recreational facilities and natural vegetation.

Managing fire risk in these LNAs is part of the City's responsibility and is largely based on managing fuel loads, conducted by prescribed burning, mechanical removal of woody and herbaceous weeds, and installation and maintenance of firebreaks.

However, these management tools do not take into consideration the biodiversity values of natural vegetation. This Fire Management Procedure has been developed to identify and manage the significant biodiversity values of each LNA, balanced against the fire risk and taking the fire management principles of Shedley (2007) into consideration.

LNAs are considered to have significant biodiversity values if they:

- are known to have Threatened or Priority-listed flora, or they are likely to be present based on proximity. Fifty-six conservation listed flora species have been recorded from within the CoK with 23 recorded from within LNAs or 100 m of them and therefore having potential to occur.
- are known to have Threatened or Priority-listed fauna species, or provide habitat suitable for them and are likely to have such species. Forty conservation listed fauna species have been recorded within the CoK although a number are historical records and the species no longer occurs in the vicinity. Twelve conservation listed fauna species are considered to occur or likely to occur in at least some of the LNAs.
- are known to have a Threatened or Priority Ecological Community (TEC or PEC). Eight TECs and one PEC have been mapped as occurring or potentially occurring in the CoK, noting that mapped occurrences are frequently not ground truthed and may not be accurate based on current vegetation condition, land use change since recording and, for the Banksia Woodlands TEC, not of sufficient size to meet extent requirements.
- have fire-sensitive flora species or vegetation requiring specific management regimes
- have a habitat type that is restricted in extent, is isolated from other similar habitats, or is significant for various suites of plants or animals
- includes wetlands or waterways.

Each LNA has been investigated based on available data and a procedure developed. General principles applied to managing fire risk balanced against biodiversity values include:

- there is a legal requirement to maintain ground fuel at less than 8 tons/ha, however, unless this is exceeded conduct activities other than fuel reduction burning to mitigate fire risk (e.g. remove standing dead shrubs that contribute to above-ground fuel load)
- the current burning rotation to maintain low ground fuel levels is 8 years; it is recommended to extend the rotation to 10-years as a minimum (but preferably 12 years) to permit vegetation to recover and develop fauna habitat value (unless ground fuel exceeds 8 tons/ha)
- where fuel reduction burns are necessary, conduct burns during the season that least affects biodiversity values (mostly autumn rather than spring) where possible
- documenting dates and findings of regular inspections, including fuel loads (ground and understorey fuel loads), firebreak condition and management activities conducted
- do not plan fuel reduction burns over an entire LNA; instead use other methods to minimise fire risk including managing the interface between native vegetation and human infrastructure by removing the shrub layer to create a low fuel separation, control weeds and remove dead biomass, or conduct small-scale mosaic burns
- do not conduct fuel reduction burns in wetlands or waterways
- do not burn large trees (alive or dead) or fallen logs as these have important habitat values

- more intensive management of larger LNAs that are adjacent to contiguous bushland as these have the highest risk of wildfire.

Eighteen recommendations were made, with three of these representing tasks that are suitable for Friends Groups to undertake, and applied to each LNA. The recommendations have been provided to the City in GIS format for inclusion in the City's *IntraMaps*.

# ACRONYMS AND ABBREVIATIONS

Table 1: Acronyms and abbreviations

Acronyms	
<b>BAM Act</b>	Western Australian <i>Biosecurity and Agriculture Management Act 2007</i>
<b>BC Act</b>	Western Australian <i>Biodiversity Conservation Act 2016</i>
<b>C1, C2, C3</b>	Declared Pest categories under the BAM Act
<b>CD</b>	Conservation Dependent (fauna; specially protected species under the Western Australian BC Act)
<b>CR</b>	Critically Endangered (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
<b>DBCA</b>	Western Australian Department of Biodiversity, Conservation and Attractions
<b>DEWHA</b>	Commonwealth Department of the Environment, Water, Heritage and the Arts (2007-2010, now Department of Climate Change, Energy, the Environment and Water)
<b>DPaW</b>	Western Australian Department of Parks and Wildlife (2013-2017, now DBCA)
<b>DWER</b>	Western Australian Department of Water and Environmental Regulation
<b>EN</b>	Endangered (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
<b>EP Act</b>	Western Australian <i>Environmental Protection Act 1986</i>
<b>EPBC Act</b>	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
<b>ha</b>	hectare/hectares
<b>IBRA</b>	Interim Biogeographic Regionalisation for Australia
<b>km</b>	kilometre/kilometres
<b>m</b>	metre/metres
<b>MI</b>	Migratory species (fauna; specially protected species under the Western Australian BC Act, also EPBC Act)
<b>OS</b>	Other specially protected species (fauna; specially protected species under the Western Australian BC Act)
<b>P; P1, P2, P3, P4, P5</b>	Priority Flora and Fauna species rankings (P1-P4) or Priority Ecological Communities (P1-P5)
<b>PEC</b>	Priority Ecological Community
<b>PF</b>	Priority Flora
<b>sp.</b>	Species (generally referring to an unidentified taxon or when a phrase name has been applied)
<b>subsp.</b>	Subspecies (infrataxon)
<b>TEC</b>	Threatened Ecological Community
<b>TF</b>	Threatened Flora (formerly termed Declared Rare Flora, DRF, in Western Australia)
<b>var.</b>	Variety (infrataxon)
<b>VU</b>	Vulnerable (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
<b>WAH</b>	Western Australian Herbarium
<b>WONS</b>	Weeds of National Significance



# 1 INTRODUCTION

## 1.1 BACKGROUND

The City of Kalamunda (the City, CoK) is responsible for the management of 201 Local Natural Areas (LNAs) within its boundaries. These LNAs range in size from 0.04 ha to 124.89 ha. They range from being composed of entirely 'natural' vegetation, are largely not natural but protect a natural feature, or are a mixture of land uses that include natural vegetation and recreational facilities. They range from narrow linear features with a large proportion of edges, to a more regular shape with less of the area close to edges. Proximity to edges frequently increases weediness due to soil disturbance from access and firebreak maintenance, introduction of seeds from outside areas, and that more open areas have less shade, less leaf litter and more bare soil that favour some species including perennial grasses.

The City's management responsibilities include controlled fire management that uses standard procedures adopted by many local Government authorities. Fire management, conducted under the City's *Bushfire Risk Management Plan 2019-2024* (CoK 2019a), is currently based largely on managing fuel loads, including:

- prescribed burning when leaf litter is approximately 8 tons/ha
- mechanical removal of herbaceous and woody weeds
- maintenance and installation of firebreaks.

Whilst this management regime is appropriate in areas without native vegetation it does not take into consideration the vegetation, flora, fauna or other significant features present, nor the effects of fire intensity, frequency or seasonality on these features. Inappropriate fire regimes have the potential to cause the loss of fire sensitive species and species dependent on them, reduce species distributions, alter vegetation flammability (including by increasing the prevalence of flammable weed species), and cause a decline in vegetation resilience.

Accordingly, the City has developed a detailed set of controlled fire procedures for its LNAs that aim to preserve the significant biological features of each area, balanced against the necessity to manage fire risk in a largely urban environment.

This document details the background of, and methods used to develop fire management procedures to protect the biodiversity values of the City's LNAs. The results of these management procedures are displayed in the City's online mapping management tool *IntraMaps 98* with a summary presented in this document.

## 1.2 CITY OF KALAMUNDA LOCAL NATURAL AREAS

There are 201 separate LNAs within the City's boundaries for which it has management responsibility (**Figure 1**).

Not all of these LNAs have natural vegetation; these are identified within the data and fire management procedures based on managing fuel loads for human asset protection only.

Several of the LNAs have multiple sections that have different biodiversity attributes or sections separated by human features, mostly roads. Where relevant, separate fire management procedures have been developed for these sections.

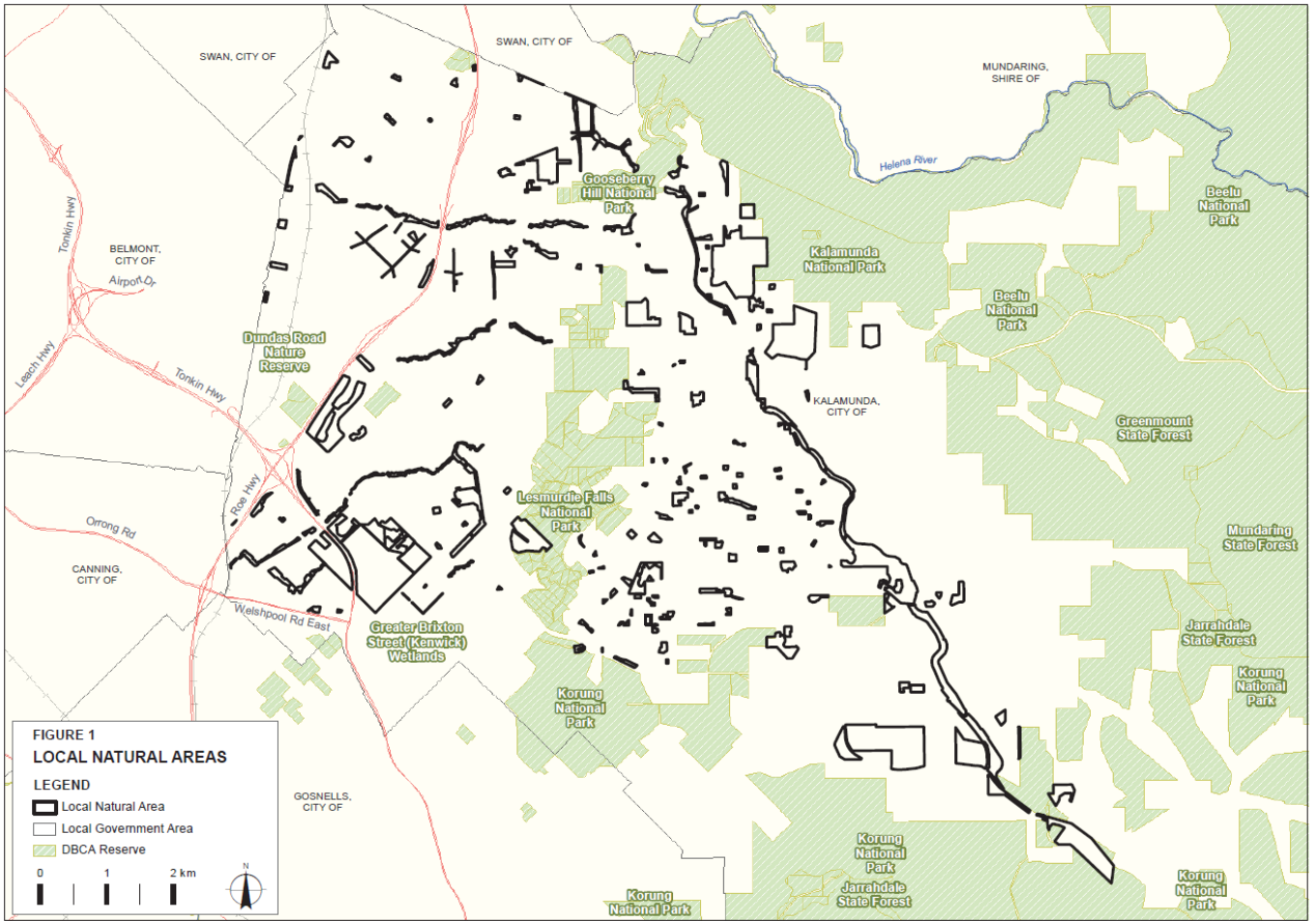


Figure 1: CoK LNA locations

### 1.3 SIGNIFICANT BIODIVERSITY VALUES

LNAs are considered to have significant biodiversity values if they:

- are known to have Threatened or Priority-listed flora
- are known to have Threatened or Priority-listed fauna species
- provide habitat suitable for Threatened or Priority Fauna where there is a reasonable chance that such species occur there (but have not been specifically recorded within the LNA) or may visit the area for a specific purpose e.g. foraging (feeding) or nesting. Note that many fauna species are considered to be mobile and they may occur in LNAs even if they have not been formally recorded from them.
- are known to have a Threatened or Priority Ecological Community (TEC or PEC)
- have fire-sensitive flora species or vegetation requiring specific management regimes
- have a habitat type that is restricted in extent, is isolated from other similar habitats, or is significant for various suites of plants or animals
- includes wetlands or waterways.

Flora, fauna or ecological communities may be:

- listed as Threatened; these are protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and/or Western Australian *Biodiversity Conservation Act 2016* (BC Act), or
- Priority-listed by the Western Australian Department of Biodiversity, Conservation and Attractions (DBCA)
- unlisted i.e. 'common' species.

Criteria for the Threatened or Priority listing of flora and fauna species, and ecological communities are outlined in **Appendix One**.

Other significant values taken into consideration are:

- presence of significant weeds i.e. Declared Pest plants listed under the Western Australian *Biosecurity and Agriculture Management Act 2007* (BAM Act) or as Weeds of National Significance (WoNS species) as described in **Appendix One**
- significant extents of weeds that respond to specific fire regimes e.g. Veldt Grass, where they could be identified from within the provided data
- proximity to human assets including houses and agricultural land
- adjacency to DBCA-managed lands where the City's LNAs are jointly managed by both authorities
- Bush Forever sites
- safety of on-ground fire personnel.

### 1.4 COMPLIANCE

Fire management is required to be compliant with mandates outlined in:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Western Australian *Bushfires Act 1954*
- Western Australian *Biodiversity Conservation Act 2016* (BC Act) and *Biodiversity Conservation Regulations 2018*
- Western Australian *Environmental Protection Act 1986*.

The biodiversity fire procedures take into consideration requirements and recommendations within the following CoK documents:

- *Local Biodiversity Strategy: 2023-2043* (City of Kalamunda 2023) that provides background information on biodiversity and identifies threats to biodiversity within the Shire of Kalamunda, outlines protection mechanisms and reasons for producing a Local Biodiversity Strategy, and identifies targets for protection.
- *Bushfire Risk Management Plan 2019-2024* (City of Kalamunda 2019a) that identifies assets at risk from bushfire and their priority for treatment.

- *Kalamunda Activity Centre Bushfire Management Plan (Strategic planning proposal)* (Strategen Environmental Consultants Pty Ltd 2019) was prepared in response to the requirements of the *State Planning Policy 3.7 Planning in Bushfire-Prone Areas* (WAPC 2015; now superseded) and *Guidelines for Planning in Bushfire-Prone Areas* (Western Australian Planning Commission 2017). As the Kalamunda Activity Centre has some native bushland, the City is obliged to manage its environmental obligations Commonwealth and State environmental legislation.
- *Kalamunda Clean and Green Local Environment Strategy 2019-2029* (CoK 2019b). This document outlines the City's framework to manage environmental pressures and improve sustainable practices. The aims include protecting green spaces, protecting waterways, and protecting natural corridors for wildlife.
- *Bushfire Preparedness Communications and Engagement Plan 26/06/2020* (CoK 2020) which the City's plans to effectively engage with the community in wanting to create the desired change in behaviour and attitude with our engagement focussing on bushfire preparedness, planning and awareness.
- *Fire Hazard Assessment Plan 2021/2022* (CoK 2021) that outlines the structure of the City's bushfire compliance scope including permits to burn, illegal burning and fire hazard assessment.

## 2 BACKGROUND INFORMATION

### 2.1 FIRE AND BIODIVERSITY GUIDELINES

In 2007 Erica Shedley developed a set of fire management principles for the Avon Basin to enhance biodiversity conservation and underpin ecological management objectives that were based on current scientific knowledge, outlined in Shedley (2007) *Fire and Biodiversity Guidelines for the Avon Basin*.

The Shedley principles, adapted to meet the conditions present in and requirements of the City of Kalamunda, formed a framework that guided these procedures.

These principles are summarised below.

**Principle 1.** Fire is an environmental factor that has influenced, and will continue to influence, the nature of the south-west landscapes and biodiversity.

**Principle 2.** Species and communities vary in their response to, and reliance on, fire. Knowledge of the life histories of organisms or communities and their relationship to fire should underpin the use of fire in natural ecosystems.

**Principle 3.** Following fire, environmental factors such as landform, topography and life histories of various species, and random climatic events, often drive ecosystems towards a new transient state with respect to species composition and structure. This may prevent scientists from identifying which changes are specifically attributable to fire.

**Principle 4.** Fire management is required for two primary reasons, which are not necessarily mutually exclusive:

- a) To conserve biodiversity.
- b) To reduce the occurrence of large intense wildfires. Fire management should consider both ecological and protection objectives in order to optimise outcomes.

**Principle 5.** The damage potential, suppression difficulty and biological impact (killing power) of a fire and rate of recovery following a fire are in direct proportion to the fires intensity and size.

**Principle 6.** Fire diversity promotes biodiversity. An interlocking mosaic of patches of vegetation – representing a range of biologically derived fire frequencies, intervals, seasons, intensities and scales – need to be incorporated into ecologically based fire regimes if they are to optimise the conservation of biodiversity at the landscape scale.

**Principle 7.** Avoid applying the same fire regime over large areas for long periods of time, and avoid extreme regimes, such as very frequent or very infrequent intervals over large areas.

**Principle 8.** The scale of the fire-induced mosaic should:

- a) Enable dispersal of young native animals.
- b) Optimise boundary habitat.
- c) Optimise connectivity or the ability of animals to move through the landscape.

**Principle 9.** All available knowledge, including life histories, attributes of native plants and animals and knowledge of Nyoongar fire regimes should be used to develop ecologically based fire regimes for a landscape or a vegetation complex.

**Principle 10.** Fire history, vegetation complexes and landscape units should be used to develop known and ideal mix of time since last fire.

**Principle 11.** Wildfire can damage and destroy both conservation and societal values, so a systematic and structured approach must be used to identify and manage the consequences of such an event.

**Principle 12.** Fire management should adapt to changing community expectations and new knowledge gained through research, monitoring and experience.

Shedley notes that these principles provide a theoretical framework within which fire planning can be modelled; that while the principles of creating and maintaining spatial and temporal variability in fire regimes to produce a patchwork of fire age mosaics is advantageous in most circumstances, it may not be achievable in the many small fragmented reserves and remnants found in the Avon Basin, and notes that these guidelines provide some tools to assess the situations where these principles can best be implemented.

## 2.2 LITERATURE REVIEW

### 2.2.1 EFFECTIVENESS OF MANAGED FIRE REGIMES

Fuel reduction fires, also known as prescribed burning, have long been used to manage fire intensity in forest areas in the southwest of Western Australia. Managing fire intensity is of particular importance at the interface of human activities, including urban, industrial and agricultural land uses where fire can be particularly damaging to human life and infrastructure. However, managing fire risk (to humans and infrastructure) by removing flammable material at an intensity and frequency may not be optimal to maintain the biodiversity components of the natural system.

There are various opinions on the effectiveness of the current regime of fuel reduction burning, including how frequently it should be conducted, if the current management requirements of 8 tons/ha of ground fuel (as per annual CoK Fire Hazard Reduction Notices) is a suitable measure of fire risk, and its effects on biodiversity including various aspects of the biota.

There are various schools of thought regarding predicting and therefore managing fire intensity, and how the fuel load that 'feeds' fire is measured. Most predictions of fuel load are based on ground fuel ('near surface' fuels including leaf litter and duff). Currently, managing fire risk is based on measuring this ground fuel with 8 tons/ha used as the level above which active management is required i.e. implementing fuel reduction burns.

Boer *et al.* (2009) postulate that a 6-year interval of prescribed fire is effective at reducing the risk of wildfire in south-western forests (in the Warren region), but also acknowledge that research is required to understand the effects of managed fire regimes on biodiversity and other environmental values.

Cruz *et al.* (2022), quoting Gould *et al.* (2007), contend that 80% of the bulk density of near-surface fuels reaches an equilibrium after an interval of 4 years, suggesting that after this period ground fuel increases and therefore increases fire intensity. However, Cruz *et al.* (2022) also acknowledge that the understorey fuel layer and fuel ladder (i.e. fibrous bark) also contribute to fire spread, transitioning a ground fire vertically into a crown fire and therefore the best predictor of fire spread is the height of understorey fuel, not ground fuel. Understorey fuel was not included in the Cruz *et al.* investigation.

Enright *et al.* (2014) note that shortened fire intervals place plants dependent on seedling recruitment for persistence at risk of local extinction, with drying climates increasing the time interval required to regenerate the soil seed storage, also noting that resprouting plant species also require seedling recruitment for persistence.

Zylstra, Bradshaw and Lindenmayer (2022) contend that regenerating forest is unlikely to burn in the 5-7 year period following fire, but is very likely to burn when understorey regrowth become taller and more dense, and less likely after a longer interval with understorey maturity ('self thinning'), with this interval between 43- and 56-years. Although this research took into consideration much of the south-western forests, the majority of the assessment appears to focus on the more southern parts of the forest, in the Southern Jarrah Forest IBRA (Interim Biogeographic Regionalisation for Australia) subregion and Warren IBRA region.

Of note, research informing the above publications was largely based in the south-west forests, which in general are in areas of higher rainfall than the Perth region. As a result, growth rates and therefore fuel build-up are likely to differ between the research areas and Kalamunda. The research was also conducted in areas of contiguous forest, which for the majority of the CoK is less relevant as most LNAs are isolated and within



the urban matrix, and smaller areas do not permit the build-up in flame height and intensity that a fire that ‘runs’ through forest areas can.

Campbell *et al.* (2022) have determined that a more spatially complex fire history reduces the probability of large wildfires. This article also identifies that there has been only one manipulative experiment published that investigated the relationship between leaf litter as ‘fuel load’ and rate of fire spread; this experiment (cited as Burrows 1999) showed no relationship between the two. Campbell *et al.* identified that understorey shrubs and tree saplings are the primary determinant of flame height, not ground fuel, and postulated that traditional Indigenous methods of small-scale burning benefit biodiversity as well as reducing the intensity and scale of wildfires.

