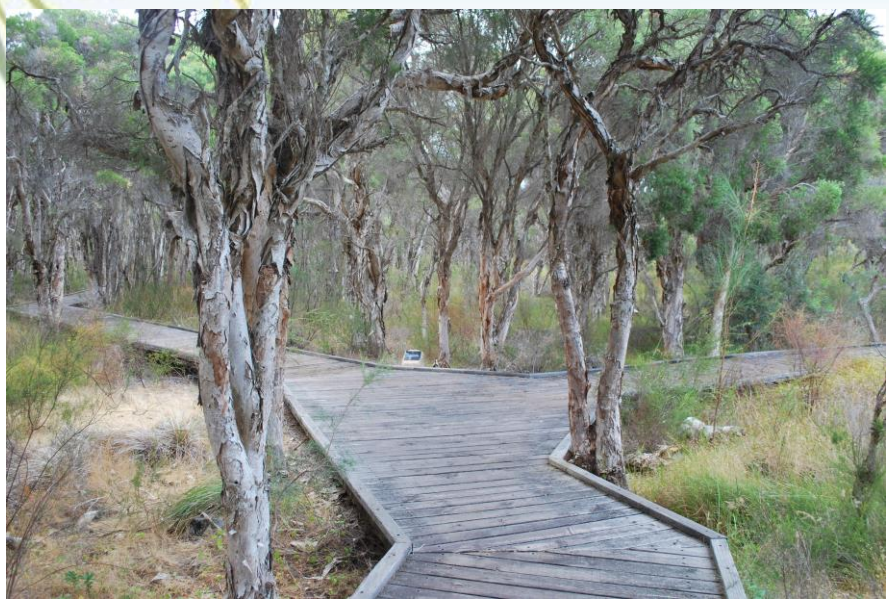
City of Melville



City of Melville

Piney Lakes Reserve Strategic Management Plan

08 August 2016

Executive Summary

Piney Lakes Reserve is a dryland and wetland reserve located within the City of Melville, in the suburb of Winthrop. It is located approximately 10 km south of the Perth Central Business District on the corner of Leach Highway and Murdoch Drive, and covers 67 ha (17 ha parkland,50 ha bushland). This Management Plan updates the Piney Lakes Management Plan (ATA Environmental, 2004).

The reserve is a Bush Forever Site 339 and was previously included on the Register of the National Estate. It is a location recognised as supporting migratory birds subject to protection under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (Government of Western Australia, 2000). Aboriginal Heritage Site 3290 extends into the north-west of the reserve (Department of Aboriginal Affairs, 2016). Wetland areas are categorised as conservation category sumplands with unique feature identifiers 6504 and 6503 (Department of Parks and Wildlife, 2016). These conservation values highlight the need for a site-specific strategic management plan prepared in accordance with the Natural Areas Asset Management Plan (City of Melville, 2011).

The site generally has an intact vegetation structure but showed signs of disturbance from trampling and weed infestation. Seventeen distinct vegetation types were identified by ATA Environmental (2003) none of which are considered regionally significant.

Eight locally significant and/or at-risk flora species were identified by Ecoscape in 2015:

- *Acacia tetragonocarpa*
- *Aotus cordifolia*
- *Conospermum triplinervium*
- *Drosera macrantha*
- *Hibbertia cuneiformis* (Cutleaf Hibbertia)
- *Jacksonia sericea* (Waldjumi) (P4)
- *Macarthuria apetala*
- *Melaleuca lanceolata*

Piney Lakes Reserve provides habitat for several threatened or priority fauna species in decline on the Swan Coastal Plain (Natural Area, 2015), including the:

- Forest Red-tailed Cockatoos (*Calyptorhynchus banksii naso*) - *Threatened*
- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) – *Threatened*
- Rainbow Bee-eater (*Merops ornata*) - *Migratory*
- Southern Brown Bandicoot or Quenda (*Isoodon obesulus fusciventer*) – *Priority 5.*

The very high impact threats affecting the reserve are:

- six weed species, including one WONS
- three feral fauna species, including two listed as C3 management category species under the *Biosecurity and Agriculture Management Act 2007* (WA) (cats, foxes, rabbits)
- stormwater derived pollutants
- one pathogen (dieback).

Of the 44 threats present a matrix was undertaken with:

- eight threats prevented (weeds)
- four contained
- thirty-two not assessable.

The major priorities for management of the bushland in the Piney Lakes Reserves should be:

- Preventing the onsite extinction of 2 plant populations that are not regionally significant by increasing numbers through propagation and revegetation.

- Increasing the extent/density of low shrubs and over storey species to enhance fauna habitat for significant bird species.
- Confirming the presence of Baudin's Cockatoo, Western Tiger Snake, Oblong Turtle and the Brush-tailed Possum.
- Eliminating the very high impact weeds in low numbers (*Schinus terebinthifolius*, Geophytes, *Lachenalia reflexa*, *Zantedeschia aethiopica*, and large woody weeds).
- Reducing occurrences of stormwater outside acceptable ranges for aluminium, chromium, copper, iron, nickel, lead, zinc.
- Containing dieback, through continued mapping and phosphite treatments.

Acknowledgements

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

- Kellie Motteram, Blair Bloomfield, Deanne Wynn, Brian Walker and Nathan Lissiman from the City of Melville
- personnel from Ecoscape, who undertook flora survey activities in 2015 that contributed to this Management Plan.

Table of Contents

1 Introduction

Natural Area Consulting Management Services (Natural Area) was contracted to prepare a Management Plan for Piney Lakes to identify management issues and to develop a 5-year strategic plan for the site. The City of Melville has developed the Natural Areas Asset Management Plan (NAAMP) (Waters A., 2011) to enable holistic management of reserves across the City. However, it is recognised that individual management plans are required for nominated locations, such as Piney Lakes Reserve, because of their conservation and environmental significance.

This plan will provide:

- the management objective for the site
- the scope of works associated with preparation of the management plan
- the outcomes of the fauna survey and site assessments undertaken by Natural Area in 2015
- the outcomes of flora and vegetation surveys undertaken by Ecoscape in 2015
- information about the current site characteristics
- threats identified within the NAAMP
- suggested management strategies
- recommendations for further action.

Note all vegetation and weed maps were created by Natural Area using grid point data recorded by Ecoscape during the 2015 flora survey activities, and ATA Environmental (2004) vegetation types.

1.1 Background

Piney Lakes is located approximately 10 km south of the Perth Central Business District, in the suburb of Winthrop. It is bounded by Leach Highway to the north, Murdoch Drive to the east, and local parkland and small residential roads to the west and south (Figure 1). Piney Lakes Reserve occupies approximately 67 ha, of which 50 ha are rehabilitated bushland areas and 17 ha are parklands. The Piney Lakes Reserve Strategic Management Plan updates the Piney Lakes Management Plan (ATA Environmental, 2004).

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 and overall strategy for the region. The major aim of the Piney Lakes Reserve Management Plan is to maintain and enhance the various ecological functions and values associated with the presence of the wetland and vegetation within the reserve, this can be achieved through:

- the identification of threatening processes outlined within the NAAMP that occur within the wetland and bushland areas
- Identification of assets as per Section 2
- identification of site specific threatening processes
- identification in the changes of assets or threatening processes over time
- provide clear reserve specific management recommendations to reduce negative impacts associated with the various threatening processes
- provide a plan to improve degraded areas within the reserve and maintain areas that are deemed to have high levels of vegetation condition.

1.3 Scope

In the context of the strategic management plan objective, Natural Area carried out the following:

- review the outcomes of the flora and vegetation survey undertaken by Ecoscape in 2015
- fauna trapping over a 5-day period and opportunistic and dusk fauna surveys to determine fauna occurrence throughout the reserve
- assess key threatening processes within the reserve
- make recommendations for ongoing management.

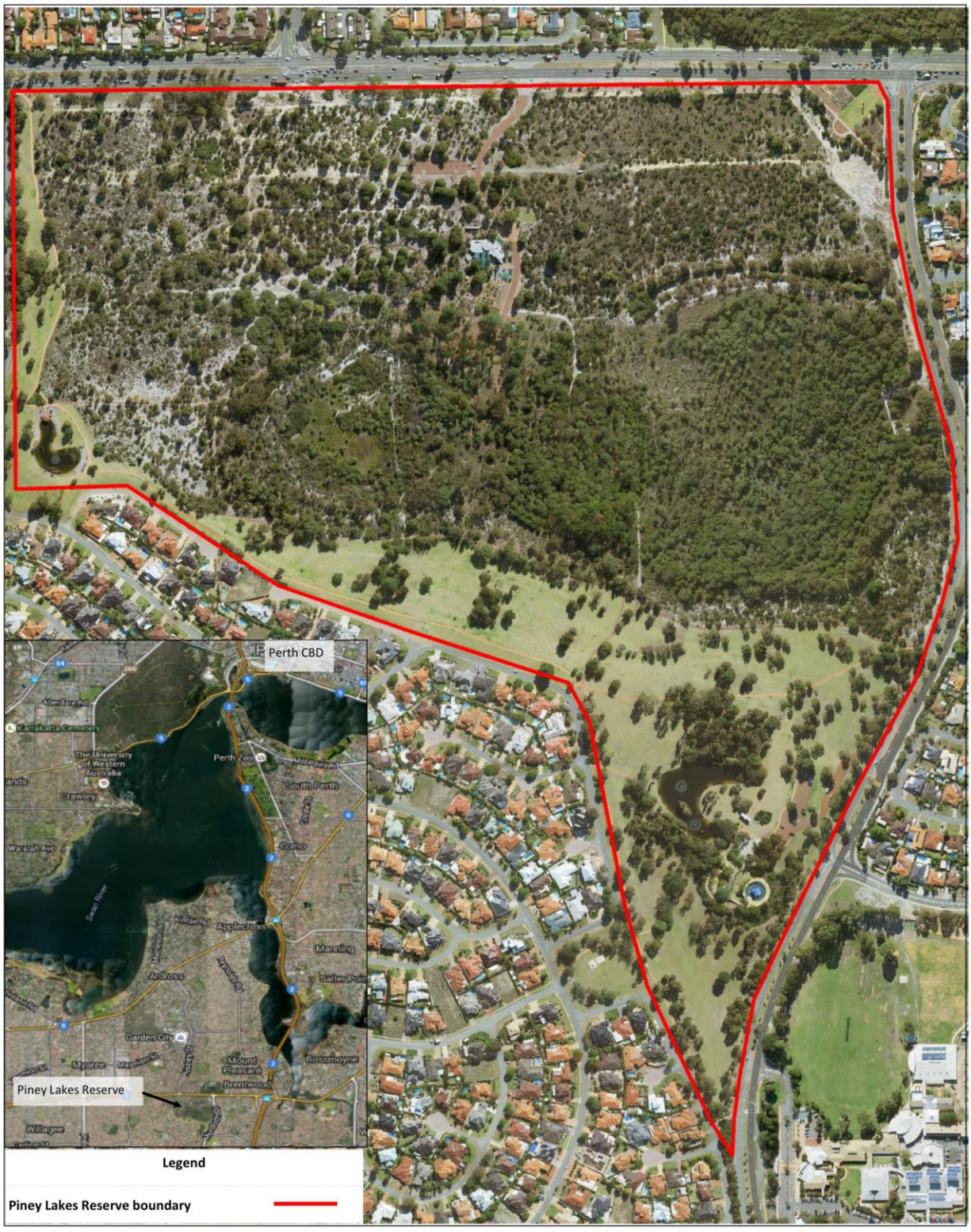


Figure 1:
Site Location,
Piney Lakes Reserve, Winthrop

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Client: City of Melville
Project: Piney lakes Reserve Strategic Management Plan
Image Source: Department of Parks and Wildlife, 2016
Prepared by: Sharon Hynes
Datum: GDA 94, Zone 50

0 100
Metres

2 Assets

Assets within the City of Melville have been identified via a range of methods including through existing management plans for reserves within the City, searches of State and Federal databases, and expert knowledge from City staff (Waters A., 2011). Assets within Melville are categorised and managed at three scales, these are:

- Reserves – administrative boundaries usually defined by cadastral boundaries
- Sites – management units (such as vegetation types) within reserves, that may cover part or all of a reserve
- Species – which are defined as 'a group of organisms capable of interbreeding freely with each other but not with members of other species' by the EPA (2000).

The process for assessment of assets in natural areas within the City of Melville is shown in Figure 2.

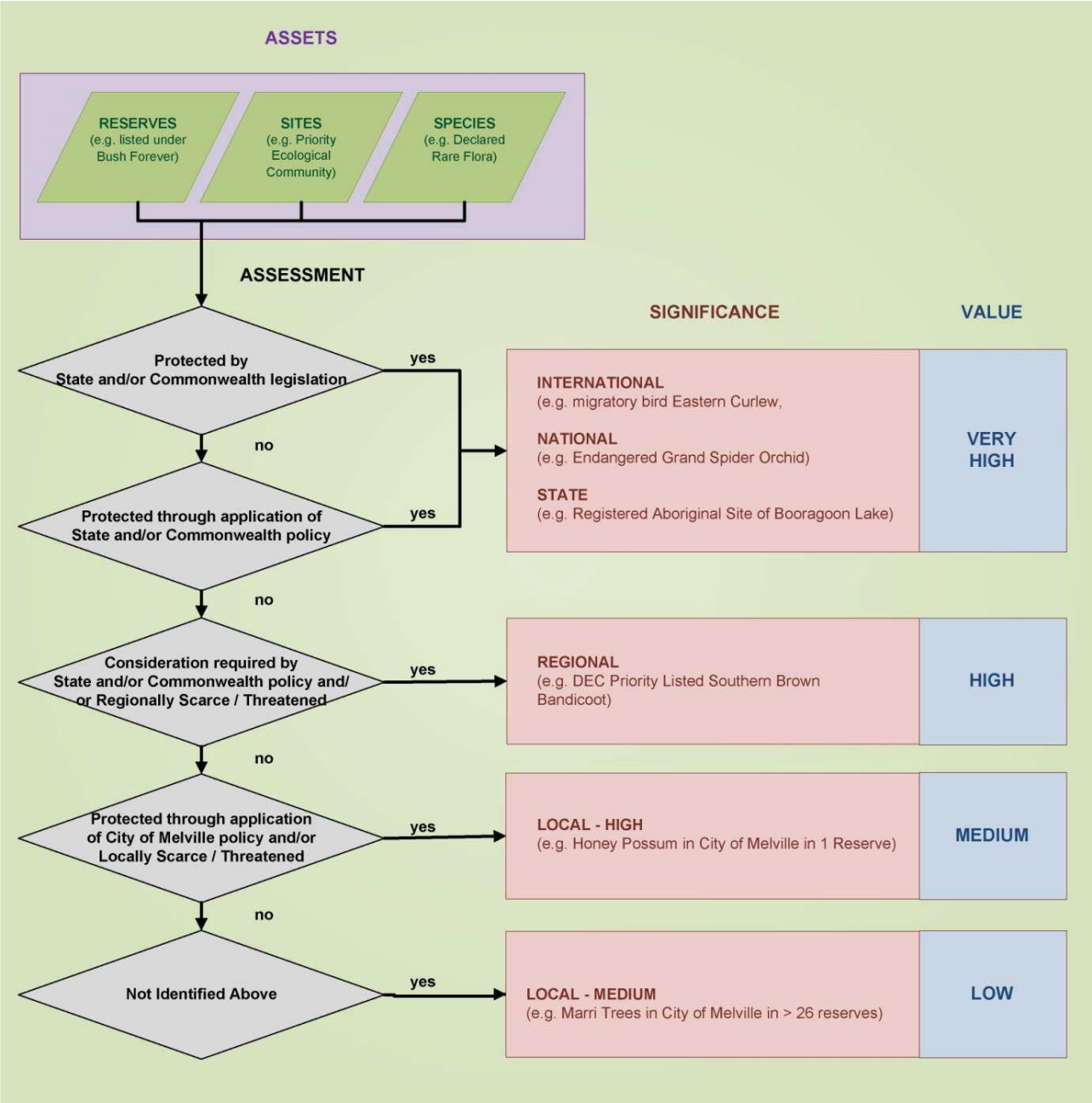


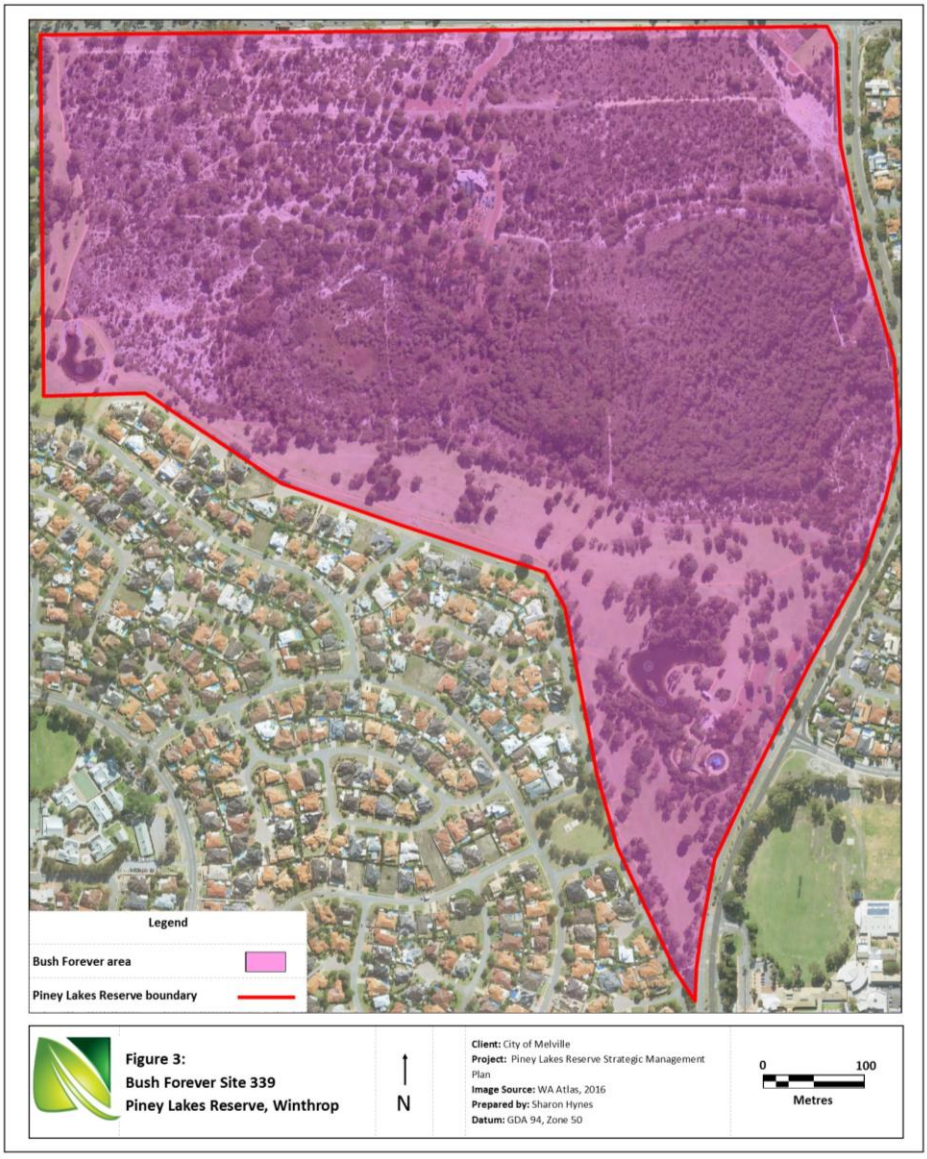
Figure 2: Assessment of assets in Natural Areas (Waters A., 2011)

2.1 Reserves Assets

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 the Perth's Bushland Project. Piney Lakes Reserve is listed as Bush Forever Site 339 in Bush Forever Volume 2 (Government of Western Australia, 2000) (Figure 3). The site meets four of a potential seven criteria for Bush Forever Sites:

- Representation of ecological communities:
  - the site includes two vegetation complexes
  - the floristic community type 5 Mixed shrub damplands is present
- Rarity:
  - two listed threatened black cockatoos the Forest Red-tailed Black Cockatoo and the Carnaby's Cockatoo are known to forage and roost in the area
- General criteria for the protection of wetland, streamline and estuarine fringing vegetation and coastal vegetation:
  - A total of 19.8 ha of the vegetation is listed as conservation category sumplands 6504 and 6503
- Criteria not relevant to determination of regional significance, but which may be applied when evaluating areas having similar values:
  - the area provides habitat for native fauna species
  - it provides ecological linkages to nearby reserves in terms of fauna movement.



2.1.2 Ecological Linkages

Piney Lakes Reserve is part of a regionally significant wetland and bushland ecological linkage that connects to other reserves within the Swan Coastal Plain region (Figures 4 and 5). The management of linkages outside of the scope of Strategic Reserve Plans is dealt with through processes such as:

- land use planning processes
- the *City of Melville Green Plan* (Alan Tingay and Associates, 1998)
- the City of Melville Streetscape Strategy
- the City of Melville Public Open Space Strategy.

Under the NAAMP, linkages are considered in terms of:

- prioritising management resources between reserves
- determining whether species can persist onsite in the long term.

Within Bush Forever Volume 2 the Piney Lakes Reserve was included in:

- part of greenways 82 and 90 (Alan Tingay and Associates, 1998) which cover areas:
  - Piney Lakes Reserve, Wireless Hill and to the Swan River (greenway 82)
  - Blue Gum, Booragoon, Piney, Bibra and North Lakes, Little Rush, Yangebup and Thompson Lakes (greenway 90)
- Beeliar Regional Park Proposal (1992), and it is now listed as a part of the Beeliar Regional Park and Adjacent Areas Heritage Place 9198 (Heritage Council (WA), 2016).

Figure 4:
Regional ecological linkages
Piney Lakes Reserve, Winthrop

Client: City of Melville
Project: Piney Lakes Reserve Strategic Management Plan
Image Source: WALGA, 2016
Prepared by: Sharon Hynes
Datum: GDA 94, Zone 50

Figure 5:
Ecological linkages
Piney Lakes Reserve, Winthrop

N

Client: City of Melville
Project: Piney Lakes Reserve Strategic Management Plan
Image Source: City of Melville, 2016
Prepared by: Sharon Hynes
Datum: GDA 94, Zone 50

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2.2 Site Assets

2.2.1 Ecological Communities

2.2.1.1 Vegetation Complexes

Piney Lakes includes two vegetation complexes, namely the Bassendean Complex Central and South and the Karrakatta Complex – Central and South (WALGA, 2013). The Bassendean Complex – Central and South is described as ranging from woodlands of Jarrah, Sheoak and Banksia on higher sand dunes to lower woodlands of Melaleuca and sedgelands in low lying depressions. The Karrakatta Complex – Central and South is described as open forest of Tuart, Jarrah and Marri, with Tuarts towards the coastal areas, Jarrah towards the eastern areas and Marris located in damper sites (Heddle, Loneragan and Havel, 1980).

The pre-European extent of the vegetation complexes remaining within the Swan Coastal Plain IBRA region is (WALGA 2013):

- 27.70% of the Bassendean – Central and South
- 23.91% of the Karrakatta Complex – Central and South.

In the Perth and Peel Region, the pre-European extent of the vegetation complexes remaining within the City of Melville is (WALGA 2010)

- 8.29% of the Bassendean – Central and South
- 4.76% of the Karrakatta Complex – Central and South.

2.2.1.2 Floristic Community Types

According to Bush Forever (Vol. 2) the floristic community types found within Piney Lakes are part of the Super Group 2 – Seasonal wetlands Floristic Community Type 5 – Mixed shrub damplands, as classified by Gibson *et al.* (1994) (Government of Western Australia, 2000).

2.2.1.3 Vegetation Types

ATA Environmental (2004) described 17 different vegetation types within Piney Lakes Reserve, these are listed and described in Table 1, and mapped in Figure 6. Nine vegetation types were recorded during 2015 flora and vegetation assessments carried out by Ecoscape 2015; these are provided with the list of species per vegetation type in Appendix 2.

