Shire of Serpentine Jarrahdale

Marri Woodland Management Plan

With Reserve Action Plans:

Brickwood Reserve
Serpentine Cemetery Reserve
Serpentine Sports Reserve
Mundijong Oval Reserve
Myara Brook Reserve
Oscar Bruns Reserve
Rainforest Reserve
Wattle Road Reserve
Clem Kentish Reserve
Yangedi Airfield Reserve
King Road Pony Club Reserve
Craghill Way Reserve

Table of Contents

MARRI WOODLAND MANAGEMENT PLAN 7

1. Executive Summary 7
1.1 Introduction 7
1.2 Objectives 8
1.3 Report Structure 8
2. Background 10
2.1 Location 10
2.2 Soils 10
2.3 Biodiversity 16
2.3.1 Description 16
2.3.2 Flora 16
2.3.3 Fauna 18
2.4 Water Resources 19
2.4.1 Surface Water 19
2.4.2 Groundwater 20
2.5 Heritage 21
2.5.1 Aboriginal Heritage 21
2.5.2 European Heritage 22
2.6 Policy and Legislation 22
2.6.1 Federal Legislation 22
2.6.2 State Legislation 23
2.6.3 State Policy and Guidelines 23
2.6.4 Local Legislation and Policy 24
3. Threats and Pressures 25
3.1 Clearing and Fragmentation 27
3.2 Altered Fire Regimes 28
3.3 Invasive Species 29
3.3.1 Plants 29
3.3.2 Animals 30
3.4 Hydrological Changes 30
3.5 Introduction of Disease 32
3.6 Climate Change 33
3.7 Fauna Decline 34
4. Reserves 36
4.1 Location and Description 36
4.2 Vesting and Land Tenure 45
4.3 User Groups 46
4.3.1 User Groups 46
4.3.2 Threats and Pressures 47
4.4 Infrastructure 47
4.4.1 Infrastructure 47
4.4.2 Threats and Pressures 48
5. Action Plan 50
5.1 Introduction 50
5.2 Priorities and Status 50
5.3 Responsibilities, Monitoring and Review 50
6. References 53
Appendix 1 – Flora Surveys and Lists 55
Appendix 2 – Fauna Surveys and Lists 63
Appendix 3 – Threatened and Priority Flora and Fauna 66
Appendix 4 – Fire Management Strategy for Marri Woodland 67
Principles of Fire Management for Marri Woodland 67

BRICKWOOD RESERVE ACTION PLAN 68

R17490, R51101, R37404 68

1. Background 68
1.1 Location *68*
1.2 Soils *69*
1.3 Biodiversity *70*
1.4 Water Resources *71*
2. Threats and Pressures 72
3. Reserve Usage 73
3.1 Vesting and Land Tenure *73*
3.2 User Groups *75*
3.3 Infrastructure *75*
4. Action Plan 76
5. Fire Management Strategy for Brickwood Reserve 78

SERPENTINE CEMETERY RESERVE ACTION PLAN 79

R10661 79
1. Background 79
1.1 Location *79*
1.2 Soils *80*
1.3 Biodiversity *81*
1.4 Water Resources *82*
2. Threats and Pressures 83
3. Reserve Usage 84
3.1 Vesting and Land Tenure *84*
3.2 User Groups *85*
3.3 Infrastructure *85*
4. Action Plan 85
5. Fire Management Strategy for Serpentine Cemetery Reserve 88

SERPENTINE SPORTS RESERVE ACTION PLAN 89

R19134 89
1. Background 89
1.1 Location *89*
1.2 Soils *92*
1.3 Biodiversity *92*
1.4 Water Resources *93*
2. Threats and Pressures 94
3. Reserve Usage 95
3.1 Vesting and Land Tenure *95*
3.2 User Groups *96*
3.3 Infrastructure *96*
4. Action Plan 97
5. Fire Management Strategy for Serpentine Sports Reserve 100

MUNDIJONG OVAL RESERVE ACTION PLAN 101

R4486 101
1. Background 101
1.1 Location *101*
1.2 Soils *102*
1.3 Biodiversity *103*
1.4 Water Resources *104*
2. Threats and Pressures 105
3. Reserve Usage 106
3.1 Vesting and Land Tenure *106*
3.2 User Groups *107*
3.3 Infrastructure *107*
4. Action Plan 108

5. Fire Management Strategy for Mundijong Oval Reserve 110

MYARA BROOK RESERVE ACTION PLAN 111

R23778 111
1. Background 111
1.1 Location 111
1.2 Soils 113
1.3 Biodiversity 114
1.4 Water Resources 115
2. Threats and Pressures 116
3. Reserve Usage 116
3.1 Vesting and Land Tenure 116
3.2 User Groups 116
3.3 Infrastructure 116
4. Action Plan 117
5. Fire Management Strategy for Myara Brook Reserve 119

OSCAR BRUNS RESERVE ACTION PLAN 120

R10385 120
1. Background 120
1.1 Location 120
1.2 Soils 122
1.3 Biodiversity 122
1.4 Water Resources 123
2. Threats and Pressures 124
3. Reserve Usage 125
3.1 Vesting and Land Tenure 125
3.2 User Groups 125
3.3 Infrastructure 125
4. Action Plan 125
5. Fire Management Strategy for Oscar Bruns Reserve 128

RAINFOREST RESERVE ACTION PLAN 129

R20165 129
1. Background 129
1.1 Location 129
1.2 Soils 131
1.3 Biodiversity 131
1.4 Water Resources 132
2. Threats and Pressures 133
3. Reserve Usage 134
3.1 Vesting and Land Tenure 134
3.2 User Groups 134
3.3 Infrastructure 134
4. Action Plan 134
5. Fire Management Strategy for Rainforest Reserve 137

WATTLE ROAD NATURE RESERVE ACTION PLAN 138

R36433 138
1. Background 138
1.1 Location 138
1.2 Soils 139
1.3 Biodiversity 140
1.4 Water Resources 141
2. Threats and Pressures 141
3. Reserve Usage 141

3.1 Vesting and Land Tenure *141*
3.2 User Groups *142*
3.3 Infrastructure *142*
4. Action Plan 142
5. Fire Management Strategy for Wattle Road Nature Reserve 145

CLEM KENTISH RESERVE ACTION PLAN 146

R9157 146
1. Background 146
1.1 Location *146*
1.2 Soils *148*
1.3 Biodiversity *149*
1.4 Water Resources *150*
2. Threats and Pressures 150
3. Reserve Usage 151
3.1 Vesting and Land Tenure *151*
3.2 User Groups *151*
3.3 Infrastructure *151*
4. Action Plan 152
5. Fire Management Strategy for Clem Kentish Reserve 154

YANGEDI AIRFIELD RESERVE ACTION PLAN 155

R25911 155
1. Background 155
1.1 Location *155*
1.2 Soils *157*
1.3 Biodiversity *158*
1.4 Water Resources *159*
2. Threats and Pressures 160
3. Reserve Usage 160
3.1 Vesting and Land Tenure *160*
3.2 User Groups *160*
3.3 Infrastructure *161*
4. Action Plan 162
5. Fire Management Strategy for Yangedi Airfield Reserve 164

KING ROAD PONY CLUB RESERVE ACTION PLAN 165

R36950 165
1. Background 165
1.1 Location *165*
1.2 Soils *167*
1.3 Biodiversity *168*
1.4 Water Resources *169*
2. Threats and Pressures 169
3. Reserve Usage 170
3.1 Vesting and Land Tenure *170*
3.2 User Groups *170*
3.3 Infrastructure *170*
4. Action Plan 171
5. Fire Management Strategy for King Road Pony Club Reserve 174

CRAGHILL WAY RESERVE ACTION PLAN 175

R34460 175
1. Background 175
1.1 Location *175*
1.2 Soils *177*

1.3 Biodiversity *178*
1.4 Water Resources *179*
2. Threats and Pressures 179
3. Reserve Usage 180
3.1 Vesting and Land Tenure *180*
3.2 User Groups *180*
3.3 Infrastructure *180*
4. Action Plan 180
5. Fire Management Strategy for Craghill Way Reserve 183

Marri Woodland Management Plan

1. Executive Summary

1.1 Introduction

Marri woodland is a characteristic vegetation type on heavy soils on the eastern side of the Swan Coastal Plain and was formerly one of the most common vegetation types on these soils. Its main feature is a tree layer dominated by marri (*Corymbia calophylla*) with a highly diverse understorey.

Marri woodlands principally occur on the heavy, clay-dominated alluvial soils of the Pinjarra Plain on the eastern side of the Swan Coastal Plain. Marri woodlands can fall within three floristic communities (sub-communities), which all occur in the Shire of Serpentine Jarrahdale. These three communities are:

- 3a (*Corymbia calophylla – Kingia australis* woodlands on heavy soils of the Swan Coastal Plain)
- 3b (*Corymbia calophylla – Eucalyptus marginata* woodlands on sandy clay soils of the southern Swan Coastal Plain)
- 3c (*Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands, Swan Coastal Plain)

Community 3a is listed as Critically Endangered and communities 3b and 3c as Endangered under the Western Australian *Biodiversity Conservation Act 2016*, while communities 3a and 3c are also listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.* The listings mean that marri woodlands have been assessed as both having undergone a high degree of loss and being under a continued high level of threat.

In 2017 (the most recent data available), the “Guildford” vegetation complex (which roughly equates to marri woodland) was assessed as having 5% remaining, and only 4% in the Shire of Serpentine Jarrahdale. The threats to marri woodland are many and significant, including:

- Clearing and fragmentation
- Altered fire regimes
- Invasive species
- Hydrological changes
- Introduction of disease
- Climate change
- Fauna decline

Twelve Shire natural area reserves contain marri woodland, as well as areas with other uses such as sports fields. These reserves, and their approximate area of marri woodland, are:

- Brickwood Reserve, Byford (40.6 ha)
- Serpentine Cemetery Reserve, Serpentine (2.1 ha)
- Serpentine Sports Reserve (Paul Robinson Reserve), Serpentine (3.8 ha)
- Mundijong Oval Reserve, Mundijong (2.07 ha)
- Myara Brook Reserve, Keysbrook (2.8 ha)

- Oscar Bruns Reserve, Darling Downs (1.67 ha)
- Rainforest Reserve, Byford (0.95 ha)
- Wattle Road Nature Reserve, Serpentine (0.97 ha)
- Clem Kentish Reserve, Serpentine (0.53 ha)
- Yangedi Airfield Reserve, Hopeland (4.6 ha)
- King Road Pony Club Reserve, Oldbury (0.36 ha)
- Craghill Way Reserve, Oakford (0.32 ha)

Some of these reserves (Brickwood Reserve, Serpentine Sports Reserve, Myara Brook Reserve, Yangedi Airfield Reserve, King Road Pony Club Reserve and Craghill Way Reserve) also contain other types of vegetation (banksia woodland and/or clay-based wetlands). Wattle Road Nature Reserve has transitional vegetation containing features of both banksia woodland and marri woodland.

The principal uses of the Shire reserves listed are conservation and recreation. The recreational uses include:

- Recreation centre and ovals – Brickwood Reserve
- Cemetery – Serpentine Cemetery Reserve
- Horse and pony clubs – Serpentine Sports Reserve and King Road Pony Club Reserve
- Golf club – Serpentine Sports Reserve
- Sports ovals – Mundijong Oval Reserve and Clem Kentish Reserve
- Airfield and aircraft hangars – Yangedi Airfield Reserve
- Clubhouses and community halls – Brickwood Reserve, Serpentine Sports Reserve, Mundijong Oval Reserve, Clem Kentish Reserve, Yangedi Airfield Reserve and King Road Pony Club Reserve
- Informal recreation – walking, riding, enjoyment of nature

1.2 Objectives

The objectives of this management plan are to:

- Provide background information and site descriptions for informed management of marri woodland.
- Provide a framework for developing action plans for individual reserves.
- Define specific management objectives for maintaining and improving the conservation values of marri woodland.
- Document the actions required to successfully manage marri woodland.
- Identify any management constraints and possible ways to overcome them.
- Ensure consistent management into the future.
- Provide a plan for user groups to follow when managing marri woodland.

1.3 Report Structure

This management plan is structured into the following sections:

- Background:
    - Identifies the location and physical characteristics of marri woodland.
    - Identifies the legislation and policies that apply and have management implications for marri woodland.

- Threats and pressures:
  - Analyses the threats to marri woodland.
- Reserves:
  - Identifies the locations of Shire reserves containing marri woodland, their vesting and tenure, and main user groups.
- Action Plan:
  - Provides guidance to land managers of marri woodland on actions common to management of all marri woodland.
- Reserve Action Plans:
  - Provides background information on Shire reserves containing marri woodland, their vesting and tenure, main user groups, threats and pressures, and relevant actions.

2. Background

2.1 Location

Marri woodland is a characteristic vegetation type of the Swan Coastal Plain and was formerly one of the most common vegetation types on heavy soils. Its main feature is a tree layer dominated by marri (*Corymbia calophylla*) with a highly diverse understorey.

Marri woodlands principally occur on the heavy, clay-dominated alluvial soils of the Pinjarra Plain on the eastern side of the Swan Coastal Plain. Limited areas can be found on the Ridge Hill Shelf (Forrestfield soil system). Marri woodlands in the Shire of Serpentine Jarrahdale occur on the Pinjarra Plain (Guildford soil system) and to a lesser extent the Ridge Hill Shelf (Forrestfield soil system), Beermullah and Dardanup soil systems.

The soil types of the coastal plain portion of the Shire of Serpentine Jarrahdale and their associated vegetation complexes are shown in Figure 1.

2.2 Soils

The exceptional biodiversity in marri woodland is due to long-term geological activity, resulting in variations in soil types within relatively short distances. Marri woodland occurs on the Swan Coastal Plain, where the soils originate from two sources. Firstly, erosion of the Darling Range formed the Pinjarra Plain soil complex, characterised by grey sandy duplex soils, clays, loams and gravels. Secondly, sea level fluctuations formed a series of sand dunes on top of the plain.

The Swan Coastal Plain has five main soil types, roughly located parallel to the coastline. The first three are sand dune systems with age increasing with distance from the coast (Quindalup, Spearwood and Bassendean systems), followed by the alluvial Pinjarra Plain and the Ridge Hill Shelf (Forrestfield soil system) at the foot of the Darling Scarp.

Marri woodlands principally occur on the heavy, clay-dominated alluvial soils of the Pinjarra Plain. Limited areas can be found on the Ridge Hill Shelf (Forrestfield soil system). Marri woodlands in the Shire of Serpentine Jarrahdale occur on the Pinjarra Plain (Guildford soil system) and to a lesser extent the Ridge Hill Shelf (Forrestfield soil system), Beermullah and Dardanup soil systems.

The coastal plain soil types of the Perth region are shown in Figure 2, and those of the Shire of Serpentine Jarrahdale in Figure 3.

Each general soil type (Pinjarra, Forrestfield etc.) can be further subdivided into soil landscape units (Pinjarra P1 phase, Pinjarra P2 phase etc.). The soil landscape units that occur in each reserve which contains marri woodland are listed in Table 1, with maps for each reserve included in their action plans.

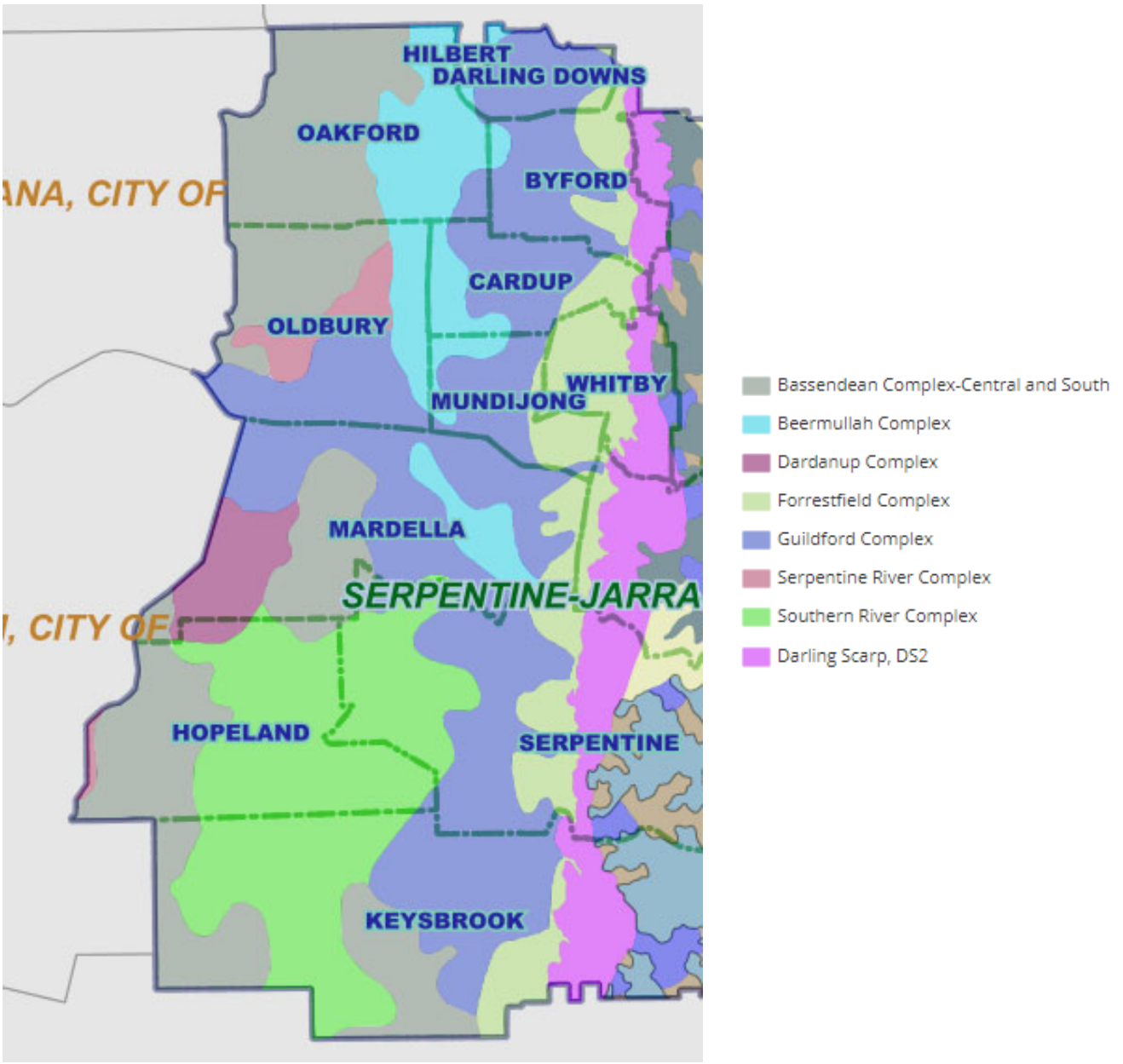


Figure 1: The coastal plain soil types and associated vegetation complexes of the Shire of Serpentine Jarrahdale.

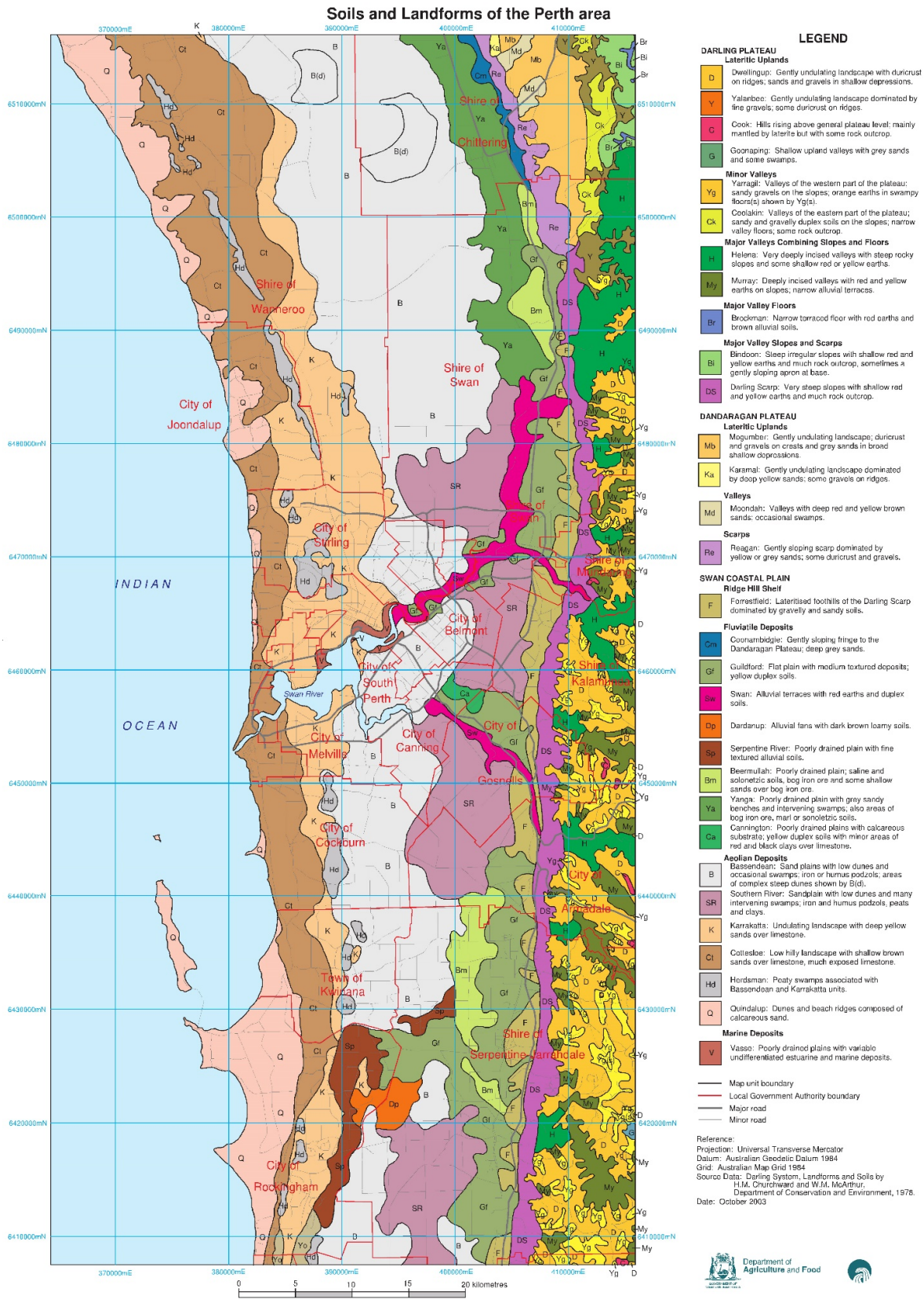


Figure 2: The coastal plain soil types of the Perth region, including the Shire of Serpentine Jarrahdale.

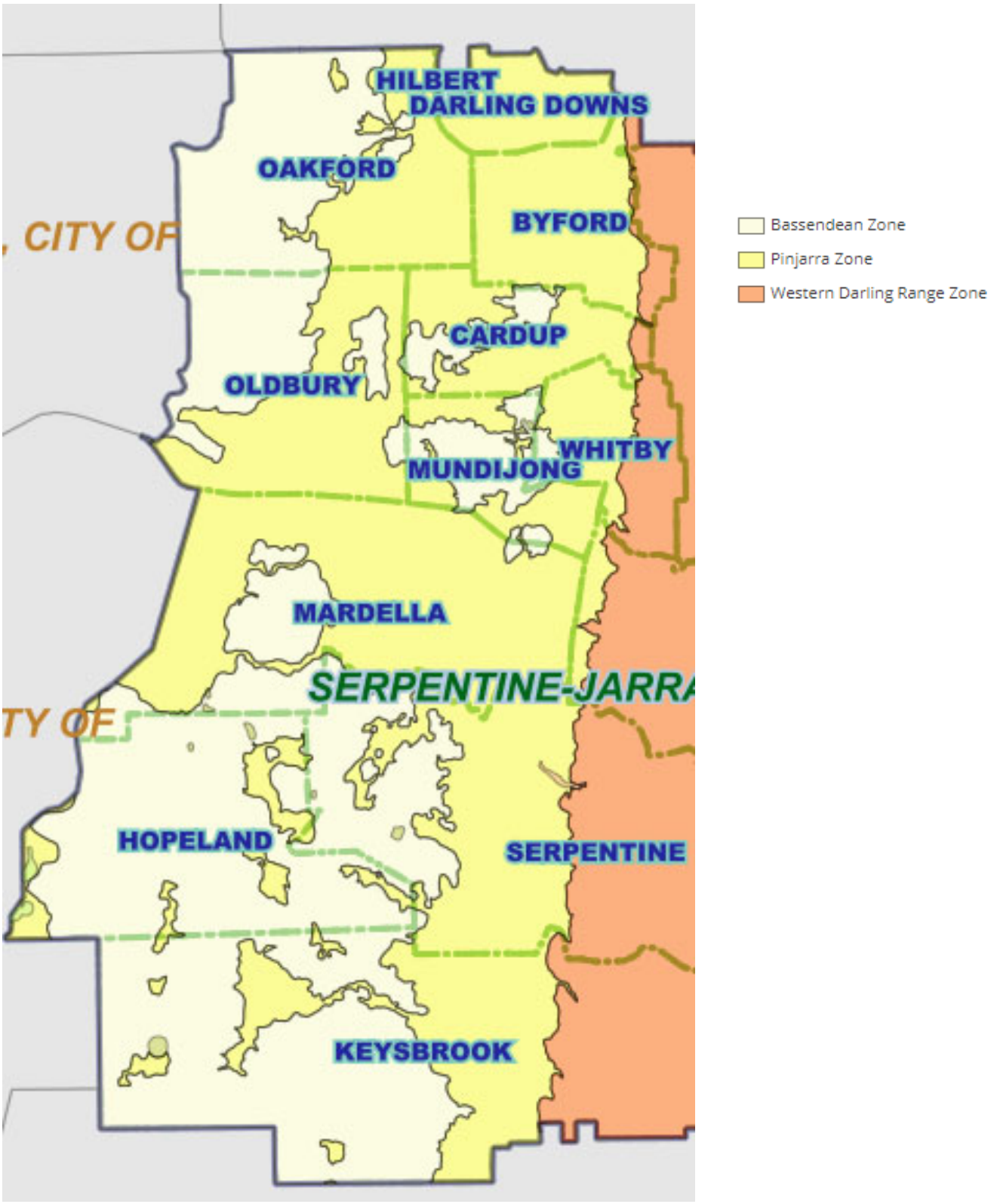


Figure 3: The coastal plain soil type zones of the Shire of Serpentine Jarrahdale.

Table 1: The soil landscape units that occur in each Shire reserve which contains marri woodland (for maps, refer to reserve action plans).

Reserve	Soil landscape unit	Description	Marri occurrence
Brickwood Reserve	Forrestfield F5 phase	Poorly defined stream channels on lowest slopes with deep acidic yellow duplex soils and sandy alluvial gradational brown earths.	Partial
	Pinjarra P1a phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or effective duplex) soils. Shallow pale sand to sandy loam over clay; imperfect to poorly drained and generally not susceptible to salinity.	Yes
	Pinjarra P1e phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or effective duplex) soils. Shallow pale sand to sandy loam over very gravelly clay; moderately well drained.	Yes
	Pinjarra B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	No
Serpentine Cemetery Reserve	Forrestfield (D Range) F7 phase	Alluvial fans on slopes <5-10%. Variable, imperfectly drained soils comprising layers of sand, sandy loam, clay, grit and weathered granitic detritus. Low woodland of *C. calophylla*, *Banksia attenuata* and *grandis* and some *Casuarina* spp.	Yes
	Forrestfield (D Range) F2 phase	Foot and low slopes < 10%. Well drained gravelly yellow or brown duplex soils with sandy topsoil. Woodland of *E. marginata, C. calophylla* and some *B. grandis.*	Yes
Serpentine Sports Reserve	Pinjarra B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	Partial
	Pinjarra B3 phase	Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam.	Partial
	Pinjarra P1b phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or effective duplex) soils. Moderately deep pale sand to loamy sand over clay: imperfectly drained and moderately susceptible to salinity in limited areas.	Yes
	Pinjarra P8 phase	Broad poorly drained flats and poorly defined stream channels with moderately deep to deep sands over mottled clays; acidic or less commonly alkaline gley and yellow duplex soils to uniform bleached or pale brown sands over clay.	Yes
Mundijong Oval Reserve	Bassendean B2a phase	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with an intensely coloured yellow B horizon usually well within 1 m of the surface.	Yes
	Pinjarra P1b phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or effective duplex) soils. Moderately deep pale sand to loamy sand over clay: imperfectly drained and moderately susceptible to salinity in limited areas.	Yes
Myara Brook Reserve	Pinjarra P9 phase	Shallowly incised stream channels of minor creeks and rivers with deep acidic mottled yellow duplex soils.	Partial
	Forrestfield F4 phase	Incised stream channels within gentle slopes with deep acidic yellow duplex soils and sandy alluvial gradational brown earths.	Partial
	Forrestfield F2b phase	Low slopes and foot slopes up to 5-10% with well drained moderately deep to deep, gravelly acidic yellow duplex soils and rare laterite.	Partial
	Pinjarra P1e phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or ieffective duplexl) soils. Shallow pale sand to sandy loam over very gravelly clay; moderately well drained.	Partial

Reserve	Soil landscape unit	Description	Marri occurrence
Oscar Bruns Reserve	Forrestfield F2b phase	Low slopes and foot slopes up to 5-10% with well drained moderately deep to deep, gravelly acidic yellow duplex soils and rare laterite.	Yes
Rainforest Reserve	Forrestfield (D Range) F2 phase	Foot and low slopes < 10%. Well drained gravelly yellow or brown duplex soils with sandy topsoil. Woodland of *E. marginata, C. calophylla* and some *B. grandis.*	Yes
Wattle Road Nature Reserve	Pinjarra B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	Partial
	Pinjarra P1b phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or ieffective duplexo) soils. Moderately deep pale sand to loamy sand over clay: imperfectly drained and moderately susceptible to salinity in limited areas	Partial
Clem Kentish Reserve	Pinjarra P3 phase	Flat to very gently undulating plain with deep, imperfect to poorly drained acidic gradational yellow or grey-brown earths and mottled yellow duplex soils, with loam to clay loam surface horizons.	No
	Pinjarra B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	Partial
	Pinjarra P6a phase	Very gently undulating alluvial terraces and low rises contiguous with the plain, with deep moderately well to well drained soils associated with major current river systems and larger streams. Acidic red and yellow duplex soils, less commonly gradational red and yellow earths.	Yes
Yangedi Airfield Reserve	Bassendean B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	No
	Bassendean B3 phase	Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam.	Partial
King Road Pony Club Reserve	Bassendean B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	No
	Bassendean B2 phase	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m.	No
	Bassendean B4 phase	Broad poorly drained sandplain with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan.	Yes
	Bassendean B6 phase	Sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands.	No
Craghill Way Reserve	Bassendean B2 phase	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m.	Partial
	Bassendean B6 phase	Sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands.	Partial

2.3 Biodiversity

2.3.1 Description

Marri woodland is a characteristic vegetation type on heavy soils on the eastern side of the Swan Coastal Plain and was formerly one of the most common vegetation types on these soils. Its main feature is a tree layer dominated by marri (*Corymbia calophylla*) with a highly diverse understorey.

Marri woodlands lie in the Swan Coastal Plain IBRA region, within which a variety of plant communities occur. The Heddle vegetation classification is based on soil types and landforms with some survey data, under which a vegetation complex contains plant communities that are associated with a single soil landscape system. By the Heddle classification, most marri woodlands are Guildford Complex (associated with Pinjarra Plain heavy soils), while others may be Forrestfield Complex (associated with the Ridge Hill Shelf / Foothills soils), Beermullah or Dardanup Complexes (associated with soils of the same name).

The Gibson analysis of communities on the Swan Coastal Plain (SCP) used the presence or absence of particular species in standard sample areas to define floristic groupings. Marri woodlands can fall within three floristic communities (sub-communities), which are:

- 3a (*Corymbia calophylla – Kingia australis* woodlands on heavy soils of the Swan Coastal Plain)
- 3b (*Corymbia calophylla – Eucalyptus marginata* woodlands on sandy clay soils of the southern Swan Coastal Plain)
- 3c (*Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands, Swan Coastal Plain)

The Shire of Serpentine Jarrahdale has twelve reserves that contain marri woodland. These reserves, their approximate area of marri woodland, and most likely community, are:

- Brickwood Reserve, Byford (40.6 ha, SCP3a)
- Serpentine Cemetery Reserve, Serpentine (2.1 ha, SCP3c)
- Serpentine Sports Reserve (Paul Robinson Reserve), Serpentine (3.8 ha, SCP3b)
- Mundijong Oval Reserve, Mundijong (2.07 ha, SCP3a and SCP3c)
- Myara Brook Reserve, Keysbrook (2.8 ha, SCP3c)
- Oscar Bruns Reserve, Darling Downs (1.67 ha, SCP3c)
- Rainforest Reserve, Byford (0.95 ha, SCP3a)
- Wattle Road Nature Reserve, Serpentine (0.97 ha, SCP3a)
- Clem Kentish Reserve, Serpentine (0.53 ha, SCP3c)
- Yangedi Airfield Reserve, Hopeland (4.6 ha, no survey data)
- King Road Pony Club Reserve, Oldbury (0.36 ha, SCP3b)
- Craghill Way Reserve, Oakford (0.32 ha, SCP3c)

Some of these reserves (Brickwood Reserve, Serpentine Sports Reserve, Myara Brook Reserve, Yangedi Airfield Reserve, King Road Pony Club Reserve and Craghill Way Reserve) also contain other types of vegetation (banksia woodland and/or clay-based wetlands). Wattle Road Nature Reserve has transitional vegetation containing features of both banksia and marri woodland.

2.3.2 Flora

Typical and common plant species in marri woodland vary according to the community type. In community 3a (*Corymbia calophylla – Kingia australis* woodlands) the typical and common species include:

- *Corymbia calophylla* (marri)

- *Eucalyptus lane-poolei* (salmon barked white gum)
- *Banksia dallanneyi* (*B. nivea*, couch honeypot)
- *Philotheca spicata* (pepper and salt)
- *Kingia australis* (kingia)
- *Xanthorrhoea preissii* (balga)
- *Cyathochaeta avenacea*
- *Dampiera linearis* (common dampiera)
- *Haemodorum laxum*
- *Desmocladus fasciculatus*
- *Mesomelaena tetragona* (semaphore sedge)
- *Tetraria octandra* (*Morelotia octandra*)

Typical and common species of community 3b (*Corymbia calophylla – Eucalyptus marginata* woodlands) include:

- *Corymbia calophylla* (marri)
- *Eucalyptus marginata* (jarrah)
- *Bossiaea eriocarpa* (common brown pea)
- *Conostylis juncea*
- *Hibbertia hypericoides* (yellow buttercups)
- *Tetraria octandra* (*Morelotia octandra*)
- *Chamaescilla corymbosa* (blue squill)
- *Desmocladus fasciculatus*
- *Banksia dallanneyi* (*B. nivea*, couch honeypot)
- *Mesomelaena tetragona* (semaphore sedge)
- *Baeckea camphorosmae* (*Babingtonia camphorosmae*, camphor myrtle)
- *Lepidosperma squamatum*
- *Neurachne alopecuroidea* (foxtail mulga grass)
- *Philotheca spicata* (pepper and salt)
- *Burchardia congesta* (milkmaids)
- *Caesia micrantha* (pale grass-lily)
- *Kingia australis* (kingia)
- *Drosera erythrorhiza* (red ink sundew)
- *Lomandra hermaphrodita*
- *Caladenia flava* (cowslip orchid)

Typical and common species of community 3c (*Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands) include:

- *Corymbia calophylla* (marri)
- *Eucalyptus wandoo* (wandoo)
- *Xanthorrhoea preissii* (balga)
- *Acacia pulchella* (prickly moses)
- *Banksia dallanneyi* (*B. nivea*, couch honeypot)
- *Gompholobium marginatum*
- *Hypocalymma angustifolium* (white myrtle)
- *Burchardia congesta* (milkmaids)
- *Cyathochaeta avenacea*
- *Neurachne alopecuroidea* (foxtail mulga grass)
- *Caesia micrantha* (pale grass-lily)

- *Mesomelaena tetragona* (semaphore sedge)
- *Tetraria octandra* (*Morelotia octandra*)
- *Desmocladus flexuosus*
- *Opercularia vaginata* (dog weed)
- *Sowerbaea laxiflora* (purple tassels)
- *Lepidosperma* spp.
- *Drosera menziesii* (pink rainbow)

Flora and vegetation surveys have identified and mapped vegetation units and floristic communities in some areas of marri woodland. Shire staff have carried out flora surveys within many Shire reserves, some associated with permanent monitoring quadrats and others as walk-though surveys. A consolidated list of the flora recorded in the Shire's marri woodland reserves can be found in Appendix 1.

Many areas of marri woodland contain or are associated with wetlands, which may be Conservation Category, Resource Enhancement or Multiple Use. Conservation Category wetlands are protected by State legislation, have high conservation value and should be managed to preserve wetland attributes and functions, while Resource Enhancement wetlands are partially modified with substantial ecological attributes and functions, and should be managed and restored to improve their conservation category. Weed presence varies in wetlands. They are naturally low nutrient environments and any increase affects the vigour of the native plants and delivers a competitive advantage to introduced plants.

2.3.3 Fauna

Marri woodlands support a rich and diverse array of fauna species. Over 70% of native mammals have become regionally extinct, and others have declined in numbers or reduced in range. Larger patches of marri woodland can still support viable populations of small mammals such as the ash-grey mouse. The quenda (southern bandicoot) occurs in many areas of marri woodland, where wide-spread and numerous scratchings can indicate that there may be a breeding population present. Kangaroos can be found in larger marri woodland remnants, particularly those connected to other natural areas.

Birds are abundant and diverse. The most iconic bird species are the three species of black cockatoos which are frequently found in marri woodland feeding on the nuts. These birds are protected under Commonwealth as well as State legislation. Black cockatoos feed on local species such as marri and banksia. Cockatoo breeding has been recorded on the Swan Coastal Plain, requiring large tree hollows which only form in larger trees such as mature marris.

The Swan Coastal Plain has an exceptional reptile species richness. Some reptile species are endemic, and others are nearly so. There is a distinct change in reptile assemblages across the Plain that reflects the underlying soil structures and their vegetation. Frog calls are frequent in wetlands, and frogs are likely an important dietary component for snakes and lizards.

The invertebrates are less well known, but there are several endemic species and a clear association between some groups and landform types. Pollinating and herbivorous insects are often host-specific, which is likely to contribute to community endemism.

Rabbits are a major threat in marri woodland, damaging vegetation and introducing weeds. Periodical control of rabbits can occur in larger areas of bushland. Feral cats and foxes predate on native animals.

Fauna surveys, of mammals, reptiles and birds, have occurred in some areas of marri woodland. A consolidated list of the fauna recorded in the Shire's marri woodland reserves can be found in Appendix 2.

2.4 Water Resources

Water is essential to the survival of marri woodlands. The three marri dominated communities occur on the heavy soils of the Pinjarra Plain, with floristic composition varying with water regime. Community 3a (*Corymbia calophylla – Kingia australis* woodlands) occurs on the wettest sites, with groundwater generally within 3m of the ground surface. This community type is a wetland that is highly dependent on groundwater and surface water. Community 3c (*Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands) occurs on the driest sites, with community 3b (*Corymbia calophylla – Eucalyptus marginata* woodlands) occurring on intermediate sites with usually a sandier soil composition. All three communities are highly dependent on groundwater and surface water and are frequently co-located with wetland communities.

Water resources provide a variety of ecosystem services and include waterways, drains, wetlands, and superficial and artesian groundwater. Groundwater provides storage that interacts with the surface wetlands. During long dry spells the groundwater supports surface water and wetland ecosystems. This relationship, and the inundation of the wetlands, is threatened by groundwater drawdown from increased usage and reduced recharge.

2.4.1 Surface Water

The majority of the coastal plain portion of the Shire of Serpentine Jarrahdale is low-lying and originally formed a variety of wetlands and seasonally inundated lands. From the 1920s, a network of drains was constructed to reduce inundation and enable agriculture. The drains flow west to the Serpentine River and the Peel Inlet.

The Peel Harvey Estuary is of regional, national and international significance and levels of protection. The estuary has been severely degraded by nutrients from the catchment which cause algal blooms (eutrophication), which reduce oxygen levels in the water and contribute to fish deaths and ecosystem changes. The Dawesville Channel increased estuarine flushing, and water quality has also been improved through better land management to reduce nutrient inputs.

Catchment land use is subject to policies that set nutrient export targets. These include a maximum phosphorus load from the Serpentine River, water management plans for recreation facilities, and maximum nutrient (fertiliser) application rates for nitrogen and phosphorus.

Average annual rainfall has decreased, dominated by reduced winter rainfall, and resulting in decreased annual stream flow. Many waterways from the plateau have reduced flow, or flow seasonally or intermittently rather than permanently.

Many of the Shire reserves containing marri woodland are associated with surface water features, including waterways, drains, wetlands and water bodies. These features are detailed in Table 2 and maps can be found in the individual reserve action plans. The classification of wetlands as Conservation Category, Resource Enhancement or Multiple Use is described in section 2.6.

Table 2: Surface water features of marri woodland reserves in the Shire of Serpentine Jarrahdale.

Reserve	Surface water features
Brickwood Reserve	A clay-based wetland lies in the southeast of the reserve. A waterway drains the wetland to the west. All of the reserve, except the recreational facilities and the banksia woodland, is a Conservation Category wetland.
Serpentine Cemetery Reserve	The Serpentine River adjoins the reserve to the south. Watercourses run to the river to the east and west of the reserve. A Multiple Use wetland surrounds the reserve on the north, west and south.
Serpentine Sports Reserve	A clay based Conservation Category wetland lies to the southeast of the banksia woodland. A drain runs along the boundary between the ovals and the bushland, with a dam towards the western side. The majority of the reserve, except for the northern boundary and the banksia woodland (and some marri to its east) is a Resource Enhancement wetland.
Mundijong Oval Reserve	Watercourses run along the western and southern boundaries of the reserve. The southwest corner of the reserve is a Conservation Category wetland which extends to the south, and to the west as a Multiple Use wetland.
Myara Brook Reserve	Myara Brook runs along the length of the reserve. The northeastern part of the reserve, including the watercourse (Myara Brook) and its northeastern bank, is a Conservation Category wetland, surrounded by Multiple Use wetland.
Oscar Bruns Reserve	The Wungong River runs 250 m north of the reserve. A Multiple Use wetland surrounds the reserve to the west and north.
Rainforest Reserve	Watercourses (drains) run through nearby reserves to discharge to the west. The reserve and its surrounding areas are not registered as wetlands
Wattle Road Nature Reserve	A drain runs along the curve of the northern boundary of the reserve. A Resource Enhancement wetland covers the eastern, northern and western edges of the reserve.
Clem Kentish Reserve	A watercourse runs to the east of the reserve, discharging into the Serpentine River 250 m to the north. The western part of the reserve is a Resource Enhancement wetland, and the remainder is Multiple Use.
Yangedi Airfield Reserve	A clay-based wetland lies in the northeastern corner of the reserve. A drain runs through the southeastern corner of the reserve. The area southeast of the main runway is Multiple Use wetland, with a Resource Enhancement wetland over the clay-based wetland, and Conservation Category wetlands between the runways and south of the grass runway. A third Conservation Category wetland lies north of the hangars, near the northern boundary of the reserve.
King Road Pony Club Reserve	Conservation Category wetlands lie to the east and west of the reserve. A drain runs along the northern boundary. Multiple Use wetlands intersect the western and eastern corners of the reserve, buffering the nearby Conservation Category wetlands.
Craghill Way Reserve	The northern and eastern part of the reserve is a Resource Enhancement wetland, extending to Multiple Use outside the reserve boundaries.

2.4.2 Groundwater

Extensive supplies of groundwater are contained in superficial aquifers. In general, Bassendean sands store more water than the Pinjarra soils. One of the most significant threats to ecosystems in the Swan Coastal Plain is declining water tables due to increased groundwater abstraction, patterns in water regulation and decreased rainfall and subsequent groundwater recharge.

Groundwater decline is not only influenced by extraction but also by declining rainfall and recharge rates as a result of climate change. Average annual rainfall has decreased, dominated by reduced winter rainfall, and resulting in decreased annual stream flow.

The older underlying sediments contain substantial quantities of groundwater in confined (artesian) aquifers. Water leaks down and up between the two aquifers. Groundwater movement is generally from east to west, but flows close to the Serpentine River are more complex. The superficial aquifer discharges to the river (and the artificial surface drains), and water leaks upward to recharge it.

2.5 Heritage

2.5.1 Aboriginal Heritage

Local Aboriginal people are part of the Noongar community, whose territory covers the area southwest of a line from Geraldton to Esperance. Prior to European settlement, family groups in the Serpentine Jarrahdale region were part of the Wadjuk tribe. During the post-European settlement period, forced migration to Aboriginal settlement camps or into areas where labour was required resulted in a shift of tribal groups.

Noongar family groups did not have permanent places of habitation and generally moved along major river systems, such as the Serpentine and Murray, or chains of freshwater bodies. The family groups would camp for short periods of time at favoured points where food and water were reliable.

The water systems are spiritual places for Aboriginal people. Local tradition records that Waugal, the dreaming ancestor, created the Murray and Serpentine river systems. The Waugal is a spiritual force with a physical serpentine manifestation that is widespread throughout the southwest region. Most of the major rivers that drain the Darling Range, and many creeks, springs, pools, swamps and lakes within the Swan Coastal Plain, are associated with the Waugal belief.

The Shire's large expanses of level to undulating plain were mostly inundated swamp land during winter. Wetlands would have been a source of food and may have held spiritual meaning for the local Aboriginal people. The higher sandy rises with banksia woodland provided dry areas to camp.

The Swan Coastal Plain has a high density of Aboriginal archaeological sites, associated with the richness of food resources. The State government currently has 23 heritage sites registered in the Shire, and an additional 63 sites are not (or not yet) registered. All places and objects of Aboriginal importance are protected by State legislation. The Serpentine River is listed on the register of mythological and ceremonial sites and includes a wide buffer to cover all the Aboriginal values in the vicinity.

