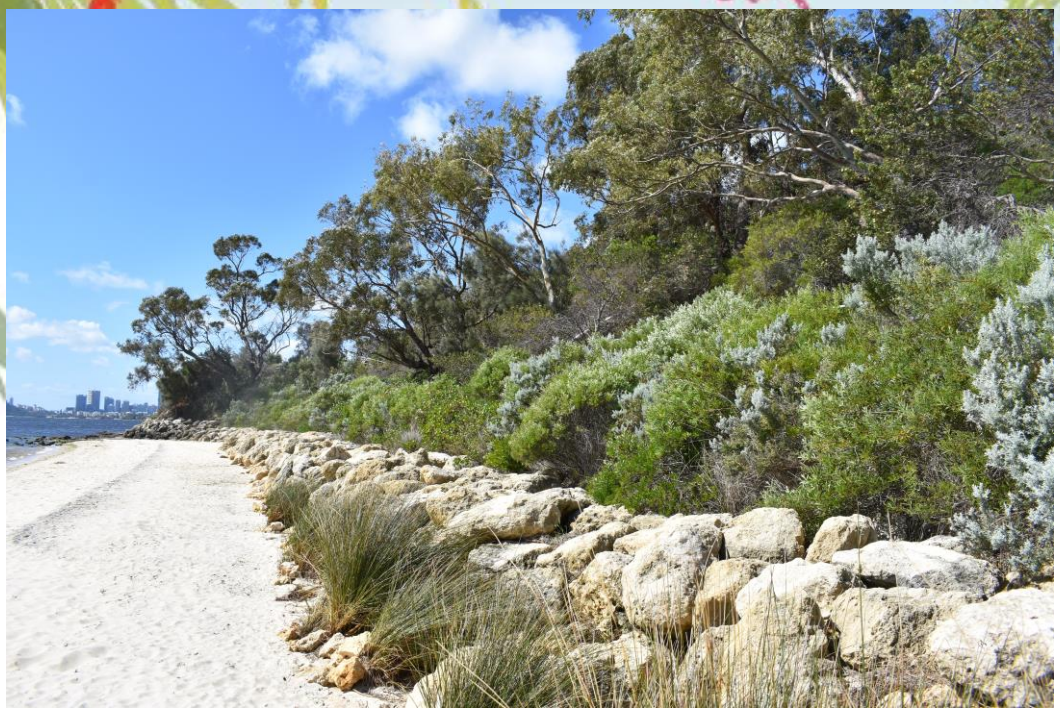
City of Melville



City of Melville

Heathcote Reserve Strategic Management Plan

2021-2027

Executive Summary

Heathcote Reserve includes a 1.07 ha portion of bushland reserve 47152, which is 2.97 ha in total. This strategic management plan updates the previous Heathcote Strategic Management Plan 2014-2019.

Assets in terms of flora, fauna ecological communities and fauna habitat were recorded during the 2021 spring survey:

- Regionally significant vegetation complex Karrakatta Complex - Central and South, which has less than 25% of its original extend remaining in the Swan Coastal Plain
- One vegetation type Open Tuart (*Eucalyptus gomphocephala*) Woodlands, this vegetation type also meet the criteria of the threatened ecological community Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain listed under the EPBC Act 1999
- 93 flora species present including 44 (47.3%) native species
- 14 fauna species including:
  - ten birds
  - three reptiles
  - three mammals
  - four invertebrates
- three native species classified as 'at-risk' by the City, these include:
  - Weebil
  - Tree Martin
  - Pacific Black Duck
- Two habitat trees with a DBH > 500 mm that can potentially provides habitat for threatened black cockatoos
- One European heritage site Heritage Place No 3289
- Two Aboriginal heritage sites Goolugatup (18623) and Swan River (3565).

Several threats are present within Heathcote Reserve, these include:

- physical disturbances e.g. rubbish dumping and graffiti
- a total of 44 weeds, none were declared pests or weeds of national significance
- presence of habitat loss (bare ground and weed cover)
- a total of four feral species.

Management Strategies have been developed for 2022-2027 including Key Performance Indicators for Heathcote Reserve. The main priorities for management include:

- undertake weed control of Very High and High impact weeds
- revegetate across the entire site particularly the understorey species, to enhance vegetation condition of the TEC and reduce habitat loss.
- Continue to monitor and report any increase in threats within the reserve and undertake management in accordance with the NAAMP
- Continue to monitor assets for decline in health or damage and repair or mange in accordance with the NAAMP.

Acknowledgements

Natural Area Consulting Management Services would like to acknowledge the contribution of the following people during the preparation of the strategic of the strategic management plan:

- Kellie Fowler, Environmental Officer (City of Melville)

Table of Contents

1 Introduction

The City of Melville (the City) commissioned Natural Area Consulting Management Services (Natural Area) to update a site-specific Management Plan for Heathcote (Heathcote Reserve Bushland), in accordance with the City of Melville's *Natural Areas Asset Management Plan* (NAAMP) (2019a). Natural Area carried out flora, vegetation, and fauna surveys within Heathcote to provide updated flora and fauna inventory lists outlined in the NAAMP, to ensure the management strategy addresses local and current conditions.

1.1 Background

Heathcote Reserve is located within the suburb of Applecross in the City of Melville and is approximately 6km south-west of the Perth Central Business District (CBD). The reserve is located within Lot 302 D44663 and Lot 304 D44663 of the City (Reserve 47152). It is a heritage-listed site, containing several cultural land-uses, and covers a total of 2.97 ha. The scope of this management plan is the 1.07 ha of bushland within the 2.97 ha reserve (Figure 1).

A previous management plan has been conducted*; Heathcote Strategic Management Plan 2014-2019* (Waters, 2014), which highlights site-specific threats and assets while outlining strategies to manage them accordingly. This management plan updates the former and provides a renewed five-year plan for 2022-2027.

1.2 Objectives

The objective of this plan is to provide flexible management strategies for site specific risks in accordance with the City's NAAMP. The aim of the management plan is to maintain and enhance the various ecological functions and values associated within Heathcote, which included:

- identification of threatening processes outlined within the NAAMP that occur within the bushland areas
- identification of assets
- identification of site-specific threatening processes over time
- provision of clear reserve management key performance indicators and recommendations to reduce negative impacts associated with the various threatening processes
- provision of a plan to improve degraded areas within the reserve and maintain areas.

Figure 1:
Site Location
Heathcote Reserve, City of Melville

Client: City of Melville
Date: March 2022
Created by: S. Treloar
Image Source: Nearmap, 2022
Datum: GDA 94

1.3 Scope

Natural Area carried out the following works:

- basic flora survey to record any at-risk species, vegetation types and conditions
- point infestation and density mapping of all weed species
- detailed fauna survey including funnel and Elliot trapping over a 5-day period, installation of camera traps, and bat detection surveys
- mapping locations of existing tracks and paths within the reserve
- mapping locations of disturbance activities and infrastructure
- mapping locations of habitat trees
- assess key threatening processes within the reserve
- management recommendations for Heathcote Reserve.

1.4 Land Tenure and Zoning

Heathcote Reserve is approximately 2.97 ha and is a public open space, which contains several cultural and recreational facilities.

According to the City of Melville Local Planning Policy Scheme No. 6, Heathcote Reserve is zoned as Parks and Recreation.

2 Assets

2.1 Reserve Ratings

The City of Melville's NAAMP (2019a) developed a framework considering factors such as species present, vegetation types and community value in order to rate the City's numerous reserves from 1 (highest) to 5 (lowest). This allows the prioritisation and management of higher rated reserves in order to maintain their value. Heathcote reserve is one of five reserves that were given the rating of 1.

2.1.1 Bush Forever

Bush Forever Sites are regionally significant bushland and wetland areas within the Swan Coastal Plain that were identified as needing protection in Perth's Bushland Project (Government of Western Australia, 2000).

Heathcote meets two key criteria and is currently listed as Bush Forever Site Number 329, Point Heathcote Foreshore, Applecross (Table 1).