Table 1: Vegetation types described by ATA Environmental (2004)

Code	Description
Wetlands	
LCFMp	*Melaleuca preissiana* Low Closed Forest. *Melaleuca preissiana* dominates this vegetation type, which is up to 20m in height over a closed sedgeland dominated by *Baumea articulata*. The Priority 3 listed taxa *Aotus cordifolia* was also a prominent component of the understorey throughout this vegetation type. This vegetation is most prominent in the south-eastern corner and the central core of the study area. LCFMr *Melaleuca rhaphiophylla* Low Closed Forest. *Melaleuca rhaphiophylla* to 10m tall dominates this vegetation type with occasional scattered Flooded Gum (*Eucalyptus rudis), Banksia littoralis* over an understorey dominated by *Acacia saligna*, *A. pulchella, Hypocalymma angustifolium* and *Daviesia triflora.* This vegetation is prominent over a small area within the central portion of the study area.
LOWMp	*Melaleuca preissiana* Low Open Woodland. *Melaleuca preissiana* dominates this vegetation type, which is to 10m tall with scattered Marri (*Corymbia calophylla*), Swamp Banksia and Holly-leafed Banksia (*Banksia ilicifolia*) over a low open shrubland comprised of *Acacia pulchella, Astartea fascicularis, Pultenaea reticulata, Jacksonia furcellata, Hypocalymma angustifolium, Hibbertia subvaginata, Petrophile linearis Daviesia triflora, Macrozamia fraseri*, and *Gompholobium tomentosum*. This

Code	Description
	vegetation is prominent over a small area in the central southern portion of the study area.
LWMpBl	*Melaleuca preissiana* and *Banksia littoralis* Low Woodland to Low Forest. The *Melaleuca preissiana* and *Banksia littoralis* trees dominate this vegetation type, which is up to 10m in height, with scattered Marri over an open heath dominated by *Acacia saligna, A. pulchella, Jacksonia furcellata, J. sternbergiana, Astartea fascicularis, Hypocalymma angustifolium, Daviesia triflora, Macrozamia fraseri* and *Gompholobium tomentosum*. This vegetation is most prominent over the eastern portion of the study area.
WMpCc	*Melaleuca preissiana* and *Corymbia calophylla* (Marri) Woodland to 15m
Upland Areas	
CHAcAs	*Acacia saligna* and *Adenanthos cygnorum* Closed Heath. This vegetation type is similar in species composition to Open Shrubland vegetation type, but is structurally more intact and closed with fewer introduced weed species present.
CLH (mixed)	Mixed Closed Low Heath – This vegetation type is floristically similar but less diverse than the Mixed Low Heath vegetation type.
CSAc	Woolly Bush (*Adenanthos cygnorum*) Closed Shrubland. This vegetation type, which has been previously cleared, is comprised almost completely of colonising *Adenanthos cygnorum,* with some *Banksia menziesii, Acacia saligna* and *Dianella revoluta* planted on the periphery of the area.
LH (mixed)	Mixed Low Heath - This vegetation is the most species rich within the Reserve with more than 40 native species recorded. Although no one species dominates this vegetation, species that were common included *Hibbertia hypericoides*, *Gompholobium tomentosum*, *Daviesia decurrens*, *Stirlingia latifolia*, *Xanthorrhoea preissii* and *Acacia pulchella*.
LSAcJfAs	*Adenanthos cygnorum*, *Acacia saligna* and *Jacksonia furcellata* Low Shrubland
OSAcAs	*Acacia saligna* and *Adenanthos cygnorum* Open Shrubland. This previously cleared area is almost completely dominated by colonising *Adenanthos cygnorum* and *Acacia saligna*, with scattered *Jacksonia furcellata* and introduced weed species including Wild Oats and Pigface.
OWCc	Marri (*Corymbia calophylla*) Open Woodland. This open woodland to the north of Piney Lake, is dominated by Marri, with scattered mature planted *Eucalyptus citriodora* trees over a relatively degraded understorey comprised of *Acacia saligna*, *Xanthorrhoea preissii* and *Adenanthos cygnorum*. Rose Pelargonium (*Pelargonium capitatum*) and Wild Oats (*Avena barbata*) infestations occurs throughout this vegetation type.
OWLc	*Lophostemon confertus* dominated Open Woodland. This vegetation type, north of Piney Lake, is comprised of introduced plantings of *Lophostemon confertus*
TOSJfAc	*Jacksonia furcellata* and *Acacia saligna* Tall Open Shrubland
TWCc	Marri (*Corymbia calophylla*) Tall Woodland. This transitional vegetation type to 20 m tall occurs over the south-eastern corner of the study area. The understorey is degraded with only a few native plant species including *Jacksonia furcellata, J. sternbergiana, Daviesia physodes* and *Acacia pulchella*.

(Source: ATA Environmental, 2004)

Legend

LOFMr—*Melaleuca rhaphiophylla* Low Open Forest		CSAc—*Adenanthos cygnorum* Closed Shrubland	
OSBaJp—*Baumea articulata* and *Juncus pallidus* Open Sedgeland		OSAcAs—*Acacia saligna* and *Adenanthos cygnorum* Open Shrubland	
LWMpBl—*Melaleuca preissiana* and *Banksia littoralis* Low Woodland		LH(mixed) - Mixed Low Heath	
LOWMp—*Melaleuca preissiana* Low Open Woodland		OWLc—*Lophostemon confertus* dominated Open Woodland	
LCFMp—*Melaleuca preissiana* Low Closed Forest		TOSJfAc—*Jacksonia furcellata* and *Acacia saligna* Tall Open Shrubland	
LCFMr—*Melaleuca rhaphiophylla* Low Closed Forest		CHAcAs—*Adenanthos cygnorum* and *Acacia saligna* Closed Heath	
WMpCc—*Melaleuca preissiana* and *Corymbia calophylla* (Marri) Woodland		LSAcJfAs—*Adenanthos cygnorum* , *Acacia saligna* and Jacksonia *furcellata* Low Shrublands	
TWCc—*Corymbia calophylla* Tall Woodland		Pine—*Pinus* sp. Plantation	
OWCc—*Corymbia calophylla* open Woodland		Piney Lakes Reserve boundary	

Figure 6:
Vegetation Types
Piney Lakes Reserve, Winthrop

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Client: City of Melville
Project: Piney Lakes Reserve Strategic Management Plan
Image Source: Nearmap, 2015
Data Source: ATA Environmental, 2004
Prepared by: Sharon Hynes
Datum: GDA 94, Zone 50

0 100
Metres

2.2.2 Fauna Habitat

Piney Lakes Reserve provides important habitat for threatened and priority fauna species. It is recorded as a confirmed roosting area and potential foraging habitat for the threatened Carnaby's Cockatoo (*Calyptorhynchus latirostris*) (WALGA, 2016). Food sources for the all three threatened black cockatoos and dense wetland consisting of shrubs and sedges that provide habitat for the Priority 5 Southern Brown Bandicoot or Quenda (*Isoodon obesulus fusciventer*) were recorded on site during 2015 and 2016 site assessments.

The two artificial lakes within the parkland adjacent the bushland and wetland areas provide habitat for migratory waterbirds, frogs and the Oblong Turtle (*Chelodina oblonga*). Climate change has seen a reduction in the water levels within the conservation category sumplands, and these artificial wetlands have played a key role in the survival of these species during dry conditions.

Large trees provide suitable nesting and roosting habitat for a range of native fauna such as bats, native birds, possums and invertebrates. Habitat trees with a diameter at breast height of greater than 50 cm were recorded by Ecoscape during 2015 flora surveys, as the larger trees are more likely to have hollow formation, including:

- a total of 59 trees were recorded, with 10 native and three introduced species (Figure 7)
- diameter at breast height (DBH) of trees recorded ranged from 60 – 200 cm
- Piney Lakes had a higher diversity of species recorded as habitat trees and overall numbers where consistent with other reserves (Table 2)
- the majority were wetland trees, which is most likely due to the fact that the wetland areas were less disturbed by clearing from pine plantation activities, as it was deemed too wet for growing pines.

Nesting boxes have also been installed throughout the western side of the bushland area and in a large tree within Juett Park (Figure 8), by City of Melville staff and volunteers. Nesting boxes consist of:

- five bat boxes
- nine pardalote boxes
- seven parrot boxes
- one possum box
- three boxes observed were being used during the 2015 fauna surveys (Table 3), two of which were being utilised by introduced species (Figure 18), with:
  - introduced Rainbow Lorikeets observed nesting in a Parrot box adjacent to the red bitumen path in a **Corymbia citriodora*
  - an introduced European Honey Bee hive was occupying a nesting box at the intersection of the limestone and blue metal paths
  - a native Weebill (*Smicrornis brevirostris*) was observed entering the pardalote box, on the opposite side of the tree to the Lorikeets
- one bird box on the west side of Juett Park was damaged with a hole in the bottom and the side of the box, resulting in it being unusable (refer to Section 3.1.2).

Table 2: Comparison of numbers of habitat trees with other City of Melville reserves

Species		Piney Lakes	Bateman	Bull Creek	Curedale Mews	Debries Place	Reg Bourke	Richard Lewis	Trevor Gribble	Adjacent	Total
Wetland Trees	*Banksia littoralis*	3									**3**
	Eucalyptus rudis	2	36	59			23	19		3	**142**
	Melaleuca lanceolata	1									**1**
	Melaleuca preissiana	12		14	3	6	5	12			**52**
	Melaleuca rhaphiophylla	1	35	4				1			**41**
	Total Wetland Trees	19	71	77	3	6	28	32	0	3	**239**
Dryland Trees	*Allocasuarina fraseriana*	2		17	1	2				3	**25**
	**Corymbia citriodora*	3									**3**
	Corymbia calophylla	20						1			**21**
	Eucalyptus gomphocephala	2									**2**
	Eucalyptus marginata	3		1		3			1	1	**9**
	Eucalyptus sp.	1									**1**
	Nuytsia floribunda			1							**1**
	**Pinus* sp.	4									**4**
	**Quercus suber*	5									**5**
	Total Dryland Trees	40	0	19	1	5	0	1	1	4	**71**
Total number Trees		**59**	**71**	**96**	**4**	**11**	**28**	**33**	**1**	**7**	**310**

* Denotes introduced species

Table 3: Nesting boxes in use in Piney Lakes Reserve

Box Type	Latitude	Longitude	Observations
Pardalote	-32.04899	115.83562	In eastern states Eucalypt near tin man sculpture, had a Weebill observed entering the nesting box
Parrot	-32.04899	115.83562	In eastern states Eucalypt near tin man sculpture, had a pair of Lorikeets nesting in the box
Parrot	-32.04859	115.83918	In a dead Eucalypt near corner of limestone and blue metal track, had an active bee hive in the nesting box

Table 4: Habitat tree assets over time

Values	Habitat Sites	Tree/ha (2004)	Trees/ha (2016)	Assets 2004-2016
Medium Very large trees	Live native tree	No data	1.18	Maintained (assumed unchanged)
	Dead Tree		0	

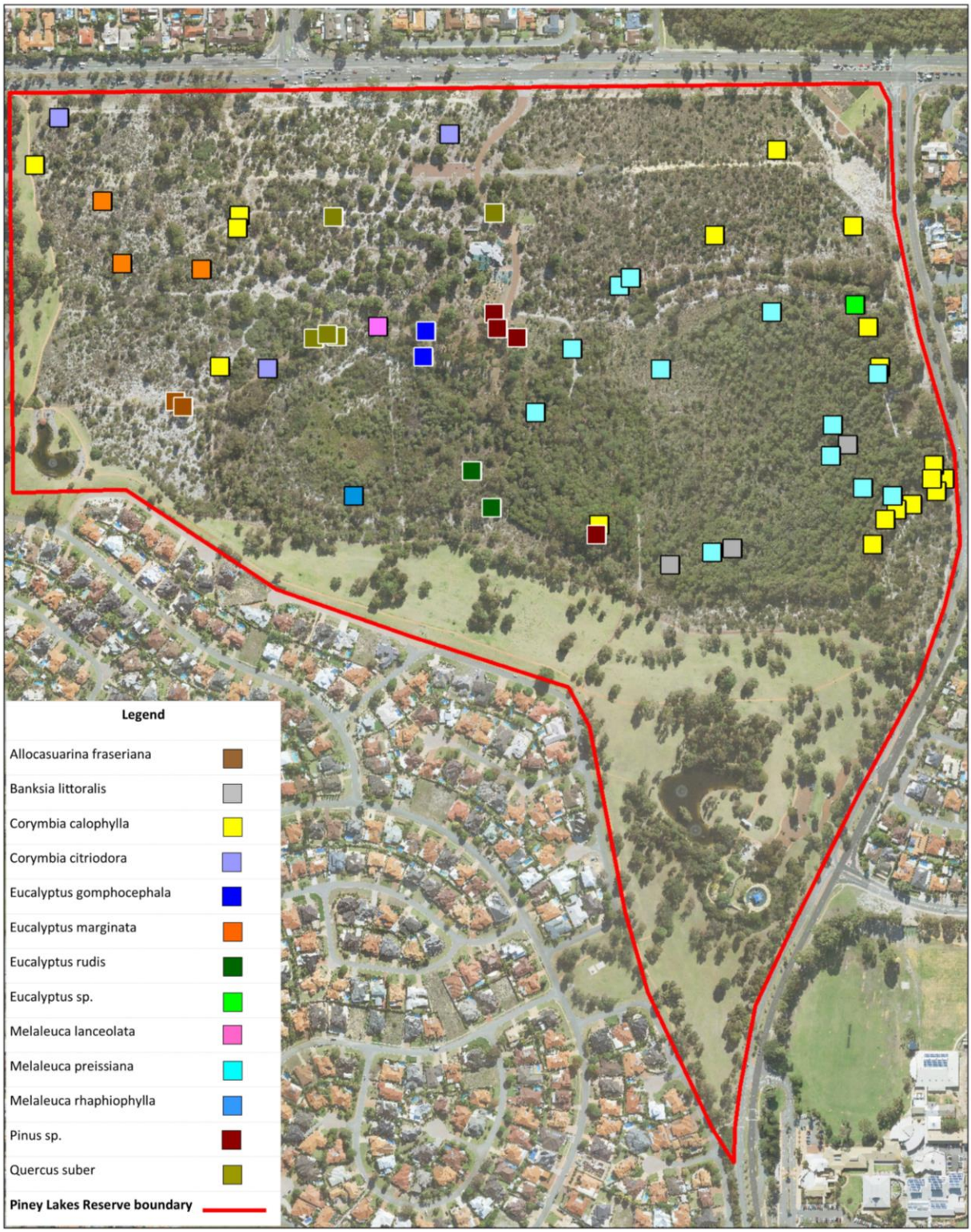

Figure 7:
Habitat tree locations
Piney Lakes Reserve, Winthrop

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Client: City of Melville
Project: Piney Lakes Reserve Strategic Management Plan
Image Source: Nearmap, 2016
Prepared by: Sharon Hynes
Datum: GDA 94, Zone 50

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Metres

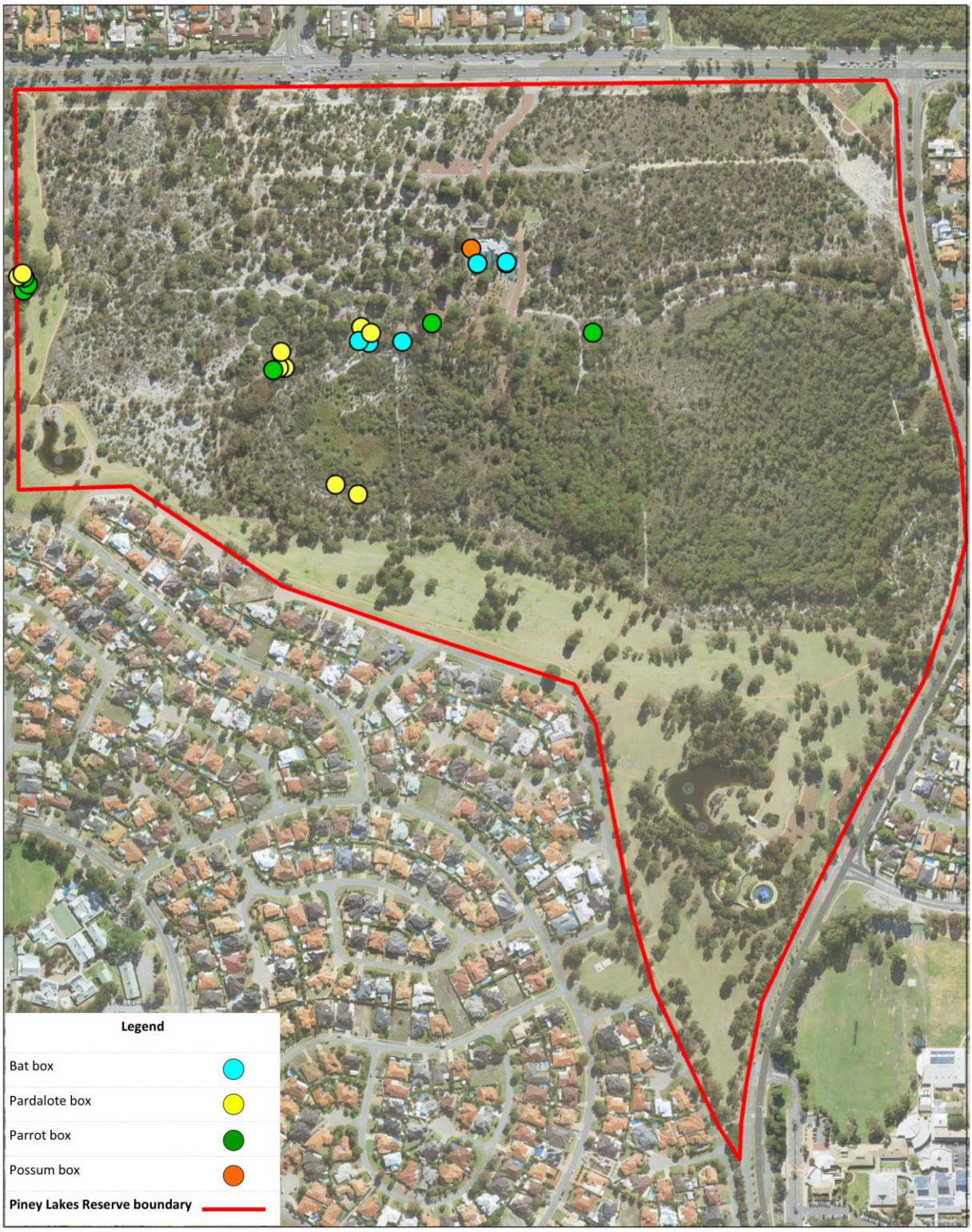

Figure 8:
Nesting box locations
Piney Lakes Reserve, Winthrop

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Client: City of Melville
Project: Piney lakes Reserve Strategic Management Plan
Image Source: Nearmap, 2016
Prepared by: Sharon Hynes
Datum: GDA 94, Zone 50

0 100
Metres

2.2.3 Wetlands

Piney Lakes is part of the Beeliar Wetland chain, which consists of a system of interdunal depressions that form a series of lakes running parallel to the coast. The site includes two regionally significant wetlands listed as conservation category sumplands (Figure 9), which are defined as seasonally inundated groundwater dependant basins (Department of Parks and Wildlife, 2016c), including:

- conservation category sumpland 6503 (eastern wetland)
- conservation category sumpland 6504 (western wetland).

The western lake contained permanent water throughout the year until recently, with no surface expressions of water even during winter since 2014. The wetlands within the reserve also provide important wetland linkages to surrounding wetland areas, which include:

- Booragoon Lake which is conservation category lake 6502 to the north-west
- a multiple use wetland 6506 to the south-east.

2.2.4 Heritage

The *Aboriginal Heritage Act 1972* (WA) recognises the strong relationship of Aboriginal people to the land and provides protection for all places and objects that were important to them. Under the Act, it is an offence for anyone to excavate, destroy, damage, conceal or in any way alter an Aboriginal site without the Minister's permission.

A review of the Aboriginal Heritage Inquiry System (Department of Aboriginal Affairs, 2016) identified:

- Aboriginal Heritage Site 3290 (Appendix 1), which extends into the north-east corner of Piney Lakes Reserve. This is a significant site utilised as a camping ground by the Beeliar and Nyungar people with artefacts and scatter recorded by the West Australian Museum in 1995.

A review of the Heritage Council of Western Australia's State Register identified:

- Piney Lakes Reserve as part of Heritage Place No. 9198 – Beeliar Regional Park and Adjacent Areas (Heritage Council, 2016).

Heritage sites for which objectives apply are listed in Table 5.

Table 5: Heritage Sites

Values	Heritage Sites	Extent 2004	Extent 2016	Assets 2004 - 2016
Very high Site on WA Aboriginal Sites Register	Aboriginal Heritage Site 3290	No data	1.9 ha	Maintained (assumed unchanged)
High Site on WA Heritage Register	Heritage Place No. 9198		67 ha	

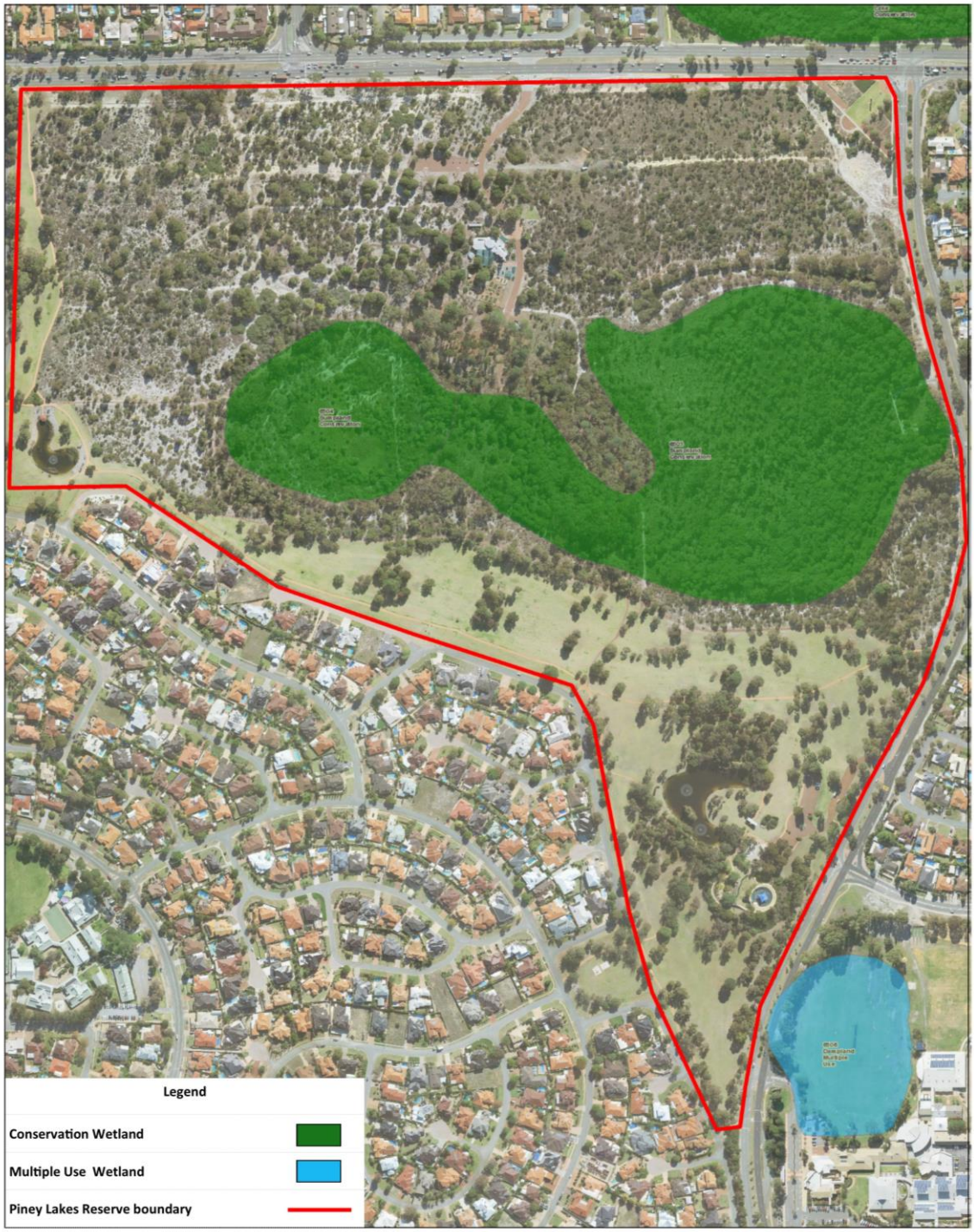

Figure 9:
Geomorphic wetlands,
Piney Lakes Reserve, Winthrop

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Client: City of Melville
Project: Piney Lakes Reserve Strategic Management Plan
Image Source: Department of Parks and Wildlife & Nearmap, 2016
Prepared by: Sharon Hynes
Datum: GDA 94, Zone 50

0 100
Metres

2.2.5 Community Interest

A number of community volunteers undertake restoration and maintenance works within Piney Lakes Reserve. Volunteer works include:

- maintaining priority areas: Bidi Kaitjiny Aboriginal Women's Trail and the Black Cockatoo Habitat Restoration Site, which is the south west rehabilitation area (Figure 10)
- revegetation and maintenance works (planting, mulching, watering and guarding)
- manual weed control (weed identification and eradication).