Research by Bradshaw *et al.* (2018) indicate that, prior to European settlement, the fire frequency in the Darling Scarp Jarrah forest was 80-100 years. Bradshaw *et al.* recommend a minimum burn frequency of 12 years in Jarrah forest to permit obligate seeders to produce sufficient viable seed to persist, and a minimum interval of 15 years in kwongkan (south coast) heath. However, taking the habitat requirements of fauna species into consideration, intervals of 25-30 years in forest areas and 20-40 years (but a minimum of 12 years between fires) in Banksia woodland are considered as optimal, with mosaic fires creating a matrix of habitat types also suitable for fauna species.

Tangney *et al.* (2022) identified that fuel loads in Banksia woodlands accumulate more slowly than Eucalypt forests and woodlands, with fine (ground) fuels peaking at approximately 20 years following fire (on Bassendean sands) and understorey fuel loads in Banksia woodlands are lower than for Jarrah forests and patchy, leading to variable fire spread rates. Habitat preferences for Honey Possums and Carnaby’s Cockatoo are for Banksia woodland more than 16 years after fire.

## 2.3 IMPLICATIONS OF RECENT RESEARCH ON FIRE PROCEDURE RECOMMENDATIONS

The selected research presented above in **Section 2.2.1** suggests that current fuel reduction burning practices in Western Australia could be amended to better manage fire risk to humans and human infrastructure, while having less impact on biodiversity.

Managing the risks to humans and their infrastructure and balancing this risk with managing biodiversity is a juggling act requiring compromise. Accordingly, the following general principles are recommended in the CoK:

- conduct regular inspections of LNAs on a 3-year rotation recording ground fuel load and inspecting fire breaks
- where possible (i.e. where fuel load can be maintained within the legal constraint of <8 tons/ha) increase the planned burning interval to 10 years (if possible to 12 years) to minimise impacts on biodiversity values
- areas with contiguous forest (i.e. towards the eastern edge of the CoK) require more intensive management to maintain a lower fire risk due to the likelihood of wildfire from (or into) the surrounding forest
- wetlands should not be burnt as they have fauna and flora species that are susceptible to fire and, in the urban matrix within which they occur, do not have recolonisation opportunities
- concentrate fuel reduction efforts on managing understorey fuel loads at the interface between human assets and bushland i.e. at fencelines and property edges
- where of sufficient size, consider small-scale mosaic burns to create a more diverse array of habitat available in LNAs
- areas with significant weeds, including perennial grasses and weedy shrubs, should not be burnt as they are favoured by fire, thereby further increasing fire risk. If burnt, there should be follow-up works to remove regrowth and new germinants e.g. by herbicide use.

# 3 METHODS

## 3.1 DATASETS

Research to determine the significant features of the LNAs came from the data sources outlined below (**Table 2**), provided by the CoK in GIS format non 05/08/2022 unless noted otherwise. Not all data could be taken into consideration or was considered to provide significant information.

Data provided by the Department of Biodiversity, Conservation and Attractions (DBCA) is confidential; for this reason this document has only de-identified conservation-listed flora, fauna and ecological communities information.

**Table 2: CoK-supplied GIS datasets used in the assessment**

Dataset	File Name	Description/comment/data owner
LNAs	LNA_edit_20230202	Boundaries of LNAs (CoK data)
	LNA_vegetation_calc	Vegetation condition (CoK data)
	Priority_Matrix	LNA prioritisation from Local Biodiversity Strategy 2020, corresponds with native vegetation extent, attribute table has total scores but does not have priority value..
	LNA_viability_areas	Viability rating for each LNA (CoK data)
	NativeVegetationExtent_DPIRD_005_KAL	Native vegetation extent (CoK data)
Conservation-listed flora	FloraSearchExtracts_TPFL_RES_DBCA_KAL	Locations of conservation-listed flora in City of Kalamunda: TPFL records (DBCA data) provided 17/02/2023
	FloraSearchExtracts_WAHERB_RES_DBCA_KAL	Locations of conservation-listed flora in City of Kalamunda: WAH records (DBCA data) provided 17/02/2023
Conservation-listed fauna	FaunaSearchExtracts_RES_DBCA_KAL	Locations of conservation-listed fauna in the City of Kalamunda (DBCA data) provided 10/02/2023
TECs/PECs	TECsPECsBuffersSearchResults_RES_DBCA_KAL	Buffers of TEC/PEC (DBCA data) provided 10/02/2023
	TECsPECsSearchResults_RES_DBCA_KAL	TECs/PECs (DBCA data) provided 10/02/2023
Fire Management	FM_Burns_FPC_edit	Location of fires (planned and wildfire) 2006-2021. 5% of data has no date (CoK data)
	FM_Works_FPC_edit	Fire management works, no dates (CoK data)
	FM_Firebreaks_FPC_edit	Location of firebreaks. Incomplete attribute table. (CoK data)
	FM_WaterTank_Points_ROAM	Water Tank and gate locations (CoK data)
	BurnAchievementsPH (multiple datasets)	2011-2018 Spring & Autumn Burns by DEC/DPAW (CoK data)
Weeds	ENV_Weed_Site_20190823	2019 Weed locations. Some names missing but each record has a Weed ID (CoK data)
	ENV_Weed_Site_20220705	2022 Weed locations. Some names missing but each record has a Weed ID (CoK data)
	ENV_Weed_Survey_20190823	2019 Weed surveys, attribute table incomplete (CoK data)
	ENV_Weed_Survey_20220705	2022 Weed surveys, attribute table incomplete, most records have a Weed ID (CoK data)
	Weeds	Weed polygons, only some with density info (CoK data)

In addition, the following publicly available GIS data were used:

- *RIWI Act, Rivers (DWER-036)* (DWER 2018)
- *Hydrography Linear (Hierarchy) (DWER-031)* (DWER 2022)
- *Consanguineous Wetland Suites (DBCA-020)* (DBCA 2017).



### 3.1.1 DATA LIMITATIONS

Data provided by the City has not been ground truthed i.e. no LNA has been subject to a site assessment to determine data accuracy.

This procedure has been developed using only the provided data, supplemented by aerial imagery (Google LLC 2022) viewing and interpretation. Parts of each LNA adjacent to roads were viewed using *Google Street View*, particularly to aid vegetation type interpretation and therefore ecological community type.

DBCA conservation-listed species and ecological communities data is provided on the basis that it is confidential and used only for the purpose for which it was supplied; in this case for the development of these Fire Procedures.

Descriptions for DBCA conservation codes for flora and fauna are reproduced in **Table 9** in **Appendix One**; the conservation code descriptions for ecological communities are reproduced in **Table 10**.

Specific datasets and their limitations are discussed below.

## 3.2 KNOWN CONSERVATION-LISTED FLORA

### 3.2.1 DATA AND LIMITATIONS

DBCA data is comprised of records from two sources: specimens held in the Western Australian Herbarium (WAHERB) and locations reported to the DBCA primarily through its Threatened and Priority Flora Report Forms (TPFL in data; otherwise abbreviated to TPFRFs).

TPFL records are considered to be less reliable than WAHERB records as TPFL records rely on the recorder accurately identifying the reported species. These records do not have a vouchered specimen that can be checked for accuracy or be cross-checked for name currency in the event of taxonomic revisions.

DBCA conservation-listed species data is provided on the basis that it is confidential and used only for the purpose for which it was supplied; in this case for the development of these Fire Procedures. In order to identify if there were any 'off the record' occurrences of conservation-listed species the City contacted its Friends Groups coordinators requesting additional information. However, no additional information was provided.

DBCA flora data is point-based. On occasion, usually for newer records, population counts or estimates are included in the data, however, there is no information available regarding the area (extent) that conservation-listed flora occupy.

DBCA flora data is provided with a latitude and longitude location, with a precision as below (**Table 3**). Many records also have a 'locality' described; the detail provided is variable, however, there is frequently a mismatch between the locality as described and the point location as provided.

#### 3.2.1.1 Location Precision

DBCA data is usually provided with a location precision of between 0 and 6 (as per **Table 3**). However, on occasion the collecting information provides a greater degree of accuracy than the assigned precision e.g. northwest corner of Alpha Street and Beta Road intersection.

**Table 3: Location precision of DBCA flora records (DBCA 2019)**

Precision code	Meaning
1	Within 100 m; must be determined by GPS
2	Within 3 km
3	Within 10 km
4	Within 50 km
5	Large geographical area e.g. within a state
6	Broad e.g. New Holland, Eastern Australia or not given

### 3.2.2 METHODS

This data was extracted and intersected with the LNAs to determine known locations of conservation-listed flora within each LNA. Locations were also extrapolated to 100 m from the DBCA record location as the DBCA data is point based and not extent based. Records were cross-checked to confirm location accuracy (i.e. if the locality description matches the GIS location) and checked for land use changes since collection. DBCA records have not been groundtruthed to confirm that they are still extant thus older records are less likely to be accurate than newer records.

All DBCA records from LNAs and within 100 m were checked for accuracy. Where a collecting location was described and clearly did not match the indicated location the record was deemed to be inaccurate at that location and that species was not taken into consideration in the fire management recommendations. However, on occasion, the collecting location as described was identifiable to another LNA, or sufficiently close to be possible, and that species was taken into consideration at the re-assigned location.

Not all DBCA records of conservation-listed species from within the City were checked unless they were indicated as occurring within 100 m of a LNA. Therefore, some of the conservation-listed flora with an inaccurate location may actually occur within a LNA.

### 3.2.3 ECOLOGICAL DATA

Ecological data used to define each conservation-listed flora's response to fire and other disturbance has been gathered from a number of sources:

- collecting information attached to the DBCA record that may include comments like 'resprouting after fire', 'area burnt approximately 2 years earlier'
- within recovery plans or approved conservation advice for TF species
- other references as available.

Known ecological data for the conservation-listed flora identified as occurring in CoK LNAs are listed and referenced in **Table 13** in **Appendix Two**.

## 3.3 KNOWN CONSERVATION-LISTED FAUNA

### 3.3.1 DATA AND LIMITATIONS

Conservation-listed fauna data was provided to the CoK by the DBCA and is not guaranteed to be error-free. The provided data had a 5 km buffer applied.

Fauna data is provided with an accuracy field, similar to the location precision used for flora (**Table 3**), ranging from 30 m to 50 km, however, as for flora the collecting information ('locality', 'site') has not been checked against the location coordinates.

The DBCA does not provide detailed information regarding how the data is collected, listing only 'observation method' and 'observation type', and is also provided with a 'certainty' limitation, with much of the data described as 'not sure' or 'moderately certain', or without an attribution in this data field.

The above listed data limitations are not considered as significant for the purposes of taking these species into consideration for developing fire procedures.

### 3.3.2 METHODS

Occurrence data was extracted by intersecting the conservation-listed fauna locations with LNAs, adding a 100 m buffer.

### 3.3.3 GENERAL FAUNA ASSUMPTIONS

Most vertebrate fauna species are mobile and, for at least the larger species, have the potential to be both transient and resident in any area, and can travel between LNAs and other areas. Therefore, just because a LNA has not had conservation-listed fauna species recorded on it does not mean that it is not of interest to fauna species, conservation-listed or otherwise.

Birds, particularly larger species, may overfly any area and thus be recorded as occurring 'in' it. This does not mean that they are resident or make use of any resource within it.

In general, any area with any vegetation is likely to provide habitat value for some fauna species even if it is parkland with planted tree species. The main broad assumption used for developing fire procedures that take fauna values into consideration is that by providing suitable and variable habitat the majority of fauna suites and species are provided with the greatest opportunities for survival as possible.

Specific requirements for some of the more iconic fauna species are described below.

#### **Black Cockatoos**

Any areas with trees in the City may be of significance to Black Cockatoo species, including for resting during traverses, with larger trees also being used as 'lookouts'. Other birds and other fauna suites including reptiles (lizards), mammals (bats), invertebrates (spiders, insects) are also dependent on trees for shelter, food and breeding, thus all treed areas should be managed to maintain tree persistence.

Baudin's Cockatoo is not known to occur on the Swan Coastal Plain, however, Carnaby's Cockatoo and Forest Red-tailed Black Cockatoo do. They forage and roost on the Swan Coastal Plain but are unlikely to breed in the Perth area. All three Black Cockatoo species occur in the 'hills' where they forage, roost and breed.

Black Cockatoos forage (feed) on Proteaceous species (favouring *Banksia* and *Hakeas*), Eucalypts (favouring Marri, Jarrah and larger-fruited *Eucalyptus* species, including – for Forest Red-tailed Black Cockatoo – planted Illyarrie *Eucalyptus erythrocorys*), and Pines. They also forage in fruit and nut orchards (Department of Agriculture Water and the Environment 2022).

#### **Quenda**

Quenda appear to be well tolerant of human disturbance and persist in many unexpected (and unrecorded) small areas of native vegetation, including in 'back yards', and are considered to favour the dense vegetation common around waterways. Quenda require dense vegetation and safe refuges including hollow logs or burrows, including those created by rabbits, to escape predators, and leaf litter to construct nests under shrubs (DBCA 2018). They are omnivorous, eating plants, fungi and insects – and favour lawn beetles and (anecdotally) cockroaches. Therefore, providing some areas of dense shrubs and hollow logs has potential to be of use to Quenda.

#### **Chuditch**

Chuditch are nocturnal and secretive, ranging widely particularly when the young are dispersing. They have been recorded recently from the 'hills' but are less likely to occur on the Swan Coastal Plain. However, providing habitat for Quenda also meet the requirements of habitat for Chuditch, particularly if hollow logs and dense vegetation are present.

### 3.4 KNOWN CONSERVATION-LISTED ECOLOGICAL COMMUNITIES

#### 3.4.1 DATA AND LIMITATIONS

DBCA ecological communities data was reviewed to identify LNAs that intersect with Threatened and Priority Ecological Communities (TECs and PECs).

Eleven Western Australian-listed TECs and one Western Australian PEC have been identified as occurring within the CoK. The buffers of eight of these TECs and the PEC have been mapped as intersecting LNAs. These ecological communities are listed in **Section 0** and described in more detail in **Appendix Four**.

Identified data limitations are:

- as the data is provided with applied buffers (500 m for TECs and 200 m for the PEC) it is generally not possible to determine the actual location of the ecological community, particularly where multiple occurrences have been mapped within the one buffered area
- many of the mapped occurrences have since been cleared and not removed from the DBCA data
- many of the mapped occurrences are from older site assessments and, even if the vegetation is still present, may no longer resemble what was present at the time of assessment including now being in a significantly more degraded condition. Vegetation assessed as being in Degraded or Completely Degraded condition (according to the scale used in current flora and vegetation surveys (EPA 2016) not being considered to represent extant native vegetation i.e. the vegetation needs to be in Good or better condition to be representative of conservation-listed ecological communities.
- the Banksia Woodlands TEC data has been sourced in a number of ways including via point location data (i.e. a floristic quadrat recorded during a flora and vegetation survey) that does not include vegetation type mapping (thus extent of similar vegetation) or extent of bushland remnant, or has been indicatively included in the data due to desktop mapping of pre-European vegetation associations or land systems intersecting apparent native vegetation extents (TSSC 2016) but not ground truthed in any way. This TEC has detailed assessment methodology (see below and **Appendix Four**).

**Appendix Four** summarises available information used to describe the conservation-listed ecological communities that have been assessed as intersecting LNAs.

#### Banksia Woodlands TEC

The endangered *Banksia Woodlands of the Swan Coastal Plain* TEC ('Banksia Woodlands TEC') is listed for protection under the Commonwealth EPBC Act and has detailed methodology for assessment and detailed descriptive, condition and extent criteria to determine representation (TSSC 2016), summarised in **Appendix Four**. In Western Australia it is sometimes listed as a P3 PEC.

However, the provided DBCA data (i.e. mapped extents) have largely not been ground truthed and frequently have been assigned from a point location (i.e. recorded quadrat) without taking into consideration the condition and, more importantly, the extent of contiguous vegetation. Additionally, it is likely that some of the provided points considered as this TEC would be more accurately assigned to other Western Australian-listed TECs, some of which are listed in the CoK data (specifically, one of the SCP20-group).

#### 3.4.2 METHODS

Occurrence data was extracted by intersecting the conservation-listed ecological communities buffers with LNAs.

### 3.5 WETLANDS AND WATERWAYS

#### 3.5.1 DATA AND LIMITATIONS

Locations of registered wetlands and waterways were identified using the following Landgate spatial data:

- *RIWI Act, Rivers (DWER-036)* (DWER 2018)

- *Hydrography Linear (Hierarchy) (DWER-031) (DWER 2022)*
- *Consanguineous Wetland Suites (DBCA-020) (DBCA 2017).*

Wetlands are broadly mapped, and in most cases cover broad wetland suites rather than individual wetlands or damplands. Aerial imagery as above was used to identify actual edges of wetlands and damplands.

### 3.5.2 METHODS

LNA GIS data were intersected with mapped rivers (DWER 2018) and minor waterways (DWER 2022) to determine if any significant watercourses intersected them, and DBCA's (2017) wetland mapping to determine if the LNA intersected any Swan Coastal Plain wetlands and their conservation status.

The LNAs were also viewed using Google Earth (Google LLC 2022) imagery (aerial and Street View) and imagery available on the *Shared Land Information Platform (SLIP)* (Landgate 2023) to determine if:

- there were any manmade (artificial) wetlands (lakes) or waterways (drains)
- there was any riparian or wetland-fringing vegetation present.

### Wetland Categories

The conservation status of wetlands on the Swan Coastal Plain are categorised into three levels of conservation protection (Hill *et al.* 1996):

- Conservation Category Wetlands (CCW) are wetlands with significant conservation value; these are classed as Environmentally Sensitive Areas and clearing of native vegetation within 50 m of the edge of the wetland is not permitted
- Resource Enhancement Wetlands (REW) are wetlands that have some conservation values, however, require management. Clearing may be permitted in these areas if it can be demonstrated that there are unlikely to be any negative effects on the wetland as a result of the works.
- Multiple Use Wetlands (MUW) are wetlands with little conservation value and can be developed or used in multiple ways including for urban development and grazing.

## 3.6 FIRE MANAGEMENT

### 3.6.1 DATA, METHODS AND LIMITATIONS

The various CoK fire management datasets were joined to identify burning history and other management activities conducted on each LNA. The CoK spatial data outlined dates of the burns (both wildfire and managed fuel reduction) and their intensity, and where they occurred.

The following limitations were noted in the CoK data:

- management activities (e.g. grass slashing, weed control) were not dated so it was not possible to understand the frequency of these activities
- there were almost no inspection dates or documentation of results including fuel load and fire break trafficability or effectiveness, nor any other notes regarding potential fire risks e.g. presence of dense grass weeds that may trigger more frequent or changes to management activities
- a number of fuel reduction burns were listed as 'planned' but there was no indication if (or when) they were done
- apparent DBCA burns that abutted or encroached into LNAs were largely not documented.

Spatial data was used to identify where burns had not been conducted and were recommended, where burns had been conducted and (subject to fuel load assessment) when they are next recommended.

### 3.7 WEEDS AND VEGETATION CONDITION

#### 3.7.1 DATA, METHODS AND LIMITATIONS

Weed data was amalgamated from the various datasets (**Table 2**), however, no background information including data collection methods was made available. It was not possible to determine if there were significant weed populations (species or density) on most LNAs.

However, all LNAs had been assessed for vegetation condition. In terms of identifying if LNAs are suitable for fuel reduction burns (as many weed species are advantaged by fire, including by encouraging seed germination), vegetation condition was used as a surrogate for weediness as this is the most common feature leading to poor vegetation condition.

Some vegetation condition assessments appear to be inaccurate based on aerial imagery and Street View (particularly in LNA190).

### 3.8 HIGH PRIORITY VEGETATION

The City identified the following high priority vegetation communities with fire sensitive species:

1. Granite rock communities.
2. Heath communities.
3. Banksia woodland communities, many of which are also significant as conservation-listed ecological communities. These communities have many fire-sensitive species, including the characteristic Banksias, that require infrequent fire intervals to permit mature trees to set seed, as well as being susceptible to weed invasion exacerbated by inappropriate fire regimes.
4. Wetlands that include flora species susceptible to inappropriate seasons and intensity of fires and fauna species that are unable to escape fires at any time, particularly frogs.
5. Habitats for hollow-dependent fauna including Black Cockatoos.

While not possible to determine where a 'high value' representative occurred, the following methods were used to identify where the feature may occur (**Table 4**).

**Table 4: High priority vegetation identification**

High Priority Vegetation	How they were identified
<b>Granite rock communities</b>	Generally, these were considered as the equivalent of the <i>Central Northern Darling Scarp Granite Shrubland Community</i> PEC. On aerial imagery these can be identified (on the Darling Scarp and eastwards) by their smooth texture and frequent proximity to granite outcrop.
<b>Heath communities</b>	Heath is a low shrubland, generally considered to occur on sandplain i.e. on the Swan Coastal Plain. Similar to granite rock communities the digital signature is a smooth texture. None were identified from CoK LNAs.
<b>Banksia woodland communities</b>	These were considered to be the equivalent of the Banksia Woodlands TEC and SCP20-group TECs.
<b>Wetlands</b>	Wetlands were identified from the consanguineous wetlands suite mapping (DBCA 2017), with their actual extents identified from aerial imagery by their smooth texture (e.g. LNA084). Other wetlands were identified through aerial imagery and notes in the LNA GIS data.
<b>Black Cockatoo tree habitat</b>	Black Cockatoos require trees for breeding (hollows) and roosting, as well as trees for day rests and lookouts. Suitable habitat was not specifically identified during the development of this procedure, rather all areas with trees were considered of significance as potential Black Cockatoo habitat.

Note that vegetation types occurring within LNAs have not been described within the City's data.

### 3.9 STAKEHOLDER CONSULTATION

Stakeholder consultation was managed by the CoK and included a Friends Groups coordinators meeting on 16 February 2023. Following this meeting, the CoK contacted Friends Groups coordinators, few of which attended, to identify any significant values of their LNAs or interest that would not be available within the

supplied data. Only one response was received, identifying two LNAs that had recent tubestock plantings that were taken into consideration when developing management procedures.

### **3.10 CONFERENCE ATTENDANCE**

The following were attended as an aid to researching current developments in fire management:

- Nature Reserves Preservation Group Annual General Meeting featuring a presentation by Dr Phil Zylstra *Prescribed burning in the southwest: evidence to date* (22 March 2023)
- Fire and Biodiversity WA *Fire and Air Forum: Biodiversity, Environmental Sustainability and Human Health* (8 May 2023).



