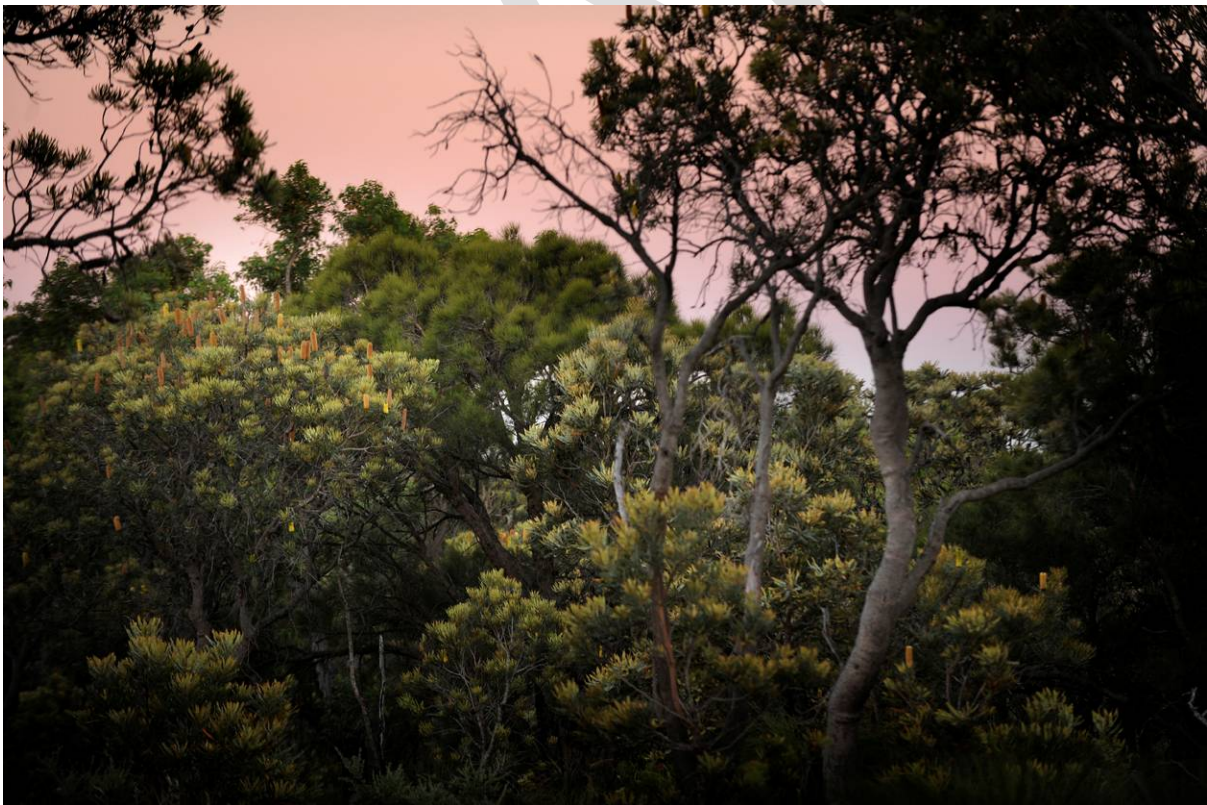




City of Joondalup Warwick Open Space Bushland Management Plan



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Please formally acknowledge the City of Joondalup if you choose to use any of the content contained within the Warwick Open Space Bushland Management Plan.

Suggested citation:

City of Joondalup, 2013, *Warwick Open Space Bushland Management Plan*, Perth, WA.

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Acronyms

Acronym / Abbreviation	Definition
AHD	Australian Height Datum
BoM	Bureau of Meteorology
the City	City of Joondalup
CoJ	City of Joondalup
DAFWA	Department of Agriculture and Food Western Australia
DEC	Department of Environment and Conservation
DEP	Department of Environmental Protection
DEPI	Department of Environment and Primary Industries
DFES	Department of Fire and Emergency Services
DoC	Department of Commerce
DoE	Department of Environment
DoW	Department of Water
DPaW	Department of Parks and Wildlife
DPI	Department of Primary Industries
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities
EDOWA	Environmental Defender's Office Western Australia (Inc)
ELA	Eco Logical Australia
EPA	Environmental Protection Authority
EPBC	Environment Protection and Biodiversity Conservation
EWSWA	Environmental Weed Strategy for Western Australia
FCT	Floristic Community Type
FESA	Fire and Emergency Services Authority
GIS	Geographic Information System
ha	Hectare
IUCN	International Union for Conservation of Nature
JAMBA	Japan-Australia Migratory Bird Agreement
JSCWSC	Joint Steering Committee for Water Sensitive Cities
mAHD	Elevation in metres with respect to the Australian Height Datum
NWCPAG	National Wildlife Corridors Plan Advisory Group
Syrinx	Syrinx Environmental PL
TDS	Total Dissolved Solids
WA	Western Australia
WALGA	Western Australian Local Government Association

Executive Summary

The Warwick Open Space Bushland Management Plan outlines a framework for the environmental management of Warwick Open Space bushland (referred to as Warwick Open Space) for the next five years.

Warwick Open Space is located approximately 13 kilometres north from the Perth Central Business District in the suburb of Warwick. The reserve covers approximately 60 hectares (ha) of bushland, contains Warwick Leisure Centre and Warwick Sports Centre and is bounded by Warwick Road, Wanneroo Road, Beach Road and Erindale Road. Warwick Open Space also surrounds the north, east and south sides of Warwick Senior High School.

Warwick Open Space is classified as a Major Conservation Area and is ranked in the City of Joondalup's top five natural areas due to the high biodiversity values of the area. Warwick Open Space contains regionally significant plant communities including Jarrah-Banksia Woodland and has been recognised for its regional environmental significance by being designated as a Bush Forever site (not including the Warwick Senior High School bushland) by the Western Australian Planning Commission in 2000.

As part of the development of the Warwick Open Space Bushland Management Plan, a flora, fauna and fungi survey was conducted in spring 2012. The results of this survey were combined with previous surveys undertaken to develop a comprehensive species list and ecological assessment of the site.

The majority of the native vegetation on site is in very good or excellent condition and surveys indicate that the area supports 250 native flora species (including 1 naturally occurring priority species and 4 naturally occurring significant species), 48 native fungi species, 2 native mammals, 63 native birds (including 7 species of conservation significance), 13 native reptile species, 1 native amphibian, and 35 native invertebrates (including 1 species of conservation significance).

Environmental threats have the potential to degrade natural areas and reduce biodiversity values. Environmental threats addressed in this Plan include weeds, plant diseases, fire, non-native fauna species, human impacts, access and infrastructure. A total of 139 weed species (including 4 declared plants and 1 Weed of National Significance), 5 non-native mammals, 5 non-native birds and 2 non-native invertebrates have been identified at Warwick Open Space. A number of fires have occurred in the reserve over the past decade, resulting in some degradation of vegetation.

In order to address the key environmental threats at Warwick Open Space a number of management actions are outlined within the Plan. Management actions have been proposed for the next five years and include regular weed control, annual fire fuel load assessments, engaging consultants to undertake flora, weeds, fungi, fauna, bat and invertebrates surveys and implementation of the City's Pathogen Management Plan. The management actions will be implemented in partnership with key stakeholders and community groups, where relevant.

1.0 Introduction

1.1 Background

The City of Joondalup ('the City') is situated along the Swan Coastal Plain, 30 kilometres from the Perth Central Business District. The City covers an area of 96.5 kilometres which encompasses a diverse range of natural areas including 17 kilometres of coastal foreshore, a chain of wetlands and a variety of bushland ecosystems (as shown in **Figure 1**).

The City's southern boundary is located approximately 16 kilometres from the Perth Central Business District, and is bounded by the City of Wanneroo to the east and north, the City of Stirling to the south, and the Indian Ocean to the west.

There are a number of regionally, nationally and internationally significant natural areas located within the City including the Yellagonga Regional Park and a number of Bush Forever sites which contain species of high conservation value. Natural areas adjacent to the City include the Marmion Marine Park and the Neerabup National Park.

The City of Joondalup is committed to conserving and enhancing the City's natural assets to ensure the long term protection of the environment for future generations.

1.2 Natural Areas Management Plans

The City is developing Natural Areas Management Plans to provide strategic ongoing management of the City's natural areas and protect native vegetation and ecosystems.

Environmental threats have the potential to degrade natural areas and reduce biodiversity values. Environmental threats addressed in this Plan include weeds, plant diseases, fire, non-native fauna species, human impacts and access and infrastructure.

Natural Areas Management Plans describe the potential environmental impacts and risks of activities and environmental threats in natural areas and the associated management strategies that are implemented to minimise potential impacts.

1.3 Study Area

The Study Area for the Warwick Open Space Bushland Management Plan is Warwick Open Space, Warwick. The site has been recognised for its regional environmental significance by being designated as a Bush Forever site (202) by the Western Australian Planning Commission in 2000.

Warwick Open Space covers an area of approximately 60 hectares and is bounded by Warwick Road, Wanneroo Road, Beach Road and Erindale Road (as shown in **Figure 2**). Warwick Open Space contains Warwick Leisure Centre and Warwick Sports Centre. Warwick Open Space surrounds the north, east and south sides of Warwick Senior High School and is bordered by residential properties (north and west), City of Stirling (south) and City of Wanneroo (east).

Warwick Open Space is Crown Land managed by the City of Joondalup and is reserved for the purposes of Parks and Recreation under the Metropolitan Region Scheme. Nearby properties to the north and west are zoned as Low Density Residential. The main uses of Warwick Open Space bushland are for passive recreational purposes such as walking or dog walking or travel to and from the sporting facilities and Warwick Senior High School.