The main areas where community member undertake volunteer work in the bushland are shown in Figure 10.

The Piney Lakes Environment Education Centre (PLEEC) is situated within the Piney Lakes Reserve and is a place for community members to learn about the natural local environment, environmental sustainability practices and Noongar culture (Figure 10). Education programs and events are held at the centre, as well as a resource facility for the local community. The centre aims to inspire people to connect with the local environment and encourage the development of positive behaviour changes towards protection (City of Melville, 2016a).

Piney Lakes Reserve provides important recreation areas for the local community, and includes both active and passive recreational opportunities. The grassed parkland provides areas for active recreation such as sporting activities, playgrounds, dog walking and exercise off the lead, picnicking and barbequing. Passive recreation occurs along pathways within the bushland areas such as walking, dog walking on leads, cycling, bird watching and photography. A number of walking trails have been installed throughout the reserve (Figure 10), including the:

- Bidi Kaitjiny Aboriginal Walk Trail, which includes educational signage
- Climatewatch trails made up of both sealed and sandy tracks
- Sculpture Walk, including art work and education signage
- Sensory Playground Walk which leads through the parkland to the bushland area
- Wetland Walk, which includes sealed pathways, a boardwalk and sandy tracks
- Murdoch Drive and Leach Highway access carparks.

2.2.6 Reference sites

Reference sites are 10 m x 10 m plots that can be installed permanently and marked using a handheld GPS for monitoring purposes and data trending over time. Currently there are no established reference sites within Piney Lakes Reserve. A minimum of 10 reference sites are recommended with two recommended in each of the conservation category sumplands to monitor changes in wetland vegetation over time and assess trends, and a minimum of two per revegetation area (3 current revegetation areas) to assess success of planting and monitor changes over time and potential threatening processes.

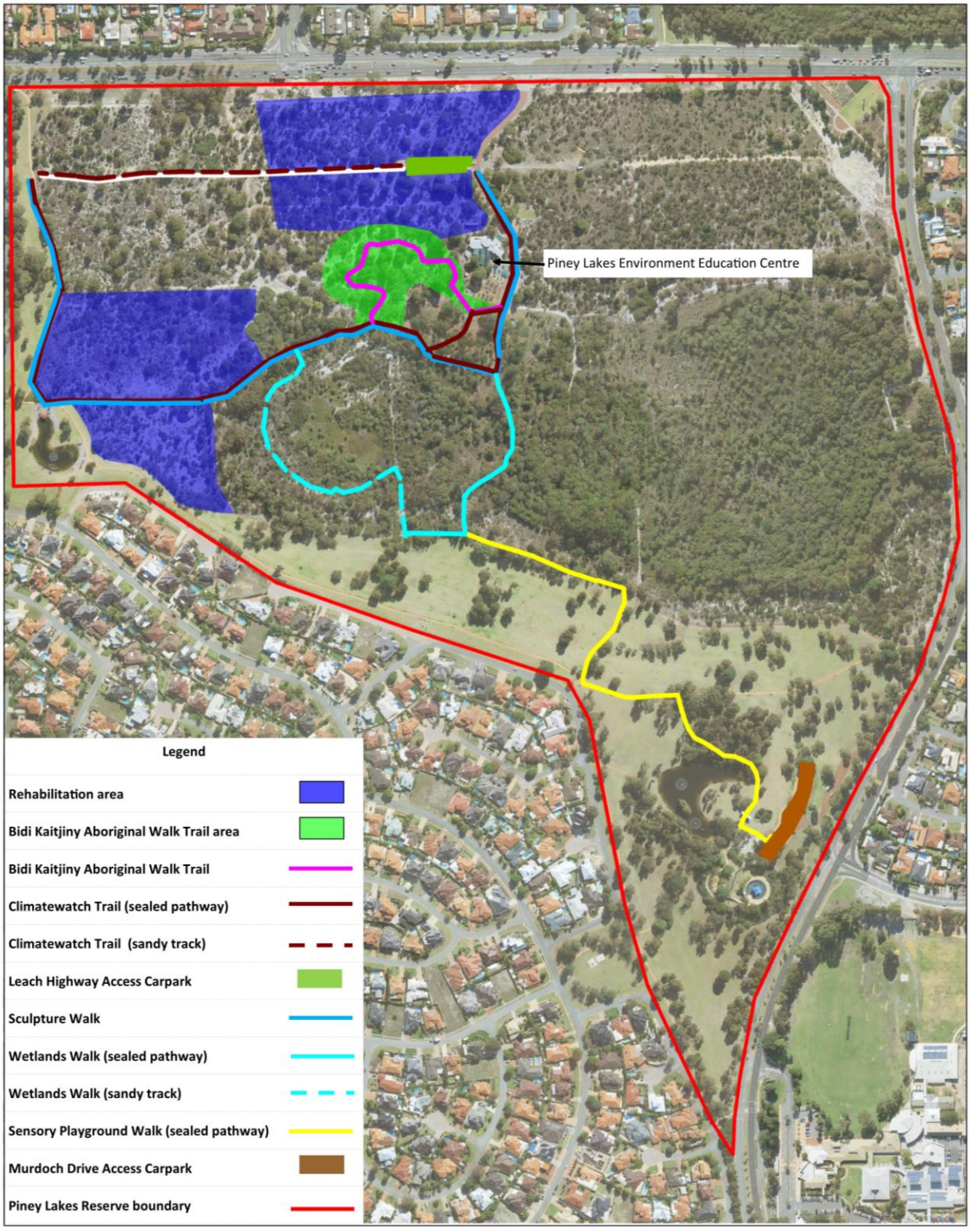


Figure 10:
Community interest areas, Piney Lakes Reserve, Winthrop

N

Client: City of Melville
Project: Piney Lakes Reserve Strategic Management Plan
Image Source: Nearmap, 2016
Prepared by: Sharon Hynes
Datum: GDA 94, Zone 50

0 100
Metres

2.3 Species

2.3.1 Native Flora

A total of 176 flora species from 58 families were recorded by Ecoscape in 2015, of which 48 were introduced (weeds). The complete flora list of 259 flora species, including Ecoscape's 2015 results combined with records from the City of Melville's Piney Lakes Database and ATA Environmental 2003 results is provided in Appendix 2.

2.3.1.1 Significant and At-risk Flora Species

The Priority 4 species *Jacksonia sericea* (Waldjumi) was recorded on site by Ecoscape during 2015 surveys, with an additional seven at-risk species as categorised by the City of Melville found, including:

High Priority

- *Jacksonia sericea* (Waldjumi) (P4):
  - This species has been planted in revegetation areas, although only two plants were recorded in 2015 and one of these was recorded as a planting. This species is Priority 4 listed and requires protection and management of threatening processes. It is found across 14 local government areas on the Swan Coastal Plain, but is at risk due to its small range being restricted to the coastal areas around Perth, which is largely affected by urban development leading to fragmentation of populations (Department of Parks and Wildlife, 2016b).
  - Seed for this species is easy to collect, readily germinates and grows successfully in nurseries. The main difficulty is accurate identification in the field as this species is easy to confuse with *Jacksonia calcicola*, which tends to grow in the same areas.
- *Conospermum triplinervium*:
  - This species was very localised with only three plants found within the reserve, and these were considered to be plantings and not naturally occurring within the site. This species is well represented on the Swan Coastal Plain occurring across 11 local government areas, and is unlikely to be at risk of being lost from this region (Department of Parks and Wildlife, 2016b).
  - This species is recorded as a high priority by the City as previous populations have been lost from various reserves across the City of Melville. Previous surveys have found one 4 m high tree was in Harry Sandon Park in 2013, it is now extinct at Heathcote, Point Walter and cannot be relocated at Wireless Hill.
  - This species prefers deep well drained sandy soils and to be in full sun to partial shade, which will need to be taken into account during planting works, it will be best planted into the dryland areas to the west and north of the wetlands (Department of Agriculture and Food WA, 2016c). It grows up to 4 m in height and 1 – 2 m wide so appropriate spacing will need to be considered. This plant grows on a wide range of soils and tolerates a pH ranging from mildly acidic to mildly alkaline. Sourcing of stock should be from areas with similar soil types to the chosen revegetation area, and seed/plant stock should be sourced locally within 20 km of the reserve.
  - This plant readily germinates and grows quite well in nurseries, the main difficulty is sourcing an adequate amount of seed for propagation and appropriate timing of seed collection. Seed collection times for this species is usually from November to December, and plants will need to be monitored as there is only a short period of time from seed ripening to when it drops off the tree to collect it.
- *Aotus cordifolia*:

  This species is localised with only nine plants found within the wetland area of the reserve, which increases the risk of this species being lost from this reserve in the event of localised threatening processes such as fire. It is found across 11 local government areas on the Swan Coastal Plain and is unlikely to be lost from this region (Department of Parks and Wildlife, 2016b).
- *Macarthuria apetala*:

- Only one plant was recorded for this species within the reserve, indicating it is at risk of being lost. This species is common on the Swan Coastal Plain and found across 10 local government areas (Department of Parks and Wildlife, 2016b).

Medium Priority

- *Acacia tetragonocarpa*:
  - This species was widespread throughout the reserve with 137 plants found and is unlikely to be at risk of being lost from this reserve, it is found in five local government areas within the Swan Coastal Plain but is represented as common and not threatened in this region (Department of Parks and Wildlife, 2016b).
- *Drosera macrantha*:
  - Four plants of this species were found within the reserve, indicating it is localised, and at increased the risk of being lost from this reserve in the event of localised threatening processes. This species is well represented across the Swan Coastal Plain and unlikely to be at risk of disappearing from this region. As its preferred habitat is wetlands it may be affected by climate change or any drying of the wetland areas on site (Department of Parks and Wildlife, 2016b).

Low Priority

- *Hibbertia cuneiformis* (Cutleaf Hibbertia):
  - This species was widespread throughout the wetland area with 195 individual plants recorded, and has been recorded in nearby wetland reserves such including Quenda Wetland Reserve. It grows readily in wetland areas and is unlikely to be at risk of being lost from this reserve. It is found in 10 local government areas on the Swan Coastal Plain (Department of Parks and Wildlife, 2016b).
  - This species was considered to be introduced via plantings and not naturally occurring on site by Ecoscape (2015). It has been known to become invasive and act like a weed on the edge of wetlands within Perth and control of this species is recommended.
- *Melaleuca lanceolata*
  - This species was widespread throughout the site with 535 plants recorded, and it is unlikely to be at risk of being lost form this reserve. It is found in nine local government areas on the Swan Coastal Plain, where numbers have been reduced due to urban development through much of its range. However, it is not likely to be lost from this region, as it is commonly used in revegetation projects and grows readily with many plantings becoming established outside its natural range (Department of Parks and Wildlife, 2016b).
  - These plants were most likely planted and not naturally occurring, and have naturalised well within the reserve.

2.3.1.2 Banksia Tree Count

A banksia tree count was undertaken by Ecoscape during 2015 surveys to determine a population count for the reserve (Table 6).

Table 6: Banksia tree count for Piney Lakes Reserve

Banksia Species	Common Name	2015 Count
Banksia attenuata	Candlestick Banksia	110
Banksia grandis	Bull Banksia	24
Banksia littoralis	Swamp Banksia	91
Banksia menziesii	Firewood Banksia	202
Banksia sessilis	Parrot Bush	7
	Grand Total	**434**

2.3.2 Native Fauna

Piney Lakes Reserve contains significant fauna habitat and provides ecological connectivity to other natural areas within the City of Melville, including the Swan River, and Booragoon and Blue Gum Lakes, and Quenda Wetland. The major habitat areas are the:

- upland *Banksia* and *Eucalyptus* woodlands
- wetland vegetation within the conservation category sumplands.

A total of seven mammals, 80 birds, 12 reptiles, 6 amphibians, two fish and 30 invertebrate species have been recorded within Piney Lakes Reserve. These species were recorded by Rodda (1986), Birds Australia (2003) (birds only), and by Natural Area (2015), the combined list can be found in Appendix 3. No bats were recorded during 2015 surveys.

2.3.1.1 Mammals

A combined total of seven mammal species were recorded, of these two were natives, and five were recorded in 2015. The Southern Brown Bandicoot or Quenda (*Isoodon obesulus fusciventer*) (Figure 11), which is listed as a Priority 5 species under the *Wildlife Conservation Act 1950* (WA) was captured during trapping activities within the wetland; it was also recorded by Rodda in 1986. The targeted at-risk species not found on site and their likelihood of occurring are listed within Appendix 4, with all unlikely to occur due to the previous clearing and degradation of the site. The Brush-tailed Possum (Trichosurus vulpecula) was not recorded but is likely to be present within the reserve. Mammal habitat requirements are listed in Table 7.

Table 7: Mammal habitat considerations for revegetation

Mammals	Habitat Requirements	Diet
Quenda *(Isoodon obesulus fusciventer)*	Dense understory vegetation adjacent open feeding areas, associated with wetlands. Home ranges of 2-7 ha for males and 1-3 ha for females	Invertebrates, underground fungi, subterranean plant material and rarely small vertebrates
Brush-tailed Possum *(Trichosurus vulpecula)*	Forests to woodlands that provide sufficient tree hollows, and ground refuge such as hollow logs. Possums are also known to live in ceiling cavities of houses in urban areas. Home ranges vary from 1 - 15 ha.	Insects, eggs and meat rarely, leaves, fruits and flowers of vegetation including toxic *Gastrolobium* species and some *Eucalyptus.* Meat is rarely eaten in the wild.

(Source: Department of Environment and Conservation, 2012a and 2012b)

2.3.1.2 Bats

No bats including target species were recorded during the 2015 fauna surveys. Target species that were not found and the likelihood of their presence on site is shown in Appendix 4, with all but one of the species likely to occur within the reserve due to suitable habitat and location.

2.3.1.3 Birds

A total of 80 species of birds have been recorded within the reserve to date, of which four are introduced. The 2015 surveys recorded 35 species, with three being conservation significant (Figure 11). The Forrest Red-tailed Cockatoos (*Calyptorhynchus banksii naso*), the Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and the Rainbow Bee-eater (*Merops ornatus*) are listed as Endangered, Endangered and a Migratory Species, respectively under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth). Under the *Wildlife Conservation Act 1950* (WA) the black cockatoos are listed as threatened and the Rainbow Bee-eater as protected under International agreement (Figure 11). Forest Red-tailed Cockatoos were observed foraging in a patch of *Corymbia calophylla* (Marri) along the eastern side of the site. Signs of foraging by the

Carnaby's Cockatoos was observed within the Pine and *Banksia* woodlands, and the Rainbow Bee-eater was observed within the dry *Banksia* and *Eucalyptus* woodland areas.

The list of at-risk target species not found and their potential to occur on site are listed in Appendix 4. With 17 likely to occur due to suitable habitat and location, and 6 unlikely due to unsuitable habitat, location, previous degradation on site and current scarcity on the Swan Coastal Plain. Indicator species are listed in Table 8.

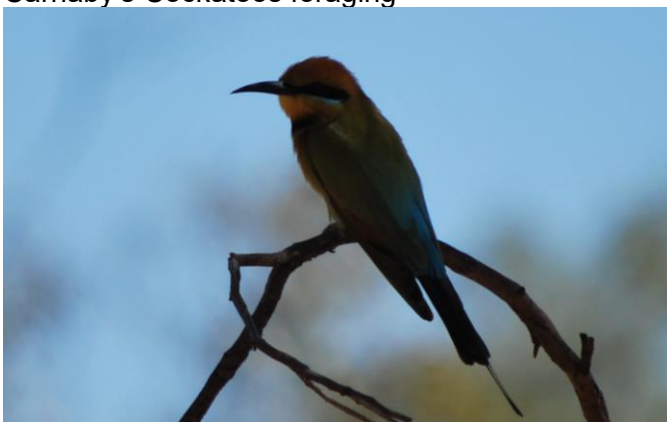
Table 8: Bird indices

Values	Birds	Status 2003	Status 2016	Assets
Very High Conservation significant species listed under the EPBC Act 1999	Red-tailed Black Cockatoo (*Calyptorhynchus banksia naso*)	Not confirmed	Confirmed present	1 species Change not assessable
	Baudin's Cockatoo (*Calyptorhynchus baudinii*)	Confirmed present 1986 (assumed present)		3 species Maintained (no change)
	Carnaby's Cockatoo (*Calyptorhynchus latirostris*)	Confirmed present		
	Rainbow Bee-eater (*Merops ornatus*)	Confirmed present (2003 and 1986)		
High Significant birds with reduced populations on the Swan Coastal Plain listed in Bush Forever	Common Greenshank (*Tringa nebularia*)	Confirmed present	Not confirmed	1 species Change not assessable
	Hardhead (*Aythya australis*)	Confirmed present (2003 and 1986)	Confirmed present	7 species Maintained (no change)
	Brown Goshawk (*Accipiter fasciatus*)			
	Splendid Fairy Wren (*Malurus splendens*)			
	Yellow-rumped Thornbill (*Acanthiza chrysorrhoa*)			
	New Holland Honeyeater (*Phylidonyris novaehollandiae*)	Confirmed present		
	White-cheeked Honeyeater			
	Western Little Wattlebird (*Anthochaera lunulata*)			
	Common Bronzewing (*Phaps chalcoptera*)	Not confirmed		2 species Change not assessable
	Weebill (*Smicrornis brevirostris*)			
Low Bushland dependant species recorded in 2 or more Melville reserves	Grey Fantail (*Rhipidura fulignosa preissii*)	Confirmed present 1986 (assumed present)	Not confirmed	1 species Change not assessable
	Rufous Whistler (*Pachycephala rufiventris*)	Confirmed present (2003 and 1986)	Confirmed present	1 species Maintained (no change)

Quenda (*Isoodon obesulus fusciventer*)

Carnaby's Cockatoos foraging

Forrest Red-tailed Cockatoos foraging



Rainbow Bee-eater (*Merops ornatus*)

Figure 11: Significant fauna within Piney Lakes Reserve

2.3.1.4 Reptiles

Twelve native reptiles have been recorded since 1986 within Piney Lakes Reserve, with 10 recorded in 2015, eight of which have not previously been recorded. The two that were not recorded in 2015 were the Tiger Snake (*Notechis scutatus*) and the Oblong Turtle (*Chelodina oblonga*). Both these species are most likely still within the site, with the Tiger snake habitat consisting of thick under storey vegetation which can make observation difficult. The Oblong Turtle is known to occur within the site with City of Melville staff noting that they utilise the artificial lake adjacent to the bushland when there is no water in the western lake.

The list of at-risk target reptile species not found and their potential to occur on site are listed in Appendix 4. Of the 18 species listed only 3 are unlikely to occur due to unsuitable habitat, location and previous degradation on site. Reptile indices are listed in Table 9.

Table 9: Reptile indices

Values	Reptiles	Status 2004	Status 2016	Assets
Medium Bushland dependant species recorded in 1 or 2 Melville reserves	Western Tiger Snake (*Notechis scutatus*)	Confirmed present 1986 (assumed present)	Not confirmed	1 species, change is not assessable
	West-coast Laterite Ctenotus (*Ctenotus fallens*)	Not confirmed (assumed present)	Confirmed present	2 species Maintained (no change)
	South-west Cool Skink (*Acritoscincus trilineatum*)			
Low Bushland Dependant species recorded in more than 2 Melville reserves	Bobtail (*Tiliqua rugosa*)	Confirmed present 1986 (assumed present)	Confirmed Present	2 species Maintained (no change)
	Dugite (*Pseudonaja affinis*)			
	Oblong Turtle (*Chelodina oblonga*)	Confirmed present 1986 (assumed present)	Not confirmed	1 species Change not assessable
	Common Dwarf Skink (*Menetia greyii*)	Not confirmed (assumed present)	Confirmed present	6 species Maintained (no change)
	Elegant Slider (*Lerista elegans*)			
	Westcoast Pale-flecked Morethia (*Morethia lineoocellata*)			
	Western Bearded Dragon (*Pogona minor*)			
	Fence Skink (*Cryptoblepharus buchananii*)			
	Two-toed earless skink (*Hemiergis quadrilineata*)			

2.3.1.5 Amphibians

Two of the six frog species recorded for the site were captured during 2015 surveys. These were the Moaning Frog (*Heleioporus eyrei*) and the Western Banjo Frog (*Limnodynastes dorsalis*), which are both species that can exist in drier environments. This could be related to drier weather conditions experience at the site over the past two years in particular, when the western lake has had no surface water. Amphibian indices are listed in Table 10.

Table 10: Amphibian indices

Values	Reptiles	Status 2004	Status 2016	Assets
Medium Bushland dependant species recorded in 1 or 2 Melville reserves	Slender Tree Frog (*Litoria adelaidensis*)	Confirmed present 1986 (assumed present)	Not confirmed	4 species Change not assessable
	Motorbike Frog (*Litoria moorei*)			
Low Bushland Dependant species recorded in more than 2 Melville reserves	Rattling or Clicking Froglet (*Crinia glauerti*)			
	Squelching Froglet (*Crinia insignifera*)			
	Moaning Frog (*Heleioporus eyrei*)		Confirmed present	2 species Maintained (no change)
	Western Banjo Frog (*Limnodynastes dorsalis*)			

2.3.1.7 Invertebrates

A total of 30 species were captured or opportunistically observed during 2015 surveys (Appendix 3), with no prior surveys having been undertaken. The at-risk species the Western Petalura (*Petalura hesperia*) was not recorded on site, as its preferred habitat is marshes and drainage basins adjacent freshly oxygenated streams and rivers. Accordingly, it is unlikely that this species will be found within Piney Lakes Reserve as this habitat type is not present.

3 Threats

There are a number of actual and potential threatening activities and processes that could result in degradation and pollution within Piney Lakes Reserve. These include physical disturbance, bushfire, weed invasion, loss of habitat, feral animals, introduction or spread of disease and pathogens, erosion, pollution, reticulation, acid sulfate soils and climate change.

3.1 Physical Disturbance

Physical disturbance within Piney Lakes relates to use of the area by people, including inappropriate access, trampling of vegetation, graffiti and vandalism, dumping of rubbish and garden waste into the bushland, removal of vegetation and geocaching (Figure 12). Physical disturbance indices are listed in Table 11.

Missing seat and graffiti on bitumen path

Dumped rubbish

Figure 12: Examples of Physical disturbance in Piney Lakes reserve

Access infrastructure (Figure 13), and signage (Figure 14) are common targets for graffiti and vandalism, and inappropriate access can lead to an increase in physical disturbance. Access infrastructure within Piney Lakes Reserve includes carparks, pedestrian and vehicle access gates, tracks and pathways and fencing. Two access car parks include the Murdoch Drive carpark and the Leach Highway carpark. The perimeter of the bushland areas within the reserve are fenced with pine post bollard and wire ringlock fencing, and there are a number of access points through this fence into the bushland area including:

- pedestrian access points that are not gated and allow access for the local community members along the walk trails
- locked maintenance gates that allow access by the City's staff, emergency services and contractors into the vegetated bushland areas

locked vehicle gates, that allow access by the City's staff, emergency services and contractors into the bushland area of the reserve.