A Native Title Claim was registered over land including the Shire of Serpentine Jarrahdale, to enable local Aboriginal people to have their rights and interests recognised under Australian law. This claim was resolved as part of the South West Native Title Settlement, the details of which are recorded in six Indigenous Land Use Agreements (ILUAs), including the Gnaala Karla Booja ILUA which covers the Shire. The Native Title Registrar registered the ILUAs in October 2018. Applications for judicial review of the Registrar's decision were rejected by the Federal Court in December 2019, and applications seeking special leave to appeal the decision of the Federal Court were rejected by the High Court in November 2020. Resolution of all legal proceedings has cleared the way for implementation of the Settlement. The Gnaala Karla Booja ILUA is being co-ordinated by the South West Aboriginal Land and Sea Council.

To date no formal consultation has occurred with either the South West Aboriginal Land and Sea Council or local Noongar people regarding management of marri woodland. A lack of effective

consultation with Noongar people and their representatives could lead to poor management decisions, conflict of use and the degradation of Aboriginal values.

2.5.2 European Heritage

In March 1827, Captain James Stirling arrived in the Swan River, and the Swan River Settlement was founded in June 1829. In 1830, Mandurah was established and settlers moved up the Murray River.

Navigational difficulties on the Serpentine River delayed settlement. The area was part of a massive 250,000 acre land grant to Thomas Peel, but the nature of the land and vegetation, and the availability of good agricultural land elsewhere, ensured that it mostly remained in its natural state for many years.

Some small farms were established below the scarp in 1865. The Serpentine settlement was about 1 km east of its present location, but in 1893, the railway almost complete, the present townsite was gazetted.

Major agricultural development occurred with the group settlement scheme in the early 1920s. Land from the Peel Estate was bought by the Government for settlers from England. The sandy soil and persistent winter inundation made the transition to farmland particularly difficult.

A program to drain the group settlement areas began in 1922. Large drains were cut with the aid of horse-drawn carts and finished by hand, completing 540 km by 1925. The drainage network was later expanded, with administration and management taken over during the 1950s by the Public Works Department, later to become the Water Corporation.

Comprehensive and accurate records of reserve activities and developments should be kept. There are no obvious historical remains on many reserves, but visitor experience could be enriched by signage on site, museum displays, school programs and other publications.

The biodiversity conservation value of reserves is generally not devalued by their historic or current use. Management plans include actions for establishing, monitoring and managing these assets while allowing for their use in such a way that their conservation value is maintained.

2.6 Policy and Legislation

2.6.1 Federal Legislation

The key item of Federal legislation is the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In 2000 communities 3a (marri-kingia woodlands) and 3c (marri-xanthorrhoea woodlands) were listed as Endangered under this Act, with the listing approved by the Minister in 2017. The listing means that marri woodlands have been assessed as both having undergone a high degree of loss and being under a continued high level of threat.

Due to the very restricted distribution of these communities, no condition thresholds have been applied to the listed ecological communities and all areas meeting the relevant descriptions are habitat areas critical to their survival. This means that ten of the twelve Shire reserves containing marri woodland are protected under the EPBC Act (excluding King Road Pony Club Reserve and Serpentine Sports Reserve, which contain community 3b).

As the edges of a patch are particularly sensitive to disturbance, a buffer zone may be appropriate to protect the marri woodland but is not formally protected under the EPBC Act. The recommended minimum buffer zone is 20-50m, depending on local context and the conservation value of the patch (wider buffers for higher value patches).

The EPBC Act allows for the listing of key threatening processes (as well as threatened communities and species). These are discussed further in section 3.

2.6.2 State Legislation

The key item of State legislation is the *Biodiversity Conservation Act 2016* (BC Act). The BC Act allows for the listing of Threatened Ecological Communities, and of Threatened plants and animals. Community 3a (marri-kingia woodland) is listed as Critically Endangered and communities 3b (marri-jarrah woodland) and 3c (marri-xanthorrhoea woodland) as Endangered.

Threatened ecological communities (TECs) are also protected under Western Australian legislation through the *Environmental Protection Act 1986* and *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. A clearing permit is required for the removal of any native vegetation, with a presumption against the clearing of a TEC.

2.6.3 State Policy and Guidelines

There are two key items of State policy that provide protection to marri woodland. The first is *State Planning Policy 2.8 Bushland Policy for the Perth Metropolitan Region* (SPP2.8, often referred to as the Bush Forever policy). It identifies areas of regionally significant bushland and strategies for their protection. Many marri woodland areas are mapped as Bush Forever, sometimes grouped with vegetation on adjacent properties to form a larger, more significant area. Bush Forever areas are afforded a higher level of protection.

Brickwood Reserve, Serpentine Cemetery Reserve, Serpentine Sports Reserve, Mundijong Oval Reserve, Myara Brook Reserve, Oscar Bruns Reserve and Yangedi Airfield Reserve are listed as Bush Forever. SPP2.8 classifies bushland that is outside Bush Forever areas as Local Bushland, which should be protected by a local government under a local biodiversity strategy.

The second item of State policy is *Statement of Planning Policy No. 2 Environment and Natural Resources Policy* (SPP2). The objectives of SPP2 are to integrate environmental management with land use planning, to protect the natural environment, and to promote sustainable use of natural resources. This includes avoiding development that may cause unacceptable environmental damage and considering mechanisms to protect areas of high biodiversity and/or conservation value. There are also measures relating to water resources, air quality, soil and land quality, basic raw materials, and greenhouse gas emissions, all of which aid in the protection of biodiversity.

State guidelines have produced the *Geomorphic Wetlands Swan Coastal Plain* dataset, under which wetlands have been evaluated and assigned a management category to provide guidance on how they should be managed and protected. These management categories are:

- Conservation – wetlands which support a high level of attributes and functions
    - Highest priority wetlands.
    - Objective is to preserve and protect the existing conservation values of the wetlands through various mechanisms including:
        - reservation in national parks, crown reserves and State owned land
        - protection under Environmental Protection Policies
        - wetland covenanting by landowners
    - No development or clearing is considered appropriate. These are the most valuable wetlands and any activity that may lead to further loss or degradation is inappropriate.
- Resource Enhancement – Wetlands which may have been partially modified but still support substantial ecological attributes and functions

- Priority wetlands
- Ultimate objective is to manage, restore and protect towards improving their conservation value. These wetlands have the potential to be restored to Conservation category. This can be achieved by restoring wetland function, structure and biodiversity.
- Protection is recommended through a number of mechanisms.

- Multiple Use – Wetlands with few remaining important attributes and functions
  - Use, development and management should be considered in the context of ecologically sustainable development and best management practice catchment planning through landcare.

2.6.4 Local Legislation and Policy

The Shire of Serpentine Jarrahdale has a number of policy measures that assist in the conservation and protection of marri woodland. These include:

- Local Planning Scheme No. 3 – provides protection to all vegetation by requiring development approval for all vegetation removal
- Local Biodiversity Strategy 2008 – protects areas of bushland that are not protected under other measures such as Bush Forever
- Local Planning Policy 2.8 Biodiversity Planning Policy – incorporates biodiversity protection into planning and development decision-making
- Urban and Rural Forest Strategy 2017 – protects trees and canopy cover throughout the Shire
- State of the Environment Report 2019 – protects the environment in the context of expected growth
- Significant Tree Register – allows for the listing of special and significant trees

3. Threats and Pressures

In 2017 (the most recent data available), the “Guildford” vegetation complex (which roughly equates to marri woodland) was assessed as having 5% remaining, and only 4% in the Shire of Serpentine Jarrahdale. The extent of clearing on the coastal plain portion of the Shire of Serpentine Jarrahdale can be seen by comparison of Figures 4 and 5, and that very little vegetation on heavy soils remains.

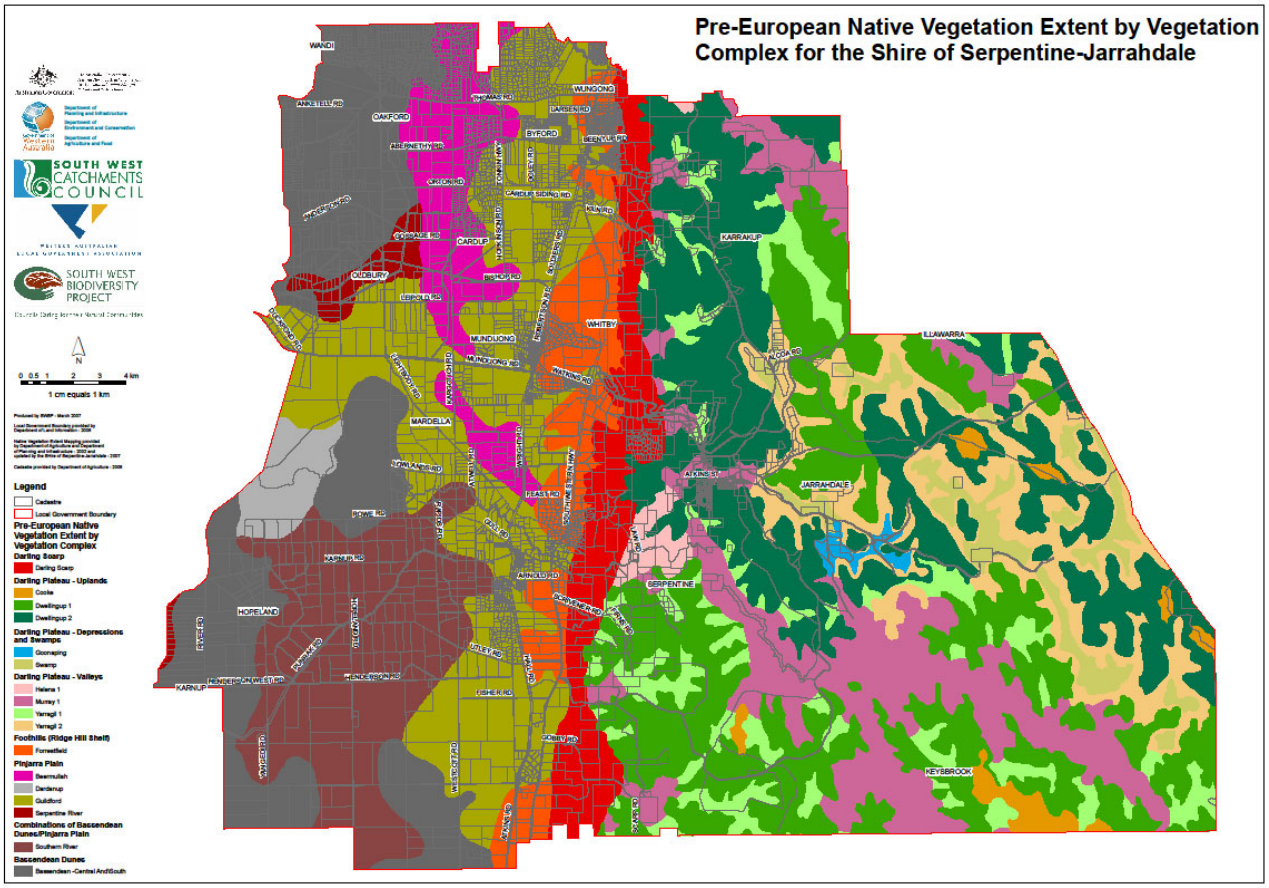


Figure 4: Pre-European Native Vegetation Extent and Complexes for the Shire of Serpentine Jarrahdale (South West Biodiversity Project, 2007).

The threats to marri woodland are many and significant, including:

- Clearing and fragmentation
- Altered fire regimes
- Invasive species
- Hydrological changes
- Introduction of disease

- Climate change
- Fauna decline

These threats apply to all areas of marri woodland to a greater or lesser extent.

The EPBC Act allows for the listing of key threatening processes, as well as threatened communities and species. The listed key threatening processes that are relevant to marri woodland are:

- Land clearance
- Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*)
- Novel biota and their impact on biodiversity
- Competition and land degradation by rabbits
- Predation by European red fox
- Predation by feral cats
- Predation, habitat degradation, competition and disease transmission by feral pigs
- Fire regimes that cause declines in biodiversity
- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases

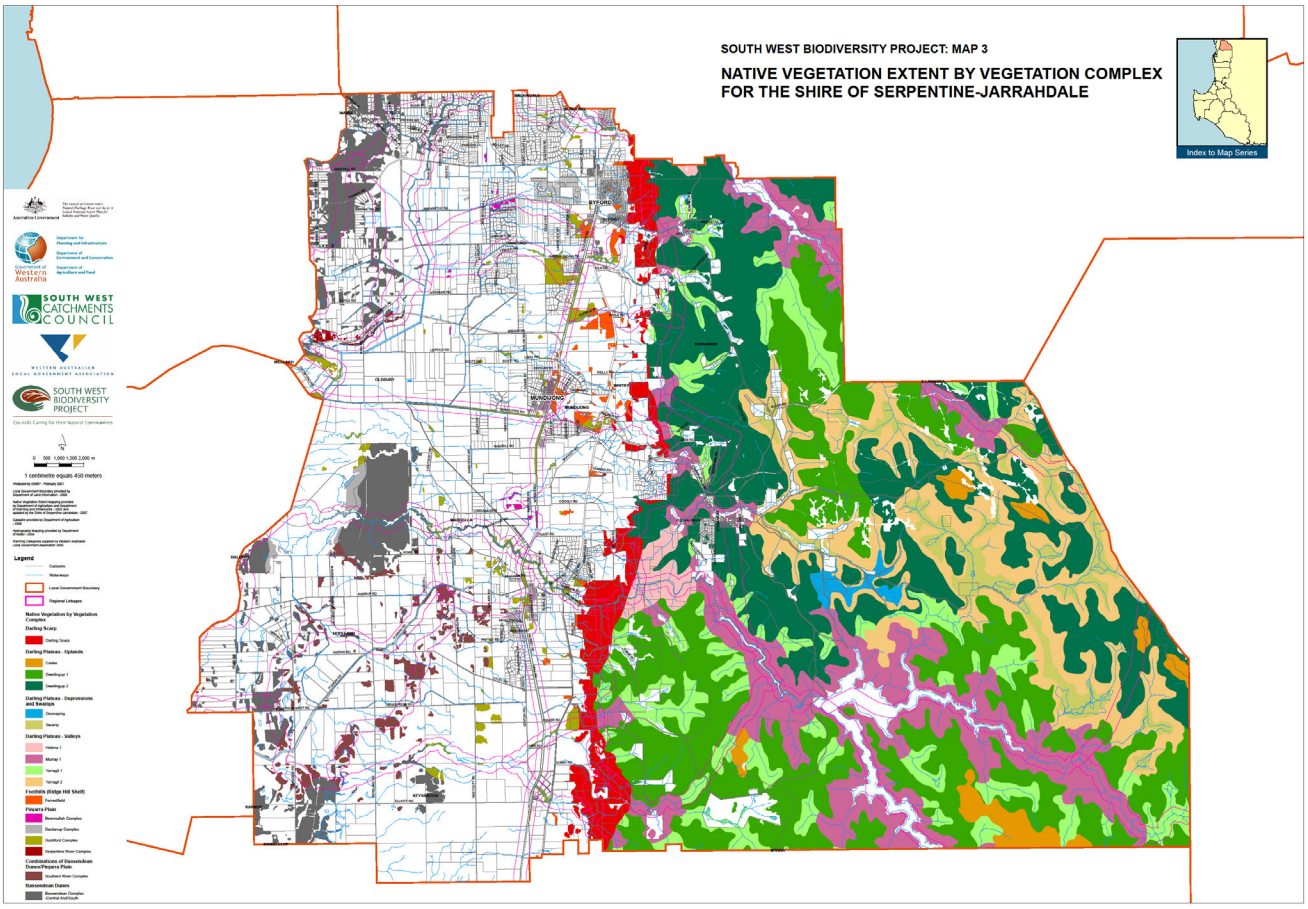


Figure 5: Native Vegetation Extent and Complexes for the Shire of Serpentine Jarrahdale (South West Biodiversity Project, 2007).

3.1 Clearing and Fragmentation

Clearing for agriculture has been extensive on the heavy soils on the eastern side of the Swan Coastal Plain, with approximately 97% of all vegetation in the area being cleared. The marri dominated types on these heavy soils were probably some of the most common on this portion of the plain but are now very rare and are likely to be at least 90% cleared. Many areas of marri woodland were cleared historically for agriculture, residential or other uses, and have been grazed or otherwise disturbed since and have not regenerated. Most remnants are surrounded by cleared land.

These historical losses have ongoing consequences for the conservation of marri woodland in terms of reduced range of variation, and ongoing threats related to fragmentation and disruption of ecological processes. Pressure for future clearing is accelerating and likely to be associated with developments for road works, housing or industry.

Land clearing, development and intensification of land use results in habitat loss, fragmentation and change. Clearing reduces the amount of vegetation and isolates remaining patches, reducing connectivity. Connectivity is important for landscape scale habitat quality for flora and fauna, as well as condition and persistence of marri woodland.

Urbanisation has recently been the main driver of marri woodland clearing and fragmentation. The Shire of Serpentine Jarrahdale is one of the fastest growing local government areas in Australia, with associated rapid urbanisation and development which drives clearing and fragmentation. Impacts are likely to spread as development encroaches on remnant vegetation.

Fragmentation results in reduced connectivity for flora and fauna, impedes movement and dispersal, and causes greater “edge effects” in remaining patches. Edge effects refer to the penetration of disturbance (human impacts, invasive species etc.) relatively further into the vegetation remnant where the patch is smaller and has a greater edge to area ratio. Disturbance is more likely in urban and peri-urban areas due to the proximity to people, and these patches are prone to impacts such as rubbish dumping, unauthorised vehicle access, walking paths, vegetation removal (e.g. for firewood), more bare ground, inappropriate fire regimes, and animal invasion.

Many plant species need both burnt occupied and unoccupied sites for seed dispersal and colonisation. Fragmentation creates barriers to dispersal and fewer opportunities for colonisation. Long distance dispersal is required to adapt to rapid climate change and is less likely in a fragmented landscape. Fragmentation reduces the ability of flora and fauna to escape from or recolonise after disturbances such as fire.

The impacts of fragmentation may take time to become apparent but are generally more rapid in smaller remnants. Plant species richness declines with time since isolation, associated with altered soil properties such as increased litter depth and increased weed invasion. Bird numbers and diversity are related to the amount of other vegetation patches in the immediate surroundings. Reptiles are more common and diverse in larger areas of bushland. Fragmentation into smaller, more degraded patches limits both plant and animal diversity.

There is evidence of ongoing degradation and fragmentation of native vegetation within the Swan Coastal Plain. Remnants are smaller, closer to highly modified landscapes, have altered vegetation structures and lose species richness. The impacts are greater in the central and southern parts of Perth due to more intensive development. The metropolitan area effectively bisects the Swan Coastal Plain and represents a significant, often impenetrable barrier to the remnant populations of many species that prevents processes necessary for their future survival. There is an ‘extinction debt’ inherent in all smaller fragments that is likely to result in ongoing local extinctions and changes in species assemblages.

Clearing, fragmentation and degradation of marri woodland are ongoing in the Shire of Serpentine Jarrahdale. Development often requires the clearing of marri woodland, and remaining buffer areas are fragmented and impacted by the effects of excavation, such as declining groundwater. While the Shire endeavours to retain and protect native vegetation, the applicant can appeal a refusal to the State Administrative Tribunal.

Degradation of marri woodland in or near urban areas is a continual issue. The rapid growth of the Shire of Serpentine Jarrahdale means that previously isolated reserves are coming under increasing pressure from encroaching urban development. The pressures are most commonly in the form of increased recreational use (with associated trampling, informal path creation, and impacts on wildlife by dogs) and concern about fire hazard (with associated pressure for control burning).

3.2 Altered Fire Regimes

Prior to European settlement, some fires occurred through lightning strikes and Aboriginal burning of the landscape. It is likely that the Swan Coastal Plan had a mosaic of burning regimes from regular burning to long unburnt. Mediterranean ecosystems are usually fire prone and may require a particular fire regime to assist regeneration.

Some fire regimes are a major threat to the long-term survival, diversity, viability and conservation of communities, habitats and species populations. These are the result of cool-season prescribed burning and high overall frequency of fires. While many plants and ecosystems are resilient to a range of fire regimes, marri woodlands and some component species respond to fire in ways that require fire-free intervals long enough to build up seed resources and sensitivity of resprouting species to cool season fires.

Recently, fires have occurred as a result of fire management practices, escapes from prescribed burning, arson, and accidental ignition. There has been a change in fire regime in many areas, with a skewed distribution of frequency to less than seven-year intervals.

Higher frequency fire regimes and burning during the growing/seeding season (late autumn to late spring) result in the following changes to marri woodlands:

- Structural change (reduced canopy cover and loss of resprouting shrub cover)
- A shift from native species to introduced species (increased weed abundance and diversity)
- Decrease in native plant cover, richness and diversity
- Changes to ecological function
- Feedback loops that promote weed species and the expense of native plants (e.g. highly flammable veldt grass *Ehrharta calycina* infestations promote further fires, with higher fire frequencies reducing the cover and regeneration capacity of native plants)

There is no single optimum fire regime that will meet all management objectives, but that there are fire regimes that can be applied based on available evidence. The recommendation is for fire regimes that provide for diversity of frequency, season and intensity, and provide habitat diversity and a fine-grain mosaic of habitats.

The juvenile period of plant species that are killed by fire and only reproduce from seed can be used as a guide to determine minimum inter-fire intervals, which should be at least twice the juvenile period of the slowest maturing species. In fire-sensitive habitats, this may be increased to 3-4 times the juvenile period for fire-sensitive species. *Hakea trifurcata* and *Petrophile serruriae* are killed by fire and reproduce only from seed. Their juvenile period is 48 months, therefore a minimum inter-fire period of eight years and up to 16 years would be recommended. The juvenile period for other species in marri woodland is also quite long. For example, although *Regelia ciliata* and *Melaleuca*

tricophylla survive fire, they have a juvenile period of 60 and 72 months respectively. Long juvenile periods should be taken into account when designing appropriate fire regimes for marri woodland.

The richness and diversity of fauna is generally maximised by avoiding widespread intense fires and maintaining a diversity of vegetation successional stages to provide habitat diversity. The fire responses of fauna vary depending on the extent of, and interaction of fire with, habitat fragmentation and other disturbances. In general, many native fauna groups in marri woodland prefer long-unburnt areas (more than 16 years fire interval) and become more abundant with increasing time since fire.

Current fire prescriptions reduce the availability of longer unburnt habitats. For marri woodlands overall, the recommended fire intervals based on life history traits of flora and fauna are:

- Minimum 8-16 years
- Maximum 40 years
- Ideal fire cycle 24-28 years

However, the distribution of post-fire ages of marri woodland is skewed to 1-6 years from last fire. There are also few unburnt patches within individual burns, indicating that fire patterns are not mosaics. This reduces the chance of an area of suitable habitat being available. Smaller and more isolated remnants that escape frequent burns are increasingly important.

Remnant marri woodland areas that are small and isolated are particularly sensitive to fire. A high intensity fire that affects the whole area may change the structure of the community, and the loss of populations of rare plants. Small remnants also have more problems with post-fire recovery, such as kangaroo grazing and weed invasion.

The drying climate and interactions with diseases also need to be considered when designing appropriate fire regimes. It is likely that reduced rainfall will cause slower growth rates, and plant maturation times will also therefore increase. Longer inter-fire intervals will therefore be desirable.

3.3 Invasive Species

3.3.1 Plants

Weeds are a major ongoing problem, particularly in urban areas with significant weed seed banks and ongoing weed invasion from urban boundaries. Most exotic plant species in marri woodlands are herbs and grasses from the Mediterranean Basin, California and South Africa.

The weed species with the greatest effect on community composition are African perennial grasses (e.g. perennial veldgrass), and bulbous weeds such as gladiolus, as they not only transform the ecological character of the community but also reduce the diversity of the native shrubs and herbs.

Other weeds can increase fuel loads in bushland, resulting in native remnants becoming more prone to fire, and to more frequent fires (particularly perennial veldt grass, wild oats, ursinia and fleabane). Increased fire frequency creates feedback loops that promote the greater presence of weed species due to their shorter generation lengths, higher seedbanks and faster response to postfire ash-bed nutrients than many native species.

Disturbances such as fires and grazing can make weed invasion more likely if weed seeds are present. All remnants of marri woodland are close to weed sources such as urban or agricultural areas and would be vulnerable to weed invasion following any disturbance. However, even small remnants often exhibit surprising resistance to weed invasion particularly if left undisturbed. In marri woodland, resistance to weed invasion relates to the density of cover, seasonal inundation and the hardness of the soils in summer; and alteration of any of these factors reduces the ability to resist weed invasion.

There are tracks through most remnants of marri woodland. Weeds have invaded to varying extents along these tracks and should be considered a priority for weed control. Piles of soil scraped from tracks generally contain high concentrations of weeds and act as a source of weed invasion. Piles of soil should be avoided when tracks are cleared or be removed.

The primary means of controlling weeds in remnant vegetation is to avoid disturbance. The second strategy is to reduce the carriers of weed seed, including introduced materials such as soil, and exclude sources such as storm-water runoff that can introduce nutrients and other pollutants. Large-scale weed control must be integrated with revegetation, otherwise the bare areas will be recolonised by weeds. The control of weeds that provide significant habitat values also needs to be carefully planned and integrated with revegetation.

The aims of weed control are to maintain the pre-invasion condition of the habitat (prevention), control or arrest ongoing weed invasion (intervention), and reverse the degraded condition of the habitat where applicable (rehabilitation). Disturbances such as fires need to be followed up with a post-disturbance weed control program that responds to weed establishment, particularly in the following 1–2 years after disturbance. Subsequent control of weeds is very important to prevent their re-establishment.

3.3.2 Animals

Introduced animals affect biodiversity values through habitat modification, predation, grazing and competition. Common invasive animals include the European rabbit, red fox, cat, black rat, house mouse, long-billed corella, little corella, rainbow lorikeets, laughing kookaburra and the introduced honey bee. There can be many kangaroos in small fragmented reserves, and wild pigs in wetland areas. Feral animals are difficult to control, particularly in urban settings, due to safety considerations for non-target species and the public.

Foxes and cats are now the primary predators on remaining native animals (e.g. quenda) and have contributed to local extinctions of other native animals. Non-native herbivores promote non-native herbaceous species, possibly through the disturbance of topsoil through their digging habits. Given that small to medium native mammals are now largely absent from the community, digging by non-native mammals such as the European rabbit now results in weed invasion, due to the large weed seed banks present at many sites. Disturbance of topsoil is known to promote invasion, as it provides an opportunity for establishment by non-native species, which are abundant in the topsoil seed bank, and germinate and grow faster than native species.

Whilst native herbivores suppress non-native herbaceous species abundance, non-native herbivores such as the European rabbit promote non-native herbaceous species abundance as a result of their digging activities that promote germination of the weed soil seed bank.

Grazing of plant communities by feral herbivores such as rabbits causes alterations to species composition by the selective removal of edible species and the introduction and encouragement of weeds by the addition of dung, and through trampling and general disturbance. Some remnants of marri woodland have been grazed by livestock historically. The significance of the impact of grazing has not been quantified.

3.4 Hydrological Changes

One of the most significant threats to ecosystems in the Swan Coastal Plain is declining water tables due to increased groundwater abstraction, patterns in water regulation and decreased rainfall and subsequent groundwater recharge. Impacts range from a gradual change in structure and composition to sudden and widespread vegetation death.

The hydrology of areas of the eastern side of the Swan Coastal Plain has been altered through the construction of drains to lower the water table. The area is characterised by much valued heavy soils, which were historically highly cleared for agriculture. Despite a likely increase in runoff and recharge of the groundwater resulting from this clearing, drainage has probably brought about an overall lowering of the water table in localised areas. Altered surface flow and/or alteration of the height of the local water table may change the length of the period or the depth of any ponding.

Remnants of marri woodland may become inundated in the wetter months due to rainfall and surface flows because marri woodland occurs mainly on soils that contain a clay layer that is quite impervious. In some areas groundwater is very close to the surface.

Available hydrological and floristic data indicate that marri woodland is a wetland and that groundwater is likely to be generally less than 3m below the surface in remnants. Wetlands in which the groundwater is within 0–3m of natural ground surface are highly susceptible to changes in groundwater levels and would be considered to be highly groundwater dependent.

Groundwater decline is not only influenced by extraction but also by declining rainfall and recharge rates as a result of climate change. Average annual rainfall has decreased, dominated by reduced winter rainfall, and resulting in decreased annual stream flow. Changes in soil temperature and distribution of surface water will impact on marri woodland that is restricted to lower-lying areas and thus heavily dependent on subsurface soil moisture and groundwater. Climate change may reduce seasonally waterlogged areas as well as increasing the depth to groundwater.

Groundwater decline may also result in flow-on effects which can impact fauna species dependent on seasonal wetlands. Marris may be susceptible to death or decline due to increased acidity and aluminium in subsoil water where the water table has rapidly declined. Soils may contain enough iron compounds to create acid sulfate soil conditions when the water table declines and the soil is exposed to air. The acids leach to groundwater, impacting water quality and causing acidity in seasonal wetlands with associated impacts on fauna.

Inflows to wetlands could disrupt their ecological balance. Drains may import nutrients, weeds and disease, and affect water levels. A wetland is an expression of the water table, and any activities that affect the water table impact on it, including alteration of water levels and leaching of nutrients and other pollutants into the groundwater.

Water availability has, and is likely to continue to, decline across the Swan Coastal Plain. Declining water availability is likely to be having severe detrimental impacts on marri woodland. Recent studies have determined that groundwater across most of the Shire of Serpentine Jarrahdale is fully allocated, with no more licences available for human uses. This is partly due to the environmental impacts of the declining water table.

Particular remnants may potentially be threatened by dewatering from mining or groundwater abstraction activities that are occurring nearby or immediately adjacent.

Salinisation may increase as a result of evaporation of surface water, especially where saline superficial aquifers are in contact with the surface. If increased ponding occurs in remnants due to urbanisation or clearing in the catchment, evaporation of a greater volume of water may result in larger amounts of residual salt. This is especially true for clay soils, which inhibit rainfall infiltration and result in high evaporation rates and concentration of salts. Some remnants may be under threat from salinisation, but other remnants may also be under threat in future if water tables rise as a result of urbanisation or other causes.

The levels of salinity in marri woodland should be monitored to determine if salinisation poses a major threat to the community. Remedial actions such as replanting with deep rooted vegetation in strategic parts of the catchment may be a solution if monitoring indicates salinisation is a significant

issue. However, implementing such a strategy may prove difficult in areas that are surrounded by urban development.

3.5 Introduction of Disease

“Dieback” generally refers to the effects of a plant disease caused by the water mould *Phytophthora cinnamomi* and other *Phytophthora* species. Other common pathogens in marri woodland include cankers c<PN@?!=T!OC@!I<ODQ@!APIB<G!K<OCJB@I!2P<H=<G<MD<!>JTM@>PK!and the native parasitic honey fungus.

The consequences of *Phytophthora* infection range in severity and include:

- Localised infection affecting one or more individual plants
- Dramatic modification of the structure and composition of the community
- Significant reduction in primary productivity
- Habitat loss and degradation

Dieback disease caused by *Phytophthora* species has the potential to impact marri woodland, although it is not known if marri woodland is particularly susceptible to the disease. Plant communities that occur on heavy soils, especially in relatively flat areas, are generally not highly susceptible to *Phytophthora*. In fact, *Corymbia calophylla* (marri) has been shown to have a strong resistance to dieback.

However, some species that commonly occur in marri woodland are indicated as being susceptible or possibly susceptible to the disease, including *Allocasuarina humilis*, *Astroloma pallidum*, *Banksia lindleyana*, *Eucalyptus marginata*, *Grevillea bipinnatifida*, *Hakea ceratophylla*, *Hakea lissocarpha*, *Hakea varia*, *Patersonia occidentalis* and *Xanthorrhoea preissii*. For most species that commonly occur in marri woodland, susceptibility to the disease is not known.

Dieback disease continues to spread and affect the distribution and abundance of many plant species and their associated fauna in southwest Western Australia. This plant pathogen and a number of related *Phytophthora* species present a significant threat to the health and vitality of many ecosystems on the Swan Coastal Plain. It can alter species composition and ecosystem function by impacting susceptible species and vegetation types, and by increasing vulnerability to invasion by weeds.

Diseased sites have reduced plant species richness, litter, shrub, tree and canopy cover, high bare ground and significantly lower flowering scores, than healthy sites. Bird community composition differs significantly between diseased and healthy sites, associated with habitat structural changes. Average species richness of birds and the abundance of nectivores is lower in diseased than healthy sites. Dieback is therefore potentially a serious threat to bird biodiversity and especially for nectivores, with implications for pollination.

Transmission of plant pathogens occurs through movement of infected soil and plant material, and in surface and ground water. Soil is carried by humans and kangaroos (and other animals such as horses), and contaminated vehicles and machinery. Effective hygiene practices can help to manage human and mechanical transmission. This would involve adequately washing down any equipment used on or adjacent to remnant vegetation, and restricting access by vehicles and machinery to dry soil conditions.

There is no known way to eliminate dieback once it has been introduced. Dieback control therefore involves minimising its spread by controlling the movement of vehicles, people and stock from affected areas into dieback free areas. It is standard management practice to route pathways to avoid

crossing boundaries, provide wash-down or other hygiene facilities for vehicles and pedestrians, provide education, and avoid transporting soil and plant material into dieback free areas.

Phosphite (phosphoric acid), sprayed on vegetation and injected into trees, mitigates the intensity of disease and can delay onset. Mapping of boundaries can monitor the spread and invasion of disease and locate the areas most at risk and therefore most in need of treatment.

Cankers caused by the native fungal pathogen *Quambalaria coyrecup* is also a significant disease threat to marri woodland. The spores of the fungus enter the stem, usually through a wound or crack, and infect the sapwood. The infected tree will usually produce an abundance of kino (sap) in response to the infection. As the infection spreads it will cause a target-like infection site that may ring-bark the tree and will often cause the bark to crack and shed.

This severe canker disease has been contributing to decline in marri for some years. The cankers are a symptom caused by the death of areas of bark and sapwood. Cankers can be present on trunks, branches and twigs of trees of all ages.

Canker disease occurs on marri trees throughout its natural range, and appears to be more severe in smaller remnants and isolated trees. Once canker symptoms are evident, trees do not appear to be able to recover.

3.6 Climate Change

Marri woodlands occur in a region that has (and is continuing to) undergone major and rapid changes to the climate. Long-term climate change has a trend of increasing temperatures, declining rainfall and altered rainfall timing. Mean annual temperatures have risen by more than 1°C and mean annual rainfall has declined by over 15%. The decline in rainfall is particularly pronounced in late autumn and winter, which is the most important period for native plant growth, as well as for agriculture and horticulture. Further decreases in average rainfall are expected, as are higher temperatures and increased incidence and intensity of extreme events, such as heatwaves, storms and heavy rainfall.

The reduction in rainfall has an increased effect through decreased streamflow in waterways and in reduced recharge of groundwater. Streamflow has declined by more than 50%, impacting on plant reproduction and seedling recruitment. Human populations are becoming more reliant on groundwater (and desalination plants), increasing water table declines and increased stress on vegetation. Extensive mortality of vegetation will become more frequent.

The ecological integrity of marri woodlands is declining in response to the new climate regimes. Marris are producing fewer flowers in response to declining rainfall, which results in less food for nectar-feeding and seed-eating birds and insects, and slower accumulation of smaller seedbanks. Marri populations are thus less resilient to fires, disease, seed predation and other threats. The drying climate also impacts on seedling recruitment, which is highly sensitive to soil moisture.

Although fire is an important process in marri woodland, plants whose seeds are stimulated to germinate by fire will be particularly vulnerable to high frequency or unseasonal fires. Resprouters whose adult plants can survive low to medium intensity fires and regenerate from lignotubers may also fail to resprout if fires are too frequent.

Urban heat islands can affect local climate and impact on nearby remnants. Urban heat islands occur when urban areas are hotter than their surrounds due to built materials trapping heat, machinery producing waste heat, and the removal of trees and vegetation (and their cooling effect from shade and transpiration). Ongoing clearing of native remnants is likely to exacerbate urban heat.

The Shire of Serpentine Jarrahdale is managing its response to climate change through implementation of strategies such as the Climate Change Strategy and Action Plan, and the Urban and Rural Forest Strategy.

3.7 Fauna Decline

Threats also have resulted in decline of the fauna of the marri woodlands. This, in turn, feeds back into the decline of native vegetation because fauna are essential to ecological functions of the community. Many animals have habitat or dispersal requirements that are no longer available due to loss, fragmentation and degradation of the natural vegetation and remnants now occurring amongst highly modified, often unsuitable landscapes. The greatest decline in native fauna has been in urban and peri-urban areas, notably the Perth metropolitan region, and this is likely to worsen with ongoing urban sprawl.

Mammals appear to be the most affected group with 52% of the original mammal fauna of the Perth region now considered regionally extinct. 40 native mammals were once present in the Swan Coastal Plain and ten species are now extinct from the region with another eight in serious decline. Regionally extinct mammals include iconic species such as the numbat, bilby and woylie, but also five species of native mice and rats. The decline of marsupials resulted from a combination of the threats outlined above.

Native marsupials would have played a key role in trophic interactions, pollination, seed dispersal, decomposition, mineral nutrient cycling and fuel load reduction in marri woodland (by turnover of the soil and burying of leaf litter through extensive digging). The most common native mammals that now remain in urban bushland remnants are species able to adapt to human presence, such as the western grey kangaroo and common brushtail possum. The quenda is possibly the only medium-sized ground-dwelling native mammal that survives in the Perth metropolitan region, but it is subject to ongoing habitat loss and predation by foxes and cats.

Birds have also been affected by the loss or declining condition of marri woodlands. Across the Swan Coastal Plain, nearly 50% of the passerines and 40% of the non-passerines have declined or have become locally extinct since European settlement. These include species that are habitat specialists and generalists.

A major concern is the impacts of habitat losses to the black cockatoos of the Swan Coastal Plain. A particular threat is the clearing of feeding habitat, as marri woodlands and commercial pine plantations provide a significant food resource. On the Swan Coastal Plain, black cockatoos show a strong preference for food resources from marris, banksia and hakea shrubs, so the marri woodlands provide a key resource. With the decline in marri and banksia woodlands, however, they have adapted to roosting in pine plantations, and are therefore threatened by their removal.

The rate of decline of Carnaby's black cockatoos was estimated as 15% per year of the total number on the Perth-Peel Coastal Plain. This indicates Carnaby's black cockatoo remains in serious decline. The decline of cockatoos will become more severe if remnant marri woodlands are removed, as well as continuing to reduce the pine plantations. Further removal of pines as feeding habitat will place greater reliance on the remaining (but also declining) patches of marri woodlands as habitat.

Reptile species assemblages in the Swan Coastal Plain depend on the size of the bushland remnant. The long-term persistence of reptile populations may be affected by the presence of barriers to dispersal and, consequently, a reduced ability to recolonise a patch if local extinction occurs. For many species of reptiles, roads, buildings and other infrastructures are effective barriers to dispersal.

Impacts to the invertebrate component of the marri woodland community are poorly studied. Within the Perth metropolitan region, the native earthworm fauna has been mostly replaced by introduced species in disturbed soils. However, introduced species of earthworm were not found in undisturbed bushland remnants. This suggests that the loss of native vegetation remnants has led to a decline of the native earthworm fauna and that remnant vegetation fragments will continue to provide refuges in the future.

4. Reserves

4.1 Location and Description

The Shire of Serpentine Jarrahdale has twelve reserves that contain marri woodland. These reserves, their approximate area of marri woodland, and most likely community, are:

- Brickwood Reserve, Byford (40.6 ha, SCP3a)
- Serpentine Cemetery Reserve, Serpentine (2.1 ha, SCP3c)
- Serpentine Sports Reserve (Paul Robinson Reserve), Serpentine (3.8 ha, SCP3b)
- Mundijong Oval Reserve, Mundijong (2.07 ha, SCP3a and SCP3c)
- Myara Brook Reserve, Keysbrook (2.8 ha, SCP3c)
- Oscar Bruns Reserve, Darling Downs (1.67 ha, SCP3c)
- Rainforest Reserve, Byford (0.95 ha, SCP3a)
- Wattle Road Nature Reserve, Serpentine (0.97 ha, SCP3a)
- Clem Kentish Reserve, Serpentine (0.53 ha, SCP3c)
- Yangedi Airfield Reserve, Hopeland (4.6 ha, no survey data)
- King Road Pony Club Reserve, Oldbury (0.36 ha, SCP3b)
- Craghill Way Reserve, Oakford (0.32 ha, SCP3c)

Some of these reserves (Brickwood Reserve, Serpentine Sports Reserve, Myara Brook Reserve, Yangedi Airfield Reserve, King Road Pony Club Reserve and Craghill Way Reserve) also contain other types of vegetation (banksia woodland and/or clay-based wetlands). Wattle Road Nature Reserve has transitional vegetation containing features of both banksia and marri woodland.

The locations of the reserves are shown in Figures 6 – 9, and the reserves and the location of their marri woodland are shown in Figures 10 – 21. More detail on the reserves, such as soil types, wetlands, and vegetation management zones can be found in their individual action plans.

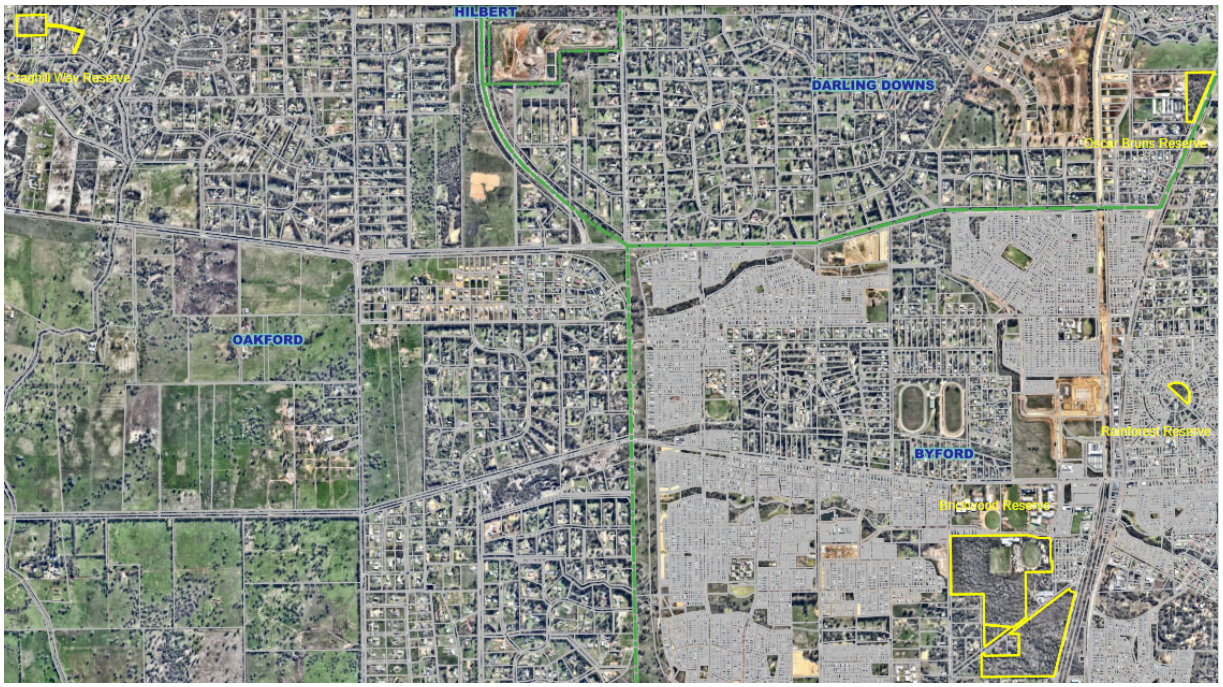


Figure 6: Location of Byford, Darling Downs and Oakford Reserves – Brickwood Reserve, Rainforest Reserve, Oscar Bruns Reserve and Craghill Way Reserve.

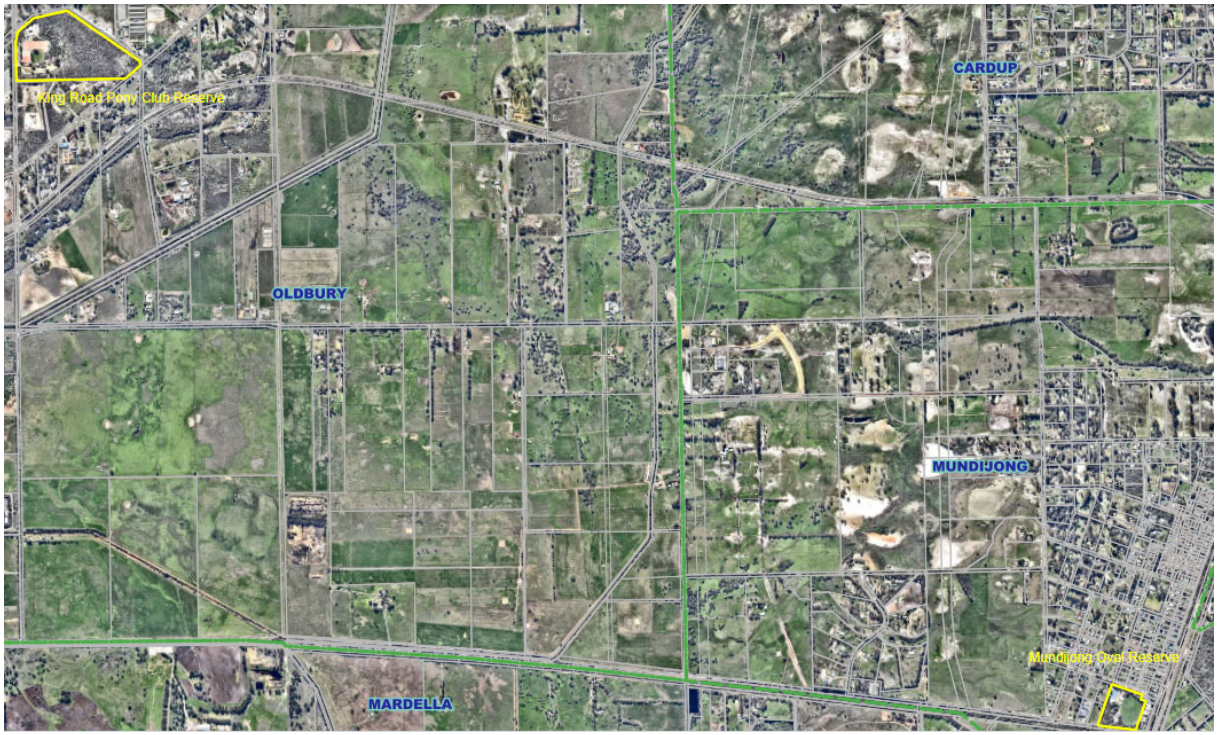


Figure 7: Location of Mundijong and Oldbury Reserves – Mundijong Oval Reserve and King Road Pony Club Reserve.