Figure 1: Location of Warwick Open Space in City of Joondalup

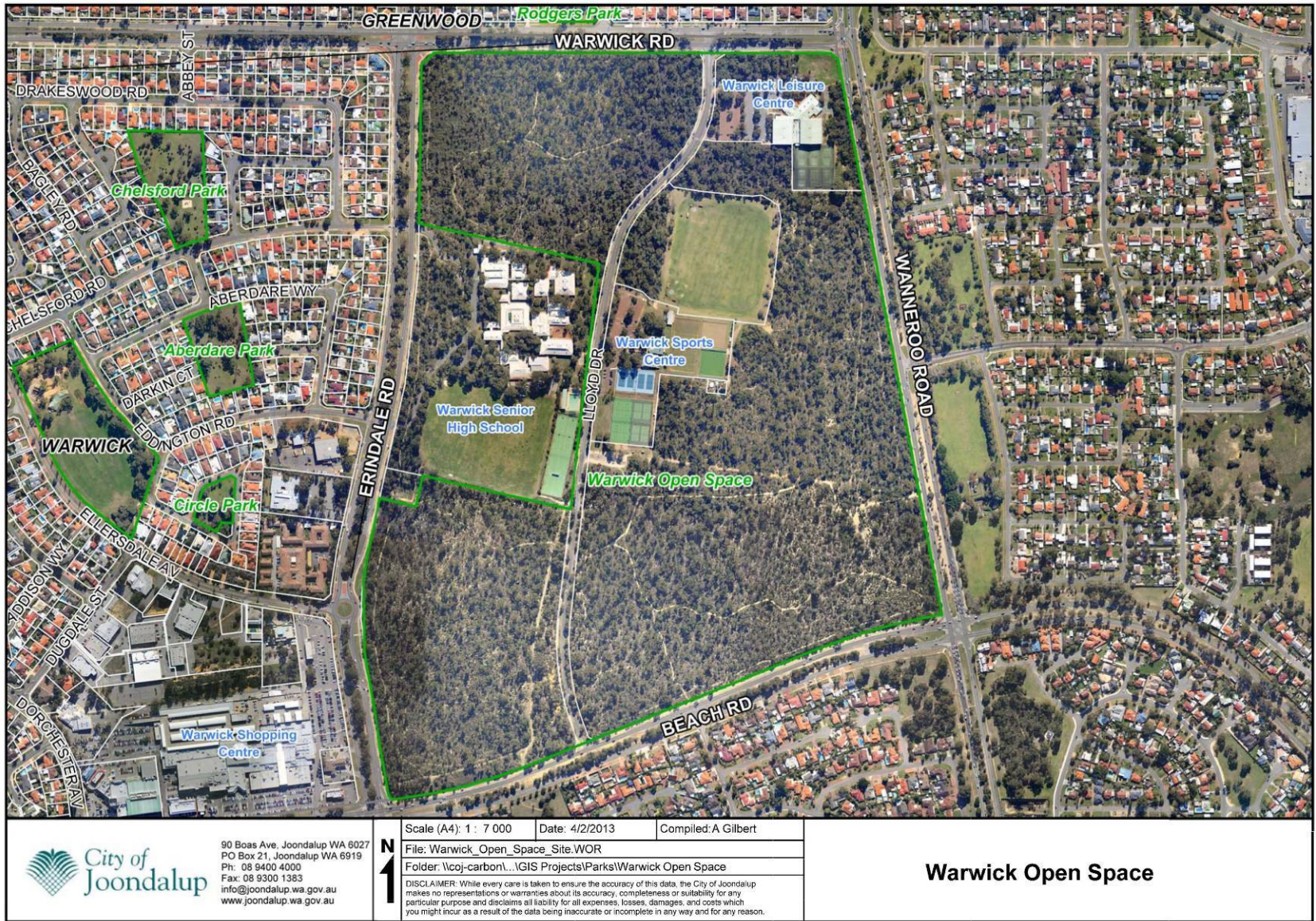


Figure 2: Map of Study Area



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Warwick Open Space

1.4 Purpose

The purpose of the Warwick Open Space Bushland Management Plan is to:

- Provide information to assist the City of Joondalup in prioritising maintenance schedules;
- Guide the future development of the City's Conservation Capital Works Program;
- Increase opportunities for grant funding by having a detailed schedule of projects; and
- Provide guidance to City employees and contractors and Friends Groups operating within Warwick Open Space.

1.5 Aims and Objectives

The aims of the Warwick Open Space Bushland Management Plan are to:

- Establish a baseline description of the environment to guide future environmental planning and recommended management actions.
- Outline key environmental threats and management strategies to minimise impact and protect conservation and recreation values.
- Outline management actions to address key threats including monitoring and reporting.

The objective of the Warwick Open Space Bushland Management Plan is to provide mechanisms to protect and enhance biodiversity values of the natural area whilst maintaining appropriate community access and awareness of the natural area.

1.6 Strategic Context

To ensure the Warwick Open Space Bushland Management Plan complements other management initiatives, relevant legislation, policies, guidelines and documents were reviewed and are briefly detailed below.

1.6.1 Local Government

Strategic Community Plan

The City of Joondalup *Strategic Community Plan 2012-2022* highlights the focus on preservation, conservation and accessibility of the City's natural assets and the importance of engaging with the community and regional stakeholders.

Environment Plan

The *City of Joondalup Draft Environment Plan 2013-2018* provides strategic direction in the delivery of environmental initiatives within the City of Joondalup.

Biodiversity Action Plan

The *City of Joondalup Biodiversity Action Plan 2009 – 2019* provides direction for the City's biodiversity management activities and details the development of individual Natural Area Management Plans as an action.

The City of Joondalup Strategic Environmental Framework is outlined in **Figure 3**.



Figure 3: City of Joondalup Strategic Environmental Framework

Local Biodiversity Program (formerly Perth Biodiversity Project)

The City of Joondalup is one of 32 local governments participating in the Western Australian Local Government Association's (WALGA's) Local Biodiversity Program. The aim of the Local Biodiversity Program is to support local governments to effectively integrate biodiversity conservation into land use planning to protect and manage local natural areas.

As part of the Local Biodiversity Program, the City of Joondalup assessed all natural areas from 2004 onwards using the ecological criteria of the Natural Area Initial Assessment, resulting in a priority ranking of natural areas. The City of Joondalup assess major conservation, high priority and medium priority natural areas approximately every 5-7 years using this assessment tool.

Natural Area Initial Assessments include a desktop assessment and field survey and document information such as:

- vegetation complexes;
- threatened or significant flora or ecological communities;
- structural plant communities;
- weed species;
- vegetation condition assessment;
- ecological criteria rankings;
- a viability estimate; and
- fauna species observed.

Warwick Open Space is one of the City's five Major Conservation Areas due to the high biodiversity values of the area.

City of Joondalup District Planning Scheme No. 2 Schedule 5

Planning for land use occurs under the District Planning Scheme No. 2. Schedule 5 (Clause 5.3.1) of the District Planning Scheme lists *Places and Objects Having Significance for the Purpose of Protection of the Landscape or Environment*.

Warwick Open Space is currently not listed as a place having significance for the purpose of protection of the landscape or environment in Schedule 5 of the District Planning Scheme No 2.

1.6.2 State Government

Relevant Legislation, Policies and Documents

Aboriginal Heritage Act 1972

The Act makes provision for the preservation on behalf of the community of places and objects customarily used by or traditional to the original inhabitants of Australia or their descendants.

Warwick Open Space is not listed on any State or Federal Indigenous heritage inventory or register.

Agriculture and Related Resources Protection Act 1976

The Act gives provision to declare plants and animals that are known to be a significant environmental threat and provides for the management, control and prevention of these declared plants and animals for the protection of agriculture and related resources.

Four declared plants have been recorded in Warwick Open Space, Skeleton Weed (*Chondrilla juncea*), Paterson's Curse (*Echium plantagineum*), One-leaf Cape Tulip (*Moraea flaccida*) and Lantana (*Lantana camara*).^{1,2}

Bushfires Act 1954

The Act makes provision for diminishing the dangers resulting from bush fires and for the prevention, control and extinguishment of bush fires.

Cat Act 2011

The Act makes provision for the control and management of cats and promotes and encourages the responsible ownership of cats.

Environmental Protection Act 1986

The Act provides authority to the Environmental Protection Authority (EPA) for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment in Western Australia.

¹ ELA (2013)

² Brundrett and Clarke (2004)

Heritage of Western Australia Act 1990

The Act provides for and encourages the conservation of places which have significance to the cultural heritage in the State.

Warwick Open Space is not listed on any State or Federal cultural heritage inventory or register.

Wildlife Conservation Act 1950

The Act provides the statute relating to conservation and legal protection of flora and fauna.

Seven fauna species listed under the *Wildlife Conservation Act 1950* utilise Warwick Open Space, the threatened Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*), Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) and Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), the migratory species Rainbow Bee-eater (*Merops ornatus*), Fork-tailed Swift (*Apus pacificus*) and Great Egret (*Ardea modesta*) and the specially protected Peregrine Falcon (*Falco peregrinus*).^{3,4}

WA Planning Commission "Bush Forever" Strategy 2000

The Strategy identifies regionally significant bushland in the Perth Metropolitan Region to be retained, managed and protected forever.

Warwick Open Space is designated as a Bush Forever site (202). Four species in Warwick Open Space are listed as naturally occurring significant flora of the Perth Metropolitan Region, Waldjumi (*Jacksonia sericea*), *Conostylis aculeata* subsp *cygnorum*, Common Popflower (*Glischrocaryon aureum*) and Pale Grass-lily (*Caesia micrantha*).^{3,5}

State Planning Policy 2.8 – Bushland Policy for the Perth Metropolitan Region

The *State Planning Policy 2.8 – Bushland Policy for the Perth Metropolitan Region* aims to provide direction and an implementation framework that will ensure bushland protection and management issues in the Perth Metropolitan Region are appropriately addressed and integrated with broader land use planning and decision-making.

Environmental Weed Strategy for Western Australia 1999

The Department of Parks and Wildlife (DPaW) developed an Environmental Weed Strategy for Western Australia (WA) (1999). The Strategy prioritises 1,350 weed species using the criteria of invasiveness, distribution and environmental impacts to rate weeds as high, moderate, mild or low priority. High ratings were issued to 34 weed species.⁶

Warwick Open Space contains 12 high priority rated weeds in the Environmental Weed Strategy for WA.

³ ELA (2013)

⁴ Clarke et. al. (2012)

⁵ Brundrett and Clarke (2004)

⁶ CALM (1999)

1.6.3 Federal Government

Environment Protection and Biodiversity Conservation Act 1999

The Act provides for the protection of the environment and the conservation of biodiversity, and for related purposes.

Seven *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* listed species have been recorded in Warwick Open Space, Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*), Baudin's Black Cockatoo (*Calyptorhynchus baudinii*), Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), Graceful Sun Moth (*Synemon gratioiosa*) and the migratory species Rainbow Bee-eater (*Merops ornatus*), Fork-tailed Swift (*Apus pacificus*) and Great Egret (*Ardea modesta*).^{7,8}

Australia's Biodiversity Conservation Strategy 2010-2030

The Strategy aims to protect biological diversity and maintain ecological processes and systems.

National Weeds Strategy 1997

The National Weeds Strategy provides a strategic framework for managing weeds at a national level. As part of the implementation of the National Weeds Strategy, 32 Weeds of National Significance are identified as nationally agreed priority plant species for control and management based on the criteria of invasiveness and impact characteristics, potential and current area of spread and economic, environmental and social impacts.

Warwick Open Space contains one known Weed of National Significance, Lantana (*Lantana camara*).⁹

1.6.4 International Conventions or Listings

International Union for Conservation of Nature (IUCN) Red List of Threatened Species

The IUCN Red List of Threatened Species™ provides taxonomic, conservation status and distribution information on plants and animals that have been globally evaluated using the IUCN Red List Categories and Criteria.

Two endangered IUCN Red List species have been recorded in Warwick Open Space, Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) and Baudin's Black Cockatoo (*Calyptorhynchus baudinii*).^{7,8}

⁷ ELA (2013)

⁸ Clarke et. al. (2012)

⁹ Brundrett and Clarke (2004)

2.0 Description of the Environment

2.1 Physical Environment

2.1.1 Geology, Soils and Landforms

Soils of the Swan Coastal Plain

Warwick Open Space is situated with the City of Joondalup which is located within the Swan Coastal Plain. Warwick Open Space is characterised by Tuart and heath on limestone soils, and Banksia-Jarrah-Marri woodland on sandy soils.¹⁰ The majority of the soils of the Swan Coastal Plain are formed by material deposited by rivers and wind. A series of dune systems has been formed with the youngest dunes being the Quindalup Dunes nearest the coast, followed by the Spearwood Dunes and the oldest Bassendean Dunes are farthest from the coast, as shown in **Figure 4**.¹¹

Warwick Open Space is located within the Spearwood Dunes which have a core of sandy aeolianite with a capping of secondary limestone (Tamala Limestone, predominantly calcarenite) overlain by yellow brown siliceous sands with weak podzol development.^{12,13} The Spearwood Dunes are believed to have formed around 40,000 years ago and comprise of red/brown, yellow and pale yellow/grey sands. The Spearwood Sand Phase is characterised by undulating dunes with rocky crests on Aeolian sand over limestone.¹⁴

The land contours of Warwick Open Space range from 29 to 44 metres Australian Height Datum (AHD).