Table 1: Bush Forever Criteria, Heathcote Reserve

Bush Forever Criteria	Comments
General criteria for the protection of wetland and coastal vegetation	▪ Contains Conservation Wetlands
Criteria not relevant to determination of regional significance	▪ Contains the following criteria: - recreation values - sites of historical significance (post-European settlement) - sites of significance for Aboriginal people - social values - aesthetic value.

Source: Government of Western Australia (2000) and NAAMP (2019a)

2.1.2 Ecological Linkages

Ecological Linkages provide refuge for fauna to move between natural bushland areas, therefore increasing the size of available fauna habitat and increasing genetic diversity of species present. Ecological linkages can also increase the effective size and maintain genetic diversity of flora populations between isolated bushland remnants. Extensive land clearing has led to a fragmented landscape which can disrupt native species. Therefore, it is important to identify and protect remnant ecological linkages which act as stepping stones to facilitate ecological processes and movement across a landscape (Western Australian Local Government Association, 2009).

City of Melville's NAAMP (2019a) assesses Heathcote to be a Very High value linkage, and forms part of the Swan River regional linkage as well as serving as a local linkage with Booragoon Lake (north-south Regional Greenway 24: Swan River (Alan Tingay and Associates, 1998)). High number of urban developments within the suburb of Applecross has reduced the abundance of remnant native vegetation. As such, green spaces such as roadside planting verges, parks and private residential gardens should be rehabilitated and revegetated to provide ecological linkages.

2.2 Site Assets

This section discusses the environmental, heritage and social assets of Heathcote Reserve.

2.2.1 Ecological Communities

Ecological communities are biological assemblages of plants and animals found in particular landscapes. They are mainly described based on the dominant plant structures and assemblages present but do provide fauna habitat for specific species. In this strategic management plan, ecological communities are described based on the flora assemblages present within the reserve.

2.2.1.1 Vegetation Complex

Heathcote is situated within the Karrakatta Complex - Central and South (DPIRD, 2021). This complex is described as open-forest composed of Tuart, Jarrah and Marri, with lower-storey species including *Banksia attenuata, B. menziesii, B. grandis, Allocasuarina fraseriana, Agonis flexuosa, Jacksonia furcellata, J. sternbergiana, Acacia cyclops, A. saligna, Allocasuarina humilis, Calothamnus quadrifidus, Grevillea thelemanniana* and *Hibbertia spp.* (Heddle, Loneragan and Havel, 1980). The pre-European extent of this vegetation complex remaining is:

- 23.49% within the Swan Coastal Plain
- 4.7% within the City of Melville local government area (Government of Western Australia, 2019).

2.2.1.2 Vegetation Types

Protected Matters Search Tool (PMST) indicated the potential for three Threatened Ecological Communities (TEC) to occur within 5 km of Heathcote (Department of Agriculture, Water and the Environment (DAWE), 2021). These are:

- Banksia Woodlands of the Swan Coastal Plain: Endangered
- Subtropical and Temperate Coastal Saltmarsh: Vulnerable
- Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain: Critically Endangered.

Due to the species composition at Heathcote, the only TEC likely to occur is Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain.

One vegetation type was identified during the 2021 survey by Natural Area; Tuart (*Eucalyptus gomphocephala*) Woodland. This varies slightly from those previously recorded, however field assessment did not confirm the presence of the additional vegetation type identified in 2014: Cockies Tongues (*Templetonia retusa*) shrubland (Waters, 2014). Differences are attributed to the time since the last assessment allowing for different species to mature and changes to dominant

species composition, as well the judgement of different assessors in the field. Certain portions of the site contained revegetation and therefore were not assessed as Tuart Woodland.

2.2.2 Fauna Habitat

Heathcote serves as an important habitat at a local level as well as providing regional ecological linkages to surrounding areas, particularly for mobile species such as bats and birds.

Black cockatoo activity within Heathcote is possible, as the reserve occurs within:

- Carnaby's Cockatoo Confirmed Roost Sites Buffered 6km
- Carnaby's Cockatoo Unconfirmed Roost Sites Buffered 6km
- Carnaby's Cockatoo Unconfirmed Breeding Areas within the Swan Coastal Plain and Jarrah Forest IBRA Regions
- Carnaby's Cockatoo Areas requiring investigation as feeding habitat in the Swan Coastal Plain (SCP) IBRA Region (DBCA 2021a).

Spring surveys undertaken in 2021 by Natural Area determined that some black cockatoo foraging flora species were present including *Banksia sessilis, B. attenuata, B. menziesii, Banksia nivea* and *Hakea prostrata*. However, these were in low densities across the site and considered of low foraging value. Additionally, no black cockatoo individuals or evidence of feeding were observed.

Large native trees with a diameter at breast height (DBH) greater than 500 mm provide important habitat for bird and bat species. They provide roosting, foraging and nesting habitats with larger trees more likely to contain hollows suitable for black cockatoo nesting. Habitat trees with a DBH greater than 500 mm were mapped across Heathcote with any notable fauna interactions such as nests, hollows and feral beehives recorded (Figure 2). Tree hollows with a sufficiently wide entrance (≤10 cm), suitable entry angle and hollow depth may present potential breeding habitat for black cockatoos. Smaller hollows within trees provide nesting habitat for other bird species and have the potential to become suitable for black cockatoos in the future.

Two bird boxes were recorded on Tuart trees within Heathcote, one of which was being utilized by a Rainbow Lorikeet (*Trichoglossus haematodus*) (Figure 2). One bat box was also observed (Figure 3). All nest boxes are in good condition. Fauna habitat site indices for habitat trees are shown in Table 2.

Figure 2: Bird box on a Tuart tree being utilised by a Rainbow Lorikeet within Heathcote Reserve bushland

Table 2: Fauna Habitat Trees With DBH > 500 mm in Heathcote Reserve Bushland

Values	Habitat Sites	Trees/Hectare 2013	Trees/Hectare 2021
High Very large trees	Live native tree	4	2
	Dead tree	0	0

Figure 3:
Habitat Trees and Nest Boxes
Heathcote Reserve, City of Melville

Client: City of Melville
Date: March 2022
Created by: K.Grant
Image Source: Nearmap, 2022
Datum: GDA 94

0 50 100 m

N

2.2.3 Wetlands

Wetlands are areas that experience permanent, seasonal or intermittent waterlogging or inundation by water (DBCA, 2018). The Perth Ground Water Map from the Department of Water and Environmental Regulation (DWER) (2021a) identifies the depth to groundwater ranging from 4.0 to 17.0 m.

The foreshore boundary of Heathcote was classified in 2019 as a conservation estuary (DBCA, 2021b), being part of the Swan-Canning Estuary (Identifier WA091) (City of Melville, 2019a).

2.2.4 Heritage

The bushland at Heathcote is located within the Heathcote Hospital Precinct, recognized by the WA Heritage Register as Heritage Place No. 3289. It is classified as a Category 1 - Exceptional heritage site, being essential to the heritage of the area (City of Melville, 2019b). This classification is due primarily to the social value, authenticity, and historic value of the infrastructure located within the site, and not due to the bushland (Heritage Council, 2022). Heathcote contains no heritage sites listen on Australia's National Heritage List (DAWE, 2021).

Heathcote is located directly adjacent to two Aboriginal Heritage Places recognized by the *Aboriginal Heritage Act 1972* (AHA). Both are Registered Sites, having been evaluated to meet the section 5 criteria of the AHA (Government of Western Australia, 1972). These being:
Goolugatup (18623) which is listed as having ceremonial, historical, mythological values, as well as being a site for birthplace, camp, hunting place, meeting place, named place, natural feature, ochre, plant resource and water source.
Swan River (3536) which is listed as having mythological value.
Neither site is traditionally restricted by gender (Department of Planning, Lands and Heritage, 2021).

2.2.5 Community Interest

Heathcote Reserve is zoned as Parks and Recreation according to City of *Melville Local Planning Policy Scheme No. 6*. As such, the reserve is accessible to the public with formal paths and seating located within the bushland of the reserve. The bushland is well utilised by surrounding residents for passive recreation such as walking, dog walking, bike riding, and bird watching along the formal pathways. Educational signage on native flora and fauna species is also present within the bushland. Heathcote Reserve contains parkland with a playground adjacent to the bushland, as well as other facilities including a restaurant and art gallery. The western side of the bushland occurs along the Swan River shoreline that is utilised by the community.