Figure 8: Location of Serpentine Reserves – Serpentine Sports Reserve, Clem Kentish Reserve, Serpentine Cemetery Reserve and Wattle Road Nature Reserve.

Figure 9: Location of Hopeland and Keysbrook Reserves – Yangedi Airfield Reserve and Myara Brook Reserve.

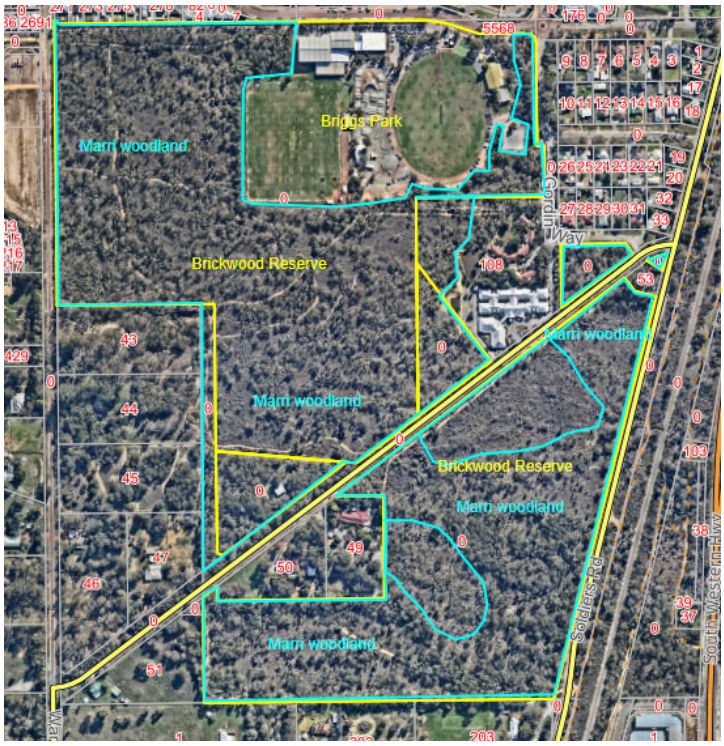


Figure 10: Location of Marri Woodland of Brickwood Reserve.

Figure 11: Location of Marri Woodland of Serpentine Cemetery Reserve.

Figure 12: Location of Marri Woodland of Serpentine Sports Reserve.

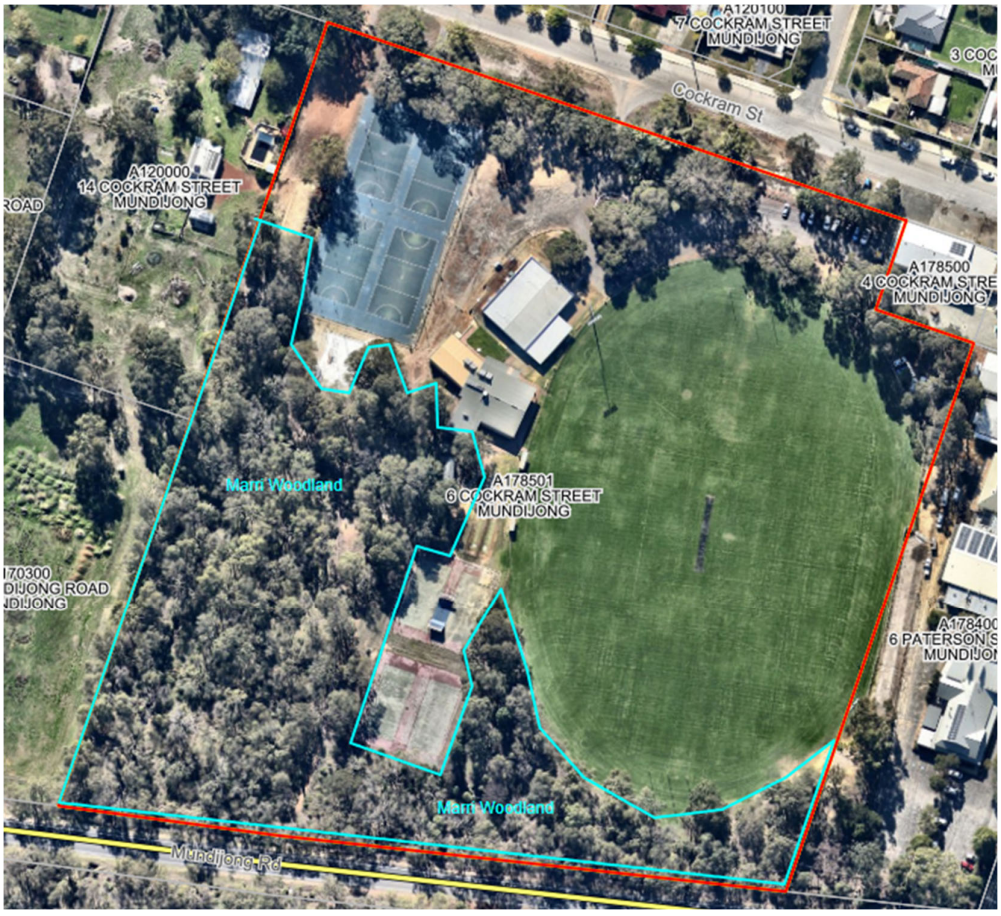


Figure 13: Location of Marri Woodland of Mundijong Oval Reserve.

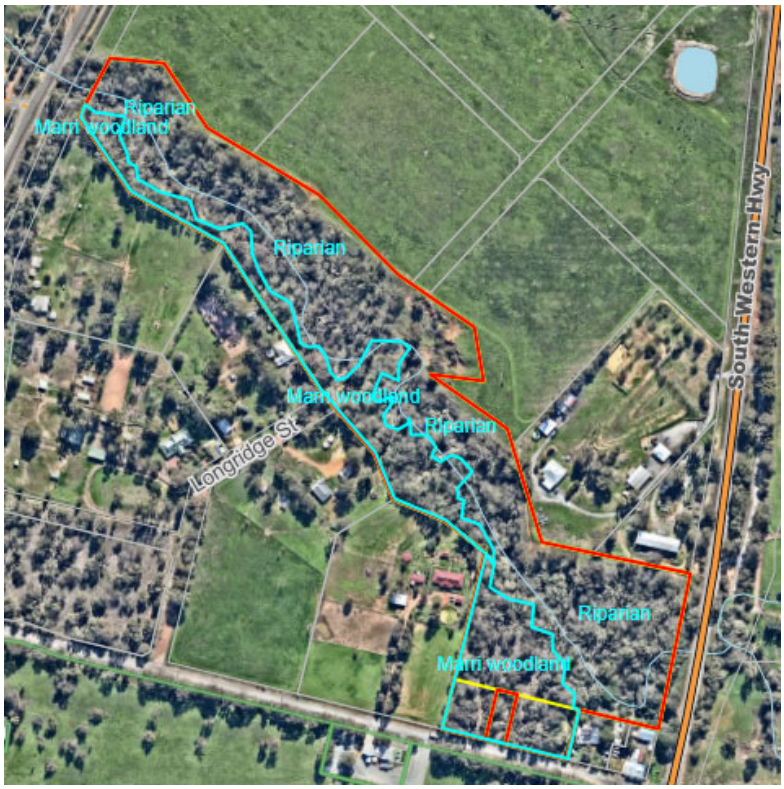


Figure 14: Location of Marri Woodland of Myara Brook Reserve.

Figure 15: Location of Marri Woodland of Oscar Bruns Reserve.

Figure 16: Location of Marri Woodland of Rainforest Reserve.

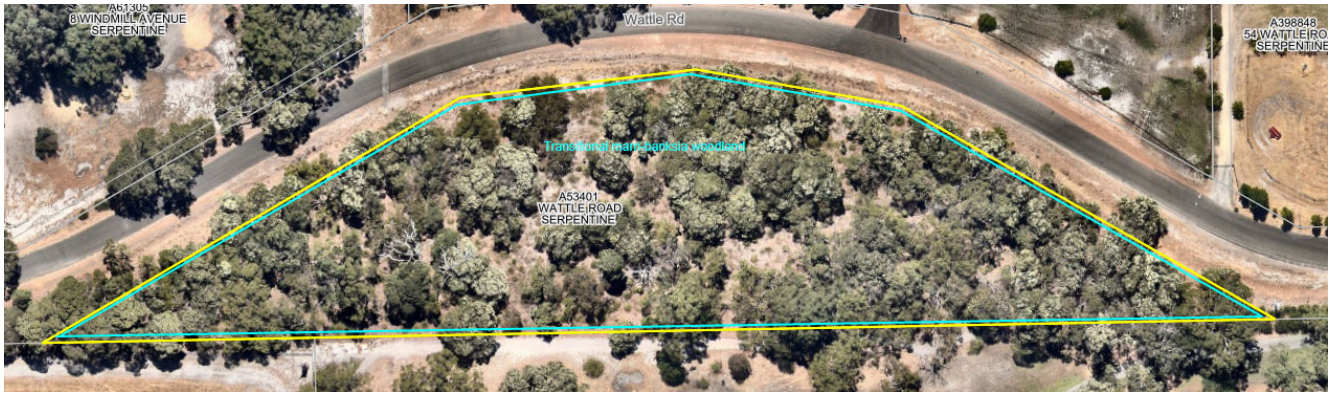


Figure 17: Location of Marri Woodland of Wattle Road Nature Reserve.

Figure 18: Location of Marri Woodland of Clem Kentish Reserve.

Figure 19: Location of Marri Woodland of Yangedi Airfield Reserve.

Figure 20: Location of Marri Woodland of King Road Pony Club Reserve.

Figure 21: Location of Marri Woodland of Craghill Way Reserve.

4.2 Vesting and Land Tenure

Most of the Shire reserves containing marri woodland are Crown land vested with the Shire of Serpentine Jarrahdale for the purpose of recreation, but their use now includes conservation. Changes to the vesting purpose of the reserves would give greater protection to their marri woodland, but this is being kept in reserve for future offsets for unavoidable clearing by the Shire. The vested purpose and current use of the reserves is listed in Table 3. For reserves that cover more than one lot, only the lot containing the marri woodland is listed.

Table 3: Vesting and Land Use of Shire Reserves.

Reserve	Reserve and Lot Number	Vested Purpose	Current Uses
Brickwood Reserve	R17490 L5567, L111 and L112 Mead Street, Byford	Recreation	Recreation and Conservation
	R51101 L48 Turner Road, Byford	Environmental Conservation, Recreation, Community Centre and Purposes Ancillary Thereto	Recreation and Conservation
BaptistCare Graceford Aged Care Home (Brickwood)	R37404 L106 Turner Road, Byford	Aged Persons Homes	Buffer Zone and Conservation
Serpentine Cemetery Reserve	R10661 L162 South Western Highway, Serpentine	Cemetery	Cemetery and Conservation
Serpentine Sports Reserve	R19134 L778 Karnup Road, Serpentine	Recreation	Recreation and Conservation
Mundijong Oval Reserve	R4486 L232 Cockram Street, Mundijong	Recreation	Recreation and Conservation
Myara Brook Reserve	R23778 L73 Elliott Road, Keysbrook	Conservation / River Diversion	Conservation
Oscar Bruns Reserve	R10385 L61 Butcher Road, Darling Downs	Recreation	Recreation and Conservation
Rainforest Reserve	R20165 L808 Park Road, Byford	Recreation	Recreation and Conservation
Wattle Road Nature Reserve	R36433 L2597 Wattle Road, Serpentine	Conservation of Flora	Conservation
Clem Kentish Reserve	R9157 L57 Wellard Street, Serpentine	Recreation	Recreation and Conservation
Yangedi Airfield Reserve	R25911 L164 Yangedi Road, Hopeland	Recreation	Recreation and Conservation
King Road Pony Club Reserve	R36950 L427 King Road, Oldbury	Recreation	Recreation and Conservation
Craghill Way Reserve	R34460 L1374 Craghill Way, Oakford	Public Recreation	Recreation and Conservation

4.3 User Groups

4.3.1 User Groups

The user groups of each Shire reserve are related to the current uses, as listed above in Table 3. These range from informal users, for walking and enjoyment of nature, to the three major users of Yangedi Airfield Reserve. The user groups for each reserve are listed in Table 4. More detail is provided in the individual action plans.

Table 4: User Groups of Shire Reserves

Reserve	User groups
Brickwood Reserve	Recreation centre – gym, courts, function rooms etc. Sports fields users, e.g. cricket, football and diamond sports groups Sport pavilion users and hire BMX track Friends of Brickwood Informal users, particularly walking and dog exercise
Serpentine Cemetery Reserve	Funerals – mourners, funeral directors, masons, gravediggers Grave visitors Historical society and tourism Informal users
Serpentine Sports Reserve	Serpentine Horse and Pony Club Polocrosse Club Golf Club Irregular oval hire, e.g. Southside Jumps Club Community events Informal users, particularly walking and dog exercise Community conservation groups, including Landcare SJ Inc., Serpentine Environmental Group
Mundijong Oval Reserve	Sports fields users, e.g. cricket, football Sport pavilion users and hire Netball courts Playground equipment Parking for Shire offices and events Informal users, including exercise
Myara Brook Reserve	Community conservation groups, including Landcare SJ Inc., Friends Group Informal users, infrequent
Oscar Bruns Reserve	Informal users, infrequent
Rainforest Reserve	Community conservation groups, including Landcare SJ Inc., Byford Environmental Group Users of nearby facilities, e.g. tennis courts, kindergarten Informal users
Wattle Road Nature Reserve	Informal users, infrequent
Clem Kentish Reserve	Sports fields users, e.g. cricket, football Sport pavilion (hall) users and hire Tennis courts Tractor museum Playground equipment Skate park Informal BMX track Parking for events Informal users, including exercise
Yangedi Airfield Reserve	Sports Aircraft Builders Club DFES (helipad) BOM (radar tower)

King Road Pony Club Reserve	Peel Horse and Pony Club
Craghill Way Reserve	Informal users, infrequent Equestrian (connected to bridle trail network)

4.3.2 Threats and Pressures

4.3.2.1 Risk Management

Increasing insurance premiums and stricter attitudes to liability have made risk management plans mandatory for recreational facilities and clubs. Formal risk management plans must be developed by each user group of a reserve in cooperation with the Shire to avoid exposing participants to unacceptable levels of risk.

4.3.2.2 Membership and Member Involvement

Any community group has a general problem with attracting and maintaining motivated volunteers to fill positions and undertake other tasks. A few people tend to do most of the work.

4.3.2.3 Conflict Among User Groups

Conflict among user groups can lead to a lack of cooperation in management of reserves, and conflicts over the use of resources can lead to ineffective use and possibly degradation. The main conflicts tend to be between user groups' desire to expand, and protection of the conservation values of the remnant vegetation. Nearby residents are frequently concerned about fuel loads in bushland and fire risk, which can lead to pressure for regular control burns and the potential for degradation of the bushland.

Management plans are intended to facilitate broad community input, provide an acceptable level of certainty for all stakeholders, and ensure that Council is fully informed.

4.3.2.4 Compliance with Legislation

The use of reserves and their facilities is subject to health regulations and legislation. Some reserves also host events during which camping occurs. The Shire assesses compliance with legislation, and ensures that the locations used, management of pets, numbers of people per ablution facility during events, litter and other waste management issues are considered.

Compliance with Federal, State and Local environmental legislation and policies is also essential. Many user groups may be unaware of the legislative requirements, or the environmental values they are intended to protect. It is the Shire's responsibility to ensure that user groups are informed of and comply with relevant requirements.

4.3.2.5 Security of Tenure

Ongoing long-term lease agreements for user groups are essential to ensure that private investment in reserves is supported. User groups and their facilities are mostly developed and maintained entirely by volunteers.

4.4 Infrastructure

4.4.1 Infrastructure

The infrastructure present on each Shire reserve is related to the current uses and user groups, as listed above in Tables 3 and 4. These range from basic fencing to the highly valuable infrastructure

of the three major users of Yangedi Airfield Reserve. The main infrastructure present at each reserve is listed in Table 5. More detail is provided in the individual action plans.

4.4.2 Threats and Pressures

4.4.2.1 Facility Maintenance

Most user groups maintain their buildings and other infrastructure by volunteer labour from their members. Other reserve facilities are public and maintained by the Shire, such as sports fields and irrigation systems. Inadequate maintenance would lead to accelerated deterioration and increased risk. Poorly maintained facilities also tend to attract vandalism.

4.4.2.2 Vandalism and Theft

Vandalism and theft are constant but low-level threats. The design of buildings and other structures may incorporate vandalism-resistant features. Use of tough materials, protection of vulnerable surfaces with resistant barriers, visibly high maintenance, removal of objects likely to be used by vandals, high security and appropriate lighting all decrease the likelihood of theft and damage. Surveillance is an effective deterrent. The highly valuable infrastructure and property on Yangedi Airfield Reserve is protected by on-site caretakers.

4.4.2.3 Fire Damage

Fire can threaten people, property and conservation values. Prevention and resistance should be incorporated into the design and management of buildings, other structures and their surrounds. Fires can start inside or adjacent to buildings and structures, and are often the result of vandalism, kitchen accidents or electrical faults. Bush or grass fires threaten buildings and structures through embers, radiant heat and direct contact.

Cleared areas around buildings limit the opportunity for bush and grass fires to reach them. No flammable material should be stored close to buildings, and gutters kept clear. Strategies to limit the frequency and severity of vandalism will reduce the likelihood of arson. Fire in nearby bushland has the potential to damage infrastructure.

4.4.2.4 Public Access

The use of club facilities by the public may lead to conflict with the user group. Some clubs hire out their facilities to other users but may not be satisfied with the level of care taken. Public access to other infrastructure, such as jumps and cross-country courses, may lead to liability issues in the case of injury, leading clubs to limit public access as far as possible and erect warning signage.

Table 5: Infrastructure present at Shire Reserves

Reserve	Infrastructure
Brickwood Reserve	Recreation centre – gym, courts, function rooms etc. Sports pavilion Sports fields BMX track and pavilion Car parks Firebreaks and walking paths Fences and gates Signage Dilapidated building intended for community uses Irrigation systems and bores

Reserve	Infrastructure
Serpentine Cemetery Reserve	Cemetery – graves, memorial wall (ashes), benches Rotunda and toilets Car park
Serpentine Sports Reserve	Equestrian clubhouse and storage sheds Two equestrian sports fields (pony club and polocrosse club) Cross-country course Golf Clubhouse and storage sheds Golf course fairways and greens Firebreaks and walking paths Irrigation systems and bores Fences and gates Signage
Mundijong Oval Reserve	Two sports pavilions Sports field Netball courts Playground Car park Fences and gates Firebreaks
Myara Brook Reserve	Firebreaks, fences and gates
Oscar Bruns Reserve	Firebreaks, fences and gates
Rainforest Reserve	Playground
Wattle Road Nature Reserve	Firebreaks, fences and gates
Clem Kentish Reserve	Community hall / sports pavilion Tractor museum Sports field Irrigation system and bore Tennis courts Cricket nets Skate park Playgrounds Water tanks Car park
Yangedi Airfield Reserve	SABC clubhouse and ablution facilities Hangars with stored aircraft and taxiways Two runways Fuel storage DFES helipad and heli-tankers BOM radar tower Firebreaks, fences and gates Signage Irrigation systems and bores
King Road Pony Club Reserve	Clubhouse Storage sheds Car parking area Arenas with fencing Cross-country course with permanent jumps Dilapidated, unused infrastructure, e.g. dog pens for Peel Hunt Club hounds Firebreaks, fences and gates Signage
Craghill Way Reserve	Firebreaks, fences and gates

5. Action Plan

5.1 Introduction

An implementation plan is provided in this section. Various divisions within the Shire are responsible for implementation and it is anticipated that the actions will be implemented over several years. All actions arising from this plan are presented below, along with priorities, responsibilities and requirements.

5.2 Priorities and Status

Priorities for implementation of the actions have been classified as follows:

- Key – an essential action for successful management of banksia woodland
- High – a significant action which should be implemented in the short term
- Medium – a secondary, longer-term action
- Low – a desired action that is funding dependent

The status of each action has been assessed as Implemented, Implemented in Part, Not Yet Implemented, and Ongoing. In addition, each action has been classified as:

- Business as Usual – an ongoing action that occurs as a matter of course
- Short Term – to be implemented within three years of adoption of the management plan
- Medium Term – to be implemented within seven years of adoption of the management plan
- Long Term – a desired action that is funding dependent and may be implemented within ten years of adoption

5.3 Responsibilities, Monitoring and Review

The Shire of Serpentine Jarrahdale is responsible for actions within this plan. In some instances, the Shire may be assisted in implementing a strategy by a partner who has an interest or responsibility, and there may be opportunities for grants to implement strategies. The management plan actions will be monitored and reviewed, and the management plan will be revised every three years.

The best single point of contact will be the Natural Reserves Specialist. Divisions within the Shire with responsibilities for implementation, sometimes in collaboration with user groups, include:

- Natural Reserves Specialist
- Strategic Environmental Specialist
- Emergency Services
- Community Development
- Development Services
- Environmental Health

Resources are designated as staff time, budget dependent and/or funding (grant) dependent. Costs are not estimated here as they are highly context dependent (particularly on vegetation condition and patch size) but will be estimated for each reserve.

Table 4: Marri Woodland Action Plan

No.	Action	Priority	Timing	Status	Responsibility	Resources
1	**Utilise the planning system to retain and protect remnant marri woodland.**	**Key**	**Business as Usual**	**Ongoing**	**Statutory Planning**	**Staff Time**
2	Keep up to date with the latest research trends with regard to marri woodland and integrate into reserve management.	High	Long Term	Ongoing	Natural Reserves, Emergency Services	Staff Time
3	Formalise access to marri woodland in high use areas through establishment of walking paths that reduce trampling.	Medium	Medium Term	Not Yet Implemented	Operations	Budget Dependent
4	Erect signage in high use areas to inform users of the values of the marri woodland.	Medium	Short Term	Implemented in Part	Operations	Budget Dependent
5	**Survey for dieback presence, and map and treat dieback every three years if present.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent**
6	**Survey for marri canker, and treat infected trees.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent**
7	Survey for wandoo decline, and treat according to best practice methods.	High	Business as Usual	Ongoing	Natural Reserves	Budget Dependent
8	Monitor and manage new and emerging pests and diseases such as polyphagous shot hole borer.	High	Medium Term	Ongoing	Natural Reserves	Budget Dependent
9	Control access to marri woodland through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations	Budget Dependent
10	Work with user groups to protect and minimize impacts to the remnant vegetation.	High	Business as Usual	Ongoing	Natural Reserves, User Groups	Staff Time
11	Liaise with other landholders to work together and integrate management of all marri woodland areas.	Medium	Medium Term	Not Yet Implemented	Natural Reserves, Strategic Environment	Staff Time
12	Implement measures to exclude motorised vehicles from bridle trails, and/or the remnant vegetation.	High	Medium Term	Implemented in Part	Operations	Budget Dependent
13	Erect fences or other structures to delineate user group areas.	Low	Long Term	Not Yet Implemented	Natural Reserves, User Groups	Budget Dependent
14	Ensure that formalised paths and other access routes cross dieback fronts to the lowest degree possible.	Medium	Medium Term	Not Yet Implemented	Natural Reserves	Staff Time
15	Establish dieback hygiene policies, including vehicle washdown points and foot baths for pedestrians with appropriate signage where appropriate.	High	Long Term	Implemented in Part	Natural Reserves	Budget Dependent
16	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environment	Budget Dependent
17	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves	Budget Dependent

No.	Action	Priority	Timing	Status	Responsibility	Resources
18	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves	Staff Time
19	**Establish and implement a weed control program that utilises best practice methods.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves, Landcare SJ**	**Budget Dependent**
20	Establish and implement a control program for woody weeds.	High	Business as Usual	Ongoing	Natural Reserves	Budget Dependent
21	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ	Budget and/or Funding Dependent
22	**Minimise burning and other disturbance of marri woodland.**	**Key**	**Short Term**	**Implemented in Part**	**Emergency Services**	**Staff Time**
23	Avoid disturbance to the Conservation Zone of a reserve and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves	Staff Time
24	Maintain fire intervals of 8-40 years.	High	Long Term	Not Yet Implemented	Emergency Services	Staff Time
25	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Staff Time
26	Restrict any essential fuel load management to the Vegetation Management Zone of a reserve.	High	Short Term	Not Yet Implemented	Emergency Services	Budget Dependent
27	Carry out fuel load management on adjacent road verges to avoid fire entering the reserve from the verge.	High	Medium Term	Not Yet Implemented	Emergency Services	Budget Dependent
28	Ensure that any essential fuel load management utilises weed control as a priority, with control burning as a last resort.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves	Budget Dependent
29	Ensure that any control burning is restricted to vegetation boundaries, providing a mosaic of vegetation ages including long unburnt.	High	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Budget Dependent
30	**Follow any burning or other disturbance with weed control for at least two years post-fire.**	**Key**	**Business as Usual**	**Implemented in Part**	**Emergency Services, Natural Reserves**	**Budget Dependent**
31	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations	Staff Time
32	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves	Funding Dependent
33	Monitor implementation of the management plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environment	Staff Time
34	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environment	Staff Time
35	Review and revise the management plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environment	Staff Time

6. References

Coy N (1984) *The Serpentine. A History of the Shire of Serpentine Jarrahdale*. NJ Coy, Mundijong, Western Australia.

Davidson WA (1995) *Hydrogeology and Groundwater Resources of the Perth Region Western Australia*. Western Australian Geological Survey, Bulletin 142.

Dieback Working Group (1999) *Managing Dieback: A Manual for Local Government*.

ENV Australia Pty Ltd (2008) *Flora and Vegetation of Yangedi Reserve, Shire of Serpentine Jarrahdale*. Unpublished report February 2008.

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (s 266B) Approved Conservation Advice for *Corymbia calophylla – Kingia australis* woodlands on heavy soils of the Swan Coastal Plain (2000).

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (s 266B) Approved Conservation Advice for *Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands of the Swan Coastal Plain (2000).

Gibson N, Keighery BJ, Keighery GJ, Burbidge AH & Lyons MN (1994) *A Floristic Survey of the Southern Swan Coastal Plain.* Unpublished Report for the Australian Heritage Commission Prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.).

Government of Western Australia (1992) *Statement of Planning Policy No. 2. The Peel-Harvey Coastal Plain Catchment.* Government Gazette, WA, Feb 1992.

Government of Western Australia (2000) *Bush Forever*. Western Australian Planning Commission, Perth, Western Australia.

Harvey M., Dell J, How RA & Waldock JM (1997) *Ground Fauna of the Bushland Remnants on the Ridge Hill shelf and Pinjarra Landforms Perth.*

Hill AL, Semeniuk CA, Semeniuk V & Del Marco A (1996a) *Wetlands of the Swan Coastal Plain, Volume 1: Wetland Mapping, Classification and Evaluation – Main Report*. Prepared for the Water and Rivers Commission and the Department of Environmental Protection, Perth, Western Australia.

Hill AL, Semeniuk CA, Semeniuk V & Del Marco A (1996b) *Wetlands of the Swan Coastal Plain, Volume 1: Wetland Mapping, Classification and Evaluation – Wetland Atlas*. Prepared for the Water and Rivers Commission and the Department of Environmental Protection, Perth, Western Australia.

Jenkins J (1995) *Preliminary Report of Biological Survey on Reserve No. 25911*. Unpublished Report Prepared for the Sport Aircraft Builder's Club.

Keighery BJ & Trudgeon ME (1992) *The Remnant Vegetation of the Eastern Side of the Swan Coastal Plain.* Unpublished Report to the Department of Conservation and Land Management for the National Estate Grants Program.

Keighery GJ and Keighery BJ (1993) *Parts V-VII Floristics of Three Bushland Areas of the Eastern Side of the Swan Coastal Plain.* IN Keighery GJ & Keighery BJ (1993) *Floristics of Reserves and Bushland Areas of the Perth Region (System 6). Parts V-IX*. Wildflower Society of WA (Inc.), Nedlands, Western Australia.

van Gool D (1990) *Land Resources in the Northern Section of the Peel Harvey Catchment, Swan Coastal Plain Western Australia*. Division of Resource Management, Western Australian Department of Agriculture.

Appendix 1 – Flora Surveys and Lists

The Shire's marri woodland reserves have been surveyed, up to five times, by Shire staff. Some reserves were surveyed by quadrat, supplemented by nearby species, and some by a walk-through survey. Yangedi Airfield Reserve has only been surveyed in its banksia woodland, so has not been included here.

The following table includes all of the species recorded in the marri woodland reserves, and which reserve(s) they have been recorded in.

A total of 349 species were recorded across the eleven surveyed marri woodland reserves, comprising 276 native species and 73 weeds.

Demonstrating the diversity and variability of marri woodland, fewer than 10% of native species or weeds were recorded in eight or more reserves, while more than 70% were recorded in three or fewer reserves with 39% of native species and 50% of weeds recorded in only one reserve. Only 21 native species (7.6%) and seven weeds (9.6%) were recorded in eight or more reserves, while 195 native species (70.7%) and 55 weeds (75.3%) were recorded in three or fewer reserves with 108 native (39.1%) and 37 weeds (50.7%) in only one reserve.

Wattle Road Nature Reserve, being transitional between banksia and marri woodlands, recorded 28 species (23 native and five weeds) which were not recorded in any other reserve. Many of these species were more typical of banksia woodland.

Species (* denotes an introduced/weedy species)	**Brickwood**	**Serpentine Cemetery**	**Serpentine Sports**	**Mundijong Oval**	**Myara Brook**	**Oscar Bruns**	**Rainforest**	**Wattle Road**	**Clem Kentish**	**King Road Pony Club**	**Craghill Way**
Acacia alata			X			X		X			
Acacia applanata				X			X	X			
**Acacia decurrens*						X					
Acacia extensa					X		X				
**Acacia iteaphylla*				X	X	X	X	X	X		X
Acacia lasiocarpa			X			X			X		
**Acacia longifolia*		X		X	X			X			X
**Acacia microbotrya*				X							
**Acacia podalyriifolia*									X		
Acacia preissiana									X		
Acacia pulchella	X	X	X	X	X	X	X		X		X
Acacia saligna				X		X		X	X		
Acacia sessilis	X		X								
Acacia stenoptera				X							
Acacia willdenowiana			X						X		
Actinostrobus pyramidalis				X	X			X			
Adenanthos cygnorum								X		X	X
Adenanthos meisneri			X					X			
Adenanthos obovatus										X	
**Agonis flexuosa*				X				X			

Species (* denotes an introduced/weedy species)	Brickwood	Serpentine Cemetery	Serpentine Sports	Mundijong Oval	Myara Brook	Oscar Bruns	Rainforest	Wattle Road	Clem Kentish	King Road Pony Club	Craghill Way
Agrostocrinum hirsutum		X	X	X	X	X	X	X	X		
Agrostocrinum scabrum	X										
**Aira cupaniana*		X		X		X					
Allocasuarina fraseriana						X		X		X	
Allocasuarina humilis	X	X	X	X	X	X	X	X	X		
Allocasuarina microstachya	X										
Amphipogon turbinatus				X				X			
**Anagallis arvensis*		X		X	X	X		X	X		
Andersonia caerulea								X	X		
Anigozanthos bicolor		X									
Anigozanthos manglesii	X	X	X				X	X			
**Arctotheca calendula*	X	X		X		X					
**Arundo donax*						X					
Astartea fascicularis								X			
Astroloma pallidum								X			
Austrodanthonia acerosa	X	X		X	X	X			X		
Austrodanthonia occidentalis	X			X	X						
Austrostipa compressa							X				
Austrostipa elegantissima		X				X	X		X		
Austrostipa flavescens				X							
Austrostipa semibarbata	X	X		X		X					
**Avena barbata*	X	X	X	X	X	X	X	X	X		X
Baeckea camphorosmae	X	X		X	X	X	X	X	X		
Banksia attenuata								X		X	
Banksia dallaneyi					X		X		X		
Banksia grandis		X	X								
Banksia ilicifolia										X	X
Banksia littoralis										X	
Banksia mensiesii										X	
Banksia nivea	X	X	X	X	X	X	X	X	X		
Banksia telmatiaea								X			
Baumea juncea								X			
Billardiera fraseri							X				
Billardiera heterophylla								X			
Boronia ramosa								X			
Boronia sp.						X					
Borya scirpoidea	X										
Borya sphaerocephala						X					
Bossiaea eriocarpa		X	X		X		X	X		X	X
Brachyloma preissii											X
**Briza maxima*	X	X	X	X	X	X	X	X	X	X	X
**Briza minor*		X	X	X	X	X		X			
**Bromus diandrus*								X			
**Bromus hordeaceus*					X						
Burchardia congesta		X	X	X	X	X	X	X	X	X	X
Burchardia multiflora	X			X							
Caesia micrantha	X	X	X	X		X		X	X	X	
Caesia occidentalis		X									
Caladenia flava		X	X					X		X	
Caladenia latifolia										X	

Species (* denotes an introduced/weedy species)	Brickwood	Serpentine Cemetery	Serpentine Sports	Mundijong Oval	Myara Brook	Oscar Bruns	Rainforest	Wattle Road	Clem Kentish	King Road Pony Club	Craghill Way
Caladenia longicauda						X					
Calectasia grandiflora	X										
**Callistemon phoenicius*				X				X			
**Calothamnus quadrifidus*					X				X		
**Calothamnus rupestris*					X						
Calytrix flavescens											X
Cassytha flava							X				
Cassytha glabella	X	X				X		X	X		
Cassytha ramosa								X			
**Centaurium tenuiflorum*				X	X				X		
**Chamaecytisus palmensis*									X		
Chamaescilla corymbosa	X	X	X	X		X		X	X	X	
Chorizema dicksonii					X	X	X		X		
Chorizema ilicifolium					X						
**Cicendia filiformis*				X							
Clematis pubescens								X	X		
Comesperma calymega						X		X			
Conospermnum stoechadis								X			
Conostephium pendulum											X
Conostylis aculeata	X		X	X		X		X			
Conostylis juncea			X		X			X		X	
Conostylis setigera	X	X	X		X	X		X	X		
Corymbia calophylla	X	X	X	X	X	X	X	X	X	X	X
**Cotula turbinata*		X									
Craspedia variabilis										X	
Cristonia biloba			X								
Cryptandra arbutifolia						X			X		
Cyathochaeta avenacea	X	X	X	X	X	X	X	X	X		
Cyathochaeta clandestina	X						X		X		
**Cynodon dactylon*				X				X			
Dampiera alata			X	X					X		
Dampiera linearis	X		X	X	X		X	X	X	X	
Dampiera teres					X	X		X	X		
Dasypogon bromeliifolius	X	X	X	X				X		X	X
Daviesia decurrens	X			X	X	X	X		X		
Daviesia divaricata						X					
Daviesia horrida					X						
Daviesia nudiflora		X	X								
Daviesia physodes	X		X					X			
Daviesia preissii	X			X				X			
Daviesia triflora								X			
Desmocladus fasciculatus	X	X	X	X		X	X	X	X	X	X
Desmocladus flexuosus	X			X	X			X	X	X	X
Dianella revoluta			X			X				X	
Dichopogon capillipes					X	X					
Dillwynia dillwynioides									X		
**Dipogon lignosus*						X					
**Disa bracteata*		X		X	X	X		X	X		X
Diuris magnifica										X	
Diuris sp.				X					X		

Species (* denotes an introduced/weedy species)	Brickwood	Serpentine Cemetery	Serpentine Sports	Mundijong Oval	Myara Brook	Oscar Bruns	Rainforest	Wattle Road	Clem Kentish	King Road Pony Club	Craghill Way
Drosera erythrorhiza	X	X	X	X		X		X		X	
Drosera gigantea	X					X					
Drosera glanduligera	X			X							
Drosera menziesii	X	X		X		X		X	X		
Drosera nitidula								X			
Drosera pallida			X								
Drosera porrecta			X								
Drosera pulchella									X		
**Echium plantagineum*						X					
**Ehrharta calycina*		X	X	X	X	X	X	X	X	X	X
**Eragrostis curvula*		X	X	X	X		X	X	X	X	X
Eremaea pauciflora		X					X	X			
**Eucalyptus forrestiana*									X		
**Eucalyptus maculata*											X
Eucalyptus marginata	X	X	X	X			X	X	X		
Eucalyptus rudis					X	X					
Eucalyptus todtiana											X
Eucalyptus wandoo					X	X					
**Euphorbia terracina*				X							
Eutaxia virgata					X						
**Freesia alba x leichtlinii*		X				X			X		
**Fumaria capreolata*		X				X					
Gastrolobium capitatum	X	X	X		X	X		X			
**Gladiolus angustus*						X					
**Gladiolus caryophyllaceous*			X						X	X	X
**Gomphocarpus fruticosus*								X			
Gompholobium aristatum	X						X				
Gompholobium knightianum								X			
Gompholobium marginatum	X			X	X	X			X		
Gompholobium tomentosum		X	X				X	X			X
Gonocarpus pithyoides				X		X		X	X		
Grevillea bipinnatifida	X	X		X		X	X		X		
Grevillea diversifolia						X					
Grevillea pilulifera	X			X		X					
Grevillea wilsonii		X					X		X		
Haemodorum brevisepalum		X									
Haemodorum laxum	X	X	X	X	X	X	X	X	X		
Haemodorum loratum								X			
Haemodorum simulans			X						X		
Haemodocum sparsiflorum	X										
Haemodorum spicatum		X		X		X				X	
Hakea ceratophylla		X									
**Hakea laurina*				X					X		
Hakea lissocarpha				X	X	X			X		
Hakea marginata		X									
Hakea prostrata			X	X				X			
Hakea ruscifolia	X	X	X								
Hakea trifurcata					X	X	X		X		
Hakea undulata		X					X				
Hakea varia	X				X				X		

Species (* denotes an introduced/weedy species)	Brickwood	Serpentine Cemetery	Serpentine Sports	Mundijong Oval	Myara Brook	Oscar Bruns	Rainforest	Wattle Road	Clem Kentish	King Road Pony Club	Craghill Way
Hardenbergia comptoniana							X	X			
Hemiandra pungens			X								
Hemigenia incana							X		X		
**Hesperantha falcata*									X		
Hibbertia diamesogenos						X			X		
Hibbertia huegelii		X						X			
Hibbertia hypericoides		X		X	X	X	X		X	X	
Hovea trisperma							X	X		X	
Hyalosperma cotula	X										
Hypocalymma angustifolium				X	X	X		X	X		
Hypocalymma robustum						X	X				
**Hypochaeris glabra*		X	X	X	X	X		X	X	X	
**Hypochaeris radicata*	X	X	X	X	X	X	X	X	X	X	
Hypolaena exsulca	X	X	X				X	X		X	X
Hypolaena sp.		X									
Isolepis cernua				X							
Isotoma hypocrateriformis						X			X		
**Ixia polystachya*		X									
Jacksonia furcellata		X			X						
Jacksonia lehmannii								X			
Jacksonia sternbergiana	X			X	X	X			X		
Johnsonia pubescens	X										
**Juncus capitatus*	X										
Juncus pallidus					X						
Kennedia prostrata		X	X	X	X	X		X	X		
Kingia australis	X	X		X			X	X			
Kunzea glabrescens							X	X		X	X
Kunzea micrantha			X								
Kunzea recurva	X			X				X	X		
Labichea punctata						X		X			
Lachnagrostis filiformis				X	X				X		
Lagenophora huegelii		X			X						
**Lathyrus tingitanus*						X					
**Lavandula stoechas*									X		
Laxmannia squarrosa				X					X		
Lechenaultia biloba	X	X		X		X	X	X	X		
Lepidobolus preissianus		X						X			
Lepidosperma angustatum					X						
Lepidosperma leptostachyum			X	X	X	X	X	X	X		
Lepidosperma pubisquameum	X	X		X	X	X	X	X	X	X	
Lepidosperma scabrum	X	X	X	X		X	X	X	X		
Lepidosperma squamatum	X		X	X	X			X	X	X	
Lepidosperma sp. E Perth Flora			X	X		X					
Lepidosperma striatum					X						
Leporella fimbriata		X									
Leptospermum erubescens	X										
**Leptospermum laevigatum*									X		
Leucopogon gracillimus									X		
Leucopogon sp.		X									X
Levenhookia pusilla	X										

Species (* denotes an introduced/weedy species)	Brickwood	Serpentine Cemetery	Serpentine Sports	Mundijong Oval	Myara Brook	Oscar Bruns	Rainforest	Wattle Road	Clem Kentish	King Road Pony Club	Craghill Way
Levenhookia stipitata						X					
Lobelia rhytidosperma		X									
Lobelia tenuior										X	
**Lolium rigidum*	X					X				X	
Lomandra brittanii						X					
Lomandra caespitosa		X	X								
Lomandra micrantha				X							
Lomandra odora						X					
Lomandra preissii					X			X	X		
Lomandra purpurea						X			X		
Lomandra sp.	X			X			X			X	
**Lotus angustissimus*						X		X			
Loxocarya cinerea								X		X	
**Lupinus* sp.								X			
Lyginia barbata	X							X			X
Lyginia imberbis	X	X			X			X			X
Macrozamia riedlei		X			X					X	X
**Melaleuca nesophila*				X					X		
Melaleuca preissiana				X							X
Melaleuca radula							X				
Melaleuca rhaphiophylla					X						
**Melaleuca scabra*									X		
Melaleuca teretifolia									X		
Melaleuca thymoides								X			
Melaleuca trichophylla				X	X	X	X	X	X		
Mesomelaena pseudostygia		X	X					X			
Mesomelaena tetragona	X	X	X	X	X	X	X	X	X		
Microlaena stipoides					X						
Microtis media		X		X		X		X		X	
Monotaxis grandiflora						X		X			
**Moraea* spp.				X			X				
Neurachne alopecuroidea	X	X		X	X	X		X	X		
Nuytsia floribunda	X	X			X		X	X	X		X
**Olea europaea*									X		
Opercularia hispidula										X	
Opercularia vaginata		X		X	X				X		
**Ornithopus sativus*								X			
**Orobanche minor*					X	X		X			
Orthrosanthus laxus					X						
**Oxalis* spp.		X		X	X	X			X		
**Paspalum dilatatum*					X						
Patersonia juncea	X			X							
Patersonia occidentalis		X	X	X		X		X	X	X	X
**Pennisetum clandestinum*				X	X						
**Pentaschistis airoides*				X							
Pericalymma ellipticum	X		X								
Petrophile linearis								X			
Petrophile seminuda				X							
**Petrorhagia dubia*		X									
Philotheca spicata	X			X				X	X	X	

Species (* denotes an introduced/weedy species)	Brickwood	Serpentine Cemetery	Serpentine Sports	Mundijong Oval	Myara Brook	Oscar Bruns	Rainforest	Wattle Road	Clem Kentish	King Road Pony Club	Craghill Way
Philydrella pygmaea	X			X							
Phlebocarya ciliata			X					X		X	
Phlebocarya filifolia								X			
Phyllanthus calycinus		X			X	X	X		X		
Pimelea sp.							X	X			
**Plantago lanceolata*						X					
**Plantago major*						X					
**Poa porphyroclados*						X					
Podolepis gracilis		X									
Podotheca chrysantha										X	
Prasophyllum sp.	X					X					
Pterostylis recurva								X		X	
Pterostylis vittata			X					X		X	
Ptilotus manglesii					X	X					
Pyrorchis nigricans			X								
Ranunculus pumilio									X		X
**Romulea flava*					X	X					
**Romulea rosea*		X		X	X	X		X	X	X	
Scaevola calliptera			X	X							
Scaevola repens								X			
Schoenus clandestinus	X	X									
Schoenus curvifolius								X			
Schoenus pedicellatus				X				X	X		
Schoenus sp.						X					
Schoenus subbarbatus		X									
Schoenus tenellus	X										
Scholtzia involucrata			X					X			
Senecio hispidulus						X					
**Silene gallica*		X									
Siloxerus humifusus	X										
**Solanum nigrum*				X		X				X	X
**Sonchus oleraceus*		X		X	X			X	X	X	
Sowerbaea laxiflora		X		X		X				X	
**Sparaxis bulbifera*				X							
Sphaerolobium aff. *macranthum*			X	X					X		
Stackhousia monogyna									X		
Stirlingia latifolia	X	X	X	X			X	X			X
Stylidium brunonianum	X							X	X		
Stylidium bulbiferum				X	X	X			X		
Stylidium ciliatum								X			
Stylidium hirsutum								X			
Stylidium petiolare				X							
Stylidium thesiodes				X					X		
Synaphea petiolaris	X	X		X		X			X		
Tetraria australiensis		X	X	X				X			
Tetraria octandra	X	X	X	X	X	X	X	X	X		
Tetrarrhena laevis					X						
Thelymitra crinita		X				X			X		
Thelymitra macrophylla			X					X			
Thelymitra vulgaris								X			

Species (* denotes an introduced/weedy species)	Brickwood	Serpentine Cemetery	Serpentine Sports	Mundijong Oval	Myara Brook	Oscar Bruns	Rainforest	Wattle Road	Clem Kentish	King Road Pony Club	Craghill Way
Themeda triandra						X					
Thomasia foliosa						X					
Thomasia thriphylla					X		X				
Thysanotus manglesianus		X		X		X	X	X	X	X	
Thysanotus multiflorus	X										
Thysanotus sparteus		X		X					X		X
Thysanotus triandrus		X	X					X		X	
Trachymene pilosa		X				X		X			
Trichocline spathulata		X								X	
Tricoryne elatior	X	X	X	X	X	X	X	X	X	X	
Tricoryne humilis				X						X	
**Trifolium angustifolium*				X					X		
Trymalium odoratissimum							X				
Trymalium sp.			X								
**Ursinia anthemoides*		X		X		X		X	X	X	X
Verticordia densiflora		X									
Verticordia huegelii									X		
Verticordia plumosa								X			
Viminaria juncea									X		
**Vitis vinifera*					X						
**Wahlenbergia capensis*								X			
**Watsonia meriana*	X	X	X	X	X	X	X	X	X		X
Wurmbea dioica				X							
Xanthorrhoea brunonis			X					X		X	X
Xanthorrhoea gracilis			X				X	X		X	
Xanthorrhoea preissii	X	X	X	X	X	X	X	X	X	X	X
Xanthosia huegelii	X	X		X	X	X	X	X	X		
Xylomelum occidentale								X			
**Zantedeschia aethiopica*		X								X	X

Appendix 2 – Fauna Surveys and Lists

The primary source of information on fauna inhabiting Shire reserves is Harvey *et al.* (1997) *Ground Fauna of the Bushland Remnants on the Ridge Hill shelf and Pinjarra Landforms Perth.* The reserves have not been surveyed in detail for fauna more recently. While the original document has not been located, individual lists can be found in some reserve management plans, which form the basis for the following table.