Acid Sulphate Soils

Acid Sulphate Soils are naturally occurring soils and sediments that contain iron sulphides. Acid Sulphate Soils are predominantly found in low-lying coastal wetlands and tidal flats and are harmless when left undisturbed. Exposure to air causes the iron sulphides in Acid Sulphate Soils to react with oxygen and water producing iron compounds and sulphuric acid, which can lead to heavy metals being released into the surrounding environment.¹⁵

Acid Sulphate Soils are categorised as Potential Acid Sulphate Soils or Actual Acid Sulphate Soils. Potential Acid Sulphate Soils have not been oxidised by exposure to air whilst Actual Acid Sulphate Soils have been disturbed or exposed to oxygen and become acidic.¹⁵

There is no known risk of Acid Sulphate Soils in Warwick Open Space.¹³ The risk of Acid Sulphate Soils is based on the likelihood of Acid Sulphate Soils occurring within soil profiles and has been mapped by the DPaW using available desk-top information and limited ground-truthing within areas where intensive on-ground mapping and soil analysis work has been undertaken. The mapping undertaken has found that Acid Sulphate Soils are not known or expected to occur in the environment of Warwick Open Space on the basis of origin of the geological units present, depth to groundwater and partial “ground truthing” or onsite investigation.^{15,16}

¹⁰ ELA (2013)

¹¹ Bolland (1998)

¹² McArthur and Bettenay cited in Syrinx (2012)

¹³ DoW (2004)

¹⁴ DAFWA cited in Eco Logical Australia (2013)

¹⁵ DEC n.d.(a)

¹⁶ Landgate (2006)

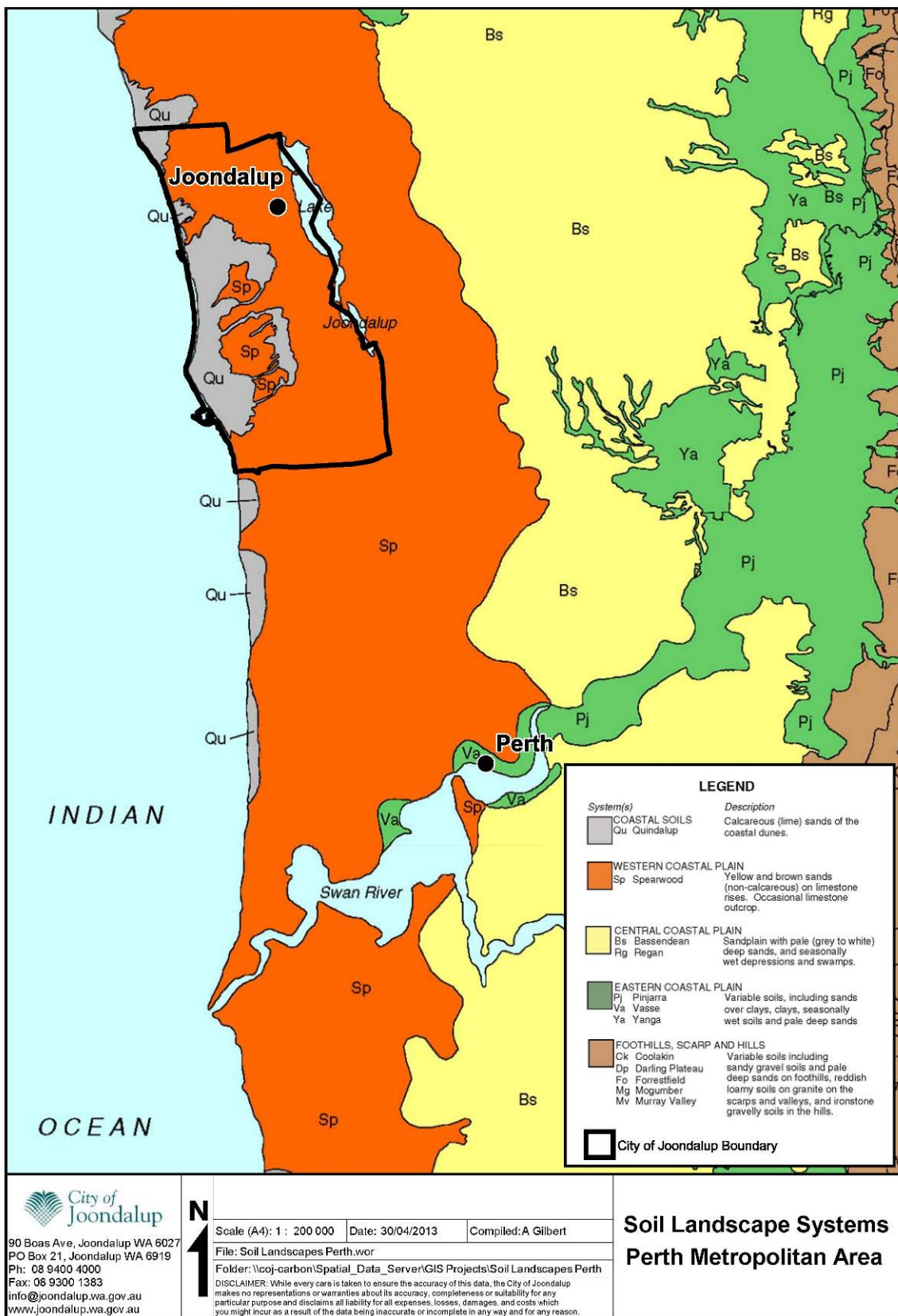


Figure 4: Soils of the Swan Coastal Plain (sourced from Department of Agriculture 2002)

2.1.2 Hydrology

Groundwater

The City of Joondalup is located on Perth's largest source of groundwater, the Gngangara Groundwater System, comprising four main aquifers: superficial (shallow, unconfined), Mirrabooka (deeper, semi-confined), Leederville (deep, mostly confined) and the Yarragadee (deep, mostly confined). The Gngangara Mound extends across most of the superficial aquifer and refers to the water table creating a mound shape, as shown in **Figure 5**. Groundwater levels in the superficial aquifer have been declining over recent years due to pressure from extraction and the impacts of climate change.¹⁷

Gngangara Groundwater System

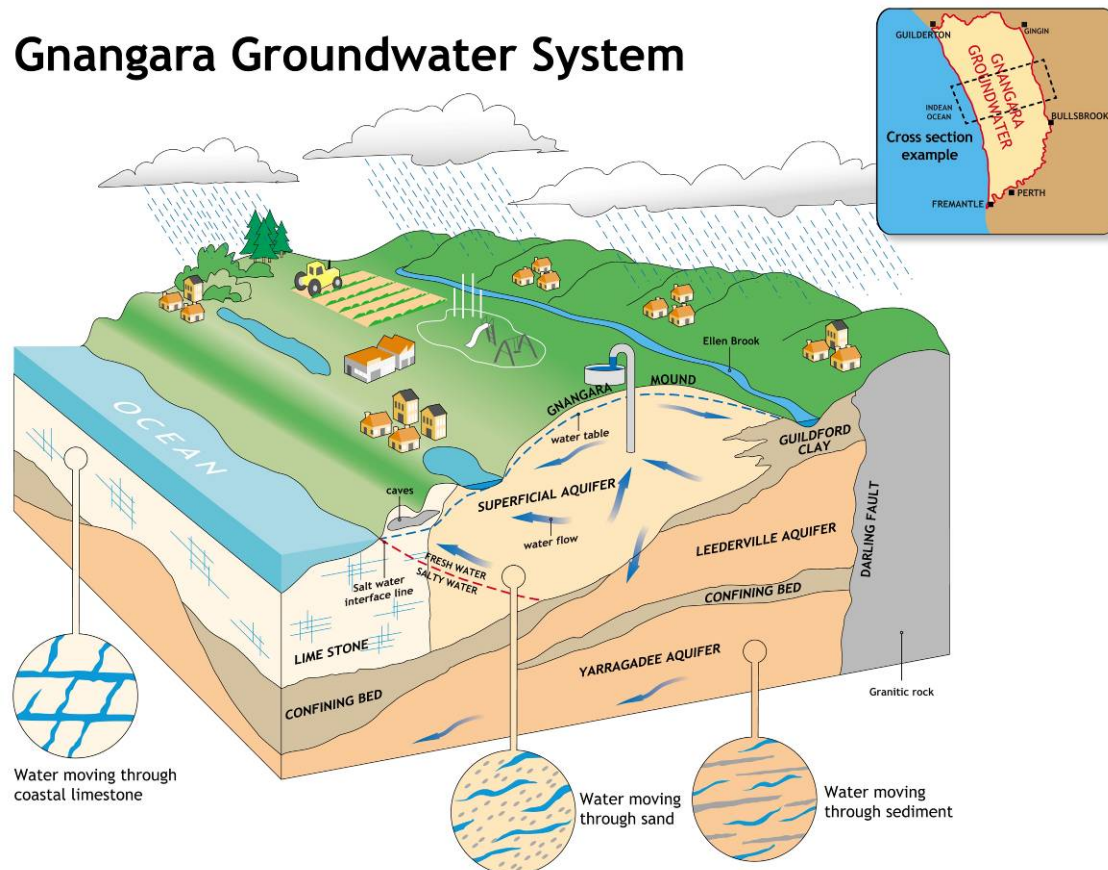


Figure 5: Gngangara Groundwater System (sourced from DoW n.d.)

Vegetation at Warwick Open Space is likely to be dependent on groundwater for survival as the depth to water is 9.5 to 29 metres. In general, vegetation in the Perth metropolitan area within 10 metres of groundwater is likely to access the water table.¹⁸ Depth to water is the depth from the natural surface contours to the water table (see **Figure 6**). Groundwater salinity at Warwick Open Space is fresh (0 – 500 TDS in mg/L).

¹⁷ CoJ (2012a)

¹⁸ A Paton (DoW) 2013, pers. comm., 26 March

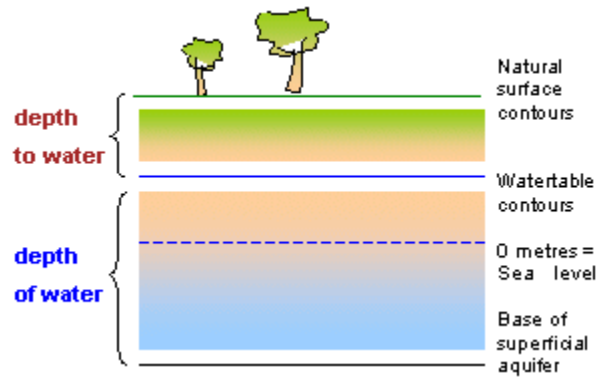


Figure 6: Groundwater Depth Explanation (sourced from DoW 2004)

The Department of Water operate a groundwater monitoring bore to the west of Warwick Open Space on Ellersdale Avenue, close to Centro Warwick Shopping Centre (as shown in **Figure 7**).