Heathcote Reserve is suggested as a potential revegetation site due to the high level of bare ground and a lack of native understory species present throughout the entirety of the reserve. It is recommended to revegetate using Tuart (*Eucalyptus gomphocephala*) Woodland species. Along with regular maintenance following revegetation installation.

2.2.6 Reference Sites

There are no existing reference sites present within the Heathcote Reserve. The flora quadrat and fauna trapping locations that were set up during the 2021 survey of Heathcote will be used as reference sites for future monitoring.

2.3 Species

Native flora, fauna and weed species were identified during the 2021 survey of Heathcote. Native flora and fauna are described in section 2.3.1 and 2.3.2, with introduced species described under Threats, sections 3.3 and 3.5.

2.3.1 Native Flora

A total of 93 flora species from 31 families were recorded in Heathcote. Of the species recorded, 44 (47.3%) are introduced (weeds) and two are dubious. No threatened or priority species were recorded during the survey. The family Fabaceae (peas) was the most species rich, observing 15 species followed by the Poaceae (grasses) family observing 11 species.

Using the City of Melville's 'At-Risk' species list, no species were identified across Heathcote. Examples of the native flora species are shown in Figure 4, with a complete flora list in Appendix 3.

Table 3: Plant Indices

Values	Plants	Status 2001	Status 2013	Status 2021	Assets 2013-2021
High 'Poorly reserved' and 'significant populations' in Bush Forever Area	*Conospermum triplinervium*	No assumption (confirmed 1998)	Not observed (presumed extinct)	Not observed (presumed extinct)	Change not assessable
High 'endemic' and 'significant populations' in Bush Forever area	*Callitris preissii*	Assumed absent (confirmed 1872)	Not observed (presumed extinct)	Not observed (presumed extinct)	Change not assessable
High 'species associated with the spearwood dunes (sands and Tamala limestone) the occurrence of which is extended inland along the river' in Bush Forever	*Acanthocarpus preissii*	Confirmed Present	Moderate Numbers	Moderate Numbers	Species maintained
	Lepidosperma gladiatum				
	Conostylis candicans				
	Banksia sessilis var. *cygnorum*	Confirmed Present	Moderate Numbers	Moderate Numbers	Species maintained
	Acacia cochlearis	Assumed Present			
	Olearia axillaris				
	Rhagodia baccata				
	Grevillea crithmifolia		Low Numbers	Low Numbers	
	Eucalyptus gomphocephala	Confirmed Present			
	Scaevola nitida			Not observed	Change not assessable
	Lepidosperma gracile		Not observed (possibly extinct)		
	Lomandra maritima	No assumption (confirmed 1998)		Not observed (possibly extinct)	

Values	Plants	Status 2001	Status 2013	Status 2021	Assets 2013-2021
	Melaleuca systena	No assumption (confirmed 1998)	Not observed (presumed extinct)	Not observed (presumed extinct)	
	Templetonia retusa	Confirmed Present	Low Numbers	Low Numbers	Species maintained

Source: Woodgis (2014)

Scaevola crassifolia (Thick-leaved Fan-flower)

Conostylis candicans subsp. candicans

Acacia cochlearis (Rigid wattle)

Allocasuarina humilis (Dwarf Sheoak)

Figure 4: Examples of native flora observed within Heathcote

2.3.2 Native Fauna

Heathcote fauna surveys included trapping, night stalks, bat call surveys and motion activated camera trapping, and were conducted between the 18th to the 22nd of October 2021.

A total of 14 native species from 12 families were observed across the reserve. Examples of species observed are shown in Figure 5 with a complete species list in Appendix 4.

Native fauna observed within Heathcote Reserve bushland included:

- ten birds
- three reptiles
- three mammals
- four invertebrates.

Two-toed Earless Skink (*Hemiergis quadrilineata*)

Buchanan's Snake-eyed Skink (*Cryptoblepharus buchananii*)

Wolf Spider (*Venator immansueta*)

Red Wattlebird (*Anthochaera carunculata*)

Figure 5: Examples of native fauna species observed within Heathcote

2.3.2.1 Mammals

Three mammal species were identified within Heathcote Reserve during the 2021 survey, all of which are introduced. This includes the Domestic Dog (*Canis lupus familiaris*), which was observed off lead on the shoreline and via a camera trap within the bushland.

The City's NAAMP (2019a) identified six 'at-risk' native mammal species, all of which are assumed to be locally extinct. The six 'at-risk' mammal species listed by the City are shown in Table 4 and their presence or absence is compared against fauna surveys from previous management plans.

Table 4: At Risk Mammal Species Indices

Species Values	Mammals	Previously Recorded	Presence 2021	Assets
Very high	Southern Brown Bandicoot/ Quenda – P4 (*Isoodon fusciventer*)	-	-	Assumed locally extinct
	Western Brush Wallaby – P4 (*Macropus irma*)	-	-	Assumed locally extinct
	Rakali – P4 (*Hydromys chrysogaster*)	-	-	Assumed locally extinct
Medium	Western Grey Kangaroo (*Macropus fuliginosus*)	-	-	Assumed locally extinct

Species Values	Mammals	Previously Recorded	Presence 2021	Assets
	Bush Rat (*Rattus fuscipes*)	-	-	Assumed locally extinct
	Honey Possum (*Tarsipes rostratus*)	-	-	Assumed locally extinct
	Brush-tailed Possum (*Trichosurus vulpecula*)	-	-	Assumed locally extinct

Source: Woodgis (2014) and (2019a)

2.3.2.2 Bats

Heathcote Reserve would provide suitable habitat and natural refuge for urban bat populations. However, no bat species or indicators of their presence were observed within the reserve in the 2021 survey. One at risk bat species, the Gould's Wattled Bat (*Chalinolobus gouldii*), was recorded in 2013 at Heathcote (Waters, 2014). It is assumed that all at risk bat species would still be present and utilise the site (Table 5).

Table 5: At Risk Bat Species Indices

Species Values	Bats	Previously Recorded	Presence 2021	Assets
Very high	Western False Pipistrelle - P4 (*Falsistrellus mackenziei*)	-	-	Assumed present
Medium	Gould's Wattled Bat (*Chalinolobus gouldii*)	2013	-	Assumed present
	Chocolate Wattled Bat (*Chalinolobus morio*)	-	-	Assumed present
	Lesser Long-eared Bat (*Nyctophilus geoffroyi*)	-	-	Assumed present
	Gould's Long-eared Bat (*Nyctophilus gouldii*)	-	-	Assumed present
	Greater Long-eared Bat (*Nyctophilus major*)	-	-	Assumed present
	Southern Forest Bat (*Vespadelus regulus*)	-	-	Assumed present

Source: Woodgis (2014) and (2019a)

2.3.2.3 Birds

A total of ten bird species were identified within Heathcote, including two introduced species, the Rainbow Lorikeet (*Trichoglossus moluccanus*) and Laughing Kookaburra (*Dacelo novaeguineae*). One low 'at risk' species was also observed during the 2021 survey, the Pacific Black Duck (*Anas superciliosa*). Appendix 4 lists all birds observed during the 2021 survey and Table 6 lists all 'at risk' species recorded by the City.

Table 6: At Risk Bird Species Indices

Species Values	Birds	Status 2001	Status 2013	Status 2021	Assets
High	Weebill *Smicrornis brevirostris*	Assumed present	Confirmed present	Assumed present	Species maintained
Low	Tree Martin *Hirundo nigricans*				

Species Values	Birds	Status 2001	Status 2013	Status 2021	Assets
	Pacific Black Duck *Anas superciliosa*	No record	No record	Confirmed present	New species recorded
	Rainbow Lorikeet **Trichoglossus haematodus*	Assumed present	Assumed present	Present	Species maintained

Source: Woodgis (2014) and (2019a)

2.3.2.4 Reptiles and Amphibians

A total of three native reptile species, all from one family, were observed within Heathcote. These were the Buchanan's Snake-eyed Skink (*Cryptoblepharus buchananii*), Shingle-back (*Tiliqua rugosa*) and Two-toed Earless Skink (*Hemiergis quadrilineata*). No reptiles classified as 'at risk' by the City were identified (Table 7).