Fauna surveys are only known to have occurred in Brickwood Reserve, Serpentine Sports Reserve, Yangedi Airfield Reserve and King Road Pony Club Reserve (mammals only). The other reserves have been omitted here for the sake of simplicity.

Species (* denotes an introduced species)	**Brickwood Reserve**	**Serpentine Sports Reserve**	**Yangedi Airfield Reserve**	**King Road Pony Club Reserve**
Mammals				
Quenda (southern brown bandicoot)	X	X	X	X
Western grey kangaroo	X		X	
*House mouse	X	X		
*Rabbit	X		X	X
*Cat	X		X	X
*Fox	X		X	X
*Rat		X		
Amphibians				
Red-thighed froglet	X			
Sandplain froglet	X	X		
Moaning frog	X	X		
Pobblebonk	X	X		
Guenther's toadlet	X			
Glauert's froglet		X		
Reptiles				
South-western sandplain worm lizard	X			
Western bearded dragon	X			
South-western cool skink	X	X		
Fence skink	X	X		
South-western odd striped ctenotus	X			
West coast four-toed lerista	X			
Common dwarf skink	X	X		
Southern pale-flecked morethia	X			
Bobtail	X	X		
Racehorse goanna	X	X		
Southern blind snake	X	X		
Dugite	X		X	
Gould's hooded snake	X			
Two toed earless skink		X		
Tiger snake		X	X	
Burton's legless lizard				
Marbled gekko			X	
Black-tailed monitor			X	
Birds				
Australian magpie	X	X	X	
Australian raven	X	X	X	
Australian sittella	X			

Species (* denotes an introduced species)	Brickwood Reserve	Serpentine Sports Reserve	Yangedi Airfield Reserve	King Road Pony Club Reserve
Baudin's black cockatoo			X	
Black swan			X	
Black-faced cuckoo-shrike	X	X	X	
Black-faced woodswallow	X			
Brown goshawk	X			
Brown honeyeater	X	X	X	
Brown thornbill			X	
Buff-banded rail			X	
Carnaby's black cockatoo	X		X	
Common bronzewing		X	X	
Crested pigeon			X	
*Domestic pigeon	X			
Dusky woodswallow	X		X	
Elegant parrot	X		X	
Fan-tailed cuckoo			X	
Galah	X	X	X	
Great egret			X	
Grey butcherbird			X	
Grey fantail	X	X	X	
Grey-breasted white-eye	X			
*Laughing dove	X			
*Laughing kookaburra	X	X	X	
Little eagle	X			
Magpie-lark	X			
Misteltoebird	X			
Nankeen kestrel			X	
New holland honeyeater			X	
Painted button-quail	X			
Pallid cuckoo	X			
Rainbow bee-eater	X	X	X	
Red wattlebird	X		X	
Red-capped parrot	X	X	X	
Red-capped robin			X	
Red-tailed black cockatoo	X			
Richard's pipit			X	
Ringnecked parrot	X	X	X	
Rufous whistler	X	X	X	
Sacred kingfisher	X		X	
Shining bronze-cuckoo		X		
Silvereye	X	X	X	
Singing honeyeater		X		
Splendid fairy wren		X	X	
Southern boobook owl			X	
*Spotted turtle-dove			X	
Straw-necked ibis			X	
Striated pardalote	X			
Swamp harrier			X	
Tree martin	X		X	
Welcome swallow	X		X	
Western gerygone	X	X	X	
Western rosella	X			
Western spinebill	X		X	
Western thornbill			X	
White-browed scrub wren			X	
White-cheeked honeyeater			X	

Species (* denotes an introduced species)	Brickwood Reserve	Serpentine Sports Reserve	Yangedi Airfield Reserve	King Road Pony Club Reserve
White-faced heron			X	
White-fronted chat	X			
Willy wagtail	X		X	
Yellow-rumped thornbill		X	X	

Appendix 3 – Threatened and Priority Flora and Fauna

Threatened and priority flora and fauna have been recorded in the Shire's marri woodland reserves. The species listed in official records from the Department of Biodiversity, Conservation and Attractions are listed in the table below. Anecdotal or informal records are not listed.

Fauna surveys are only known to have occurred in Brickwood Reserve, Serpentine Sports Reserve and Yangedi Airfield Reserve. The other reserves have been omitted here for the sake of simplicity.

Species	**Status T (Threatened) P1-4 (Priority 1-4)**	**Brickwood Reserve**	**Serpentine Sports Reserve**	**Yangedi Airfield Reserve**
Flora				
Acacia oncinophylla	P3		X	
Drosera occidentalis	P4	X	X	
Morelotia australiensis	T		X	
Schoenus pennisetis	P3	X		
Fauna				
Birds				
Calyptorhynchus banksii naso (Forest red-tailed black cockatoo)	T		X	
Calyptorhynchus baudinii (Baudin's black cockatoo)	T	X	X	
Calyptorhynchus latirostris (Carnaby's black cockatoo)	T	X	X	X
Mammals				
Isoodon fusciventer (quenda)	P4	X	X	X
Reptiles				
Acanthophis antarcticus (common death adder)	P3	X		

Appendix 4 – Fire Management Strategy for Marri Woodland

Principles of Fire Management for Marri Woodland

1. **For fuel load management, weed control is preferable to control burning and should be the method of choice.**

2. **All fire in marri woodland, whether wildfire or control burning, must be followed by at least two years of thorough weed control.**

3. **Burning of marri woodland increases fire hazard and rate of spread through increased growth and invasion of flammable grassy weeds.**

4. **Any disturbance of marri woodland results in growth and invasion of highly flammable grassy weeds, leading to increased fire hazard.**

5. **The fire interval for marri woodland should be 8 – 40 years, and the ideal cycle is 24 – 28 years between fires.**

6. **Fire control in marri woodland should consider dieback and marri canker and avoid spread into uninfected areas by movement of machinery across dieback fronts and other hygiene methods.**

Brickwood Reserve Action Plan

R17490, R51101, R37404

1. Background

1.1 Location

Brickwood Reserve is located in Byford, associated with the Briggs Park recreation centre and surrounded by urban development (Figure 1). It is also adjacent to the BaptistCare Graceford Aged Care Home.

Brickwood Reserve contains three main vegetation communities: marri woodland, banksia woodland and clay-based wetlands. The reserve is 53.1 ha with 45.5 ha remnant vegetation, of which approximately 40.6 ha is marri woodland. This action plan specifically deals with the marri woodland area, while the other communities are addressed in the other management plans.

The majority of the reserve (including the marri woodland) is vested with the Shire for the purpose of Recreation, but current uses also include Conservation. There are numerous user groups for the reserve, particularly associated with the Briggs Park recreation centre, and significant infrastructure.

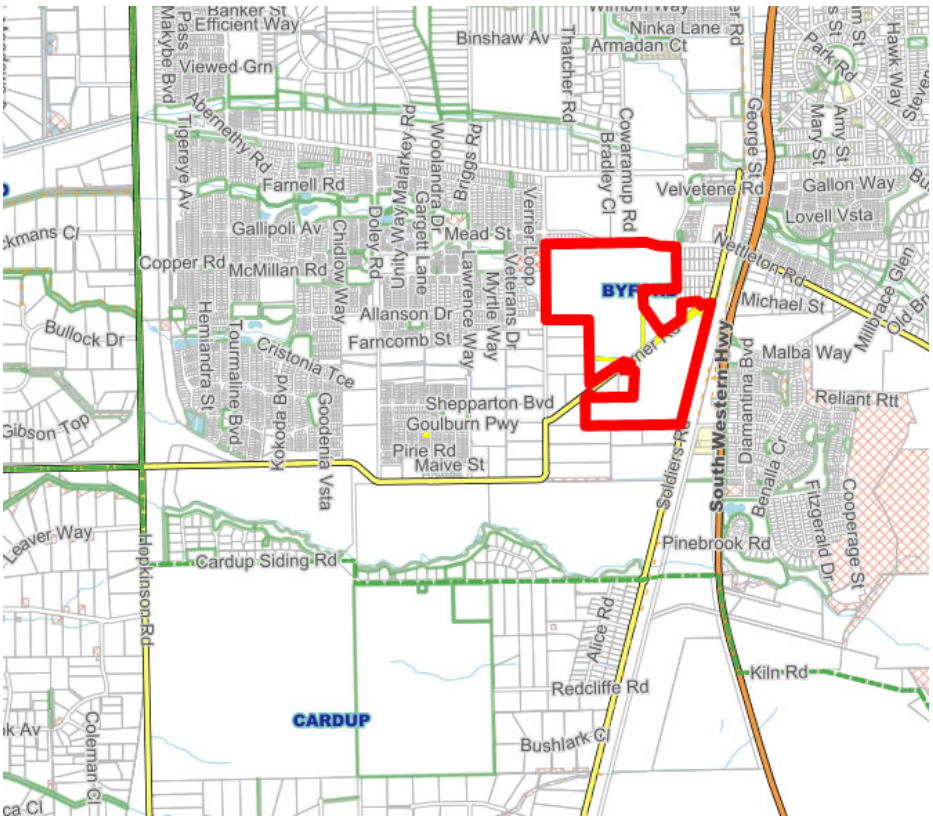


Figure 1: Location of Brickwood Reserve.

Brickwood Reserve is classified into four main management zones (Figure 2). These are:

Conservation Zone (green): Areas of remnant vegetation of high biodiversity and scientific reference value which include both dieback free and dieback infected areas. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must utilise dieback hygiene procedures such as clean-down and take extreme care to prevent spread of dieback from infected to uninfected areas.

Vegetation Management Zone (red): Areas of remnant vegetation of biodiversity and scientific reference value which may be disturbed, or dieback or weed infested. This is a buffer zone and may receive fuel load management for protection of people, property and conservation values by weed control or control burning on assessment by officers as required and appropriate. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must consider movement and reduce spread of dieback from infected to uninfected areas through clean down procedures.

Recreation Zone (yellow): This is largely the areas of Briggs Park used for active and passive recreation. Management of this zone is principally for the purpose of recreation, while minimising impacts on the adjacent remnant vegetation.

Community Zone (blue): This zone contains the BaptistCare Graceford Aged Care Home. The high vulnerability of the residents means that management of the adjacent vegetation prioritises the protection of people and property.

This Action Plan applies to the Conservation and Vegetation Management Zones.

1.2 Soils

Four soil types occur in Brickwood Reserve: Forrestfield F5, Pinjarra P1a, Pinjarra P1e and Pinjarra B1 (Table 1 and Figure 3). Marri woodland occurs on all but the Pinjarra B1 soil type.

Table 1: Soil Types of Brickwood Reserve.

Reserve	Soil landscape unit	Description	Marri occurrence
Brickwood Reserve	Forrestfield F5 phase	Poorly defined stream channels on lowest slopes with deep acidic yellow duplex soils and sandy alluvial gradational brown earths.	Partial
	Pinjarra P1a phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or effective duplex) soils. Shallow pale sand to sandy loam over clay; imperfect to poorly drained and generally not susceptible to salinity.	Yes
	Pinjarra P1e phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or effective duplex) soils. Shallow pale sand to sandy loam over very gravelly clay; moderately well drained.	Yes
	Pinjarra B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	No

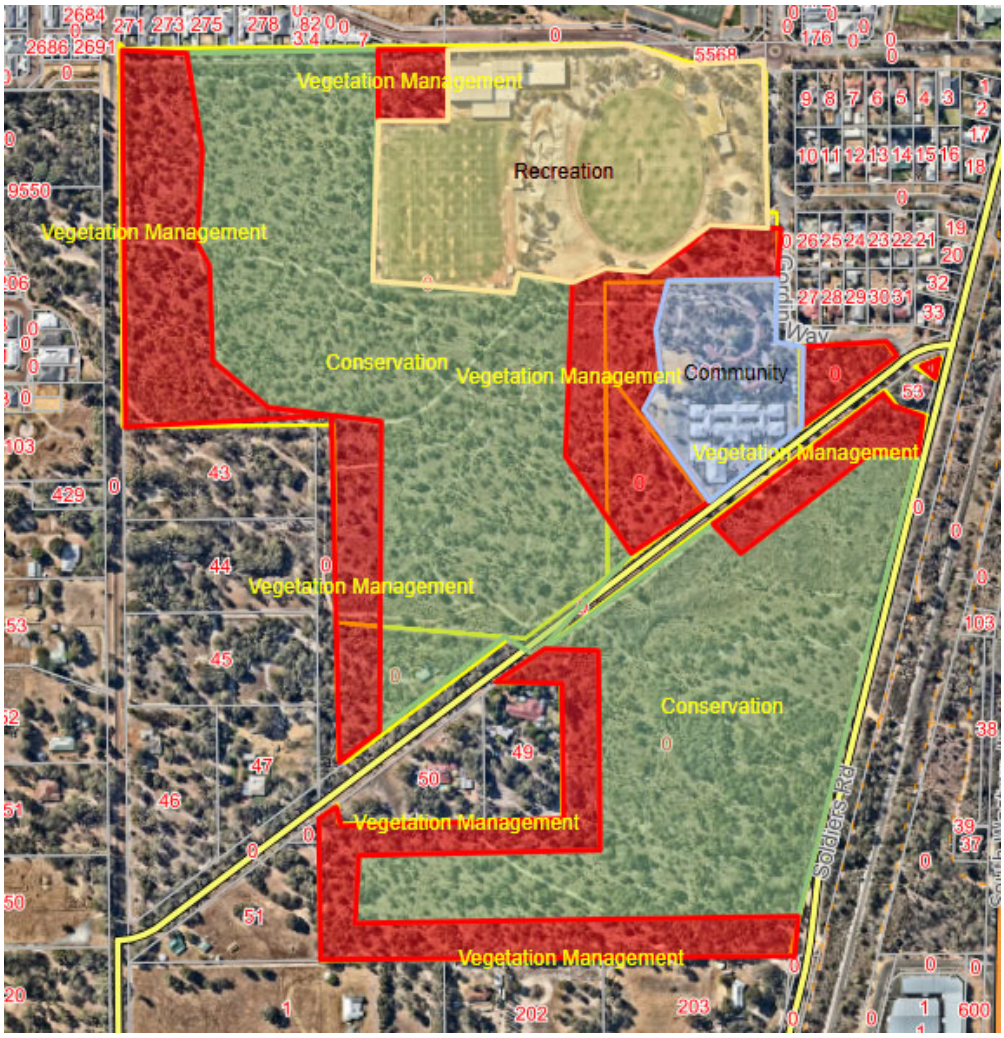


Figure 2: Uses and Management Zones of Brickwood Reserve.

1.3 Biodiversity

Brickwood Reserve contains three main vegetation communities: marri woodland, banksia woodland and clay-based wetlands. The marri woodland is approximately 40.6 ha in area (Figure 4) and belongs to the vegetation complex SCP3a (*Corymbia calophylla – Kingia australis* woodlands).

The entire reserve belongs to Threatened Ecological Communities and is an Environmentally Sensitive Area. Bush Forever site 321 includes the reserve and adjacent vegetated corridors.

The vegetation in Brickwood Reserve is in Very Good to Excellent condition overall. The flora of Brickwood Reserve has been frequently surveyed and is diverse. A number of Threatened and Priority flora species have been recorded in the area.

The fauna of Brickwood Reserve has not been thoroughly surveyed since 1997. The fauna recorded at the time was diverse, and anecdotal evidence suggests that the majority are still present. A number of Threatened and Priority fauna species have been recorded, including all three species of black cockatoos, and quenda (southern brown bandicoot).

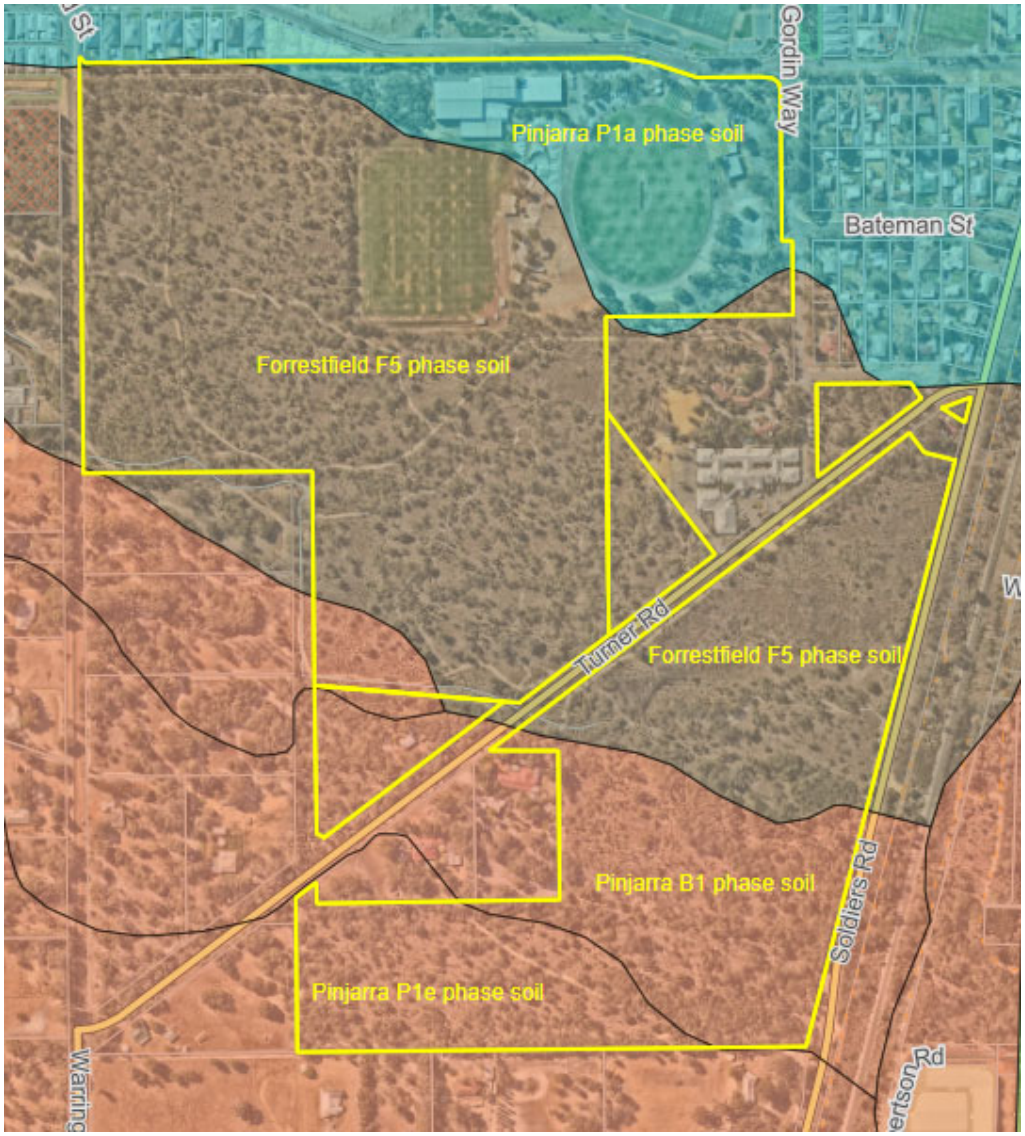


Figure 3: Soil types of Brickwood Reserve.

1.4 Water Resources

Brickwood Reserve is generally low-lying, and as such much of it is seasonally waterlogged. A clay-based wetland lies in the south-east of the reserve, with a watercourse (drain) running from the wetland along the boundary of the reserve to discharge across Warrington Road to the west.

The entire reserve, except for the recreational facilities and the banksia woodland, is a Conservation Category wetland (Figure 5). A small area of Resource Enhancement wetland lies between the reserve and the BaptistCare Graceford Aged Care Home, while the recreational facilities and the land surrounding the reserve is classified as a Multiple Use wetland.

Figure 4: Location of Marri Woodland of Brickwood Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of Brickwood Reserve include:

- Recreational pressure from surrounding urban areas
- Community anxiety about fire hazard and pressure for control burning
- Arson, vandalism and degradation
- Illegal dumping of rubbish and garden waste
- Illegal access by motorised vehicles and associated damage to fences and vegetation
- Weed invasion, from ovals, dumping, surrounding urban areas, and carried in by users
- Feral and domestic animals (foxes, rabbits, cats) predating fauna and damaging vegetation
- Dieback disease (*Phytophthora cinnamomi*) and marri canker
- Nutrient runoff from ovals and from Graceford

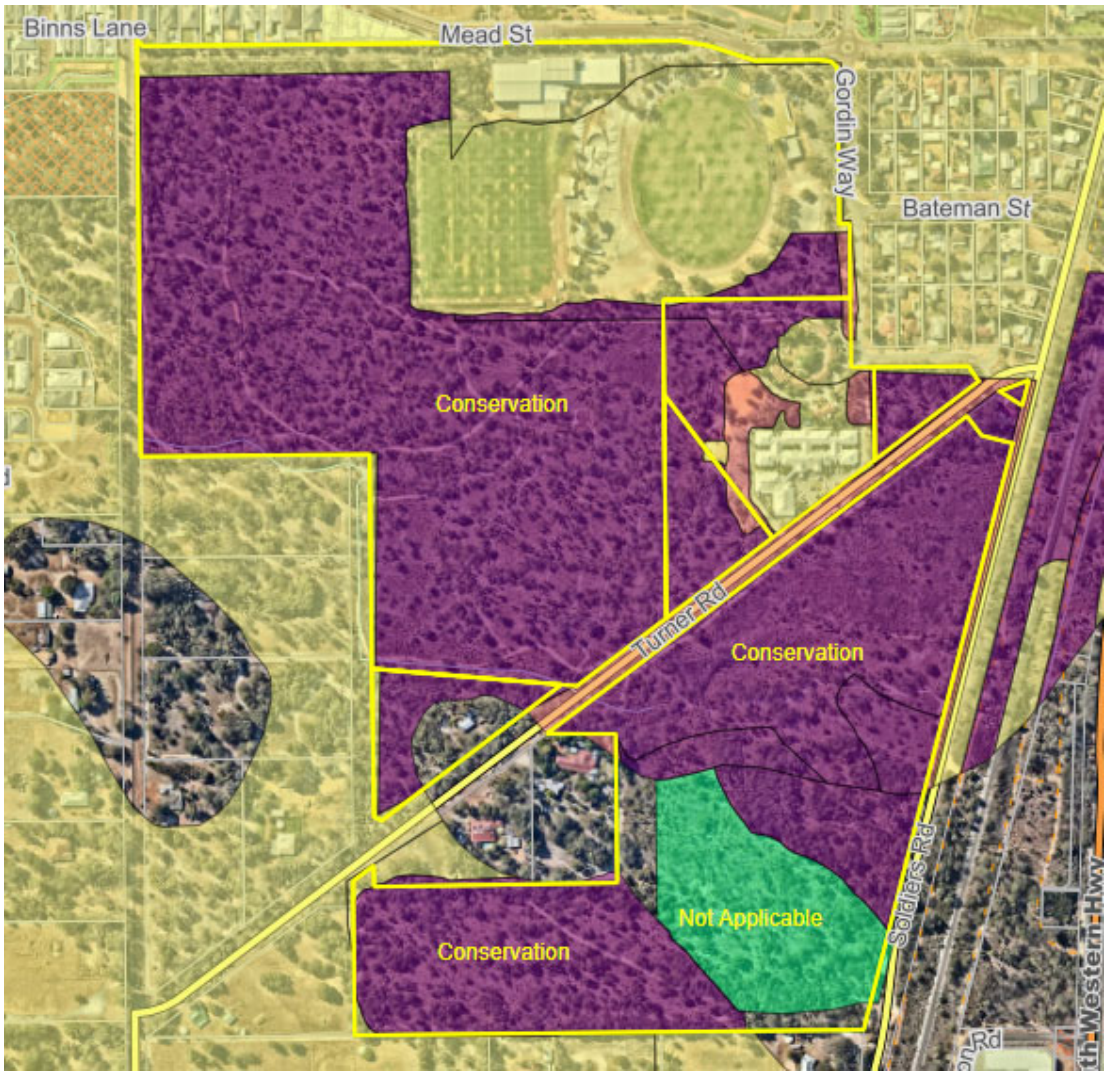


Figure 5: Geomorphic Wetland Types of Brickwood Reserve.

3. Reserve Usage

3.1 Vesting and Land Tenure

The vesting purpose, land tenure and current uses of the various lots that make up Brickwood Reserve are listed below in Table 2, and the land parcels shown in Figure 6. While R37404 (L106, in two parcels on either side of Graceford) is not vested with the Shire, it is traditionally managed as part of Brickwood Reserve and so is included here.

Table 2: Vesting Purpose, Land Tenure and Uses of Brickwood Reserve.

Reserve	Reserve and Lot Number	Vesting Purpose and Land Tenure	Current Uses
Brickwood Reserve	R17490 L5567, L111 and L112 Mead Street, Byford	Shire of Serpentine Jarrahdale – Recreation	Recreation and Conservation
	R51101 L48 Turner Road, Byford	Shire of Serpentine Jarrahdale – Environmental Conservation, Recreation, Community Centre and Purposes Ancillary Thereto	Recreation and Conservation
BaptistCare Graceford Aged Care Home	R37404 L106 Turner Road, Byford	WA Baptist Hospital and Homes Trust Inc. – Aged Persons Homes	Buffer Zone and Conservation

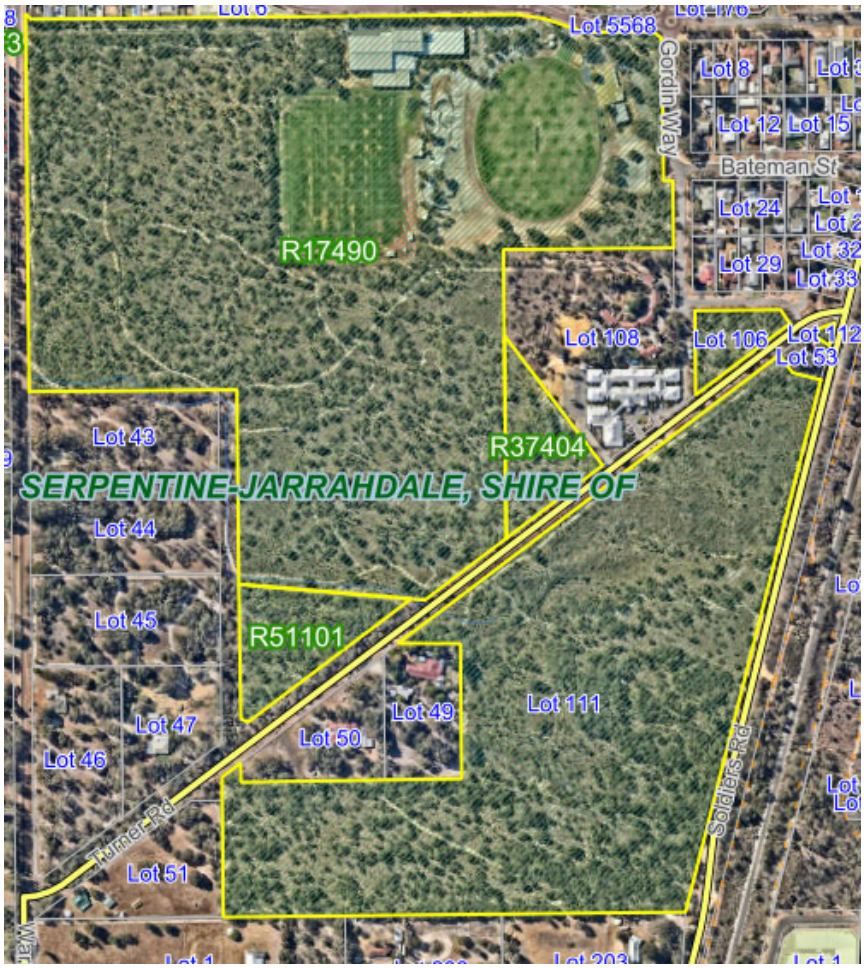


Figure 6: Reserve Numbers and Locations of Brickwood Reserve.

3.2 User Groups

The principal users of Brickwood Reserve are:

- Users of the recreation centre's facilities (gym, courts and function rooms), including school children in out of school hours care and coaching
- Sports groups, including cricket, football and diamond sports groups
- BMX club
- Friends of Brickwood
- Landcare SJ Inc.
- Informal users, particularly for walking and dog exercise
- BaptistCare Graceford Aged Care Home management, for R37404 vegetation management

Conflict between user groups with differing priorities can cause issues for management of the reserve. Informal users, particularly as pressure grows with the expanding urban development around the reserve, can degrade the vegetation and conflict with the conservation groups. BaptistCare's management of the vegetation around Graceford for protection of people and property can also conflict with conservation.

3.3 Infrastructure

The infrastructure located in Brickwood Reserve includes:

- Recreation centre (gym, courts and function rooms) managed by The Y (formerly YMCA)
- Sports pavilions and associated storage sheds
- Cricket nets
- Tennis courts (dilapidated and unused)
- Skate park
- BMX track
- Car parks
- Dilapidated building intended for community uses (R51101)
- Sports fields
- Bores and irrigation systems
- Fences and gates
- Signage, relating to entry and use, and conservation
- Firebreaks, some surfaced with limestone for trafficability
- Informal walking paths

The infrastructure is mostly maintained by the Shire. Despite a high standard of maintenance. good lighting and high community use and surveillance, vandalism and theft are constant but low-level threats.

Fire can threaten people, property and conservation values. Fires can start inside or adjacent to buildings and structures, and are often the result of vandalism, kitchen accidents or electrical faults. Bush or grass fires threaten buildings and structures through embers, radiant heat and direct contact. Cleared areas around buildings limit the opportunity for bush and grass fires to reach them. Fire in nearby bushland has the potential to damage infrastructure.

4. Action Plan

Table 3: Action Plan for Brickwood Reserve.

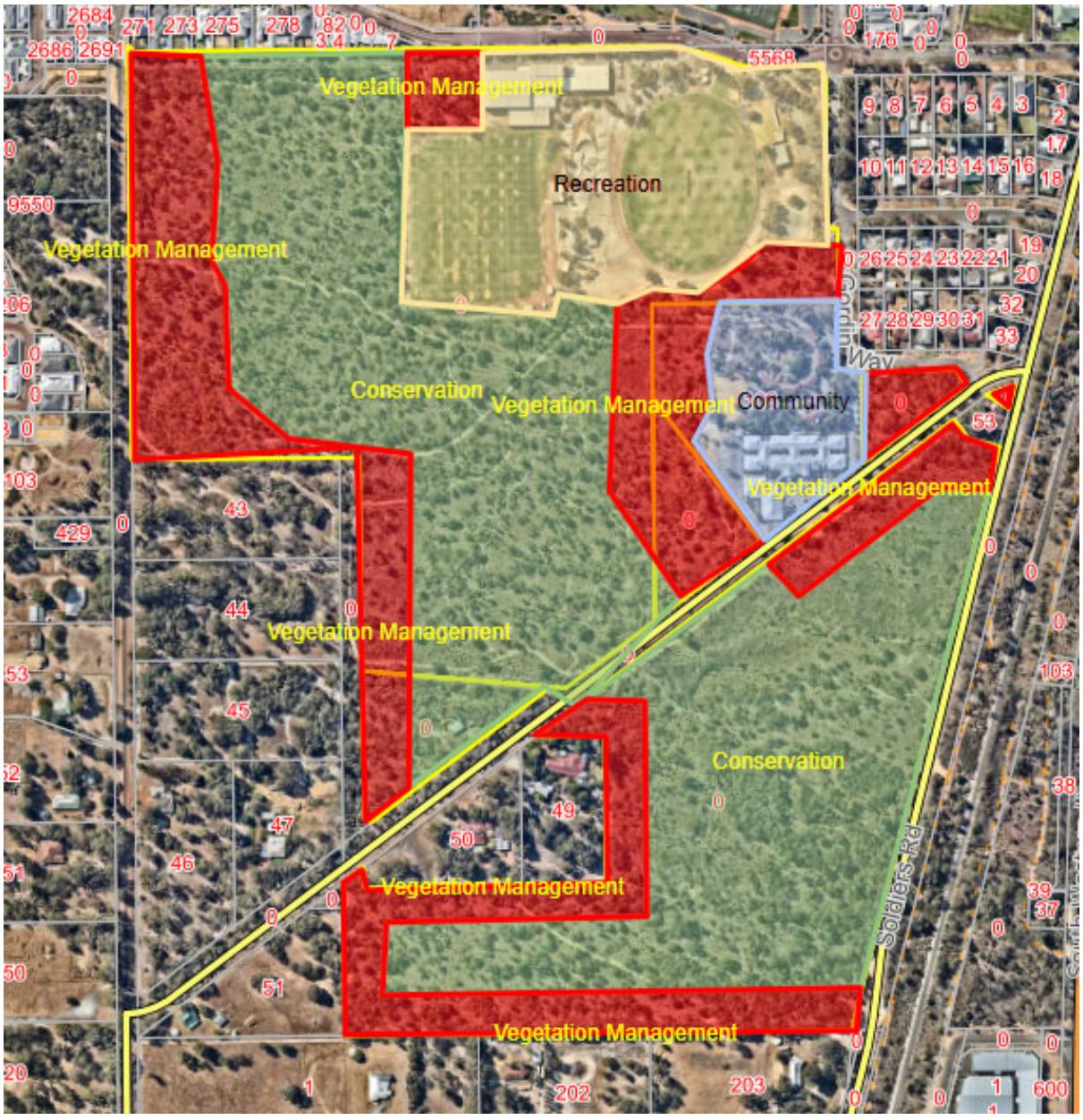
No.	Action	Priority	Timing	Status	Responsibility	Cost
1	**Utilise the planning system to retain and protect remnant marri woodland.**	**Key**	**Business as Usual**	**Ongoing**	**Statutory Planning**	**Staff Time**
2	Keep up to date with the latest research trends with regard to marri woodland and integrate into reserve management.	High	Long Term	Ongoing	Natural Reserves, Emergency Services	Staff Time
3	Formalise access to marri woodland in high use areas through establishment of walking paths that reduce trampling.	Medium	Medium Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
4	Erect signage in high use areas to inform users of the values of the marri woodland.	Medium	Short Term	Implemented in Part	Operations	Budget Dependent - $2,000
5	**Survey for dieback presence, and map and treat dieback every three years if present.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $6,000**
6	**Survey for marri canker, and treat infected trees.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $1,000**
7	Monitor and manage new and emerging pests and diseases such as polyphagous shot hole borer.	High	Medium Term	Ongoing	Natural Reserves	Budget Dependent - $2,000
8	Control access to marri woodland through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
9	Work with user groups to protect and minimize impacts to remnant vegetation.	High	Business as Usual	Ongoing	Natural Reserves, User Groups	Staff Time
10	Liaise with other landholders to work together and integrate management of all marri woodland areas.	Medium	Medium Term	Not Yet Implemented	Natural Reserves, Strategic Environment	Staff Time
11	Implement measures to exclude motorised vehicles from the remnant vegetation.	High	Medium Term	Implemented in Part	Operations	Budget Dependent - $2,000
12	Ensure that formalised paths and other access routes cross dieback fronts to the lowest degree possible.	Medium	Medium Term	Not Yet Implemented	Natural Reserves	Staff Time
13	Establish dieback hygiene policies, including vehicle washdown points and foot baths for pedestrians with appropriate signage where appropriate.	High	Long Term	Implemented in Part	Natural Reserves	Budget Dependent - $2,000
14	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environment	Budget Dependent - $3,000
15	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves	Budget Dependent - $3,000

No.	Action	Priority	Timing	Status	Responsibility	Cost
16	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves	Staff Time
17	**Establish and implement a weed control program that utilises best practice methods.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves, Landcare SJ**	**Budget Dependent - $3,000**
18	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ	Budget and/or Funding Dependent - $1,500
19	**Minimise burning and other disturbance of banksia woodland.**	**Key**	**Short Term**	**Implemented in Part**	**Emergency Services**	**Staff Time**
20	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves	Staff Time
21	Maintain fire intervals of 8-40 years.	High	Long Term	Not Yet Implemented	Emergency Services	Staff Time
22	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Staff Time
23	Restrict any essential fuel load management to the Vegetation Management Zone.	High	Short Term	Not Yet Implemented	Emergency Services	Budget Dependent - $1,500
24	Carry out fuel load management on adjacent road verges to avoid fire entering the reserve from the verge.	High	Medium Term	Not Yet Implemented	Emergency Services	Budget Dependent - $2,000
25	Ensure that any essential fuel load management utilises weed control as a priority, with control burning as a last resort.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves	Budget Dependent - $3,000
26	Ensure that any control burning is restricted to vegetation boundaries, providing a mosaic of vegetation ages including long unburnt.	High	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Budget Dependent - $1,500
27	**Follow any burning or other disturbance with weed control for at least two years post-fire.**	**Key**	**Business as Usual**	**Implemented in Part**	**Emergency Services, Natural Reserves**	**Budget Dependent - $3,000**
28	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations	Staff Time
29	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves	Funding Dependent - $2,500
30	Monitor implementation of the action plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environment	Staff Time
31	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environment	Staff Time
32	Review and revise the action plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environment	Staff Time

5. Fire Management Strategy for Brickwood Reserve

Conservation Zone (green) – works exclusion; avoid disturbance

Vegetation Management Zone (red) – fuel load management if deemed appropriate and necessary by weed control and/or control burning followed by weed control



Dieback – present in some areas

Weeds – control required following disturbance

Firebreaks – present along boundaries

Serpentine Cemetery Reserve Action Plan

R10661

1. Background

1.1 Location

Serpentine Cemetery Reserve is located in Serpentine, surrounded by semi-rural development (Figure 1). It is close to the Serpentine River and Serpentine townsite.

Serpentine Cemetery Reserve contains one vegetation community, marri woodland. The reserve is 2.44 ha with 2.1 ha remnant vegetation (marri woodland). This action plan specifically deals with the marri woodland area.

The reserve is vested with the Shire for the purpose of Cemetery, but current uses also include Conservation. The user groups and infrastructure for the reserve are associated with the cemetery.

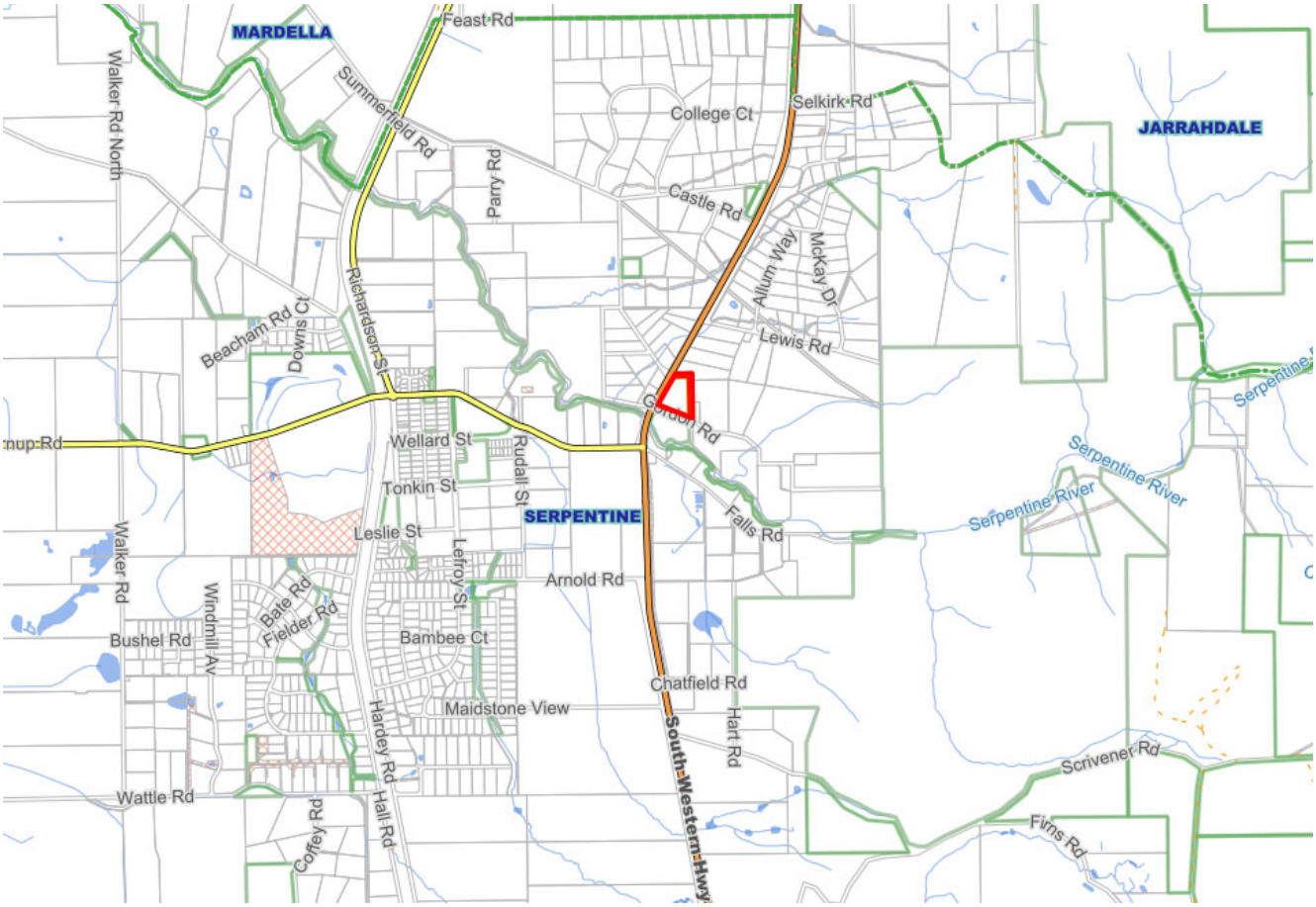


Figure 1: Location of Serpentine Cemetery Reserve.

Serpentine Cemetery Reserve is classified into three main management zones (Figure 2). These are:

Conservation Zone (green): Areas of remnant vegetation of high biodiversity and scientific reference value which include both dieback free and dieback infected areas. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must utilise dieback hygiene procedures such as clean-down and take extreme care to prevent spread of dieback from infected to uninfected areas.

Vegetation Management Zone (red): Areas of remnant vegetation of biodiversity and scientific reference value which may be disturbed, or dieback or weed infested. This is a buffer zone and may receive fuel load management for protection of people, property and conservation values by weed control or control burning on assessment by officers as required and appropriate. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must consider movement and reduce spread of dieback from infected to uninfected areas through clean down procedures.

Community Zone (blue): This zone contains the Serpentine Cemetery. The high vulnerability of many users means that management of the adjacent vegetation prioritises the protection of people and property.

This Action Plan applies to the Conservation and Vegetation Management Zones.

1.2 Soils

Two soil types occur in Serpentine Cemetery Reserve: Forrestfield F7 and Forrestfield F2 (Table 1 and Figure 3). Marri woodland occurs on both soil types.

Table 1: Soil Types of Serpentine Cemetery Reserve.

Reserve	Soil landscape unit	Description	Marri occurrence
Serpentine Cemetery Reserve	Forrestfield (D Range) F7 phase	Alluvial fans on slopes <5-10%. Variable, imperfectly drained soils comprising layers of sand, sandy loam, clay, grit and weathered granitic detritus. Low woodland of *C. calophylla*, *Banksia attenuata* and *grandis* and some *Casuarina* spp.	Yes
	Forrestfield (D Range) F2 phase	Foot and low slopes < 10%. Well drained gravelly yellow or brown duplex soils with sandy topsoil. Woodland of *E. marginata, C. calophylla* and some *B. grandis.*	Yes

Figure 2: Management Zones of Serpentine Cemetery Reserve.

1.3 Biodiversity

Serpentine Cemetery Reserve contains one vegetation community, marri woodland. The marri woodland is approximately 2.1 ha in area (Figure 4) and belongs to the vegetation complex SCP3c (*Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands).

The vegetated parts of the reserve are an Environmentally Sensitive Area. Bush Forever site 371 includes the vegetated parts of the reserve and adjacent vegetated corridors such as the Serpentine River.

The vegetation in Serpentine Cemetery Reserve is in Good condition overall. The flora of Serpentine Cemetery Reserve has been frequently surveyed and is diverse. The Threatened flora species *Morelotia australiensis* has been recorded in the area.

The fauna of Serpentine Cemetery Reserve has never been formally surveyed, although anecdotally some Threatened and Priority fauna species are present, such as all three species of black cockatoos and quenda (southern brown bandicoot).

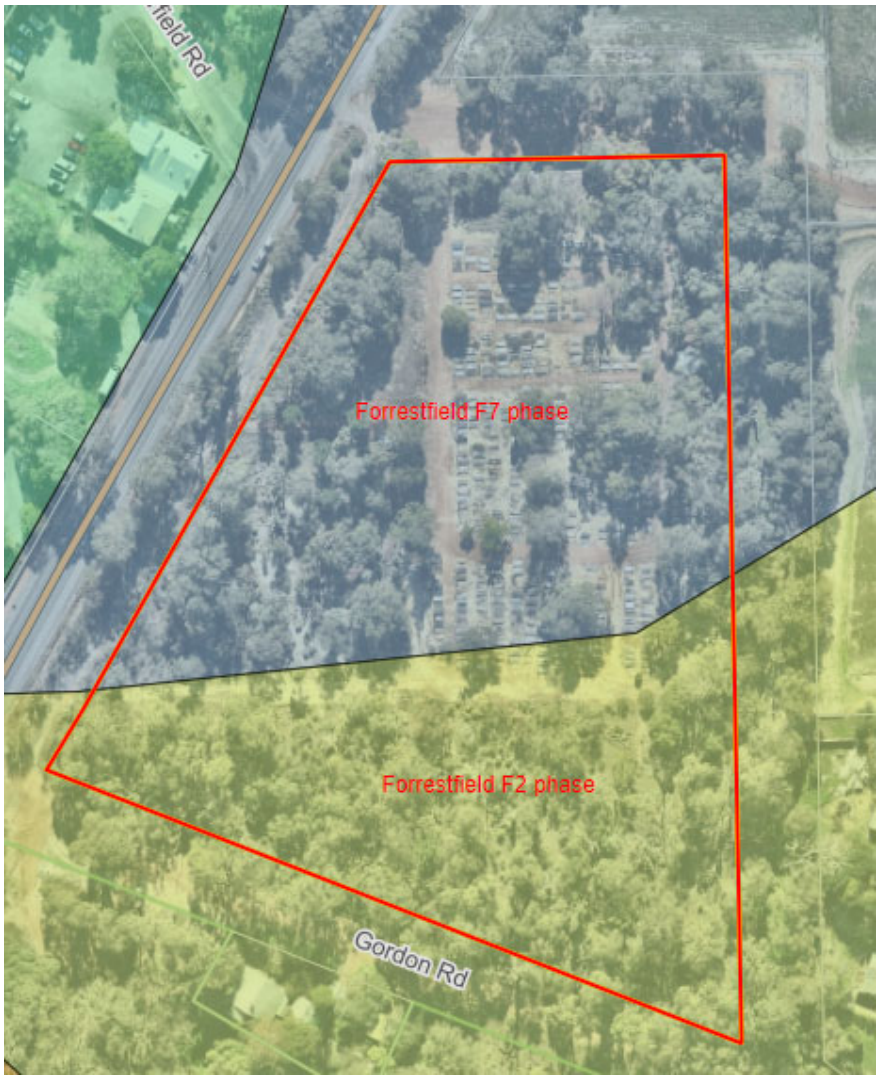


Figure 3: Soil Types of Serpentine Cemetery Reserve.