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		<small>DISCLAIMER: While every care is taken to ensure the accuracy of this data, the City of Joondalup makes no representations or warranties about its accuracy, completeness or suitability for any particular purpose and disclaims all liability for all expenses, losses, damages, and costs which you might incur as a result of the data being inaccurate or incomplete in any way and for any reason.</small>			

Figure 7: Warwick Open Space Groundwater Monitoring Bore Location

The historical water level records from the nearby groundwater monitoring bore indicate that the groundwater table has steadily decreased over the past 40 years, from approximately 14 metres above sea level in 1974 to 10 metres above sea level in 2012. This is the equivalent of a 4 metre lowering of the groundwater table over the past 40 years, largely due to increased groundwater abstraction, land use change and climatic change.¹⁹ **Figure 8** shows the historical water level data for the groundwater monitoring bore on Ellersdale Avenue in metres Australian Height Datum (mAHD), meaning the metres above sea level (with sea level being at zero metres).²⁰

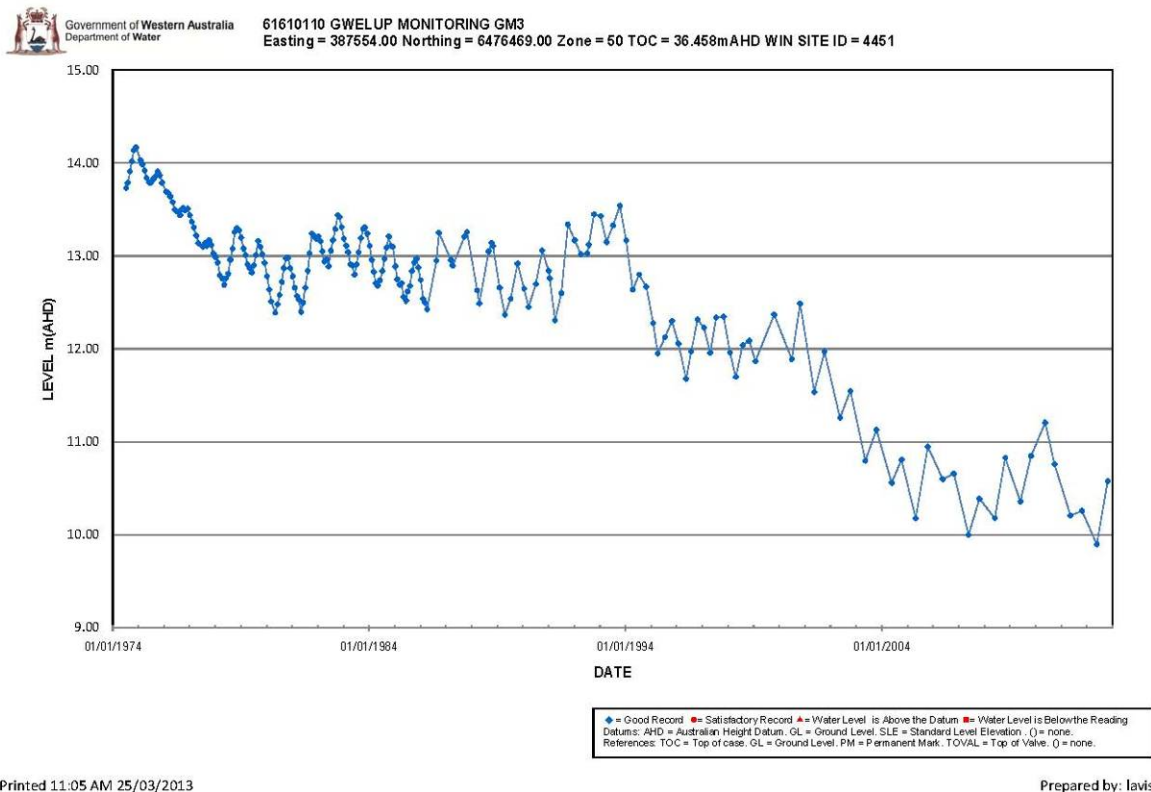


Figure 8: Groundwater Monitoring Bore Historical Water Levels (sourced from DoW 2013)

The effect of long-term persistent hydrological change can cause changes in vegetation community composition and structure, with a potential loss of some species and a gradual replacement by more drought-tolerant species. The rate (m/yr) and magnitude (metres) of groundwater level change are also relevant to potential vegetation impact.¹⁹

The use of groundwater for domestic irrigation through bores is deemed suitable in the area and is supported in preference to scheme water. The area is low in iron concentration, resulting in a low iron staining risk.²¹

Stormwater Drainage

Stormwater consists of runoff from rainfall and any material collected in its path of flow. Stormwater is channelled and collected in sumps and swales to recharge the superficial

¹⁹ Loomes and Froend (n.d.)

²⁰ DoW (2013)

²¹ DoW (2004)

aquifer and prevent the spread of weeds, pollutants, pathogens and sediment to vegetation.²²

Sumps allow stormwater to infiltrate retention basins (sumps), detain the water, collect sediment and over time the water is absorbed back into groundwater. Most sumps are steeply graded rectangular excavations with an inflow at the bottom. Sumps are fenced off in the interest of community safety due to the potential for rapid stormwater inflow.²³

Swales are broad, shallow channels that are grassed or vegetated and used to collect and convey stormwater flows, promote infiltration and removal of sediment.²⁴

The main stormwater drainage lines in Warwick Open Space are from west to east along Warwick Road and into a sump on the corner of Rodgers Street and Warwick Road; from west to east into the Erindale Road sump; and from Warwick Leisure Centre north-east into the swale on the corner of Warwick Road and Wanneroo Road, as shown in **Figure 9**. The Erindale Road sump receives water from the Erindale Rd Catchment (233,573 m² in area), whilst the swale on the corner of Warwick Road and Wanneroo Road receives water from the Warwick Leisure Centre Catchment (44,245 m² in area).

²² DoE (2004)

²³ Grose and Hedgcock (n.d.)

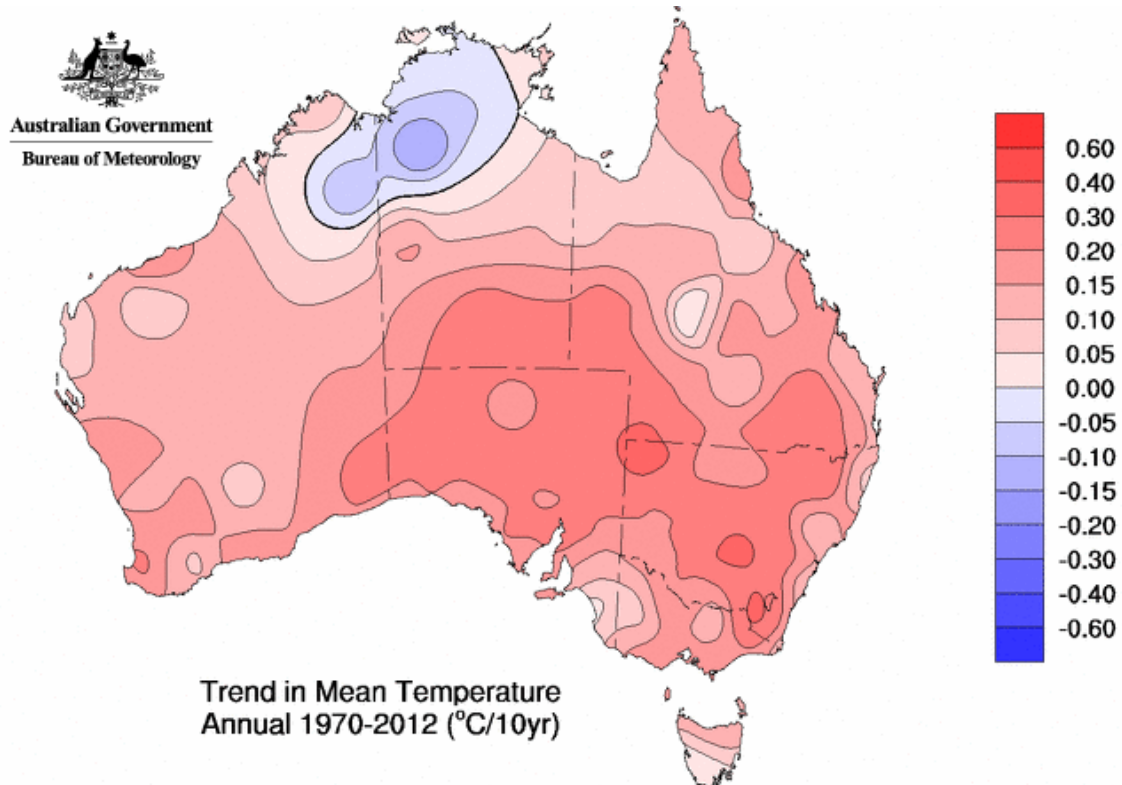
²⁴ DoW (2011)



Figure 9: Warwick Open Space Drainage Lines and Sump

2.1.3 Climate Change

The City of Joondalup is located in the southwest of Western Australia, an area that will be impacted considerably by the effects of climate change. The drying climate will reduce the availability of water resources across the region. The City is facing a future with less water, increased evaporation rates and more hot days.²⁵ **Figure 10** shows the trend towards an increase in annual mean temperature for most of Australia over the last four decades.



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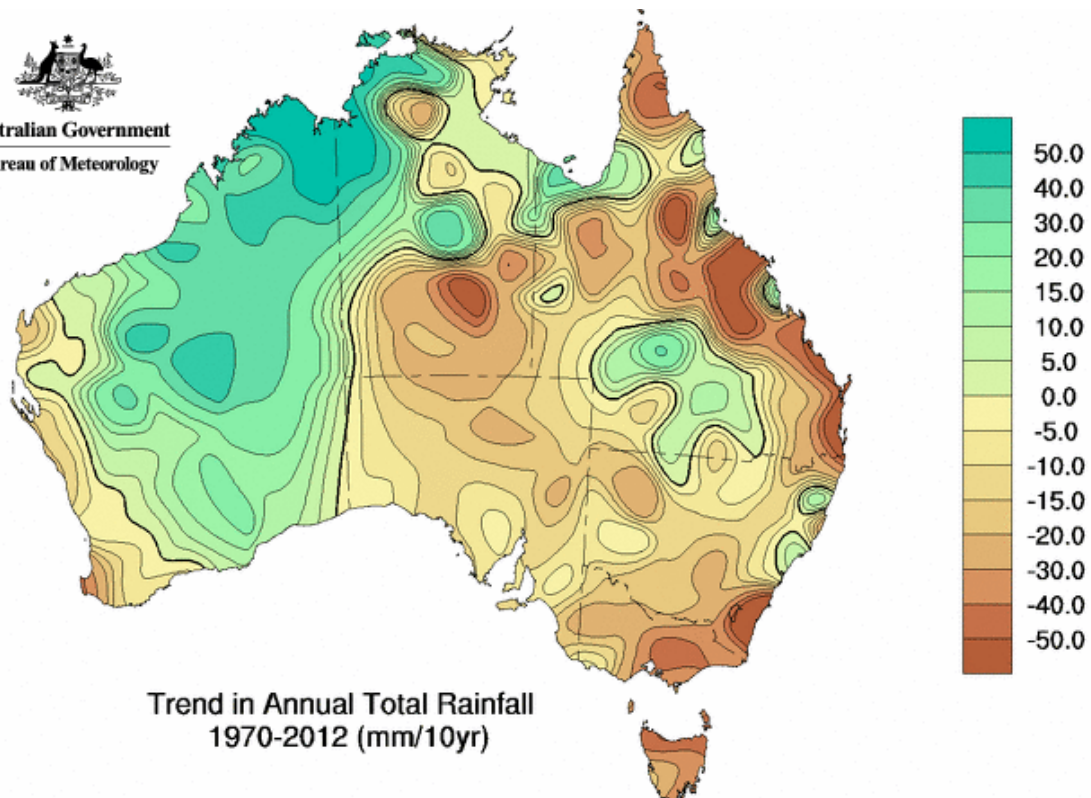
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Figure 10: Annual Trend in Mean Temperature 1970-2012 (sourced from BoM 2013)

Climate change is likely to increase temperatures and the number of days over 30 degrees in the southwest, and will subsequently increase evaporation rates from surface water bodies and soil. By 2030, the annual average number of days over 35°C in Perth could grow from the current 27 to 29-38 days. More extreme weather events are also predicted, including more frequent and severe droughts.²⁵

Adaptation to the drying climate is critical, particularly as the impacts of climate change are already being experienced. Rainfall in the Perth-Peel region has decreased by over 10 per cent since the 1970s.²⁵ **Figure 11** shows the decreasing trend in annual total rainfall for Perth over the past four decades.