## 4 RESULTS SUMMARIES

### 4.1 KNOWN CONSERVATION-LISTED FLORA

Fifty-six conservation-listed flora species have been recorded within the City. Two of these have been only reported to DBCA via TPFs (generally considered not reliable data), however, as both are distinctive orchid species they are unlikely to have been misidentified.

Twenty-three conservation-listed flora species have been recorded from at least one LNA or from within 100 m of an LNA.

Thirty-two LNAs have records of conservation-listed flora from within them or within 100 m. Of these, 18 have TF species, eight have at least one PF species and six have both TF and PF.

Conservation-listed flora are listed in **Table 11**; the LNAs they occur in are listed in **Table 12**.

### 4.2 KNOWN CONSERVATION-LISTED FAUNA

Forty conservation-listed fauna species have been recorded from within the CoK (**Table 14** in **Appendix Three**), consisting of:

- 20 birds; 11 of them migratory species which, if they occur in LNAs, would likely to be transient or overflying only
- nine mammals
- five reptiles
- six invertebrates.

Fifteen conservation-listed fauna species have been recorded from within the CoK LNAs (or within 100 m of them; **Table 5**), however, at least three of these are considered to be locally extinct:

- Numbat; which was last sighted in the Jarrah forest in 1985 (Department of Parks and Wildlife 2017)
- Quokka; which are now distributed in isolated patches in the Northern Jarrah Forest IBRA subregion (none from the CoK); none are known from the Swan Coastal Plain in the vicinity of Perth (Department of Environment and Conservation 2013a)
- Woylie; has only four remaining indigenous mainland populations, none near Perth (Yeatman & Groom 2012).

Other species that are unlikely to occur in all or part of the CoK include:

- Chuditch, which are only likely to occur in areas with contiguous bushland or with well-vegetated corridors connecting large areas of bushland. They are unlikely to occur in LNAs on the Swan Coastal Plain west of the Darling Scarp due to the fragmented nature of bushland and large human presence.
- Black-striped Snake; this species has only three records from the CoK and only one in the last 50 years, the location of which is only accurate to within 50 km. As such it is unlikely to occur.
- Western Brush Wallaby; all recent records of this species are from forest areas where it is likely to persist in small numbers and be seen on occasion. However, it is unlikely to occur on the Swan Coastal Plain where the most recent record is from 1967, as it requires contiguous bushland.
- South-western Brush-tailed Phascogale; all records are from the forest area. It is unlikely to be present on the Swan Coastal Plain.



**Table 5: Conservation-listed fauna species recorded from within the CoK (DBCA data)**

Scientific Name	Common Name	WA Conservation Status	EPBC status
<i>Acanthophis antarcticus</i>	Southern Death Adder	P3	
<i>Bettongia penicillata ogilbyi</i>	Woylie, Brush-tailed Bettong	Threatened - Critically endangered	EN
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black Cockatoo	Threatened - Vulnerable	VU
<i>Dasyurus geoffroi</i>	Chuditch, Western Quoll	Threatened - Vulnerable	VU
<i>Hydromys chrysogaster</i>	Water-rat, Rakali	P4	
<i>Idiosoma sigillatum</i>	Swan Coastal Plain Shield-backed Trapdoor Spider	P3	
<i>Isodon fusciventer</i>	Quenda, Southwestern Brown Bandicoot	P4	
<i>Myrmecobius fasciatus</i>	Numbat, Walpurti	Threatened - Endangered	EN
<i>Neelaps calonotos</i>	Black-striped Snake, Black-striped Burrowing Snake	P3	
<i>Notamacropus irma</i>	Western Brush Wallaby	P4	
<i>Phascogale tapoatafa wambenger</i>	South-western Brush-tailed Phascogale, Wambenger	Specially Protected - conservation dependent	
<i>Setonix brachyurus</i>	Quokka	Threatened - Vulnerable	VU
<i>Tringa nebularia</i>	Common Greenshank	Specially Protected - migratory	MI
<i>Zanda baudinii</i>	Baudin's Cockatoo	Threatened - Endangered	EN
<i>Zanda latirostris</i>	Carnaby's Cockatoo	Threatened - Endangered	EN

### 4.3 KNOWN CONSERVATION-LISTED ECOLOGICAL COMMUNITIES

The following eight TECs and one PEC have been identified from the CoK within the provided data and intersect (or their buffers intersect) LNAs:

- *Banksia Woodlands of the Swan Coastal Plain*; EPBC-listed endangered TEC/Western Australian-listed PEC
- SCP3-group of TECs:
  - *Corymbia calophylla - Kingia australis woodlands on heavy soils, Swan Coastal Plain (SCP3a)*; EPBC-listed endangered/Western Australian-listed critically endangered TEC
  - *Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands, Swan Coastal Plain (SCP3c)*; EPBC-listed endangered/Western Australian-listed critically endangered TEC
- SCP20-group of TECs:
  - *Banksia attenuata woodland over species rich dense shrublands (SCP20a)*; Western Australian-listed endangered TEC
  - *Banksia attenuata and/or Eucalyptus marginata woodlands of the eastern side of the Swan Coastal Plain (SCP20b)*; Western Australian-listed endangered TEC
  - *Shrublands and woodlands of the eastern side of the Swan Coastal Plain (SCP20c)*, Western Australian-listed critically endangered TEC
- *Southern wet shrublands, Swan Coastal Plain (floristic community type 2 as originally described in Gibson et al. (1994)) (FCT02)*; Western Australian-listed endangered TEC
- *Shrublands on dry clay flats (floristic community type 10a as originally described in Gibson et al. (1994)) (SCP10a)*; Western Australia-listed endangered TEC that is part of the EPBC-listed *Clay Pans of the Swan Coastal Plain* critically endangered TEC
- *Central Northern Darling Scarp Granite Shrubland Community*; Western Australian-listed PEC.

More detailed descriptions for these ecological communities are in **Appendix Four**.

The following TECs and PECs have been identified from the DBCA data but do not intersect any LNAs:

- *Shrublands and woodlands on Muchea Limestone of the Swan Coastal Plain*; EPBC-listed endangered/Western Australian-listed endangered TEC

- *Herb rich saline shrublands in clay pans (floristic community type 7 as originally described in Gibson et al. (1994))* (FCT07); Western Australia-listed vulnerable TEC that is part of the EPBC-listed *Clay Pans of the Swan Coastal Plain* critically endangered TEC
- *Herb rich shrublands in clay pans (floristic community type 8 as originally described in Gibson et al. (1994))* (FCT08); Western Australia-listed vulnerable TEC that is part of the EPBC-listed *Clay Pans of the Swan Coastal Plain* critically endangered TEC.

The *Shrublands on dry clay flats (floristic community type 10a as originally described in Gibson et al. (1994))* (SCP10a) Western Australia TEC (within or buffers intersecting LNAs) and *Herb rich saline shrublands in clay pans (floristic community type 7 as originally described in Gibson et al. (1994))* (FCT07) and *Herb rich shrublands in clay pans (floristic community type 8 as originally described in Gibson et al. (1994))* (FCT08) Western Australian-listed TECs (neither intersecting the LNAs) are combined into the *Clay pans of the Swan Coastal Plain* EPBC-listed critically endangered TEC (Department of Sustainability, Environment, Water, Population and Communities 2012).

#### 4.4 HIGH PRIORITY VEGETATION

The following high priority vegetation communities with fire sensitive species have been identified as occurring within the City:

- granite rock communities
- heath communities
- Banksia woodland communities, many of which are also significant as conservation-listed ecological communities. These communities have many fire-sensitive species, including the characteristic Banksias, that require infrequent fire intervals to permit mature trees to set seed, as well as being susceptible to weed invasion exacerbated by inappropriate fire regimes.
- wetlands that include flora species susceptible to inappropriate seasons and intensity of fires and fauna species that are unable to escape fires at any time, particularly frogs
- habitats for hollow-dependent fauna including Black Cockatoos.

**Table 6** lists how these high priority vegetation types are taken into consideration.

**Table 6: High priority vegetation fire management recommendations**

High Priority Vegetation	How they were identified
<b>Granite rock communities</b>	Fuel reduction burning is not recommended in these communities (e.g. LNA086).
<b>Heath communities</b>	None were identified from CoK LNAs.
<b>Banksia woodland communities</b>	These were considered to be the equivalent of the Banksia Woodlands TEC and SCP20-group TECs.
<b>Wetlands</b>	Burning is not recommended in wetlands due to the presence fire sensitive fauna species.
<b>Black Cockatoo tree habitat</b>	General recommendations include not burning large trees (alive or dead).

## 5 DISCUSSION

Fire management is conducted to manage the risks to biodiversity and humans and their assets. The main methods used to manage fire risk are the creation and maintenance of fire breaks and the management of fuel load. Fuel load management can be accomplished in a number of ways including:

- slashing low-growing grassy areas to lower the height of vegetation – this is most successful when conducted after flowering culms have developed but prior to seed set (i.e. spring)
- 'burning off', also known as prescribed, fuel reduction or managed burning – this can be large or small-scale in size and conducted at various times to achieve biodiversity management targets
- targeted use of herbicides to prevent plant growth (and therefore reducing fuel load) in selected areas including along edges/firebreaks or (using wetland-friendly products) in wetlands or along waterways (e.g. to control *Watsonia*)
- forest mulcher which knocks down (**Image 1**) and incorporates the lower-growing plant strata and small trees into the soil (**Image 2**). The main disadvantages of this method are cost, the risk of spreading soil-borne disease, that it can lead to a proliferation of disturbance opportunist species including dense stands of Marri and Prickly Moses, and that it can create suitable soil for establishment and/or increases in weed cover. The main advantage is that it doesn't create smoke which can be a nuisance and health hazard so could be more suited to sites close to housing. It is not recommended as part of this Procedure but should be considered.
- manual removal of above ground biomass including standing dead shrubs, and removal of living biomass that forms above-ground fuel (understorey shrubs, saplings). This method of fuel reduction is time consuming and (if requiring paid labour) expensive, and also requires either removal of, or preferably, onsite mulching of plant material that can be used to smother weeds. Manual removal is only recommended within this Procedure for LNA edges adjacent to human infrastructure (i.e. fences) as a means to reduce fire risk without significantly affecting fauna habitat in the interior of LNAs.



**Image 1: Forest mulcher**



**Image 2: Soil after mulching**

However, every area and every LNA has its own attributes and values, as well as its own risk profile including:

- proximity to human assets (homes, businesses, agricultural land, public facilities, roads) and human life
- biological assets including flora, fauna and vegetation, both common and uncommon
- fuel load which can increase or decrease the risk to biological and human assets
- safety of personnel conducting fire risk mitigation activities including steep slopes and lack of access.

At times managing fire risk is not compatible with the aim of preserving the biodiversity values within an LNA, including:

- many fauna species (e.g. Quenda, Chuditch) require shrub cover for shelter and breeding; such shrubs contribute significantly to the above-ground fuel load
- the shrubs that germinate following fire are frequently the attractive 'wildflowers', however, they are also frequently short-lived and in the following years contribute significantly to the above-ground fuel load (e.g. Prickly Moses *Acacia pulchella*)
- dense shrubs are flammable and can form a corridor for fire, however, these linear corridors are also important for fauna movement
- leaf litter, used to calculate the current requirement for management when it exceeds 8 tons/ha, is habitat for a large array of fauna species including invertebrates, reptiles and ground-foraging birds and mammals, as well as supporting other trophic groups including fungi and lichens, and ultimately forming part of the nutrient cycle that feeds plants
- fallen logs add to the above-ground fuel load and may burn for a significant period thus causing fire re-ignition. However, fallen logs are also habitat for animals and non-vascular plants (fungi, moss, lichens), and ultimately break down to as part of the nutrient cycle.
- large dead trees when they burn can produce a funnel that fountains sparks, can burn for a significant time potentially causing fire re-ignition, and may be unsafe for humans as they can fall unexpectedly. However, while still standing they are significant as fauna habitat, including potentially for Black Cockatoos. However, as a standing dead tree they are not a fire risk on their own, except possibly when they are 'lightning rods'.

In order to balance fire risk and maintain as much biodiversity as possible, these fire procedures recommend adopting the following concepts:

1. LNA bushland that is contiguous with the forest area from whence fires are likely to occur (or spread into) require more management than isolated and smaller LNAs. The recommended management is more intense (more frequent fuel reduction burns are recommended). Due to the larger scale of the contiguous bushland the effects on biodiversity are likely to be lower.
2. Where there are no or few natural biological attributes, manage the LNA for fuel load and human safety, taking into consideration:
  - a) minimising ground disturbance particularly if the LNA is associated with a riparian area or drainage sump
  - b) minimising ground disturbance to limit increasing weed growth (thus fire hazard)
  - c) if there is above-ground fuel (shrubs) close to fences
  - d) the slope of the land as fire travels faster upslope.
3. In areas where there are potentially significant human safety risks (e.g. steep slopes, significant distances between access points, restricted water supply, very high fuel loads) proactive management may not be achieved safely. In these cases, generally on the Darling Scarp, reactive management (i.e. wildfire suppression) may be the only possible management method.
4. Where there are some natural biological attributes, primarily manage the LNA for fuel load and human safety, taking into consideration:
  - a) where possible prevent large standing-dead and living trees from burning
  - b) protecting fallen logs
  - c) ensuring boundaries with human infrastructure are maintained as a lower risk area (i.e. removal of biomass adjacent to fences, creating low-growing or largely clear edges).
5. Significant biological assets should be managed as a priority, taking into consideration:
  - a) previous burning history, with the aim of managing fire frequency, seasonality and intensity to best preserve the flora and fauna species and vegetation types or habitat present
  - b) the life cycle of flora species
  - c) fauna habitat requirements.

6. Some LNA do not have natural vegetation, including where 'parkland cleared'. These may still have biodiversity value in their role as fauna habitat (particularly birds) and to protect waterways, and we cannot discount the value to human as public open spaces.



# 6 MANAGEMENT RECOMMENDATIONS

## 6.1 GENERAL MANAGEMENT RECOMMENDATIONS

The following recommendations take into consideration fauna habitat as it is assumed that ALL areas of native vegetation in the City of Kalamunda:

- potentially have resources for Black Cockatoos (foraging, nesting, roosting or resting) regardless of if the birds have been recorded from an LNA or not
- frequently have resources for Quenda that are documented as requiring dense vegetation but persist in some urban environments.

General management recommendations:

- document all activities including inspections and actions, including date
- inspect ground fuel load every 7 years over all bushland LNAs or in response to public enquiry
- if, as noted during inspections or observed opportunistically, ground fuel load is >8 tons/ha (or close to this) plan burnoffs as this is a legal requirement for land managers, however, if fuel loads are less extend the burning interval to 10-12 years (or longer) where possible
- keep records of actual burn-offs
- prioritise areas with higher fuel loads adjacent to human infrastructure over areas with lower fuel loads and/or that do not have a human interface. Consider creating a shrub-free break rather than ground-disturbing firebreak.
- autumn burns are generally preferable to spring burns in terms of impact on many significant flora species and to avoid breeding periods of many fauna species, however, given the small windows of burning opportunity it may not be possible to accommodate this as a preference. If previous fires were in autumn plan a spring burn if the same area requires management (and *vice versa*). Additionally, conducting fuel reduction burns at differing times provides opportunities for different biodiversity outcomes.
- Perennial Veldt Grass and Haas Grass can be controlled using fire. However, control requires a hot burn (to reduce the soil seed store) prior to seed set and follow-up herbicides to control the resprouting plants. However, the required conditions and sequence are difficult to attain. Therefore, slashing prior to seed set is recommended although opportunistic control by herbicide application in autumn after planned or unplanned fire is suggested. (Bettink 2009).
- African Love Grass requires similar control therefore recommendations are the same – consider slashing prior to seed set
- consider other methods to control fuel loads.

Season:

- fire is a naturally-occurring phenomenon that was present in the landscape before human occupation, noting that the natural frequency of burning from lightning fires prior to first nations occupation is unknown, and estimated to be at approximately 80-100 year intervals prior to European occupation (Bradshaw *et al.* 2018)
- on the whole plant's reproductive strategies have evolved based on natural fire regimes with changes to fire regimes altering species composition. Generally, in the Perth area, thunderstorms that ignite bushfires are more likely during the summer period (dry lightning), however, mimicking this regime is not feasible.
- overall, autumn burns have a lower impact on biodiversity as fewer plants are flowering thus seed production is not affected, and fauna species are largely not breeding thus reducing potential impacts as mature animals are more able to move away from fire fronts and potentially move to areas where food is available
- varying seasons of burning may provide different biodiversity outcomes as a result of different plant's responses.

General recommendations for fuel reduction burns (controlled burns):

- clean footwear, equipment and (if use cannot be avoided) vehicles before entering each reserve to minimise the risk of spreading dieback – particularly if moving between LNAs. Dieback kills some plants and reduces habitat quality for fauna. The dieback fungus is favoured by burning as more sunlight reaches the soil surface, warming it.
- avoid burning large standing-dead Eucalypt trees as they are significant for fauna (noting if they are burnt they should be assessed for human safety and dropped if necessary – but do not remove when fallen). These may provide nests (present or future) or shelter for birds, bats, reptiles, and provide ‘lookouts’. This is particularly important for Black Cockatoo species.
- avoid burning fallen logs as these provide habitat for fauna and perform an important role for other trophic groups including fungi, mosses, lichens, liverworts and invertebrates, and ultimately vascular plants through soil nutrients. Large hollow logs provide habitat/shelter for small mammals and reptiles. They break down slowly and provide resources for different fungi at different stages of wood decay. Termites are also associated with wood decay – these provide food for some lizards, as well as echidnas and potentially other small mammals or birds. Alates (winged, sexual forms of colonial insects including ants and termites) are a seasonal, high protein food source for numerous birds including Magpies.
- consider burning in small-scale mosaics in areas of Good or better condition only. Carefully consider small-scale mosaic burns in weedy areas as burning generally encourages weeds.
- consider non-burning methods to manage above ground fuel load including manual removal of shrubs adjacent to properties, removal of standing dead shrubs (larger standing dead trees should not be removed as they provide fauna habitat) and slashing of long grass. Consider that woody weeds may be (or become) a fire risk. Consider manual removal if possible (prior to seed set), including removal of biomass.

Avoid planned burns:

- in wetlands and damplands, regardless of ground fuel load. Many wetlands do not have standing water all year (i.e. are damplands) and are highly flammable during summer and autumn. In these areas:
  - consider manual methods to reduce fuel load (removal of dead shrubs, thinning of shrubs to reduce leaf fall, slashing/whipper snipping of sedges/rushes and removal of cut material)
  - avoid herbicides but if necessary to control weeds like *Watsonia* use only wetland-friendly herbicides (e.g. Roundup Biactive or equivalent). Do not use herbicides that are not wetland-friendly as they can be fatal for frogs and other aquatic life.
  - wetlands and damplands provide habitat for suites of fauna and flora species that are not found elsewhere. Fauna (particularly frogs) are highly susceptible to fire, as are some flora species.
- along waterways as they tend to be narrow and have a large edge vulnerable to weed invasion, bare soil is more prone to erosion and sediment and nutrients released by burning and erosion may impact water quality downstream, weeds are frequently favoured by fires and (particularly in more intact environments) there may be fauna present that require dense cover (e.g. Quenda) or damp soil (frogs, invertebrates).
  - consider other methods to control fuel load/fire risk (manual removal or targeted herbicides only if necessary). *Watsonia*, which is highly flammable in summer and burning is known to promote flowering, can be controlled by herbicide application, preferably in September just as flower spikes emerge which is when the corms are exhausted (Brown *et al.* 2008). Wetland-friendly herbicide must be used for this and other plants in creeklines and wetlands.
  - slash long grass/weeds in disturbed areas adjacent to creeklines, particularly adjacent to human infrastructure
  - creeklines frequently provide a corridor for uncontrolled fire to move along so it is important to manage the fuel load. However, they also provide wildlife corridors, therefore the recommendation is to manage (remove) weeds within the waterway/riparian area and manage fuel load in adjacent areas.

General information and rationale:

- research indicates that fuel loads in Jarrah forest increases until approximately 22 years following fire suggesting that long intervals, which mimic natural (pre-European) conditions, may be beneficial for



reducing fuel load and therefore reducing fire severity. However, land managers are constrained by legal requirements so small-scale burns around edges (unless weedy, as weeds are frequently favoured by burning) could be an option to assist with the fuel load requirement.

- the City of Kalamunda currently plans for areas of bushland to never be intentionally burned. These areas occur within large parcels of bushland where mitigation measures can occur around them and achieve a satisfactory risk profile, and are planned to achieve a mosaic of mitigation ages around the never to be intentionally burned area.
- orchids are particularly of interest to wildflower enthusiasts – and their flowering is frequently in response to fire. However, their corms are often close to the surface and seeds are small and easily killed therefore fire season and intensity are significant to their survival and flowering. In general, do not burn when above ground parts are visible. If the species present have known fire response and ecology, plan burning appropriately, however, as a general rule autumn burns (prior to leaves appearing) would be more appropriate than spring burns. Hot fires, required by some species, are difficult to safely manage so are not recommended. Note: some species have leaves present at most times.
- mosaic burns at different frequencies and intensities maintain seral diversity. However, unless required where the fuel load exceeds 8 tons/ha, avoid burning areas at less than 10-12 year frequency to permit seed stores and plant biomass (particularly for resprouter species) to accumulate. Small-scale burn-offs may suit this purpose and be achievable in smaller LNAs e.g. burning 50 m x 50 m areas, using (clean) hand tools to produce small-scale fire breaks (30 cm is usually sufficient for a cool fire; **Image 3**) with observers to monitor and contain breakouts. Do not mosaic burn near edges as this could encourage weeds to colonise into bushland.