1.4 Water Resources

Serpentine Cemetery Reserve sits on the slope above the Serpentine River's floodplain, and as such much of it is seasonally waterlogged. The major water feature in the area is the Serpentine River, and watercourses run to the river to the east and west of the reserve.

The reserve itself is not classified as a wetland (Figure 5). A Multiple Use wetland surrounds the reserve on the north, west and south, including the Serpentine River.

Figure 4: Location of Marri Woodland of Serpentine Cemetery Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of Serpentine Cemetery Reserve include:

- Pressure for cemetery expansion and addition of facilities
- Recreational pressure from surrounding urban areas
- Community anxiety about fire hazard and pressure for control burning
- Arson, vandalism and degradation
- Weed invasion, from surrounding urban areas, and carried in by users
- Feral and domestic animals (foxes, rabbits, cats) predating fauna and damaging vegetation
- Dieback disease (*Phytophthora cinnamomi*) and marri canker

Figure 5: Geomorphic Wetlands of Serpentine Cemetery Reserve.

3. Reserve Usage

3.1 Vesting and Land Tenure

The vesting purpose, land tenure and current uses of Serpentine Cemetery Reserve are listed below in Table 2.

Table 2: Vesting Purpose, Land Tenure and Current Uses of Serpentine Cemetery Reserve.

Reserve	Reserve and Lot Number	Vesting and Land Tenure	Current Uses
Serpentine Cemetery Reserve	R10661 L162 South Western Highway, Serpentine	Shire of Serpentine Jarrahdale – Cemetery	Cemetery and Conservation

3.2 User Groups

The principal users of Serpentine Cemetery Reserve are:

- Users associated with funerals – mourners, funeral directors, masons, gravediggers
- Visitors to graves
- Historical society and tourism
- Informal users

Conflict between user groups with differing priorities can cause issues for management of the reserve. Informal users, particularly as pressure grows with the expanding urban development around the reserve, can degrade the vegetation and conflict with conservation groups. Funerals can also conflict with conservation values, particularly access for gravedigging machinery.

3.3 Infrastructure

The infrastructure located in Serpentine Cemetery Reserve includes:

- Cemetery – graves, memorial wall for ashes, benches for contemplation
- Rotunda
- Toilets
- Car park

The infrastructure is mostly maintained by the Shire. Despite a high standard of maintenance. good lighting and high community use and surveillance, vandalism and theft are constant but low-level threats.

Fire can threaten people, property and conservation values. Bush or grass fires threaten nearby buildings and structures through embers, radiant heat and direct contact. Cleared areas around buildings limit the opportunity for bush and grass fires to reach them. Fire in nearby bushland has the potential to damage infrastructure.

4. Action Plan

Table 3: Action Plan for Serpentine Cemetery Reserve.

No.	Action	Priority	Timing	Status	Responsibility	Cost
1	**Utilise the planning system to retain and protect remnant marri woodland.**	**Key**	**Business as Usual**	**Ongoing**	**Statutory Planning**	**Staff Time**
2	Keep up to date with the latest research trends with regard to marri woodland and integrate into reserve management.	High	Long Term	Ongoing	Natural Reserves, Emergency Services	Staff Time
3	Formalise access to marri woodland in high use areas through establishment of walking paths that reduce trampling.	Medium	Medium Term	Not Yet Implemented	Operations	Budget Dependent - $3,000

No.	Action	Priority	Timing	Status	Responsibility	Cost
4	Erect signage in high use areas to inform users of the values of the marri woodland.	Medium	Short Term	Implemented in Part	Operations	Budget Dependent - $2,000
5	**Survey for dieback presence, and map and treat dieback every three years if present.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $6,000**
6	**Survey for marri canker, and treat infected trees.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $1,000**
7	Monitor and manage new and emerging pests and diseases such as polyphagous shot hole borer.	High	Medium Term	Ongoing	Natural Reserves	Budget Dependent - $2,000
8	Control access to marri woodland through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
9	Work with user groups to protect and minimize impacts to remnant vegetation.	High	Business as Usual	Ongoing	Natural Reserves, User Groups	Staff Time
10	Liaise with other landholders to work together and integrate management of all marri woodland areas.	Medium	Medium Term	Not Yet Implemented	Natural Reserves, Strategic Environment	Staff Time
11	Establish access routes to exclude gravedigging machinery from remnant vegetation.	High	Business as Usual	Ongoing	Operations	Staff Time
12	Formalise access and funeral areas to minimize impacts to remnant vegetation.	Medium	Business as Usual	Ongoing	Operations	Budget Dependent - $2,000
13	Ensure that formalised paths and other access routes cross dieback fronts to the lowest degree possible.	Medium	Medium Term	Not Yet Implemented	Natural Reserves	Staff Time
14	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environment	Budget Dependent - $3,000
15	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves	Budget Dependent - $3,000
16	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves	Staff Time
17	**Establish and implement a weed control program that utilises best practice methods.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves, Landcare SJ**	**Budget Dependent - $3,000**
18	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ	Budget and/or Funding Dependent - $1,500
19	**Minimise burning and other disturbance of marri woodland.**	**Key**	**Short Term**	**Implemented in Part**	**Emergency Services**	**Staff Time**
20	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves	Staff Time
21	Maintain fire intervals of 8-40 years.	High	Long Term	Not Yet Implemented	Emergency Services	Staff Time

No.	Action	Priority	Timing	Status	Responsibility	Cost
22	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Staff Time
23	Restrict any essential fuel load management to the Vegetation Management Zone.	High	Short Term	Not Yet Implemented	Emergency Services	Budget Dependent - $1,500
24	Carry out fuel load management on adjacent road verges to avoid fire entering the reserve from the verge.	High	Medium Term	Not Yet Implemented	Emergency Services	Budget Dependent - $2,000
25	Ensure that any essential fuel load management utilises weed control as a priority, with control burning as a last resort.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves	Budget Dependent - $3,000
26	Ensure that any control burning is restricted to vegetation boundaries, providing a mosaic of vegetation ages including long unburnt.	High	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Budget Dependent - $1,500
27	**Follow any burning or other disturbance with weed control for at least two years post-fire.**	**Key**	**Business as Usual**	**Implemented in Part**	**Emergency Services, Natural Reserves**	**Budget Dependent - $3,000**
28	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations	Staff Time
29	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves	Funding Dependent - $2,500
30	Monitor implementation of the action plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environment	Staff Time
31	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environment	Staff Time
32	Review and revise the action plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environment	Staff Time

5. Fire Management Strategy for Serpentine Cemetery Reserve

Conservation Zone (green) – works exclusion; avoid disturbance

Vegetation Management Zone (red) – fuel load management if deemed appropriate and necessary by weed control and/or control burning followed by weed control

Dieback – present in some areas

Weeds – control required following disturbance

Firebreaks – present along boundaries

Serpentine Sports Reserve Action Plan

R19134

1. Background

1.1 Location

Serpentine Sports Reserve is located in Serpentine (Figure 1). It consists of two land parcels, one on each side of Karnup Road. The northern side contains holes 10-18 of the golf course, while the southern side contains the first nine holes, the David Buttfield Equestrian Park, the John Lyster Polocrosse Ground and a small area leased for a communications tower (Figure 2). It also includes regionally significant areas of remnant vegetation in the Paul Robinson Reserve and nearby woodland. This action plan applies to the southern land parcel only.

The reserve contains three main vegetation complexes: banksia woodland, marri woodland and a clay-based wetland. The reserve is 46.4 ha with 10.1 ha remnant vegetation of which 3.8 ha is marri woodland. This action plan specifically deals with the marri woodland area.

The reserve is vested with the Shire for the purpose of Recreation, Racecourse and Showground, but current uses also include Conservation. The principal user groups for the reserve are the Serpentine Horse and Pony Club, the Serpentine/Foothills Polocrosse Club, the Serpentine and Districts Golf Club, and the Serpentine Environmental Group. Each user group uses and maintains significant infrastructure.

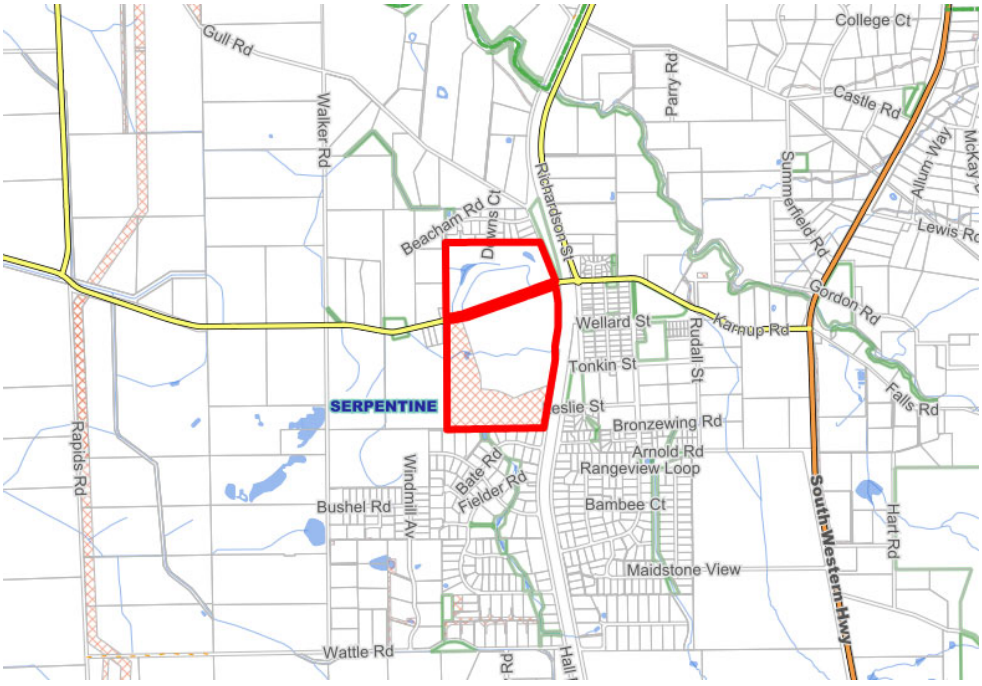


Figure 1: Location of Serpentine Sports Reserve.

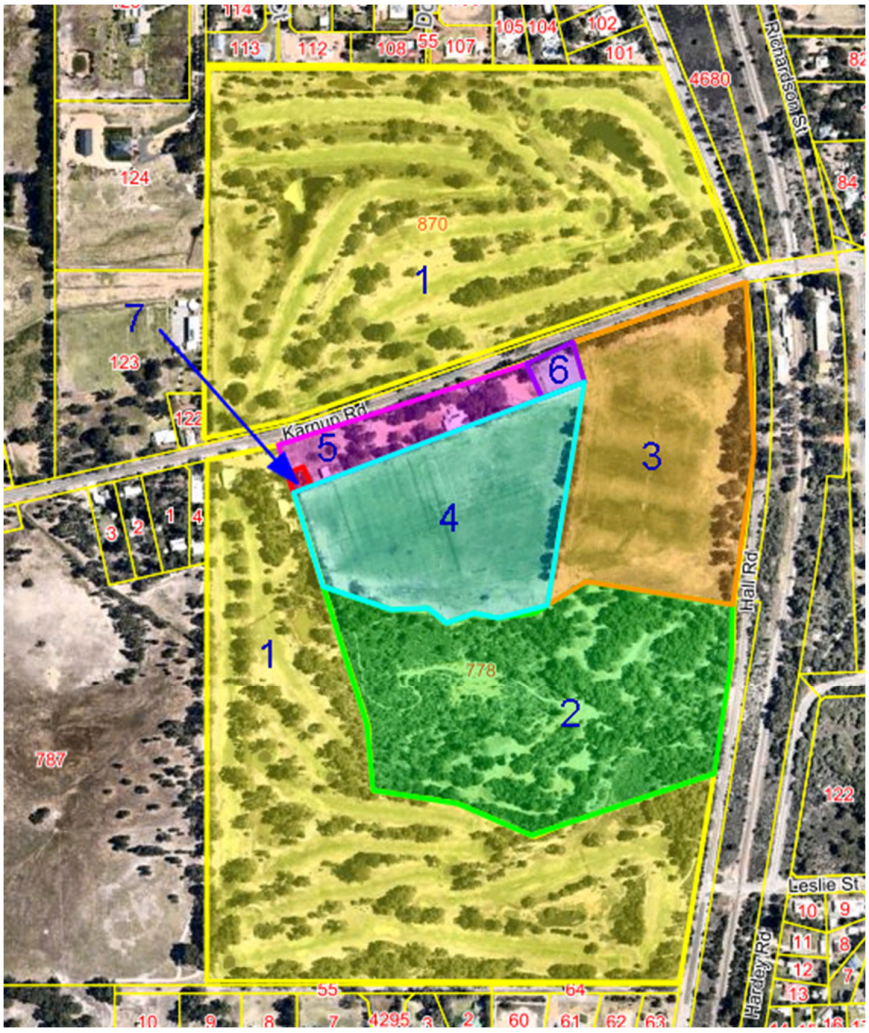


Figure 2: Land Uses of Serpentine Sports Reserve.

1 – Golf course
2 – Conservation area
3 – John Lyster Polocrosse Ground
4 – David Buttfield Equestrian Park
5 – Equestrian clubhouses and parking
6 – Netball courts (disused)
7 – Communications tower

Serpentine Sports Reserve is classified into three main management zones (Figure 3). These are:

Conservation Zone (green): Areas of remnant vegetation of high biodiversity and scientific reference value which include both dieback free and dieback infected areas. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must utilise dieback hygiene procedures such as clean-down and take extreme care to prevent spread of dieback from infected to uninfected areas.

Vegetation Management Zone (red): Areas of remnant vegetation of biodiversity and scientific reference value which may be disturbed, or dieback or weed infested. This is a buffer zone and may receive fuel load management for protection of people, property and conservation values by weed control or control burning on assessment by officers as required and appropriate. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must consider movement and reduce spread of dieback from infected to uninfected areas through clean down procedures.

Recreation Zone (yellow): This is the area in use by the Serpentine Horse and Pony Club, the Serpentine/Foothills Polocrosse Club, and the Serpentine and Districts Golf Club. Management of this zone is principally for the purpose of recreation, while minimising impacts on the adjacent remnant vegetation.

This Action Plan applies to the Conservation and Vegetation Management Zones.

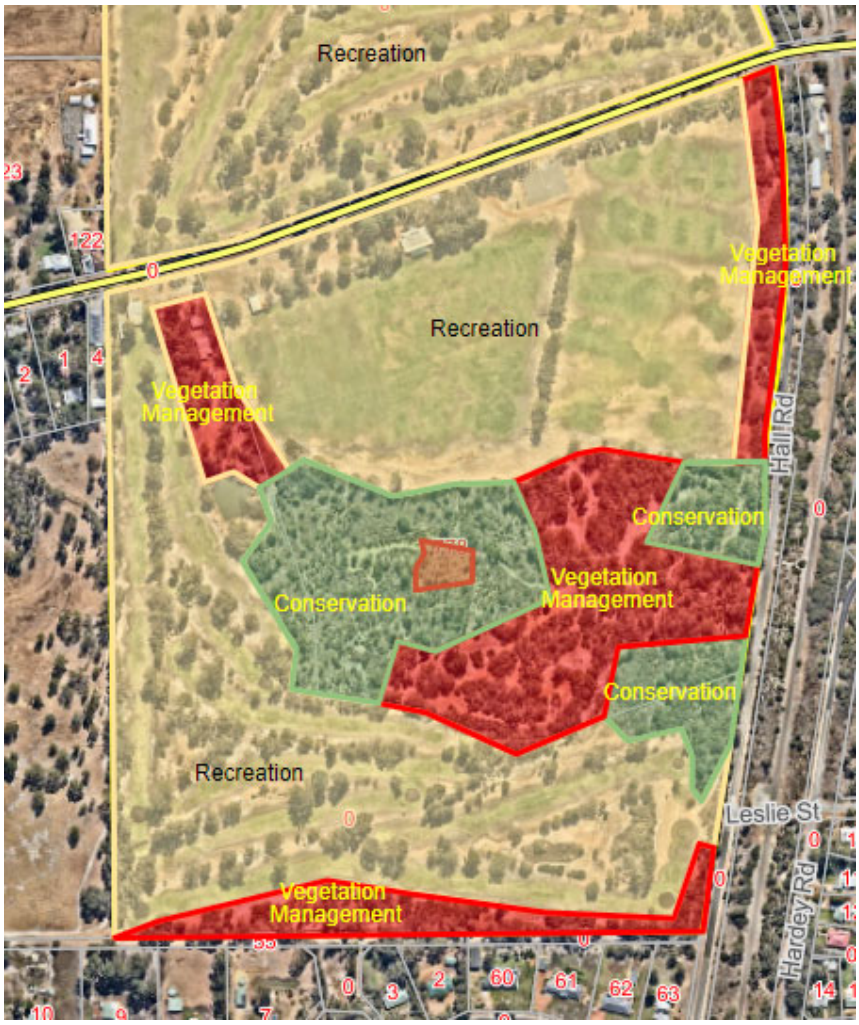


Figure 3: Management Zones of Serpentine Sports Reserve.

1.2 Soils

Four soil types occur in Serpentine Sports Reserve: Pinjarra B1, Pinjarra B3, Pinjarra P1b and Pinjarra P8 (Table 1 and Figure 4). Marri woodland occurs on all four soil types.

Table 1: Soil Types of Serpentine Sports Reserve.

Reserve	Soil landscape unit	Description	Marri occurrence
Serpentine Sports Reserve	Pinjarra B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	Partial
	Pinjarra B3 phase	Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam.	Partial
	Pinjarra P1b phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or effective duplex) soils. Moderately deep pale sand to loamy sand over clay: imperfectly drained and moderately susceptible to salinity in limited areas.	Yes
	Pinjarra P8 phase	Broad poorly drained flats and poorly defined stream channels with moderately deep to deep sands over mottled clays; acidic or less commonly alkaline gley and yellow duplex soils to uniform bleached or pale brown sands over clay.	Yes

1.3 Biodiversity

Serpentine Sports Reserve contains three vegetation communities: banksia woodland, marri woodland and a clay-based wetland. The reserve is 46.4 ha with 10.1 ha remnant vegetation of which 3.8 ha is marri woodland (Figure 5) that belongs to the vegetation complex SCP3b (*Corymbia calophylla* - *Eucalyptus marginata* woodlands).

The areas classified as Conservation Zone for management (Figure 3) belong to Threatened Ecological Communities, and the entire reserve is an Environmentally Sensitive Area. The remnant vegetation in the reserve forms part of Bush Forever site 375, along with adjoining vegetation which forms a corridor along the railway to other reserves. The vegetation is in Very Good to Good condition overall.

The flora of Serpentine Sports Reserve has been frequently surveyed and is diverse. A number of Threatened and Priority flora species have been recorded in the area.

The fauna of Serpentine Sports Reserve has not been thoroughly surveyed since 1997. The fauna recorded at the time was diverse, and anecdotal evidence suggests that the majority are still present. A number of Threatened and Priority fauna species have been recorded, including black cockatoos and quenda (southern brown bandicoot).

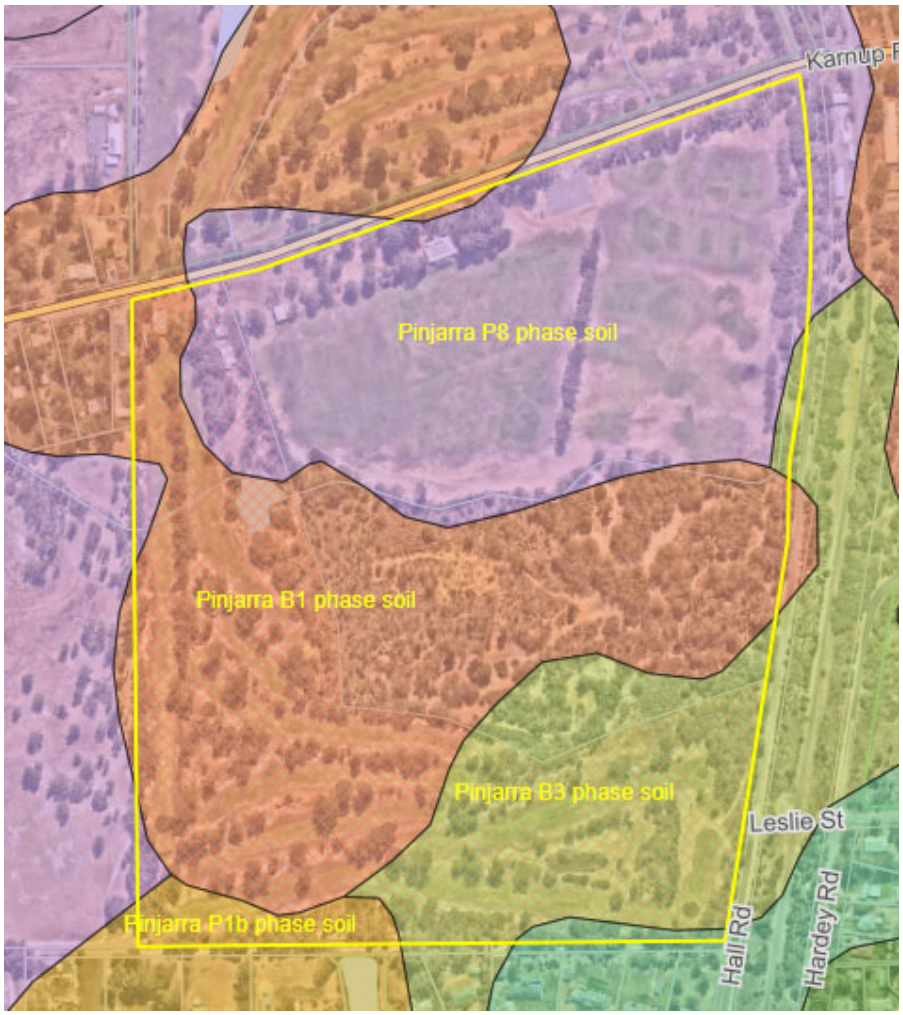


Figure 4: Soil Types of Serpentine Sports Reserve.

1.4 Water Resources

The marri woodland of Serpentine Sports Reserve is low in the landscape, sitting adjacent to a sand dune, occupying lower-lying areas that are frequently waterlogged in winter (and inundated in the case of the wetland). A major watercourse (drain) runs along the boundary between the equine areas and the bushland, flowing from east to west to a dam, and then across the golf course to discharge eventually into the Serpentine River.

The clay-based wetland in the east of the reserve is classified as Conservation Category, while the majority of the reserve (other than the banksia woodland and the northern boundary) is a Resource Enhancement wetland (Figure 6).

Figure 5: Location of Marri Woodland of Serpentine Sports Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of Serpentine Sports Reserve include:

- Recreational pressure from users
- Community anxiety about fire hazard and pressure for control burning
- Illegal access by motorised vehicles and associated damage to fences and vegetation
- Arson and vandalism, to vegetation and infrastructure
- Weed invasion, from surrounding land and carried in by users
- Nutrient rich drainage from ovals and golf course, particularly into the wetland
- Feral and domestic animals (foxes, rabbits, cats) predating fauna and damaging vegetation
- Dieback disease (*Phytophthora cinnamomi*)
- Pony club's cross-country course, which passes through infected and dieback free zones

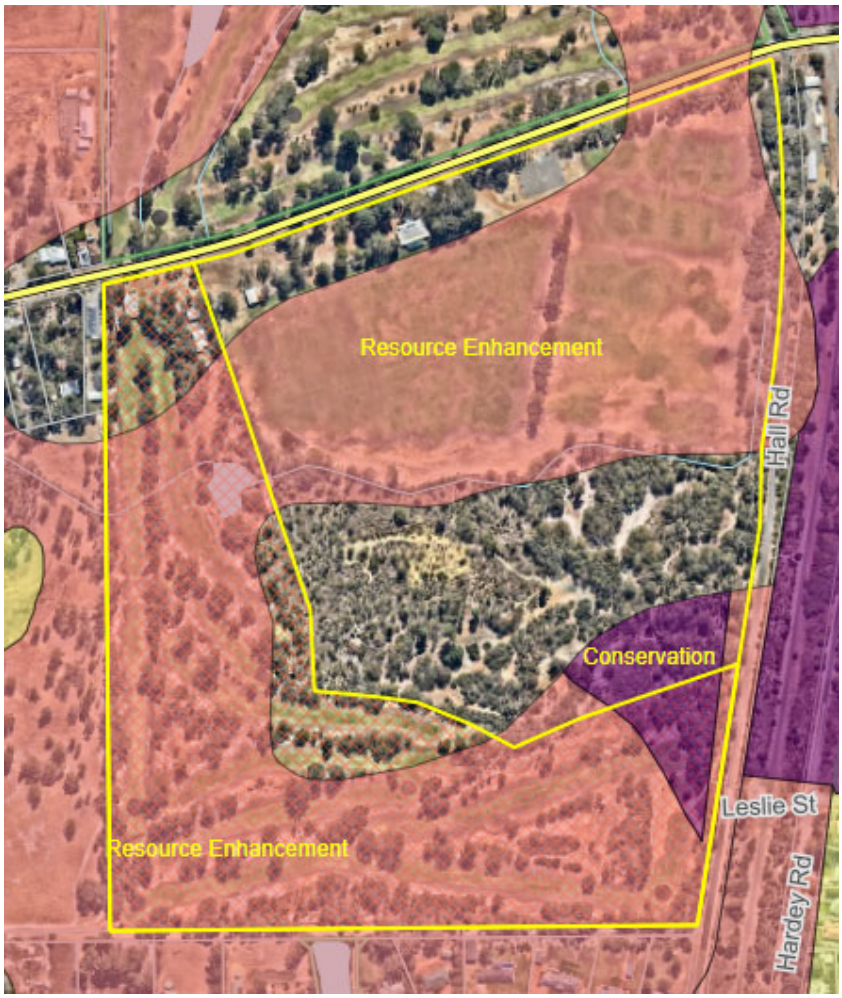


Figure 6: Geomorphic Wetlands of Serpentine Sports Reserve.

3. Reserve Usage

3.1 Vesting and Land Tenure

The vesting purpose, land tenure and current uses of Serpentine Sports Reserve are listed below in Table 2.

Table 2: Vesting Purpose, Land Tenure and Current Uses of Serpentine Sports Reserve.

Reserve	Reserve and Lot Number	Vesting and Land Tenure	Current Uses
Serpentine Sports Reserve	R19134 L778 Karnup Road, Serpentine	Shire of Serpentine Jarrahdale – Recreation, Racecourse and Showground	Recreation and Conservation

3.2 User Groups

The user groups of Serpentine Sports Reserve include:

- Serpentine and Districts Golf Club
- Serpentine Horse and Pony Club
- Serpentine/Foothills Polocrosse Club
- Serpentine Environmental Group
- Landcare SJ Inc., with frequent revegetation planting events
- Serpentine Primary School historically participated in planting events
- Occasional oval hire, e.g. Southside Jumps Club
- Facility hire (pony club and golf club clubhouses)
- Community events
- Informal users, particularly walking, dog exercise and horse riders

Conflict between user groups with differing priorities can cause issues for management of the reserve. Clubs who use the same facilities (e.g. pony club, polocrosse camping around both ovals, oval and clubhouse hire) can experience conflict around dates of use, or expectations of facility maintenance. Clubs can feel proprietorial about public facilities, with associated reluctance to allow other users. Liability issues over the use of jumps makes the pony club reluctant to allow casual riders onto the reserve.

Many users of the reserve can conflict with conservation groups. The golf club has historically discharged nutrient-rich water into the wetland. The pony club's cross-country course passes through the banksia woodland, with potential to spread dieback into clean areas. The polocrosse club historically camped and tethered horses within the marri woodland. Informal users have created new footpaths through the banksia woodland, degrading the vegetation and increasing the potential for the spread of dieback. There has even been conflict between conservation groups, with local enthusiasts believing that Landcare's weed control had killed orchid populations.

Other threats and pressures for the user groups include:

- Risk management and insurance, with stricter liability and higher premiums.
- Membership and member involvement, as any community group has a general problem with attracting and maintaining motivated volunteers to fill positions and undertake other tasks, with a few people tending to do most of the work.
- Compliance with legislation, such as health regulations.
- Security of tenure with ongoing long-term lease agreements essential to ensure that private investment in reserves is supported. User groups' facilities are mostly developed and maintained entirely by volunteers.

3.3 Infrastructure

The infrastructure located in Serpentine Sports Reserve includes:

- Communications tower
- Clubhouses for the pony club, golf club and polocrosse club, with associated storage sheds and a shared ablution facility
- Car parking areas
- Two equestrian sports fields and one fenced arena

- Horse yards, wash bays, stock ramp and manure bay
- Bores, water tanks, dams and irrigation systems
- Cross-country course with permanent jumps
- Golf course fairways and greens
- Dilapidated, unused netball courts
- Firebreaks and informal walking paths
- Fences and gates
- Signage, for conditions of entry and environmental education
- Drainage network

The golf club has built and maintains its own infrastructure by volunteer labour from members. The pony club and polocrosse club clubhouses (Eric Senior and Ivan Elliott Pavilions respectively) are public facilities and maintained by the Shire. The sports fields are maintained by the Shire, but the equine clubs maintain their other infrastructure. Despite fences and locked gates, good lighting and high usage providing surveillance, vandalism and theft are constant but low-level threats.

Fire can threaten people, property and conservation values. Fires can start inside or adjacent to buildings and structures, and are often the result of vandalism, kitchen accidents or electrical faults. Bush or grass fires threaten buildings and structures through embers, radiant heat and direct contact. Cleared areas around buildings limit the opportunity for bush and grass fires to reach them. Fire in nearby bushland has the potential to damage infrastructure.

4. Action Plan

Table 3: Action Plan for Serpentine Sports Reserve.

No.	Action	Priority	Timing	Status	Responsibility	Cost
1	**Utilise the planning system to retain and protect remnant marri woodland.**	**Key**	**Business as Usual**	**Ongoing**	**Statutory Planning**	**Staff Time**
2	Keep up to date with the latest research trends with regard to marri woodland and integrate into reserve management.	High	Long Term	Ongoing	Natural Reserves, Emergency Services	Staff Time
3	Formalise access to marri woodland in high use areas through establishment of walking paths that reduce trampling.	Medium	Medium Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
4	Erect signage in high use areas to inform users of the values of the marri woodland.	Medium	Short Term	Implemented in Part	Operations	Budget Dependent - $2,000
5	**Survey for dieback presence, and map and treat dieback every three years if present.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $6,000**
6	**Survey for marri canker, and treat infected trees.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $1,000**
7	Monitor and manage new and emerging pests and diseases such as polyphagous shot hole borer.	High	Medium Term	Ongoing	Natural Reserves	Budget Dependent - $2,000
8	Control access to marri woodland through boundary fencing, convenient formal access points, and path	Low	Long Term	Not Yet Implemented	Operations	Budget Dependent - $3,000

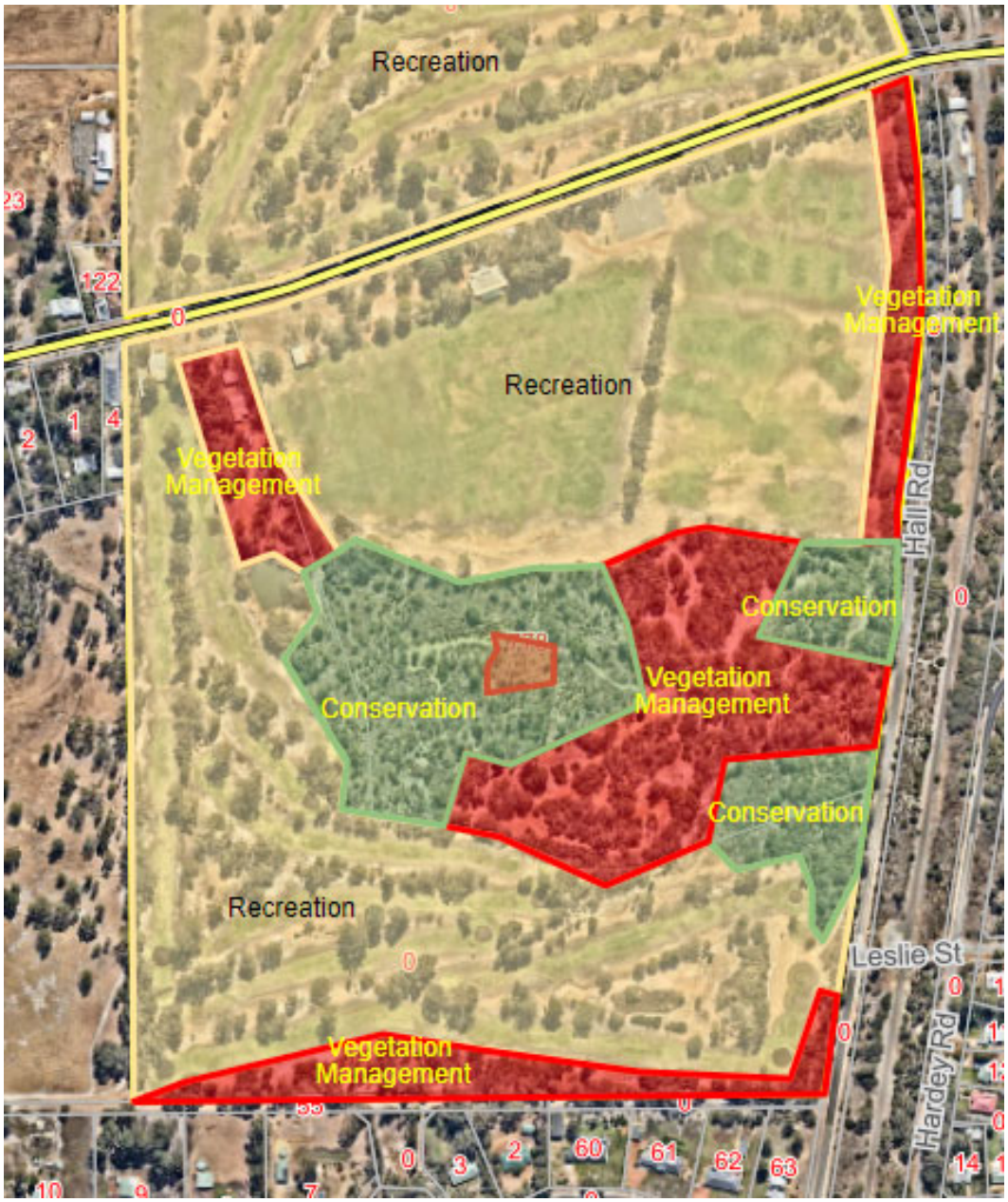
No.	Action	Priority	Timing	Status	Responsibility	Cost
	construction that discourages deviation.					
9	Work with user groups to protect and minimize impacts to remnant vegetation.	High	Business as Usual	Ongoing	Natural Reserves, User Groups	Staff Time
10	Liaise with other landholders to work together and integrate management of all marri woodland areas.	Medium	Medium Term	Not Yet Implemented	Natural Reserves, Strategic Environment	Staff Time
11	Implement measures to exclude motorised vehicles from the remnant vegetation.	High	Medium Term	Implemented in Part	Operations	Budget Dependent - $2,000
12	Work with the Serpentine Horse and Pony Club to protect vegetation along the cross-country course.	High	Business as Usual	Ongoing	Natural Reserves, Pony Club	Staff Time
13	Ensure that formalised paths and other access routes cross dieback fronts to the lowest degree possible.	Medium	Medium Term	Not Yet Implemented	Natural Reserves	Staff Time
14	Establish dieback hygiene policies, including vehicle washdown points and foot baths for pedestrians with appropriate signage.	High	Long Term	Implemented in Part	Natural Reserves	Budget Dependent - $2,000
15	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environment	Budget Dependent - $3,000
16	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves	Budget Dependent - $3,000
17	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves	Staff Time
18	**Establish and implement a weed control program that utilises best practice methods.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves, Landcare SJ**	**Budget Dependent - $3,000**
19	Establish and implement a control program for woody weeds.	High	Business as Usual	Ongoing	Natural Reserves	Budget Dependent - $2,000
20	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ	Budget and/or Funding Dependent - $1,500
21	**Minimise burning and other disturbance of marri woodland.**	**Key**	**Short Term**	**Implemented in Part**	**Emergency Services**	**Staff Time**
22	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves	Staff Time
23	Maintain fire intervals of 16-40 years.	High	Long Term	Not Yet Implemented	Emergency Services	Staff Time
24	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Staff Time
25	Restrict any essential fuel load management to the Vegetation Management Zone.	High	Short Term	Not Yet Implemented	Emergency Services	Budget Dependent - $1,500
26	Carry out fuel load management on adjacent road verges to avoid fire entering the reserve from the verge.	High	Medium Term	Not Yet Implemented	Emergency Services	Budget Dependent - $2,000

No.	Action	Priority	Timing	Status	Responsibility	Cost
27	Ensure that any essential fuel load management utilises weed control as a priority, with control burning as a last resort.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves	Budget Dependent - $3,000
28	Ensure that any control burning is restricted to vegetation boundaries, providing a mosaic of vegetation ages including long unburnt.	High	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Budget Dependent - $1,500
29	**Follow any burning or other disturbance with weed control for at least two years post-fire.**	**Key**	**Business as Usual**	**Implemented in Part**	**Emergency Services, Natural Reserves**	**Budget Dependent - $3,000**
30	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations	Staff Time
31	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves	Funding Dependent - $2,500
32	Rehabilitate and revegetate unused infrastructure such as the old horse yards and sand pit.	Medium	Medium Term	Implemented in Part	Natural Reserves, Landcare SJ, Friends Group	Funding Dependent - $2,500
33	Monitor implementation of the action plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environment	Staff Time
34	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environment	Staff Time
35	Review and revise the action plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environment	Staff Time

5. Fire Management Strategy for Serpentine Sports Reserve

Conservation Zone (green) – works exclusion; avoid disturbance

Vegetation Management Zone (red) – fuel load management if deemed appropriate and necessary by weed control and/or control burning followed by weed control



Dieback – present in some areas

Weeds – control required following disturbance

Firebreaks – present along boundaries

Mundijong Oval Reserve Action Plan

R4486

1. Background

1.1 Location

Mundijong Oval Reserve is located in Mundijong, surrounded by urban development (Figure 1). It is adjacent to the Shire offices and Mundijong fire station and SES.

Mundijong Oval Reserve contains two main vegetation communities, both of which are marri woodland. The reserve is 6.04 ha with 2.08 ha remnant vegetation, of which approximately 2.07 ha is marri woodland. This action plan deals with the marri woodland area.

The reserve (including the marri woodland) is vested with the Shire for the purpose of Recreation, but current uses also include Conservation. There are numerous user groups for the reserve, particularly associated with the ovals and sporting pavilions, and significant infrastructure.

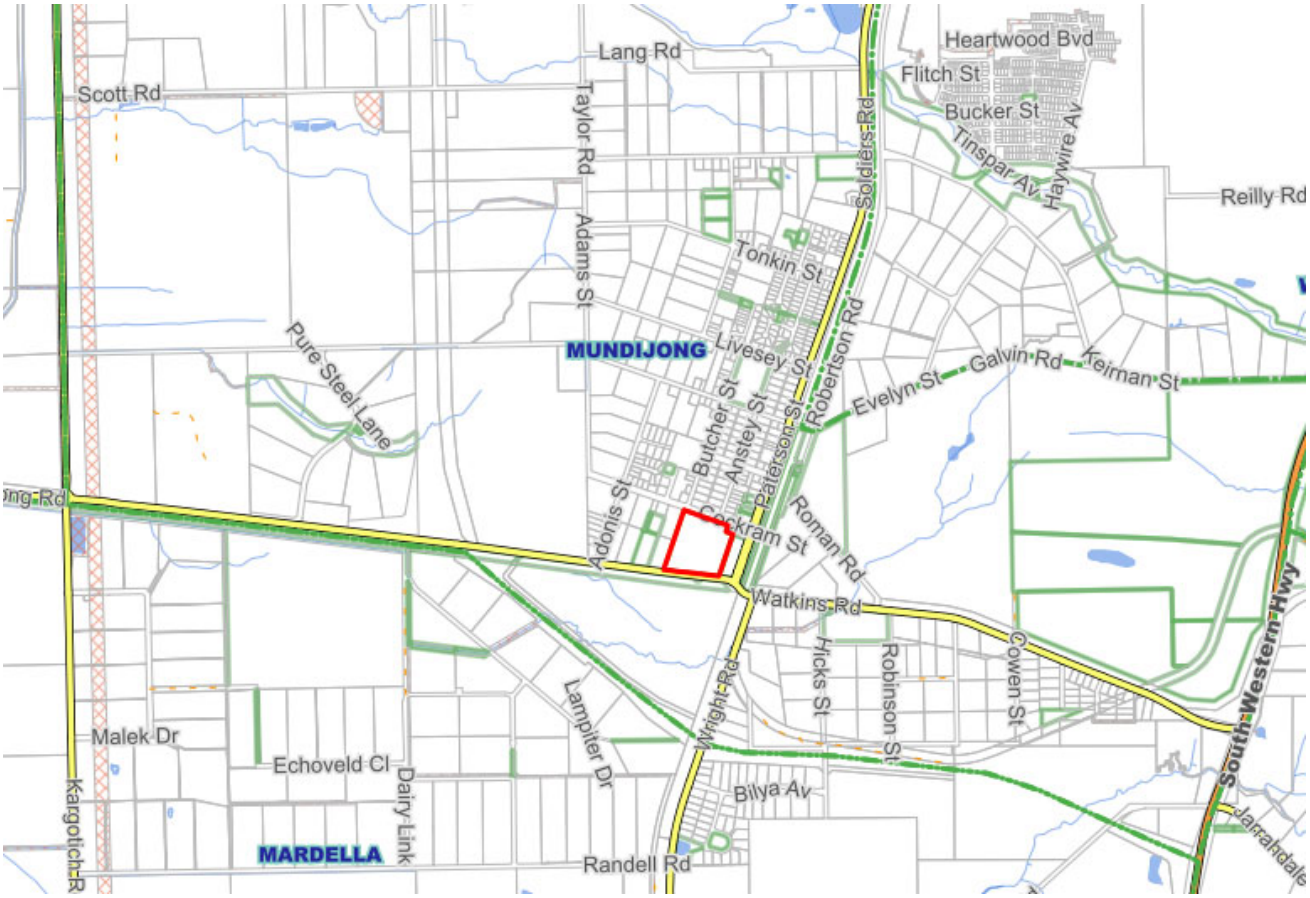


Figure 1: Location of Mundijong Oval Reserve.

Mundijong Oval Reserve is classified into three main management zones (Figure 2). These are:

Conservation Zone (green): Areas of remnant vegetation of high biodiversity and scientific reference value which include both dieback free and dieback infected areas. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must utilise dieback hygiene procedures such as clean-down and take extreme care to prevent spread of dieback from infected to uninfected areas.

Vegetation Management Zone (red): Areas of remnant vegetation of biodiversity and scientific reference value which may be disturbed, or dieback or weed infested. This is a buffer zone and may receive fuel load management for protection of people, property and conservation values by weed control or control burning on assessment by officers as required and appropriate. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must consider movement and reduce spread of dieback from infected to uninfected areas through clean down procedures.

Recreation Zone (yellow): This is largely the areas of the reserve used for active and passive recreation. Management of this zone is principally for the purpose of recreation, while minimising impacts on the adjacent remnant vegetation.

This Action Plan applies to the Conservation and Vegetation Management Zones.

1.2 Soils

Two soil types occur in Mundijong Oval Reserve: Bassendean B2a and Pinjarra P1b (Table 1 and Figure 3). Marri woodland occurs on both soil types.

Table 1: Soil Types of Mundijong Oval Reserve.

Reserve	Soil landscape unit	Description	Marri occurrence
Mundijong Oval Reserve	Bassendean B2a phase	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with an intensely coloured yellow B horizon usually well within 1 m of the surface.	Yes
	Pinjarra P1b phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or effective duplex) soils. Moderately deep pale sand to loamy sand over clay: imperfectly drained and moderately susceptible to salinity in limited areas.	Yes

Figure 2: Management Zones of Mundijong Oval Reserve.

1.3 Biodiversity

Mundijong Oval Reserve contains two main vegetation communities, both of which are marri woodland. The marri woodland is approximately 2.07 ha in area (Figure 4) and belongs to the vegetation complexes SCP3a (*Corymbia calophylla – Kingia australis* woodlands) and SCP3c (*Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands).

The reserve is not mapped as a Threatened Ecological Community but is an Environmentally Sensitive Area. Bush Forever site 360 includes the reserve and adjacent vegetated corridors.

The vegetation in Mundijong Oval Reserve is in Very Good to Good condition overall. The flora has been frequently surveyed and is diverse. The Threatened flora species *Morelotia australiensis* has been recorded in the area.

The fauna of Mundijong Oval Reserve has never been formally surveyed, although anecdotally some Threatened and Priority fauna species may occur, such as black cockatoos and quenda (southern brown bandicoot).

Figure 3: Soil Types of Mundijong Oval Reserve.

1.4 Water Resources

Mundijong Oval Reserve is generally low-lying, and as such much of it is seasonally waterlogged. Watercourses (drains) run along the western and southern boundaries of the reserve.

The southwest corner of the reserve is a Conservation Category wetland (Figure 5) which extends to the south, and to the west as a Multiple Use wetland.