²⁵ CoJ (2012a)



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Issued: 07/02/2013

Figure 11: Trend in Annual Total Rainfall 1970-2012 (mm/10yr) (sourced from BoM 2013)

The City of Joondalup experiences a Mediterranean climate of hot dry summers with an average temperature of 31 degrees during the day and mild wet winters with an average day time temperature of 18 degrees. The average annual rainfall from 2002 to 2012 was 679mm. Approximately 80 percent of the annual rain falls between the months of May and September, as shown in **Figure 12**.²⁶

²⁶ BoM (2013)

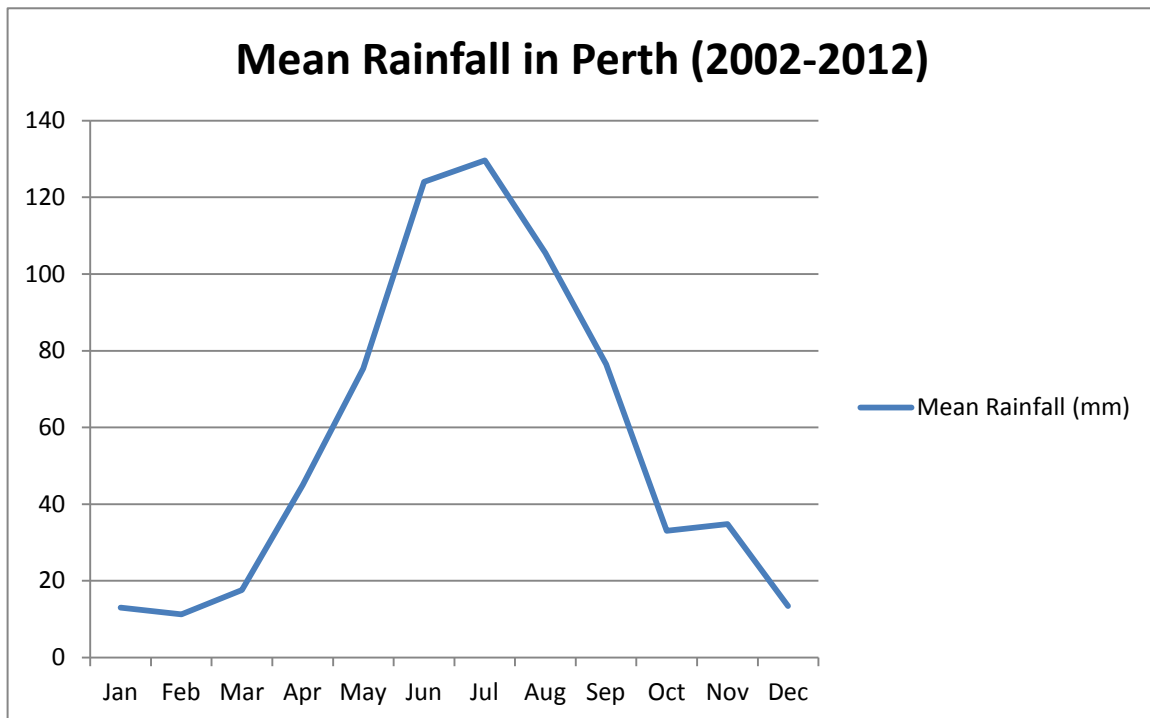


Figure 12: Mean Rainfall Recorded at Perth Airport Weather Station 2002-2012 (sourced from BoM 2013)

2.1.4 Vegetation

Vegetation Complexes

Vegetation complexes are classified by the soil and landforms contained in medium to large areas along the Swan Coastal Plain. Regional scale mapping shows the study area is classified as having Karrakatta Complex - Central and South (see **Figure 13**). This complex consists of predominantly open forest of *Eucalyptus gomphocephala* – *Eucalyptus marginata* – *Eucalyptus calophylla* and woodland of *Eucalyptus marginata* – *Banksia* species.²⁷

The State Government has established targets under Bush Forever which aim to protect at least 10% of each vegetation complex²⁸ in the Perth Metropolitan Region to achieve a comprehensive representation of all the ecological communities originally occurring in the region.²⁹

The City of Joondalup portion of the pre-European extent of Karrakatta Complex – Central and South in Perth and Peel was 13% (2,704 ha). Approximately 18% (6,735 ha) of this vegetation complex currently remains in Perth and Peel. The City of Joondalup proportion of the current extent of Karrakatta complex – Central and South in Perth and Peel is 5% (350 ha), while the City of Joondalup level of retention of pre-European Karrakatta complex Central and South is approximately 13%.

Due to the limited extent of the Karrakatta Complex – Central and South vegetation complex remaining within the Perth Metropolitan Region, it is important to retain bushland within Warwick Open Space for its conservation value.

²⁷ Heddle et. al. cited in Eco Logical Australia (2013)

²⁸ Department of Planning (2000)

²⁹ WALGA (2010)

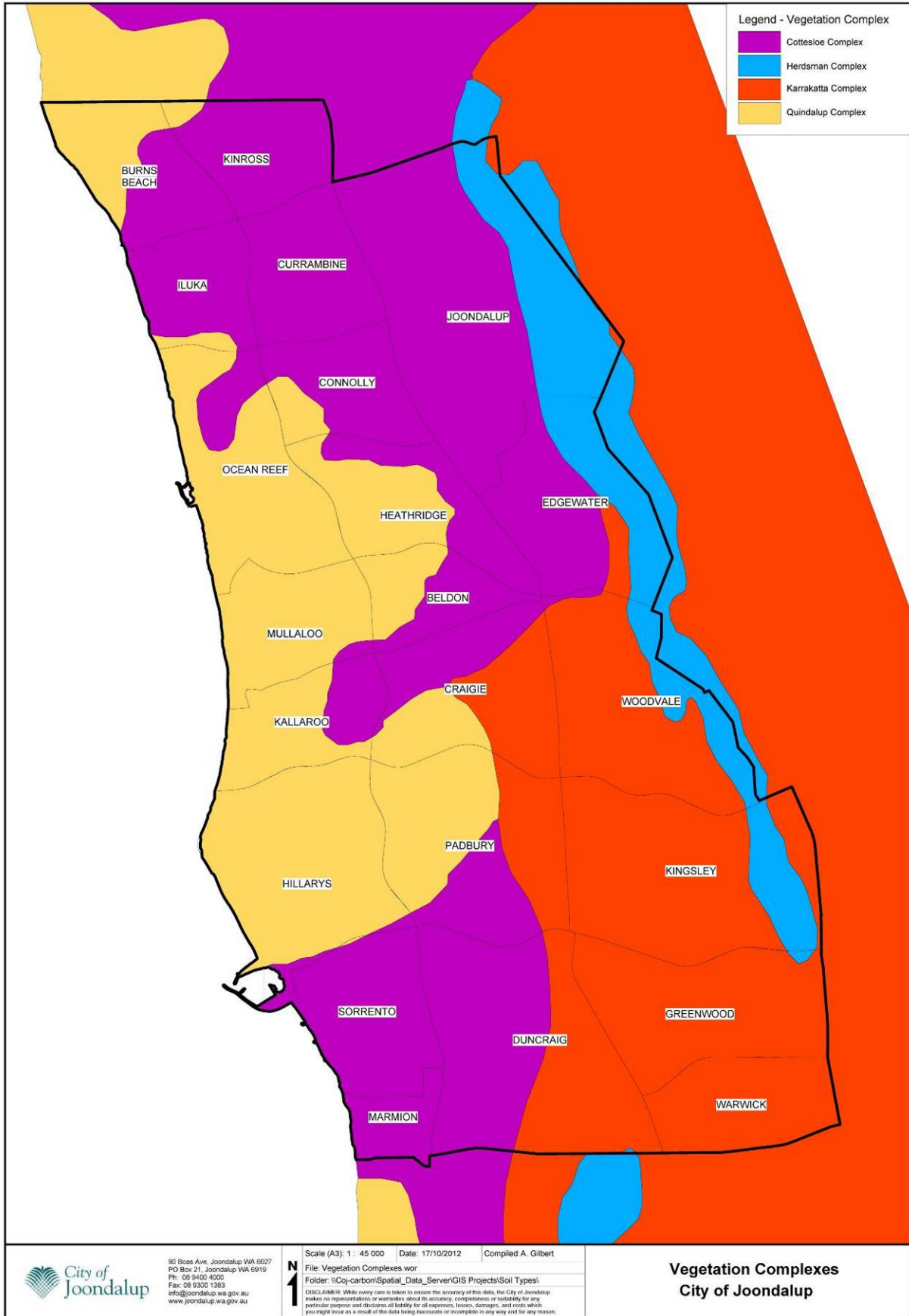


Figure 13: City of Joondalup Vegetation Complexes

Floristic Community Types

Floristic Community Types (FCTs) are generally groups of flora species that consistently occur together. Warwick Open Space has been assigned FCT 28 Spearwood *Banksia attenuata* or *Banksia attenuata* - *Eucalyptus* woodlands.³⁰ Whilst FCTs can be a useful way of describing groups of flora species, vegetation communities are more commonly used to define plant communities.

Vegetation Communities

The vegetation communities that exist within the Jarrah-Banksia Woodland of Warwick Open Space are of high conservation value and are described in **Table 1** and shown in **Figure 14**:

Vegetation Community No.	Description	Site Coverage
1	<i>Eucalyptus marginata</i> subsp. <i>marginata</i> , <i>Banksia attenuata</i> and <i>Banksia menziesii</i> open forest to low open woodland	84%
2	<i>Allocasuarina fraseriana</i> , <i>Eucalyptus marginata</i> subsp. <i>marginata</i> and <i>Banksia attenuata</i> low open forest to low woodland	7%
3	<i>Eucalyptus gomphocephala</i> and <i>Eucalyptus marginata</i> subsp. <i>marginata</i> open forest to low woodland	6%

Note: The remaining vegetation on site has been cleared (3%).

Table 1: Vegetation Communities at Warwick Open Space

No Threatened or Priority Ecological Communities were identified within Warwick Open Space or in nearby bushland.³⁰

Vegetation Condition

The Keighery Scale is a tool used to rate the condition of vegetation from pristine to completely degraded, as detailed in **Appendix 4**. The vegetation condition at Warwick Open Space ranges from excellent to completely degraded. The majority of the remnant vegetation is in very good or excellent condition, with the excellent condition bushland being in the north-west corner of the site. The majority of the bushland is in very good condition with some good condition or degraded patches near infrastructure and paths. Vegetation condition is shown in **Table 2** and **Figure 15**.

The City of Joondalup conducted Natural Areas Initial Assessments in 2005 and 2011 to assess the vegetation condition at the site. Eco Logical Australia conducted a vegetation condition assessment in September 2012, with the majority of the vegetation condition being rated as “very good”, followed by “excellent”, as shown in **Table 2**.

Vegetation condition assessments include observations regarding the numbers of native species, weed cover, vegetation structure, species diversity, amount of understorey, health condition of most species’ populations and physical disturbance. Since 2011 there has been a reduction in the amount of vegetation rated as “excellent” and an increase in the amount of vegetation rated as “very good”. This can be largely attributed to the amount of bush fires that have occurred at Warwick Open Space over the past 12 months.