Geocaching is a new management issue within Piney Lakes Reserve, with one known location in the reserve noted by the City's staff in 2016. The practise involves hiding a container (treasure) that others use GPS-enabled devices to find. According to the Geocache website (2016), geocaching is a real-world treasure hunt where participants use their GPS device to navigate to a set of coordinates and attempt to find the geocache container hidden in the area. The containers used in geocaching range in size from a small film canister, to very large containers with a 20 L or more capacity (Geocaching, 2016).

Geocaches are often hidden in bushes, buried, placed in a tree, or placed on the ground and covered. The cache can stay in place for lengthy periods, resulting in regular visits to its location. Environmental impacts can include trampling of vegetation, rubbish dumping, habitat destruction, spread of pathogens and damage to infrastructure by people looking for them.

Table 11: Physical disturbance indices

Impacts	Physical disturbance	Disturbances 1994 - 2004	Disturbances 2004 - 2016	Threats
High Potential to substantial change to ecosystem structure, composition or function	Clearing for utilities	No data	No data	Change not assessable
Medium Potential to moderate change to ecosystem structure, composition or function	Trampling	No data	2.73 ha	Change not assessable
	Trampling via geocaching		1 geocache located	
	Rubbish		No data	
	Tree Poisoning, Illegal Clearing, Firewood Collection		0	
Medium Potential costly remediation	Vandalism		3 incidences of theft of artwork, 2 incidences of graffiti	

3.1.1 Trampling

There are a number of informal paths throughout the reserve, particularly around the Piney Lakes Environmental Education Centre (Figure 15).

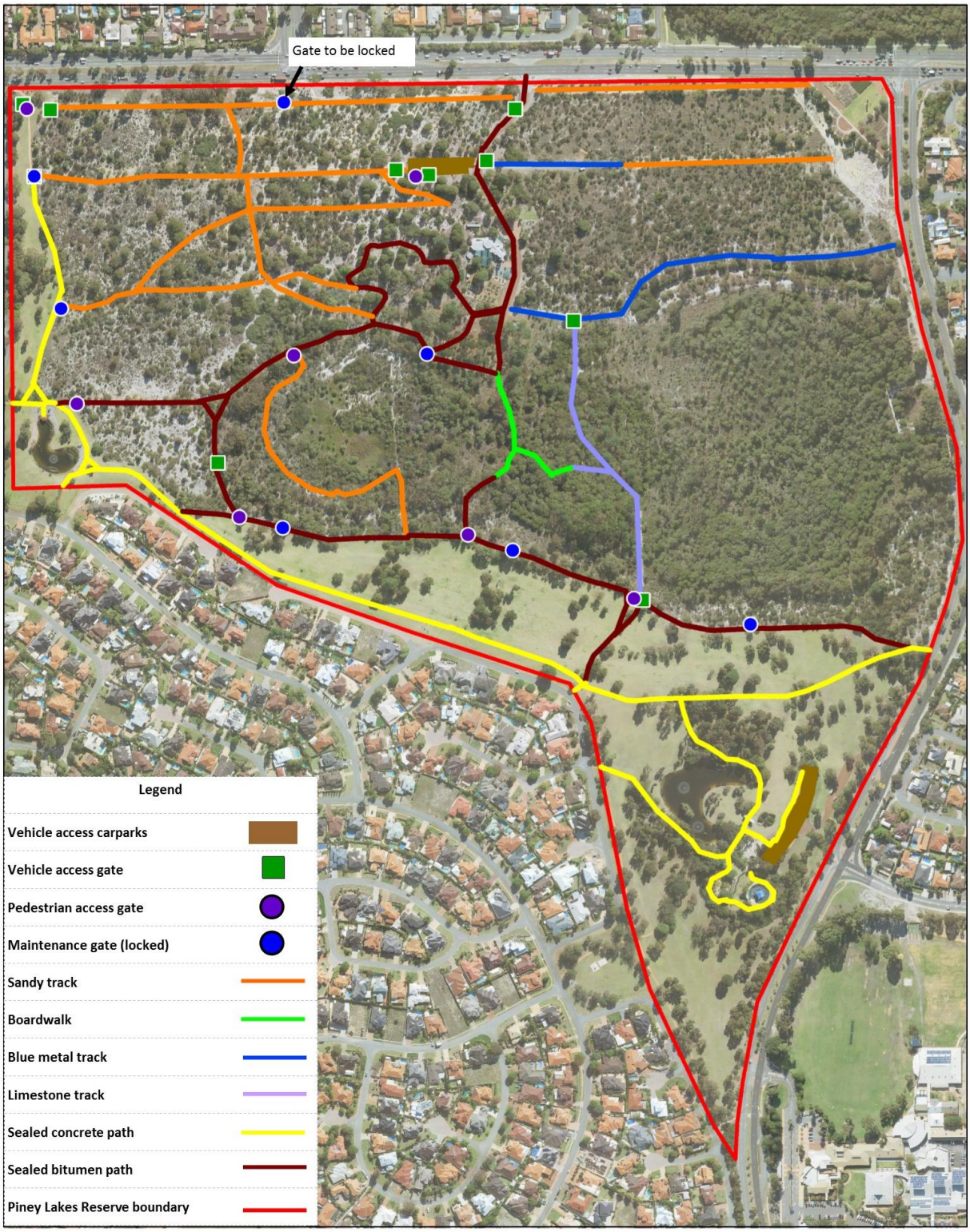


Figure 13:
Access infrastructure
Piney Lakes Reserve, Winthrop

N

Client: City of Melville
Project: Piney Lakes Reserve Strategic Management Plan
Image Source: Nearmap, 2016
Prepared by: Sharon Hynes
Datum: GDA 94, Zone 50

0 100
Metres

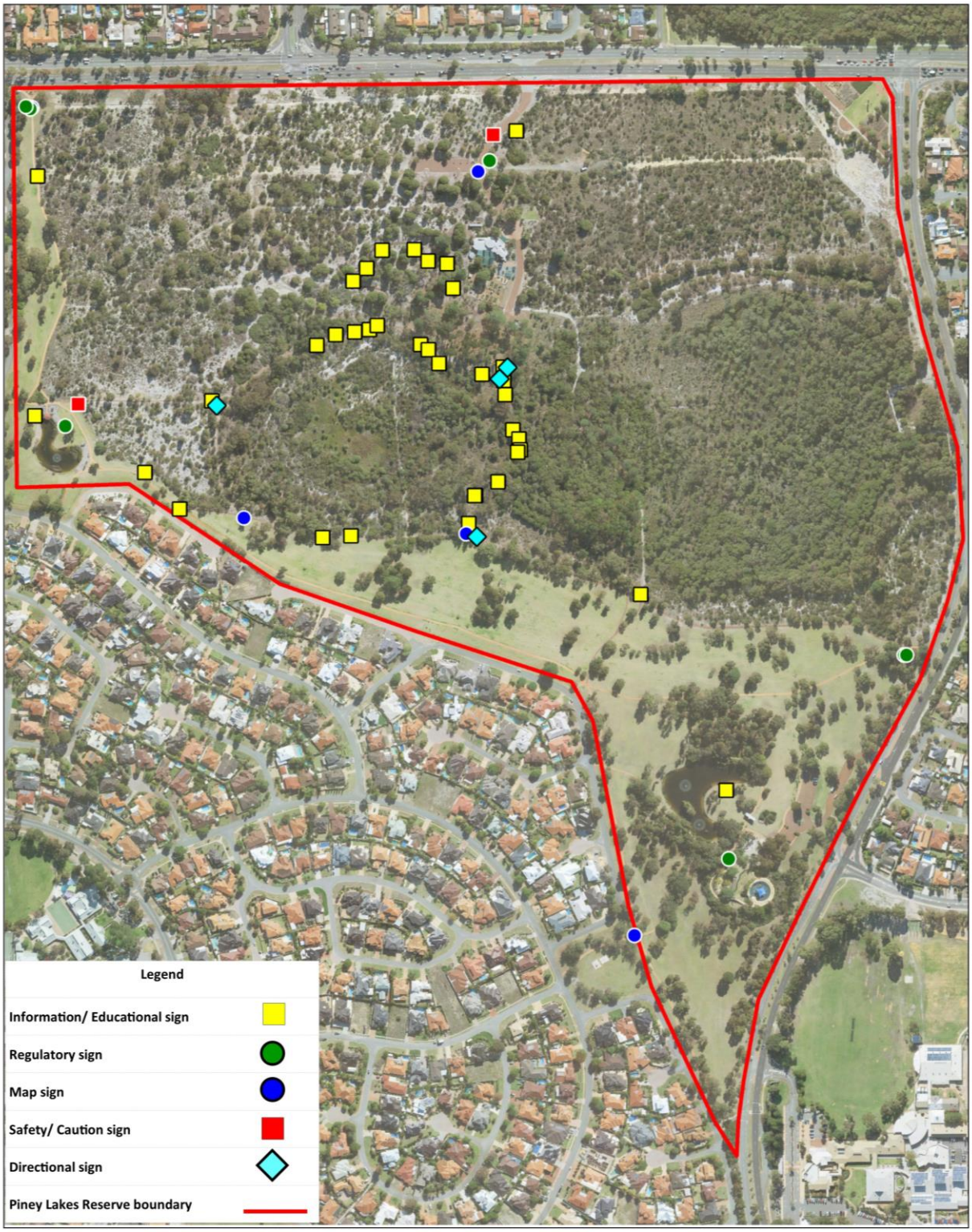


Figure 14:
Signage locations
Piney Lakes Reserve, Winthrop

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Client: City of Melville
Project: Piney Lakes Reserve Strategic Management Plan
Image Source: Nearmap, 2016
Prepared by: Sharon Hynes
Datum: GDA 94, Zone 50

0 100
Metres

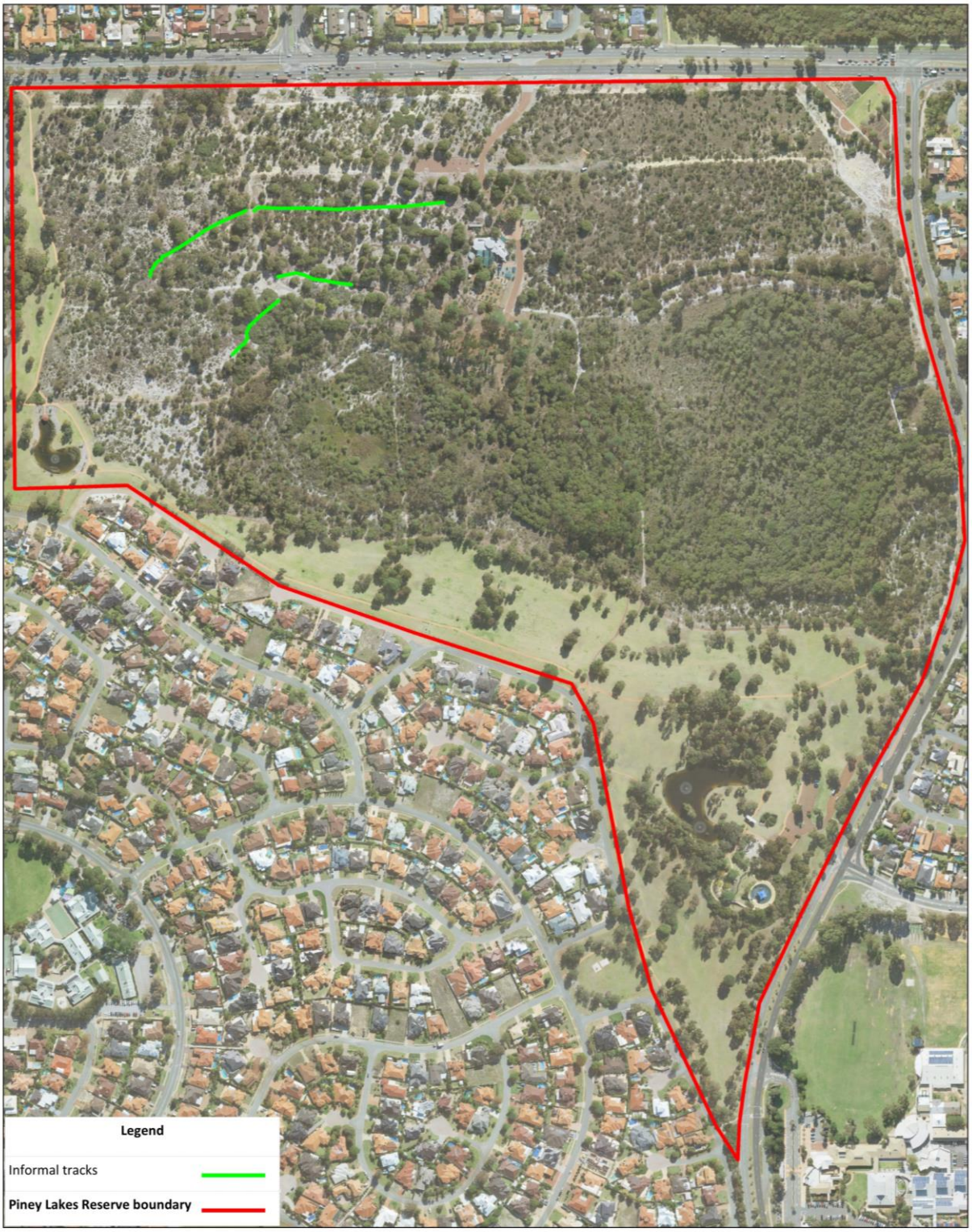

Figure 15:
Informal tracks proposed for closure
Piney Lakes Reserve, Winthrop

N

Client: City of Melville
Project: Piney lakes Reserve Strategic Management Plan
Image Source: Nearmap, 2016
Prepared by: Sharon Hynes
Datum: GDA 94, Zone 50

0 100
Metres

3.2 Fire

3.2.1 Location

The Piney Lakes Reserve is located in an urban location where the bushfire hazard level is manageable and the time for fire-fighting appliance arrival is lower as the nearest DFES fire station is located on Murdoch Drive in Murdoch, approximately 2 km or 5 minutes' drive away.

3.2.2 Fire History

Records provided by the City of Melville (2016) and from reviewing aerial imagery (Landgate 2016) of the site indicate that four fires have occurred within the reserve in the last 10 years (Figure 16; Table 12), including:

- a small fire in 2015 (0.14 ha) adjacent to Leach Highway near the entrance to the reserve
- a larger fire in 2010 (0.65 ha) at the southern boundary of the eastern wetland
- two fires which appear to have occurred between 2006 and 2008 in the south-west corner of the bushland (0.3 ha) and adjacent the PLEEC (0.9 ha).

Table 12: Fire indices

Impacts	Fires	Extent 1994-2004	Extent 2006-2016	Threats
Very high Potential for local extinctions of ground dwelling species	Large fires	No data	0 ha	Maintained (assumed unchanged)
High Potential for local extinction of trees and shrubs that regenerate only from seed stored on the plant	Repeated fires		0 ha	
Medium Temporarily altered floristic composition of the area, until regeneration occurred	Low occurrences of fire		2 ha	Change not assessable

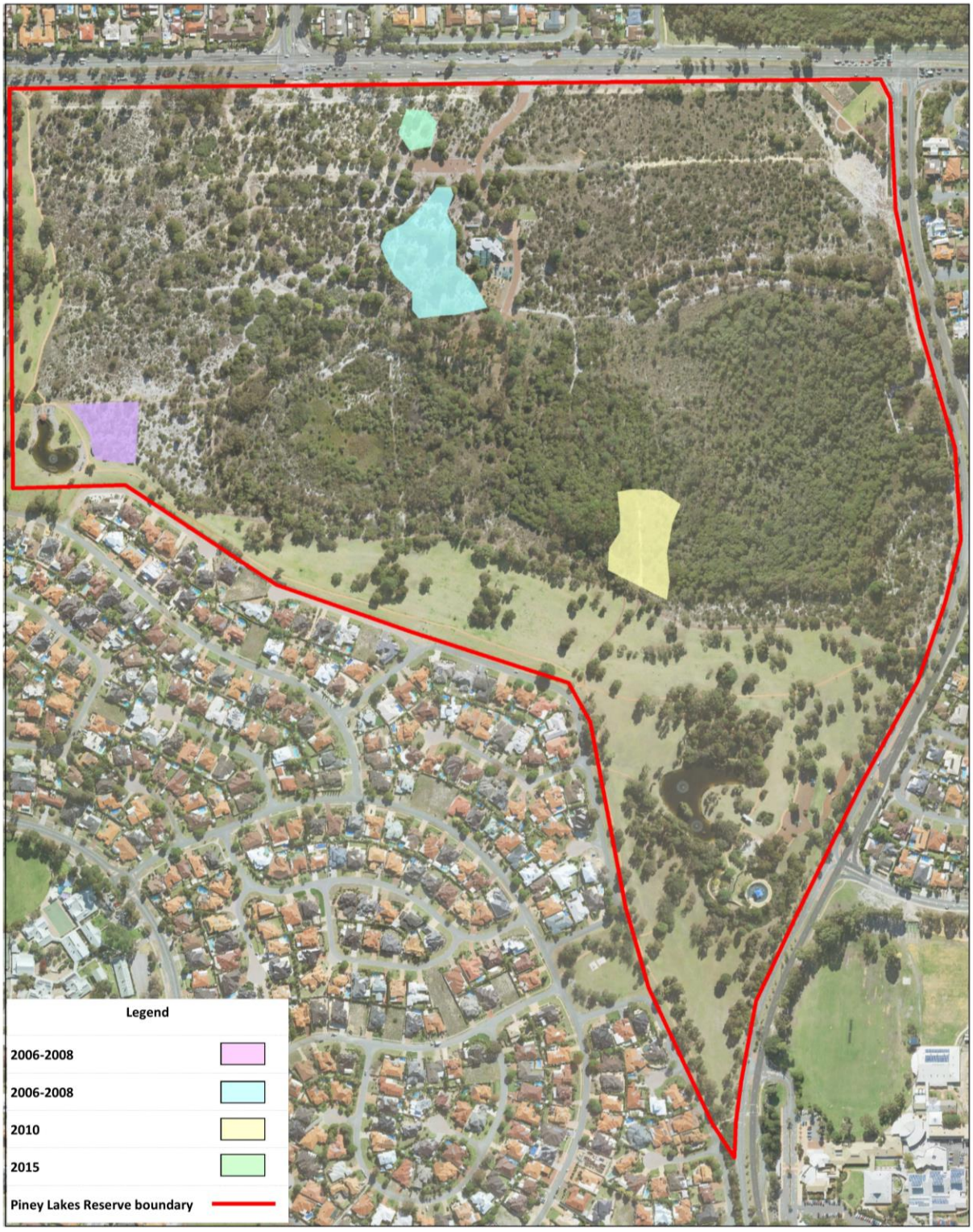

Figure 16:
Recent fire history (2006—2016)
Piney Lakes Reserve, Winthrop

N

Client: City of Melville
Project: Piney Lakes Reserve Strategic Management Plan
Image Source: Nearmap, 2015
Prepared by: Sharon Hynes
Datum: GDA 94, Zone 50

0 100
Metres

3.3 Weeds

A total of 48 introduced flora species were identified during the 2015 flora surveys undertaken by Ecoscape. Of these, three were considered very high priority weeds, two were high priority giant grasses and 12 were high priority woody weeds; the locations of these species are provided in Appendix 4. Density weed mapping of grasses and geophytes was undertaken and split into five groups, and are also provided in Appendix 4. *Quercus suber* (Cork Oak) was one of the woody weeds found on site and although it was introduced into the site, it is considered a part of the local heritage. The extent of high and very high individual weed species or group infestations is described as either widespread (highlighted pink) or localised, and is shown in Table 13.

All other medium and low priority weeds were recorded as overall densities within the Reserve. Perennial weeds were recorded at 5 – 25% throughout the site, with Rose Pelargonium (*Pelargonium capitatum*) and *Oenothera laciniata* both making up significant components of this weed cover category. Annual weeds were recorded at 5 – 25% densities throughout the site. Most weeds within both of these categories were found around the edges of native vegetation areas and closer to tracks and fire breaks, in more disturbed areas.

Table 13: Extent of high and very high priority weed infestation

Species or Group	Common Names	Priority	Count	Area >20 Grid Points	Area >2 ha	Area > 50% of Reserve	Extent
Asparagus asparagoides	Bridal Creeper	Very High	6	No	No	No	Localised
Schinus terebinthifolius		Very High	3	No	No	No	Localised
Zantedeschia aethiopica	Arum Lily	Very High	1	No	No	No	Localised
Lachenalia	Yellow Soldiers	Very High	n/a	No	No	No	Localised
Perennial Grasses		Very High	n/a	Yes	Yes	Yes	Widespread
Acacia iteaphylla	Flinders Range Wattle	High	2	No	No	No	Localised
Acacia longifolia		High	19	No	No	No	Localised
Arundo donax	Giant Reed	High	1	No	No	No	Localised
Chamaecytisus palmensis	Tagasaste	High	6	No	No	No	Localised
Cinnamomum camphora		High	1	No	No	No	Localised
Corymbia Citriodora		High	4	No	No	No	Localised
Cotoneaster pannosus		High	1	No	No	No	Localised
Ficus sp.		High	1	No	No	No	Localised
Leptospermum laevigatum	Coast Teatree	High	729	Yes	Yes	No	Widespread
Lophostemon confertum		High	3	No	No	No	Localised
Pinus sp.		High	34	No	No	No	Localised
Quercus suber		High	15	No	No	No	Localised

Species or Group	Common Names	Priority	Count	Area >20 Grid Points	Area >2 ha	Area > 50% of Reserve	Extent
Typha orientalis	Bulrush	High	370	No	No	No	Localised
Annual Grasses		High	n/a	Yes	Yes	No	Widespread
Perennial Running Grasses		High	n/a	No	No	No	Localised
Geophytes		High	n/a	Yes	Yes	Yes	Widespread

3.4 Habitat Loss

As the reserve is a rehabilitated bushland no habitat has been lost in recent history, with most of the site being rehabilitated with native species since 1976 after the removal of the pine plantation. Potential habitat loss in the future can be monitored by looking at the percentage of bare ground within vegetated areas and using comparison of results over time to establish trends. Two areas of habitat loss were identified during 2015 flora surveys with bare ground and weed coverage greater than 25% (Figure 17). It is recommended that these areas as well as the informal tracks be targeted for revegetation to enhance future fauna habitat within Piney Lakes. Revegetation works should also occur in conjunction with weed control and reference site monitoring, to maximise the success of plantings (refer to Sections 2.2.5 and 3.3).

Figure 17:
Proposed revegetation areas
Piney Lakes Reserve, Winthrop

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Client: City of Melville
Project: Piney Lakes Reserve Strategic Management Plan
Image Source: WA Atlas, 2016
Prepared by: Sharon Hynes
Datum: GDA 94, Zone 50

0 100
Metres

3.5 Feral Animals

Nine species of introduced fauna were recorded within Piney Lakes Reserve during 2015 and 2016 surveys (Appendix 3). Four of the introduced species were mammals including the Domestic Cat (*Felis catus*), the Domestic Dog (*Canis lupus familiaris*), the European Red Fox (*Vulpes vulpes*) and the European Rabbit (*Oryctolagus cuniculus*). Four of the introduced species were birds, including the Laughing Kookaburra (*Dacelo novaeguineae*), Laughing Dove (*Streptopelia senegalensis*), Eastern Long-billed Corella (*Cacatua tenuirostris*) and the Rainbow Lorikeet (*Trichoglossus haematodus*) (Figure 18). One introduced species was an invertebrate, the European Honey Bee (*Apis mellifera*) (Figure 19). Feral animal indices are listed in Table 14.