**Image 3: Raked small break c30 cm-wide in cool, small-scale mosaic fire**



## City data management:

- data quality is variable and in some cases inaccurate or of poor quality. Identified issues include lack of accurate street addresses, lack of metadata including how data collected (including supporting literature) thus reducing usefulness (e.g. weed data), lack of dates of activities.
- ensure fire data is entered and is accurate per LNA
- ensure management activities including dates are entered in data e.g. slashing, firebreak maintenance
- set up fuel load/firebreak trafficability inspection schedule and maintain records including:
  - date of recording
  - estimated ground fuel (leaf litter)
  - observation of above ground fuel (dead open fuel – not including fallen logs)
  - above ground fuel at property interface/edges
  - evidence of fire since last inspection
  - fire break trafficability
  - identification of additional maintenance activities required.

## 6.2 SPECIFIC RECOMMENDATIONS AND EXPLANATIONS

Seventeen specific recommendations have been made as part of this Procedure, listed for each LNA in **Table 16**. Explanations and rationale follow in **Table 7**.

**Table 7: Specific recommendations and explanations**

Recommendation	Explanation	Rationale
<b>CoK</b>		
<b>Recommendation 1</b>	<p><b>Documentation:</b> Document all activities relevant to fire management including date of activities and mapping where appropriate. Relevant activities include inspections, fuel reduction burns (including recording fire intensity), wildfire, adjacent DBCA burns, slashing/mowing, weed control (herbicide or other method).</p>	<p>Up to date and accurate documentation aids planning of future fuel reduction activities.</p>
<b>Recommendation 2:</b>	<p><b>Inspection intervals:</b> Set up a regular inspection cycle for all LNAs (recommended as 3-yearly). Inspections should include assessing and recording fuel loads or other observations that affect flammability and thus fire risk (e.g. occurrence of dense vegetation adjacent to fences) and fuel management requirements, state of and trafficability of fire breaks, condition of gates and access, water supply and date of the inspection.</p>	<p>A regular inspection interval assists with identifying and planning for future activities including firebreak maintenance and planned fuel reduction burns. Regular inspections and documentation may also identify activities that need to be conducted more regularly or can be conducted more frequently.</p> <p>High-risk LNAs may require more frequent inspection i.e. LNAs that are large and contiguous with large tracks of bushland. These LNAs are more likely to be burnt during wildfires, which may spread into adjacent urban or semi-rural (or agricultural) areas, or be the source of fire that spreads. Managing bushfire risk in these areas is a City obligation, and identifying risks as early as possible can assist with planning mitigating activities.</p>
<b>Recommendation 3:</b>	<p><b>Maintain firebreaks, edges, interface:</b> Firebreaks should be maintained as mineral earth in high risk areas, including where access is required, and as low vegetation/low fuel load in lower-risk and smaller LNAs including adjacent to fencelines in urban areas.</p>	<p>Firebreaks are essential for access to LNAs although in reality they are rarely responsible for 'breaking' a hot, running fire. Mineral earth firebreaks in larger LNAs are essential to maintain access and provide a fuel-free zone of retreat for firefighters.</p> <p>However, smaller LNAs may not require a mineral earth break as any unplanned fire is unlikely to build to sufficient intensity where it cannot be managed. For smaller LNAs, particularly those for which fuel reduction burns are not recommended, removal of above ground biomass along the edges and most importantly next to fences, adjacent to infrastructure including houses or commercial properties, would significantly reduce the fire risk to these properties, meanwhile not affecting the interior of the LNA, allowing it to retain its biodiversity values.</p> <p>Mid-sized LNAs should be inspected and assessed for their risk of developing a fire of sufficient intensity to cause damage to human property and the interface managed appropriately by removal of biomass, creating or maintaining firebreaks along the edges, or accepting current fire risk.</p>

Recommendation	Explanation	Rationale
<b>Recommendation 4:</b>	<p><b>Control perennial grass:</b> Slash perennial grasses in weedy areas, removing biomass where possible. Managed LNAs have grass mown as part of regular maintenance.</p>	<p>LNAs with significant grassy weeds or little native vegetation, including managed parkland areas, should be slashed or mowed to reduce the above-ground fuel load and therefore fire risk. Slashing around the edges of LNAs may be suitable to avoid affecting the biodiversity value of the interior area.</p>
<b>Recommendation 5</b>	<p><b>Waterway and wetland weed management:</b> Manage weeds in wetlands and along waterways, including <i>Watsonia</i> species that are highly flammable when dry.</p>	<p>Dense vegetation associated with wetland edges and along waterways (creeks) may be important habitat for species like Quenda and used by more generalist fauna species as a corridor for movement through the landscape.</p> <p>However, weeds including <i>Watsonia</i>, perennial grasses and some shrubs (including Brazilian Pepper <i>Schinus terebinthifolius</i> and Coastal Teatree <i>Leptospermum laevigatum</i>) can be a significant fire risk on wetland fringes and along waterways and should be removed to reduce fire risk if possible.</p> <p>Where used, herbicides should be wetland-friendly to avoid impacts to aquatic life in the vicinity and downstream.</p>
<b>Recommendation 6:</b>	<p><b>No fuel reduction burns.</b> Fuel reduction burns are not always the best method to manage fire risk. Other methods are recommended in this LNA.</p>	<p>Do not conduct fuel reduction burning over an entire LNA.</p> <p>No fuel reduction burns: fuel reduction burning is not recommended. Management is recommended to be by means other than prescribed burning (see Recommendation 4, 5, 10, 11).</p> <p>Fuel reduction burns not recommended: only conduct fuel reduction burns if there are no other suitable methods to reduce ground fuel loads when these have exceeded 8 tons/ha. However, small-scale mosaic burns, rather than large-scale burning of entire or significant portions of the LNA, may be suitable to create a mosaic of fire ages (biodiversity fires). These small-scale burns are labour intensive and would require training to manage safely (see Recommendation 18).</p>
<b>Recommendation 7</b>	<p><b>Fuel reduction or biodiversity burns recommended.</b> Fuel reduction burns are recommended as being appropriate in this LNA.</p>	<p>Fuel reduction/biodiversity burns are recommended in some LNAs that are either significant in terms of potential risks to human safety or have not been recently burnt thus targeted burns are recommended for biodiversity purposes.</p> <p>In general, however, fuel reduction burns should not be conducted unless the fuel load exceeds 8 tons/ha unless the LNA has an important role in reducing the fire risk in other areas.</p> <p>LNAs with wetlands, or in wetland sections of LNAs are not recommended for fuel reduction burning due to the risk of damaging or killing fire sensitive flora and fauna, including amphibians.</p>

Recommendation	Explanation	Rationale
<p><b>Recommendation 8</b></p>	<p><b>Fire season:</b> Where fuel reduction burns are recommended, the optimal season for burning is suggested.</p>	<p>Overall, autumn is the optimal for biodiversity as plants are mostly not flowering and thus setting seed, and animals are largely not breeding and can escape fire more readily and/or move to other areas for feeding.</p> <p>However, due to the small time window when managed burns can be safely conducted it is unlikely to be possible to conduct all activities during this period and, in areas where season is less important, either a spring burn or 'as available' is nominated. Burning over various seasons can also favour different outcomes and thus adding to habitat variability/mosaic formation.</p>
<p><b>Recommendation 9</b></p>	<p><b>Avoid burning before:</b> A 10-year burning rotation is recommended (increased from the previous 8-year rotation), noting that burning may be required more frequently if the ground fuel load exceeds the legal requirement.</p>	<p>A longer rotation permits plants that rely on seed production to persist to grow to a sufficient size to produce viable seed, and soil seed stores to accumulate. Resprouter species also require sufficient time to build up sufficient biomass to withstand burning.</p> <p>Many fauna species require mature vegetation to survive, including Fairy Wrens (minimum 12 years), Honey Possums (16 years in Banksia woodland; 25 years in Jarrah forest) and Carnaby's Cockatoo (16 years in Banksia woodland, however, it is estimated that trees must be more than 220 years old to be suitable for nesting). While 10 years is recommended as a minimum rotation period, additional time would be beneficial to promote mature vegetation more suitable for many fauna species.</p> <p>However, legal requirements to maintain minimal fuel loads are interpreted as taking precedence over managing habitat for fauna persistence.</p>
<p><b>Recommendation 10</b></p>	<p><b>Remove standing dead biomass.</b> Manually remove standing dead biomass that contribute to the above ground fuel load. Generally, this refers to dead shrubs and small trees with flammable, well-aerated biomass. 'Removal' includes either taking the dead material elsewhere or, preferably, mulching and using on-site to suppress weeds or form breaks or edges, or for use in parkland gardens (unless there is a significant weed seed component e.g. weedy <i>Acacias</i> or Coastal Teatree with seeds attached). Manual removal of biomass is generally only recommended for areas close to human structures e.g. fences for property protection as potentially this material may provide shelter for fauna and will ultimately become part of soil nutrients. This task may be suitable for some Friends Groups although the City may be required to support this activity by mulching of cut and piled material.</p>	<p>Above-ground fuel load isn't taken into consideration during ground fuel load assessments.</p> <p>Standing dead biomass (largely dead shrubs) significantly increase fire risk by providing fuel that increases flame height, fire intensity and rate of spread. Manual removal of dead plant material, particularly along fencelines including dumped garden prunings, can significantly reduce fire risk in these areas.</p> <p>However, fallen logs provide habitat for fauna and non-vascular plants (mosses, lichens, fungi etc.) and should not be removed.</p> <p>Piles of dead biomass increase fire risk more than dispersed dead material due to concentration of fuel load, particularly when stacked or pushed up against trees. Mulching of removed material, unless it contains weed seeds, and use on-site to suppress weeds or form paths, is a preferable option to removal. Mulched plant material, when spread, has relatively low flammability as it does not hold significant oxygen within its matrix, however, piles of mulch can become a fire hazard due to the heat generated by composting plant material.</p> <p>Whilst not listed for all LNAs this recommendation should be applied where necessary and may be particularly relevant when short-lived shrubs have exceeded their lifespan after germinating following fire.</p>

Recommendation	Explanation	Rationale
<p><b>Recommendation 11</b></p>	<p><b>Control woody and geophyte weeds.</b>                      Woody weeds can be killed by herbicides or frequently by manual removal, particularly when young. Dead biomass should be removed (see Recommendation 10).                      Geophytes can be manually removed which is labour-intensive, or managed by using appropriate wetland-friendly herbicides at the appropriate time i.e. at leaf withdrawal.                      Removing woody and geophyte weeds may be best conducted by Friends Groups if possible although the City may be required to support this activity (see Recommendation 16).</p>	<p>As for dead biomass, woody weeds are frequently fire hazards when alive (e.g. Coastal Teatree <i>Leptospermum laevigatum</i>) or short-lived and becoming part of the standing dead biomass after a relatively brief period (e.g. Flinders Range Wattle <i>Acacia iteaphylla</i>).</p> <p>Geophyte weeds include <i>Watsonia</i> spp., primarily Bulbil <i>Watsonia meriana</i>, and other similar plants. Frequently these are found in association with waterways or damplands; while green during the winter growing season they die back to corms during summer leaving a flammable biomass that may contribute to forming a linear corridor that supports fires.</p>
<p><b>Recommendation 12</b></p>	<p><b>Avoid burning fallen logs, large trees and standing dead trees.</b>                      Fuel reduction burns should, if possible, avoid damaging fallen logs, large (living) trees or standing dead trees.                      If safe to do so during wildfire suppression target protecting large trees (both alive and dead) and large fallen logs from fire damage.</p>	<p>Fallen logs provide habitat for fauna species including shelter for larger mammals and reptiles, crevices for lizards and invertebrates and food sources including termites and other insects that are consumed by Echidnas, birds and reptiles and for alates (winged reproductive insects i.e. 'flying ants') provide a burst of high protein food.</p> <p>Fallen logs are also important to maintain the non-vascular plant biodiversity including mosses, lichens, liverworts and fungi that play an important role in the ecosystem. Ultimately, fallen logs break down and release nutrients into the soil.</p> <p>Large trees are important for many fauna species including smaller animals that live in and under bark, including insects, spiders, reptiles and bats, and in hollows, particularly birds that can also nest in branch axils. Large trees are also important for roosting or for lookouts, particularly for birds. They are also critical nesting habitat for endangered Black Cockatoo species, with suitable hollows only occurring in the larger trees. Large trees can be damaged by fire leading to tree death or significant damage that impedes their growth and longevity.</p> <p>Standing dead trees are also important for bird roosting and resting, including (if of sufficient size) for nesting. They may also host other fauna species that may be significant in their own right or as food for other species. Standing dead trees are easily damaged by fire.</p>
<p><b>Recommendation 13</b></p>	<p><b>Manage with adjacent DBCA lands.</b>                      It may be efficient to manage LNAs as part of a single unit when they are adjacent to DBCA-managed lands.</p>	<p>If not managed as a single unit, fuel reduction burns or wildfire on adjacent DBCA lands should be taken into consideration when planning fuel reduction burns on LNAs.</p>

Recommendation	Explanation	Rationale
<p><b>Recommendation 14</b></p>	<p><b>Take into consideration TF/PF.</b> Threatened Flora species are protected by legislation and must not be intentionally damaged. Therefore, fuel reduction activities should take their presence and fire response into consideration during the planning of fuel reduction burns.</p>	<p>Some of the Threatened or Priority Flora species recorded in CoK LNAs have known responses to fire (see <b>Table 13</b>), however, many responses are not documented on the public record.</p> <p>In general, most species will persist during a hot burn (e.g. following a wildfire), however, in a more managed situation most respond to autumn fires or are less likely to be killed during a cooler fire.</p> <p>LNAs with known or likely TF or PF are recommended as having a high priority for autumn rather than spring burns, if fuel reduction burns are recommended (see also Recommendation 18).</p> <p>Other methods of fuel reduction may also be appropriate in the vicinity of TF or PF species.</p>
<p><b>Recommendation 15</b></p>	<p><b>Consider known or potentially TEC/PECs.</b> Threatened Ecological Communities are protected by legislation and must not be intentionally damaged. While it is unlikely that a fuel reduction burn would significantly impact an ecological community as a whole, consideration should be given frequency and season of burning.</p>	<p>Overall, autumn fires appear to cause less damage to plant species and therefore vegetation (ecological communities). Frequent or hot fires are likely to cause the death of keystone species, including <i>Banksia</i> species in the Banksia Woodlands TEC and SCP20-group of TECs, and particularly in the Central Granite Shrublands PEC.</p>

Recommendation	Explanation	Rationale
<b>Friends Groups</b>		
<b>Recommendation 16</b>	<b>Weed management.</b>	<p>Weed management is a task well suited to groups caring for bushland as time can be taken to concentrate on areas of particular significance or requiring particular care, including:</p> <ul style="list-style-type: none"> <li>• along edges and firebreaks, taking care not to affect the interior of the LNA</li> <li>• adjacent to houses/along fencelines to reduce fire risk</li> <li>• along waterways, including manual removal of <i>Watsonia</i> or other weeds meanwhile permitting native plant species to persist.</li> </ul>
<b>Recommendation 17</b>	<b>Manually remove standing dead biomass.</b>	<p>Standing dead biomass (largely dead shrubs) significantly increase fire risk by providing fuel that increases flame height, fire intensity and rate of spread. Manual removal of dead plant material, particularly along fencelines including dumped garden prunings, can significantly reduce fire risk in these areas.</p> <p>However, fallen logs provide habitat for fauna and non-vascular plants (mosses, lichens, fungi etc.) and should not be removed.</p> <p>Removal of the dead material may require assistance from the City as a piles of dead biomass are an even larger fire risk (due to concentration of fuel load) than dispersed dead material, particularly when stacked or pushed up against trees. Mulching of removed material, unless it contains weed seeds, and use on-site to suppress weeds or form paths, is a preferable option to removal and is also likely to require assistance from the City.</p>
<b>Recommendation 18</b>	<b>Consider small-scale mosaic burns.</b>	<p>Trained personnel will be required to undertake or assist with this activity.</p> <p>Many LNAs are too small to consider a fuel reduction burn encompassing the entire LNA. Small-scale mosaic burns, potentially as small as 20 m x 20 m or 50 m x 50 m, conducted in part of an LNA are labour-intensive but not difficult to conduct. Raked firebreaks as small as 30 cm are effective to control cool burns that can be conducted at varying times (although autumn is generally preferable, but will be dependent on seasonal conditions as burning orchids when they have above-ground parts is detrimental) to form a mosaic of fuel ages and variety of vegetation responses.</p> <p>Ensure that fallen logs and large trees (alive or dead) are not burnt or damaged during the activity.</p> <p>Document activities, including informing the City of any fuel reduction or biodiversity burns.</p>

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# APPENDIX ONE

# LEGISLATIVE CONTEXT, DEFINITIONS AND CRITERIA

## COMMONWEALTH ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The EPBC Act is a legal framework to protect and manage matters of national environmental significance (MNES) including important flora, fauna, ecological communities and heritage areas listed under the Act.

Threatened taxa (flora and fauna) are protected under the EPBC Act, which lists species and ecological communities that have been assessed as meeting the criteria to be listed as Critically Endangered, Endangered, Vulnerable, Conservation Dependant, Extinct, or Extinct in the Wild, as detailed in **Table 8**.

Threatened Ecological Communities protected under the EPBC Act are categorised as Critically Endangered, Endangered or Vulnerable, also detailed in this table.

Migratory species subject to international agreements are also protected under the EPBC Act. The definition of a migratory species under the Act follows that prescribed by the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) (Department of Climate Change, Energy, the Environment and Water 2023). The list of migratory species established under section 209 of the EPBC Act comprises:

- migratory species which are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II);
- migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA); and
- native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

**Table 8: EPBC Act categories for flora, fauna and ecological communities**

Category	Threatened species	Threatened Ecological Communities
<b>Extinct</b>	A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.	n/a
<b>Extinct in the wild</b>	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time: (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.	n/a
<b>Critically Endangered (CR)</b>	A native species is eligible to be included in the <i>critically endangered</i> category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the <i>critically endangered</i> category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria
<b>Endangered (EN)</b>	A native species is eligible to be included in the <i>endangered</i> category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the <i>endangered</i> category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.



Category	Threatened species	Threatened Ecological Communities
<b>Vulnerable (VU)</b>	A native species is eligible to be included in the <i>vulnerable</i> category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the <i>vulnerable</i> category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
<b>Conservation Dependent</b>	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time: (a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long-term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.	n/a

**WESTERN AUSTRALIAN ENVIRONMENTAL PROTECTION ACT 1986**

The Western Australian EP Act was created to provide for an Environmental Protection Authority (the EPA) that has the responsibility for:

- prevention, control and abatement of pollution and environmental harm
- conservation, preservation, protection, enhancement and management of the environment
- matters incidental to or connected with the above.

The EPA is responsible for providing the guidance and policy under which environmental assessments are conducted. It conducts environmental impact assessments (based on the information provided by the proponent), initiates measures to protect the environment and provides advice to the Minister responsible for environmental matters.



**WESTERN AUSTRALIAN BIODIVERSITY CONSERVATION ACT 2016**

The Western Australian BC Act provides for the conservation, protection and ecologically sustainable use of biodiversity and biodiversity components in Western Australia.

Threatened species (both flora and fauna) and ecological communities that meet the categories listed within the BC Act are protected under this legislation and require authorisation by the Minister to take or disturb. These are known as Threatened Flora, Threatened Fauna and Threatened Ecological Communities. The conservation categories of Critically Endangered, Endangered and Vulnerable are detailed in **Table 9**; these categories align with those of the EPBC Act. Some State-listed threatened species and ecological communities are provided with additional protection as they are also listed under the Commonwealth EPBC Act (see **Table 8** for conservation status category descriptions).

The most recent Western Australian flora and fauna listings were published in the Government Gazette on 30 September 2022 (Government of Western Australia 2022).

**PRIORITY-LISTED FLORA AND FAUNA**

Flora are listed as PF where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to TF categories. Whilst PF are not specifically listed in the BC Act, some may qualify as being of special conservation interest and thereby have a greater level of protection than unlisted species.

There are three categories covering Western Australian-listed TF and four categories covering PF species which are outlined in **Table 9**. PF for Western Australia are regularly reviewed by the DBCA whenever new information becomes available, with species status altered or removed from the list when data indicates that they no longer meet these requirements.

Conservation significant fauna species are listed by the DBCA as Priority Fauna where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to threatened fauna categories. Whilst Priority Fauna are not specifically listed in the BC Act, these have a greater level of significance than other native species. The categories covering Priority Fauna species are outlined in **Table 9**.

Flora and fauna species may be listed as being of special conservation interest if they have a naturally low population, have a restricted natural range, are subject to or recovering from a significant population decline or reduction of range or are of special interest, and the Minister considers that taking may result in depletion of the species. Migratory species and those subject to international agreement are also listed under the Act. These are known as ‘specially protected species’ in the BC Act.