Figure 4: Location of Marri Woodland of Mundijong Oval Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of Mundijong Oval Reserve include:

- Recreational pressure from surrounding urban areas
- Community anxiety about fire hazard and pressure for control burning
- Arson, vandalism and degradation
- Weed invasion, from ovals, surrounding urban areas, and carried in by users
- Feral and domestic animals (foxes, rabbits, cats) predating fauna and damaging vegetation
- Dieback disease (*Phytophthora cinnamomi*) and marri canker
- Nutrient runoff from ovals

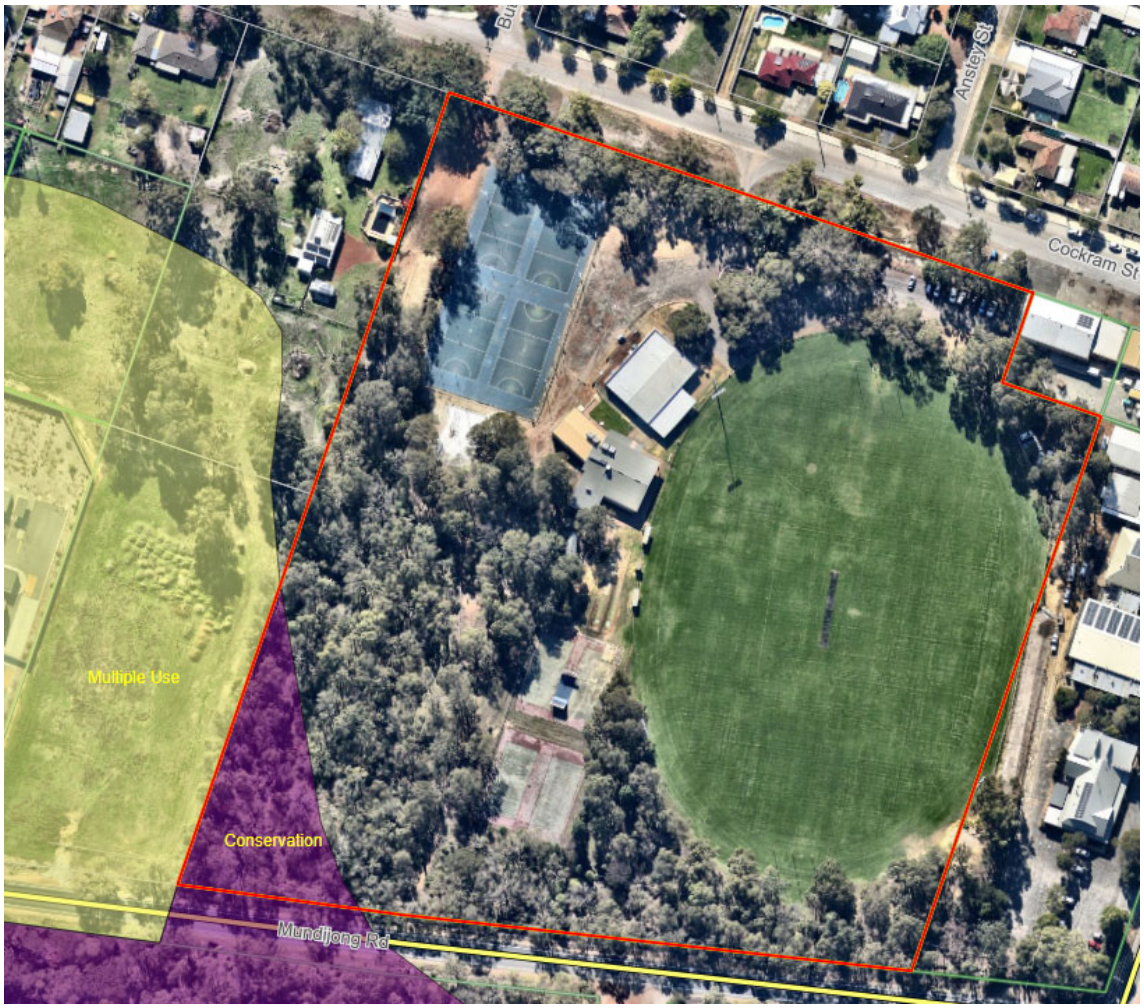


Figure 5: Geomorphic Wetlands of Mundijong Oval Reserve.

3. Reserve Usage

3.1 Vesting and Land Tenure

The vesting purpose, land tenure and current uses of Mundijong Oval Reserve are listed below in Table 2.

Table 2: Vesting Purpose, Land Tenure and Current Uses of Mundijong Oval Reserve.

Reserve	Reserve and Lot Number	Vesting and Land Tenure	Current Uses
Mundijong Oval Reserve	R4486 L232 Cockram Street, Mundijong	Shire of Serpentine Jarrahdale – Recreation	Recreation and Conservation

3.2 User Groups

The principal users of Mundijong Oval Reserve are:

- Oval user sports groups, including cricket and football
- Pavilion users and hire
- Netball courts users
- Playground equipment users
- Events on oval and in pavilions
- Parking for Shire offices and events
- Informal users, particularly for walking and dog exercise

Conflict between user groups with differing priorities can cause issues for management of the reserve. Informal users, particularly as pressure grows with the expanding urban development around the reserve, can degrade the vegetation. Conflict can arise between regular users of the oval and pavilions from conflicting schedules.

3.3 Infrastructure

The infrastructure located in Mundijong Oval Reserve includes:

- Two sports pavilions
- Sports oval
- Netball courts
- Tennis courts (dilapidated and unused)
- Playground
- Car parks
- Bores and irrigation systems
- Fences and gates
- Signage, relating to entry and use
- Firebreaks
- Informal walking paths

The infrastructure is mostly maintained by the Shire. Despite a high standard of maintenance. good lighting and high community use and surveillance, vandalism and theft are constant but low-level threats.

Fire can threaten people, property and conservation values. Fires can start inside or adjacent to buildings and structures, and are often the result of vandalism, kitchen accidents or electrical faults. Bush or grass fires threaten buildings and structures through embers, radiant heat and direct contact. Cleared areas around buildings limit the opportunity for bush and grass fires to reach them. Fire in nearby bushland has the potential to damage infrastructure.

4. Action Plan

Table 3: Action Plan for Mundijong Oval Reserve.

No.	Action	Priority	Timing	Status	Responsibility	Cost
1	**Utilise the planning system to retain and protect remnant marri woodland.**	**Key**	**Business as Usual**	**Ongoing**	**Statutory Planning**	**Staff Time**
2	Keep up to date with the latest research trends with regard to marri woodland and integrate into reserve management.	High	Long Term	Ongoing	Natural Reserves, Emergency Services	Staff Time
3	Formalise access to marri woodland in high use areas through establishment of walking paths that reduce trampling.	Medium	Medium Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
4	Erect signage in high use areas to inform users of the values of the marri woodland.	Medium	Short Term	Implemented in Part	Operations	Budget Dependent - $2,000
5	**Survey for dieback presence, and map and treat dieback every three years if present.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $6,000**
6	**Survey for marri canker, and treat infected trees.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $1,000**
7	Monitor and manage new and emerging pests and diseases such as polyphagous shot hole borer.	High	Medium Term	Ongoing	Natural Reserves	Budget Dependent - $2,000
8	Control access to marri woodland through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
9	Work with user groups to protect and minimize impacts to remnant vegetation.	High	Business as Usual	Ongoing	Natural Reserves, User Groups	Staff Time
10	Liaise with other landholders to work together and integrate management of all marri woodland areas.	Medium	Medium Term	Not Yet Implemented	Natural Reserves, Strategic Environment	Staff Time
11	Ensure that formalised paths and other access routes cross dieback fronts to the lowest degree possible.	Medium	Medium Term	Not Yet Implemented	Natural Reserves	Staff Time
12	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environment	Budget Dependent - $3,000
13	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves	Budget Dependent - $3,000
14	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves	Staff Time
15	**Establish and implement a weed control program that utilises best practice methods.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves, Landcare SJ**	**Budget Dependent - $3,000**
16	Establish and implement a control program for woody weeds.	High	Business as Usual	Ongoing	Natural Reserves	Budget Dependent - $2,000

No.	Action	Priority	Timing	Status	Responsibility	Cost
17	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ	Budget and/or Funding Dependent - $1,500
18	**Minimise burning and other disturbance of marri woodland.**	**Key**	**Short Term**	**Implemented in Part**	**Emergency Services**	**Staff Time**
19	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves	Staff Time
20	Maintain fire intervals of 8-40 years.	High	Long Term	Not Yet Implemented	Emergency Services	Staff Time
21	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Staff Time
22	Restrict any essential fuel load management to the Vegetation Management Zone.	High	Short Term	Not Yet Implemented	Emergency Services	Budget Dependent - $1,500
23	Carry out fuel load management on adjacent road verges to avoid fire entering the reserve from the verge.	High	Medium Term	Not Yet Implemented	Emergency Services	Budget Dependent - $2,000
24	Ensure that any essential fuel load management utilises weed control as a priority, with control burning as a last resort.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves	Budget Dependent - $3,000
25	Ensure that any control burning is restricted to vegetation boundaries, providing a mosaic of vegetation ages including long unburnt.	High	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Budget Dependent - $1,500
26	**Follow any burning or other disturbance with weed control for at least two years post-fire.**	**Key**	**Business as Usual**	**Implemented in Part**	**Emergency Services, Natural Reserves**	**Budget Dependent - $3,000**
27	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations	Staff Time
28	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves	Funding Dependent - $2,500
29	Monitor implementation of the action plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environment	Staff Time
30	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environment	Staff Time
31	Review and revise the action plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environment	Staff Time

5. Fire Management Strategy for Mundijong Oval Reserve

Conservation Zone (green) – works exclusion; avoid disturbance

Vegetation Management Zone (red) – fuel load management if deemed appropriate and necessary by weed control and/or control burning followed by weed control

Dieback – present in some areas

Weeds – control required following disturbance

Firebreaks – present along boundaries

Myara Brook Reserve Action Plan

R23778

1. Background

1.1 Location

Myara Brook Reserve is located in Keysbrook, surrounded by semi-rural development (Figure 1). It is adjacent to the Keysbrook townsite.

Myara Brook Reserve contains two main vegetation communities: marri woodland and riparian wetlands. The reserve is 10.23 ha with 8.85 ha remnant vegetation, of which approximately 2.8 ha is marri woodland. This action plan specifically deals with the marri woodland area.

The reserve is vested with the Shire for the purpose of Conservation and River Diversion, but the current use is primarily Conservation. The main user groups for the reserve are associated with its environmental values.

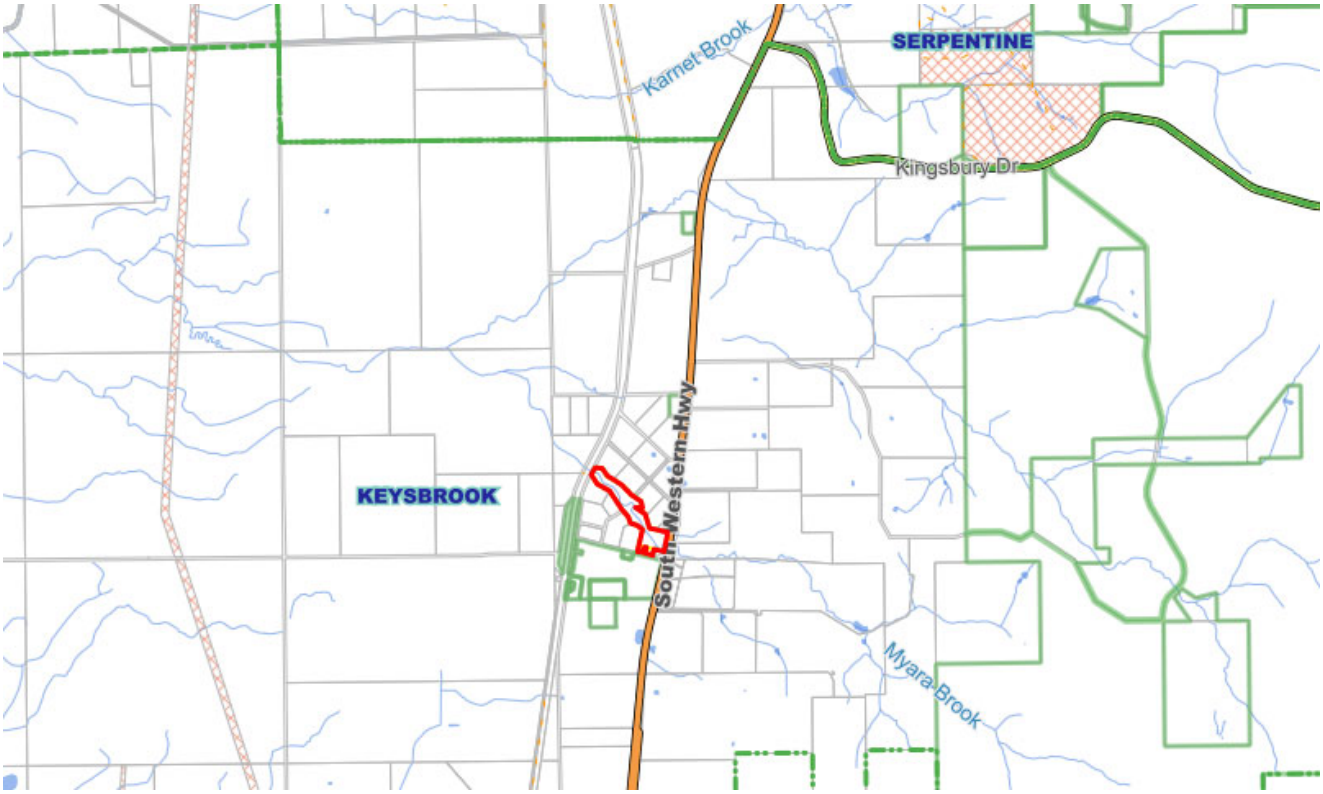


Figure 1: Location of Myara Brook Reserve.

Myara Brook Reserve is classified into two main management zones (Figure 2). These are:

Conservation Zone (green): Areas of remnant vegetation of high biodiversity and scientific reference value which include both dieback free and dieback infected areas. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must utilise dieback hygiene procedures such as clean-down and take extreme care to prevent spread of dieback from infected to uninfected areas.

Vegetation Management Zone (red): Areas of remnant vegetation of biodiversity and scientific reference value which may be disturbed, or dieback or weed infested. This is a buffer zone and may receive fuel load management for protection of people, property and conservation values by weed control or control burning on assessment by officers as required and appropriate. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must consider movement and reduce spread of dieback from infected to uninfected areas through clean down procedures.

This Action Plan applies to the Conservation and Vegetation Management Zones.

Figure 2: Management Zones of Myara Brook Reserve.

1.2 Soils

Four soil types occur in Myara Brook Reserve: Forrestfield F4, Forrestfield F2b, Pinjarra P1e and Pinjarra P9 (Table 1 and Figure 3). Marri woodland occurs on all soil types to some extent.

Table 1: Soil Types of Myara Brook Reserve.

Reserve	Soil landscape unit	Description	Marri occurrence
Myara Brook Reserve	Pinjarra P9 phase	Shallowly incised stream channels of minor creeks and rivers with deep acidic mottled yellow duplex soils.	Partial
	Forrestfield F4 phase	Incised stream channels within gentle slopes with deep acidic yellow duplex soils and sandy alluvial gradational brown earths.	Partial
	Forrestfield F2b phase	Low slopes and foot slopes up to 5-10% with well drained moderately deep to deep, gravelly acidic yellow duplex soils and rare laterite.	Partial
	Pinjarra P1e phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or ieffective duplexl) soils. Shallow pale sand to sandy loam over very gravelly clay; moderately well drained.	Partial

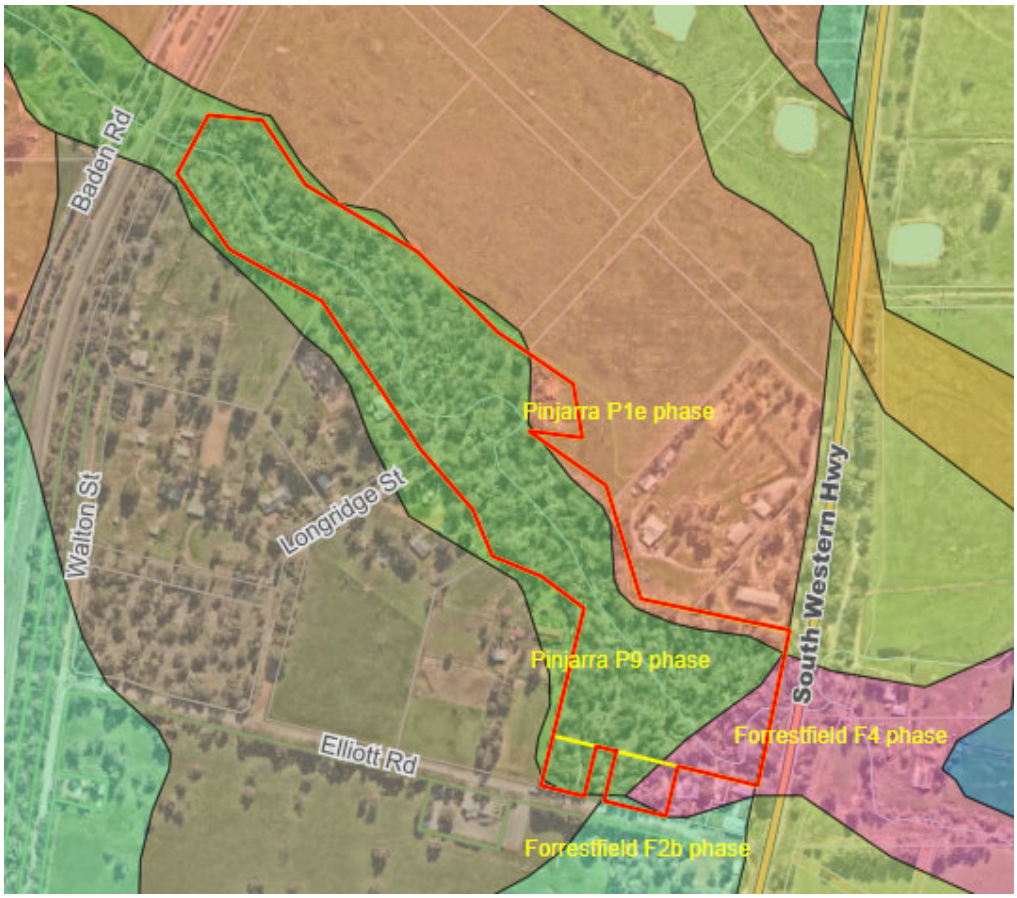


Figure 3: Soil Types of Myara Brook Reserve.

1.3 Biodiversity

Myara Brook Reserve contains two main vegetation communities: marri woodland and riparian wetlands. The marri woodland is approximately 2.8 ha in area (Figure 4) and belongs to the vegetation complex SCP3c (*Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands).

The reserve is not registered as a Threatened Ecological Community but is an Environmentally Sensitive Area. Bush Forever site 426 includes the reserve.

The vegetation in Myara Brook Reserve is in Good to Degraded condition overall. The flora of Myara Brook Reserve has been frequently surveyed and is diverse. No Threatened and Priority flora species have been recorded in the reserve, although at least two species occur nearby.

The fauna of Myara Brook Reserve has never been formally surveyed, although some Threatened and Priority fauna species may occur, such as black cockatoos and quenda (southern brown bandicoot) which have been recorded nearby.

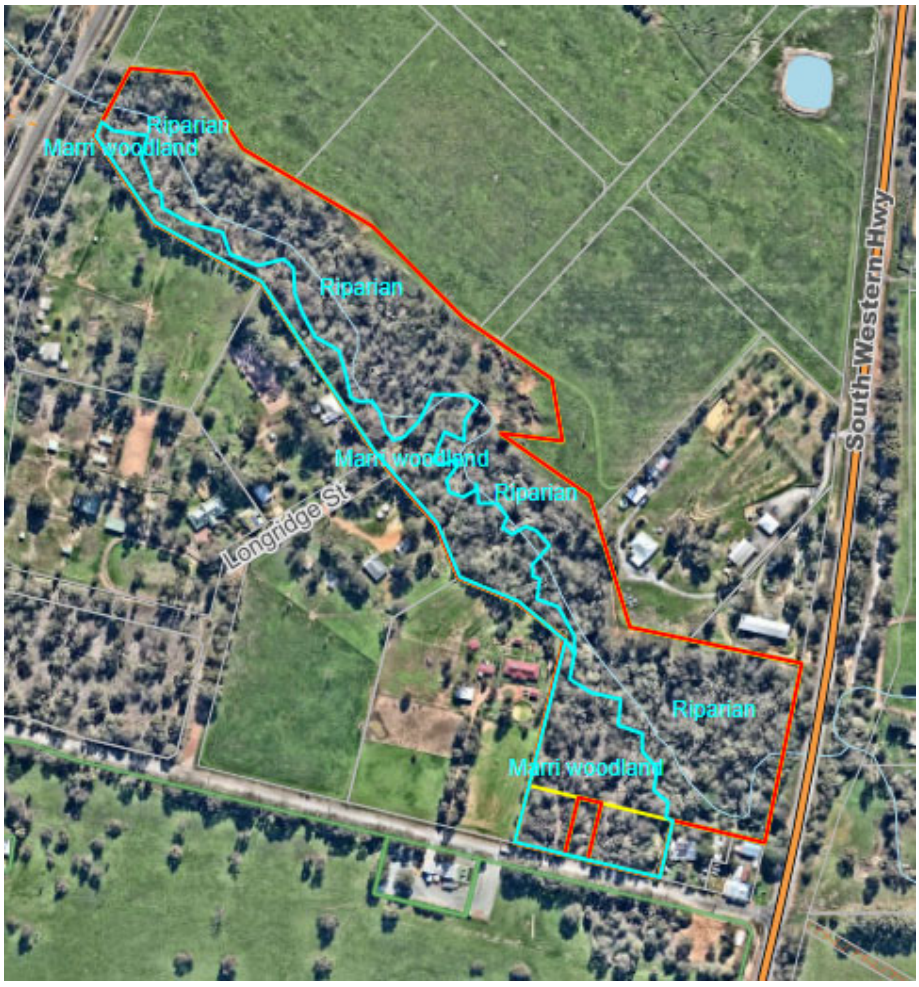


Figure 4: Location of Marri Woodland of Myara Brook Reserve.

1.4 Water Resources

Myara Brook Reserve is generally low-lying, running along the course of a section of Myara Brook, and contains both riparian and upland zones.

The northeastern part of the reserve, including the watercourse (Myara Brook) and its northeastern bank, is a Conservation Category wetland (Figure 5). The remainder of the reserve and the surrounding area is classified as a Multiple Use wetland.

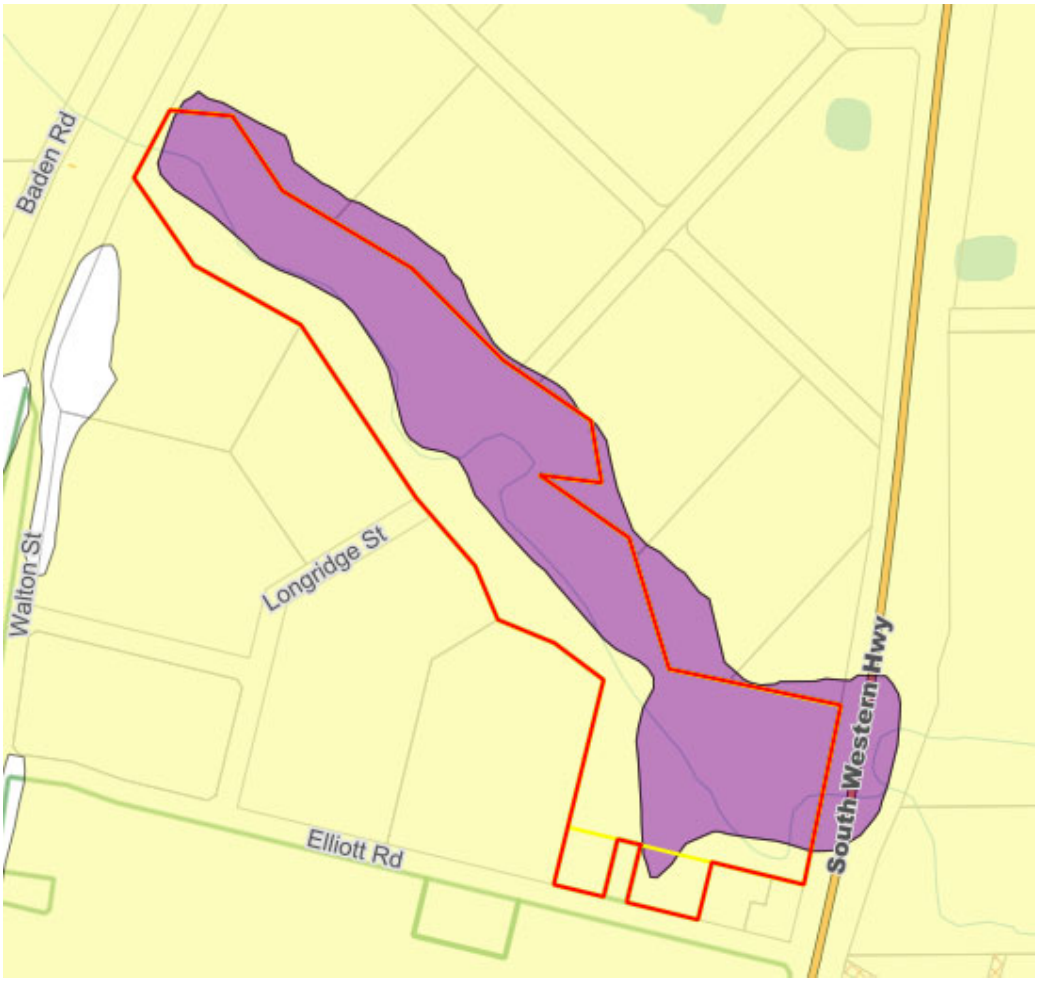


Figure 5: Geomorphic Wetlands of Myara Brook Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of Myara Brook Reserve include:

- Recreational pressure from surrounding semi-rural areas
- Community anxiety about fire hazard and pressure for control burning
- Arson, vandalism and degradation
- Illegal dumping of rubbish and garden waste
- Illegal access by motorised vehicles and associated damage to fences and vegetation
- Weed invasion, from dumping, surrounding areas, and carried in by users
- Feral and domestic animals (foxes, rabbits, cats) predating fauna and damaging vegetation
- Dieback disease (*Phytophthora cinnamomi*), marri canker and wandoo decline

3. Reserve Usage

3.1 Vesting and Land Tenure

The vesting purpose, land tenure and current uses of Myara Brook Reserve are listed in Table 2.

Table 2: Vesting Purpose, Land Tenure and Current Uses of Myara Brook Reserve.

Reserve	Reserve and Lot Number	Vesting and Land Tenure	Current Uses
Myara Brook Reserve	R23778 L73 Elliott Road, Keysbrook	Shire of Serpentine Jarrahdale – Conservation / River Diversion	Conservation

3.2 User Groups

The principal users of Myara Brook Reserve are:

- Community conservation groups, including Friends group and Landcare SJ Inc.
- Informal users, infrequent, including horse riders

Conflict between user groups with differing priorities can cause issues for management of the reserve. Informal users, particularly horse riders, can degrade the vegetation and conflict with the conservation groups. The conservation groups have carried out extensive weed control and revegetation, particularly in the riparian zone.

3.3 Infrastructure

The infrastructure located in Myara Brook Reserve includes firebreaks, fences and gates. The infrastructure is mostly maintained by the Shire. Despite a high standard of maintenance, vandalism is a constant but low-level threat.

Fire can threaten people, property and conservation values. Bush or grass fires threaten nearby buildings and structures through embers, radiant heat and direct contact. Cleared areas around buildings limit the opportunity for bush and grass fires to reach them. Fire in nearby bushland has the potential to damage infrastructure.

4. Action Plan

Table 3: Action Plan for Myara Brook Reserve.

No.	Action	Priority	Timing	Status	Responsibility	Cost
1	**Utilise the planning system to retain and protect remnant marri woodland.**	**Key**	**Business as Usual**	**Ongoing**	**Statutory Planning**	**Staff Time**
2	Keep up to date with the latest research trends with regard to marri woodland and integrate into reserve management.	High	Long Term	Ongoing	Natural Reserves, Emergency Services	Staff Time
3	Formalise access to marri woodland in high use areas through establishment of walking paths that reduce trampling.	Medium	Medium Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
4	Erect signage in high use areas to inform users of the values of the marri woodland.	Medium	Short Term	Implemented in Part	Operations	Budget Dependent - $2,000
5	**Survey for dieback presence, and map and treat dieback every three years if present.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $6,000**
6	**Survey for marri canker, and treat infected trees.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $1,000**
7	Survey for wandoo decline, and treat according to best practice methods.	High	Business as Usual	Ongoing	Natural Reserves	Budget Dependent - $1,000
8	Monitor and manage new and emerging pests and diseases such as polyphagous shot hole borer.	High	Medium Term	Ongoing	Natural Reserves	Budget Dependent - $2,000
9	Control access to marri woodland through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
10	Liaise with other landholders to work together and integrate management of all marri woodland areas.	Medium	Medium Term	Not Yet Implemented	Natural Reserves, Strategic Environment	Staff Time
11	Implement measures to exclude motorised vehicles and horses from the remnant vegetation.	High	Medium Term	Implemented in Part	Operations	Budget Dependent - $2,000
12	Ensure that formalised paths and other access routes cross dieback fronts to the lowest degree possible.	Medium	Medium Term	Not Yet Implemented	Natural Reserves	Staff Time
13	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environment	Budget Dependent - $3,000

No.	Action	Priority	Timing	Status	Responsibility	Cost
14	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves	Budget Dependent - $3,000
15	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves	Staff Time
16	**Establish and implement a weed control program that utilises best practice methods.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves, Landcare SJ**	**Budget Dependent - $3,000**
17	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ	Budget and/or Funding Dependent - $1,500
18	**Minimise burning and other disturbance of marri woodland.**	**Key**	**Short Term**	**Implemented in Part**	**Emergency Services**	**Staff Time**
19	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves	Staff Time
20	Maintain fire intervals of 8-40 years.	High	Long Term	Not Yet Implemented	Emergency Services	Staff Time
21	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Staff Time
22	Restrict any essential fuel load management to the Vegetation Management Zone.	High	Short Term	Not Yet Implemented	Emergency Services	Budget Dependent - $1,500
23	Carry out fuel load management on adjacent road verges to avoid fire entering the reserve from the verge.	High	Medium Term	Not Yet Implemented	Emergency Services	Budget Dependent - $2,000
24	Ensure that any essential fuel load management utilises weed control as a priority, with control burning as a last resort.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves	Budget Dependent - $3,000
25	Ensure that any control burning is restricted to vegetation boundaries, providing a mosaic of vegetation ages including long unburnt.	High	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Budget Dependent - $1,500
26	**Follow any burning or other disturbance with weed control for at least two years post-fire.**	**Key**	**Business as Usual**	**Implemented in Part**	**Emergency Services, Natural Reserves**	**Budget Dependent - $3,000**
27	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations	Staff Time
28	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves	Funding Dependent - $2,500
29	Monitor implementation of the action plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environment	Staff Time
30	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environment	Staff Time
31	Review and revise the action plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environment	Staff Time

5. Fire Management Strategy for Myara Brook Reserve

Conservation Zone (green) – works exclusion; avoid disturbance

Vegetation Management Zone (red) – fuel load management if deemed appropriate and necessary by weed control and/or control burning followed by weed control

Dieback – present in some areas

Weeds – control required following disturbance

Firebreaks – present along boundaries

Oscar Bruns Reserve Action Plan

R10385

1. Background

1.1 Location

Oscar Bruns Reserve is located in Darling Downs, surrounded by semi-rural development (Figure 1). It is adjacent to historical rural land uses, including an abattoir and chicken farm.

Oscar Bruns Reserve contains one main vegetation community, marri woodland. The reserve is 3.90 ha with 1.67 ha remnant vegetation (marri woodland). This action plan specifically deals with the marri woodland area.

The reserve is vested with the Shire for the purpose of Recreation, but current uses also include Conservation. Users are casual and infrequent.

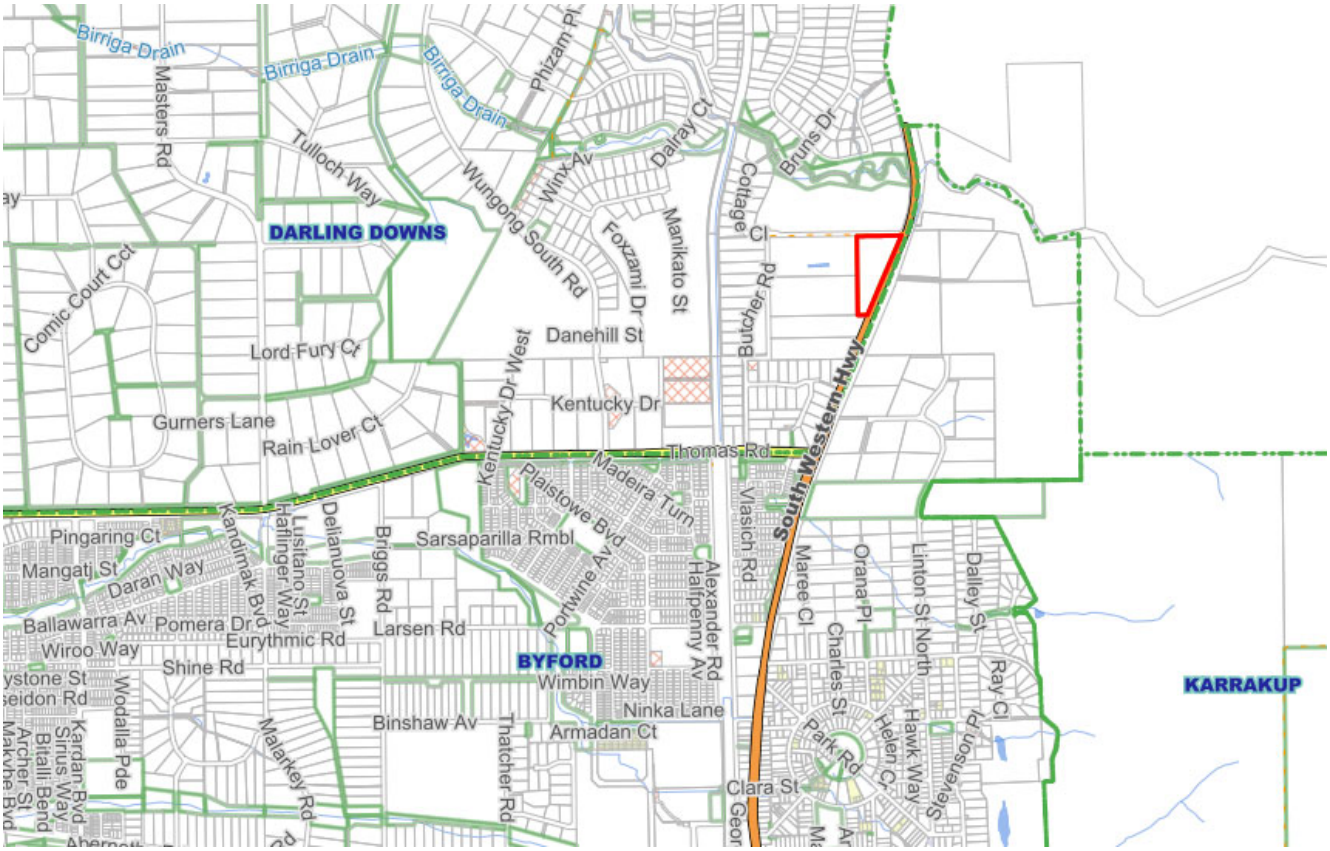


Figure 1: Location of Oscar Bruns Reserve.

Oscar Bruns Reserve is classified into two main management zones (Figure 2). These are:

Conservation Zone (green): Areas of remnant vegetation of high biodiversity and scientific reference value which include both dieback free and dieback infected areas. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must utilise dieback hygiene procedures such as clean-down and take extreme care to prevent spread of dieback from infected to uninfected areas.

Vegetation Management Zone (red): Areas of remnant vegetation of biodiversity and scientific reference value which may be disturbed, or dieback or weed infested. This is a buffer zone and may receive fuel load management for protection of people, property and conservation values by weed control or control burning on assessment by officers as required and appropriate. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must consider movement and reduce spread of dieback from infected to uninfected areas through clean down procedures.

This Action Plan applies to the Conservation and Vegetation Management Zones.

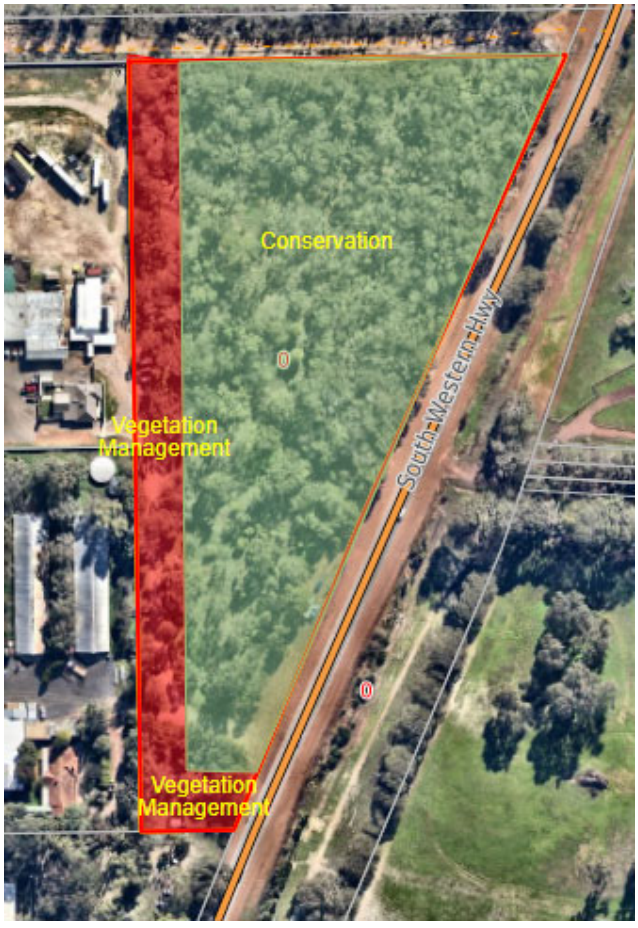


Figure 2: Management Zones of Oscar Bruns Reserve.

1.2 Soils

One soil type occurs in Oscar Bruns Reserve, Forrestfield F2b (Table 1 and Figure 3).

Table 1: Soil Types of Brickwood Reserve.

Reserve	Soil landscape unit	Description	Marri occurrence
Oscar Bruns Reserve	Forrestfield F2b phase	Low slopes and foot slopes up to 5-10% with well drained moderately deep to deep, gravelly acidic yellow duplex soils and rare laterite.	Yes

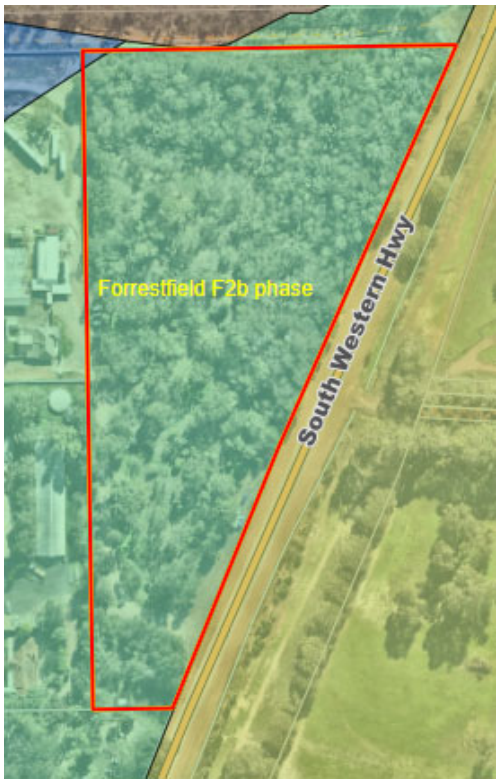


Figure 3: Soil Types of Oscar Bruns Reserve.

1.3 Biodiversity

Oscar Bruns Reserve contains one vegetation community, marri woodland. The marri woodland is approximately 1.67 ha in area (Figure 4) and belongs to the vegetation complex SCP3c (*Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands).

The northern half of the reserve is registered as a Threatened Ecological Community and the entire reserve is an Environmentally Sensitive Area. Bush Forever site 449 covers part of the north of the reserve.

The vegetation in Oscar Bruns Reserve is in Very Good to Degraded condition overall. The flora has been frequently surveyed and is diverse. No Threatened and Priority flora species have been recorded in the area.

The fauna of Oscar Bruns Reserve has never been formally surveyed, although it contains a known roosting site for the Forest Red-tailed Black Cockatoo, and Carnaby's Cockatoo has been recorded nearby.

Figure 4: Location of Marri Woodland of Oscar Bruns Reserve.

1.4 Water Resources

Oscar Bruns Reserve lies relatively high in the landscape, at the foot of the Ridge Hill Shelf (Forrestfield soils) with seasonally waterlogged areas to the west and north. The Wungong River runs from east to west 250 m north of the reserve.

The reserve itself is not a wetland, but a Multiple Use wetland lies to the west and north (Figure 5).

Figure 5: Geomorphic Wetlands of Oscar Bruns Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of Oscar Bruns Reserve include:

- Recreational pressure from surrounding semi-rural areas
- Community anxiety about fire hazard and pressure for control burning
- Arson, vandalism and degradation
- Illegal dumping of rubbish and garden waste
- Illegal access by motorised vehicles and associated damage to fences and vegetation
- Weed invasion, from dumping, surrounding areas, and carried in by users
- Feral and domestic animals (foxes, rabbits, cats) predating fauna and damaging vegetation
- Dieback disease (*Phytophthora cinnamomi*), marri canker and wandoo decline
- Livestock entering from adjacent abattoir, damaging vegetation

3. Reserve Usage

3.1 Vesting and Land Tenure

The vesting purpose, land tenure and current uses of Oscar Bruns Reserve are listed in Table 2.

Table 2: Vesting Purpose, Land Tenure and Current Uses of Oscar Bruns Reserve.

Reserve	Reserve and Lot Number	Vesting and Land Tenure	Current Uses
Oscar Bruns Reserve	R10385 L61 Butcher Road, Darling Downs	Shire of Serpentine Jarrahdale – Recreation	Recreation and Conservation

3.2 User Groups

The principal users of Oscar Bruns Reserve are infrequent informal users and Landcare SJ Inc., who have revegetated some of the more degraded areas of the reserve.

Conflict between user groups with differing priorities can cause issues for management of the reserve. Informal users can degrade the vegetation and conflict with conservation groups. Revegetation can be damaged by informal users, feral animals and livestock.

3.3 Infrastructure

The infrastructure located in Oscar Bruns Reserve includes firebreaks, fences and gates.

The infrastructure is mostly maintained by the Shire. Despite a high standard of maintenance, vandalism is a constant but low-level threat.

Fire can threaten people, property and conservation values. Bush or grass fires threaten nearby buildings and structures through embers, radiant heat and direct contact. Cleared areas around buildings limit the opportunity for bush and grass fires to reach them. Fire in nearby bushland has the potential to damage infrastructure.

4. Action Plan

Table 3: Action Plan for Oscar Bruns Reserve.

No.	Action	Priority	Timing	Status	Responsibility	Cost
1	**Utilise the planning system to retain and protect remnant marri woodland.**	**Key**	**Business as Usual**	**Ongoing**	**Statutory Planning**	**Staff Time**
2	Keep up to date with the latest research trends with regard to marri woodland and integrate into reserve management.	High	Long Term	Ongoing	Natural Reserves, Emergency Services	Staff Time

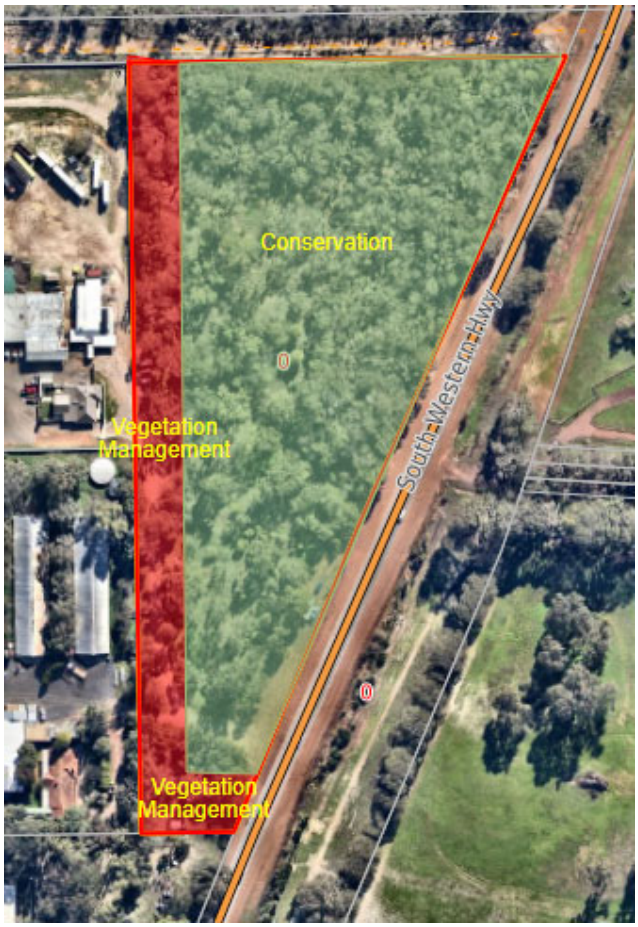
No.	Action	Priority	Timing	Status	Responsibility	Cost
3	Formalise access to marri woodland in high use areas through establishment of walking paths that reduce trampling.	Medium	Medium Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
4	Erect signage in high use areas to inform users of the values of the marri woodland.	Medium	Short Term	Implemented in Part	Operations	Budget Dependent - $2,000
5	**Survey for dieback presence, and map and treat dieback every three years if present.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $6,000**
6	**Survey for marri canker, and treat infected trees.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $1,000**
7	Survey for wandoo decline, and treat according to best practice methods.	High	Business as Usual	Ongoing	Natural Reserves	Budget Dependent - $1,000
8	Monitor and manage new and emerging pests and diseases such as polyphagous shot hole borer.	High	Medium Term	Ongoing	Natural Reserves	Budget Dependent - $2,000
9	Control access to marri woodland through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
10	Work with user groups to protect and minimize impacts to remnant vegetation.	High	Business as Usual	Ongoing	Natural Reserves, User Groups	Staff Time
11	Work with abattoir to exclude livestock from the remnant vegetation.	High	Business as Usual	Ongoing	Natural Reserves, Abattoir	Staff Time
12	Liaise with other landholders to work together and integrate management of all marri woodland areas.	Medium	Medium Term	Not Yet Implemented	Natural Reserves, Strategic Environment	Staff Time
13	Implement measures to exclude motorised vehicles from the remnant vegetation.	High	Medium Term	Implemented in Part	Operations	Budget Dependent - $2,000
14	Ensure that formalised paths and other access routes cross dieback fronts to the lowest degree possible.	Medium	Medium Term	Not Yet Implemented	Natural Reserves	Staff Time
15	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environment	Budget Dependent - $3,000
16	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves	Budget Dependent - $3,000
17	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves	Staff Time
18	**Establish and implement a weed control program that utilises best practice methods.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves, Landcare SJ**	**Budget Dependent - $3,000**
19	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ	Budget and/or Funding Dependent - $1,500

No.	Action	Priority	Timing	Status	Responsibility	Cost
20	**Minimise burning and other disturbance of marri woodland.**	**Key**	**Short Term**	**Implemented in Part**	**Emergency Services**	**Staff Time**
21	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves	Staff Time
22	Maintain fire intervals of 8-40 years.	High	Long Term	Not Yet Implemented	Emergency Services	Staff Time
23	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Staff Time
24	Restrict any essential fuel load management to the Vegetation Management Zone.	High	Short Term	Not Yet Implemented	Emergency Services	Budget Dependent - $1,500
25	Carry out fuel load management on adjacent road verges to avoid fire entering the reserve from the verge.	High	Medium Term	Not Yet Implemented	Emergency Services	Budget Dependent - $2,000
26	Ensure that any essential fuel load management utilises weed control as a priority, with control burning as a last resort.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves	Budget Dependent - $3,000
27	Ensure that any control burning is restricted to vegetation boundaries, providing a mosaic of vegetation ages including long unburnt.	High	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Budget Dependent - $1,500
28	**Follow any burning or other disturbance with weed control for at least two years post-fire.**	**Key**	**Business as Usual**	**Implemented in Part**	**Emergency Services, Natural Reserves**	**Budget Dependent - $3,000**
29	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations	Staff Time
30	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves	Funding Dependent - $2,500
31	Monitor implementation of the action plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environment	Staff Time
32	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environment	Staff Time
33	Review and revise the action plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environment	Staff Time

5. Fire Management Strategy for Oscar Bruns Reserve

Conservation Zone (green) – works exclusion; avoid disturbance

Vegetation Management Zone (red) – fuel load management if deemed appropriate and necessary by weed control and/or control burning followed by weed control



Dieback – present in some areas

Weeds – control required following disturbance

Firebreaks – present along boundaries

Rainforest Reserve Action Plan

R20165

1. Background

1.1 Location

Rainforest Reserve is located in Byford, surrounded by urban development (Figure 1). It is adjacent to recreational facilities and a kindergarten.