No amphibians were identified within Heathcote bushland during the 2021 survey.

Table 7: At Risk Reptile and Amphibian Species Indices

Species Values	Reptiles and Amphibians	Status 2001	Status 2013	Status 2021	Assets
Low	Western Limestone Ctenotus *Ctenotus australis*	Assumed Present	Confirmed Present	No record	Species not maintained

Source: Woodgis (2014) and (2019a)

2.3.2.5 Invertebrates

A total of three native invertebrate species were identified within Heathcote; the Australian Golden Orb Weaver (*Nephila edulis*), Roly-poly (*Armadillidium vulgare*) and Wolf Spider (*Venator immansueta*). Additionally, one invasive species of invertebrate was identified: the Portuguese Millipede (*Ommatoiulus moreleti*). No 'at-risk' species listed by the City were observed (Table 8).

Table 8: At Risk Invertebrate Species Indices

Species Values	Invertebrates	Previously Recorded	Presence 2020	Assets
High	Western Petalura (*Petalura hesperia*)	-	-	Occurrence possible. Habitat suitable

Source: Woodgis (2014) and (2019a)

3 Threats

Threats present within Heathcote Reserve bushland include:

- physical disturbance
- fire
- weed species
- habitat loss
- feral animals
- diseases and pathogens
- stormwater
- reticulation
- acid sulphate soils
- climate change.

3.1 Physical Disturbance

Physical disturbance relates to anthropogenic influences such as informal tracks, trampling of vegetation, dumping of rubbish and garden waste, removal of vegetation and geocaching.

Physical disturbance within Heathcote includes:

- rubbish dumping
- graffiti vandalism

Examples of physical disturbances are shown in Figure 6 with locations provided in Appendix 2 and assessed in Table 9.

Rubbish dumping

Graffiti vandalism

Figure 6: Examples of physical disturbance

Table 9: Physical Disturbance Indices

Impacts	Physical Disturbance	Disturbances 2001-2013	Disturbances 2021	Threats
High Potential to substantially change ecosystem, composition, or function	Clearing for utilities	15 m^2	0 m^2	Decreased
Medium	Rubbish dumping	3 m^2/month	4 occurrences	Decreased

Impacts	Physical Disturbance	Disturbances 2001-2013	Disturbances 2021	Threats
Potential to moderately change ecosystem structure, composition, or function	Trampling (informal paths)	0 m^2	0 m^2	Contained
	Tree poisoning, illegal clearing, firewood collection	0	0	Contained
Medium Potentially costly remediation	Vandalism	No data	2 occurrences	Change not assessable

3.2 Fire

No signs of fires were observed during the 2021 survey and no signs of fire could be determined from aerial photographs from 2015-2020. No records of bushfire occur within Heathcote Reserve according to the DBCA Fire History dataset (DBCA, 2022).

Table 10 reflects that there has been no evidence of large or repeat fire from 2001 – 2021. Several piles of dead wood were observed throughout Heathcote during the 2021 survey (Figure 7). This creates unnecessary fire fuel load, potentially increasing the intensity of a bush fire if one were to occur. Bigger dead logs will provide suitable habitat and refuge for native fauna and has value in retaining. Smaller fine fuels should be actively managed to reduce the fire fuel load of the reserve.

Table 10: Fire Indices

Impacts	Fires	Extent of Fires 2001-2013	Extent of Fires 2015-2021	Threats
High Potential for local extinctions of ground dwelling species	Large fires	0 ha	No recent fires observed	Threat prevented
High Potential for local extinctions of trees and shrubs that regenerate only from seed stored on a plant	Repeat fires	0 ha		
Medium Potential for moderate impact of ground dwelling species	Small spot fires, unauthorized campfires and bonfires	No data		

Figure 7: Deadwood observed within Heathcote Reserve bushland

3.3 Weeds

A total of 44 introduced flora species were identified during the 2021 survey. No Declared Pests or Weeds of National Significance (WoNS) were identified within Heathcote. Figure 8 displays examples of identified introduced flora species. Weed species were then categorised through the categorization plan by the City of Melville under the categories Very High, High, Medium and Low (Table 11).

While introduced weeds will need to be actively managed, a staged approach paired with succession revegetation and planting will need to be considered. This will help reduce potential erosion issues caused by the removal of stabilising vegetation.

Table 11: Number of Weed Species in Each Impact Category

Impact Category	Number of Species
Very High	2
High	16
Medium	3
Low	23
Total	44

Date Palm *(Phoenix dactylifera)*

French Catchfly (*Silene gallica)*

Suckling Clover (*Trifolium dubium*)

Pimpernel (*Lysimachia arvensis*)

Figure 8: Examples of introduced flora species observed within Heathcote

Table 12: Extent of infestations within Heathcote

Species	Common Names	Priority	Count	Area >20 Grid Points	Area >2 ha	Area >50% of Reserve	Assessment
Perennial Clumping Grasses *Ehrharta calycina*	Perennial Veldt Grass	Very High	3	N	N	N	Localised
Schinus terebinthifolius	Brazilian Pepper	Very High	9	N	N	N	Localised
Annual Clumping Grasses *Avena barbata* *Bromus diandrus* *Ehrharta longiflora* *Lagurus ovatus* *Lolium rigidum* *Poa annua* *Vulpia myuros*	 Bearded Oat Great Brome Annual Veldt Grass Hare's Tail Grass Wimmera Ryegrass Winter Grass Rat's Tail Fescue	High	7	N	N	N	Localised
Perennial Running Grasses *Cenchrus clandestinus*	Kikuyu Grass	High	2	N	N	N	Localised
Clumping Geophytes *Oxalis pes-caprae*	Soursob	High	2	N	N	N	Localised
Giant Grasses *Arundo donax*	Giant Reed	High	1	N	N	N	Localised
Woody Weeds *Acacia longifolia* *Casuarina glauca* *Chamelaucium uncinatum* *Leptospermum laevigatum* *Phoenix dactylifera* *Washingtonia filifera*	 Geraldton Wax Coast Teatree Date Palm	High	12	N	N	N	Localised

Table 13: Weed Indices within Heathcote- change in extent of infestation over time

Impact	Species	1998	2001	2005	2008	2013	2021	Threats
Very High	Lantana							8 weeds prevented
	Paterson's Curse							
	Arum Lily							
	Blackberry							
	One Leaf Cape Tulip							
	Asparagus Fern							
	Golden Dodder							
	Madeira Vine							
	Perennial Clumping Grasses		X	100%	X	11%	2.8%	Change not assessable (overall decrease)
	Brazilian Pepper	X	X	22%	X	33%	12.7%	
	Bridal Creeper		X	X		11%	0	
	Tamarisk				X		0	
	Soldiers	X		X			0	
High	Annual Clumping Grasses	X		100%	X	100%	9.9%	
	Clumping Geophytes	X	X	11%	X	11%	2.8%	
	Perennial Running Grasses		X		X	33%	2.8%	
	Giant Grasses		X	X	X	11%	1.4%	
	Woody Weeds	X	X	X	X	77%	16.9%	
Medium	All other perennial weeds	X	X	X	X	11%	14.1%	Increase
Low	All other annual weeds	X	X	X	X	100%	50.7%	Decrease

3.4 Habitat Loss

Habitat loss can be assessed through assessment of bare ground and weed coverage over time in order to establish trends. The percentage of bare ground is shown in Figure 9 and in Table 14, and the percentage of weed cover is shown in Table 15.

Overall habitat loss is assessed in Table X, looking at the extent of bare ground and weed cover greater than 25%. It is recommended that areas with >25% bare ground and weed cover be targeted for future revegetation. To maximise success it is recommended to undertake revegetation in conjunction with weed control activities and watering if required. Bare ground was mapped as a percentage where 0% was no bare ground and 25% was the highest bare ground cover.