**Table 9: Conservation codes for Western Australian flora and fauna (DBCA 2020a)**

<b>Conservation Codes for Western Australian Flora and Fauna</b>	
Threatened, Extinct and Specially Protected fauna or flora <sup>1</sup> are species <sup>2</sup> which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.	
<b>The <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> and the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> have been transitioned under regulations 170, 171 and 172 of the <i>Biodiversity Conservation Regulations 2018</i> to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the <i>Biodiversity Conservation Act 2016</i>.</b>	
<b>Categories of Threatened, Extinct and Specially Protected fauna and flora are:</b>	
<b>T</b>	<p><b>Threatened species</b> Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the <i>Biodiversity Conservation Act 2016</i> (BC Act).</p> <p><b>Threatened fauna</b> is the species of fauna that are listed as critically endangered, endangered or vulnerable threatened species.</p> <p><b>Threatened flora</b> is the species of flora that are listed as critically endangered, endangered or vulnerable threatened species.</p> <p>The assessment of the conservation status of threatened species is in accordance with the BC Act listing criteria and the requirements of Ministerial Guideline (Number 1) and Ministerial Guideline (Number 2) that adopts the use of the International Union for Conservation of Nature (IUCN) Red List of Threatened Species Categories and Criteria<sup>4</sup>, and is based on the national distribution of the species</p>

<b>Conservation Codes for Western Australian Flora and Fauna</b>	
<b>CR</b>	<p><b>Critically endangered species</b></p> <p>Threatened species considered to be “<i>facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines</i>”.</p> <p>Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines.</p>
<b>EN</b>	<p><b>Endangered species</b></p> <p>Threatened species considered to be “<i>facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines</i>”.</p> <p>Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines.</p>
<b>VU</b>	<p><b>Vulnerable species</b></p> <p>Threatened species considered to be “<i>facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines</i>”.</p> <p>Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines.</p>
<p><b>Extinct species</b></p> <p>Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.</p>	
<b>EX</b>	<p><b>Extinct species</b></p> <p>Species where “<i>there is no reasonable doubt that the last member of the species has died</i>”, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).</p>
<b>EW</b>	<p><b>Extinct in the wild species</b></p> <p>Species that “<i>is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form</i>”, and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).</p>
<p><b>Specially protected species</b></p> <p>Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.</p> <p>Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.</p>	
<b>MI</b>	<p><b>Migratory species</b></p> <p>Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).</p> <p>Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the <i>Convention on the Conservation of Migratory Species of Wild Animals</i> (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.</p>
<b>CD</b>	<p><b>Species of special conservation interest (conservation dependent)</b></p> <p>Species of special conservation need that are dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act)</p>
<b>OS</b>	<p><b>Other specially protected species</b></p> <p>Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).</p>
<b>P</b>	<p><b>Priority species</b></p> <p>Priority is not a listing category under the BC Act.</p> <p>All fauna and flora are protected in WA following the provisions in Part 10 of the BC Act. The protection applies even when a species is not listed as threatened or specially protected, and regardless of land tenure (State managed land (Crown land), private land, or Commonwealth land).</p> <p>Species that may possibly be threatened species that do not meet the criteria for listing under the BC Act because of insufficient survey or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of prioritisation for survey and evaluation of conservation status so that consideration can be given to potential listing as threatened.</p> <p>Species that are adequately known, meet criteria for near threatened, or are rare but not threatened, or that have been recently removed from the threatened species list or conservation dependent or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.</p> <p>Assessment of priority status is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.</p>

<b>Conservation Codes for Western Australian Flora and Fauna</b>	
<b>1</b>	<p><b>Priority 1: Poorly-known species – known from few locations, none on conservation lands</b></p> <p>Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, for example, agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation</p> <p>Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. These species are in urgent need of further survey.</p>
<b>2</b>	<p><b>Priority 2: Poorly-known species – known from few locations, some on conservation lands</b></p> <p>Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, for example, national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation.</p> <p>Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements for threatened listing and appear to be under threat from known threatening processes. These species are in urgent need of further survey.</p>
<b>3</b>	<p><b>Priority 3: Poorly-known species – known from several locations</b></p> <p>Species that are known from several locations and the species does not appear to be under imminent threat or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat.</p> <p>Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. These species need further survey.</p>
<b>4</b>	<p><b>Priority 4: Rare, Near Threatened and other species in need of monitoring</b></p> <p>(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.</p> <p>(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.</p> <p>(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>
<p><sup>1</sup> The definition of flora includes algae, fungi and lichens.</p> <p><sup>2</sup> Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).</p>	

### THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

Western Australian TECs are protected under the BC Act and are categorised much like those of the EPBC Act. Western Australian definitions and criteria for TECs are shown in **Table 10**.

Currently described TECs are listed on the DBCA website, with the most recent list endorsed by the Minister for Environment in June 2018 (DBCA 2018).

DBCA also maintains a list of Priority Ecological Communities (PECs). PECs include potential TECs that do not meet survey criteria, or that are not adequately defined. They are not protected under legislation but are taken into consideration as part of the environmental approvals process.

Currently described PECs are listed on the DBCA website, with the most recent list dated 21 December 2022 (Species and Communities Program, DBCA 2022). Definitions and criteria for PECs are shown in **Table 10**.

Table 10: DBCA definitions and criteria for TECs and PECs (Department of Environment and Conservation 2013b)

Criteria	Definition
<b>Threatened Ecological Communities</b>	
<b>Presumed Totally Destroyed (PD)</b>	<p>An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.</p> <p>An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B):</p> <ul style="list-style-type: none"> <li>A. Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or</li> <li>B. All occurrences recorded within the last 50 years have since been destroyed</li> </ul>
<b>Critically Endangered (CR)</b>	<p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.</p> <p>An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):</p> <ul style="list-style-type: none"> <li>A. The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii): <ul style="list-style-type: none"> <li>i. geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years);</li> <li>ii. modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.</li> </ul> </li> <li>B. Current distribution is limited, and one or more of the following apply (i, ii or iii): <ul style="list-style-type: none"> <li>i. geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years);</li> <li>ii. there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;</li> <li>iii. there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.</li> </ul> </li> <li>C. The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).</li> </ul>
<b>Endangered (EN)</b>	<p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.</p> <p>An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C):</p> <ul style="list-style-type: none"> <li>A. The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii): <ul style="list-style-type: none"> <li>i. the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);</li> <li>ii. modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.</li> </ul> </li> <li>B. Current distribution is limited, and one or more of the following apply (i, ii or iii): <ul style="list-style-type: none"> <li>i. geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);</li> <li>ii. there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;</li> <li>iii. there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.</li> </ul> </li> </ul> <p>The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).</p>

Criteria	Definition
<b>Vulnerable (VU)</b>	<p>An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.</p> <p>An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C):</p> <ul style="list-style-type: none"> <li>A. The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.</li> <li>B. The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.</li> <li>C. The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.</li> </ul>
<b>Priority ecological communities</b>	
<b>Priority One</b>	<p><i>Poorly known ecological communities</i></p> <p>Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.</p>
<b>Priority Two</b>	<p><i>Poorly known ecological communities</i></p> <p>Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, state forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities, but do not meet adequacy of survey requirements, and / or are not well defined, and appear to be under threat from known threatening processes.</p>
<b>Priority Three</b>	<p><i>Poorly known ecological communities</i></p> <ul style="list-style-type: none"> <li>i. Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or;</li> <li>ii. Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;</li> <li>iii. Communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.</li> </ul> <p>Communities may be included if they are comparatively well known from several localities, but do not meet adequacy of survey requirements and / or are not well defined, and known threatening processes exist that could affect them.</p>
<b>Priority Four</b>	<p>Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.</p> <ul style="list-style-type: none"> <li>i. Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change These communities are usually represented on conservation lands.</li> <li>ii. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.</li> <li>iii. Ecological communities that have been removed from the list of threatened communities during the past five years.</li> </ul>
<b>Priority Five</b>	<p><i>Conservation Dependent Ecological Communities</i></p> <p>Ecological Communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.</p>

## INTRODUCED FLORA/WEEDS

Introduced plant species, known as weeds, are plants that are not indigenous to an area and have been introduced either directly or indirectly (unintentionally) through human activity. Species are regarded as introduced if they are listed as 'alien' on *FloraBase* (Western Australian Herbarium [WAH] 1998-2023) and are designated with an asterisk (\*) in this document.

### Weeds of National Significance

At a national level there are 32 weed species listed as Weeds of National Significance (WoNS) (Weeds Australia & Centre for Invasive Species Solutions 2021). The Commonwealth *Australian Weeds Strategy 2017-2027* (Invasive Plants and Animals Committee 2016) describes broad goals and objectives to manage these species.

### Declared Pest Plants

The Western Australian Organism List (WAOL) details organisms listed as Declared Pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). Under the BAM Act, Declared Pests are listed as one of the three categories, or exempt:

- C1 (exclusion), that applies to pests not established in Western Australia; control measures are to be taken to prevent their entry and establishment
- C2 (eradication), that applies to pests that are present in Western Australia but in low numbers or in limited areas where eradication is still a possibility
- C3 (management), that applies to established pests where it is not feasible or desirable to manage them in order to limit their damage
- exempt (no category).

## ENVIRONMENTALLY SENSITIVE AREAS

There are a number of areas within Western Australia identified as being of environmental significance within which the exemptions to the Native Vegetation Clearing Regulations do not apply. These are referred to as Environmentally Sensitive Areas (ESAs), and are declared under section 51B of the EP Act and described in the *Environmental Protection (Environmentally Sensitive Areas) Notice*.

## CONSERVATION ESTATE

The National Reserve System is a network of protected areas managed for conservation under international guidelines. The objective of placing areas of bushland into the Conservation Estate is to achieve and maintain a comprehensive, adequate and representative reserve system for Western Australia. The Conservation and Parks Commission is the vesting body for conservation lands, forest and marine reserves that are managed by DBCA (Government of Western Australia 2018).



## APPENDIX TWO

## CONSERVATION-LISTED FLORA

Table 11: Conservation-listed flora recorded from within the City of Kalamunda and LNAs (data checked for accuracy)

Taxa recorded in City of Kalamunda	WA Conservation Status	Recorded from LNA or within 100 m	Number of LNAs
<b>Acacia anomala</b>	T	Y	2
<i>Acacia aphylla</i>	T		
<b>Andersonia gracilis</b>	T	Y	1
<i>Anthocercis gracilis</i>	T		
<i>Austrostipa bronweniae</i>	T		
<b>Banksia mimica</b>	T	Y	1
<b>Conospermum undulatum</b>	T	Y	17
<b>Darwinia apiculata</b>	T	Y	1
<i>Diuris drummondii</i>	T		
<i>Diuris purdiei</i>	T		
<i>Grevillea thelemanniana</i>	T		
<i>Lepidosperma rostratum</i>	T		
<i>Macarthuria keigheryi</i>	T		
<b>Thelymitra magnifica</b>	T	Y	2
<b>Thelymitra stellata</b>	T	Y	2
<b>Boronia humifusa</b>	P1	Y	1
<b>Hydrocotyle striata</b>	P1	Y (historical)	1
<i>Senecio gilbertii</i>	P1		
<i>Andersonia</i> sp. <i>Blepharifolia</i> (F. & J. Hort 1919)	P2		
<i>Bossiaea modesta</i>	P2		
<b>Johnsonia pubescens</b> subsp. <i>cygnorum</i>	P2	Y	1
<i>Melaleuca viminalis</i>	P2		
<i>Paracaleana ferricola</i>	P2		
<i>Thysanotus</i> sp. <i>Badgingarra</i> (E.A. Griffin 2511)	P2		
<i>Acacia horridula</i>	P3		
<i>Acacia oncinophylla</i> subsp. <i>oncinophylla</i>	P3		
<i>Amanita fibrillopes</i>	P3		
<i>Amanita kalamundae</i>	P3		
<b>Asteridea gracilis</b>	P3	Y	1
<b>Banksia pteridifolia</b> subsp. <i>vernalis</i>	P3	Y	2
<b>Beaufortia purpurea</b>	P3	Y	1
<b>Byblis gigantea</b>	P3	Y	1
<i>Grevillea dissectifolia</i>	P3		
<b>Haemodorum loratum</b>	P3	Y	1
<b>Halgania corymbosa</b>	P3	Y	1
<b>Isopogon autumnalis</b>	P3	Y	6
<i>Lasiopetalum glutinosum</i> subsp. <i>glutinosum</i>	P3		
<i>Pithocarpa corymbulosa</i>	P3		
<i>Platysace ramosissima</i>	P3		
<i>Schoenus pennisetis</i>	P3		
<i>Sporobolus blakei</i>	P3		
<b>Stackhousia</b> sp. <i>Red-blotched corolla</i> (A. Markey 911)	P3	Y	1
<b>Styphelia filifolia</b>	P3	Y	1
<b>Thysanotus anceps</b>	P3	Y	2
<i>Thysanotus cymosus</i>	P3		
<i>Acacia oncinophylla</i> subsp. <i>patulifolia</i>	P4		
<i>Cyanicula ixiooides</i> subsp. <i>ixiooides</i>	P4		

Taxa recorded in City of Kalamunda	WA Conservation Status	Recorded from LNA or within 100 m	Number of LNAs
<i>Cyanothamnus tenuis</i>	P4		
<i>Grevillea pimeleoides</i>	P4		
<b><i>Lasiopetalum bracteatum</i></b>	<b>P4</b>	<b>Y</b>	<b>4</b>
<i>Ornduffia submersa</i>	P4		
<b><i>Pimelea rara</i></b>	<b>P4</b>	<b>Y</b>	<b>4</b>
<i>Senecio leucoglossus</i>	P4		
<b><i>Stylidium striatum</i></b>	<b>P4</b>	<b>Y</b>	<b>1</b>
<i>Thysanotus glaucus</i>	P4		
<b><i>Verticordia lindleyi</i> subsp. <i>lindleyi</i></b>	<b>P4</b>	<b>Y</b>	<b>1</b>

Table 12: LNAs with conservation-listed flora

LNA	Name
LNA-00003	Old Yorna Rd
LNA-00010	Fleming Reserve
LNA-00011	Poison Gully West
LNA-00025	Old Bridle trail
LNA-00026	Schippe Road Reserve
LNA-00030	Millson Reserve
LNA-00031	Norwood Reserve
LNA-00034	Combined Berry Drive Reserve, Nestle Brae Creek Reserve, Meloway Drive Reserve
LNA-00039	Old Railway Reserve
LNA-00049	Ledger Road Reserve
LNA-00051	Snowball Road Reserve
LNA-00053	Crocus Road Reserve
LNA-00062	Old Railway Reserve
LNA-00064	71 Moira Avenue, Forrestfield
LNA-00083	(Woodlupine)
LNA-00084	Hartfield Park
LNA-00085	Edinburgh Road Centre
LNA-00086	Lesmurdie Falls
LNA-00091	Keane Street Reserve
LNA-00092	14 Trott Road, Lesmurdie
LNA-00116	236 Hartfield Road, Wattle Grove
LNA-00117	176 Hartfield Road, Wattle Grove
LNA-00118	2 Lewis Road, Wattle Grove
LNA-00119	Lesmurdie Lions Lookout
LNA-00129	(Maida Vale reserves)
LNA-00138	John MacLarty Park
LNA-00175	Willow Lakes Estate
LNA-00182	8 Quartz Lane, Forrestfield
LNA-00190	(Pioneer Park)
LNA-00191	Old Railway Reserve
LNA-00214	(Pickering Brook)
LNA-00221	Old Tip Site, Smokebush Place
LNA-00225	Canning Road Reserve

Table 13: Fire response and relevant physiology of conservation-listed flora recorded in CoK LNAs

Taxa recorded in City of Kalamunda	Known fire ecology	References	Flowering (WAH 2023)	Soils, landforms (WAH 2023 unless otherwise noted)	Soils, landforms (WAH 2023 unless otherwise noted)
<b>Threatened Flora</b>					
<i>Acacia anomala</i>	Rhizomatous in the Perth area, reproducing only vegetatively. 'Inappropriate fire regimes' are the main threat but not defined.	(Buist, Coates & Yates 2002; Coates 1988; Department of the Environment Water Heritage and the Arts 2008a)	Aug-Oct	Laterite, lateritic sandy clay. Slopes.	Jarrah/Marri, Jarrah/Marri over heath/shrublands, Jarrah/Marri/Powderbark Wandoo
<i>Andersonia gracilis</i>	Killed by fire followed by mass germination; seed bank not long lived but longevity not defined, nor age to maturity. Highly dieback susceptible. Requires fire to persist.	(Department of Environment and Conservation 2006)	Sep-Nov	White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps. Clay pan.	Tall shrubland, heath over sedges. <i>Callitris</i> , <i>Beaufortia</i> , <i>Hypocalymma</i> .
<i>Banksia mimica</i>	Dieback tolerance variable but suspected to be vulnerable. Frequent (interval undefined) fire is a threat due to increasing weeds.	(DEWHA 2008b; Williams <i>et al.</i> 2001)	Dec-Feb	White or grey sand over laterite, sandy loam. Winter-damp areas.	Shrubland; heath with emergent <i>Kingia</i> , <i>Nuytsia</i> , <i>Banksia menziesii</i>
<i>Conospermum undulatum</i>	Requires open sandy patches. Lack of fire considered a threat as aging (senescing) plants produce less seed and will eventually die. Resprouts following fire.	(Close <i>et al.</i> 2006; Department of Environment and Conservation 2008)	May-Oct	Sand (white, grey, yellow, brown), clayey sand, sandy clay loam. Mostly flat; occasionally sloping.	Banksia or Jarrah woodlands - TECs
<i>Darwinia apiculata</i>	Killed by fire (obligate seeder), seed stored in soil thought to be long-lived. Plant maturity until seed set unknown but possibly 7-10 years. May be dieback resistant. Cool burns may not stimulate seed germination but kill adults; spring burns may stimulate germination at inappropriate time. Biggest risk is frequent fire and weeds and rabbits.	(Department of Agriculture Water and the Environment 2021; Department of Environment and Conservation 2009)	Oct-Feb	Lateritic soils; granite	Marri; Marri over heath; Jarrah/Marri
<i>Thelymitra magnifica</i>	Fuel reduction burns in growing season are detrimental, as is grazing.	(Brown & Uhe 2019)	Oct	Laterite or granite; dry slopes; clay/loam; creek bank	Jarrah/Marri; <i>E. rudis</i> / <i>E. wandoo</i> ; Wandoo/Marri
<i>Thelymitra stellata</i>	Killed by fire during growing season (i.e. when above ground parts are present; May-November). Unaffected by fire at other times.	(Department of the Environment Water Heritage and the Arts 2008c)	Oct-Nov	Sand, gravel, lateritic loam; slopes	Jarrah/Marri
<b>Priority 1</b>					
<i>Boronia humifusa</i>	Responds to physical disturbance; dieback response unknown. Gravel pits common habitat.	(WAH 2023; Williams <i>et al.</i> 2001)	Jun-Sep	Lateritic hilltop.	Jarrah/Marri over <i>Banksia sessilis</i> / <i>B. lindleyana</i>
<i>Hydrocotyle striata</i>	No disturbance or fire ecology information located. However, as an annual species its response to fire is likely to be related to quantities and longevity of soil seed storage.		Sep-Dec	Clay, springs	<i>Melaleuca preissiana</i> , <i>Melaleuca raphiophylla</i> , <i>Eucalyptus rudis</i>
<b>Priority 2</b>					
<i>Johnsonia pubescens</i> subsp. <i>cygnorum</i>	No disturbance or fire ecology information located.		Sep	Grey-white-yellow sand. Flats, seasonally-wet sites.	Jarrah/Marri/ <i>E. patens</i> woodlands

CONSERVATION-LISTED FLORA

Taxa recorded in City of Kalamunda	Known fire ecology	References	Flowering (WAH 2023)	Soils, landforms (WAH 2023 unless otherwise noted)	Soils, landforms (WAH 2023 unless otherwise noted)
<b>Priority 3</b>					
<i>Asteridea gracilis</i>	Annual species; recorded in the year following fire.	(WAH 2023)	Sep-Dec	Sand, clay, gravelly soils. Steep slope; granite boulders. Laterite.	Shrubland; open woodland (Marri, Wandoo, Banksia) over low shrubs
<i>Banksia pteridifolia</i> subsp. <i>vernalis</i>	Lignotuberous resprouting after fire (Brae Rd) but recorded as reproducing by seeds (Gillingarra).	(WAH 2023)	Sep-Oct	White/grey sand over laterite.	Open Jarrah/ <i>Allocasuarina fraseriana</i> over low shrubs; Banksia/Jarrah
<i>Beaufortia purpurea</i>	Serotinous fruit with seeds released following fire; regenerates from seed.	(Burbidge 2016)	Oct-Feb	Lateritic or granitic soils. Rocky slopes. Sandy clay over laterite (Talbot Rd Reserve)	Jarrah/Marri over shrubs; Wandoo/Jarrah/Marri
<i>Byblis gigantea</i>	Regenerates from deep rootstock following fire. Dies back over summer.	(Conran, Lowrie & Moyle-Croft 15AD; Lowrie 2013)	Sep-Jan	Sandy-peat swamps. Seasonally wet areas.	<i>Eucalyptus tottiana</i> , <i>Lambertia</i> swampy heath
<i>Haemodorum loratum</i>	Reported as having old flowers 2 years after fire - potentially flowers more frequently in year after year	(WAH 2023)	Nov	Grey or yellow sand, gravel	Jarrah/Banksia
<i>Halgania corymbosa</i>	No disturbance or fire ecology information located.		Aug-Nov	Gravelly soils, soils over granite.	Jarrah/Marri/Wandoo
<i>Isopogon autumnalis</i>	Mature fruit March-May. Resprouting from lignotuber (Fleming Res)	(Rye & Macfarlane 2019; WAH 2023)	Feb-May	Sand	Banksia woodland
<i>Stackhousia</i> sp. <b>Red-blotched corolla (A. Markey 911)</b>	One record indicates the specimen was collected 3-4 years after fire; another record indicates it was collected in dieback-affected Jarrah forest.	(Atlas of Living Australia 2023)	unknown	Sand, sandy clay, granite rock edges, laterite. Slopes. (ALA 2023)	Jarrah, Wandoo woodland. Shrublands and heath. (ALA 2023)
<i>Styphelia filifolia</i>	No disturbance or fire ecology information located.		Oct-Dec	Sandy soils on the coastal plain. Low-lying areas. (Hislop & Puente-Lelievre 2017)	Banksia or Jarrah woodland. (Hislop & Puente-Lelievre 2017)
<i>Thysanotus anceps</i>	Recorded 11 and 14 years following fire.	(WAH 2023)	Oct-Dec	White or grey sand, lateritic gravel, laterite.	Heath, woodland, shrubland. Jarrah/Marri woodland.
<b>Priority 4</b>					
<i>Lasiopetalum bracteatum</i>	No disturbance or fire ecology information located.		Aug-Nov	Sandy clay, clay, lateritic gravel. Along drainage lines, creeks, gullies, granite outcrops.	Marri/Jarrah woodland.
<i>Pimelea rara</i>	No disturbance or fire ecology information located.		Dec-Jan	Lateritic soils.	Marri/Jarrah woodland.
<i>Stylidium striatum</i>	Recorded 2 years following fire (significant number of plants)	(WAH 2023)	Oct-Nov	Brown clay loam over laterite. Hillslopes.	Jarrah/Marri forest, Wandoo woodland.
<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>	Most <i>Verticordia</i> species are fire-sensitive. Grows on disturbed sandy soil/firebreaks; the only WAH specimens mentioning fire indicated 'fire age – old'.	(George 2002)	May, Nov-Dec	Sand, sandy clay. Winter-wet depressions.	Swamy heath, shrubland.