Rainforest Reserve contains one vegetation community, marri woodland. The reserve is 1.08 ha with 0.95 ha remnant vegetation (marri woodland). This action plan specifically deals with the marri woodland area.

The reserve is vested with the Shire for the purpose of Recreation, but current uses also include Conservation. Users are casual but frequent.

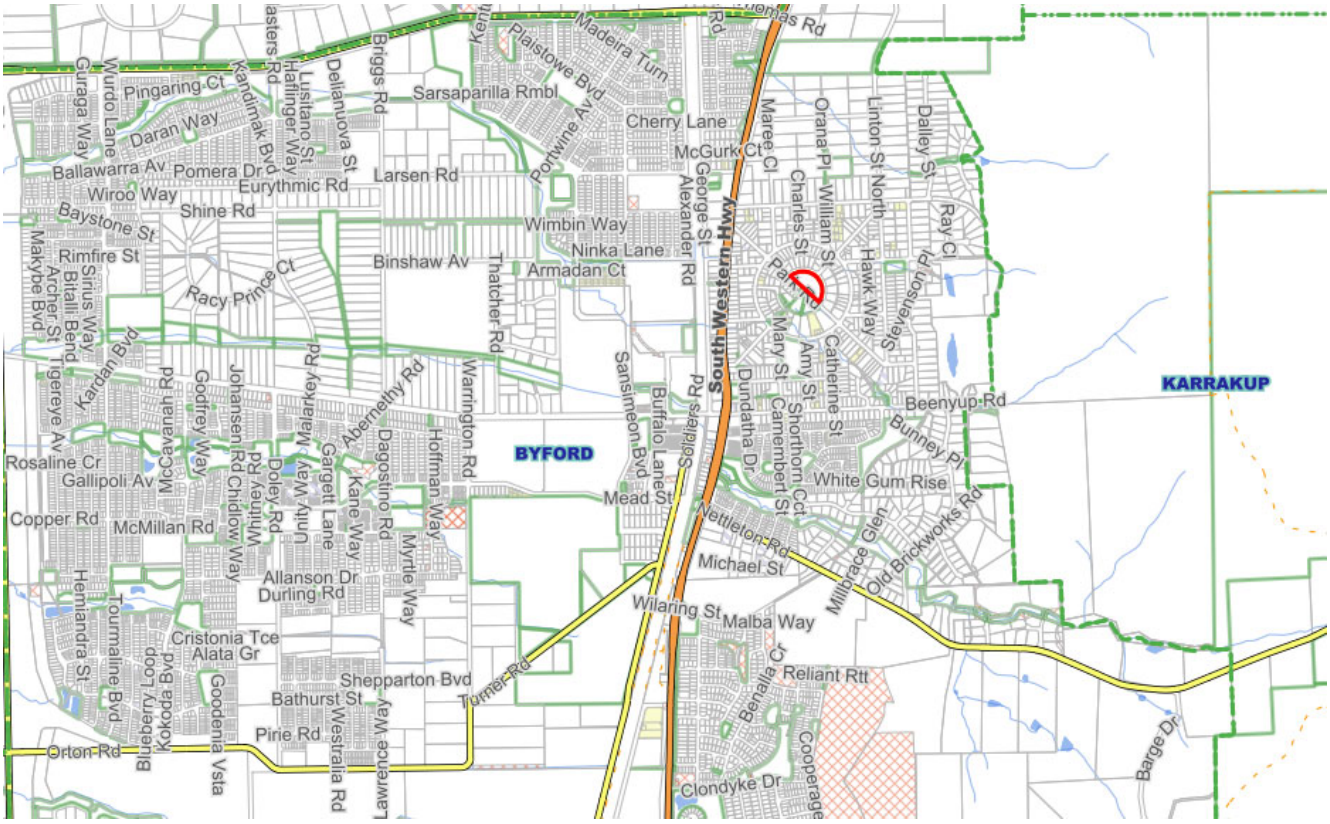


Figure 1: Location of Rainforest Reserve.

Rainforest Reserve is classified into three main management zones (Figure 2). These are:

Conservation Zone (green): Areas of remnant vegetation of high biodiversity and scientific reference value which include both dieback free and dieback infected areas. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must utilise dieback hygiene procedures such as clean-down and take extreme care to prevent spread of dieback from infected to uninfected areas.

Vegetation Management Zone (red): Areas of remnant vegetation of biodiversity and scientific reference value which may be disturbed, or dieback or weed infested. This is a buffer zone and may receive fuel load management for protection of people, property and conservation values by weed control or control burning on assessment by officers as required and appropriate. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must consider movement and reduce spread of dieback from infected to uninfected areas through clean down procedures.

Recreation Zone (yellow): This is the cleared, grassy area containing playground equipment. Management of this zone is principally for the purpose of recreation, while minimising impacts on the adjacent remnant vegetation.

This Action Plan applies to the Conservation and Vegetation Management Zones.

Figure 2: Management Zones of Rainforest Reserve.

1.2 Soils

One soil type occurs in Rainforest Reserve, Forrestfield F2 (Table 1 and Figure 3).

Table 1: Soil Types of Rainforest Reserve.

Reserve	Soil landscape unit	Description	Marri occurrence
Rainforest Reserve	Forrestfield (D Range) F2 phase	Foot and low slopes < 10%. Well drained gravelly yellow or brown duplex soils with sandy topsoil. Woodland of *E. marginata, C. calophylla* and some *B. grandis.*	Yes

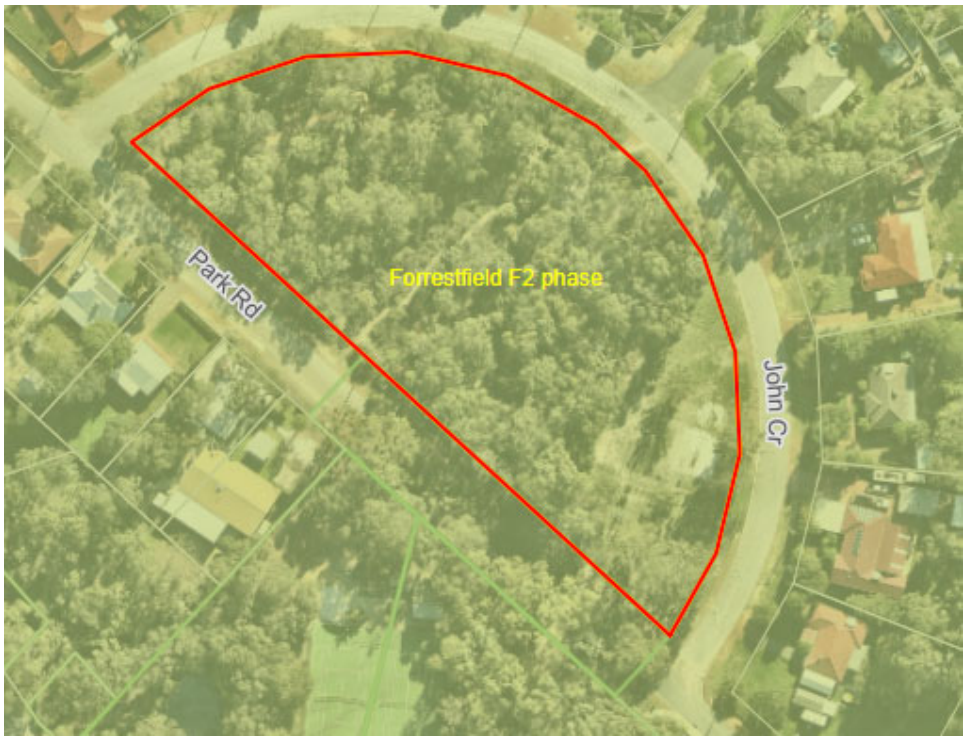


Figure 3: Soil Types of Rainforest Reserve.

1.3 Biodiversity

Rainforest Reserve contains one vegetation community, marri woodland. The marri woodland is approximately 0.95 ha in area (Figure 4) and belongs to the vegetation complex SCP3a (*Corymbia calophylla – Kingia australis* woodlands).

The vegetated part of the reserve belongs to a Threatened Ecological Community. The vegetation in Rainforest Reserve is in Very Good to Good condition overall. The flora has been frequently surveyed and is diverse. No Threatened and Priority flora species have been recorded in the area.

The fauna of Rainforest Reserve has never been formally surveyed, although anecdotally some Threatened and Priority fauna species may occur, such as black cockatoos and quenda (southern brown bandicoot) as they have been recorded nearby.

Figure 4: Location of Marri Woodland of Rainforest Reserve.

1.4 Water Resources

Rainforest Reserve is relatively high in the landscape, lying on the Ridge Hill Shelf (Forrestfield soils). Watercourses (drains) run through nearby reserves to discharge west across the South Western Highway.

The reserve and its surrounding areas are not registered as wetlands (Figure 5).

Figure 5: Geomorphic Wetlands of Rainforest Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of Rainforest Reserve include:

- Recreational pressure from surrounding urban areas
- Community anxiety about fire hazard and pressure for control burning
- Arson, vandalism and degradation
- Illegal dumping of rubbish and garden waste
- Weed invasion, from dumping, surrounding urban areas, and carried in by users
- Feral and domestic animals (foxes, rabbits, cats) predating fauna and damaging vegetation
- Dieback disease (*Phytophthora cinnamomi*) and marri canker

3. Reserve Usage

3.1 Vesting and Land Tenure

The vesting purpose, land tenure and current uses of Rainforest Reserve are listed in Table 2.

Table 2: Vesting Purpose, Land Tenure and Current Uses of Rainforest Reserve.

Reserve	Reserve and Lot Number	Vesting and Land Tenure	Current Uses
Rainforest Reserve	R20165 L808 Park Road, Byford	Shire of Serpentine Jarrahdale – Recreation	Recreation and Conservation

3.2 User Groups

The principal users of Rainforest Reserve are:

- Community conservation groups, including Landcare SJ Inc. and Byford Environmental Group
- Users of nearby facilities, including the kindergarten, playground and tennis courts
- Informal users, particularly for walking and dog exercise

Conflict between user groups with differing priorities can cause issues for management of the reserve. Informal users can degrade the vegetation and conflict with the conservation groups.

3.3 Infrastructure

The infrastructure located in Rainforest Reserve includes a small playground area.

The infrastructure is maintained by the Shire. Despite a high standard of maintenance, vandalism is a constant but low-level threat.

Fire can threaten people, property and conservation values. Bush or grass fires threaten nearby buildings and structures through embers, radiant heat and direct contact. Cleared areas around buildings limit the opportunity for bush and grass fires to reach them. Fire in nearby bushland has the potential to damage infrastructure.

4. Action Plan

Table 3: Action Plan for Rainforest Reserve.

No.	Action	Priority	Timing	Status	Responsibility	Cost
1	**Utilise the planning system to retain and protect remnant marri woodland.**	**Key**	**Business as Usual**	**Ongoing**	**Statutory Planning**	**Staff Time**
2	Keep up to date with the latest research trends with regard to marri woodland and integrate into reserve management.	High	Long Term	Ongoing	Natural Reserves, Emergency Services	Staff Time

No.	Action	Priority	Timing	Status	Responsibility	Cost
3	Formalise access to marri woodland in high use areas through establishment of walking paths that reduce trampling.	Medium	Medium Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
4	Erect signage in high use areas to inform users of the values of the marri woodland.	Medium	Short Term	Implemented in Part	Operations	Budget Dependent - $2,000
5	**Survey for dieback presence, and map and treat dieback every three years if present.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $6,000**
6	**Survey for marri canker, and treat infected trees.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $1,000**
7	Monitor and manage new and emerging pests and diseases such as polyphagous shot hole borer.	High	Medium Term	Ongoing	Natural Reserves	Budget Dependent - $2,000
8	Control access to marri woodland through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
9	Liaise with other landholders to work together and integrate management of all banksia woodland areas.	Medium	Medium Term	Not Yet Implemented	Natural Reserves, Strategic Environment	Staff Time
10	Ensure that formalised paths and other access routes cross dieback fronts to the lowest degree possible.	Medium	Medium Term	Not Yet Implemented	Natural Reserves	Staff Time
11	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environment	Budget Dependent - $3,000
12	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves	Budget Dependent - $3,000
13	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves	Staff Time
14	**Establish and implement a weed control program that utilises best practice methods.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves, Landcare SJ**	**Budget Dependent - $3,000**
15	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ	Budget and/or Funding Dependent - $1,500
16	**Minimise burning and other disturbance of marri woodland.**	**Key**	**Short Term**	**Implemented in Part**	**Emergency Services**	**Staff Time**
17	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves	Staff Time
18	Maintain fire intervals of 8-40 years.	High	Long Term	Not Yet Implemented	Emergency Services	Staff Time
19	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Staff Time
20	Restrict any essential fuel load management to the Vegetation Management Zone.	High	Short Term	Not Yet Implemented	Emergency Services	Budget Dependent - $1,500

No.	Action	Priority	Timing	Status	Responsibility	Cost
21	Carry out fuel load management on adjacent road verges to avoid fire entering the reserve from the verge.	High	Medium Term	Not Yet Implemented	Emergency Services	Budget Dependent - $2,000
22	Ensure that any essential fuel load management utilises weed control as a priority, with control burning as a last resort.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves	Budget Dependent - $3,000
23	Ensure that any control burning is restricted to vegetation boundaries, providing a mosaic of vegetation ages including long unburnt.	High	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Budget Dependent - $1,500
24	**Follow any burning or other disturbance with weed control for at least two years post-fire.**	**Key**	**Business as Usual**	**Implemented in Part**	**Emergency Services, Natural Reserves**	**Budget Dependent - $3,000**
25	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations	Staff Time
26	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves	Funding Dependent - $2,500
27	Monitor implementation of the action plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environment	Staff Time
28	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environment	Staff Time
29	Review and revise the action plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environment	Staff Time

5. Fire Management Strategy for Rainforest Reserve

Conservation Zone (green) – works exclusion; avoid disturbance

Vegetation Management Zone (red) – fuel load management if deemed appropriate and necessary by weed control and/or control burning followed by weed control

Dieback – present in some areas

Weeds – control required following disturbance

Firebreaks – absent, access from roads

Wattle Road Nature Reserve Action Plan

R36433

1. Background

1.1 Location

Wattle Road Nature Reserve is located in Serpentine (Figure 1). The reserve's vegetation is transitional between banksia woodland and marri woodland. The reserve is 0.97 ha in area with 0.97 ha of remnant vegetation. This action plan deals with the marri woodland aspects of the remnant vegetation.

The reserve is vested with the Shire for the purpose of Conservation of Flora, which is the current use. The principal users of the reserve are informal, infrequent walking and enjoyment of nature, although this will increase with subdivision of the land to the south. Access is restricted due to the deep drain along the northern (road) boundary.

Figure 1: Location of Wattle Road Nature Reserve.

Wattle Road Nature Reserve has only one management zone (Figure 2). This is:

Conservation Zone (green): Areas of remnant vegetation of high biodiversity and scientific reference value which include both dieback free and dieback infected areas. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must utilise dieback hygiene procedures such as clean-down and take extreme care to prevent spread of dieback from infected to uninfected areas.

Figure 2: Management Zones of Wattle Road Nature Reserve.

1.2 Soils

Two soil types occur in Wattle Road Nature Reserve: Pinjarra B1 and Pinjarra P1b (Table 1 and Figure 3). Marri woodland occurs on both soil types, transitional with banksia woodland.

Table 1: Soil Types of Wattle Road Nature Reserve.

Reserve	Soil landscape unit	Description	Marri occurrence
Wattle Road Nature Reserve	Pinjarra B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	Partial
	Pinjarra P1b phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or ieffective duplexo) soils. Moderately deep pale sand to loamy sand over clay: imperfectly drained and moderately susceptible to salinity in limited areas	Partial

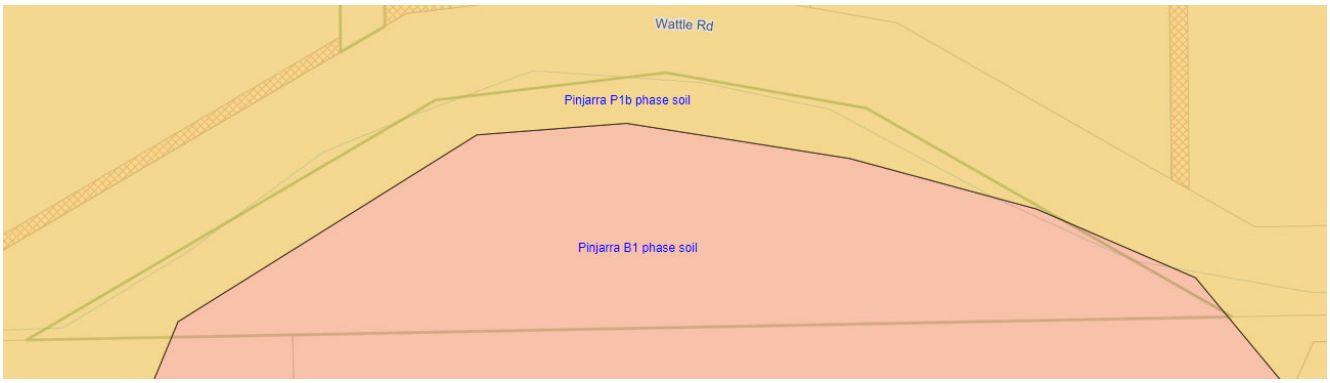


Figure 3: Soil Types of Wattle Road Nature Reserve.

1.3 Biodiversity

Wattle Road Nature Reserve contains one transitional vegetation community, which is a combination of banksia woodland and marri woodland. The marri woodland is approximately 0.97 ha in area (Figure 4) and belongs to the vegetation complex SCP3a (*Corymbia calophylla – Kingia australis* woodlands).

The reserve is not mapped as a Threatened Ecological Community. The vegetation is in Very Good condition overall.

The flora of Wattle Road Nature Reserve has been frequently surveyed and is diverse. No Threatened and Priority flora species have been officially recorded in the area, but anecdotally the Threatened species *Morelotia australiensis* has been observed. The fauna has never been formally surveyed, although anecdotally some Threatened and Priority fauna species may occur, such as black cockatoos and quenda (southern brown bandicoot).

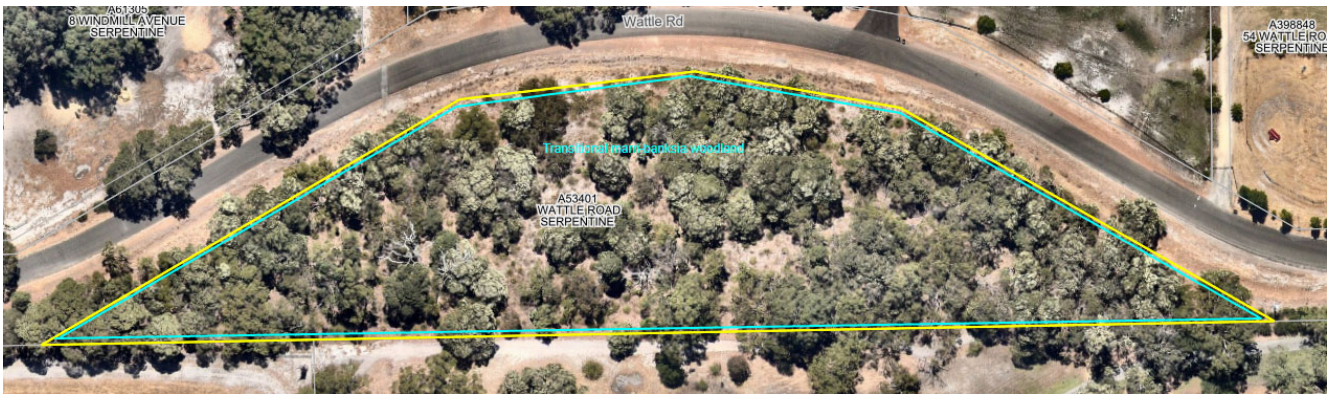


Figure 4: Location of Marri Woodland of Wattle Road Nature Reserve.

1.4 Water Resources

Wattle Road Nature Reserve is low in the landscape, sitting on a sandplain, with a vegetation type associated with low-lying areas. A deep watercourse (drain) runs along the northern (road) boundary of the reserve which restricts access.

A Resource Enhancement wetland covers the eastern, northern and western edges of the reserve (Figure 5).

Figure 5: Geomorphic Wetlands of Wattle Road Nature Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of Wattle Road Nature Reserve include:

- Recreational pressure from users, which will increase with subdivision of the land to the south
- Community anxiety about fire hazard and pressure for control burning
- Arson and vandalism (removal of grasstrees has occurred)
- Weed invasion, from surrounding land and carried in by users
- Feral and domestic animals (foxes, rabbits, cats) predating fauna and damaging vegetation
- Dieback disease (*Phytophthora cinnamomi*) and marri canker

3. Reserve Usage

3.1 Vesting and Land Tenure

The vesting purpose, land tenure and current uses of Wattle Road Nature Reserve are listed below in Table 2.

Table 2: Vesting Purpose, Land Tenure and Current Uses of Wattle Road Nature Reserve.

Reserve	Reserve and Lot Number	Vesting and Land Tenure	Current Uses
Wattle Road Nature Reserve	R36433 L2597 Wattle Road, Serpentine	Shire of Serpentine Jarrahdale – Conservation of Flora	Conservation

3.2 User Groups

The principal users of Wattle Road Nature Reserve are informal, infrequent walking and enjoyment of nature. Access is restricted due to the deep drain along the northern (road) boundary. Usage is likely to increase when the land to the south is subdivided into semi-rural lots.

Threats and pressures for the users are minimal.

3.3 Infrastructure

The infrastructure located in Wattle Road Nature Reserve includes firebreaks, fences, gates and signage.

The infrastructure is maintained by the Shire. Vandalism and theft are constant but low-level threats.

Fire can threaten people, property and conservation values. Bush or grass fires threaten buildings and structures through embers, radiant heat and direct contact. Cleared areas around buildings limit the opportunity for bush and grass fires to reach them. Fire in the reserve's bushland has the potential to damage nearby infrastructure.

4. Action Plan

Table 3: Action Plan for Wattle Road Nature Reserve.

No.	Action	Priority	Timing	Status	Responsibility	Cost
1	**Utilise the planning system to retain and protect remnant marri woodland.**	**Key**	**Business as Usual**	**Ongoing**	**Statutory Planning**	**Staff Time**
2	Keep up to date with the latest research trends with regard to marri woodland and integrate into reserve management.	High	Long Term	Ongoing	Natural Reserves, Emergency Services	Staff Time
3	**Survey for dieback presence, and map and treat dieback every three years if present.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $3,000**
4	**Survey for marri canker, and treat infected trees.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $1,000**
5	Monitor and manage new and emerging pests and diseases such as polyphagous shot hole borer.	High	Medium Term	Ongoing	Natural Reserves	Budget Dependent - $2,000
6	Control access to marri woodland through boundary fencing, convenient formal access points, and path	Low	Long Term	Not Yet Implemented	Operations	Budget Dependent - $3,000

No.	Action	Priority	Timing	Status	Responsibility	Cost
	construction that discourages deviation.					
7	Liaise with other landholders to work together and integrate management of all marri woodland areas.	Medium	Medium Term	Not Yet Implemented	Natural Reserves, Strategic Environment	Staff Time
8	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environment	Budget Dependent - $3,000
9	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves	Budget Dependent - $3,000
10	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves	Staff Time
11	**Establish and implement a weed control program that utilises best practice methods.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves, Landcare SJ**	**Budget Dependent - $1,500**
12	Establish and implement a control program for woody weeds.	High	Business as Usual	Ongoing	Natural Reserves	Budget Dependent - $1,500
13	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ	Budget and/or Funding Dependent - $800
14	**Minimise burning and other disturbance of marri woodland.**	**Key**	**Short Term**	**Implemented in Part**	**Emergency Services**	**Staff Time**
15	Maintain fire intervals of 8-40 years.	High	Long Term	Not Yet Implemented	Emergency Services	Staff Time
16	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Staff Time
17	Carry out fuel load management on adjacent road verges to avoid fire entering the reserve from the verge.	High	Medium Term	Not Yet Implemented	Emergency Services	Budget Dependent - $2,000
18	Ensure that any essential fuel load management utilises weed control as a priority, with control burning as a last resort.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves	Budget Dependent - $1,500
19	Ensure that any control burning is restricted to vegetation boundaries, providing a mosaic of vegetation ages including long unburnt.	High	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Budget Dependent - $1,500t
20	**Follow any burning or other disturbance with weed control for at least two years post-fire.**	**Key**	**Business as Usual**	**Implemented in Part**	**Emergency Services, Natural Reserves**	**Budget Dependent - $1,500**
21	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations	Staff Time
22	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves	Funding Dependent – $2,500

No.	Action	Priority	Timing	Status	Responsibility	Cost
23	Monitor implementation of the action plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environment	Staff Time
24	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environment	Staff Time
25	Review and revise the action plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environment	Staff Time

5. Fire Management Strategy for Wattle Road Nature Reserve

Conservation Zone (green) – works exclusion; avoid disturbance

Dieback – present in some areas

Weeds – control required following disturbance

Firebreaks – absent, access from road and adjacent property

Clem Kentish Reserve Action Plan

R9157

1. Background

1.1 Location

Clem Kentish Reserve is located in Serpentine, associated with an oval, tennis courts, hall and tractor museum, and surrounded by urban development (Figure 1). It is close to the Serpentine River and railway vegetation corridors.

Clem Kentish Reserve contains one vegetation community, marri woodland. The reserve is 4.53 ha with 0.53 ha remnant vegetation. This action plan specifically deals with the marri woodland area.

The reserve (including the marri woodland) is vested with the Shire for the purpose of Recreation, but current uses also include Conservation. There are numerous user groups for the reserve, particularly associated with the oval and community hall, and significant infrastructure.

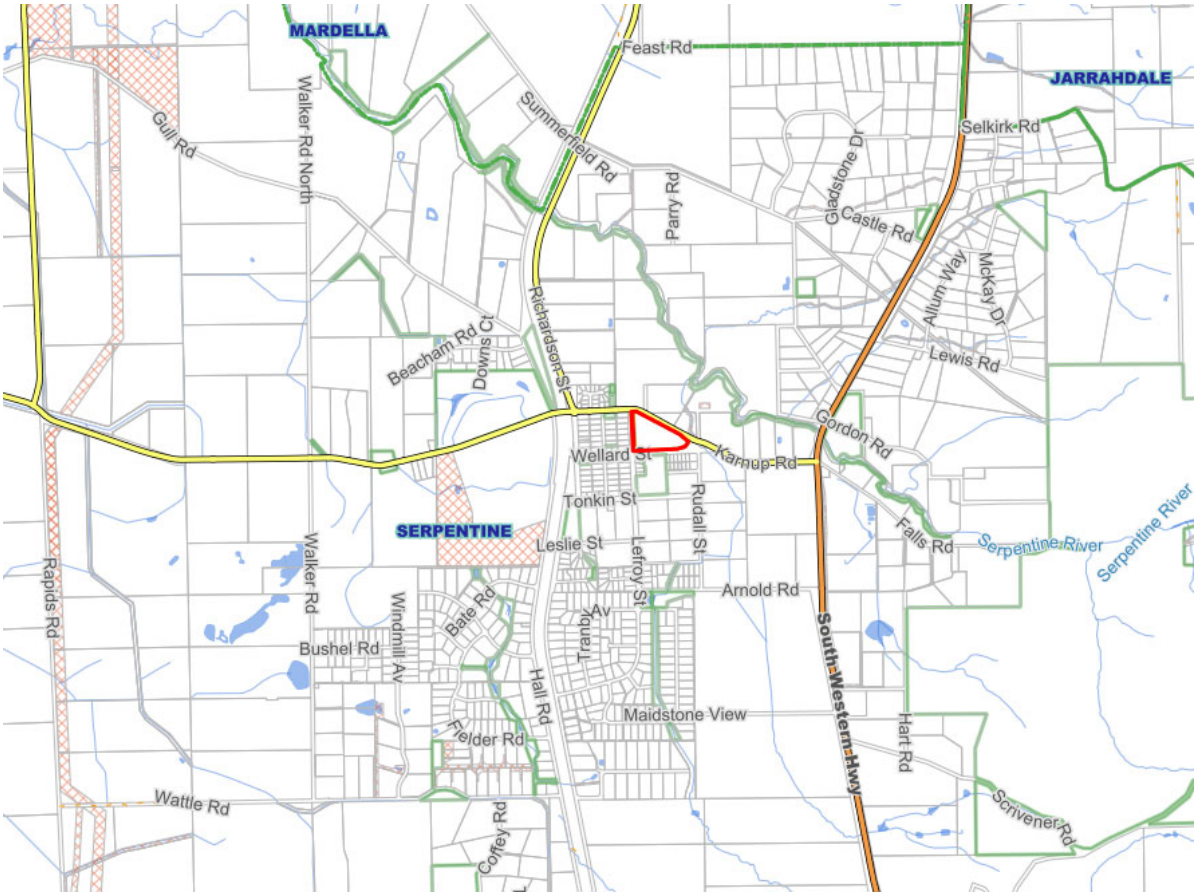


Figure 1: Location of Clem Kentish Reserve.

Clem Kentish Reserve is classified into two main management zones (Figure 2). These are:

Vegetation Management Zone (red): Areas of remnant vegetation of biodiversity and scientific reference value which may be disturbed, or dieback or weed infested. This is a buffer zone and may receive fuel load management for protection of people, property and conservation values by weed control or control burning on assessment by officers as required and appropriate. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must consider movement and reduce spread of dieback from infected to uninfected areas through clean down procedures.

Recreation Zone (yellow): This is the areas of Clem Kentish Reserve used for active and passive recreation. Management of this zone is principally for the purpose of recreation, while minimising impacts on the adjacent remnant vegetation.

This Action Plan applies to the Vegetation Management Zone.

Figure 2: Management Zones of Clem Kentish Reserve.

1.2 Soils

Three soil types occur in Clem Kentish Reserve: Pinjarra P3, Pinjarra P6a and Pinjarra B1 (Table 1 and Figure 3). Marri woodland occurs on all but the Pinjarra P3 soil type.

Table 1: Soil Types of Clem Kentish Reserve.

Reserve	Soil landscape unit	Description	Marri occurrence
Clem Kentish Reserve	Pinjarra P3 phase	Flat to very gently undulating plain with deep, imperfect to poorly drained acidic gradational yellow or grey-brown earths and mottled yellow duplex soils, with loam to clay loam surface horizons.	No
	Pinjarra B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	Partial
	Pinjarra P6a phase	Very gently undulating alluvial terraces and low rises contiguous with the plain, with deep moderately well to well drained soils associated with major current river systems and larger streams. Acidic red and yellow duplex soils, less commonly gradational red and yellow earths.	Yes

Figure 3: Soil Types of Clem Kentish Reserve.

1.3 Biodiversity

Clem Kentish Reserve contains one vegetation community, marri woodland. The marri woodland is approximately 0.53 ha in area (Figure 4) and belongs to the vegetation complex SCP3c (*Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands).

The entire reserve is an Environmentally Sensitive Area. The vegetation in Clem Kentish Reserve is in Good condition overall. The flora has been frequently surveyed and is diverse. No Threatened and Priority flora species have been recorded in the area.

The fauna of Clem Kentish Reserve has never been formally surveyed, although anecdotally some Threatened and Priority fauna species may occur, such as black cockatoos and quenda (southern brown bandicoot).

Figure 4: Location of Marri Woodland of Clem Kentish Reserve.

1.4 Water Resources

Clem Kentish Reserve is generally low-lying, and as such much of it is seasonally waterlogged. A watercourse runs to the east of the reserve, discharging into the Serpentine River 250 m to the north.

The western part of the reserve is a Resource Enhancement wetland, and the remainder is Multiple Use (Figure 5).

Figure 5: Geomorphic Wetlands of Clem Kentish Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of Clem Kentish Reserve include:

- Recreational pressure from surrounding urban areas
- Community anxiety about fire hazard and pressure for control burning
- Arson, vandalism and degradation
- Expansion of BMX track through the vegetation
- Illegal dumping of rubbish and garden waste
- Weed invasion, from ovals, surrounding urban areas, and carried in by users

- Feral and domestic animals (foxes, rabbits, cats) predating fauna and damaging vegetation
- Dieback disease (*Phytophthora cinnamomi*) and marri canker
- Nutrient runoff from ovals

3. Reserve Usage

3.1 Vesting and Land Tenure

The vesting purpose, land tenure and current uses of Clem Kentish Reserve are listed in Table 2.

Table 2: Vesting Purpose, Land Tenure and Current Uses of Clem Kentish Reserve.

Reserve	Reserve and Lot Number	Vesting and Land Tenure	Current Uses
Clem Kentish Reserve	R9157 L57 Wellard Street, Serpentine	Shire of Serpentine Jarrahdale – Recreation	Recreation and Conservation

3.2 User Groups

The principal users of Clem Kentish Reserve are:

- Sports field user groups, including cricket and football
- Community hall / sports pavilion regular users and hire
- Tennis court users
- BMX and skate park users
- Tractor museum volunteers and visitors
- Playground users
- Events and parking
- Informal users, particularly for walking and dog exercise

Conflict between user groups with differing priorities can cause issues for management of the reserve. Informal users can degrade the vegetation and conflict with conservation groups. Conflict can arise between user groups with conflicting schedules.

3.3 Infrastructure

The infrastructure located in Clem Kentish Reserve includes:

- Sports pavilion / community hall
- Tractor museum
- Sports field
- Cricket nets
- Tennis courts
- Skate park
- BMX track
- Playgrounds

- Car parks
- Bores and irrigation systems
- Water tanks
- Fences and gates
- Signage, relating to entry and use

The infrastructure is mostly maintained by the Shire. Despite a high standard of maintenance. good lighting and high community use and surveillance, vandalism and theft are constant but low-level threats.

Fire can threaten people, property and conservation values. Fires can start inside or adjacent to buildings and structures, and are often the result of vandalism, kitchen accidents or electrical faults. Bush or grass fires threaten buildings and structures through embers, radiant heat and direct contact. Cleared areas around buildings limit the opportunity for bush and grass fires to reach them. Fire in nearby bushland has the potential to damage infrastructure.

4. Action Plan

Table 3: Action Plan for Clem Kentish Reserve.

No.	Action	Priority	Timing	Status	Responsibility	Cost
1	**Utilise the planning system to retain and protect remnant marri woodland.**	**Key**	**Business as Usual**	**Ongoing**	**Statutory Planning**	**Staff Time**
2	Keep up to date with the latest research trends with regard to marri woodland and integrate into reserve management.	High	Long Term	Ongoing	Natural Reserves, Emergency Services	Staff Time
3	Erect signage in high use areas to inform users of the values of the marri woodland.	Medium	Short Term	Implemented in Part	Operations	Budget Dependent - $2,000
4	**Survey for dieback presence, and map and treat dieback every three years if present.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $6,000**
5	**Survey for marri canker, and treat infected trees.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $1,000**
6	Monitor and manage new and emerging pests and diseases such as polyphagous shot hole borer.	High	Medium Term	Ongoing	Natural Reserves	Budget Dependent - $2,000
7	Control access to marri woodland through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
8	Work with user groups to protect and minimize impacts to remnant vegetation.	High	Business as Usual	Ongoing	Natural Reserves, User Groups	Staff Time
9	Liaise with other landholders to work together and integrate management of all marriwoodland areas.	Medium	Medium Term	Not Yet Implemented	Natural Reserves, Strategic Environment	Staff Time
10	Ensure that formalised paths and other access routes cross dieback fronts to the lowest degree possible.	Medium	Medium Term	Not Yet Implemented	Natural Reserves	Staff Time

No.	Action	Priority	Timing	Status	Responsibility	Cost
11	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environment	Budget Dependent - $3,000
12	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves	Budget Dependent - $3,000
13	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves	Staff Time
14	**Establish and implement a weed control program that utilises best practice methods.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves, Landcare SJ**	**Budget Dependent - $3,000**
15	**Minimise burning and other disturbance of marri woodland.**	**Key**	**Short Term**	**Implemented in Part**	**Emergency Services**	**Staff Time**
16	Maintain fire intervals of 8-40 years.	High	Long Term	Not Yet Implemented	Emergency Services	Staff Time
17	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Staff Time
18	Carry out fuel load management on adjacent road verges to avoid fire entering the reserve from the verge.	High	Medium Term	Not Yet Implemented	Emergency Services	Budget Dependent - $2,000
19	Ensure that any essential fuel load management utilises weed control as a priority, with control burning as a last resort.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves	Budget Dependent - $3,000
20	Ensure that any control burning is restricted to vegetation boundaries, providing a mosaic of vegetation ages including long unburnt.	High	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Budget Dependent - $1,500
21	**Follow any burning or other disturbance with weed control for at least two years post-fire.**	**Key**	**Business as Usual**	**Implemented in Part**	**Emergency Services, Natural Reserves**	**Budget Dependent - $3,000**
22	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations	Staff Time
23	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves	Funding Dependent - $2,500
24	Monitor implementation of the action plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environment	Staff Time
25	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environment	Staff Time
26	Review and revise the action plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environment	Staff Time

5. Fire Management Strategy for Clem Kentish Reserve

Vegetation Management Zone (red) – fuel load management if deemed appropriate and necessary by weed control and/or control burning followed by weed control

Dieback – present in some areas

Weeds – control required following disturbance

Firebreaks – absent, access from roads and sports field

Yangedi Airfield Reserve Action Plan

R25911

1. Background

1.1 Location

Yangedi Airfield Reserve is located in Hopeland (Figure 1). The reserve contains three vegetation types: banksia woodland, marri woodland and a clay-based wetland. The reserve is 64.7 ha with 32.9 ha remnant vegetation, of which approximately 4.6 ha is marri woodland. This action plan specifically deals with the marri woodland area.

The reserve is vested with the Shire for the purpose of Recreation, but current uses also include Conservation. The principal user groups for the reserve are the Sport Aircraft Builders Club, the Bureau of Meteorology and the Department of Fire and Emergency Services, which all maintain significant infrastructure. The areas used by each group are shown in Figure 2.

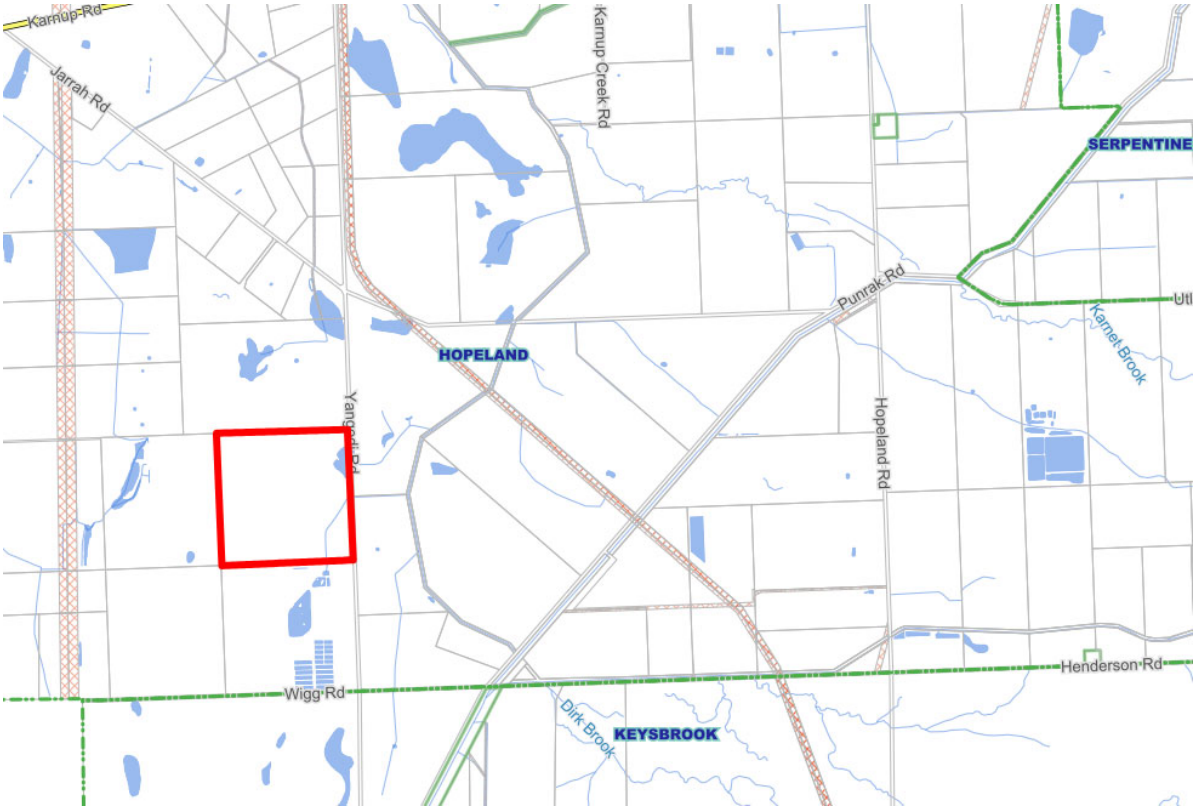


Figure 1: Location of Yangedi Airfield Reserve.

Yangedi Airfield Reserve is classified into four main management zones (Figure 2). These are:

Conservation Zone (green): Areas of remnant vegetation of high biodiversity and scientific reference value which include both dieback free and dieback infected areas. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must utilise dieback hygiene procedures such as clean-down and take extreme care to prevent spread of dieback from infected to uninfected areas.

Vegetation Management Zone (red): Areas of remnant vegetation of biodiversity and scientific reference value which may be disturbed, or dieback or weed infested. This is a buffer zone and may receive fuel load management for protection of people, property and conservation values by weed control or control burning on assessment by officers as required and appropriate. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must consider movement and reduce spread of dieback from infected to uninfected areas through clean down procedures.

Recreation Zone (yellow): This is the area in use by the Sport Aircraft Builders Club. Management of this zone is principally for the purpose of recreation and aviation safety, while minimising impacts on the adjacent remnant vegetation. Access to this zone must be negotiated with the SABC to maintain safety of aircraft and visitors.

Leased Zone (purple and blue): Areas leased by the Bureau of Meteorology (purple) and the Department of Fire and Emergency Services (blue). Management of these areas is principally for maintenance of infrastructure and protection of people and property.

This Action Plan applies to the Conservation and Vegetation Management Zones.

Figure 2: Land Uses and Management Zones of Yangedi Airfield Reserve.

1.2 Soils

Two soil types occur in Yangedi Airfield Reserve: Bassendean B1 and Bassendean B3 (Table 1 and Figure 3). Marri woodland occurs on the Bassendean B3 soil type.

Table 1: Soil Types of Yangedi Airfield Reserve.