Table 14: Extent of Bare Ground

Category	2021
<5%	10%
5-25%	60%
>25%	30%
Total	100%

Table 15: Extend of Weed Cover

Category	2021
<5%	88.7%
5-25%	5.6%
>25%	5.6%
Total	100%

Table 16: Habitat Loss Indices

Impact	Habitat Loss	% of Reserve 2013	% of Reserve 2021	Threat
Medium Process of moderate ecosystem function modification • reduced natural regeneration • increased fire or erosion risk	Weed Cover >25%	0%	5.6%	Not contained (Increase)
Low Process of low ecosystem function modification • reduced natural regeneration • increased fire or erosion risk	Bare Ground >25%	22%	30%	Not contained (Increase)

Figure 9:

Habitat Loss - Bare Ground
Heathcote Reserve, Applecross

Client: City of Melville
Date: March 2022
Created by: S. Treloar
Image Source: Nearmap, 2022
Datum: GDA 94

3.5 Feral Animals

Feral fauna impact native fauna and flora through predation, competition for food and shelter, spreading disease, and destroying habitat. Four feral fauna species were recorded within Heathcote during the 2021 survey, including two mammals and two birds (Appendix 4). Two species are considered as a declared pest under the *Biosecurity and Agriculture Management Act 2007* (WA), the European Rabbit (*Oryctolagus cuniculus*) and the Rainbow Lorikeet (*Trichoglossus haematodus)*. Examples of feral fauna observed are shown in Figure 10 and the feral fauna indices are shown in Table 17.

Rabbit (*Oryctolagus cuniculus*) scat

Laughing Kookaburra (*Dacelo novaeguineae*)

Figure 10: Examples of feral fauna recorded

Table 17: Feral Animal Indices

Impact	Feral Animal	2003-13	2014-2020	2021	Threat
Very High Key Threatening Process under the EPBC Act 1999	Feral Cat (*Felis catus)*	No Data	No Data	Assumed Present	Change not assessable
	Rabbit (*Oryctolagus cuniculus)*			Activity Present (Scats)	
	Red Fox (*Vulpes vulpes)*			Absent	
High Competition with native birds for hollows and food (impact level variable)	Honeybee (*Apis mellifera)*	No Data	Absent	Absent	Change not assessable
	Rainbow Lorikeet (*Trichoglossus haematodus)*		Assumed Present	Confirmed Present	Change not assessable
	Laughing Kookaburra (*Dacelo novaeguineae)*			Confirmed Present	
	Laughing Dove (*Streptopelia chinensis)*			Assumed Present	
	Rock Dove (*Columbia livia)*				

3.6 Diseases and Pathogens

Vegetation can be subject to diseases that result in a decline in their vigour or death in the longer term. Common plant pathogens include Dieback (*Phytophthora cinnamomi),* Honey Fungus

(Armillaria luteobubalina), Marri Canker (*Quambalaria)* and Myrtle Rust. Activities that impact directly on trees, such as the installation of nesting boxes can result in wounds making them more susceptible to infection from pathogens.

No evidence of Armillaria, Marri Canker or Myrtle Rust was found within Heathcote Reserve. However, there are signs of potential Dieback (*Phytophthora cinnamomi)* found throughout the reserve, in the form of dead Banksia trees. It is recommended that further investigation into Dieback within Heathcote Reserve is undertaken. Disease and Pathogen Indices in Table 18.

Table 18: Disease and pathogen indices

Impact	Diseases and Pathogens	Extent 2001	Extent 2013	Extent 2021	Threat
Very High Key Threatening Process under the EPBC Act 1999	Dieback *Phytophthora cinnamomi*	No Data	No Data	Mapping/ Investigation Required	Change Not Assessable
Medium Native species capable of moderate modification of structure and composition of flora by killing multiple species.	Honey Fungus *Armillaria luteobubalina*	No Data	0 ha	Assumed Absent	Change Not Assessable

3.7 Stormwater

No storm water is re-routed into Heathcote, with no observed impacts from stormwater identified during Natural Areas 2021 surveys.

3.8 Reticulation

There are areas of reticulated lawn adjacent to the bushland of Heathcote Reserve, however no incidents of water application to the bushland were observed. There is also evidence of temporary reticulation. Indices for reticulation are found in Table 19 where an occurrence is defined as a recorded sighting of excessive overspray from reticulation or leakage.

Table 19: Reticulation Indices

Impact	Water Source	Occurrences 1992-2013	Occurrences 2014-2021	Threat
Low Alteration of Surface Water Flows	Overspray or leakage from reticulation adjacent to the reserve	No Data	No Data	Change Not Assessable

3.9 Acid Sulfate Soils

Acid sulphate soils are naturally occurring soils that contain iron sulphides, primarily in the form of pyrite materials. They are formed under waterlogged conditions in fresh and saline wetlands around Western Australia. They do not pose a significant risk to humans or the environment if left unexposed to air. However, exposure to air generates sulphuric acid, which this can lead to the release of heavy metals into the surrounding environment (Department of Environmental Regulation, 2015). Acid sulfate soils can occur when the soils are disturbed, where:

- Excavations for drainage maintenance or infrastructure construction are dug below the minimum level of the watertable.
- Groundwater extraction results in oxidation of soils previously permanently saturated by lowering the minimum level of the watertable.

Maintenance activities that require excavations or groundwater extractions are to be managed so that acid sulphate soil reactions do not occur. If this is done those activities will not be recorded as an occurrence of the threat. A review of the DWER acid sulfate risk map indicated that the entire area of the Heathcote bushland is not at risk of acid sulfate soils, however it is fringed by areas of low to moderate (DWER, 2021b). No records of previous acid sulfate soils occurring form excavations or groundwater extraction are available. No obvious signs of acid sulfate soils were noted during the 2021 survey as shown in Table 20.

Table 20: Acid Sulfate Soil Indices

Impact	Potential Initiation of ASS Reactions	Occurrences 1994 - 2003	Occurrences 2004 - 2013	Occurrence 2021	Threat
Very High	Excavations below the minimum level of the watertable	No Data	0	0	Prevented (Assumed none occurred and no change)
	Groundwater extraction resulting in lowering of minimum level watertable		0		

3.10 Climate Change

Climate change within the south-west of Western Australia is expected to cause more frequent and intense weather events, decreasing rainfall, rising sea levels and increasing temperatures. With rainfall having decreased 20% in the south-west over the last 50 years, with an average temperature increase of 1.1 ^{o}C, and fire risk has increased for the state. These changes are likely to increase the potential for erosion during storm events and associated strong winds and increased water stress on plants due to rising temperatures and decreasing rainfall. Water stress has the potential to lead to changes in vegetation types and complexes which has the potential to affect the fauna that these vegetation associations support. Reduced rainfall may decrease the groundwater table and in turn negatively affect groundwater dependent species (DPIRD, 2020).

As some areas of Heathcote are listed as a wetland, and it is located directly on the foreshore of the Swan River, climate change has the potential to impact this site. The City of Melville has undertaken a risk assessment to establish climate change risks within the Melville area, which was used to develop a Climate Change Adaptation Plan. Ongoing environmental monitoring focusing on wetland related issues (erosion, flooding etc.) should be undertaken and addressed appropriately.

4 Implementation

4.1 Management Strategies

The management objectives and implementation of strategies for 2021 – 2026 will be measured in KPIs discussed in the NAAMP (City of Melville, 2019a).

4.1.1 Key Performance Indicators (KPIs)

Throughout the life of a reserve management plan, leading indicators and trends:

- indicate whether guidelines and procedures are being effective in meeting objectives of preventing, eliminating, containing and managing impacts from threats; and
- provide a feedback mechanism as to whether guidelines and procedures need to be modified.

4.1.2 Leading Indicators

Leading indicators are associated with changes in the density/ abundance/ extent/ occurrences of threats. The levels of acceptable changes are determined in the framework established in the NAAMP as summarised in Table 21 and applied in Tables 23 and 24.