# APPENDIX THREE CONSERVATION-LISTED FAUNA

Table 14: Conservation-listed fauna recorded from within the CoK (DBCA data)

Scientific name	Common name	WA status	EPBC status	Recorded within 100 m of LNA
<b>Birds</b>				
<i>Cacatua pastinator pastinator</i>	Muir's Corella	Specially Protected - conservation dependent		
<i>Calyptorhynchus banksii naso</i>	Forest red-tailed Black Cockatoo	Threatened - Vulnerable	VU	x
<i>Falco peregrinus</i>	Peregrine Falcon	Specially Protected - other specially protected		
<i>Ixobrychus flavicollis australis</i> (southwest subpop.)	Black Bittern (southwest subpop.)	P2		
<i>Leipoa ocellata</i>	Malleefowl	Threatened - Vulnerable	VU	
<i>Oxyura australis</i>	Blue-billed Duck	P4		
<i>Platycercus icterotis xanthogenys</i>	Western Rosella (inland)	P4		
<i>Zanda baudinii</i>	Baudin's Cockatoo	Threatened - Endangered	EN	x
<i>Zanda latirostris</i>	Carnaby's Cockatoo	Threatened - Endangered	EN	x
<b>Birds - migratory</b>				
<i>Actitis hypoleucos</i>	Common Sandpiper	Specially Protected - migratory	MI	
<i>Apus pacificus</i>	Fork-tailed Swift	Specially Protected - migratory	MI	
<i>Arenaria interpres</i>	Ruddy Turnstone	Specially Protected - migratory	MI	
<i>Hydroprogne caspia</i>	Caspian Tern	Specially Protected - migratory	MI	
<i>Numenius phaeopus</i>	Whimbrel	Specially Protected - migratory	MI	
<i>Pandion haliaetus</i>	Osprey	Specially Protected - migratory	MI	
<i>Plegadis falcinellus</i>	Glossy Ibis	Specially Protected - migratory	MI	
<i>Thalasseus bergii</i>	Crested Tern	Specially Protected - migratory	MI	
<i>Tringa glareola</i>	Wood Sandpiper	Specially Protected - migratory	MI	
<i>Tringa nebularia</i>	Common Greenshank	Specially Protected - migratory	MI	x
<i>Tringa stagnatilis</i>	Marsh Sandpiper	Specially Protected - migratory	MI	
<b>Invertebrates</b>				
<i>Australotomurus morbidus</i>	Cemetery Springtail, Guildford Springtail	P3		
<i>Glossurocolletes bilobatus</i>	a short-tongued bee (southwest)	P2		
<i>Idiosoma sigillatum</i>	Swan Coastal Plain Shield-backed Trapdoor Spider	P3		x
<i>Kawaniphila pachomai</i>	Grey Vernal Katydid (southwest)	P1		
<i>Leioproctus douglasiellus</i>	a short-tongued bee	Threatened - Endangered		
<i>Westralunio carteri</i>	Carter's Freshwater Mussel	Threatened - Vulnerable		
<b>Mammals</b>				
<i>Bettongia penicillata ogilbyi</i>	Woylie, Brush-tailed Bettong	Threatened - Critically endangered	EN	x
<i>Dasyurus geoffroii</i>	Chuditch, Western Quoll	Threatened - Vulnerable	VU	x
<i>Hydromys chrysogaster</i>	Water-rat, Rakali	P4		x
<i>Isodon fusciventer</i>	Quenda, Southwestern Brown Bandicoot	P4		x
<i>Myrmecobius fasciatus</i>	Numbat, Walpurti	Threatened - Endangered	EN	x
<i>Notamacropus irma</i>	Western Brush Wallaby	P4		x
<i>Phascogale tapoatafa wambenger</i>	South-western Brush-tailed Phascogale, Wambenger	Specially Protected - conservation dependent		x
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum, Ngwayir	Threatened - Critically endangered	CR	
<i>Setonix brachyurus</i>	Quokka	Threatened - Vulnerable	VU	x
<b>Reptiles</b>				
<i>Acanthophis antarcticus</i>	Southern Death Adder	P3		x
<i>Ctenotus delli</i>	Dell's Skink, Darling Range Southwest Ctenotus	P4		
<i>Lerista lineata</i>	Perth Slider, Lined Skink	P3		
<i>Neelaps calonotos</i>	Black-striped Snake, Black-striped Burrowing Snake	P3		x
<i>Pseudemydura umbrina</i>	Western Swamp Tortoise	Threatened - Critically endangered	CR	

# APPENDIX FOUR      ECOLOGICAL COMMUNITIES DEFINITIONS AND CRITERIA

## BANKSIA WOODLANDS TEC

The criteria outlined in the *Approved Conservation Advice for the Banksia Woodlands of the Swan Coastal Plain* TEC (TSSC 2016) was used to determine if the TEC occurs, as below.

The key characteristics for vegetation to be included in this TEC are that:

- it occurs on the Swan Coastal Plain IBRA region, including the Dandaragan Plateau and adjacent to the Jarrah Forest IBRA region on the lower parts of the Darling and Whicher escarpments
- it generally occurs on low-nutrient sandy substrates, including sandy colluvium and aeolean sands although may occur occasionally on other substrates (usually on the Bassendean and Spearwood sands)
- the structure is typically low woodland or forest with a distinct upper stratum of low trees dominated or co-dominated by one or more of four characteristic Banksia species (*Banksia attenuata*, *B. menziesii*, *B. prionotes*, *B. ilicifolia*) although emergent trees are sometimes present but cannot be the dominant stratum
- the understorey is typically a highly diverse shrub and herb layer
- it meets the thresholds in the table that follows (with vegetation type mapping extrapolated outside the survey area to be included in the extent calculations).

**Table 15: Condition categories and thresholds for inclusion in the Banksia Woodlands TEC** (TSSC 2016)

Condition threshold	Indicative condition measures (typical)		Minimum patch size
	Native vegetation composition <sup>1</sup>	Weed cover	
<b>Pristine</b>	Native plant species diversity	Native plant species diversity	No minimum
<b>Excellent</b>	High native plant species	High native plant species	0.5 ha / 5,000 m <sup>2</sup>
<b>Very Good</b>	Moderate native plant species	Moderate native plant species	1 ha / 10,000 m <sup>2</sup>
<b>Good</b>	Low native plant species	Low native plant species	2 ha / 20,000 m <sup>2</sup>
<b>Degraded</b>	Very low native plant species	Very low native plant species	Not representative
<b>Completely Degraded</b>	Very low to no native species	Very low to no native species	Not representative

<sup>1</sup> Relative to expected natural range of diversity for that vegetation (e.g. Floristic Community Type; FCT), where comparative data exists.

Whilst FCTs, as defined in Gibson *et al.* (1994) can be used as a guide they do not necessarily define all vegetation that may be included in the TEC. Vegetation defined by Gibson *et al.* FCTs may be listed as TECs in Western Australia or as Priority Ecological Communities (PECs) by DBCA (combined into the EPBC-listed Banksia Woodlands of the Swan Coastal Plain TEC). Some Banksia woodlands on the eastern side of the Swan Coastal Plain (FCT 20 group) are not included in this TEC and have different conservation listings; these Banksia woodland types are not subject to the same thresholds as above to be considered representative of the relevant TEC or PEC.



## SCP3<sup>1</sup> GROUP TECS

These are Marri woodlands on heavy (i.e. clay) soils on the eastern Swan Coastal Plain. SCP3b does not intersect any LNA in the CoK.

### CORYMBIA CALOPHYLLA – KINGIA AUSTRALIS WOODLANDS ON HEAVY SOILS, SWAN COASTAL PLAIN (FLORISTIC COMMUNITY TYPE 3A AS ORIGINALLY DESCRIBED IN GIBSON ET AL. (1994)) TEC

#### TEC description (DBCA 2020b):

*The community occurs on heavy soils of the eastern side of the southern Swan Coastal Plain largely between Capel and Chittering. Typical native taxa in the community are: the tree Corymbia calophylla (marri); the shrubs Banksia dallanneyi (couch honeypot), Philotheca spicata (pepper and salt), Kingia australis (kingia) and Xanthorrhoea preissii (balga); and the herbs, rushes and sedges Cyathochaeta avenacea, Dampiera linearis (common dampiera), Haemodorum laxum, Desmocladius fasciculatus, Mesomelaena tetragona (semaphore sedge) and Tetraria octandra. The community is also known as “floristic community type 3a” as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) “A floristic survey of the southern Swan Coastal Plain” (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).*

### CORYMBIA CALOPHYLLA – XANTHORRHOEA PREISSII WOODLANDS AND SHRUBLANDS, SWAN COASTAL PLAIN (FLORISTIC COMMUNITY TYPE 3C AS ORIGINALLY DESCRIBED IN GIBSON ET AL. (1994)) TECX

#### TEC description (DBCA 2020c):

*The community occurs on heavy soils of the eastern side of the southern Swan Coastal Plain, generally between Bullsbrook and Stratham. The community is dominated by Corymbia calophylla (marri) and Xanthorrhoea preissii (balga). It also occasionally includes Eucalyptus wandoo (wandoo). The more common shrubs include Gompholobium marginatum, Hypocalymma angustifolium (white myrtle) and Banksia dallanneyi (couch honeypot). The herbs, grasses and sedges including Burchardia congesta, Cyathochaeta avenacea, Neurachne alopecuroidea (foxtail mulga grass), Caesia micrantha (pale grass-lily), Mesomelaena tetragona (semaphore sedge), Tetraria octandra, Desmocladius flexuosus, Opercularia vaginata (dog weed), Sowerbaea laxiflora (purple tassels), Lepidosperma spp. and Drosera menziesii (pink rainbow) are also common. The community is also known as “floristic community type 3c” as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) “A floristic survey of the southern Swan Coastal Plain” (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).*

<sup>1</sup> ‘SCP’ refers to Swan Coastal Plain. Nomenclature of TECs and PECs arising from the *Floristic Survey of the southern Swan Coastal Plain* (Gibson et al. 1994) reference both SCP and FCT (floristic community type) almost interchangeably.

## SCP20 GROUP TECS

These TECS are *Banksia attenuata*-dominated Woodlands on the Eastern Swan Coastal Plain.

### BANKSIA ATTENUATA WOODLANDS OVER SPECIES RICH DENSE SHRUBLANDS (FLORISTIC COMMUNITY TYPE 20A AS ORIGINALLY DESCRIBED IN GIBSON ET AL. (1994)) TEC

**TEC description** (DBCA 2020d):

*The community occurs on sands near Koondoola and at the base of the Darling Scarp largely between Chittering and Gosnells. It is usually dominated by Banksia attenuata (slender banksia) occasionally with Eucalyptus marginata (jarrah) with Bossiaea eriocarpa (common brown pea), Conostephium pendulum (pearl flower), Hibbertia huegelii, Hibbertia hypericoides (yellow buttercups), Petrophile linearis (pixie mops), Scaevola repens, Stirlingia latifolia (blueboy), Mesomelaena pseudostygia and Alexgeorgea nitens being common in the understorey. The community is also known as “floristic community type 20a” as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) “A floristic survey of the southern Swan Coastal Plain” (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia.*

### BANKSIA ATTENUATA — EUCALYPTUS MARGINATA WOODLANDS OF THE EASTERN SIDE OF THE SWAN COASTAL PLAIN (FLORISTIC COMMUNITY TYPE 20B AS ORIGINALLY DESCRIBED IN GIBSON ET AL. (1994)) TEC

**TEC description** (DBCA 2020e):

*The community occurs on sands at the base of the scarp predominantly on the Pinjarra Plain and Ridge Hill Shelf. Most of the occurrences of this community comprise Banksia attenuata (slender banksia) – Eucalyptus marginata (jarrah) woodlands but the community also occurs as Banksia woodlands and heaths. The sedge Mesomelaena pseudostygia is a common component of the community, which is very species rich and has a diverse shrub layer and low weed frequency. Hakea stenocarpa (narrow-fruited hakea), Conostylis setosa (white cottonhead), and Johnsonia pubescens subsp. cygnorum (priority 2) generally differentiate the community from similar Banksia communities. The community is also known as “floristic community type 20b” as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) “A floristic survey of the southern Swan Coastal Plain” (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).*

### SHRUBLANDS AND WOODLANDS OF THE EASTERN SIDE OF THE SWAN COASTAL PLAIN (FLORISTIC COMMUNITY TYPE 20C AS ORIGINALLY DESCRIBED IN GIBSON ET AL. (1994)) TEC

**TEC description** (DBCA 2020f)

*The community generally comprises a shrubland or woodland of Banksia attenuata (candlestick banksia) and Banksia menziesii (firewood banksia), sometimes with Allocasuarina fraseriana (western sheoak), over a shrub layer that can include Adenanthos cygnorum (woolybush), Hibbertia huegelii, Scaevola repens var. repens (fan flower), Allocasuarina humilis (dwarf sheoak), Bossiaea eriocarpa (common brown pea), Hibbertia hypericoides (yellow buttercups) and Stirlingia latifolia (blueboy). A suite of herbs including Conostylis aurea (golden conostylis), Trachymene pilosa (native parsnip), Lomandra hermaphrodita, Burchardia congesta (milkmaids) and Patersonia occidentalis (purple flag), and the sedges Mesomelaena pseudostygia (semaphore sedge) and Lyginia barbata usually occur in the community. The community is also known as “floristic community type 20c” as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) “A floristic survey of the southern Swan Coastal Plain” (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).*

## **SOUTHERN WET SHRUBLANDS, SWAN COASTAL PLAIN (FLORISTIC COMMUNITY TYPE 2 AS ORIGINALLY DESCRIBED IN GIBSON ET AL. (1994))**

**TEC description** (DBCA 2020g):

*The community comprises shrublands or open woodlands. It occurs on seasonally inundated sandy clay soils that are restricted to small remnants on the eastern side of the Swan Coastal Plain. It has been recorded from Forrestfield to Chapman Hill. The community has moderate species richness with the occurrence of species reflecting the wetter nature of the sites. Typical and common native taxa in the community are the shrubs *Kingia australis* (Kingia), *Pericalymma ellipticum* (swamp teatree), *Hakea ceratophylla* (horned leaf hakea), *Calothamnus lateralis*, *Hypocalymma angustifolium* (white myrtle), *Eutaxia virgata*, *Stirlingia latifolia* (blueboy), *Banksia dallaneyi* (couch honeypot) and herbs, rushes and sedges including *Dampiera linearis* (common dampiera), *Comesperma virgatum* (milkwort), *Stylidium brunonianum* (pink fountain triggerplant), *Thysanotus multiflorus* (many-flowered fringe lily) and *Mesomelaena tetragona* (semaphore sedge). The community also contains priority flora including *Isopogon formosus* subsp. *dasylepis* (priority 3) and *Grevillea brachystylis* subsp. *brachystylis* (priority 3). This community is also known as “floristic community type 2” as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) “A floristic survey of the southern Swan Coastal Plain” (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).*

## **SHRUBLANDS ON DRY CLAY FLATS (FLORISTIC COMMUNITY TYPE 10A AS ORIGINALLY DESCRIBED IN GIBSON ET AL. (1994)) (SCP10A) TEC**

*Shrublands on dry clay flats (floristic community type 10a as originally described in Gibson et al. (1994)) (SCP10a) is a Western Australia-listed endangered TEC that is part of the EPBC-listed Clay Pans of the Swan Coastal Plain critically endangered TEC.*

**TEC description**, inclusive of other clay pan-type communities (DBCA 2020h):

*Herb rich saline shrublands in clay pans, Herb rich shrublands in clay pans, Dense shrublands on clay flats, Shrublands on dry clay flats (floristic community types 7, 8, 9, 10a as originally described in Gibson et al. (1994))*

*The seasonal clay-based wetlands are the most floristically diverse of the Swan Coastal Plain wetlands. The deeper pools and wet flats are characterised by temporally overlapping suites of annual herbs and geophytes (plants that die down to bulbs corms or tubers over summer) that flower and set seed as the pools dry through spring. Over summer the clay substrates dry to impervious pans. At least 50% of the flora comprise annual or perennial herbs, many endemic to the claypans. These clay pan communities are otherwise known as ‘floristic community type 7, 8, 9, and 10a’ as defined in the 1994 report by Gibson et al. entitled ‘A floristic survey of the southern Swan Coastal Plain’.*

## CENTRAL NORTHERN DARLING SCARP GRANITE SHRUBLAND COMMUNITY PRIORITY 4 PEC

**TEC description** (Species and Communities Program & DBCA 2022):

*Shrublands and heath on deeper loams and red earths on fragmented granite/quartzite. Heath species typically consist of the taller shrubs *Xanthorrhoea acanthostachya* and *Allocasuarina humilis* over smaller proteaceous and myrtaceous shrubs, namely *Melaleuca* aff. *scabra*, *Baeckea camphorosmae* and to a lesser extent, the proteaceous shrubs *Dryandra armata*, *Hakea incrassata* and *Hakea undulata*. Located in central region of the Northern Darling Scarp near Perth.*

The name of this PEC has been abbreviated to 'Central Granite Shrubland' within this document.



Asset ID	Street Address	LNA Section	Size (ha)	Burning history	Waterway or wetland	Adjacent to/contiguous with: (1)	Biodiversity value	Viability Score (1-5; low-high)	CoK Recommendations															Comments (CoK)	Friends Group/Task Suggestions				
									Recommendation 1: Documentation	Recommendation 2: Inspection intervals	Recommendation 3: Maintain firebreaks, edges, interface	Recommendation 4: Slash or mow grass	Recommendation 5: Waterway and wetland weed management	Recommendation 6: No fuel reduction burns	Recommendation 7: Fuel reduction or biodiversity burns recommended.	Recommendation 8: Fire season	Recommendation 9: Avoid burning before	Recommendation 10: Remove standing dead biomass	Recommendation 11: Control woody and geophyte weeds	Recommendation 12: Avoid burning fallen logs, large trees and standing dead trees	Recommendation 13: Manage with adjacent DBCA lands	Recommendation 14: Take into consideration TF/PF	Recommendation 15: Consider known or potentially TEC/PECs		Friends Group	Recommendation 16: Weed management	Recommendation 17: Consider small-scale mosaic burns	Comments (Friends)	
LNA-00010	Newburn Rd, High Wycombe	LNA-00010	2.12				Majority of vegetation in Good or better condition; may be conservation-listed ecological community. Has conservation-listed flora.	2	x	x	x	x									x			Manage for conservation-listed flora. Slash around bushland edges but fuel management fires not recommended (except small mosaics).	Friends of Fleming Reserve		x	Consider some small-scale burns (20 m x 20 m) in strategic areas (not near the edge) to create seral variation. Manually remove any woody weed shrubs that may be present (or appear).	
LNA-00011	Dundas Rd, High Wycombe	LNA-00011	3.55		Waterway		Conservation-listed flora present. May be a conservation-listed ecological community. Biodiversity value includes flora, vegetation, fauna habitat and waterway protection.	3	x	x	x	x	x										x		Manage for conservation listed flora. Slash grasses in Degraded areas particularly at property interfaces. Avoid herbicides.	Friends of Poison Gully Reserve - West	x		Consider planting along creeklines to protect fauna (Quenda) habitat but not along fencelines.
LNA-00013	John Farrant Dr, Maida Vale	LNA-00013	0.42		Waterway		Degraded vegetation; narrow strip. Not native vegetation but provides fauna habitat and waterway protection.	1	x	x	x	x	x											Slash to reduce long grass. Avoid herbicides (creekline)				n/a	
LNA-00014	Ridge Hill Rd, Maida Vale	LNA-00014	4.79		Waterway		Some Good condition vegetation; may be conservation-listed ecological community. Biodiversity value as waterway protection and fauna habitat.	2	x	x	x	x	x											Slash to reduce long grass. Avoid herbicides (creekline)	Friends of Kadina Brook Reserve	x		Consider planting along creeklines to protect fauna (Quenda) habitat but not along fencelines (fire risk).	
LNA-00015	John Farrant Dr, Maida Vale	LNA-00015	1.01		Waterway	GHNP	Mostly Good or better condition vegetation but unlikely to be conservation-listed ecological community. Contiguous with Gooseberry Hill NP. Value as waterway protection, contiguous fauna habitat.	3	x	x	x	x	x											Slash long grass but do not use herbicides (creekline). Manage in conjunction with DBCA	Friends of Kadina Brook Reserve	x		Consider planting along creeklines to protect fauna (Quenda) habitat but not along fencelines (fire risk).	