Year	Pristine	Excellent	Very Good	Good	Degraded	Completely Degraded
May 2005	0%	30%	50%	15%	5%	0%
Dec 2011	0%	30%	50%	10%	5%	5%
Sept 2012	0%	18%	67%	9%	3%	3%

Table 2: Warwick Open Space Vegetation Condition Assessment using Keighery Scale (2005, 2011 and 2012)

³⁰ ELA (2013)

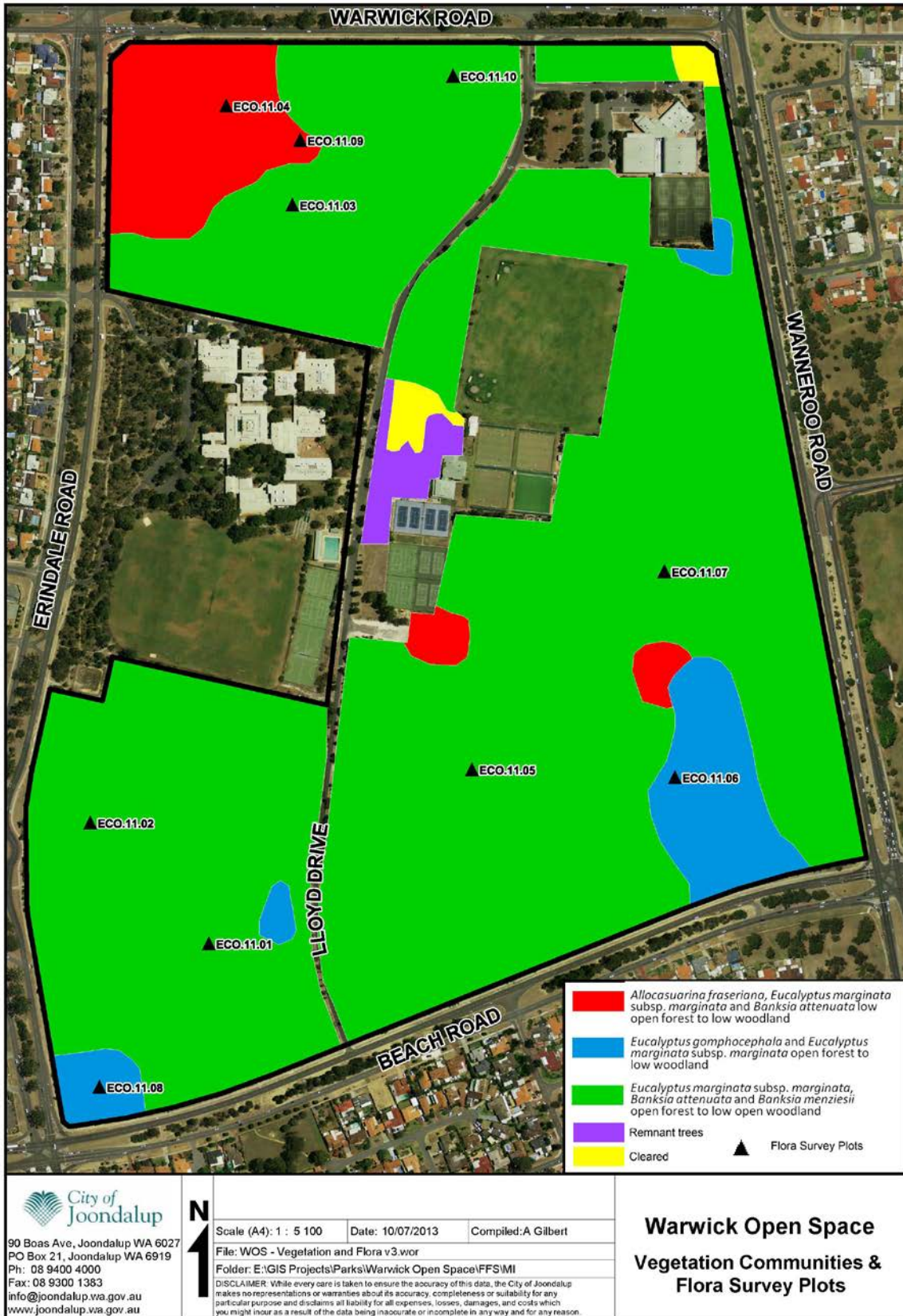


Figure 14: Warwick Open Space Vegetation Communities (sourced from ELA 2013)

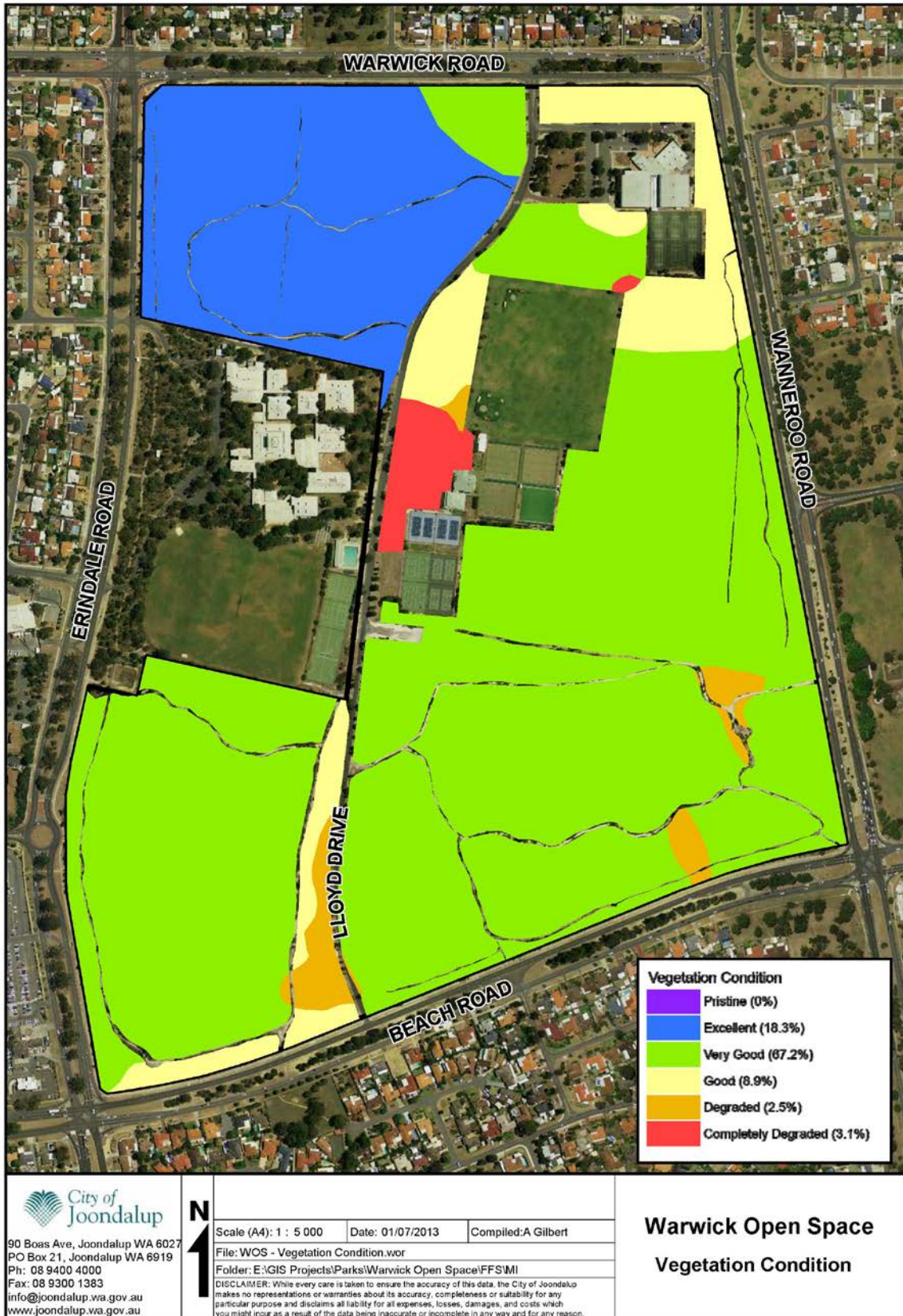


Figure 15: Warwick Open Space Vegetation Condition – September 2012 (sourced from ELA 2013)

3.0 Biodiversity Conservation

Warwick Open Space supports an abundance of plant and animal species, including some endangered species. The long term protection of biodiversity values within Warwick Open Space is critical to ensure the conservation of this unique habitat. The protection and enhancement of biodiversity within Warwick Open Space also benefits the community through the provision of ecological services such as:

- the production of oxygen and capture of carbon dioxide;
- noise and air quality regulation;
- cooling of urban environments;
- regulation of freshwater supplies;
- generation and maintenance of topsoil;
- generation and recycling of nutrients;³¹
- control of pests and diseases;
- supporting seed dispersal and pollination;
- providing a genetic store from which we can benefit in the future;³² and
- a number of recreational and cultural experiences.³³

There are a number of environmental threats that pose a risk to the biodiversity of Warwick Open Space. The key environmental threats at Warwick Open Space addressed in this Section include:

- Weeds;
- Pathogens and disease;
- Non-native fauna species;
- Human impacts;
- Access and infrastructure; and
- Fire.

Management strategies to address the key environmental threats have been established and are discussed in the following sections.

3.1 Flora

Warwick Open Space is located within the Southwest Australia biodiversity hotspot. Southwest Australia, from Shark Bay in the north to Israelite Bay in the south, is one of 34 biodiversity hotspots in the world with over 2,900 endemic plant species occurring in this region. Approximately 30% of the original vegetation extent of this area remains, with habitat loss being primarily due to agricultural expansion.³⁴

Flora surveys enable collection of scientific data related to the occurrence and distribution of flora species and vegetation communities. Information obtained from flora surveys is used as a baseline to monitor the ecological health of flora populations and vegetation communities.

The City engaged consultants, Eco Logical Australia, to undertake a desktop and field flora survey of Warwick Open Space in September 2012.

³¹ Burbidge (2004)

³² Millennium Ecosystem Assessment (2005)

³³ CoJ (2012b)

³⁴ Conservation International (2012)

The design of the flora survey was aligned with methodology outlined in EPA *Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia*.

The methodology undertaken in conducting the survey included the use of 10m x 10m quadrats and opportunistic sampling of species not recorded within the quadrats. A minimum of two quadrats were established per vegetation community, with a total of ten quadrats established in total. A total of 175 flora species were recorded on site, including 122 (70%) native species and 53 (30%) introduced species.

Previous flora surveys conducted in Warwick Open Space include:

- City of Joondalup Natural Area Initial Assessments (2005 and 2011).
- Karen Clarke and Mark Brundrett Flora Surveys (2001 and 2004).
- City of Wanneroo Warwick Open Space Management Plan (1995).

The combination of results from Warwick Open Space flora surveys indicates that there are 389 flora species on site, including 250 (64%) native species and 139 (36%) introduced species. The optimal time for surveying is spring for native flora and winter for weeds.

Native Flora

Native flora is an important part of the Warwick Open Space ecosystem. The loss of native plant species can lead to a loss of fauna that depend on flora for food and shelter. A total of 250 native flora species have been recorded at Warwick Open Space (see **Appendix 1**).

One naturally occurring priority species has been recorded in Warwick Open Space, *Jacksonia sericea*. Two priority species have been recorded in Warwick Open Space, however there are no previous records of them in Perth and they are not naturally occurring on site,³⁵ being *Caesia (Eucalyptus caesia)* and *Scaevola paludosa*.^{36,37}

Four species in Warwick Open Space are listed as naturally occurring significant flora of the Perth Metropolitan Region, *Waldjumi (Jacksonia sericea)*, *Conostylis aculeata* subsp *cygnorum*, Common Popflower (*Glischrocaryon aureum*) and Pale Grass-lily (*Caesia micrantha*).^{36,37}

Five species in Warwick Open Space are listed as significant flora of the Perth Metropolitan Region, however they are not naturally occurring on site, Rottnest Island Pine (*Callitris preissii*), Rottnest Teatree (*Melaleuca lanceolata*), Tree Smokebush (*Conospermum triplinervium*), Southern Diplolaena (*Diplolaena dampieri*) and Peppermint (*Agonis flexuosa*).^{36,37}

Several populations of *Lomandra hermaphrodita* and *Lomandra maritima* were observed in Warwick Open Space, the food source for the threatened fauna species the Graceful Sun Moth (*Synemon gratiosa*).³⁸ The threatened and significant flora species recorded in Warwick Open Space are shown in **Appendix 2**.

Mature Tuart trees (*Eucalyptus gomphocephala*) provide nesting hollows for Carnaby's Black Cockatoos. However, Tuarts take 200 years to develop hollows that are a suitable size

³⁵ WA Herbarium (n.d.)