Reserve	Soil landscape unit	Description	Marri occurrence
Yangedi Airfield Reserve	Bassendean B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	No
	Bassendean B3 phase	Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam.	Partial

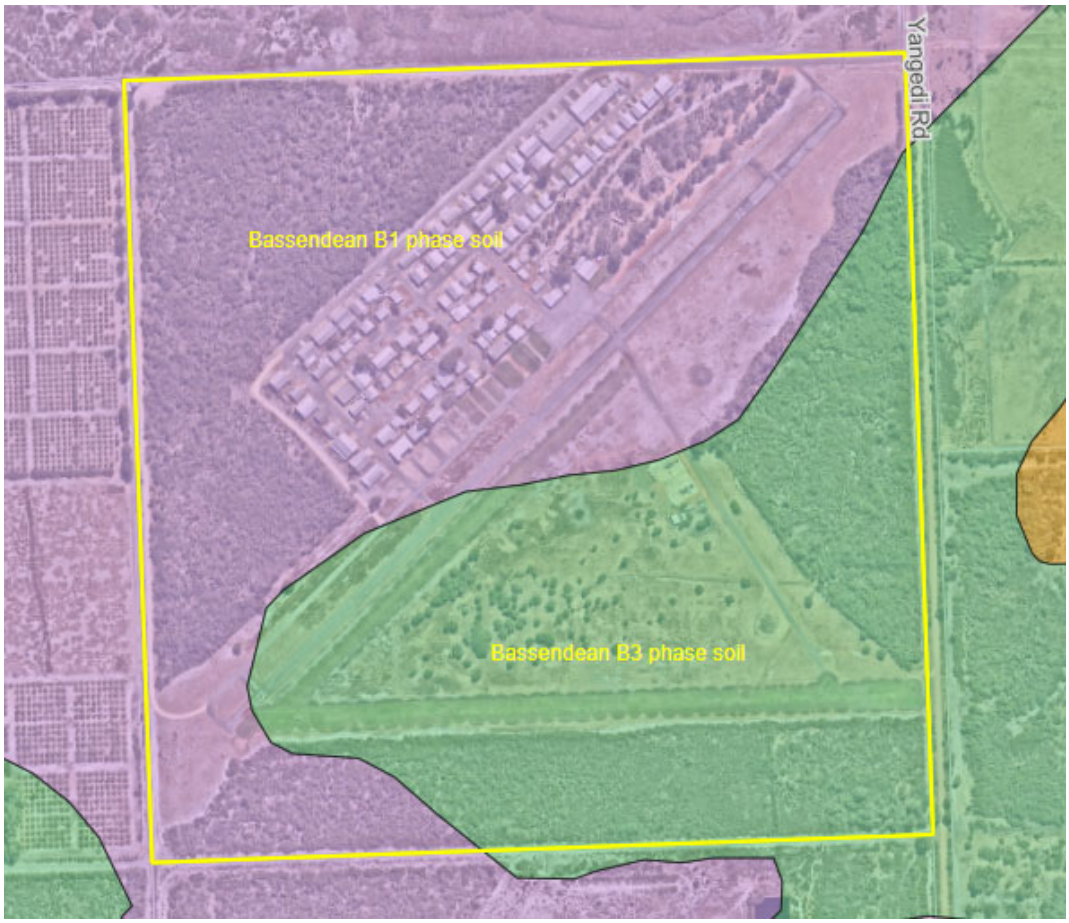


Figure 3: Soil Types of Yangedi Airfield Reserve.

1.3 Biodiversity

Yangedi Airfield Reserve contains three vegetation communities: banksia woodland in the northwest and southwest, a clay-based wetland in the east, and marri woodland in the southeast. The marri woodland is approximately 4.6 ha in area (Figure 4) although its vegetation complex is uncertain as the marri woodland area has not been surveyed.

The vegetated areas of the reserve belong to Threatened Ecological Communities, and all but the northeastern corner is an Environmentally Sensitive Area. The majority of the reserve (except for the northeastern corner) belongs to Bush Forever site 378, which extends into several neighbouring properties to provide a larger area of habitat. The vegetation is in Very Good to Good condition overall.

The flora of Yangedi Airfield Reserve has been frequently surveyed and is diverse. No Threatened and Priority flora species have been recorded in the area. The fauna has not been formally surveyed since 1997, although anecdotally most species still remain, including Threatened and Priority fauna such as black cockatoos and quenda (southern brown bandicoot). Kangaroos have also been observed in the reserve.

Figure 4: Location of Marri Woodland of Yangedi Airfield Reserve.

1.4 Water Resources

Yangedi Airfield Reserve is generally low in the landscape, containing the more low-lying types of woodland and wetlands. A watercourse (drain) runs through the southeastern corner of the reserve to discharge southwards into the water bodies on the adjacent property.

The southeastern half of the reserve, southeast of the main runway, is classified as a Multiple Use wetland (Figure 5), with a Resource Enhancement classification on the clay-based wetland on the eastern boundary and Conservation Category wetlands between the runways and south of the secondary grass runway. A third Conservation Category wetland lies north of the hangars, near the northern boundary of the reserve.

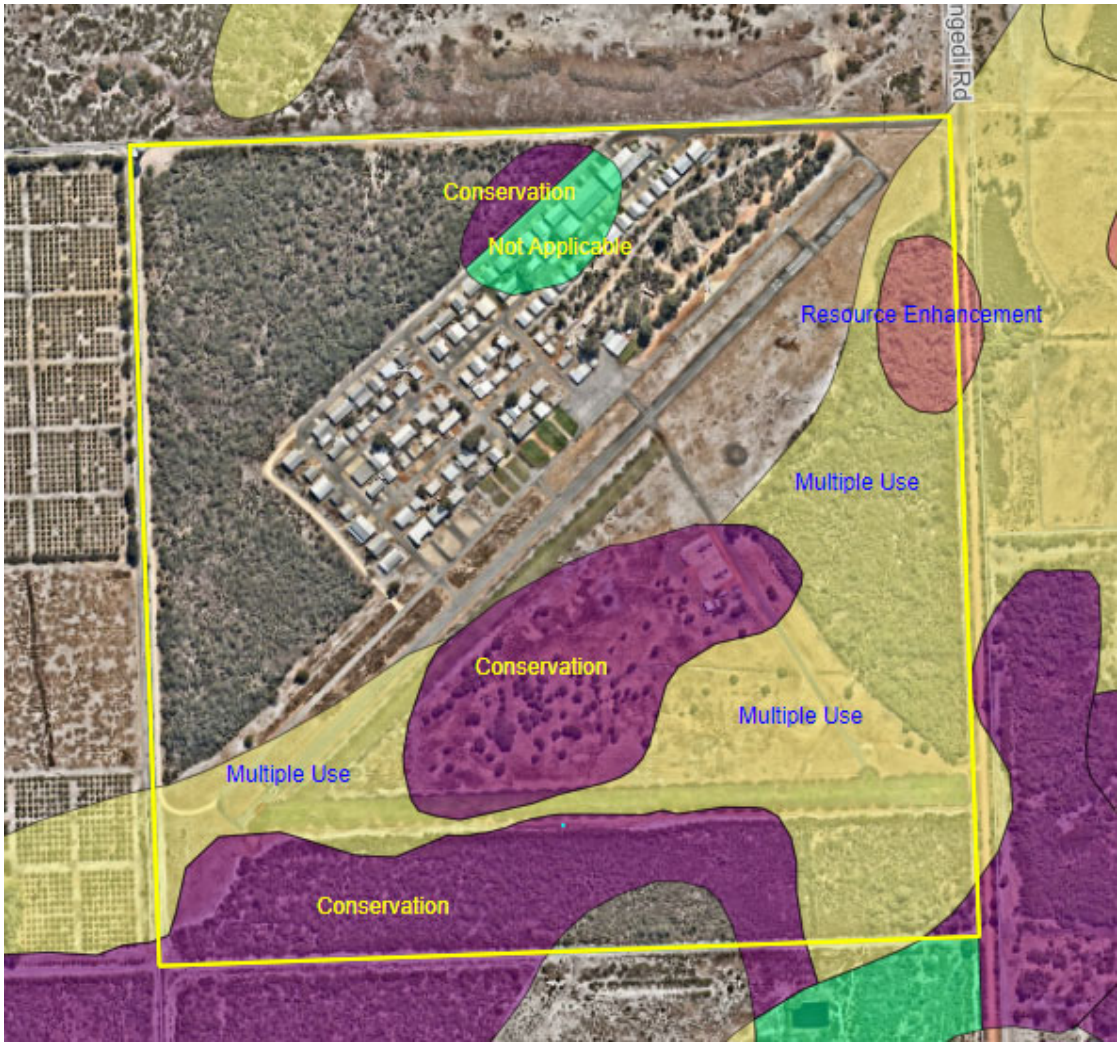


Figure 5: Geomorphic Wetlands of Yangedi Airfield Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of Yangedi Airfield Reserve include:

- Recreational and development pressure from users, including pressure for expansion into bushland for more aircraft hangars
- Community anxiety about fire hazard and pressure for control burning, particularly considering the high value of the aircraft and the BoM tower
- Fire threat of highly flammable aircraft fuel
- Weed invasion, from surrounding land and carried in by users
- Feral and domestic animals (foxes, rabbits, cats) predating fauna and damaging vegetation
- Dieback disease (*Phytophthora cinnamomi*) and marri canker
- Contaminated runoff from runways, aircraft hangars, helipad etc. entering wetland and other bushland areas

3. Reserve Usage

3.1 Vesting and Land Tenure

The vesting purpose, land tenure and current uses of Yangedi Airfield Reserve are listed below in Table 2.

Table 2: Vesting Purpose, Land Tenure and Current Uses of Yangedi Airfield Reserve.

Reserve	Reserve and Lot Number	Vesting and Land Tenure	Current Uses
Yangedi Airfield Reserve	R25911 L164 Yangedi Road, Hopeland	Shire of Serpentine Jarrahdale – Recreation	Recreation (Airfield, DFES Helipad, BoM tower) and Conservation

3.2 User Groups

The principal user groups of Yangedi Airfield Reserve are the Sport Aircraft Builders Club, the Bureau of Meteorology and the Department of Fire and Emergency Services. Casual usage is negligible, as the reserve has an electronic gate to control access due to the valuable infrastructure and public safety concerns. Maintenance of conservation values is limited to Shire staff.

Threats and pressures for the user groups include:

- Risk management and insurance, with strict liability and high premiums.
- Membership and member involvement, as any community group has a general problem with attracting and maintaining motivated volunteers to fill positions and undertake other tasks, with a few people tending to do most of the work.
- Conflict among user groups with differing priorities, such as potential conflict between the SABC's desire to expand and the conservation values of the bushland.
- Compliance with legislation, such as health regulations.

- Security of tenure, with ongoing long-term lease agreements essential to ensure that private investment in reserves is supported. User groups' facilities are mostly developed and maintained entirely by volunteers.

An airfield is an inherently hazardous place to which public access must be restricted. On a day-to-day basis, visitors can only access the reserve in the company of a club member, or by prior arrangement to be let through the electric gate. Aircraft have right of way on the taxiways, which may not be apparent to visitors. Public access is only granted on open days, and even then is strictly controlled. Public access protocols are under continuous improvement as more people become aware of the airfield.

3.3 Infrastructure

The infrastructure located in Yangedi Airfield Reserve includes:

- SABC clubhouse, ablution facilities and associated storage sheds
- SABC centralised fuel storage facility
- Aircraft hangars (about 100) with stored aircraft, parts and tools
- Hangar living quarters, toilets and treatment units, and water tanks
- Taxiways (bitumised) and two runways (one bitumised, one irrigated grass)
- Airfield-associated infrastructure such as wind socks
- Car parking area
- BoM communications tower (providing rain radar data) with maintenance access
- DFES helipad for water bombing aircraft and associated facilities
- Bores, storage dams, water tanks and irrigation
- Firebreaks and fences
- Electronic gate
- Signage, including conditions of entry and safety precautions, and bushland entry prohibition

The airfield infrastructure is maintained by the SABC, with each hangar maintained by its owner. As the hangars contain valuable aircraft, tools and spare parts, maintenance tends to be regular and focused on security and safety. Inadequate maintenance would lead to accelerated deterioration and increased risk. Poorly maintained facilities also tend to attract vandalism. The BoM and DFES also have valuable facilities which require regular maintenance and security, assisted by access to the reserve being restricted by the SABC's electronic gate. The Shire manages the bushland and maintains the firebreaks.

Despite fences and locked gates, vandalism and theft are constant but low-level threats. Surveillance is an effective deterrent. The SABC has a roster system for its members to ensure a constant presence on site for security purposes. This also assists in protection of the BoM and DFES facilities.

Fire can threaten people, property and conservation values. Fires can start inside or adjacent to buildings and structures, and are often the result of vandalism, kitchen accidents or electrical faults. Bush or grass fires threaten buildings and structures through embers, radiant heat and direct contact. Cleared areas around buildings limit the opportunity for bush and grass fires to reach them. Fire in nearby bushland has the potential to damage infrastructure.

An additional hazard at the airfield is the storage of highly flammable aircraft fuel, which greatly increases the risks and consequences of fire. Fuel is stored in a central location with the hangars only containing fuel within the aircraft. A fire within a hangar or from the bushland could quickly spread if fuel ignited and cause significant damage to or destruction of valuable property.

4. Action Plan

Table 3: Action Plan for Yangedi Airfield Reserve.

No.	Action	Priority	Timing	Status	Responsibility	Cost
1	**Utilise the planning system to retain and protect remnant marri woodland.**	**Key**	**Business as Usual**	**Ongoing**	**Statutory Planning**	**Staff Time**
2	Keep up to date with the latest research trends with regard to marri woodland and integrate into reserve management.	High	Long Term	Ongoing	Natural Reserves, Emergency Services	Staff Time
3	Formalise access to marri woodland in high use areas through establishment of walking paths that reduce trampling.	Medium	Medium Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
4	Erect signage in high use areas to inform users of the values of the marri woodland.	Medium	Short Term	Implemented in Part	Operations	Budget Dependent - $2,000
5	**Survey for dieback presence, and map and treat dieback every three years if present.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $9,500**
6	**Survey for marri canker, and treat infected trees.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $1,000**
7	Monitor and manage new and emerging pests and diseases such as polyphagous shot hole borer.	High	Medium Term	Ongoing	Natural Reserves	Budget Dependent - $2,000
8	Control access to marri woodland through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
9	Work with user groups to protect and minimize impacts to remnant vegetation.	High	Business as Usual	Ongoing	Natural Reserves, User Groups	Staff Time
10	Liaise with other landholders to work together and integrate management of all marri woodland areas.	Medium	Medium Term	Not Yet Implemented	Natural Reserves, Strategic Environment	Staff Time
11	Erect fences or other structures to delineate user group areas.	Low	Long Term	Not Yet Implemented	Natural Reserves, User Groups	Budget Dependent - $2,000
12	Ensure that formalised paths and other access routes cross dieback fronts to the lowest degree possible.	Medium	Medium Term	Not Yet Implemented	Natural Reserves	Staff Time
13	Establish dieback hygiene policies, including vehicle washdown points and foot baths for pedestrians with appropriate signage.	High	Long Term	Implemented in Part	Natural Reserves	Budget Dependent - $2,000
14	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environment	Budget Dependent - $3,000

No.	Action	Priority	Timing	Status	Responsibility	Cost
15	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves	Budget Dependent - $3,000
16	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves	Staff Time
17	**Establish and implement a weed control program that utilises best practice methods.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves, Landcare SJ**	**Budget Dependent - $8,000**
18	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ	Budget and/or Funding Dependent - $1,500
19	**Minimise burning and other disturbance of marri woodland.**	**Key**	**Short Term**	**Implemented in Part**	**Emergency Services**	**Staff Time**
20	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves	Staff Time
21	Maintain fire intervals of 16-40 years.	High	Long Term	Not Yet Implemented	Emergency Services	Staff Time
22	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Staff Time
23	Restrict any essential fuel load management to the Vegetation Management Zone.	High	Short Term	Not Yet Implemented	Emergency Services	Budget Dependent - $1,500
24	Carry out fuel load management on adjacent road verges to avoid fire entering the reserve from the verge.	High	Medium Term	Not Yet Implemented	Emergency Services	Budget Dependent - $2,000
25	Ensure that any essential fuel load management utilises weed control as a priority, with control burning as a last resort.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves	Budget Dependent - $8,000
26	Ensure that any control burning is restricted to vegetation boundaries, providing a mosaic of vegetation ages including long unburnt.	High	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Budget Dependent - $1,500
27	**Follow any burning or other disturbance with weed control for at least two years post-fire.**	**Key**	**Business as Usual**	**Implemented in Part**	**Emergency Services, Natural Reserves**	**Budget Dependent - $8,000**
28	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations	Staff Time
29	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves	Funding Dependent - $2,500
30	Monitor implementation of the action plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environment	Staff Time
31	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environment	Staff Time
32	Review and revise the action plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environment	Staff Time

5. Fire Management Strategy for Yangedi Airfield Reserve

Conservation Zone (green) – works exclusion; avoid disturbance

Vegetation Management Zone (red) – fuel load management if deemed appropriate and necessary by weed control and/or control burning followed by weed control

Dieback – present in some areas

Weeds – control required following disturbance

Firebreaks – present along boundaries

King Road Pony Club Reserve Action Plan

R36950

1. Background

1.1 Location

King Road Pony Club Reserve is located in Oldbury (Figure 1). The reserve is dominated by banksia woodland, with a small pocket of marri woodland in the east. The reserve is 25.7 ha with 18.08 ha remnant vegetation, of which 0.36 ha is marri woodland. This action plan specifically deals with the marri woodland area.

The reserve is vested with the Shire for the purpose of Recreation, but current uses also include Conservation. The principal user group for the reserve is the Peel Horse and Pony Club, which maintains significant infrastructure.

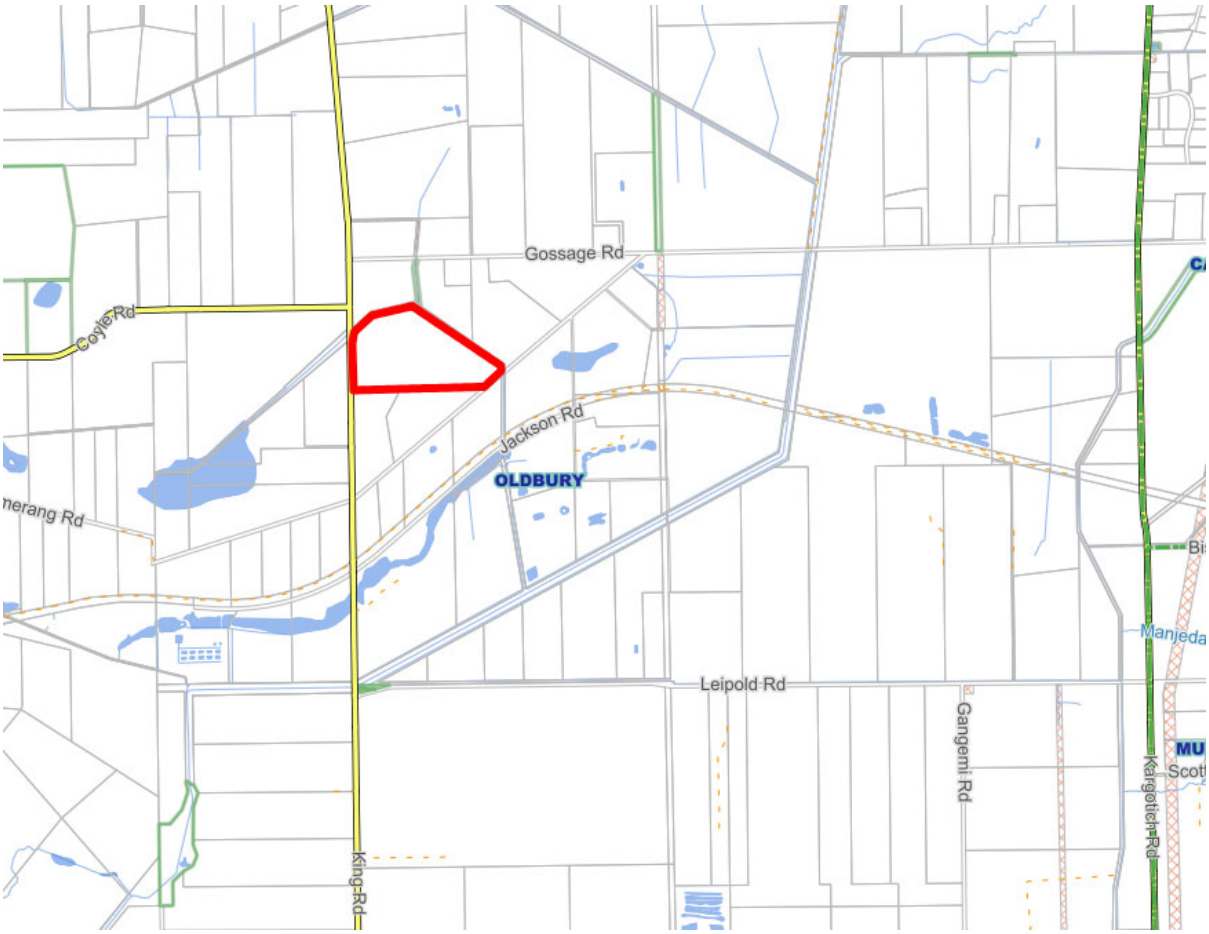


Figure 1: Location of King Road Pony Club Reserve.

King Road Pony Club Reserve is classified into three main management zones (Figure 2). These are:

Conservation Zone (green): Areas of remnant vegetation of high biodiversity and scientific reference value which include both dieback free and dieback infected areas. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must utilise dieback hygiene procedures such as clean-down and take extreme care to prevent spread of dieback from infected to uninfected areas.

Vegetation Management Zone (red): Areas of remnant vegetation of biodiversity and scientific reference value which may be disturbed, or dieback or weed infested. This is a buffer zone and may receive fuel load management for protection of people, property and conservation values by weed control or control burning on assessment by officers as required and appropriate. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must consider movement and reduce spread of dieback from infected to uninfected areas through clean down procedures.

Recreation Zone (yellow): This is the area in use by the Peel Horse and Pony Club. Management of this zone is principally for the purpose of recreation, while minimising impacts on the adjacent remnant vegetation.

This Action Plan applies to the Conservation and Vegetation Management Zones.

Figure 2: Management Zones of King Road Pony Club Reserve.

1.2 Soils

Four soil types occur in King Road Pony Club Reserve: Bassendean B1, Bassendean B2, Bassendean B4 and Bassendean B6 (Table 1 and Figure 3). Marri woodland occurs on part of the Bassendean B4 soils.

Table 1: Soil types of King Road Pony Club Reserve.

Reserve	Soil landscape unit	Description	Marri occurrence
King Road Pony Club Reserve	Bassendean B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	No
	Bassendean B2 phase	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m.	No
	Bassendean B4 phase	Broad poorly drained sandplain with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan.	Yes
	Bassendean B6 phase	Sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands.	No

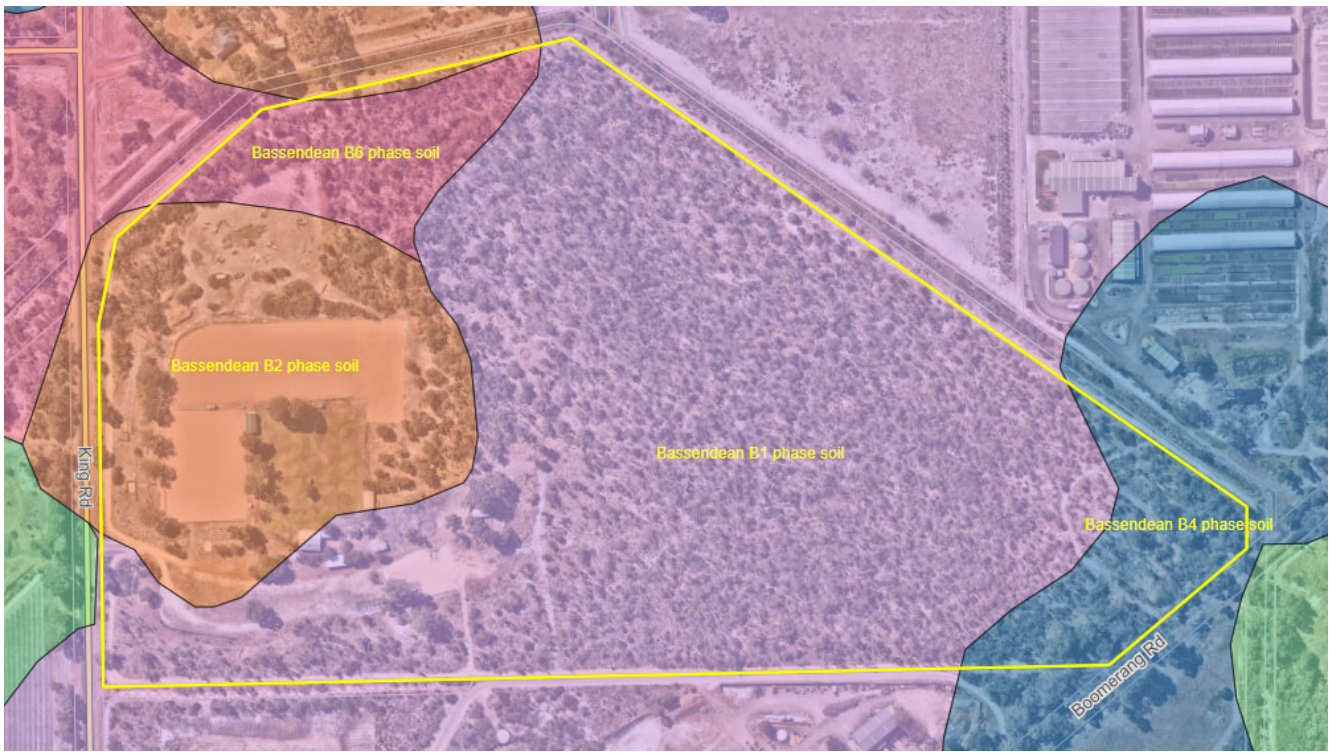


Figure 3: Soil Types of King Road Pony Club Reserve.

1.3 Biodiversity

King Road Pony Club Reserve contains one dominant vegetation community, banksia woodland, with a small area of marri woodland at the eastern end. The marri woodland is approximately 0.36 ha in area (Figure 4) and belongs to the vegetation complex SCP3b (*Corymbia calophylla* - *Eucalyptus marginata* woodlands).

The entire reserve belongs to a Threatened Ecological Community. The vegetation is in Very Good to Good condition overall.

The flora of King Road Pony Club Reserve has been frequently surveyed and is diverse. No Threatened and Priority flora species have been recorded in the area. The fauna has never been formally surveyed, although anecdotally some Threatened and Priority fauna species may occur, such as black cockatoos and quenda (southern brown bandicoot).

Figure 4: Location of Marri Woodland of King Road Pony Club Reserve.

1.4 Water Resources

King Road Pony Club Reserve is high in the landscape, sitting on top of a sand dune, with lower-lying areas in the north and east. A major watercourse (drain) runs along the northern boundary of the reserve to discharge eventually into the Serpentine River.

Multiple Use wetlands intersect the western and eastern corners of the reserve (Figure 5), and act as buffers to Conservation Category wetlands further away from the reserve.

Figure 5: Geomorphic Wetlands of King Road Pony Club Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of King Road Pony Club Reserve include:

- Recreational pressure from users
- Community anxiety about fire hazard and pressure for control burning
- Illegal access by motorised vehicles and associated damage to fences and vegetation
- Weed invasion, from surrounding land and carried in by users
- Feral and domestic animals (foxes, rabbits, cats) predating fauna and damaging vegetation
- Dieback disease (*Phytophthora cinnamomi*) and marri canker
- Pony club's cross-country course, which passes through infected and dieback free zones

3. Reserve Usage

3.1 Vesting and Land Tenure

The vesting purpose, land tenure and current uses of King Road Pony Club Reserve are listed below in Table 2.

Table 2: Vesting Purpose, Land Tenure and Current Uses of King Road Pony Club Reserve.

Reserve	Reserve and Lot Number	Vesting Purpose and Land Tenure	Current Uses
King Road Pony Club Reserve	R36950 L427 King Road, Oldbury	Shire of Serpentine Jarrahdale – Recreation	Recreation and Conservation

3.2 User Groups

The principal user group of King Road Pony Club Reserve is the Peel Horse and Pony Club. Historically the reserve was also used by the Peel Hunt Club, and periodically other users such as the Mundijong Poultry Club have used areas of the reserve. Landcare SJ Inc. has held a National Tree Day planting event in the reserve.

Threats and pressures for the user group include:

- Risk management and insurance, with strict liability and high premiums.
- Membership and member involvement, as any community group has a general problem with attracting and maintaining motivated volunteers to fill positions and undertake other tasks, with a few people tending to do most of the work.
- Conflict among user groups with differing priorities, such as potential conflict between the pony club's activities and protection of the conservation values of the remnant vegetation.
- Compliance with legislation, such as health regulations.
- Security of tenure, with ongoing long-term lease agreements essential to ensure that private investment in reserves is supported. User groups' facilities are mostly developed and maintained entirely by volunteers.

3.3 Infrastructure

The infrastructure located in King Road Pony Club Reserve includes:

- Clubhouse, toilets and associated storage sheds
- Car parking area
- Horse riding arenas with fences and jumps
- Horse yards
- Bore and water tanks
- Cross-country course with permanent jumps
- Dilapidated, unused infrastructure such as the dog pens once used by the Peel Hunt Club
- Firebreaks, fences, gates and signage

The infrastructure is almost entirely maintained by the Peel Horse and Pony Club, with the Shire maintaining firebreaks and other public infrastructure. Despite fences and locked gates, vandalism and theft are constant but low-level threats.

Fire can threaten people, property and conservation values. Fires can start inside or adjacent to buildings and structures, and are often the result of vandalism, kitchen accidents or electrical faults. Bush or grass fires threaten buildings and structures through embers, radiant heat and direct contact. Cleared areas around buildings limit the opportunity for bush and grass fires to reach them. Fire in nearby bushland has the potential to damage infrastructure.

4. Action Plan

Table 3: Action Plan for King Road Pony Club Reserve.

No.	Action	Priority	Timing	Status	Responsibility	Cost
1	**Utilise the planning system to retain and protect remnant marri woodland.**	**Key**	**Business as Usual**	**Ongoing**	**Statutory Planning**	**Staff Time**
2	Keep up to date with the latest research trends with regard to marri woodland and integrate into reserve management.	High	Long Term	Ongoing	Natural Reserves, Emergency Services	Staff Time
3	Formalise access to marri woodland in high use areas through establishment of walking paths that reduce trampling.	Medium	Medium Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
4	Erect signage in high use areas to inform users of the values of the marri woodland.	Medium	Short Term	Implemented in Part	Operations	Budget Dependent - $2,000
5	**Map and treat dieback every three years.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $10,000**
6	**Survey for marri canker, and treat infected trees.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $1,000**
7	Monitor and manage new and emerging pests and diseases such as polyphagous shot hole borer.	High	Medium Term	Ongoing	Natural Reserves	Budget Dependent - $2,000
8	Control access to marri woodland through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
9	Work with the Peel Horse and Pony Club to protect and minimize impacts to vegetation, particularly along the cross-country course.	High	Business as Usual	Ongoing	Natural Reserves, Pony Club	Staff Time
10	Liaise with other landholders to work together and integrate management of all marri woodland areas.	Medium	Medium Term	Not Yet Implemented	Natural Reserves, Strategic Environment	Staff Time
11	Implement measures to exclude motorised vehicles from the remnant vegetation.	High	Medium Term	Implemented in Part	Operations	Budget Dependent - $2,000

No.	Action	Priority	Timing	Status	Responsibility	Cost
12	Ensure that formalised paths and other access routes cross dieback fronts to the lowest degree possible.	Medium	Medium Term	Not Yet Implemented	Natural Reserves	Staff Time
13	Establish dieback hygiene policies, including vehicle washdown points and foot baths for pedestrians with appropriate signage.	High	Long Term	Implemented in Part	Natural Reserves	Budget Dependent - $2,000
14	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environment	Budget Dependent - $3,000
15	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves	Budget Dependent - $3,000
16	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves	Staff Time
17	**Establish and implement a weed control program that utilises best practice methods.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves, Landcare SJ**	**Budget Dependent - $5,000**
18	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ	Budget and/or Funding Dependent - $1,500
19	**Minimise burning and other disturbance of marri woodland.**	**Key**	**Short Term**	**Implemented in Part**	**Emergency Services**	**Staff Time**
20	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves	Staff Time
21	Maintain fire intervals of 8-40 years.	High	Long Term	Not Yet Implemented	Emergency Services	Staff Time
22	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Staff Time
23	Restrict any essential fuel load management to the Vegetation Management Zone.	High	Short Term	Not Yet Implemented	Emergency Services	Budget Dependent - $1,500
24	Carry out fuel load management on adjacent road verges to avoid fire entering the reserve from the verge.	High	Medium Term	Not Yet Implemented	Emergency Services	Budget Dependent - $2,000
25	Ensure that any essential fuel load management utilises weed control as a priority, with control burning as a last resort.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves	Budget Dependent - $5,000
26	Ensure that any control burning is restricted to vegetation boundaries, providing a mosaic of vegetation ages including long unburnt.	High	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Budget Dependent - $1,500
27	**Follow any burning or other disturbance with weed control for at least two years post-fire.**	**Key**	**Business as Usual**	**Implemented in Part**	**Emergency Services, Natural Reserves**	**Budget Dependent - $5,000**
28	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations	Staff Time
29	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ,	Funding Dependent - $2,500

No.	Action	Priority	Timing	Status	Responsibility	Cost
					Natural Reserves	
30	Monitor implementation of the action plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environment	Staff Time
31	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environment	Staff Time
32	Review and revise the action plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environment	Staff Time

5. Fire Management Strategy for King Road Pony Club Reserve

Conservation Zone (green) – works exclusion; avoid disturbance

Vegetation Management Zone (red) – fuel load management if deemed appropriate and necessary by weed control and/or control burning followed by weed control

Dieback – present in some areas

Weeds – control required following disturbance

Firebreaks – present along boundaries

Craghill Way Reserve Action Plan

R34460

1. Background

1.1 Location

Craghill Way Reserve is located in Oakford (Figure 1). The reserve is dominated by somewhat degraded banksia woodland with a small pocket of marri woodland in the south, and is notable as the only Shire reserve to contain pricklybark (*Eucalyptus todtiana*). The reserve is 3.3 ha with 2.2 ha remnant vegetation, of which 0.32 ha is marri woodland. This action plan specifically deals with the marri woodland area.

The reserve is vested with the Shire for the purpose of Public Recreation, but current uses also include Conservation. The principal users of the reserve are informal, infrequent walkers and horse riders.

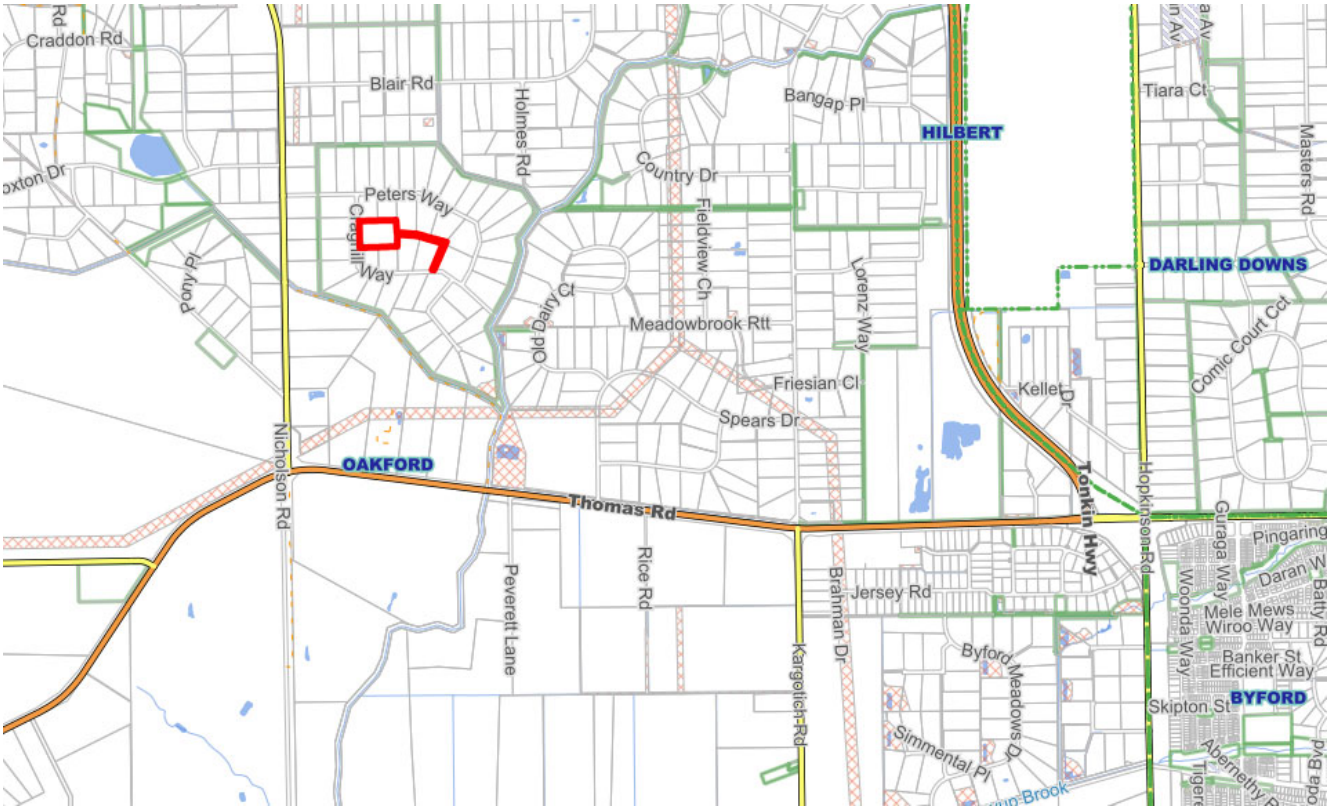


Figure 1: Location of Craghill Way Reserve.

Craghill Way Reserve is classified into two main management zones (Figure 2). These are:

Conservation Zone (green): Areas of remnant vegetation of high biodiversity and scientific reference value which include both dieback free and dieback infected areas. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must utilise dieback hygiene procedures such as clean-down and take extreme care to prevent spread of dieback from infected to uninfected areas.

Vegetation Management Zone (red): Areas of remnant vegetation of biodiversity and scientific reference value which may be disturbed, or dieback or weed infested. This is a buffer zone and may receive fuel load management for protection of people, property and conservation values by weed control or control burning on assessment by officers as required and appropriate. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must consider movement and reduce spread of dieback from infected to uninfected areas through clean down procedures.

This Action Plan applies to the Conservation and Vegetation Management Zones.

Figure 2: Management Zones of Craghill Way Reserve.

1.2 Soils

Two soil types occur in Craghill Way Reserve: Bassendean B2 and Bassendean B6 (Table 1 and Figure 3). Marri woodland occurs on both soil types.

Table 1: Soil Types of Craghill Way Reserve.

Reserve	Soil landscape unit	Description	Marri occurrence
Craghill Way Reserve	Bassendean B2 phase	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m.	Partial
	Bassendean B6 phase	Sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands.	Partial

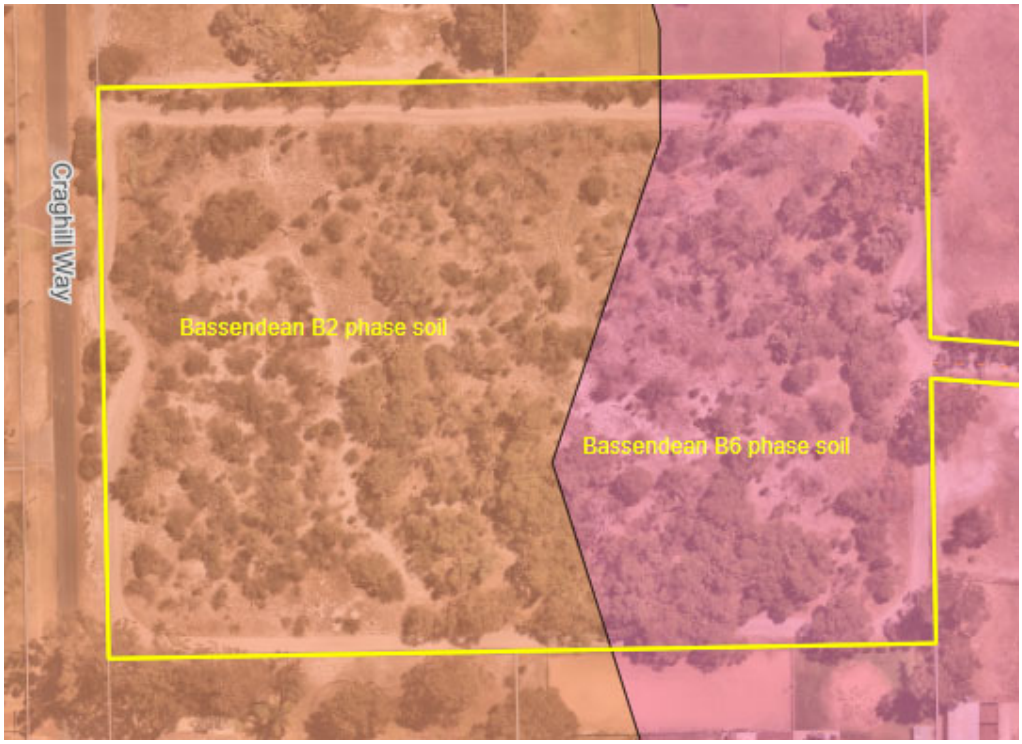


Figure 3: Soil Types of Craghill Way Reserve.

1.3 Biodiversity

Craghill Way Reserve contains one dominant vegetation community, somewhat degraded banksia woodland with a small pocket of marri woodland in the south, and is notable as the only Shire reserve to contain pricklybark (*Eucalyptus todtiana*). The marri woodland is approximately 0.32 ha in area (Figure 4) and belongs to the vegetation complex SCP3c (*Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands).

The majority of the vegetated part of the reserve belongs to a Threatened Ecological Community. The vegetation is in Good to Degraded condition overall.

The flora of Craghill Way Reserve has been surveyed and contains a low number of species, being somewhat degraded. No Threatened and Priority flora species have been recorded in the area. The fauna has never been formally surveyed, although anecdotally some Threatened and Priority fauna species may occur, such as black cockatoos.

Figure 4: Location of Marri Woodland of Craghill Way Reserve.

1.4 Water Resources

Craghill Way Reserve is low in the landscape, sitting on a sandplain and containing vegetation types associated with low-lying areas.

The northern and eastern part of the reserve is a Resource Enhancement wetland (Figure 5), extending to Multiple Use wetlands outside the reserve boundaries.

Figure 5: Geomorphic Wetlands of Craghill Way Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of Craghill Way Reserve include:

- Recreational pressure from users, being connected to the bridle trail network and originally intended as an equestrian reserve
- Community anxiety about fire hazard and pressure for control burning
- Arson and vandalism
- Weed invasion, from surrounding land and carried in by users
- Feral and domestic animals (foxes, rabbits, cats) predating fauna and damaging vegetation

3. Reserve Usage

3.1 Vesting and Land Tenure

The vesting purpose, land tenure and current uses of Craghill Way Reserve are listed in Table 2.

Table 2: Vesting Purpose, Land Tenure and Current Uses of Craghill Way Reserve.

Reserve	Reserve and Lot Number	Vesting and Land Tenure	Current Uses
Craghill Way Reserve	R34460 L1374 Craghill Way, Oakford	Shire of Serpentine Jarrahdale – Public Recreation	Recreation and Conservation

3.2 User Groups

The principal users of Craghill Way Reserve informal, infrequent walkers and horse riders. The reserve is connected to the bridle trail network and was originally intended as an equestrian reserve.

There are minimal threats and pressures for the users.

3.3 Infrastructure

The infrastructure located in Craghill Way Reserve includes firebreaks, fences and gates. The infrastructure is maintained by the Shire. Vandalism is a constant but low-level threat.

Fire can threaten people, property and conservation values. Bush or grass fires threaten buildings and structures through embers, radiant heat and direct contact. Cleared areas around buildings limit the opportunity for bush and grass fires to reach them. Fire in the reserve's bushland has the potential to damage nearby infrastructure.

4. Action Plan

Table 3: Action Plan for Craghill Way Reserve.

No.	Action	Priority	Timing	Status	Responsibility	Cost
1	**Utilise the planning system to retain and protect remnant marri woodland.**	**Key**	**Business as Usual**	**Ongoing**	**Statutory Planning**	**Staff Time**
2	Keep up to date with the latest research trends with regard to marri woodland and integrate into reserve management.	High	Long Term	Ongoing	Natural Reserves, Emergency Services	Staff Time
3	**Survey for dieback presence, and map and treat dieback every three years if present.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $2,500**

No.	Action	Priority	Timing	Status	Responsibility	Cost
4	**Survey for marri canker, and treat infected trees.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $1,000**
5	Monitor and manage new and emerging pests and diseases such as polyphagous shot hole borer.	High	Medium Term	Ongoing	Natural Reserves	Budget Dependent - $2,000
6	Control access to marri woodland through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
7	Liaise with other landholders to work together and integrate management of all marri woodland areas.	Medium	Medium Term	Not Yet Implemented	Natural Reserves, Strategic Environment	Staff Time
8	Ensure that formalised paths and other access routes cross dieback fronts to the lowest degree possible.	Medium	Medium Term	Not Yet Implemented	Natural Reserves	Staff Time
9	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environment	Budget Dependent - $3,000
10	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves	Budget Dependent - $3,000
11	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves	Staff Time
12	**Establish and implement a weed control program that utilises best practice methods.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves, Landcare SJ**	**Budget Dependent - $3,000**
13	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ	Budget and/or Funding Dependent - $800
14	**Minimise burning and other disturbance of marri woodland.**	**Key**	**Short Term**	**Implemented in Part**	**Emergency Services**	**Staff Time**
15	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves	Staff Time
16	Maintain fire intervals of 8-40 years.	High	Long Term	Not Yet Implemented	Emergency Services	Staff Time
17	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Staff Time
18	Restrict any essential fuel load management to the Vegetation Management Zone.	High	Short Term	Not Yet Implemented	Emergency Services	Budget Dependent - $1,500
19	Carry out fuel load management on adjacent road verges to avoid fire entering the reserve from the verge.	High	Medium Term	Not Yet Implemented	Emergency Services	Budget Dependent - $2,000
20	Ensure that any essential fuel load management utilises weed control as a priority, with control burning as a last resort.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves	Budget Dependent - $3,000
21	Ensure that any control burning is restricted to vegetation boundaries,	High	Business as Usual	Implemented in Part	Emergency Services,	Budget Dependent – $1,500

No.	Action	Priority	Timing	Status	Responsibility	Cost
	providing a mosaic of vegetation ages including long unburnt.				Natural Reserves	
22	**Follow any burning or other disturbance with weed control for at least two years post-fire.**	**Key**	**Business as Usual**	**Implemented in Part**	**Emergency Services, Natural Reserves**	**Budget Dependent - $3,000**
23	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations	Staff Time
24	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves	Funding Dependent - $3,000
25	Monitor implementation of the action plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environment	Staff Time
26	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environment	Staff Time
27	Review and revise the action plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environment	Staff Time

5. Fire Management Strategy for Craghill Way Reserve

Conservation Zone (green) – works exclusion; avoid disturbance

Vegetation Management Zone (red) – fuel load management if deemed appropriate and necessary by weed control and/or control burning followed by weed control

Dieback – present in some areas

Weeds – control required following disturbance

Firebreaks – present along boundaries