Asset ID	Street Address	LNA Section	Size (ha)	Burning history	Waterway or wetland	Adjacent to/contiguous with: (1)	Biodiversity value	Viability Score (1-5; low-high)	CoK Recommendations													Comments (CoK)	Friends Group/Task Suggestions							
									Recommendation 1: Documentation	Recommendation 2: Inspection intervals	Recommendation 3: Maintain firebreaks, edges, interface	Recommendation 4: Slash or mow grass	Recommendation 5: Waterway and wetland weed management	Recommendation 6: No fuel reduction burns	Recommendation 7: Fuel reduction or biodiversity burns recommended.	Recommendation 8: Fire season	Recommendation 9: Avoid burning before	Recommendation 10: Remove standing dead biomass	Recommendation 11: Control woody and geophyte weeds	Recommendation 12: Avoid burning fallen logs, large trees and standing dead trees	Recommendation 13: Manage with adjacent DBCA lands		Recommendation 14: Take into consideration TF/PF	Recommendation 15: Consider known or potentially TEC/PECs	Friends Group	Recommendation 16: Weed management	Recommendation 17: Consider small-scale mosaic burns	Comments (Friends)		
LNA-00016	Northolt St, Lesmurdie	LNA-00016-S01	0.52				Mostly Good or better condition vegetation. Biodiversity value largely as bird habitat.	2	x	x	x	x												Slash edges.				n/a		
LNA-00017	Kalamatta Wy, Gooseberry Hill	LNA-00017	1.99	01/2014, 11/2016	Waterway		Mostly Good or better condition vegetation but has significant weeds that may be a fire hazard. Biodiversity value as fauna habitat and waterway protection. High prioritisation.	4	x	x	x	x			Not recommended		Only if >8 tons/ha	Autumn	2026	x	x	x				Manage with LNA45. Do not recommend fuel reduction burns due to weed cover (except small-scale burns conducted by Friends group).	Friends of Quenda Creek	x	x	Target <i>Watsonia</i> and other weeds associated with creekline for manual removal. Consider small-scale mosaic burns in western portion of LNA in areas of better condition vegetation.
LNA-00018	Kalamatta Wy, Gooseberry Hill	LNA-00018	1.08		Waterway	GHNP	Has Good condition vegetation. Creekline; significant for waterway protection and fauna habitat. Has significant woody weeds and <i>Watsonia</i> . Adjacent to Gooseberry Hill NP.	3	x	x	x	x	x									x	x		Manage woody and geophyte weeds. Avoid herbicides if possible (creekline). Manage in conjunction with DBCA.				n/a	
LNA-00019	Lascelles Pde, Gooseberry Hill	LNA-00019	0.62	11/2012			Good or better condition vegetation but unlikely to be representative of a conservation-listed ecological community. Biodiversity value as fauna habitat and representation of good condition vegetation.	3	x	x	x						Only if >8 tons/ha	Autumn							unlikely	Last fuel reduction burn 2012. Interface with private property is upslope (significant for burning).				n/a

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									Recommendation 1: Documentation	Recommendation 2: Inspection intervals	Recommendation 3: Maintain firebreaks, edges, interface	Recommendation 4: Slash or mow grass	Recommendation 5: Waterway and wetland weed management	Recommendation 6: No fuel reduction burns	Recommendation 7: Fuel reduction or biodiversity burns recommended.	Recommendation 8: Fire season	Recommendation 9: Avoid burning before	Recommendation 10: Remove standing dead biomass	Recommendation 11: Control woody and geophyte weeds	Recommendation 12: Avoid burning fallen logs, large trees and standing dead trees	Recommendation 13: Manage with adjacent DBCA lands	Recommendation 14: Take into consideration TF/PF	Recommendation 15: Consider known or potentially TEC/PECs		Friends Group	Recommendation 16: Weed management	Recommendation 17: Consider small-scale mosaic burns	Comments (Friends)
LNA-00020	John St, Gooseberry Hill	LNA-00020	2.61	2008, 10/2018	Waterway		Mostly Good or better condition vegetation but unlikely to be representative of a conservation-listed ecological community.  Contains creek.  Biodiversity value for waterway protection and fauna habitat.	3	x	x	x	x												Slash long grass but, if used, do not use inappropriate herbicides (creekline).  Manage for fauna habitat.  Properties on downhill slope.  Last fuel reduction burn 2018.	Friends of Toornart Creek	x		Manual removal of woody shrubs ( <i>Tagasaste</i> , <i>Acacia iteaphylla</i> ) and geophytes ( <i>Watsonia</i> ), particularly at interface with properties.
LNA-00021	Milner Rd, High Wycombe	LNA-00021	1.06		Waterway		Has some Good or better condition vegetation.  May represent a conservation-listed ecological community.  Consider that conservation-listed flora may occur and manage as per required.  Biodiversity value includes waterway protection.	3	x	x	x	x	x	x										Slash long grass but, if used, do not use inappropriate herbicides (creekline).  Manage for fauna habitat.	Friends of Poison Gully Reserve - Milner	x		Weedy shrubs have not been reported but if present should be removed manually.  Consider removing shrub biomass at property interfaces.
LNA-00022	Littlefield Rd, High Wycombe	LNA-00022	1.10		Waterway		Majority in Degraded condition; not representative of a conservation-listed ecological community.  Biodiversity value as fauna habitat and waterway protection.	3	x	x	x	x	x										Slash long grass but, if used, do not use inappropriate herbicides (creekline).  Manage for fauna habitat.	Friends of Poison Gully Reserve - Bluebell	x		Weedy shrubs have not been reported but if present should be removed manually.  Consider removing shrub biomass at property interfaces.	
LNA-00023	Tree Fern Grn, Maida Vale	LNA-00023	1.62		Waterway		Has some Good or better condition vegetation.  Likely to provide good Quenda habitat.  Value includes waterway protection and fauna habitat.	3	x	x	x	x	x										Slash long grass but, if used, do not use inappropriate herbicides (creekline).  Manage for fauna habitat.  'Bamboo' has been reported but is likely to be Giant Reed ( <i>Arundo donax</i> ) that presents a significant fire hazard.	Friends of Poison Gully Reserve - Myerson			Consider removal of above-ground woody biomass (shrubs) adjacent to fencelines and 'Bamboo'.	

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									Recommendation 1: Documentation	Recommendation 2: Inspection intervals	Recommendation 3: Maintain firebreaks, edges, interface	Recommendation 4: Slash or mow grass	Recommendation 5: Waterway and wetland weed management	Recommendation 6: No fuel reduction burns	Recommendation 7: Fuel reduction or biodiversity burns recommended.	Recommendation 8: Fire season	Recommendation 9: Avoid burning before	Recommendation 10: Remove standing dead biomass	Recommendation 11: Control woody and geophyte weeds	Recommendation 12: Avoid burning fallen logs, large trees and standing dead trees	Recommendation 13: Manage with adjacent DBCA lands	Recommendation 14: Take into consideration TF/PF	Recommendation 15: Consider known or potentially TEC/PECs		Friends Group	Recommendation 16: Weed management	Recommendation 17: Consider small-scale mosaic burns	Comments (Friends)
LNA-00024	Pinker Cr, Maida Vale	LNA-00024	1.77		Waterway		Almost entirely Degraded condition so not conservation-listed ecological community.  Biodiversity value as fauna habitat including Quenda, and waterway protection.	3	x	x	x	x	x	x										Slash long grass but, if used, do not use inappropriate herbicides (creekline).  Manage for fauna habitat.	Friends of Poison Gully Reserve - Pinker			Consider removal of above-ground woody biomass (shrubs) adjacent to fencelines.
LNA-00025	Brae Rd, High Wycombe	LNA-00025	1.94				Approximately half of total area is bridle trail but has approximately 1 ha of bushland.  Majority in Good or better condition; may be representative of a conservation-listed ecological community.  Conservation-listed flora species.  Biodiversity value for flora and fauna habitat.	3	x	x	x	x												Slash long grass.  Manage for conservation-listed flora.	Friends of Brae Rd Reserve	x		Manually remove (spot herbicides) grassy weeds and weedy shrubs if they occur.  Consider small-scale mosaic burns in 'body' of LNA but not along bridle trails.
LNA-00026	Shipp Rd, Piesse Brook	LNA-00026	7.60	08/2011	Waterway	Ka NP	Good-Excellent condition vegetation.  Conservation-listed flora likely based on site description of specimen (but not attributed to location accurately).  High viability score. Biodiversity value high (multiple values).  Potential that granite rock communities occur.	4	x	x	x	x												Slash long grass in disturbed areas. Otherwise manage with DBCA.  Last fuel reduction burn in 2011.  Consider survey to check for CGS PEC.	Schippe Rd Reserve	x		No significant weeds recorded. Remove woody weeds if they occur.  Remove <i>Watsonia</i> if present (using wetland-friendly herbicide if necessary).

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									Recommendation 1: Documentation	Recommendation 2: Inspection intervals	Recommendation 3: Maintain firebreaks, edges, interface	Recommendation 4: Slash or mow grass	Recommendation 5: Waterway and wetland weed management	Recommendation 6: No fuel reduction burns	Recommendation 7: Fuel reduction or biodiversity burns recommended.	Recommendation 8: Fire season	Recommendation 9: Avoid burning before	Recommendation 10: Remove standing dead biomass	Recommendation 11: Control woody and geophyte weeds	Recommendation 12: Avoid burning fallen logs, large trees and standing dead trees	Recommendation 13: Manage with adjacent DBCA lands	Recommendation 14: Take into consideration TF/PF	Recommendation 15: Consider known or potentially TEC/PECs	Comments (CoK)	Friends Group	Recommendation 16: Weed management	Recommendation 17: Consider small-scale mosaic burns	Comments (Friends)		
LNA-00027	Crescent Rd, Kalamunda	LNA-00027	39.97	08/2008 (S3,4), 09/2009, 08/2010 (S1,2), 10/2010, 01/2015, 10/2016, 5/2017, 6/2017, 5/2018 (S3), 11/2018 (S2,3,4)		KaNP	Adjacent to Kalamunda NP. Former golf course with approximately 50% Good or better condition native vegetation. High viability score. Biodiversity value as fauna habitat.	4	x	x	x	x						Yes	Autumn or spring	Variable						Slash long grass in disturbed areas. Otherwise manage with DBCA. Long history of fuel reduction burns in sections; last listed was in 2018. Vary season of burning but due to size and proximity to city centre consider this a high priority for inspections and fuel reduction management.	Friends of Jorgensen Park	x		Inspect and control any weed incursion into native bushland.
LNA-00028	Mundaring Weir Rd, Kalamunda	LNA-00028-S01 LNA-00028-S02	0.28 0.10				Degraded vegetation; small reserve. Biodiversity value is as fauna habitat.	2 2		x	x	x	x			Not recommended	Only if >8 tons/ha	spring	As available			x			CoK data indicates planned fuel reduction burns but has no confirmation. Fuel reduction burn as necessary based on fuel load. Season of burning not significant but spring may give better weed control.				n/a	
LNA-00029	Booralie Wy, Maida Vale	LNA-00029	2.23		Waterway		Contains creekline but little native vegetation that is in Good or better condition. Biodiversity value is in protecting the creekline and as fauna habitat.	3	x	x	x	x	x	x												Slash/mow grassy areas. Avoid herbicide use near creekline (or use wetland-friendly types if necessary)	Friends of Booralie Way Reserve	x		Remove woody weeds and geophytes (e.g. <i>Watsonia</i> ) if they occur. Clear shrubs from adjacent to houses to create firebreak.



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									Recommendation 1: Documentation	Recommendation 2: Inspection intervals	Recommendation 3: Maintain firebreaks, edges, interface	Recommendation 4: Slash or mow grass	Recommendation 5: Waterway and wetland weed management	Recommendation 6: No fuel reduction burns	Recommendation 7: Fuel reduction or biodiversity burns recommended.	Recommendation 8: Fire season	Recommendation 9: Avoid burning before	Recommendation 10: Remove standing dead biomass	Recommendation 11: Control woody and geophyte weeds	Recommendation 12: Avoid burning fallen logs, large trees and standing dead trees	Recommendation 13: Manage with adjacent DBCA lands	Recommendation 14: Take into consideration TF/PF	Recommendation 15: Consider known or potentially TEC/PECs		Friends Group	Recommendation 16: Weed management	Recommendation 17: Consider small-scale mosaic burns	Comments (Friends)	
LNA-00033	Cootamundra Wy, Maida Vale	LNA-00033	0.42		Waterway		Mostly Degraded vegetation. Biodiversity value is creekline (waterway protection), connectivity and fauna habitat.	3	x	x	x	x	x	x										Slash long grass.  Remove woody weeds especially adjacent to fencelines.  Fuel reduction burning not recommended due to creekline and close proximity of houses.  Use of wetland-friendly herbicides only (if required)				n/a	
LNA-00034	Kalamunda Rd/Meloway Dr, Maida Vale	LNA-00034-S01	1.54		Waterway		Three LNA sections along Nestle Brae Creek. Conservation-listed flora recorded.	2																Slash long grass/mow in parkland areas.  Confirm presence of conservation-listed flora and avoid slashing in its vicinity.	Friends of Nestle Brae Reserve	x		Woody weeds and geophytes ( <i>Watsonia</i> ) recorded; consider manual control in creekline and adjacent to houses as priority.	
	Meloway Dr/Berry Rd, Maida Vale	LNA-00034-S02	1.14			Mostly Degraded vegetation and not likely to be conservation-listed vegetation.	3																	Fuel reduction burning not recommended due to close proximity of houses.  Spot control of <i>Watsonia</i> in creekline.					
LNA-00034	Scenic Dr, Maida Vale	LNA-00034-S03	0.77		Waterway		Biodiversity value is fauna habitat and waterway protection.	3	x	x	x	x	x	x															
LNA-00037	Maida Vale Rd/Hawtin Rd, Maida Vale	LNA-00037	0.43		Waterway		Creekline (Poison Gully). Vegetation in Degraded condition so not TEC. Biodiversity value in connectivity, fauna habitat and waterway protection.	2	x	x	x	x												Slash long grass.  Keep edges adjacent to fences clear of vegetation.	Friends of Poison Gully Reserve - Hawtin Rd	x		Manage woody weeds and geophytes manually where they occur.  Clear edges adjacent to fences by removing shrubs.	





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									Recommendation 1: Documentation	Recommendation 2: Inspection intervals	Recommendation 3: Maintain firebreaks, edges, interface	Recommendation 4: Slash or mow grass	Recommendation 5: Waterway and wetland weed management	Recommendation 6: No fuel reduction burns	Recommendation 7: Fuel reduction or biodiversity burns recommended.	Recommendation 8: Fire season	Recommendation 9: Avoid burning before	Recommendation 10: Remove standing dead biomass	Recommendation 11: Control woody and geophyte weeds	Recommendation 12: Avoid burning fallen logs, large trees and standing dead trees	Recommendation 13: Manage with adjacent DBCA lands	Recommendation 14: Take into consideration TF/PF	Recommendation 15: Consider known or potentially TEC/PECs		Friends Group	Recommendation 16: Weed management	Recommendation 17: Consider small-scale mosaic burns	Comments (Friends)		
LNA-00043	Zamia Rd, Gooseberry Hill	LNA-00043	1.62		Waterway		Contains creekline but vegetation in degraded condition.  Biodiversity value for fauna and waterway protection.	3	x	x	x	x												Slash long grass.  Control <i>Watsonia</i> which is a fire hazard in summer and weedy shrubs adjacent to fences.				n/a		
LNA-00044	The Boulevard, Gooseberry Hill	LNA-00044	0.90		Waterway		Degraded vegetation/parkland cleared/playground.  Biodiversity value is a fauna habitat and waterway protection.	3	x	x	x	x												Slash/mow grass.  Not 'natural area'.				n/a		
LNA-00045	Williams St/Railway Rd, Gooseberry Hill/Kalamunda	LNA-00045-S01	1.72	01/2014 11/2018	?		Majority of vegetation in Good or better condition but no listed conservation flora or communities.  Significant weedy shrub, weed grasses and geophytes reported.  Biodiversity value as fauna habitat and connectivity.	4															Slash weeds in preference to burning.  Recommended to only conduct small-scale mosaic fuel reduction burns (if any - see data).  If burning is required for fuel reduction in weedy areas (i.e. if slashing is not suitable) program follow-up weed control for the following Autumn (for grassy weeds) and spring (for germinating weed shrubs) over the next 1-3 years.	Friends of Railway Heritage Trail Reserve North	x	x	Spot weed control and removal of standing dead shrubs.  Consider small-scale mosaic burns in areas without significant weeds.			
		LNA-00045-S02	1.14					2																						
		LNA-00045-S03	3.02					3																						
LNA-00045		LNA-00045-S04	1.72					2	x																					
LNA-00047	Hill St, Gooseberry Hill	LNA-00047	4.04	03/2016		KaNP	Large reserve with most vegetation in Good or better condition.  Adjacent to Kalamunda NP but no known conservation flora or communities.  Biodiversity value is as contiguous habitat.	3	x	x	x													Manage with DBCA.  Suggest that Friends group could conduct small-scale burns to reduce ground fuel and the need for larger-scale fires.	Friends of Hill St Reserve	x	x	Target weedy shrubs and geophytes ( <i>Watsonia</i> ) for removal.  Consider small-scale mosaic burns over various seasons to reduce ground fuel and reduce the likelihood of large scale (planned or unplanned) fires.		



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								Viability Score (1-5; low-high)	Recommendation 1: Documentation	Recommendation 2: Inspection intervals	Recommendation 3: Maintain firebreaks, edges, interface	Recommendation 4: Slash or mow grass	Recommendation 5: Waterway and wetland weed management	Recommendation 6: No fuel reduction burns	Recommendation 7: Fuel reduction or biodiversity burns recommended.	Recommendation 8: Fire season	Recommendation 9: Avoid burning before	Recommendation 10: Remove standing dead biomass	Recommendation 11: Control woody and geophyte weeds	Recommendation 12: Avoid burning fallen logs, large trees and standing dead trees	Recommendation 13: Manage with adjacent DBCA lands	Recommendation 14: Take into consideration TF/PF	Recommendation 15: Consider known or potentially TEC/PECs	Comments (CoK)	Friends Group	Recommendation 16: Weed management	Recommendation 17: Consider small-scale mosaic burns	Comments (Friends)	
LNA-00051	Snowball Rd, Kalamunda	LNA-00051	13.23	11/2011, 10/2018		DBCA	Majority of the reserve is native vegetation in Good or better condition. Includes conservation-listed flora species. Small weed list for such a large reserve. Adjacent to DBCA freehold. Biodiversity value as flora, fauna and as contiguous habitat.	4	x	x	x	x		Variable	Yes	Autumn	No timing specified	x		x					Slash grass where necessary. Keep fencelines clear of weedy shrubs. Three proposed Autumn burns identified. No specific timing (year) is recommended, however, they should not be burnt in the same period. Known conservation-listed flora species is a (soil) disturbance opportunist so unlikely to be significantly affected by fire. Manage with DBCA?	Friends of Brine Moran Reserve	x	x	See suggested tasks
LNA-00052	East Tce, Kalamunda	LNA-00052	5.35	09/2013, 10/2017, 10/2018, 10/2019			Majority of vegetation in Good or better condition but no listed conservation flora or communities. Significant numbers of weedy shrubs and other weeds reported. Biodiversity value as fauna habitat.	3	x	x	x	x		x				x						Slash edges and around tracks; maintain (or create) shrub-free firebreaks along fencelines. Liaise with Friends group for small-scale fuel reduction burns in areas largely without weeds (no larger-scale burns proposed).	East Terrace	x	x	Consider burning in small-scale mosaics to reduce overall ground fuel. Vary season of fires.	

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								Viability Score (1-5; low-high)	Recommendation 1: Documentation	Recommendation 2: Inspection intervals	Recommendation 3: Maintain firebreaks, edges, interface	Recommendation 4: Slash or mow grass	Recommendation 5: Waterway and wetland weed management	Recommendation 6: No fuel reduction burns	Recommendation 7: Fuel reduction or biodiversity burns recommended.	Recommendation 8: Fire season	Recommendation 9: Avoid burning before	Recommendation 10: Remove standing dead biomass	Recommendation 11: Control woody and geophyte weeds	Recommendation 12: Avoid burning fallen logs, large trees and standing dead trees	Recommendation 13: Manage with adjacent DBCA lands	Recommendation 14: Take into consideration TF/PF	Recommendation 15: Consider known or potentially TEC/PECs	Comments (CoK)	Friends Group	Recommendation 16: Weed management	Recommendation 17: Consider small-scale mosaic burns	Comments (Friends)				
LNA-00053	Crocus Rd, Kalamunda	LNA-00053	2.37	08/2008, 01/2014			Majority of vegetation in Good or better condition. Conservation-listed flora species but no conservation listed communities. Biodiversity value as flora and fauna habitat and connectivity.	3	x	x	x	x				Not recommended	Only if >8 tons/ha		No timing specified	x		x					Slash long grasses if necessary. Fuel reduction fires small-scale only to reduce ground fuel but only if necessary. Do not burn western section due to health hazards of smoke at adjacent health facility (unless small scale and wind direction from the west or south). Do not burn south/central section due to weeds. Fuel reduction burns should concentrate on northern and eastern sections.	Friends of Crocus Rd Reserve	x	x		Consider burning in small-scale mosaics to reduce overall ground fuel. Vary season of fires.
LNA-00054	Crocus Rd, Kalamunda	LNA-00054	0.30				Small reserve in degraded condition. Biodiversity value as fauna habitat.	2	x	x	x					x										Inspect for ground fuel but otherwise no proposed management.					n/a	
LNA-00055		LNA-00055	0.40				Small reserve with virtually no road frontage. Vegetation in Good condition. Biodiversity value as fauna habitat.	2	x	x	x					x										Inspect for ground fuel but otherwise no proposed management.					n/a	
LNA-00056	Spring Rd, Kalamunda	LNA-00056	0.48				Best condition LNA in City. No conservation flora or communities. Biodiversity value as great representative of intact vegetation and fauna habitat.	4	x	x	x					x										Discuss with adjacent landholders if they are interested in manually reducing above ground fuel on edges (ie shrub thinning) otherwise no changes/no management.	Friends of Spring Rd Reserve North	x	x		Monitor for weeds and remove any weedy shrubs should they appear.	