³⁶ ELA (2013)

³⁷ Brundrett and Clarke (2004)

³⁸ Bishop et al. (2012)

for nesting.³⁹ Many Tuart trees on the Swan Coastal Plain have died in the past 20 years due to stress factors such as the lowering of the water table, insect infestations and fungal pathogens.⁴⁰ Planting of Tuart trees in Warwick Open Space may provide nesting habitat and a feeding and roosting resource in the long term for Carnaby's Black Cockatoos.

Weeds

Non-native flora or weeds can be exotic species or native species in ecosystems in which they previously did not exist. Weeds are commonly introduced and distributed within bushland areas through the dispersal of seed by water, wind and animals such as birds, fire, through dumping of garden refuse, human or vehicle movement in natural areas.

Weeds have major economic, environmental and social impacts in Australia and can:

- displace native plant species;
- alter nutrient recycling and soil quality;
- harbour pests and diseases;
- create fuel loads for fires;
- impact negatively on fauna and flora and their habitats; and
- compete with native species for space, water and nutrients.⁴¹

Over 28,000 known alien plant species have been introduced to Australia with approximately 10% now being established in the environment.⁴² Garden plants are the main source of Australia's weeds, accounting for 66% of recognised weed species.⁴¹

A total of 139 weed species have been recorded at Warwick Open Space (see **Appendix 1**). The majority of the weed species were grasses from the Poaceae family, legumes from the Fabaceae family and daisies from the Asteraceae family. Many of the weed species are located along disturbed tracks and edges of the remnant vegetation. The most common weed species found in Warwick Open Space were Perennial Veldt Grass (*Ehrharta calycina*), Wild Gladiolus (*Gladiolus caryophyllaceus*), Blowfly Grass (*Briza maxima*) and Smooth Catsear (*Hypochaeris glabra*).⁴³

One Weed of National Significance, Common Lantana (*Lantana camara*), has been recorded in Warwick Open Space. Four declared plants, Common Lantana (*Lantana camara*), One-leaf Cape Tulip (*Moraea flaccida*), Skeleton Weed (*Chondrilla juncea*) and Paterson's Curse (*Echium plantagineum*) have been recorded in Warwick Open Space.^{43,44} Twelve weed species recorded in Warwick Open Space were rated as high priority in the Environmental Weed Strategy for WA (1999). Key weed species existing at Warwick Open Space are shown in **Appendix 2** and the location of some significant weed species at Warwick Open Space is shown in **Figure 17**.

Revegetation

The City of Joondalup encourages natural bushland regeneration through weed management and conservation fencing to allow the vegetation to re-establish itself and maintain species diversity and populations.

³⁹ DEC (2010)

⁴⁰ Matusick, Hardy and Ruthrof (2012)

⁴¹ DSEWPC (2012)

⁴² Groves, Boden and Lonsdale (2005)

⁴³ ELA (2013)

⁴⁴ Brundrett and Clarke (2004)

Revegetation is conducted on degraded or completely degraded areas using local provenance species, as required.

Current Management Approach

The City undertakes an integrated approach to weed management, including:

- Prevention of introduction of weeds through weed hygiene measures.
- Regular monitoring and reporting of weed populations.
- On ground weed control, including prioritisation of natural areas and priority weeds to target.
- Community education initiatives.
- Fire prevention measures.

Weed monitoring is conducted monthly at Warwick Open Space to establish the extent and distribution of weed species and to identify priority weeds. Weed monitoring of grasses is conducted periodically using three 10m x 10m quadrats. Natural Areas Initial Assessments are conducted approximately every 5 years in Warwick Open Space to assess site-specific ecological values, biodiversity significance and threatening processes, at a level that is consistent with regional scientific standards.⁴⁵ The outcomes from weed monitoring inform on ground weed management programs. The vegetation condition assessment (see **Figure 15**) also informs weed management as the vegetation in the best condition can be prioritised for weed control.

The City monitors the density of priority environmental weeds in Warwick Open Space on an annual basis, measured on three transects within the reserve. There has been an increase in weed density in 2011/12, compared to 2010/11, due to prolonged rainfall in spring 2011 which increased the longevity of winter weeds and enabled new growth later in the season (see **Figure 16**).

Environmental weeds are classified as priority if they meet any of the following criteria:

- weed of national significance;
- declared plant;
- high priority weed according to the Environmental Weed Strategy for WA;
- pest plant under *Local Government Act 1995*;
- major threat to vegetation;
- major threat to the structure of vegetation communities; or
- contribute to a high fuel load, for example grasses.

⁴⁵ WALGA (n.d.)

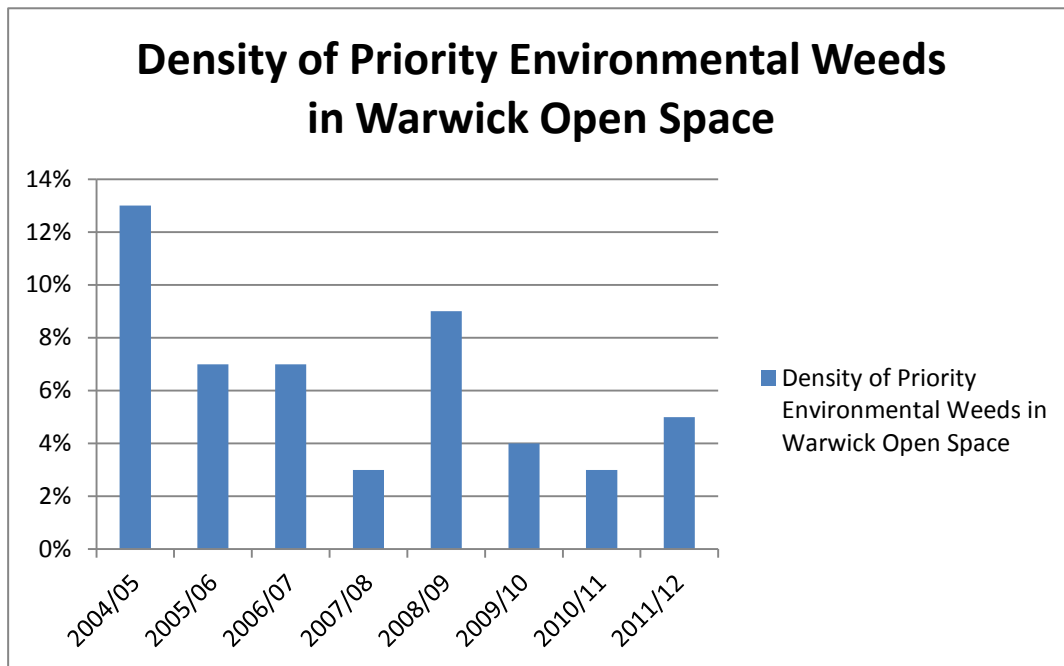


Figure 16: Density of Priority Environmental Weeds in Warwick Open Space

In accordance with the City's Annual Bushland Schedule, on ground weed management occurs through weed spraying and hand weeding methods. In addition to this, contractors are engaged to spray weeds and hand weed. City of Joondalup staff use a weed spraying procedure and conduct weed trials periodically to evaluate the most effective weed management methods. Resources, such as the DPaW's Florabase website or *Southern Weeds and their Control* (DAFWA Bulletin 4744), are consulted in regards to weed control. Weed management of weeds on verges within Warwick Open Space will be conducted from 2013/14 onwards and will consist of increasing mowing of verges to reduce seed spread, spraying of weeds and spreading of certified mulch, where required.

A City of Joondalup Weed Management Plan is to be developed in 2013/14 to provide an ongoing strategic approach to the management of natural areas in order to reduce the incidence of weeds.

The recommended weed treatment methodology for high priority weed species is detailed in **Appendix 5**.

A number of education initiatives are undertaken to raise the awareness of weeds with the community, these include:

- Delivery of Gardening Workshops;
- Development and distribution of two weed brochures – *Environmental Weeds* and *Garden Escapees* (available in hard copy and on the City's website); and
- Weed Education Workshops for Local Friends Groups.

City of Joondalup District Planning Scheme No. 2 Schedule 5

Planning for land use occurs under the District Planning Scheme No. 2. Schedule 5 (Clause 5.3.1) of the District Planning Scheme lists *Places and Objects Having Significance for the Purpose of Protection of the Landscape or Environment*, a mechanism to protect identified places of landscape or environmental value within the City.

The City is currently reviewing District Planning Scheme No. 2. It is proposed to incorporate Warwick Open Space into Schedule 5 of the District Planning Scheme No. 3 through the review process to assist in protecting native vegetation and ecosystems on site.

Pest Plant Local Law 2012

The purpose of the *Pest Plant Local Law 2012* is to prescribe pest plants within the City of Joondalup that are likely to adversely affect the value of property in the district or the health, comfort or convenience of the inhabitants of the district.

Pest plants are generally highly adaptable and will establish quickly after a disturbance event such as fire, or through unrestricted access. If pest plants are allowed to establish they have the potential to out-compete the City's unique floral biodiversity.

The *Pest Plant Local Law 2012* requires the owner or occupier of private land within the City of Joondalup district to destroy, eradicate or otherwise control scheduled pest plants on notice by the City. Currently one weed species is scheduled under the Local Law – Caltrop (*Tribulus terrestris*). Caltrop has not been identified at Warwick Open Space.

Recommended Flora Management Actions

To monitor, conserve and protect native flora in Warwick Open Space, the following management actions are proposed:

Action	Details
Flora survey	Undertake a follow up flora survey in spring to supplement previous flora survey undertaken, within 5 years.
Weed survey	Undertake a follow up weed survey in winter to supplement previous weed survey undertaken in spring, within 5 years.
Investigate planting Tuart trees	Investigate planting of Tuart trees (<i>Eucalyptus gomphocephala</i>) in Warwick Open Space to provide nesting habitat and a feeding and roosting resource in the long term for Carnaby's Black Cockatoos.
Revegetation	Conduct revegetation on degraded or completely degraded areas using local provenance species, as required.
Monthly weed monitoring	Conduct monthly weed monitoring to establish the extent of weeds and to identify priority weed species.
Natural Areas Initial Assessment	Conduct five yearly follow up of Natural Areas Initial Assessment in spring to monitor ecological health of site.
Annual priority weed monitoring and reporting	Monitor and report on the density of priority environmental weeds in Warwick Open Space on an annual basis, using three transects.
Weed control	Undertake coordinated approach to regular weed control by implementing Annual Bushland Schedule.
Weed management on verges	Conduct weed management of weeds on verges within Warwick Open Space consisting of increasing mowing of verges to reduce seed spread, spraying of weeds and spreading of certified mulch, where required.
Weed Management Plan	Develop and implement a <i>City of Joondalup Weed Management Plan</i> to provide an ongoing strategic approach to the management of natural areas in order to reduce the incidence of weeds.
<i>District Planning Scheme No. 3 Schedule 5</i>	Investigate incorporation of Warwick Open Space into <i>District Planning Scheme No. 3 Schedule 5</i> through internal review process to assist in protecting native vegetation and ecosystems.



Figure 17: Location of Significant Weed Species in Warwick Open Space (sourced from ELA 2013)

3.2 Fungi

It is estimated that there are 10 times more species of fungi than plants in the world, equating to approximately 140,000 fungi and 14,000 plant species in Western Australia.⁴⁶ The amount of species of fungi present in bushland can be an indicator of ecosystem health. Fungi are strongly interconnected with plants and animals as fungi are recyclers that break down litter and debris to provide nutrients for plants.⁴⁷ Native plants such as eucalypts, wattles and orchids have beneficial partnerships with fungi. Fungi also provide food and/or habitat for fauna such as bandicoots and beetles.⁴⁸

Fungi surveys are important in providing baseline information and to highlight changes in fungi occurrence over time. Undertaking surveys also enables comparison of ecological data with other City of Joondalup natural areas. Several fungi surveys have been conducted in Warwick Open Space since 2005 and are outlined below. The combined findings from Warwick Open Space fungi surveys indicate that there are 48 fungi species on site.