Table 21: Application of leading indicators

Objective	Leading Indicators	Acceptable When
Prevent	Prevent ▪ Introduction to or occurrence of	▪Threat absent from reserve ▪ Unplanned introduction possible
Eliminate	Reduce ▪ rate of density/ abundance/ extent ▪ eventual complete removal (short term may only reduce numbers or prevent seed set on site)	▪Large discrepancy between current and potential impact ▪ Potential impact high ▪ Elimination feasible
Contain	Stop, restrict, or reduce ▪ rate of spread or ▪ frequency of occurrence	▪ Moderate discrepancy between current and potential impact ▪ Potential but not current impact high ▪ Elimination not feasible
Manage	Limit ▪ negative impacts on assets	▪Small discrepancy between current and potential impact ▪ Threat “naturalised” or near maximum extent ▪ No information on density/ abundance/ extent
Confirm	Identify ▪ number of threats for which their presence/extent is uncertain	▪Historic but no records in reserve and/ or ▪ Presence/ extent uncertain in reserve
None	Not applicable	▪Threat absent from reserve ▪ Only planned introduction possible

4.1.3 Lagging Indicators

Lagging indicators and trends in assets, indicate whether strategic goals of maintaining assets are being met. The levels of acceptable change are discussed in the NAAMP and are summarised in Table 22 and applied to Heathcote in Table 25 and 26.

Table 22: Tiered Goals for assets and associated lagging indicators

Goal	Lagging Indicator	Application When
Enhance	Increase in either: ▪ extent ▪ density ▪ number ▪ occurrence	Assets can be enhanced when: ▪ occurs in only one reserve and/ or ▪ at risk of local extinction and/ or ▪ minimal cost (e.g., incorporated in revegetation program) and/ or ▪ reduces operational costs (e.g., reduced requirements for on-going for threat management)
Maintain	No decrease in either: ▪ extent ▪ density ▪ number ▪ occurrences	Assets can be maintained when: ▪ asset occurs in a number of reserves and / or ▪ not a risk of local extinction and/or ▪ occurs in only one reserve but insufficient knowledge/resources to enhance
Confirm	Decrease in: ▪ number of assets for which their presence is uncertain	Assets significant when: ▪ historic but no recent records in reserve and/or ▪ potentially to be in reserve based on habitat and/or proximity to other records
Monitor	No indices for management effectiveness	Assets that cannot be maintained by action within City of Melville boundaries for which no quantifiable indices exist when: ▪ reserved are not critical component of habitat (e.g., highly mobile/ wide roaming and/or infrequent/irregular visitors to the City of Melville) ▪ there is risk of local extinction from processes that cannot be mitigated by the City of Melville (e.g., climate change, some pathogens)

Table 23: Objectives for Weed species in Heathcote Reserve

Objective	Impact	Weed Species/ Group	2021 Extent	Comment
Prevent	**Very High**	▪ Lantana (*Lantana camara)* ▪ Bridal Creeper (*Asparagus asparagoides)* ▪ Tamarisk *(Tamarix aphylla)* ▪ Paterson's Curse (*Echium plantagineum)* ▪ Arum Lily (*Zantedeschia aethiopica)* ▪ Blackberry (*Rubus laudatus)* ▪ One Leaf Cape Tulip (*Moraea flaccida)* ▪ Asparagus Fern (*Asparagus aethiopicus)* ▪ Golden Dodder (*Cuscuta campestris)* ▪ Madeira Vine (*Anredera cordifolia)* ▪ Soldiers (*Lachenalia reflexa)*	0	Not present on site
Eliminate	**Very High**	▪ Brazilian Pepper (*Schinus terebinthifolia)*	▪ 12.7%	▪ Localised in Heathcote Reserve ▪ Removal should be staged and paired with revegetation as weeds currently provide soil stabilization within the steep site
	High	▪ Annual Clumping Grasses ▪ Perennial Running Grasses ▪ Clumping Geophytes ▪ Giant Grasses ▪ Woody Weeds	▪ 9.9% ▪ 2.8% ▪ 2.8% ▪ 1.4% ▪ 16.9%	▪ Localised in Heathcote Reserve
Contain	**Very High**	▪ Perennial Clumping Grasses (*Ehrharta calycina)*	▪ 2.8%	▪ Localised in Heathcote Reserve
Manage	**Medium**	▪ All other perennial weeds	▪ 14.1%	▪ Widespread usually in area with open understory
	Low	▪ All other annual weeds	▪ 50.7%	▪ Widespread usually in area with open understory

Table 24: Objective for all other threats in Heathcote Reserve

Objective	Impact	Threat	Comment
Prevent	**Very High**	Acid Sulphate Soils	These should not occur as no excavation or groundwater extraction is proposed
		Diseases and Pathogens (*Armillaria luteobubalina*)	Assumed absent – never recorded in Heathcote Reserve. Apply appropriate hygiene standards for on-ground works to prevent introduction.
		Feral Animals (Foxes)	Absent – implement controls within 10 working days of observation as per the City's Feral Animal Management Guidelines.
	High	Fires (large)	Prevent large fires that burn more than one third of the reserve, work in consultation with the Department Fire and Emergency Services to limit fires and maintain fire breaks.
		Ferals (Bees)	Absent- an occasional incursion may occur but should be removed before population can establish.
Eliminate	**Very High**	Feral Animals (Rabbits)	Present – remove population, and any subsequent incursions before they permanently establish Implement controls outlined in City's Feral Animal Management Guidelines
Contain	**Very High**	Habitat Loss	Limit fragmentation (e.g., multiple paths and tracks). Areas with weeds and bare ground >25% prioritise for revegetation and management.
	High	Fire (large or repeat)	Limit fires burning in the same location within the bushland in consultation with Department of Fire and Emergency Services.
	Medium	Physical Disturbance	Present within the reserve. Limit public access by maintaining existing paths and fencing. Present in the form of rubbish dumping and vandalism. Report disturbance through regular maintenance inspections to determine locations of dumped rubbish and to identify breaches in fencing and implement controls in accordance with the NAAMP.
Manage	**Very High**	Feral Animals (Cats)	Assumed present with a likely ongoing presence – difficult to prevent, eliminate or contain. Implement controls outlined in the City's Feral Animal Management Guidelines
		Diseases and Pathogens (Dieback)	Present and therefore difficult to prevent, eliminate and contain, as boundary of Dieback is unknown as signs were observed of potential Dieback outside of mapped areas. Recommended to undertake further testing to determine possible spread to other areas within the reserve.
		Climate Change	Consideration should be given to the wider context of climate change and impacts that may occur over time. Management can include: ▪ undertaking weed control to minimise competition for water with native plants ▪ planting and enhancement of native vegetation cover within the reserve particularly where large-scale deaths occur, and potentially substituting species that are declining in the area with more adaptable species that can fill the same niche. Records should be taken of changes over time to assist with knowledge and understanding of ongoing processes.
	Medium	Feral Animals (Rainbow Lorikeet)	Declared Pest- Implement controls outlined in the City's Feral Animal Management Guidelines
None	**Low**	Stormwater	No stormwater to be diverted into the Heathcote Reserve
		Reticulation	Not present or required within the natural bushlands of the Heathcote Reserve. However, monitor for incidence of overspray or leaks from reticulation into native bushlands.