Figure 18: Rainbow Lorikeets utilising nesting boxes within Piney Lakes Reserve

Figure 19: European Honey Bee hive within nesting box in Piney Lakes Reserve

Table 14: Feral Animal Indices

Impact	Feral Animal	Occurrences 1994-2004	Occurrences 2004-2016	Threat
Very High Key threatening process under the EPBC Act 1999	*Vulpes vulpes*	No data	1 den	Change not assessable
	Oryctolagus cuniculus		3 rabbits sighted, 2 rabbit diggings, 5 rabbit scats	
	Felis catus		No data	
High Competition with native birds for hollows and food (impact level variable)	*Apis mellifera*		1 hive in nesting box	
	Trichoglossus haematodus		1 pair in nesting box	

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 *Phytophthora* dieback, *Armillaria*, *Quambalaria* (Marri Canker) and Myrtle Rust. Activities that impact directly on trees, such as the installation of nesting boxes, can result in wounds that make them more susceptible to infection from pathogens. A range of stressors on plants contributes to the spiral of decline and death of plants. Phytophthora dieback is the only pathogen currently known to be present within the reserve (Figure 20).

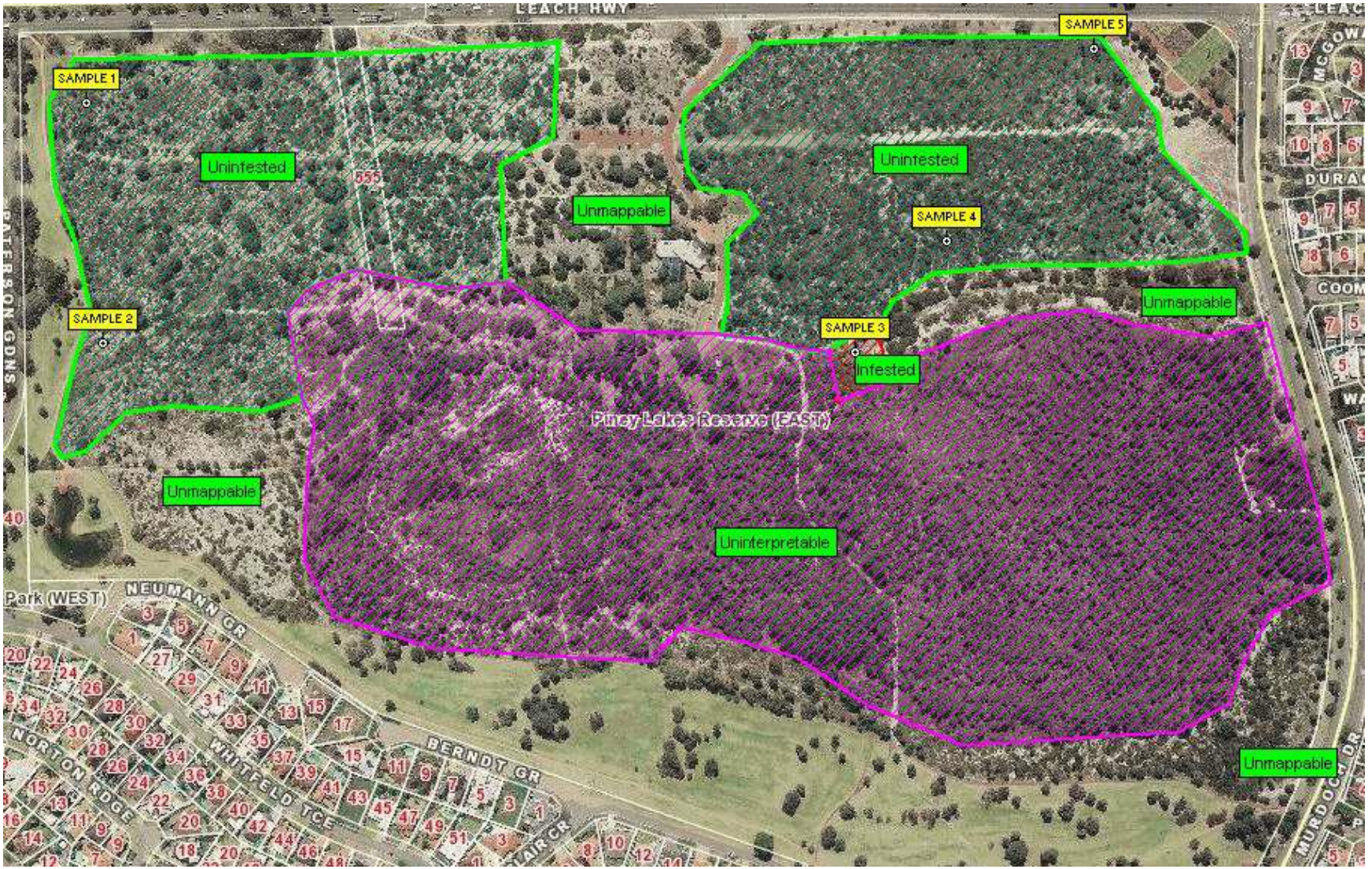

Figure 20: Dieback mapping undertaken by Dieback Treatment Services (2014)

3.7 Stormwater

Stormwater quality monitoring was undertaken by the South West Regional Centre for Urban Landcare Inc. (SERCUL) in 2014 and 2015 at 14 sites within the Bull Creek Catchment, including the Piney Lakes outlet (Site 8). The results from the Piney Lakes outlet showed (SERCUL 2015):

- a low pH level recorded below the acceptable limit for wetlands (<7) with results ranging from 5.23 – 5.43 pH, this was the lowest recording within the catchment along with Booragoon Lake outlet, may be associated with the presence of pine trees adjacent the wetland which can result in acidification
- the dissolved oxygen was recorded below the acceptable limit of 90% with results ranging from 25.5 – 40.1%
- concentration of total iron was above interim guideline of 0.3 mg/L, with results ranging from 0.68 – 1.3 mg/L
- concentrations of total aluminium above the trigger value of 0.55mg/L, with results ranging from 0.3 – 0.57mg/L, if pH decreases these concentrations will go up and can impact on aquatic organisms
- additionally, total arsenic, total chromium, total copper, total lead, total zinc and total nickel were recorded above the limits of reporting, with sediment sampling in 2014 also recording total metals above limits of reporting, but not at a level that requires any action to be taken.

Long term findings at this site have also found that pH, dissolved oxygen, total nitrogen, total phosphorus and total oxidised nitrogen have always been below the trigger values or acceptable limits. Total metals have always been above the trigger levels for total iron, total aluminium and total zinc. Total copper, total lead, total arsenic, total chromium and total nickel have been below trigger levels for the majority of samples collected (SERCUL, 2015).

3.8 Reticulation

Reticulation is present in grassed areas of Juett Park surrounding the bushland areas of Piney Lakes Reserve to the south and west. The City of Melville's reticulation team is responsible for the repair of broken sprinklers and adjusting operational times if they are running for too long, running at the wrong times or conflict with other events within the parkland (City of Melville, 2016b). There is the potential for sprinkler overspray to drift into the bushland, which can lead to an increase in weed growth and mean that native vegetation present relies on reticulation water for survival rather than developing deeper root systems that extract groundwater.

3.9 Acid Sulfate Soils

Acid sulfate soils have a high potential to occur in the environment of the Piney Lakes Reserve (Landgate 2016b) on the basis of origin of the geological units present, depth to groundwater and partial 'ground truthing' or onsite investigation (Figure 21).

3.10 Climate Change

Climate change in the near future is expected to lead to increased intensity and frequency of storm events, a drying climate, increased temperatures and rising sea level in the south-west of Western Australia. With expected impacts including increased potential for erosion with stronger winds during storm events, and an increase in water stress on flora and vegetation, particularly in ground water dependant wetlands such as in Piney Lakes Reserve. This may lead to a change in vegetation complexes and types in particular areas and affect the fauna that these vegetation associations support. The ground water levels within the Piney Lakes Reserve have been observably lower in the last few years, with no surface water present within the western lake since 2014 (Landgate, 2016a).

Figure 21:
Potential acid sulfate soils
Piney Lakes Reserve, Winthrop

N

Client: City of Melville
Project: Piney Lakes Reserve Strategic Management Plan
Image Source: WA Atlas, 2016
Prepared by: Sharon Hynes
Datum: GDA 94, Zone 50

0 50
Metres

4 Management Strategies

4.1 Management Strategies 2016 – 2021

The management objectives and implementation of strategies for 2016 – 2021 will be measured using KPIs discussed in the NAAMP (2011).

4.1.1 Key Performance Indicators

Leading indicators and trends in threats indicate (for the life of a reserve management plan) (Table 15):

- 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 (Table 15). The levels of acceptable changes are determined in the framework established in the NAAMP as summarised in Table 16 and applied in Tables 17 and 18.

Table 15: Total threat indices

Impacts	Prevented	Eliminated (no longer present)	Contained (no change)	Not contained (decrease)	Not assessable	Total threat indices
Very High	8 weeds		3 feral animals		6 weeds 1 acid sulfate soil 1 pathogen	19
High			1 feral animal		15 weeds 4 fires	20
Medium					1 weed 2 disturbances	3
Low					1 weed 1 disturbance	2
Total Threat indices	8		4		32	44

Table 16: Application of leading indicators

Objective	Leading Indicator	Applicable 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 but 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

Objective	Leading Indicator	Applicable When
		▪ 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
None	▪ Not Applicable	▪ Threat absent from reserve ▪ Only planned introduction possible

Table 17: Objectives for weed species in Piney Lakes

Objective	Impact	Weed Species/ Group	2016 Extent	Comment
Prevent	**Very High**	*Anredera cordifolia*	0%	Not present on site
		Asparagus aethiopicus		
		Cuscuta campestris		
		Echium plantagineum		
		Lantana camara		
		Moraea flaccida		
		Rubus laudatus		
		Tamarix aphylla		
Eliminate	**Very High**	*Schinus terebinthifolius*	3 plants	Plants located along the northern edge of the eastern wetland
		Geophytes	48%	Spread throughout dryland areas and the periphery of the wetlands
		Lachenalia	0.9%	Small patches in the western dryland area
		Zantedeschia aethiopica	1 plant	One isolated plant located at the southern end of the limestone track
	High	*Acacia iteaphylla*	2 plants	Located in the eastern dryland area of the reserve
		Acacia longifolia	19 plants	Patches throughout the central northern dryland area. This species is known to be an invasive species in wetland areas
		Arundo donax	1 plant	This plant is located in the north east of the site near Leach highway
		Chamaecytisus palmensis	6 plants	One isolated patch of shrubs located to the east of the entrance gate
		Cinnamon camphora	1 plant	One plants located along the red bitumen path in the west of the site
		Corymbia citriodora	4 plants	Two trees along the north of the site can be remove but the tree along the bitumen path with the nesting box should be retained as a habitat tree
		Cotoneaster pannosus	1 plant	Located in the western side of the eastern wetland
		Ficus sp.	1 plant	One plants located along the red bitumen path in the west of the site
		Lophostemon confertus	3 plants	Located adjacent the red bitumen path north of the western wetland
Contain	**Very High**	*Asparagus asparagoides*	6 plants	Species are difficult to eliminate in the short and medium term with perennial grasses widespread throughout the site.
		Perennial Grasses	63%	

Objective	Impact	Weed Species/ Group	2016 Extent	Comment
Contain	**High**	*Leptospermum laevigatum*	729 plants	*L. laevigatum* provides habitat for fauna on site so it is recommended that shrubs be removed over time and replaced with a suitable native substitute.
		Perennial Running Grasses	0.4%	Two isolated patches located on the northern edge of the eastern wetland
		Pinus sp.	34 plants	*Pinus* sp. provides fauna habitat on site and are recommended for selective removal, whilst retaining important habitat trees, particularly those with bat and bird nesting boxes.
		Quercus suber	15 plants	The larger specimens of this species are considered to have local heritage value and should be retained, although suckers should be removed when noted to stop this species from spreading throughout the bushland
		Typha orientalis	370 plants	The Typha is located in dense isolated patches in the wetter parts of the western and eastern wetlands.
Manage	**High**	Annual Grasses	14%	Control of these weeds should focus on asset protection such as revegetation sites, the Black Cockatoo Habitat Restoration Site and the Bidi Kaitjiny Aboriginal Walk Trail area and the conservation wetlands.
	Medium	All other perennial weeds	7-10%	
	Low	All other annual weeds	7-10%	

Table 18: Objectives for all other threats in Piney Lakes Reserve

Objective	Impact	Threat	Comments
Prevent	**Very High**	Acid Sulfate Soils	Undertake works in areas of potential acid sulfate soils in accordance with City's guidelines, with investigations into the presence of ASS if any excavation or groundwater extraction is proposed.
	High	Fire (large)	Prevent large fires within the reserve, in consultation with the Department of Fire and Emergency Services.
Eliminate	**High**	Feral animals (Bees)	Present - remove bee hives within 10 working days of observations.
Contain	**Very High**	Feral animals (foxes)	Present - implement controls within 10 working days of observations, control in conjunction with rabbits, to mitigate an increase in rabbit numbers due to reduction of their predators.

Contain		Feral animals (cats)	Present – implement controls within 10 working days in accordance with the City's guidelines.
		Feral animals (rabbits)	Present – management can include: ▪ implementing controls within 10 working days of observations ▪ control in conjunction with foxes to reduce predation on native species such as Quenda ▪ control prior to revegetation activities if required to reduce herbivory on plantings ▪ avoid the use of baits as a control method as it may be consumed by native species such as Quenda and may affect birds of prey that use rabbits as a food source.
	High	Fire (repeat fires)	Limit fires burning the same portion of bushland, in consultation with the Department of Fire and Emergency Services.
	Medium	Physical Disturbance	Minimise unauthorised access to bushland through: ▪ the closure and rehabilitation of informal tracks through the bushland ▪ closure/removal of the pedestrian gate at the northern boundary of the site (Figure 15).
		Stormwater (nutrients)	Continue to monitor stormwater quality and manage the reserve to reduce occurrence of nutrients outside acceptable ranges.
	Low	Stormwater (physical)	Manage the reserve and wetlands to reduce occurrences outside the acceptable range for pH, dissolved oxygen, total suspended solids and conductivity.
Manage	**Very High**	Climate Change	Consideration be given to the wider context of climate impacts that could occur over time, with assessment of vegetation associations for change undertaken. Reference sites should be installed in the wetlands (2 per wetland) to monitor changes in groundwater dependant species and vegetation associations over time, in relation to a changing climate. Management can include: ▪ weed control should be undertaken to minimise competition for water with natives ▪ planting and enhancement of native vegetation cover undertaken within the reserve particularly when large scale plant deaths occur ▪ records should be taken of changes over time to assist with knowledge and understanding of ongoing processes.

Manage		Disease and Pathogens (Dieback)	Present - continue management in accordance with the City's guidelines through: ▪ review of mapping every three years (due to occur 2017) ▪ phosphite treatments every three years (due to occur 2018) ▪ noting of signs of disease through opportunistic monitoring ▪ appropriate hygiene being undertaken during bushland works ▪ ensuring soils and other material brought to site are free of pathogens.
	High	Feral animals (Lorikeets)	Present - difficult to control at the reserve scale, if future management was to occur it will need to be undertaken at a regional scale in conjunction with surrounding local government areas to effectively control pest species such as Rainbow Lorikeets.
	Medium	Fire (low occurrence of fires)	Manage small fire within the reserve in consultation with the Department of fire and Emergency Services; record fire occurrences including date, cause (if known), location and extent of area burnt.
	Low	Feral animals (mice)	Likely to be present due to the urban location of the reserve.
		Reticulation	Monitor and manage any over spray or leaks within 5 working days of it being observed

4.1.3 Lagging Indicators

Lagging indicators and trends in assets, indicate whether strategic goals of maintaining and enhancing assets are being met. The levels of acceptable change are discussed in the NAAMP and are summarised in Table 18 and applied to Piney Lakes in Tables 19 and 20.

Table 18: Tiered Goals for assets and associated lagging indicators

Goal	Lagging indicator	Application When
Enhance	Increase in either ▪ extent ▪ density ▪ numbers or ▪ occurrences	Asset can be enhanced and ▪ 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. reduces requirements for on-going for threat management)
Maintain	No decrease in either ▪ extent ▪ density ▪ numbers or ▪ occurrences	Asset can be maintained and ▪ 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	Asset significant and ▪ historic but no recent records in reserve and/or ▪ potentially to be in reserve based on habitat and/or proximity of other records
Monitor	No indices for management effectiveness	Assets that cannot be maintained by actions within City of Melville boundaries or for which no quantifiable indices exist and: ▪ for which reserves are not critical component of habitat (e.g. highly mobile/wide roaming and/or infrequent/irregular visitors to the City of Melville) ▪ there is a risk of local extinction from processes that cannot be mitigated by the City of Melville (e.g. climate change, some pathogens)

Table 19: Goals for species

Goal	Priority	Asset	No. of Reserves	Comments
Enhance	**High**	*Jacksonia sericea*	Unknown	Start seed collection and propagation trials for this species, with plants grown used in revegetation in the dryland areas, increase the numbers from 2 to 200 plants. ▪ Priority 4 listed species ▪ seed is easy to collect, usually ready from January to March ▪ readily germinates and plant grows to 0.6 m high ▪ requires separate licence to collect Priority species

Goal	Priority	Asset	No. of Reserves	Comments
Enhance		*Conospermum triplinervium*	2	Increase species population from 3 to 100 individuals ▪ seed is easy to collect although it is not prolific on the Swan Coastal Plain, usually ready from November to December ▪ Seed ripens and drops of tree quickly so there is only a short period of time to collect seed ▪ Plant grows to 4 m high and 1-2 m wide so spacing is important when planting ▪ Plant prefers deep sandy soils and direct sun to partial shade and would be best planted in the northern dryland areas.
	Low	*Banksia attenuata*	35	Increase populations of B menziesii and B. attenuata to 250 plants. Increase the other species populations to 100 plants. ▪ avoid planting Banksia's in the dieback affected area and target phosphite treatment to Banksia's surrounding the affected area ▪ increasing these plant populations will increase the foraging food source for the threatened black cockatoos.
		Banksia grandis	16	
		Banksia littoralis	7	
		Banksia menziesii	35	
		Banksia sessilis	1	
Maintain Species	**Medium**	*Aotus cordifolia*	Unknown	Species to be maintained through the mitigation of threats, enhancement of habitat (revegetation) and weed control.
		Macarthuria apetala		
		Acacia tetragonocarpa		
		Drosera macrantha		
		Ctenotus fallens	1	Reptiles should be maintained if threats are appropriately mitigated and habitat protected, particularly leaf litter and shrubs maintained on site.
		Acritoscincus trilineatum	Unknown	
	Low	*Pseudonaja affinis*	4	
		Menetia greyii	7	
		Lerista elegans	5	
		Morethia lineoocellata	4	
		Pogona minor	3	
		Cryptoblepharus buchananii	8	
		Hemiergis quadrilineata	6	
		Heleioporus eyrei	4	Require seasonally wetland habitat, and if habitat and threats are managed these species should be retained.
		Limnodynastes dorsalis	4	

Goal	Priority	Asset	No. of Reserves	Comments
Monitor	**Very High**	*Calyptorhynchus banksii naso*	Unknown	Migratory species – maintain large over storey trees particularly Banksia and Eucalyptus species.
		Calyptorhynchus latirostris		Migratory species – maintain large over storey trees particularly Eucalyptus species.
		Merops ornatus		Migratory species – maintain large over storey trees for habitat, this species also required open areas of bare ground or grassland for nesting burrows.
	High	Isoodon obesulus fusciventer	2	Requires thick understory vegetation and is associated with the wetland on site, home ranges vary from 1-7 ha, control threats such as predators e.g. foxes and cats.
		Aythya australis	Unknown	Migratory wetland species requires open water habitat with vegetated banks.
		Accipiter fasciatus		Management of bushland particularly larger tree species and mitigation of threats will see this species retained in the area ▪ avoid the use of baiting for rabbit control as it is a known food source for this species.
		Malurus splendens		Enhancing habitat and mitigation of threats would see these species retained. All of these species require dense bushland vegetation.
		Acanthiza chrysorrhoa		
		Phylidonyris novaehollandiae	12	
		Phylidonyris nigra	8	
		Anthochaera lunulata	Unknown	
		Phaps chalcoptera		Enhancing habitat and mitigation of threats would see these species retained. Preferred habitat is very variable although it prefers to be close to water sources.
		Smicrornis brevirostris		Habitat requirements include breeding hollows.
	Low	*Hibbertia cuneiformis*		Monitor this species spread and control its abundance particularly around the wetland area ▪ this species has been known to become invasive and act as an aggressive weed in wetland areas around Perth ▪ this species is not considered to be naturally occurring on site.

Goal	Priority	Asset	No. of Reserves	Comments
Monitor		*Melaleuca lanceolata*		Monitor the numbers and spread of this species and control if it starts to out compete native vegetation in the area. ▪ this species is not considered to be naturally occurring on site ▪ it does not spread too quickly and is not considered an immediate threat.
		Pachycephala rufiventris		Maintenance of habitat which requires tree hollows for nesting and mitigate threats for this species will see it retained.
Confirm	**Very High**	*Calyptorhynchus baudinii*	Unknown	Last confirmed present in 1986 - it is a migratory species and may have simply not been there at the time of survey, maintain over storey trees particularly Marri as they are a preferred food source for the species.
	High	*Tringa nebularia*		Last confirmed present in 2003 – migratory wetland dependant species
		Trichosurus vulpecula	1	Last confirmed in 1986 presumed still present – this species has a home range that varies from 1 to 15 ha so and requires large nesting hollows and will use nesting boxes with one present on site.
	Medium	*Notechis scutatus*	2	Last confirmed 1986 – preferred habitat ranges from grassland to woodland and is associated with wetland areas.
		Litoria adelaidensis	2	Both species last confirmed in 1986, both species require permanent static or slow moving water sources.
		Litoria moorei	2	
	Low	*Chelodina oblonga*	3	Last confirmed in 1986 – requires permanent water source.
		Rhipidura fuliginosa preissii	10	Last confirmed in 2003 – maintain the bushland habitat particularly over storey.
		Crinia glauerti	4	Both species last confirmed in 1986, both species require permanent or seasonal water sources.
		Crinia insignifera	3	

Table 20: Goals for Site

Goal	Priority	Asset	Comments
Enhance	**High**	Ecological Communities: Bassendean Complex - Central and South and Karrakatta Complex – Central and South, includes 17 vegetation types	Revegetation within the reserve should take into consideration the vegetation type and flora composition in vegetation associations when planning planting lists. Priorities for each revegetation areas are: ▪ controlling abundance and spread of weeds ▪ enhancing fauna habitat within the reserve, via increased vegetation cover of shrub and tree species particularly in dryland areas

			▪ increase abundance of significant flora in their respective vegetation types ▪ maintain the high density of native vegetation in the wetland areas, including understorey vegetation, providing habitat to the Quenda ▪ increase tree cover for bird species in the reserve, particularly Banksia and Eucalyptus species in the dryland areas, which are the preferred food source of the threatened black cockatoos.
Enhance	**Medium**	Revegetation site – existing revegetation/ community interest sites	Revegetation to occur in degraded areas (2.73 ha) identified by Ecoscape 2015 and to continue in the existing community interest revegetation areas (7.27 ha), in accordance with the City of Melville's guidelines and procedures.
		Revegetation sites – informal tracks	Revegetate tracks that are located in the central north-west of the site ▪ area totals approximately 1,034 m2 ▪ block off the ends of tracks with large logs to prevent informal pedestrian access.
		Reference sites	Install 2 10 x10 m reference plots in both wetlands and each revegetation area, to determine trends over time and assess success of revegetation activities.
Maintain	**Very High**	Conservation significant sumplands	Assets to be maintained if threats are managed appropriately in accordance with the City of Melville's guidelines and procedures.
		Heritage Site – Aboriginal Site	
		Heritage Site – part of Beeliar Regional Wetland chain	
	Medium	Habitat sites - very large native trees	
		Habitat sites – nesting boxes	

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Wildlife Conservation Act 1950 (WA)

Appendix 1: Aboriginal Heritage

Search Criteria

1 Registered Aboriginal Sites in Custom search area; 389649.62mE, 6452530.35mN z50 (MGA94) : 391081.50mE, 6453977.35mN z50 (MGA94)

Disclaimer

The *Aboriginal Heritage Act 1972* preserves all Aboriginal sites in Western Australia whether or not they are registered. Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist.