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									Recommendation 1: Documentation	Recommendation 2: Inspection intervals	Recommendation 3: Maintain firebreaks, edges, interface	Recommendation 4: Slash or mow grass	Recommendation 5: Waterway and wetland weed management	Recommendation 6: No fuel reduction burns	Recommendation 7: Fuel reduction or biodiversity burns recommended.	Recommendation 8: Fire season	Recommendation 9: Avoid burning before	Recommendation 10: Remove standing dead biomass	Recommendation 11: Control woody and geophyte weeds	Recommendation 12: Avoid burning fallen logs, large trees and standing dead trees	Recommendation 13: Manage with adjacent DBCA lands	Recommendation 14: Take into consideration TF/PF	Recommendation 15: Consider known or potentially TEC/PECs		Friends Group	Recommendation 16: Weed management	Recommendation 17: Consider small-scale mosaic burns
LNA-00058	Headingly Rd, Kalamunda	LNA-00058	0.18				Mostly degraded native vegetation. Biodiversity value is as fauna habitat.	2	x	x	x	x											Slash edges. Remove standing dead shrubs.				n/a
LNA-00059	Holly Wy West, Kalamunda	LNA-00059	0.17				Tiny reserve with some Good or better condition vegetation. Biodiversity value as fauna habitat.	2	x	x	x	x											Slash grass and edges as required.				n/a
LNA-00060	Railway Rd, Kalamunda	LNA-00060-S01	6.77	S1: 11/2014			Majority of vegetation in Good or better condition but no conservation flora or communities.	2														Slash edges and around tracks; maintain (or create) shrub-free firebreaks along fencelines. Reduce frequency of planned burns but consider more regular inspections than other areas.	Friends of Railway Heritage Trail Reserve Central	x		Remove/control weedy shrubs and geophytes. Remove standing dead shrubs and mulch them where possible. Consider small-scale mosaic burns but extensive fire history indicates CoK is intensively managing this LNA	
		LNA-00060-S02	0.89	S2: 05/2009, 08/2012, 01/2013, 11/2014, 06/2015, 03/2018, 04/2018		Biodiversity value largely as fauna habitat.	3	x	x	x	x											One planned burn, preferably Autumn (not critical; spring is OK)					
LNA-00062	Gladstone Rd, Kalamunda	LNA-00062-S01	6.53	05/2011, 06/2015, 09/2015, 01/2016, 06/2017, 09/2017, 10/2017			Long narrow LNA contiguous with larger areas of bushland.	2														Slash edges/grasses as necessary.	Friends of Railway Heritage Trail Reserve South	x	x	Remove/control weedy shrubs and geophytes. Remove standing dead shrubs and mulch them where possible. Consider small-scale mosaic burns but extensive fire history indicates CoK is intensively managing this LNA	
		LNA-00062-S02	6.58	10/2012, 05/2017, 06/2017, 10/2019, 12/2022		Majority of bushland is in Good or better condition.	3															LNA has been targeted for frequent fuel reduction burns.					
		LNA-00062-S03	3.50	01/2015, 11/2015, 01/2016, 11/2016, 03/2017, 09/2017, 11/2017, 05/2019		May have conservation-listed flora. Biodiversity value as an area of contiguous bushland.	2	x	x	x	x																Only one additional burn recommended in spring (last burnt 2011) otherwise suggest at least 10-year intervals, varying season of burning if possible but otherwise as resources are available.







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									Recommendation 1: Documentation	Recommendation 2: Inspection intervals	Recommendation 3: Maintain firebreaks, edges, interface	Recommendation 4: Slash or mow grass	Recommendation 5: Waterway and wetland weed management	Recommendation 6: No fuel reduction burns	Recommendation 7: Fuel reduction or biodiversity burns recommended.	Recommendation 8: Fire season	Recommendation 9: Avoid burning before	Recommendation 10: Remove standing dead biomass	Recommendation 11: Control woody and geophyte weeds	Recommendation 12: Avoid burning fallen logs, large trees and standing dead trees	Recommendation 13: Manage with adjacent DBCA lands	Recommendation 14: Take into consideration TF/PF	Recommendation 15: Consider known or potentially TEC/PECs		Friends Group	Recommendation 16: Weed management	Recommendation 17: Consider small-scale mosaic burns
LNA-00071	Crayden Rd, Kalamunda	LNA-00071	0.26	01/2015			Approximately 1/3 of native vegetation in Good or better condition. Biodiversity value as fauna habitat.	2	x	x	x	x											Slash road edges and adjacent to fences	Friends of Crayden and Coral Reserves	x		Manually manage fuel load to protect tubestock plantings.
LNA-00072	Crayden Rd, Kalamunda	LNA-00072	0.12	10/2010			Approximately half is in Good or better condition. Biodiversity value is as fauna habitat.	2	x	x	x	x											Slash road edges and adjacent to fences	Friends of Crayden and Coral Reserves	x		Manually manage fuel load to protect tubestock plantings.
LNA-00073	Nangkita Rd, Kalamunda	LNA-00073	0.44	01/2014			All Good or better condition native vegetation. Biodiversity value is as fauna habitat.	2	x	x	x	x											Slash around edges. Fuel reduction burning not recommended (apparently last burnt in 2014).				n/a
LNA-00074	Elmwood Cres, Lesmurdie	LNA-00074	0.33	05/2012			Some Good condition vegetation but majority degraded. Little road frontage. Biodiversity value as fauna habitat.	2	x	x	x	x											Slash edges and paths. Remove weedy shrubs from fencelines. No evidence of 2012 hazard reduction burn on aerial imagery.				n/a
LNA-00075	Petunia St, Kalamunda	LNA-00075	0.39				Small proportion of LNA in Good or better condition. Biodiversity value is as fauna habitat.	2	x	x	x	x											Slash grass and paths.	Friends of Petunia Reserve	x		Remove Watsonia and other weeds (including weedy shrubs) manually or by herbicide. Remove standing dead shrub vegetation.
LNA-00076	Lyndhurst Rd, Kalamunda	LNA-00076	0.22				Approximately 2/3 of vegetation in Good or better condition but small. Biodiversity value is as fauna habitat.	2	x	x	x	x											Slash edges. Assess for weedy shrubs and standing dead biomass and remove (control shrubs) if present.				n/a
LNA-00077	Lesmurdie Rd, Kalamunda	LNA-00077	0.36				Small reserve but in Good or better condition. Biodiversity value is as fauna habitat.	2	x	x	x	x											Inspect and slash edges if necessary.				n/a

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									Recommendation 1: Documentation	Recommendation 2: Inspection intervals	Recommendation 3: Maintain firebreaks, edges, interface	Recommendation 4: Slash or mow grass	Recommendation 5: Waterway and wetland weed management	Recommendation 6: No fuel reduction burns	Recommendation 7: Fuel reduction or biodiversity burns recommended.	Recommendation 8: Fire season	Recommendation 9: Avoid burning before	Recommendation 10: Remove standing dead biomass	Recommendation 11: Control woody and geophyte weeds	Recommendation 12: Avoid burning fallen logs, large trees and standing dead trees	Recommendation 13: Manage with adjacent DBCA lands	Recommendation 14: Take into consideration TF/PF	Recommendation 15: Consider known or potentially TEC/PECs		Friends Group	Recommendation 16: Weed management	Recommendation 17: Consider small-scale mosaic burns
LNA-00080	Lesmurdie Rd East, Walliston	LNA-00080	0.23				Small reserve but in Good or better condition. Biodiversity value is as fauna habitat.	2	x	x	x	x											Slash road edges. Consider thinning of dense vegetation along southern edge.				n/a
LNA-00081	The Promenade, Wattle Grove	LNA-00081-S01 LNA-00081-S02	0.49 3.56		Waterway		All DBCA conservation flora records from here have location details indicating they are from other places. Not native vegetation; no conservation flora or communities - not LNA. Biodiversity value is waterway protection.	2	x	x	x												Not LNA. Maintain as parks and gardens.				n/a
LNA-00082	Fennell Cres, Wattle Grove	LNA-00082	0.29				No native vegetation - grassy park. Not LNA.	2	x	x	x												Not LNA. Maintain as parks and gardens.				n/a
LNA-00083	Kalari Dr, Wattle Grove	LNA-00083-S01 LNA-00083-S02 LNA-00083-S03	2.66 0.83 2.93		Waterway, Wetland		Includes man-made lakes in parkland and semi-native bushland. Approximately 1/3 considered Good condition native vegetation but not likely to be a conservation-listed vegetation type. Connected to Hartfield Park natural area. Biodiversity value as fauna habitat, landscape connectivity and waterway protection. May have conservation-listed flora.	1	x	x	x												Maintain as parks and gardens.	Friends of Woodlupine Living Stream	x		Localised weed control.











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									Recommendation 1: Documentation	Recommendation 2: Inspection intervals	Recommendation 3: Maintain firebreaks, edges, interface	Recommendation 4: Slash or mow grass	Recommendation 5: Waterway and wetland weed management	Recommendation 6: No fuel reduction burns	Recommendation 7: Fuel reduction or biodiversity burns recommended.	Recommendation 8: Fire season	Recommendation 9: Avoid burning before	Recommendation 10: Remove standing dead biomass	Recommendation 11: Control woody and geophyte weeds	Recommendation 12: Avoid burning fallen logs, large trees and standing dead trees	Recommendation 13: Manage with adjacent DBCA lands	Recommendation 14: Take into consideration TF/PF	Recommendation 15: Consider known or potentially TEC/PECs		Friends Group	Recommendation 16: Weed management	Recommendation 17: Consider small-scale mosaic burns
LNA-00105	Gladys Rd, Lesmurdie	LNA-00105	0.96	09/2016			Approximately 3/4 in Good or better condition. Biodiversity value as fauna habitat.	2	x	x	x	x											Slash grasses.  If fuel reduction required consider partial burnoff (no specific areas identified for targeting).  No specific area for repeat burn recommended.				n/a
LNA-00106	Brady Rd, Lesmurdie	LNA-00106	0.81				Approximately 3/4 in Good or better condition. Biodiversity value as fauna habitat.	2	x	x	x	x											Slash grasses				n/a
LNA-00107	Over Ave, Lesmurdie	LNA-00107	1.13	01/2014			Majority in Good or better condition; contiguous with other bushland. Biodiversity value as fauna habitat.	3	x	x	x	x											Slash if necessary.  Consider small-scale fuel reduction burns with Friends group to manage ground fuel. No specific areas recommended for burns.	Friends of Boorlaie Way Reserve	x	x	No significant weeds reported but remove if found e.g. <i>Watsonia</i> , weedy <i>Acacias</i> .  Consider small-scale mosaic burns in Autumn for fuel reduction and regeneration.
LNA-00108	Granby St, Lesmurdie	LNA-00108	0.51	05/2012, 11/2017			Majority in degraded condition. Biodiversity value as fauna habitat.	2	x	x	x	x											Slash as required.  Fuel reduction burns not recommended.				n/a
LNA-00109	Granby St, Lesmurdie	LNA-00109	0.70	05/2011, 05/2017			Approximately 3/4 in Good or better condition. Biodiversity value as fauna habitat.	2	x	x	x	x											Slash as required.  Fuel reduction burn as required; no specific areas recommended for burning.				n/a
LNA-00110	Mary Dr, Lesmurdie	LNA-00110-S01	0.36		Drain		Approximately 2/3 in Good or better condition.	2															Slash grasses.  Burning not recommended for Section 1.				
		LNA-00110-S02	0.18	S2: 01/2018			Biodiversity value as fauna habitat.	3	x	x	x	x													No burning recommended for Section 2 but conduct if necessary for ground fuel load management		













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									Recommendation 1: Documentation	Recommendation 2: Inspection intervals	Recommendation 3: Maintain firebreaks, edges, interface	Recommendation 4: Slash or mow grass	Recommendation 5: Waterway and wetland weed management	Recommendation 6: No fuel reduction burns	Recommendation 7: Fuel reduction or biodiversity burns recommended.	Recommendation 8: Fire season	Recommendation 9: Avoid burning before	Recommendation 10: Remove standing dead biomass	Recommendation 11: Control woody and geophyte weeds	Recommendation 12: Avoid burning fallen logs, large trees and standing dead trees	Recommendation 13: Manage with adjacent DBCA lands	Recommendation 14: Take into consideration TF/PF	Recommendation 15: Consider known or potentially TEC/PECs		Friends Group	Recommendation 16: Weed management	Recommendation 17: Consider small-scale mosaic burns	Comments (Friends)
LNA-00134	Lawnbrook Rd W, Walliston	LNA-00134	0.29	05/2013, 09/2013			Less than have in Good or better condition. Biodiversity value as fauna habitat.	2	x	x	x													Manage for fuel load; burn in areas as necessary (no specific recommendations)				n/a
LNA-00135	Chisolm Cres, Kewdale	LNA-00135	0.08		Waterway		Narrow inaccessible reserve in degraded condition along drain. No significant biodiversity value; unlikely to be LNA.	1	x	x	x													No management required				n/a
LNA-00136	Maamba Rd, Wattle Grove	LNA-00136	0.23		Waterway		Degraded area. Biodiversity value as waterway protection, connectivity and (poor) fauna habitat.	2	x	x	x	x												Slash as required.				n/a
LNA-00137	Milner Rd, High Wycombe	LNA-00137	0.30				Narrow bridle trail. Degraded vegetation, not TEC. Little biodiversity value.	1	x	x	x	x												Slash as required.				n/a
LNA-00138	Maclarty Wy, High Wycombe	LNA-00138	0.26				Largely Good or better condition vegetation. Biodiversity value for conservation-listed flora and for fauna.	2	x	x	x														Friends of John McLarty Park	x		Manage weeds as required.
LNA-00139	Bandalong Wy, High Wycombe	LNA-00139	0.18				Not native vegetation; not LNA	2	x	x	x	x												Mow/slash as appropriate; manage as parks and gardens. Not native vegetation.				n/a
LNA-00140	Calophylla Wy, High Wycombe	LNA-00140	0.68				Not native vegetation; not LNA	2	x	x	x													Not native bushland. Manage as parks and gardens				n/a



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LNA-00147	Barbigal Place, Lesmurdie	LNA-00147	0.17		Waterway		Entirely degraded condition vegetation. Creekline but largely cleared. Biodiversity value as fauna habitat and waterway protection.	1	x	x	x	x											Slash/mow grass. Manage as parks and gardens.				n/a
LNA-00148	Andrew St, Kalamunda	LNA-00148	2.52	11/2012	Waterway		Approximately 1/3 Good or better condition but majority is parkland/grass. Biodiversity value as fauna habitat and waterway protection.	2	x	x	x	x											Slash/mow grass. Manage as parks and gardens.				n/a
LNA-00149	Falls Rd, Lesmurdie	LNA-00149	0.15	11/2011			Degraded vegetation. Biodiversity value as fauna habitat.	2	x	x	x	x											Slash grasses.				n/a
LNA-00150	Stone Rd, Lesmurdie	LNA-00150	0.20				Small portion in Good or better condition. Biodiversity value as fauna habitat.	2	x	x	x	x											Slash grasses.				n/a
LNA-00151	Flora Tce, Lesmurdie	LNA-00151	1.45		Waterway		Degraded condition vegetation. Biodiversity value as fauna habitat and waterway protection.	2	x	x	x	x											Slash/mow grass. Manage as parks and gardens.				n/a
LNA-00152	Sing Gardens, Walliston	LNA-00152	1.81		Waterway, Wetland		Majority of vegetation in degraded condition. Has wetland and creekline. Biodiversity value as fauna habitat (including wetland) and waterway protection.	3	x	x	x	x											Slash/mow grass. Manage as parks and gardens.				n/a

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									Recommendation 1: Documentation	Recommendation 2: Inspection intervals	Recommendation 3: Maintain firebreaks, edges, interface	Recommendation 4: Slash or mow grass	Recommendation 5: Waterway and wetland weed management	Recommendation 6: No fuel reduction burns	Recommendation 7: Fuel reduction or biodiversity burns recommended.	Recommendation 8: Fire season	Recommendation 9: Avoid burning before	Recommendation 10: Remove standing dead biomass	Recommendation 11: Control woody and geophyte weeds	Recommendation 12: Avoid burning fallen logs, large trees and standing dead trees	Recommendation 13: Manage with adjacent DBCA lands	Recommendation 14: Take into consideration TF/PF	Recommendation 15: Consider known or potentially TEC/PECs		Friends Group	Recommendation 16: Weed management	Recommendation 17: Consider small-scale mosaic burns
LNA-00153	Canning Rd, Lesmurdie	LNA-00153	2.42				Approximately 1/4 in Good or better condition.  Semi-natural bushland surrounding sporting field.  Biodiversity value as fauna habitat.	2	x	x	x	x											Slash/mow grass.  Manage as parks and gardens.				n/a
LNA-00154	Ryan Wy, Lesmurdie	LNA-00154	0.40	01/2016, 03/2016			Entirely degraded condition vegetation.  Biodiversity value as fauna habitat.	2	x	x	x	x											Slash grass, particularly along edges along fencelines (firebreak) - removing shrubs as necessary.  Burning not recommended as it increases weed cover but conduct if necessary (i.e. if the only way to reduce ground fuel)				n/a
LNA-00155	Petunia St, Kalamunda	LNA-00155	0.20				Entirely degraded condition vegetation.  Minimal biodiversity as fauna habitat but very little native vegetation	2	x	x	x	x											Slash grass.  Consider turning into managed parkland.	Friends of Petunia Street Reserve	x		Weed management.  Consider approaching CoK to develop as a managed park.
LNA-00156	Currawong Dr, Gooseberry Hill	LNA-00156	0.69		Waterway		Not mapped as waterway but is a gully that accumulates water.  Entirely Degraded condition vegetation, very little of it native species.  Minor biodiversity value as fauna habitat and waterway protection.	1	x	x	x	x											Requires intensive weedy shrub removal and grass slashing to reduce fire risk.				n/a
LNA-00157	Kadina Rd, Gooseberry Hill	LNA-00157	0.36	06/2017			Approximately 2/3 Good or better condition.  Biodiversity value as fauna habitat.	3	x	x	x	x											Slash edges.  Fuel reduction burns not recommended but may be required for ground fuel management.				n/a









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								Viability Score (1-5; low-high)	Recommendation 1: Documentation	Recommendation 2: Inspection intervals	Recommendation 3: Maintain firebreaks, edges, interface	Recommendation 4: Slash or mow grass	Recommendation 5: Waterway and wetland weed management	Recommendation 6: No fuel reduction burns	Recommendation 7: Fuel reduction or biodiversity burns recommended.	Recommendation 8: Fire season	Recommendation 9: Avoid burning before	Recommendation 10: Remove standing dead biomass	Recommendation 11: Control woody and geophyte weeds	Recommendation 12: Avoid burning fallen logs, large trees and standing dead trees	Recommendation 13: Manage with adjacent DBCA lands	Recommendation 14: Take into consideration TF/PF		Recommendation 15: Consider known or potentially TEC/PECs	Friends Group	Recommendation 16: Weed management
LNA-00174	Hale Rd, Forrestfield	LNA-00174-S01	1.61		Waterway		Biodiversity value as waterway protection.	2															Largely not native vegetation or in degraded condition.			
		LNA-00174-S02	1.13				Not likely to have conservation-listed vegetation.	2	x	x	x	x												Not suitable for burning as it is a powerline easement. Slash grasses.		
LNA-00175	Magma Rd, Wattle Grove	LNA-00175	2.39		Waterway, Wetland		Managed park with modified wetlands (REW/MUW) and waterway. Biodiversity value as waterway protection (may have conservation-listed flora).	1	x	x	x	x	x										Manage as parkland. Slash/mow grass.			n/a
LNA-00176	Abernethy Rd, High Wycombe	LNA-00176	0.66		Wetland		Modified drainage basin. Biodiversity value as wetland fauna habitat and possible connection to adjacent wetland (airport). No road frontage.	2	x	x	x	x	x										Inspect and slash grass if necessary.			n/a
LNA-00177	Abernethy Rd, High Wycombe	LNA-00177	1.77		Wetland		Modified drainage basin. Biodiversity value as wetland fauna habitat.	2	x	x	x	x	x										Inspect and slash grass if necessary.			n/a
LNA-00178	Abernethy Rd, High Wycombe	LNA-00178	1.30		Wetland		Modified drainage basin. Biodiversity value as wetland fauna habitat.	2	x	x	x	x	x										Inspect and slash grass if necessary.			n/a
LNA-00179	Abernethy Rd, High Wycombe	LNA-00179	1.77		Waterway, Wetland		Modified drainage basin. Biodiversity value as wetland fauna habitat and possible connection to waterway (waterway protection).	2	x	x	x	x	x										Inspect and slash grass if necessary.			n/a









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LNA-00194	Marri Cres, Lesmurdie	LNA-00194	0.06		Waterway		Drainage easement. Degraded condition vegetation. Biodiversity value as waterway protection, fauna habitat	2	x	x	x	x	x	x										Slash grass if necessary. Manage significant weeds if the occur.				n/a
LNA-00195	Dawson Ave, Forrestfield	LNA-00195	2.11		Waterway		Contains drain. Very little (2%) of vegetation in Good condition so not TEC. Biodiversity value is waterway protection and fauna habitat.	2	x	x	x	x	x	x										Slash grasses. Remove significant weeds if they occur.				n/a
LNA-00196	Nangkita Rd, Kalamunda	LNA-00196	0.36		Waterway		Contains waterway but modified. All degraded condition vegetation. Biodiversity value as waterway protection, fauna habitat.	2	x	x	x	x	x	x										Slash grass; remove woody weeds. Manage as parks and gardens.				n/a
LNA-00197	Kaolunga Wy, Lesmurdie	LNA-00197	1.10		Waterway		Biodiversity value as waterway protection. Parkland and parkland cleared (all degraded condition vegetation).	2	x	x	x	x	x	x										Manage as parks and gardens				n/a
LNA-00198	Fletcher Rd, Lesmurdie	LNA-00198	2.33		Waterway		Biodiversity value as waterway protection. Parkland and parkland cleared (all degraded condition vegetation).	1	x	x	x	x	x	x										Manage as parks and gardens				n/a
LNA-00199	Tindale Rd, Lesmurdie	LNA-00199	0.16		Waterway		Not native vegetation. Biodiversity value as waterway protection.	1	x	x	x	x	x	x										Slash grass. Manage as parks and gardens.				n/a

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LNA-00200	Agnes Cl, Lesmurdie	LNA-00200	0.77		Waterway, Wetland		Not native vegetation. Biodiversity value as waterway protection, fauna habitat (wetland)	1	x	x	x	x	x	x											Slash grass. Manage as parks and gardens.				n/a
LNA-00201	Elmore Wy, High Wycombe	LNA-00201	0.62		Wetland		Wetland and parkland. Biodiversity value as fauna habitat.	1	x	x	x	x	x	x											Manage parkland (mow grass).				n/a
LNA-00202	Buttercup Cr, High Wycombe	LNA-00202	0.29		Wetland	?HNR	Adjacent to Hawkesvale NR. All degraded condition vegetation so not TEC. Drainage sump but not wetland. Virtually no biodiversity value; not LNA.	2	x	x	x	x		x											Slash grass.				n/a
LNA-00203	Midland Rd, Maida Vale	LNA-00203	0.40				Drainage sump. No native vegetation. Virtually no biodiversity value. Not LNA.	1	x	x	x	x		x											Slash grass if necessary				n/a
LNA-00204	Hawtin Rd, Maida Vale	LNA-00204	0.23		Waterway		Biodiversity value as waterway protection and fauna habitat. All degraded condition vegetation.	2	x	x	x	x	x	x											Undocumented but likely has significant weeds. Inspect but unlikely to be accessible for slashing due to density of vegetation.				n/a