Table 25: Goals for species

Goal	Priority	Asset	No. of Reserves (NAAMP)	Comments
Enhance	**High**	*Conospermum triplinervium* (Tree Smokebush)	4	Recently extinct on site. Enhance population through revegetation of this species. Maintain the population through maintenance of habitat and weed control.
		Melaleuca systena	4	Recently extinct on site. Enhance population through revegetation of this species. Maintain the population through maintenance of habitat and weed control.
		Tuart Woodlands and Forests of the Swan Coastal Plain Threatened Ecological Species Composition	-	Refer to *Heathcote Reserve - Threatened Ecological Community Assessment* (Natural Area, 2022).
Maintain Species	**High**	Weebill *Smicrornis brevirostris*	4	Observed in 2021 Survey. Maintain of this population through maintenance of habitat, healthy canopy, and mature trees.
	Low	Tree Martin *Hirundo nigricans*	12	Observed in 2021 Survey. Maintain of this population through maintenance of habitat, healthy canopy, and mature trees.
		Pacific Black Duck *Anas superciliosa*	8	Observed in 2021 Survey. Maintain of this population through maintenance of habitat, healthy canopy, and mature trees.
Confirm	**Low**	Western Limestone Ctenotus *Ctenotus australis*	-	Both species previously recorded in 2013. Maintain habitat through revegetation, weed control and disease management to enhance habit for these species. Further investigation required. Education programs in universities, schools and local community groups to assist in surveys and reporting potential sightings of these species.
		Gould's Wattled Bat *Chalinolobus gouldii*	1	

Table 26: Goals for Site

Goal	Priority	Asset	Comments
Enhance	**High**	Threatened Ecological Communities- Tuart Woodlands and Forests of the Swan Coastal Plain	▪ to be maintained through weed control and revegetation of understorey species, and management of threats within Heathcote Reserve ▪ refer to *Heathcote Reserve - Threatened Ecological Community Assessment* (Natural Area, 2022).
	Medium	Proposed Revegetation	▪ revegetate the understory of Heathcote Reserve in accordance with the standard of rehabilitation in the NAAMP and following City Guidelines ▪ where tubestock is available, prioritise 'at risk' species and food sources of black cockatoos (Department of Environment and Conservation, 2011) ▪ Increase engagement with surrounding schools, TAFE and university in revegetation activities, promote community planting days
Maintain	**Very High**	Ecological Communities	▪ maintain sites through weed control, revegetation, feral animal management and general reserve management (e.g., rubbish removal, fence maintenance) to manage threats within the reserve. ▪ rehabilitation within specific areas using appropriate species for the vegetation type present ▪ achieve Very High Condition for Tuart Woodland TEC by establishing ≥80 % of native understorey vegetation cover and at least 12 native understorey species per 0.01 ha (DAWE, 2019)
	High	Regional Ecological Linkage	▪ ecological linkages can be maintained through the maintenance of ecological communities and enhancement of these communities through proposed rehabilitation, also through avoiding clearing and fragmentation of the reserve
		Heritage Site	▪ consideration should be given to works conducted in close proximity to heritage sites
		Habitat Trees	▪ habitat trees to be protected by the management of threats such as fire and disease and enhancement of these communities via proposed rehabilitation. ▪ where safe, maintain dead habitat trees.
	Medium	Community Interest Sites (bat and bird boxes)	▪ additional bat boxes installed ▪ continued monitoring of assets during the City's current inspection and maintenance works, any damage or repair requirements noted to be reported ▪ investigate the use of citizen science applications (e.g., FrogID, iNaturalist) to engage the wide community and provide monitoring

			and educational opportunities
Monitor	**Low**	All assets	▪ monitoring of all assets should occur in accordance with the City's policies and guidelines outlined un the NAAMP.

5 Weed Maps

Very High Impact Weeds
Heathcote Reserve, Applecross

Client: City of Melville
Date: March 2022
Created by: S. Treloar
Image Source: Nearmap, 2022
Datum: GDA 94

0 25 50 m

N

Giant Grass Distribution
Heathcote Reserve, Applecross

Client: City of Melville
Date: March 2022
Created by: S. Treloar
Image Source: Nearmap, 2022
Datum: GDA 94

0 25 50 m

N

Woody Weed Distribution
Heathcote Reserve, Applecross

Client: City of Melville
Date: March 2022
Created by: S. Treloar
Image Source: Nearmap, 2022
Datum: GDA 94

0 25 50 m

N

Geophyte Distribution
Heathcote Reserve, Applecross

Client: City of Melville
Date: March 2022
Created by: S. Treloar
Image Source: Nearmap, 2022
Datum: GDA 94

0 25 50 m

N


Legend
<5%
5-25%
Site Boundary
Annual Clumping Grass Distribution
Heathcote Reserve, Applecross
Client: City of Melville
Date: March 2022
Created by: S. Treloar
Image Source: Nearmap, 2022
Datum: GDA 94
0
25
50 m
N

References

Alan Tingay and Associates. (1998). *A Strategic Plan for Perth's Greenways Final Report*. Retrieved from https://library.dbca.wa.gov.au/static/FullTextFiles/617627.pdf

Biosecurity and Agriculture Management Act 2007 (WA). Retrieved from https://www.legislation.wa.gov.au/legislation/statutes.nsf/main_mrtitle_2736_homepage.html

City of Melville. (2019a). *City of Melville Natural Areas Asset Management Plan 2019*. Retrieved from https://www.melvillecity.com.au/waste-and-environment/environmental-conservation-and-management/environmental-management-plans

City of Melville. (2019b). *Local Heritage Survey and Heritage List 2019*. Retrieved from https://www.melvillecity.com.au/planning-and-building/for-developers-and-builders/heritage-listed-properties

Department of Agriculture, Water and the Environment (DAWE). (2019). *Approved Conservation Advice (incorporating listing advice) for the Tuart (Eucalyptus gomphocephala) woodlands of the Swan Coastal Plain Ecological Community*. Retrieved from http://www.environment.gov.au/biodiversity/threatened/communities/pubs/131-conservation-advice.pdf

Department of Agriculture, Water and the Environment (DAWE). (2021) *EPBC Act Protected Matters Report*. Retrieved from http://www.environment.gov.au/webgis-framework/apps/pmst/pmst.jsf

Department of Biodiversity, Conservation and Attractions (DBCA). (2018). *Wetlands.* Retrieved from https://www.dpaw.wa.gov.au/management/wetlands

Department of Biodiversity, Conservation and Attractions (DBCA). (2021a). *Black Cockatoo Roosting Sites-Buffered (DBCA-064)-Web Mapping Service (WMS).* Retrieved from https://services.slip.wa.gov.au/public/services/SLIP_Public_Services/Plants_and_Animals/MapServer/WMSServer

Department of Biodiversity, Conservation and Attractions (DBCA). (2021b). *Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)-Web Mapping Service (WMS)*. Retrieved from https://services.slip.wa.gov.au/public/services/SLIP_Public_Services/Environment/MapServer/WMSServer?service=WMS&version=1.3.0&request=GetCapabilities

Department of Environmental Regulation (DER). (2015). What are acid sulfate soils? retrieved from: https://www.der.wa.gov.au/your-environment/acid-sulfate-soils/64-acid-sulfate-soils-in-wa.

Department of Planning, Lands and Heritage (DPLH). (2021). *Aboriginal Heritage Places (DPLH-001) -Web Mapping Service (WMS).* Retrieved from https://services.slip.wa.gov.au/public/services/SLIP_Public_Services/People_and_Society/MapServer/WMSServer?service=WMS&version=1.3.0&request=GetCapabilities

Department of Primary Industries and Regional Development (DPIRD). (2020). *Climate trends in Western Australia*. Retrieved from https://www.agric.wa.gov.au/climate-change/climate-trends-western-australia#:~:text=Western%20Australia's%20climate%20has%20changed,has%20increased%20across%20the%20state.

Department of Water and Environmental Regulation (DWER). (2021a). *Perth Groundwater Map.* Retrieved from https://www.water.wa.gov.au/maps-and-data/maps/perth-groundwater-atlas

Department of Water and Environmental Regulation (DWER). (2021b). *Acid Sulfate Soils Risk Map* (DWER 049), retrieved from: https://nationalmap.gov.au/.

Government of Western Australia. (2019). *2018 South West Vegetation Complex Statistics*. Current as of March 2019. WA Department of Biodiversity, Conservation and Attractions, Perth. Retrieved from https://catalogue.data.wa.gov.au/dataset/dbca

Government of Western Australia. (2000). *Bush Forever (Vol. 2).* Perth, W.A: Department of Environment Protection.

Government of Western Australia. (1972). *Aboriginal Heritage Act 1972*. Retrieved from https://www.legislation.wa.gov.au/legislation/prod/filestore.nsf/FileURL/mrdoc_25428.pdf/$FILE/Aboriginal%20Heritage%20Act%201972%20-%20%5B04-g0-05%5D.pdf?OpenElement

Heddle, E., Loneragan, O., & Havel, J. (1980). *Vegetation Complexes of the Darling System Western Australia.* In Atlas of Natural Resources - Darling System, Western Australia (pp. 37 - 72). Canberra, W.A: Department of Conservation and Environment, Western Australia.