The information provided is made available in good faith and is predominately based on the information provided to the Department of Aboriginal Affairs by third parties. The information is provided solely on the basis that readers will be responsible for making their own assessment as to the accuracy of the information. If you find any errors or omissions in our records, including our maps, it would be appreciated if you email the details to the Department at heritageenquiries@daa.wa.gov.au and we will make every effort to rectify it as soon as possible.

South West Settlement ILUA Disclaimer

Your heritage enquiry is on land within the following Indigenous Land Use Agreement(s): Whadjuk People ILUA

On 8 June 2015, six identical Indigenous Land Use Agreements (ILUAs) were executed across the South West by the Western Australian Government and, respectively, the Yued, Whadjuk People, Gnaala Karla Booja, Ballardong People, South West Boojarah #2 and Wagyl Kaip & Southern Noongar groups, and the South West Aboriginal Land and Sea Council (SWALSC).

The ILUAs bind the parties (including 'the State', which encompasses all State Government Departments and certain State Government agencies) to enter into a Noongar Standard Heritage Agreement (NSHA) when conducting Aboriginal Heritage Surveys in the ILUA areas, unless they have an existing heritage agreement. It is also intended that other State agencies and instrumentalities enter into the NSHA when conducting Aboriginal Heritage Surveys in the ILUA areas. It is recommended a NSHA is entered into, and an 'Activity Notice' issued under the NSHA, if there is a risk that an activity will ‘impact’ (i.e. by excavating, damaging, destroying or altering in any way) an Aboriginal heritage site. The Aboriginal Heritage Due Diligence Guidelines, which are referenced by the NSHA, provide guidance on how to assess the potential risk to Aboriginal heritage.

Likewise, from 8 June 2015 the Department of Mines and Petroleum (DMP) in granting Mineral, Petroleum and related Access Authority tenures within the South West Settlement ILUA areas, will place a condition on these tenures requiring a heritage agreement or a NSHA before any rights can be exercised.

If you are a State Government Department, Agency or Instrumentality, or have a heritage condition placed on your mineral or petroleum title by DMP, you should seek advice as to the requirement to use the NSHA for your proposed activity. The full ILUA documents, maps of the ILUA areas and the NSHA template can be found at https://www.dpc.wa.gov.au/lantu/Claims/Pages/SouthWestSettlement.aspx.

Further advice can also be sought from the Department of Aboriginal Affairs (DAA) at heritageenquiries@daa.wa.gov.au.

Coordinate Accuracy
Accuracy is shown as a code in brackets following the coordinates. Map coordinates (Latitude/Longitude and Easting/Northing) are based on the GDA 94 Datum. The Easting/Northing map grid can be across one or more zones. The zone is indicated for each Easting on the map, i.e. '500000mE:Z50' means Easting=500000, Zone=50.

Terminology (NB that some terminology has varied over the life of the legislation)
Place ID/Site ID: This a unique ID assigned by the Department of Aboriginal Affairs to the place
Status:
- **Registered Site**: The place has been assessed as meeting Section 5 of the *Aboriginal Heritage Act 1972*
- **Other Heritage Place which includes:**
  - **Stored Data / Not a Site:** The place has been assessed as not meeting Section 5 of the *Aboriginal Heritage Act 1972*
  - **Lodged:** Information has been received in relation to the place, but an assessment has not been completed at this stage to determine if it meets Section 5 of the *Aboriginal Heritage Act 1972*

Status Reason: e.g. Exclusion - Relates to a portion of an Aboriginal site or heritage place as assessed by the Aboriginal Cultural Material Committee (ACMC). e.g. such as the land subject to a section 18 notice.
Origin Place ID: Used in conjuction with Status Reason to indicate which Registered Site this Place originates from.
Access and Restrictions:
- **File Restricted = No:** Availability of information (other than boundary) that the Department of Aboriginal Affairs holds in relation to the place is not restricted in any way.
- **File Restricted = Yes:** Some of the information that the Department of Aboriginal Affairs holds in relation to the place is restricted if it is considered culturally sensitive. This information will only be made available if the Department of Aboriginal Affairs receives written approval from the informants who provided the information. Download the Request to Access Restricted Information letter and form.
- **Boundary Restricted = No:** place location is shown as accurately as the information lodged with the Registrar allows.
- **Boundary Restricted = Yes:** To preserve confidentiality the exact location and extent of the place is not displayed on the map. However, the shaded region (generally with an area of at least 4km²) provides a general indication of where the place is located. If you are a landowner and wish to find out more about the exact location of the place, please contact DAA.
- **Restrictions:**
  - **No Restrictions:** Anyone can view the information.
  - **Male Access Only:** Only males can view restricted information.
  - **Female Access Only:** Only females can view restricted information

Legacy ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place. This has been replaced by the Place ID / Site ID.

List of Registered Aboriginal Sites with Map

Site ID	Site Name	File Restricted	Boundary Restricted	Restrictions	Status	Status Reason	Origin Place ID	Site Type	Knowledge Holders	Coordinates	Legacy ID
3298	BOORAGOON LAKE.	No	No	No Gender Restrictions	Registered Site			Artefacts / Scatter, Camp		390687mE 6454060mN Zone 50 [Reliable]	S00194

Aboriginal Heritage Inquiry System

Aboriginal Sites Database

Legend

Selected Heritage Sites

- Registered Sites
- Aboriginal Community Occupied
- Aboriginal Community Unoccupied
- Town
- Search Area

Appendix 2: Flora Lists

The combined flora species list provided below has been prepared using data from:

- COMPLD – City of Melville's Piney Lakes Database
- ATA 2003 – ATA Environmental 2003 survey results
- ECO 2015 – Ecoscape 2015 flora survey results, to support this management plan review.

*Denotes introduced species

Weeds Species List

Family	Species Name	COMPLD	ATA 2003	ECO 2015
AIZOACEAE	**Carpobrotus edulis*	x	x	x
ANACARDIACEAE	**Schinus terebinthifolius*			x
ARACEAE	**Zantedeschia aethiopica*			x
ASPARAGACEAE	**Asparagus asparagoides*			x
	**Lachenalia reflexa*		x	x
ASTERACEAE	**Arctotheca calendula*	x	x	x
	**Centaurea melitensis*			x
	**Hypochaeris glabra*		x	x
	**Lactuca serriola*			x
	**Senecio vulgaris*		x	
	**Sonchus asper*			x
	**Sonchus oleraceus*			x
	**Ursinia anthemoides*			x
BIGNONIACEAE	**Jacaranda* sp.			x
	**Jacaranda mimosifolia*	x		
BRASSICACEAE	**Raphanus raphanistrum*			x
CARYOPHYLLACEAE	**Petrorhagia dubia*			x

Family	Species Name	COMPLD	ATA 2003	ECO 2015
CYPERACEAE	**Cyperus ?congestus* (recorded as *conquestus*)	x		
	*Cyperus polystachyos	x	x	x
	**Cyperus rotundus*	x		
	**Cyperus tenuiflorus*	x	x	
DILLENIACEAE	*Hibbertia cuneiformis			x
EUPHORBIACEAE	**Euphorbia peplus*			x
	**Euphorbia terracina*			x
FABACEAE	**Acacia decurrens*	x		
	**Acacia iteaphylla*			x
	**Acacia longifolia*			x
	**Acacia podalyriifolia*	x	x	
	**Chamaecytisus palmensis*			x
	**Lupinus cosentinii*	x		
	*Trifolium campestre			x
	**Vicia sativa*	x		
FAGACEAE	**Quercus suber*	x	x	x
GERANIACEAE	**Geranium molle*			x
	**Pelargonium capitatum*	x	x	x
IRIDACEAE	**Gladiolus caryophyllaceus*	x	x	x
	*Romulea rosea		x	
JUNCACEAE	**Juncus microcephalus*			x
LAURACEAE	**Cinnamomum camphora*			x
MORACEAE	**Ficus* sp.			x
	**Ficus macrophylla*	x		

Family	Species Name	COMPLD	ATA 2003	ECO 2015
MYRTACEAE	**Agonis flexuosa*		x	
	**Chamelaucium uncinatum*	x	x	x
	**Corymbia citriodora*	x	x	x
	**Leptospermum laevigatum*	x	x	x
	**Lophostemon confertus*	x	x	x
NYCTAGINACEAE	**Bougainvillea spectabilis*	x		
OLEACEAE	**Olea europaea*			x
ONAGRACEAE	**Oenothera drummondii*			x
	**Oenothera laciniata*			x
	**Oenothera stricta*			x
OROBANCHACEAE	**Orobanche minor*	x		x
OXALIDACEAE	**Oxalis pes-caprae*	x	x	
PAPAVERACEAE	**Fumaria capreolata*			x
PINACEAE	**Pinus pinaster*	x	x	
	**Pinus radiata*	x	x	
	**Pinus* sp.			x
POACEAE	**Arundo donax*			x
	**Avena barbata*	x	x	x
	**Briza maxima*	x	x	x
	**Briza minor*	x		
	**Bromus diandrus*			x
	**Cenchrus clandestinus* (syn. *Pennisetum clandestinum*)	x	x	
	**Cortaderia selloana*	x	x	
	**Cynodon dactylon*	x	x	x
	**Ehrharta calycina*	x	x	x

Family	Species Name	COMPLD	ATA 2003	ECO 2015
	**Ehrharta longiflora*			x
	**Lagurus ovatus*	x	x	
	**Parapholis dilatatum*	x		
	**Paspalum dilatatum*	x		
	**Vulpia myuros*			x
POLYGONACEAE	**Persicaria capitata*			x
PRIMULACEAE	**Lysimachia arvensis* (Syn. *Anagallis arvensis*)		x	
ROSACEAE	**Cotoneaster pannosus*			x
SCROPHULARIACEAE	**Dischisma capitatum*			x
SOLANACEAE	**Solanum nigrum*	x	x	x
TYPHACEAE	**Typha orientalis*	x	x	x

(Source: Department of Parks and Wildlife, 2016b)

Native Species List

Family	Species Name	COMPLD	ATA 2003	ECO 2015
AMARANTHACEAE	*Ptilotus drummondii*	x		
	Ptilotus polystachyus	x		x
ANARTHRIACEAE	*Lyginia imberbis*	x	x	x
APIACEAE	*Centella asiatica*			x
ASPARAGACEAE	*Laxmannia squarrosa*	x		x
	Sowerbaea laxiflora	x	x	
	Thysanotus manglesianus			x
	Thysanotus multiflorus			x
	Thysanotus patersonii	x		

Family	Species Name	COMPLD	ATA 2003	ECO 2015
	Thysanotus sparteus	x		x
ASTERACEAE	*Conyza albida*	x		
	Podotheca gnaphalioides	x		x
BRASSICACEAE	*Brassica oxyrrhina*	x	x	
CASUARINACEAE	*Allocasuarina fraseriana*		x	x
	Allocasuarina humilis	x	x	x
	Casuarina obesa	x		
CELASTRACEAE	*Stackhousia huegelii*	x		
	Tripterococcus brunonis		x	
COLCHICACEAE	*Burchardia congesta*	x	x	x
CRASSULACEAE	*Crassula colorata*	x	x	x
CUPRESSACEAE	*Callitris acuminata*			x
	Callitris preissii			x
CYPERACEAE	*Baumea articulata*	x	x	x
	Baumea juncea			x
	Baumea rubiginosa			x
	Ficinia nodosa			x
	Lepidosperma angustatum	x	x	
	Lepidosperma longitudinale			x
	Lepidosperma squamatum			x
	Mesomelaena pseudostygia	x	x	x
	Mesomelaena tetragona	x	x	
	Schoenus brevisetus	x		
	Schoenus grandiflorus			x
	Schoenus subfascicularis			x

Family	Species Name	COMPLD	ATA 2003	ECO 2015
	Tetraria octandra	x	x	
DASYPOGONACEAE	*Dasypogon bromeliifolius*		x	x
DENNSTAEDTIACEAE	*Pteridium esculentum*	x	x	x
DILLENIACEAE	*Hibbertia huegelii*			x
	Hibbertia hypericoides	x	x	x
	Hibbertia racemosa	x	x	
	Hibbertia stellaris	x		
	Hibbertia subvaginata		x	x
DROSERACEAE	*Drosera gigantea*	x		
	Drosera macrantha			x
	Drosera menziesii subsp. *penicillaris*	x		
	Drosera sp.		x	
ERICACEAE	Astroloma pallidum	x	x	
	Brachyloma preissii			x
	Conostephium pendulum	x	x	
	Leucopogon australis	x	x	x
	Leucopogon capitellatus		x	
	Leucopogon conostephioides			x
	Leucopogon propinquus			x
	Lysinema ciliatum	x	x	
EUPHORBIACEAE	*Monotaxis grandiflora*	x		x
	Phyllanthus calycinus		x	
	Ricinocarpos glaucus			x
FABACEAE	*Acacia applanata*			x
	Acacia cyclops			x
	Acacia huegelii	x		

Family	Species Name	COMPLD	ATA 2003	ECO 2015
	Acacia pulchella var. glaberrima	x	x	x
	Acacia saligna	x	x	x
	Acacia stenoptera	x	x	
	Acacia tetragonocarpa			x
	Acacia willdenowiana	x	x	
	Aotus cordifolia	x	x	x
	Bossiaea eriocarpa	x	x	x
	Daviesia divaricata	x	x	
	Daviesia decurrens	x	x	
	Daviesia nudiflora	x	x	x
	Daviesia physodes	x	x	
	Daviesia preissii			x
	Daviesia triflora	x	x	x
	Euchilopsis linearis	x		x
	Eutaxia virgata	x		
	Gastrolobium capitatum (Syn. *Nemcia capitata*)	x	x	
	Gastrolobium ebracteolatum (Syn. *Oxylobium lineare*)	x	x	x
	Gompholobium tomentosum	x	x	x
	Hardenbergia comptoniana	x	x	x
	Hovea pungens	x		x
	Jacksonia furcellata	x	x	x
	Jacksonia sericea		x	x
	Jacksonia sternbergiana	x	x	x
	Kennedia prostrata	x	x	x
	Latrobea tenella	x		x
	Paraserianthes lophantha	x		
	Pultenaea reticulata	x	x	x
	Viminaria juncea		x	x
GOODENIACEAE	*Dampiera linearis*	x	x	x
	Lechenaultia floribunda	x	x	x
	Lechenaultia linarioides	x		

Family	Species Name	COMPLD	ATA 2003	ECO 2015
	Scaevola canescens	x	x	x
	Scaevola repens			x
HAEMODORACEAE	*Anigozanthos humilis*	x		
	Anigozanthos manglesii	x		x
	Conostylis aculeata	x	x	x
	Conostylis aurea			x
	Conostylis candicans subsp. candicans	x		x
	Conostylis juncea	x	x	x
	Conostylis setigera subsp. setigera	x	x	x
	Phlebocarya ciliata	x		x
	Tribonanthes longipetala	x		
HEMEROCALLIDACEAE	*Corynotheca micrantha*	x		x
	Dianella revoluta	x	x	x
	Tricoryne elatior	x		x
HOLORAGACEAE	*Gonocarpus pithyoides*			x
IRIDACEAE	*Patersonia occidentalis*	x	x	x
JUNCACEAE	*Juncus kraussii*			x
	Juncus pallidus	x	x	x
LAMIACEAE	*Hemiandra glabra*			x
	Hemiandra pungens			x
	Hemigenia pungens		x	
	Westringia fruticosa	x		
LAURACEAE	*Cassytha racemosa*		x	x
LORANTHACEAE	*Nuytsia floribunda*	x	x	x

Family	Species Name	COMPLD	ATA 2003	ECO 2015
MELIACEAE	*Melia azedarach*	x		
MOLLUGINACEAE	*Macarthuria apetala*			x
	Macarthuria australis			x
MYRTACEAE	*Astartea* aff. *fasciculatus*		x	
	Astartea scoparia			x
	Beaufortia elegans		x	x
	Calothamnus lateralis	x	x	
	Calytrix fraseri		x	
	Corymbia calophylla	x	x	x
	Eucalyptus gomphocephala	x	x	x
	Eucalyptus marginata	x	x	x
	Eucalyptus rudis	x	x	x
	Eucalyptus sp.			x
	Hypocalymma angustifolium	x	x	x
	Hypocalymma robustum	x	x	
	Kunzea glabrescens			x
	Melaleuca lanceolata	x		x
	Melaleuca lateralis	x	x	
	Melaleuca lateritia		x	
	Melaleuca preissiana	x	x	x
	Melaleuca rhaphiophylla	x	x	x
	Melaleuca teretifolia	x	x	x
	Melaleuca thymoides	x	x	x
	Pericalymma ellipticum	x	x	
	Regelia inops		x	
	Scholtzia involucrata	x	x	x
	Taxandria linearifolia			x
ORCHIDACEAE	*Caladenia flava*	x		
	Diuris longifolia	x		
	Elythranthera brunonis	x		

Family	Species Name	COMPLD	ATA 2003	ECO 2015
	Microtis media			x
POLYGALACEAE	*Comesperma virgatum*	x		x
POLYGONACEAE	*Persicaria prostrata* (Syn. *Polygonum prostratum*)	x		
PROTEACEAE	*Adenanthos cygnorum* subsp. *cygnorum*	x	x	x
	Banksia attenuata	x	x	x
	Banksia grandis		x	x
	Banksia ilicifolia		x	
	Banksia littoralis	x	x	x
	Banksia menziesii	x	x	x
	Banksia sessilis			x
	Conospermum triplinervium			x
	Hakea lissocarpha			x
	Hakea prostrata		x	x
	Persoonia saccata	x	x	
	Petrophile axillaris			x
	Petrophile linearis		x	x
	Petrophile macrostachya			x
	Stirlingia latifolia	x	x	x
	Synaphea spinulosa		x	
RESTIONACEAE	*Chaetanthus aristatus*	x	x	
	Desmocladus asper			x
	Desmocladus flexuosus	x	x	x
	Hypolaena exsulca			x
	Meeboldina sp.			x
RUTACEAE	*Philotheca spicata*	x	x	
SANTALACEAE	*Exocarpos sparteus*			x

Family	Species Name	COMPLD	ATA 2003	ECO 2015
	Santalum acuminatum			x
SCROPHULARIACEAE	*Kickxia elatine*	x		
STYLIDIACEAE	*Stylidium brunonianum*	x		x
	Stylidium caespitosum	x		
	Stylidium hesperium			x
	Stylidium junceum	x		
THYMELAEACEAE	*Pimelea rosea*	x		x
VIOLACEAE	*Hybanthus calycinus*			x
XANTHORRHOEACEAE	*Xanthorrhoea preissii*	x	x	x
ZAMIACEAE	*Macrozamia fraseri*	x	x	
	Macrozamia riedlei			x

Species List by Vegetation Types (Ecoscape, 2015)

Species	pE	pEB	pMp	pMrEr	pPin	pSedge	pUNK	pUnmapped	pWetshrub	Native/Weed/Dubious
Acacia applanata			1							Native
Acacia cyclops		1								Native
Acacia iteaphylla		1								Introduced Flora on WAH
Acacia longifolia		1	1			1				Introduced Flora on WAH
Acacia pulchella var. *glaberrima*		1	1				1			Native/Dubious
Acacia saligna		1	1	1		1	1	1	1	Native/Dubious
Acacia tetragonocarpa		1								Native/Dubious
Adenanthos cygnorum subsp. *cygnorum*		1			1					Native
Allocasuarina fraseriana		1								Native
Allocasuarina humilis				1			1			Native/Dubious
Anigozanthos manglesii		1					1			Native/Dubious
Aotus cordifolia			1							Native
Arctotheca calendula			1							Introduced Flora on WAH
Arundo donax		1								Introduced Flora on WAH
Asparagus asparagoides		1								Introduced Flora on WAH
Astartea scoparia			1	1		1		1		Native
Avena barbata			1							Introduced Flora on WAH
Banksia attenuata							1			Native/Dubious
Banksia grandis				1			1			Native/Dubious

Species	pE	pEB	pMp	pMrEr	pPin	pSedge	pUNK	pUnmapped	pWetshrub	Native/Weed/Dubious
Banksia littoralis			1	1					1	Native
Banksia menziesii		1								Native
Banksia sessilis		1		1						Native/Dubious
Baumea articulata						1				Native
Baumea juncea						1		1		Native
Baumea rubiginosa								1		Native
Beaufortia elegans				1			1			Native/Dubious
Bossiaea eriocarpa		1								Native
Brachyloma preissii	1	1								Native/Dubious
Briza maxima	1		1			1	1			Introduced Flora on WAH
Bromus diandrus			1							Introduced Flora on WAH
Burchardia congesta		1	1							Native
Callitris acuminata		1								Native
Callitris preissii		1								Native
Carpobrotus edulis	1	1	1				1			Introduced Flora on WAH
Cassytha racemosa	1		1							Native
Centaurea melitensis		1								Introduced Flora on WAH
Centella asiatica			1			1		1		Native
Chamaecytisus palmensis		1								Introduced Flora on WAH
Chamelaucium uncinatum		1								Native

Species	pE	pEB	pMp	pMrEr	pPin	pSedge	pUNK	pUnmapped	pWetshrub	Native/Weed/Dubious
Cinnamomum camphora		1								Introduced Flora on WAH
Comesperma virgatum			1							Native
Conospermum triplinervium		1					1			Native/Dubious
Conostylis aculeata		1					1			Native/Dubious
Conostylis aurea			1							Native
Conostylis candicans subsp. *candicans*		1								Native
Conostylis juncea	1	1								Native
Conostylis setigera subsp. *setigera*		1								Native
Corymbia calophylla	1	1	1		1		1			Native/Dubious
Corymbia citriodora		1								Introduced Flora on WAH/ Dubious
Corynotheca micrantha		1								Native
Cotoneaster pannosus			1							Introduced Flora on WAH
Crassula colorata			1				1			Native
Cyperus polystachyos								1		Introduced Flora on WAH
Dampiera linearis		1								Native
Dasypogon bromeliifolius	1	1			1					Native
Daviesia nudiflora		1								Native
Daviesia preissii	1	1					1			Native/Dubious
Daviesia triflora		1								Native
Desmocladus asper		1								Native

Species	pE	pEB	pMp	pMrEr	pPin	pSedge	pUNK	pUnmapped	pWetshrub	Native/Weed/Dubious
Desmocladus flexuosus		1								Native
Dianella revoluta		1	1		1				1	Native
Dischisma capitatum		1								Introduced Flora on WAH
Drosera macrantha			1							Native
Ehrharta calycina		1	1	1		1	1			Introduced Flora on WAH
Ehrharta longiflora			1							Introduced Flora on WAH
Eucalyptus gomphocephala		1	1	1						Native
Eucalyptus marginata		1					1			Native/Dubious
Eucalyptus rudis		1	1	1		1			1	Native
Eucalyptus sp.			1							Native
Euchilopsis linearis	1	1								Native
Euphorbia peplus			1	1						Introduced Flora on WAH
Euphorbia terracina		1	1				1			Introduced Flora on WAH
Exocarpos sparteus				1						Native
Ficinia nodosa				1						Native
Ficus sp.		1								Native
Fumaria capreolata				1						Introduced Flora on WAH
Gastrolobium ebracteolatum			1							Native
Geranium molle		1		1						Introduced Flora on WAH