Heritage Council. (2022). *Heathcote Hospital*. Retrieved from Heritage council of WA – Places Database: http://inherit.stateheritage.wa.gov.au/Public/Search/Results?newSearch=True&placeNameContains=Heathcote+hospital&streetNameContains=&suburbOrTownContains=applecross&lgaContains=&isCurrentlyStateRegistered=false

Woodgis. (2014) *Heathcote Strategic Management Plan 2014-2019.Perth, WA:* Woodgis Environmental Assessment and Management for the City of Melville.

Western Australian Local Government Association (WALGA). (2009). *South West Regional Ecological Linkages – Technical Report*. Retrieved from https://walga.asn.au/getattachment/Policy-Advice-and-Advocacy/Environment/Biodiversity/SWREL_LowRes.pdf?lang=en-AU

Appendix 1 – Flora and Fauna Reference Locations


Q1
F3
E4
E3
Q2
Cam2
F2
E2
E1
F1
Q3
Cam1
Legend
Flora Quadrats
Fauna Trap Locations
Elliot
Funnel
Trail Camera
Survey area
Flora and Fauna Reference Locations
Heathcote Reserve, City of Melville
Client: City of Melville
Date: March 2022
Created by: K.Grant
Image Source: Nearmap, 2022
Datum: GDA 94
0
50
100 m
N

Appendix 2- Disturbances

Disturbances
Heathcote Reserve, City of Melville

Client: City of Melville
Date: March 2022
Created by: K.Grant
Image Source: Nearmap, 2022
Datum: GDA 94

0 50 100 m

N

Appendix 3- Flora Species List

Native Species

Family	Species Name
Fabaceae	*Acacia cochlearis*
Fabaceae	*Acacia cyclops*
Fabaceae	*Acacia lasiocarpa*
Fabaceae	*Acacia rostellifera*
Fabaceae	*Acacia saligna*
Asparagaceae	*Acanthocarpus preissii*
Casuarinaceae	*Allocasuarina fraseriana*
Casuarinaceae	*Allocasuarina humilis*
Proteaceae	*Banksia attenuata*
Proteaceae	*Banksia menziesii*
Proteaceae	*Banksia nivea*
Proteaceae	*Banksia sessilis* var. *cygnorum*
Myrtaceae	*Calothamnus sanguineus*
Haemodoraceae	*Conostylis aculeata* subsp. *Cygnorum*
Haemodoraceae	*Conostylis candicans* subsp. *candicans*
Hemerocallidaceae	*Corynotheca micrantha*
Hemerocallidaceae	*Dianella revoluta* var. *divaricata*
Myrtaceae	*Eucalyptus camaldulensis*
Myrtaceae	*Eucalyptus gomphocephala*
Cyperaceae	*Ficinia nodosa*
Fabaceae	*Gompholobium tomentosum*
Proteaceae	*Grevillea crithmifolia*
Proteaceae	*Hakea prostrata*
Fabaceae	*Hardenbergia comptoniana*
Myrtaceae	*Hypocalymma angustifolium*
Cyperaceae	*Isolepis cernua*
Fabaceae	*Jacksonia furcellata*
Fabaceae	*Jacksonia sternbergiana*
Fabaceae	*Kennedia prostrata*
Myrtaceae	*Kunzea glabrescens*

Cyperaceae	*Lepidosperma gladiatum*
Zamiaceae	*Macrozamia riedlei*
Myrtaceae	*Melaleuca systena*
Cyperaceae	*Mesomelaena pseudostygia*
Orchidaceae	*Microtis media*
Asteraceae	*Olearia axillaris*
Chenopodiaceae	*Rhagodia baccata*
Goodeniaceae	*Scaevola crassifolia*
Cyperaceae	*Schoenoplectus tabernaemontani* (syn. *Schoenoplectus validus)*
Asteraceae	*Senecio pinnatifolius*
Poaceae	*Sporobolus virginicus*
Rhamnaceae	*Spyridium globulosum*
Fabaceae	*Templetonia retusa*
Araliaceae	*Trachymene pilosa*
Hemerocallidaceae	*Tricoryne elatior*
Xanthorrhoeaceae	*Xanthorrhoea preissii*

Weed and Dubious Species

# Denotes a Dubious Species and * denotes introduced species.

Family	**Species Name**
Scrophulariaceae	*#Eremophila glabra* (landscape hybrid)
Scrophulariaceae	*#Eremophila* 'Kalbarri Carpet'
Myrtaceae	*#Eucalyptus citriodora*
Fabaceae	**Acacia longifolia*
Asteraceae	**Arctotheca calendula*
Poaceae	**Arundo donax*
Chenopodiaceae	**Atriplex prostrata*
Poaceae	**Avena barbata*
Brassicaceae	**Brassica tournefortii*
Poaceae	**Bromus diandrus*
Casuarinaceae	**Casuarina glauca*
Poaceae	**Cenchrus clandestinus*
Myrtaceae	**Chamelaucium uncinatum*
Crassulaceae	**Crassula alata*

Poaceae	**Ehrharta calycina*
Poaceae	**Ehrharta longiflora*
Asteraceae	**Erigeron sumatrensis*
Euphorbiaceae	**Euphorbia peplus*
Euphorbiaceae	**Euphorbia terracina*
Papaveraceae	**Fumaria capreolata*
Asteraceae	**Lactuca serriola*
Poaceae	**Lagurus ovatus*
Myrtaceae	**Leptospermum laevigatum*
Poaceae	**Lolium rigidum*
Fabaceae	**Lupinus cosentinii*
Primulaceae	**Lysimachia arvensis*
Fabaceae	**Medicago polymorpha*
Plantaginaceae	**Misopates orontium*
Asteraceae	**Monoculus monstrosus*
Oxalidaceae	**Oxalis pes-caprae*
Caryophyllaceae	**Petrorhagia dubia*
Arecaceae	**Phoenix dactylifera*
Plumbaginaceae	**Plumbago auriculata*
Poaceae	**Poa annua*
Caryophyllaceae	**Polycarpon tetraphyllum*
Asteraceae	**Pseudognaphalium luteoalbum*
Anacardiaceae	**Schinus terebinthifolius*
Caryophyllaceae	**Silene gallica*
Solanaceae	**Solanum nigrum*
Asteraceae	**Sonchus asper*
Asteraceae	**Sonchus oleraceus*
Caryophyllaceae	**Stellaria media*
Fabaceae	**Trifolium campestre*
Asteraceae	**Ursinia anthemoides*
Poaceae	**Vulpia myuros*
Campanulaceae	**Wahlenbergia capensis*
Arecaceae	**Washingtonia filifera*

Appendix 4- Fauna Species List

Family	Species Name	Common Name
Mammals		
Canidae	*Canis lupus familiaris*	*Domestic Dog
Leporidae	*Oryctolagus cuniculus*	*Rabbit
Muridae	*Rattus rattus*	*Black Rat
Reptile		
Scincidae	*Cryptoblepharus buchananii*	Buchanan's Snake-eyed Skink
Scincidae	*Hemiergis quadrilineata*	Two-toed Earless Skink
Scincidae	*Tiliqua rugosa*	Bobtail
Bird		
Anatidae	*Anas superciliosa*	Pacific Black Duck
Meliphagidae	*Anthochaera carunculata*	Red Wattlebird
Ardeidae	*Ardea cinerea*	Grey Heron
Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo
Corvidae	*Corvus coronoides*	Australian Raven
Alcedinidae	*Dacelo novaeguineae*	*Laughing Kookaburra
Hirundinidae	*Hirundo neoxena*	Welcome Swallow
Laridae	*Larus novaehollandiae*	Silver Gull
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail
Psittacidae	*Trichoglossus haematodus*	*Rainbow Lorikeet
Invertebrate		
Armadillidiidae	*Armadillidium vulgare*	Roly-Poly
Nephilidae	*Nephila edulis*	Australian Golden Orb-weaver
Julidae	*Ommatoiulus moreletii*	*Portuguese Millipede
Lycosidae	*Venator immansueta*	Wolf Spider

*introduced species (highlight red)