Species	pE	pEB	pMp	pMrEr	pPin	pSedge	pUNK	pUnmapped	pWetshrub	Native/Weed/Dubious
Gladiolus caryophyllaceus	1	1	1							Introduced Flora on WAH
Gompholobium tomentosum		1		1			1		1	Native/Dubious
Gonocarpus pithyoides	1									Native
Hakea lissocarpha		1								Native
Hakea prostrata		1		1						Native/Dubious
Hardenbergia comptoniana			1	1	1					Native
Hemiandra glabra							1			Native
Hemiandra pungens		1								Native
Hibbertia cuneiformis		1	1		1					Introduced
Hibbertia huegelii		1								Native
Hibbertia hypericoides		1								Native
Hibbertia subvaginata			1							Native
Hovea pungens		1								Native
Hybanthus calycinus		1								Native
Hypocalymma angustifolium	1		1	1	1					Native
Hypochaeris glabra			1	1						Introduced Flora on WAH
Hypolaena exsulca		1								Native
Jacaranda sp.		1								Native
Jacksonia furcellata	1	1	1				1			Native/Dubious
Jacksonia sericea		1	1							Native/Dubious

Species	pE	pEB	pMp	pMrEr	pPin	pSedge	pUNK	pUnmapped	pWetshrub	Native/Weed/Dubious
Jacksonia sternbergiana		1		1			1			Native/Dubious
Juncus kraussii			1							Native
Juncus microcephalus								1		Introduced Flora on WAH
Juncus pallidus			1					1		Native
Kennedia prostrata		1								Native
Kunzea glabrescens			1			1	1		1	Native/Dubious
Lactuca serriola				1						Introduced Flora on WAH
Latrobea tenella			1							Native
Laxmannia squarrosa		1								Native
Lechenaultia floribunda				1						Native
Lepidosperma longitudinale			1			1				Native
Lepidosperma squamatum			1							Native
Leptospermum laevigatum		1	1	1						Introduced Flora on WAH
Leucopogon australis			1							Native
Leucopogon conostephioides		1								Native
Leucopogon propinquus		1								Native/Dubious
Lophostemon confertus		1								Introduced Flora on WAH/Dubious
Lyginia imberbis		1					1			Native
Macarthuria apetala		1								Native/Dubious
Macarthuria australis		1								Native

Species	pE	pEB	pMp	pMrEr	pPin	pSedge	pUNK	pUnmapped	pWetshrub	Native/Weed/Dubious
Macrozamia riedlei		1					1			Native
Meeboldina sp.			1							Native
Melaleuca lanceolata		1		1						Native/Dubious
Melaleuca preissiana	1	1	1							Native
Melaleuca rhaphiophylla			1	1		1		1		Native
Melaleuca teretifolia				1		1				Native
Melaleuca thymoides				1						Native
Mesomelaena pseudostygia		1								Native
Microtis media								1		Native
Monotaxis grandiflora		1								Native
Nuytsia floribunda		1								Native
Oenothera drummondii							1			Introduced Flora on WAH
Oenothera laciniata		1	1							Introduced Flora on WAH
Oenothera stricta		1								Introduced Flora on WAH
Olea europaea		1								Introduced Flora on WAH
Orobanche minor							1			Introduced Flora on WAH
Patersonia occidentalis		1			1		1			Native/Dubious
Pelargonium capitatum		1	1				1			Introduced Flora on WAH
Persicaria capitata		1								Introduced Flora on WAH
Petrophile axillaris		1								Native

Species	pE	pEB	pMp	pMrEr	pPin	pSedge	pUNK	pUnmapped	pWetshrub	Native/Weed/Dubious
Petrophile linearis		1	1							Native
Petrophile macrostachya		1								Native/Dubious
Petrorhagia dubia		1					1			Introduced Flora on WAH
Phlebocarya ciliata		1	1							Native
Pimelea rosea			1							Native
Pinus sp.		1	1		1				1	Introduced Flora on WAH/Dubious
Podotheca gnaphalioides		1					1			Native
Pteridium esculentum	1									Native
Ptilotus polystachyus		1								Native
Pultenaea reticulata			1			1				Native
Quercus suber		1								Introduced Flora on WAH/Dubious
Raphanus raphanistrum		1								Introduced Flora on WAH
Ricinocarpos glaucus		1								Native/Dubious
Santalum acuminatum		1								Native
Scaevola canescens		1								Native
Scaevola repens		1								Native
Schinus terebinthifolius			1							Introduced Flora on WAH
Schoenus grandiflorus			1							Native
Schoenus subfascicularis				1		1				Native
Scholtzia involucrata		1	1		1					Native/Dubious

Species	pE	pEB	pMp	pMrEr	pPin	pSedge	pUNK	pUnmapped	pWetshrub	Native/Weed/Dubious
Solanum nigrum		1	1							Introduced Flora on WAH
Sonchus asper				1						Introduced Flora on WAH
Sonchus oleraceus		1	1							Introduced Flora on WAH
Stirlingia latifolia		1								Native
Stylidium brunonianum		1								Native
Stylidium hesperium			1							Native
Taxandria linearifolia				1		1				Native
Thysanotus manglesianus			1							Native
Thysanotus multiflorus			1							Native
Thysanotus sparteus		1								Native/Dubious
Tricoryne elatior	1	1								Native
Trifolium campestre			1							Introduced Flora on WAH
Typha orientalis								1		Introduced Flora on WAH
Ursinia anthemoides		1		1		1				Introduced Flora on WAH
Viminaria juncea			1			1		1		Native
Vulpia myuros							1			Introduced Flora on WAH
Xanthorrhoea preissii	1	1			1					Native
Zantedeschia aethiopica		1								Introduced Flora on WAH
Grand Total	**17**	**108**	**66**	**32**	**11**	**18**	**31**	**12**	**7**	

Appendix 3: Fauna List

The total combined species lists are provided in this section and split into fauna groups, they were combined from surveys undertaken by Rodda 1986, C. A. Cole 2003 (birds only), and Natural Area Consulting Management Services 2015; the fauna is listed by species name.

- Denotes introduced Species

Mammals				
Family	**Species Name**	**Common Name**	**1986**	**2015**
Canidae	**Canis lupus familiaris*	Domestic Dog		x
Felidae	**Felis catus*	Domestic cat	x	x
Muridae	**Mus musculus*	House Mouse	x	
Leporidae	**Oryctolagus cuniculus*	European Rabbit	x	x
Canidae	**Vulpes vulpes*	European Red Fox	x	x
Peramelidae	*Isoodon obesulus fusciventer*	Southern Brown Bandicoot	x	x
Phalangeridae	*Trichosurus vulpecula*	Common Brushtail Possum	x	

Birds					
Family	**Species Name**	**Common Name**	**1986**	**2003**	**2015**
Acanthizidae	*Acanthiza apicalis*	Inland Thornbill	x		
Acanthizidae	*Acanthiza chrysorrhoa*	Yellow-rumped thornbill	x	x	x
Acanthizidae	*Acanthiza inornata*	Western Thornbill	x	x	
Meliphagidae	*Acanthorhynchus superciliosus*	Western Spinebill	x	x	
Accipitridae	*Accipiter cirrocephalus*	Collared Sparrowhawk	x		
Accipitridae	*Accipiter fasciatus*	Brown Goshawk	x	x	x
Acrocephalidae	*Acrocephalus stentoreus*	Clamorous Reed-Warbler	x	x	
Anatidae	*Anas gracilis*	Grey Teal Duck	x	x	x
Anatidae	*Anas superciliosa*	Pacific Black Duck	x	x	x
Anatidae	*Anas rhynchotis*	Australasian Shoveler		x	
Anhingidae	*Anhinga melanogaster*	Darter	x		
Anthochaera	*Anthochaera carunculata*	Red Wattlebird	x	x	x
Anthochaera	*Anthochaera lunulata*	Western Wattlebird		x	x
Ardeidae	*Ardea alba*	Eastern Great Egret	x	x	
Ardeidae	*Ardea novaehollandiae*	White-faced Heron	x	x	
Ardeidae	*Ardea pacifica*	White-necked Herron	x		

Birds					
Family	**Species Name**	**Common Name**	**1986**	**2003**	**2015**
Anatidae	*Aythya australis*	Hardhead	x	x	x
Psittacidae	*Barnardius zonarius*	Australian Ringneck	x	x	x
Anatidae	*Biziura lobata*	Musk Duck	x		
Cacatuidae	*Cacatua roseicapilla*	Galah		x	x
Cacatuidae	**Cacatua tenuirostris*	Eastern Long Billed Corella			x
Cacatuidae	*Calyptorhynchus banksii naso*	Forest Red-tailed Black Cockatoo			x
Cacatuidae	*Calyptorhynchus baudinii*	Baudin's Cockatoo	x		
Cacatuidae	*Calyptorhynchus latirostris*	Carnaby's Cockatoo		x	x
Cuculidae	*Chrysococcyx lucidus*	Shining Bronze-Cuckoo	x		
Columbidae	*Columba livia*	Feral Pidgeon	x		
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	x	x	x
Corvidae	*Corvus coronoides*	Australia Raven	x	x	x
Artamidae	*Cracticus nigrogularis*	Pied Butcherbird	x		
Artamidae	*Cracticus tibicen*	Australian Magpie	x	x	x
Artamidae	*Cracticus torquatus*	Grey Butcherbird	x		
Cuculidae	*Cuculus pallidus*	Pallid Cuckoo	x		
Anatidae	*Cygnus atratus*	Black Swan		x	
Halcyonidae	**Dacelo novaeguinea*	Laughing Kookaburra	x		x
Neosittidae	*Daphoenositta chrysoptera pileata*	Varied Sittella	x		
Accipitridae	*Elanus axillaris*	Black-shouldered Kite	x		
Falconidae	*Falco berigora*	Brown Falcon	x		
Falconidae	*Falco cenchroides*	Nankeen Kestrel	x		
Rallidae	*Fulica atra*	Eurasian Coot	x	x	x
Acanthizidae	Gerygone fusca	Western Gerygone	x	x	
Monarchidae	*Grallina cyanoleuca*	Magpie Lark	x	x	x
Rallidae	*Gallinula tenebrosa*	Dusky Moorhen	x		
Accipitridae	*Haliastur sphenurus*	Whistling Kite		x	
Accipitridae	*Hieraaetus morphnoides*	Little Eagle	x		
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt		x	
Hirundinidae	*Hirundo neoxena*	Welcome Swallow	x	x	
Hirundinidae	*Hirundo nigricans neglecta*	Tree Martin	x	x	

Birds					
Family	**Species Name**	**Common Name**	**1986**	**2003**	**2015**
Campephagidae	*Lalage sueurii*	White-winged Triller		x	
Laridae	*Larus novaehollandiae*	Silver Gull	x		
Meliphagidae	*Lichenostomus virescens*	Singing Honeyeater	x	x	x
Meliphagidae	*Lichmera indistincta*	Brown Honeyeater	x	x	x
Maluridae	*Malurus splendens*	Splendid Fairy Wren	x	x	x
Locustellidae	*Megalurus gramineus*	Little Grassbird	x		
Meropidae	*Merops ornatus*	Rainbow Bee-eater	x	x	x
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler	x	x	x
Pelecanidae	*Pelecanus conspicillatus*	Australian Pelican		x	
Phalacrocoracidae	*Phalacrocorax melanoleucos*	Little Pied Cormorant	x	x	
Phalacrocoracidae	*Phalacrocorax sulcirostris*	Little Black Cormorant	x	x	
Phalacrocoracidae	*Phalacrocorax varius*	Pied Cormorant		x	
Columbidae	*Phaps chalcoptera*	Common Bronzewing			x
Meliphagidae	*Phylidonyris nigra*	White-cheeked honeyeater		x	x
Meliphagidae	*Phylidonyris novaehollandiae*	New Holland Honeyeater		x	x
Threskiornithidae	*Platalea flavipes*	Yellow-billed Spoonbill	x	x	
Rallidae	*Porphyrio porphyrio*	Purple Swamphen	x		x
Rallidae	*Porzana tabuensis*	Spotless Crake	x		
Psittaculidae	*Purpureicephalus spurius*	Red-capped Parrot	x	x	
Rhipiduridae	*Rhipidura fuliginosa preissi*	Grey Fantail	x		
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail	x	x	x
Acanthizidae	*Sericornis frontalis maculatus*	White-browed Scrubwren		x	
Acanthizidae	*Smicrornis brevirostris*	Weebill			x
Columbidae	**Streptopelia chinensis*	Spotted Turtle-Dove	x	x	
Columbidae	**Streptopelia senegalensis*	Laughing Turtle-Dove	x	x	x
Podicipedidae	*Tachybaptus novaehollandiae*	Australasian Grebe	x	x	x
Threskiornithidae	*Threskiornis molucca*	Australian White Ibis	x	x	x
Threskiornithidae	*Threskiornis spinicollis*	Straw Necked Ibis			x
Halcyonidae	*Todiramphus sanctus*	Sacred Kingfisher	x		
Psittacoidea	*Trichoglossus haematodus**	Rainbow Lorikeet	x	x	x

Birds					
Family	**Species Name**	**Common Name**	**1986**	**2003**	**2015**
Scolopacidae	*Tringa nebularia*	Common Greenshank		x	
Tytonidae	*Tyto alba*	Barn Owl	x		
Zosteropidae	*Zosterops lateralis chloronotas*	Silvereye	x	x	x

Reptiles				
Family	***Species Name***	***Common name***	**1986**	**2015**
Scincidae	*Acritoscincus trilineatum*	South-west Cool Skink		x
Chelidae	*Chelodina oblonga*	Oblong Turtle	x	
Scincidae	*Cryptoblepharus buchananii*	Fence Skink		x
Scincidae	*Ctenotus fallens*	West-coast Laterite Ctenotus		x
Scincidae	*Hemiergis quadrilineata*	Two-toed earless skink		x
Scincidae	*Lerista elegans*	Elegant Slider		x
Scincidae	*Menetia greyii*	Common Dwarf Skink		x
Scincidae	*Morethia lineoocellata*	Westcoast Pale-flecked Morethia		x
Elapidae	*Notechis scutatus*	Western Tiger Snake	x	
Agamidae	*Pogona minor*	Western Bearded Dragon		x
Elapidae	*Pseudonaja affinis*	Dugite	x	x
Scincidae	*Tiliqua rugosa*	Bobtail	x	x

Amphibians				
Family	**Species Name**	**Common name**	**1986**	**2015**
Myobatrachidae	*Crinia glauerti*	Rattling or Clicking Froglet	x	
Myobatrachidae	*Crinia insignifera*	Squelching Froglet	x	
Myobatrachidae	*Heleioporus eyrei*	Moaning Frog	x	x
Myobatrachidae	*Limnodynastes dorsalis*	Western Banjo Frog	x	x
Hylidae	*Litoria adelaidensis*	Slender Tree Frog	x	
Hylidae	*Litoria moorei*	Motorbike Frog	x	

Fish				
Family	**Species Name**	**Common name**	**1986**	**2015**
Poeciliidae	*Gambusia affinis*	Mosquito Fish	x	x
Cyprinidae	*Cyprinus carpio haematopterus*	Koi		x

Invertebrates			
Family	**Species Name**	**Common Name**	**2015**
Acrididae		Acrididae 1	x
Reduviidae		Reduviidae sp.	x
Sparassidae		Huntsman spider 1	x
Asilidae		Robber Fly	x
Scutigeridae		House Centipede	x
Apidae	**Apis mellifera*	European honey bee	x
Formicidae	*Camponotus minimus*	small Black ant	x
Formicidae	*Camponotus terebrans*	Brownleg Mattneck Glossblack Ant	x
Curculionidae	*Catasarcus impressipenis*	Red-legged Weevil	x
Curculionidae	*Catasarcus spinipennis*	Spiny Weevil	x
Lycosidae	*Cheiracanthium sp.*	Wolf spider 2	x
Pompilidae	*Cryptocheilus fabricolor*	Great Orange Huntsman Wasp	x
Blattidae	*Cutila nigra*	Bush Cockroach	x
Anisolabididae	*Dermaptera anisolabididae*	Earwig	x
Pentatomidae	*Eumecopus* sp.	Flower wasp	x
Acrididae	*Goniaea australasiaea*	Gumleaf grasshopper	x
Gryllidae	*Gryllodes suplicans*	Field Cricket/Indian House Cricket	x
Hemicorduliidae	*Hemicordulia tau*	Australian Emerald Hemidragonfly	x
Nymphalidae	*Heteronympha merope*	Common Brown Butterfly	x
Buthidae	*Lychas marmoreus*	Marbled Scorpion	x
Lycosidae	*Lycosa* sp.	Wolf spider 1	x
Muscidae	*Musca vetustisissima*	Bush fly	x
Formicidae	*Myrmecia* sp.	Bull Ant	x
Julidae	*Ommatioulus moreleti*	Portuguese millipede	x
Libellulidae	*Orthetrum caledonicum*	Blue skimmer dragon fly	x
Amorphoscelidae	*Paraoxypilus laticollis*	Praying mantis	x
Pieridae	*Pieris rapae*	Cabbage Butterfly	x
Tenebrionidae	*Pterohelaeus* sp.	Pie-dish Beetle	x
Formicidae	*Rhytidoponera metallica*	Common Metallic Ant	x
Blattidae	*Zonioploca bicolour*	Spotted Desert Cockroach	x

Appendix 4: Likelihood of At-risk Fauna Species to Occur

The likelihood of at-risk fauna species not recorded on site to occur within the reserve is shown in the tables below.

Likelihood of at-risk mammal species to occur

Species Name	Common Name	Likelihood of occurrence
Macropus Irma	Western Brush Wallaby	Unlikely due to the isolation of the site, the surrounding built up area and previous clearing of the pine forests
Macropus fuliginosus	Western Grey Kangaroo	Unlikely due to the isolation of the site, the surrounding built up area and previous clearing of the pine forests
Rattus fuscipes	Bush Rat	Unlikely due to previous disturbance and clearing
Tarsipes rostratus	Honey Possum	Unlikely due to previous disturbance and clearing, rare species on the Swan Coastal Plain
Trichosurus vulpecula	Brush-tailed Possum	Unlikely as it has not been recorded in Melville for a number of years, although, it was recorded in 1986

Likelihood of at-risk bat species to occur

Species Name	Common Name	Likelihood of occurrence
Chalinolobus gouldii	Gould's Wattle Bat	Likely as habitat and location are suitable
Chalinolobus morio	Chocolate Wattle Bat	Likely as the site is within their range and the habitat is suitable
Falsistrellus mackenziei	Western False Pipistrelle	Unlikely as Perth is north of their known range and the habitat is unsuitable as no Karri, Jarrah or Tuart forests occur on site
Nyctophilus geoffroyi	Lesser Long-eared Bat	Likely to occur as habitat and location are suitable
Nyctophilus gouldii	Gould's Long-eared Bat	Likely as the site is within their range and the habitat is suitable
Nyctophilus major	Greater Long-eared Bat	Likely as the site is within their range and the habitat is suitable
Vespadelus regulus	Southern Forest Bat	Likely as the site is within their range and the habitat is suitable

Likelihood of at-risk bird species to occur

Species Name	Common Name	Likelihood of occurrence
Acanthiza apicalis	Inland Thornbill	Unlikely has not been recorded on site since 1986, due to disturbance to vegetation and fragmentation of bushland areas during surrounding development
Acanthiza inornata	Western Thornbill	Likely, as it was recorded in 2003, and location and habitat is suitable, moderately common in the Swan Coastal Plain except suburban areas

Species Name	Common Name	Likelihood of occurrence
Acanthorhynchus superciliosus	Western Spinebill	Likely, it was recorded in 2013, and location and habitat is suitable
Anas rhynchotis	Australian Shoveler	Likely as it has been recorded in previous surveys, and location and habitat are suitable
Apus pacificus	Fork-tailed Swift	Unlikely, not previously recorded and vegetation type is not their preferred habitat
Ardea ibis	Cattle Egret	Likely as the habitat and location are suitable
Ardea alba	Eastern Great Egret	Likely, as it is a highly migratory species and the habitat is suitable, but it would only be a seasonal visitor
Biziura lobata	Musk Duck	Likely as the habitat and location are suitable, and it has been recorded previously
Cacatua sanguinea	Little Corella	Likely as habitat and location are suitable
Calyptorhynchus baudinii	Baudin's Cockatoo	Likely as location and foraging habitat are suitable, and it has been previously recorded
Climacteris rufa	Rufous Treecreeper	Unlikely as this species is very scarce on the Swan Coastal Plain
Colluricincla harmonica	Grey Shrike-thrush	Likely as habitat and location are suitable
Gallinula tenebrosa	Dusky Moorhen	Likely as habitat and location are suitable, and has been recorded previously
Hirundo nigricans	Tree Martin	Likely as habitat and location are suitable, and has been recorded previously
Malacorhynchus membranaceus	Pink-eared Duck	Likely as habitat and location are suitable, although uncommon on the Swan Coastal Plain
Ninox connivens	Barking Owl	Unlikely as they are scarce in the south-west and their main food source are small marsupials which limit their distribution
Nycticorax caledonicus	Nankeen Night-Heron	Likely as habitat and location are suitable
Oxyura australis	Blue-billed Duck	Likely as habitat and location are suitable
Pardalotus striatus	Striated Pardalote	Likely as habitat and location are suitable, and this species is common in the Perth Region
Petroica multicolor	Scarlet Robin	Unlikely as vegetation is not their preferred habitat
Purpureicephalus spurius	Red-capped Parrot	Likely as habitat and location are suitable, and has been recorded previously
Todiramphus sanctus	Sacred Kingfisher	Likely as habitat and location are suitable, and has been recorded previously
Turnix varia	Painted Button-quail	Unlikely due to previous disturbance and clearing

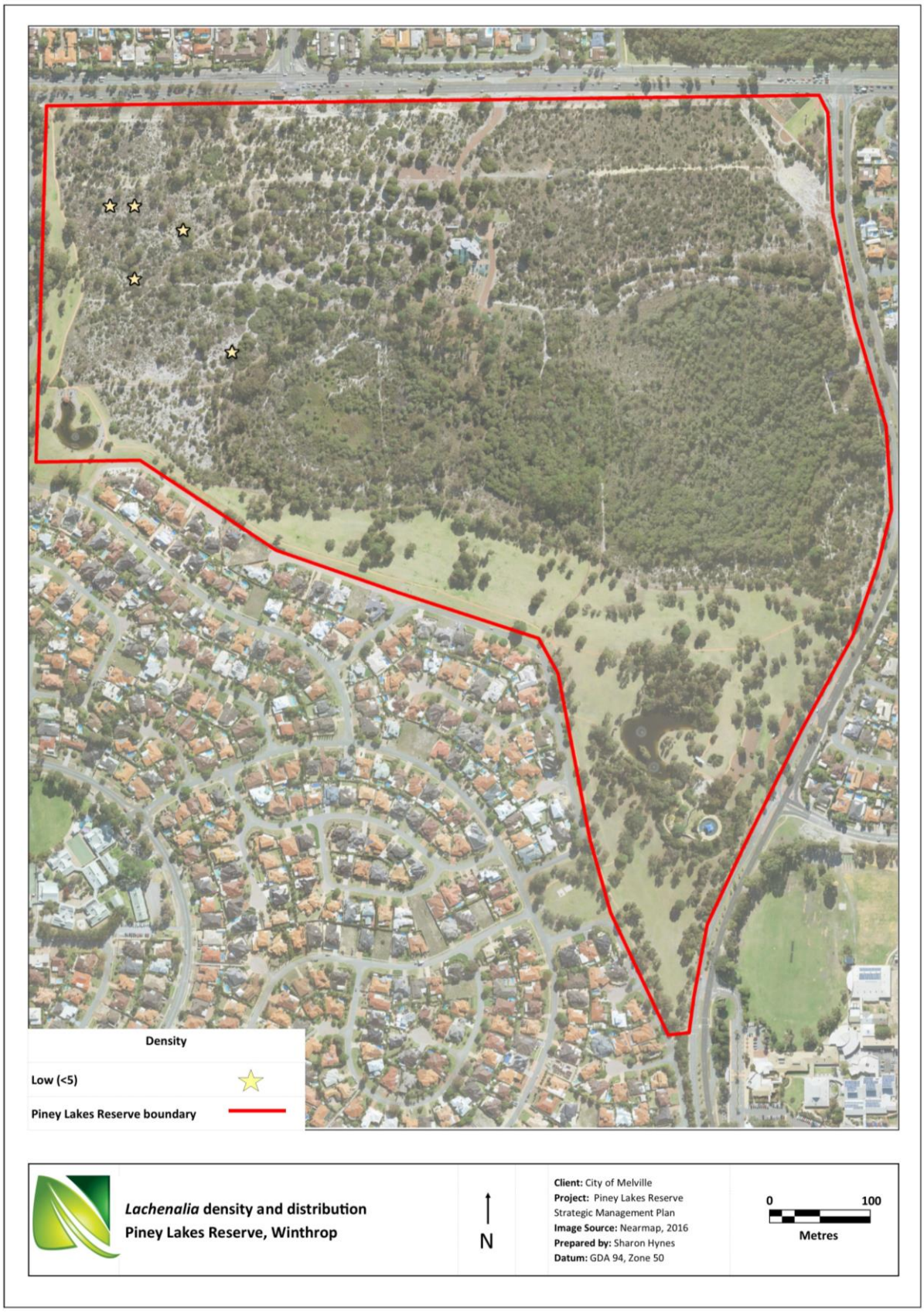
(Source: Birdlife Australia, 2016)

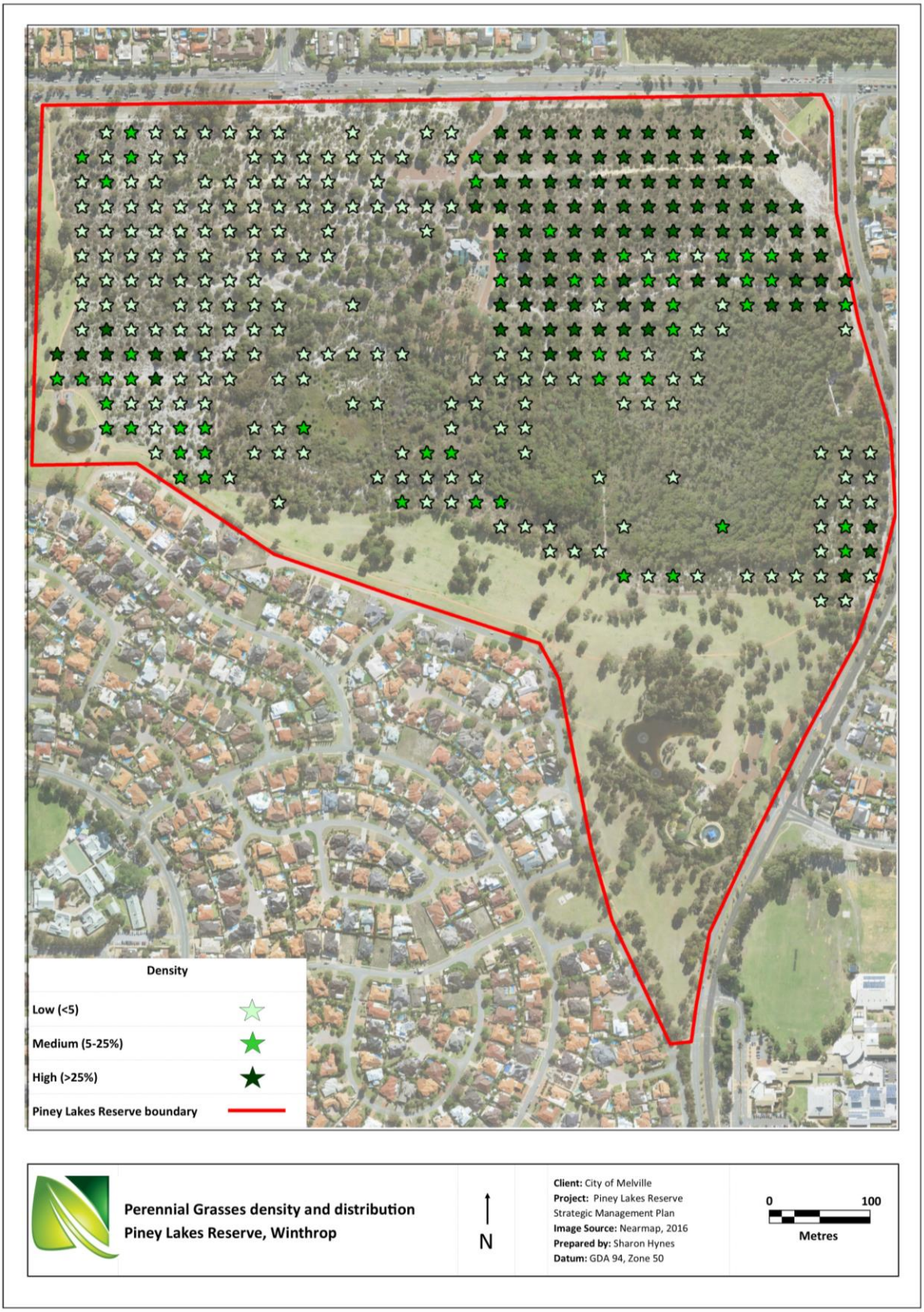
Likelihood of at-risk reptile species to occur

Species Name	Common Name	Likelihood of occurrence
Aprasia repens	Worm Lizard	Likely as habitat and location are suitable, common on the Swan Coastal Plain

Species Name	Common Name	Likelihood of occurrence
Christinus marmoratus	Marbled Gecko	Likely as habitat and location are suitable, common on the Swan Coastal Plain
Ctenophorus adelaidensis	Western Heath Dragon	Likely as habitat and location are suitable
Delma fraseri	Fraser's Legless Lizard	Likely as habitat and location are suitable
Delma greyii	Gray's Legless Lizard	Likely as habitat and location are suitable
Demansia psammophis	Yellow-faced Whipsnake	Likely as habitat and location are suitable
Egernia luctuosa	Western Glossy Swamp Egernia	Likely as habitat and location are suitable
Lerista lineata	Lined Skink	Likely as habitat and location are suitable, and it has been recorded in nearby reserves
Lialis burtonis	Burton's Snake Lizard	Likely as habitat and location are suitable, common on the Swan Coastal Plain
Neelaps bimaculatus	Black-naped Snake	Unlikely as the site has been heavily disturbed in the past and this species in very rare on the Swan Coastal Plain
Neelaps calonotos	Black-striped Snake	Unlikely as the site has been heavily disturbed in the past and this species in very rare on the Swan Coastal Plain
Notechis scutatus	Western Tiger Snake	Likely as habitat and location are suitable and it has previously been recorded on site
Parasuta gouldii (syn. *Rhinoplocephalus gouldii)*	Gould's Hooded Snake	Unlikely as they usually occur in the Darling Range
Pletholax gracilis	Keeled Legless Lizard	Likely as habitat and location are suitable, although rare on the Swan Coastal Plain
Pygopus lepidopodus	Common Scaly-Foot	Likely as habitat and location are suitable
Ramphotyphlops australis	Southern Blind Snake	Likely as habitat and location are suitable
Ramphotyphlops waitii	Common Beaked Blind Snake	Likely as habitat and location are suitable, common on the Swan Coastal Plain
Varanus gouldii	Gould's Monitor	Likely as habitat and location are suitable

Appendix 5: Weed Maps




Density
Low (<5)
Medium (5-25%)
High (>25%)
Piney Lakes Reserve boundary
Perennial Grasses density and distribution
Piney Lakes Reserve, Winthrop
N
Client: City of Melville
Project: Piney Lakes Reserve Strategic Management Plan
Image Source: Nearmap, 2016
Prepared by: Sharon Hynes
Datum: GDA 94, Zone 50
0
100
Metres

Annual grasses density and distribution
Piney Lakes Reserve, Winthrop

N

Client: City of Melville
Project: Piney Lakes Reserve Strategic Management Plan
Image Source: Nearmap, 2016
Prepared by: Sharon Hynes
Datum: GDA 94, Zone 50

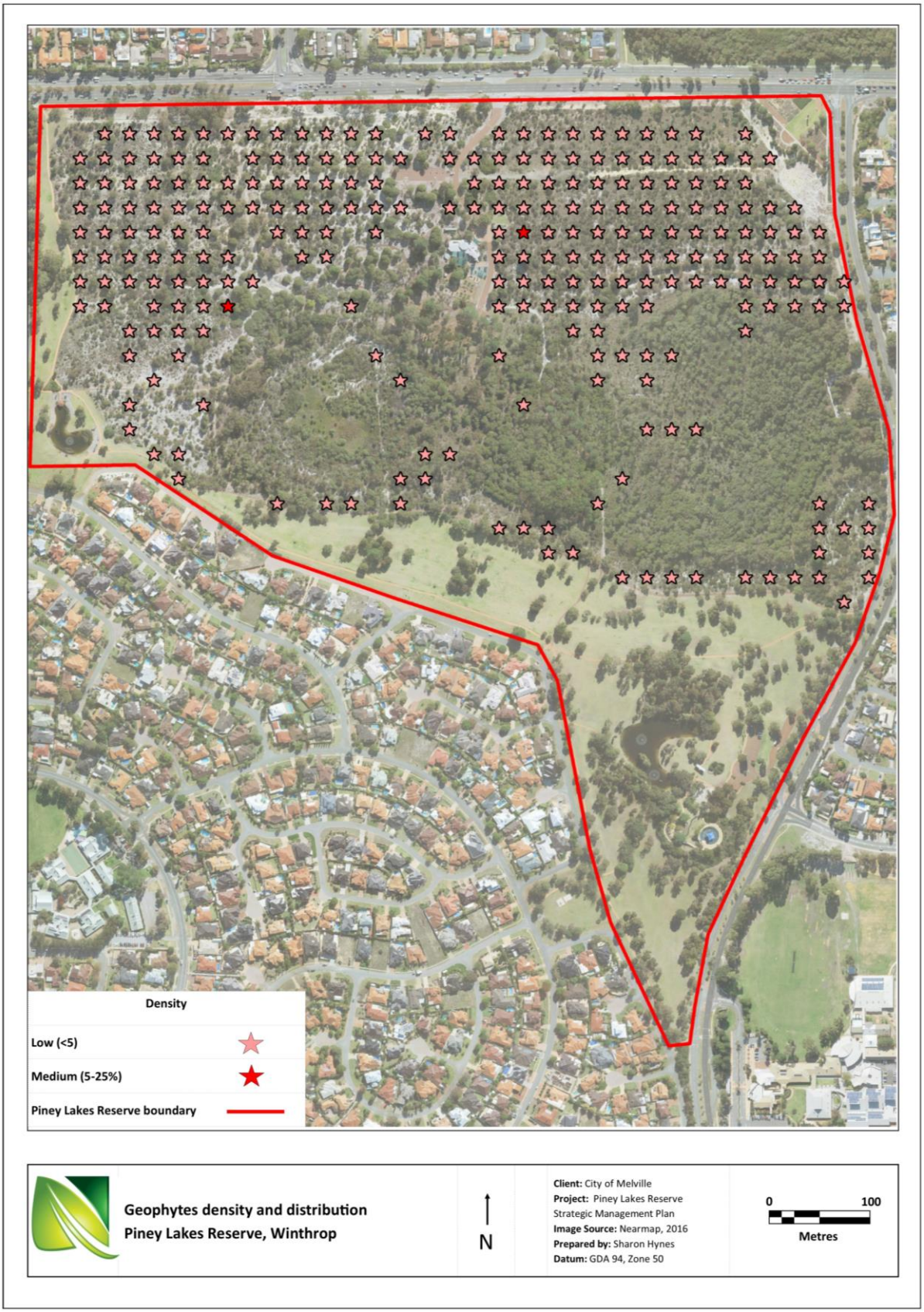
0 100
Metres

Perennial running grasses density and distribution
Piney Lakes Reserve, Winthrop

N

Client: City of Melville
Project: Piney Lakes Reserve Strategic Management Plan
Image Source: Nearmap, 2016
Prepared by: Sharon Hynes
Datum: GDA 94, Zone 50

0 100
Metres

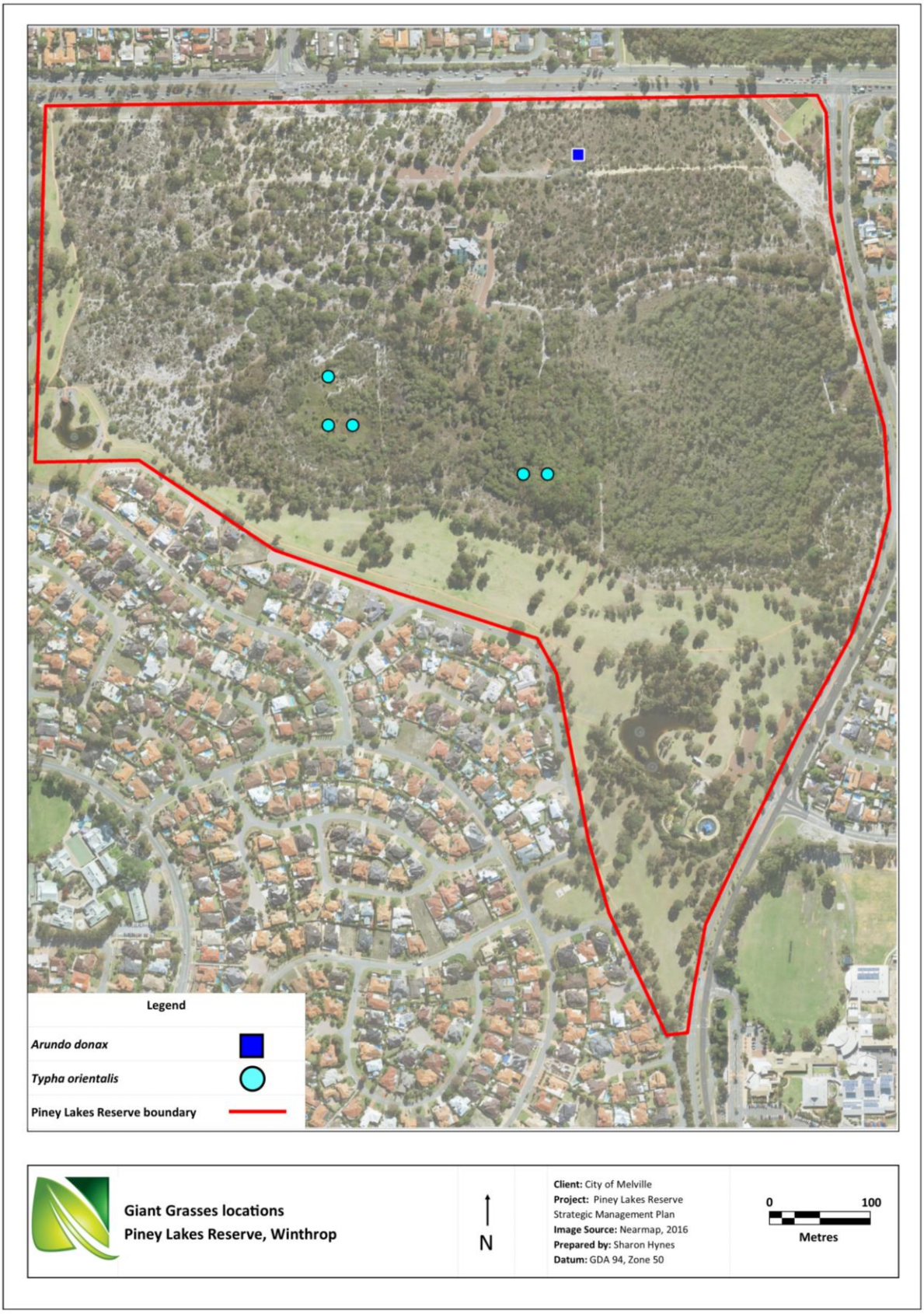


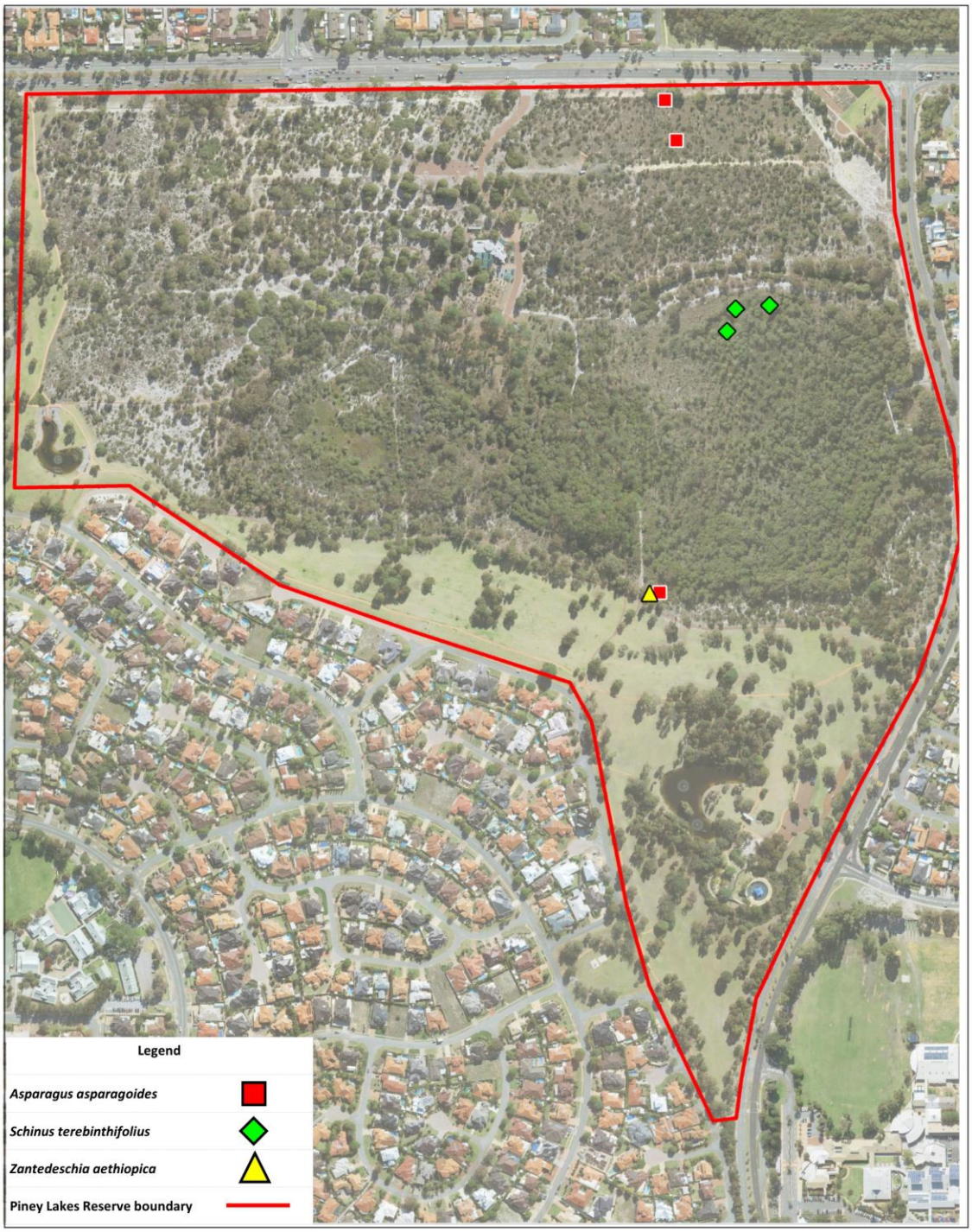
Geophytes density and distribution
Piney Lakes Reserve, Winthrop

N

Client: City of Melville
Project: Piney Lakes Reserve Strategic Management Plan
Image Source: Nearmap, 2016
Prepared by: Sharon Hynes
Datum: GDA 94, Zone 50

0 100
Metres


Legend
Arundo donax
Typha orientalis
Piney Lakes Reserve boundary
Giant Grasses locations
Piney Lakes Reserve, Winthrop
N
Client: City of Melville
Project: Piney Lakes Reserve Strategic Management Plan
Image Source: Nearmap, 2016
Prepared by: Sharon Hynes
Datum: GDA 94, Zone 50
0
100
Metres



Very high priority weed locations
Piney Lakes Reserve, Winthrop

N

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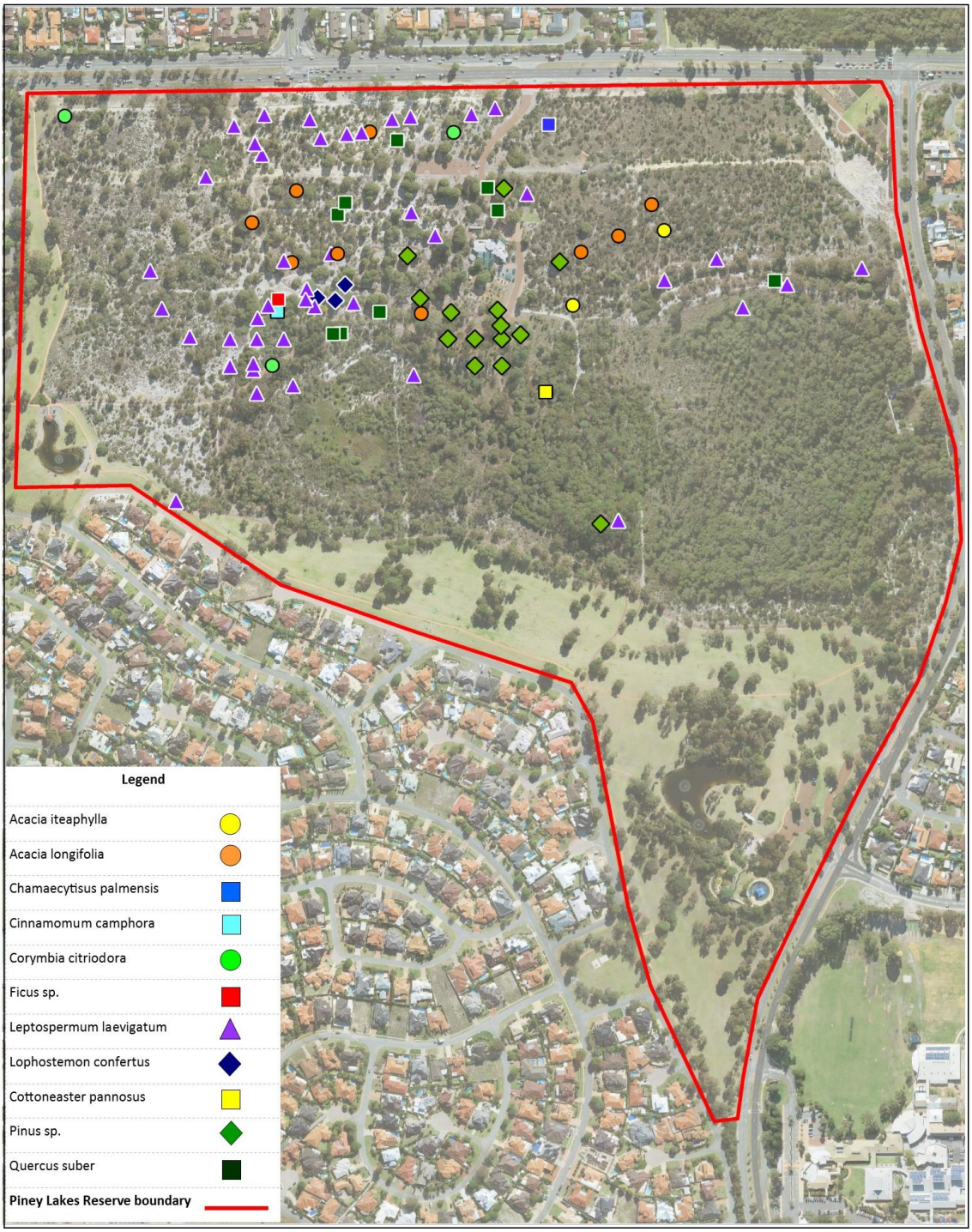
Project: Piney Lakes Reserve Strategic Management Plan
Image Source: Nearmap, 2016
Prepared by: Sharon Hynes
Datum: GDA 94, Zone 50

0 100
Metres



Woody weed locations
Piney Lakes Reserve, Winthrop

N

Client: City of Melville
Project: Piney Lakes Reserve Strategic Management Plan
Image Source: Nearmap, 2016
Prepared by: Sharon Hynes
Datum: GDA 94, Zone 50

0 100
Metres