Eco Logical Australia Fungi Survey (2012)

The City engaged consultants, Eco Logical Australia, to undertake a fungi survey of Warwick Open Space in September 2012 and record all incidental sightings of fungi. Three fungi species were recorded from the study area.

Due to time limitations, the fungi survey was conducted in spring. The optimum time for fungi surveys is in autumn or winter after substantial rainfall.

The Perth Urban Bushland Fungi and Friends of Warwick Bushland Workshop Report (2005) was also utilised to inform the development of this Plan.

Fungi

Forty-eight fungi species have been observed in Warwick Open Space are listed in **Appendix 9**. Several of these fungi species are shown in **Figure 18** and **Appendix 10**.

Current Management Approach

The City of Joondalup currently monitor fungi in Warwick Open Space through surveying for incidental sightings of fungi species every 5 years.

Recommended Fungi Management Action:

To monitor fungi health in Warwick Open Space, the following management action is proposed:

Action	Details
Fungi survey	Undertake a comprehensive fungi survey in autumn or winter after substantial rain, to supplement previous incidental fungi survey, within 5 years.

⁴⁶ Bougher (2009)

⁴⁷ Robinson (n.d.)

⁴⁸ DEC (n.d.b)



Figure 18: Warwick Open Space Fungi Locations (sourced from ELA 2013)

3.3 Plant Diseases

Organisms such as fungi, bacteria and viruses that cause plant diseases are known as pathogens. Whilst some pathogens are naturally occurring within soil populations, others have been introduced to the environment through the movement of plant materials and soils.⁴⁹

The symptoms produced by plants that are affected by pathogens vary depending upon the species of pathogen, host species, environment and climatic conditions. Some pathogens can cause rapid death of plants whilst others result in a slow, perennial decline in health.⁴⁹

Phytophthora dieback refers to the disease caused by the introduced plant pathogen *Phytophthora*. While there are numerous species of *Phytophthora*, the most aggressive species affecting native plants throughout South-western Western Australia is *Phytophthora cinnamomi*.

Whilst *Phytophthora cinnamomi* is the most common species of *Phytophthora* dieback within Western Australia a second species of *Phytophthora*, *Phytophthora multivora* is common in urban areas of the Perth, particularly along the inland dune systems, and has been identified within the City's parks areas. *Phytophthora multivora* is named due to its wide host range, including *Banksia* and Eucalypt species. *Phytophthora multivora* can cause rapid death of plants, or a slow, perennial decline in health of the crown and is commonly associated with individual spot deaths and areas of tree decline.⁴⁹

Armillaria luteobubalina has also been identified within a number of parks within the City of Joondalup. *Armillaria* is a soil-borne fungus that causes root rot of a wide variety of plants including many species of native flora. The fungus is native to Australia and can cause major damage to natural ecosystems. *Armillaria luteobubalina* is commonly known as the "Honey Fungus" due to the colour of the fruiting body seen above the ground during certain times of the year, as shown in **Figure 19**. Fruiting bodies (mushrooms) are not evident at all infected sites and their presence is usually a sign that the fungus is well established in that area.⁴⁹



Figure 19: Fruiting Bodies of *Armillaria luteobubalina* (sourced from CoJ 2012c)

At present there is no reliable mechanism for the complete eradication of *Phytophthora* species and the control of *Armillaria luteobubalina* is both expensive and labour intensive.⁴⁹

There are currently no suspected plant diseases in Warwick Open Space, however no soil or other sampling activities have been undertaken to confirm this. The closest site to Warwick

⁴⁹ CoJ (2012c)

Open Space with a confirmed pathogen, *Phytophthora multivora*, is Granadilla Park in Duncraig, approximately 3km west of Warwick Open Space. A desktop study was undertaken by Arbor Carbon that identified Warwick Open Space as a high risk priority area for further investigation.⁵⁰ The criteria used in a pathogen risk analysis of natural areas included confirmed or suspected disease, connectivity to natural areas and Bush Forever sites and presence/absence of irrigation within the site or in connected sites.

Current Management Approach

The City of Joondalup has developed a Pathogen Management Plan to protect native vegetation and ecosystems by establishing the level of risk for areas to be infected by pathogens, prioritisation of areas and detail preventative and management actions to be implemented within the City, including guidelines for dieback-free purchasing and a hygiene procedure.

In order to reduce the risk of spreading pathogens between vegetated areas, City of Joondalup staff currently spray vehicles, shoes and tools with methylated spirits and brush down before they enter and leave Warwick Open Space.

Recommended Pathogen Management Action:

To prevent pathogen spread and protect biodiversity values at Warwick Open Space, the following management action is proposed:

Action	Details
Pathogen Management	Implement recommendations from the Pathogen Management Plan that are applicable to the management of Warwick Open Space.

3.4 Fauna

Fauna surveys document the occurrence, distribution and population of fauna species. Information from fauna surveys is used as a baseline to monitor the health of fauna species.

The City engaged consultants, Eco Logical Australia, to undertake a fauna survey of Warwick Open Space in September 2012. As part of the fauna survey, Eco Logical Australia reviewed data provided by City of Joondalup and Friends of Warwick Bushland to compile a complete data set which has been utilised in the development of this Plan.

The fauna survey design was aligned with *EPA Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia*, the principles outlined in *EPA Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection*, and the *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*.

The fauna survey method included a variety of sampling techniques, both systematic and opportunistic. Trapping was conducted over 5 nights using a combination of pitfall traps, Elliot box traps, funnel traps and cage traps in six trapping transects. Other fauna survey methods included a bird census at each transect, a bat survey, opportunistic sampling and sightings, hand searches and nocturnal searches.

⁵⁰ Arbor Carbon (2012)

Previous fauna surveys at Warwick Open Space include:

- Karen Clarke, Bob Horwood and Pat Horwood Fauna Observations (1997 to 2012)
- City of Joondalup Natural Area Initial Assessments (2005 and 2011)
- How and Dell Ground Vertebrate Fauna of Perth Survey (2000)

The combination of results from Warwick Open Space fauna surveys indicates that there are 2 native mammals, 63 native birds (including 7 species of conservation significance), 13 native reptile species, 1 native amphibian, and 35 native invertebrates (including 1 species of conservation significance). In addition, 5 non-native mammals, 5 non-native birds and 2 non-native invertebrates have been identified at Warwick Open Space. The optimal time for surveying is spring for native flora and winter for weeds.

Fauna Habitat

Vegetation condition at Warwick Open Space, in terms of fauna habitat, ranges from excellent to degraded. Whilst the site provides habitat for several small mammals and birds the inner metropolitan location of Warwick Open Space and its small size limits the reserves use by fauna.

Three fauna habitats were identified in Warwick Open Space:

1. Tuart Woodland over *Banksia* spp, Grass trees, and mixed Myrtaceous, Proteaceous shrubs, *Hibbertia*, *Conostylis*, *Isopogon*, occasional sedges and weeds on yellow sandy soil.
2. Jarrah woodland over *Banksia*, open Grass trees and *Macrozamia*, over sparse sedges, *Hibbertia*, and weeds on grey-brown sandy soil.
3. Jarrah - *Allocasuarina* woodland over *Banksia*, open Grass trees and *Macrozamia*, over sparse sedges, *Hibbertia*, and weeds on grey-brown sandy soil.

Native Fauna

Fauna and flora are interconnected in complex relationships with each other and with factors such as soil, water, climate and landscape. The decline of native fauna can cause loss of plant species and changes to ecological communities.⁵¹

Mammals

Two native mammals were recorded at Warwick Open Space, the Western Grey Kangaroo and Gould's Wattled Bat. The Western Grey Kangaroo (*Macropus fuliginosus*) was identified by old scats which indicate that it no longer persists or is an infrequent visitor to Warwick Open Space.

Gould's Wattled Bat (*Chalinolobus gouldii*) is a microbat and one of approximately 75 species of bat in Australia. These native mammals fall into two main groups: the megabats and the microbats. Two groups of bat occur in Western Australia, flying-foxes (megabats) and insectivorous bats (microbats). Bats can be useful for pest control, feeding on moths, beetles, mosquitoes, invertebrate larvae, flying ants and other invertebrates.⁵² A comprehensive bat survey would require a one week remote monitoring bat survey during summer.⁵³ Bats can be encouraged to roost in the area by installing bat boxes.

⁵¹ DSEWPC (2012)

⁵² DEC (2007)

⁵³ J Tonga (2012), pers. comm., 6 July

Reptiles

Thirteen reptile species were recorded at Warwick Open Space, with the most common being skinks. The Speckled Stone Gecko (*Diplodactylus polyophthalmus*) was observed and is rare elsewhere on the Swan Coastal Plain.

Amphibians

One native amphibian was recorded at Warwick Open Space, the Turtle Frog (*Myobatrachus gouldii*), which is relatively common on the coastal plain. The Turtle Frog is one of the few frogs that does not undergo the tadpole stage and can inhabit sandy areas without free standing water.⁵⁴

Birds

A total of 63 native birds have been recorded as occurring in Warwick Open Space, including the endangered Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) and the vulnerable Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) and Baudin's Black Cockatoo (*Calyptorhynchus baudinii*), as shown in **Appendix 6** and **Appendix 7**.

Carnaby's Black-Cockatoos

Carnaby's Black-Cockatoos are endemic to the south-west of Western Australia. Warwick Open Space contains a confirmed roost site for Carnaby's Black-Cockatoos.⁵⁵ The *Banksia*, *Hakea*, *Grevillea* and Marri species on site provide a significant food source which Carnaby's use for foraging. Carnaby's Black-Cockatoos nest in hollows of smooth-barked eucalypts, including Tuarts (*Eucalyptus gomphocephala*) and Marris (*Corymbia calophylla*) which are found on site.⁵⁶

Artificial hollows could be installed in trees such as Tuart or Marri to encourage Carnaby's Black-Cockatoos or Forest Red-tailed Black Cockatoos to nest, however research indicates that they are most successful when placed where Carnaby's are already known to breed. Further research is still required to ascertain whether it is possible to encourage the birds to breed in areas where they currently aren't breeding. Artificial hollows have been used successfully at Murdoch University and resulted in the breeding of Forest Red-tailed Black Cockatoos. Artificial hollows require regular monitoring due to competitors for nests including European Honey Bees, Galahs, Corellas and Rainbow Lorikeets.⁵⁷

Forest Red-tailed Black Cockatoos

Forest Red-tailed Black Cockatoos are endemic to the south-west of Western Australia. The Marri and Jarrah trees on site provide food for Forest Red-tailed Black Cockatoos, as do introduced species such as Sheoak (*Allocasuarina fraseriana*), Snottygobble (*Personia saccata*) and White Cedar (*Melia azedarach*). Forest Red-tailed Black Cockatoos have been found to nest in hollows of trees such as Jarrah and Marri on site.

Baudin's Black Cockatoo

Baudin's Black Cockatoos are endemic to the south-west of Western Australia. The Jarrah, Marri, *Banksia* and *Hakea* trees on site provide food resources for Baudin's. Baudin's nest in hollows of trees such as Marri and Tuart on site.⁵⁸

⁵⁴ WA Museum (2010a)

⁵⁵ T Kabat (2012), email, 20 June

⁵⁶ DEC (2011a)

⁵⁷ DEC (2011b)

⁵⁸ WA Museum (2010b)

Migratory Species

Migratory species of conservation significance at Warwick Open Space include the Rainbow Bee-eater (*Merops ornatus*) with nests having been observed on site, Fork-tailed Swift (*Apus pacificus*) and Great Egret (*Ardea modesta*). The specially protected Peregrine Falcon (*Falco peregrinus*) has also been recorded on site.

Rainbow Bee-eaters

A Rainbow Bee-eater nest has been observed in the walls of the sump in Warwick Open Space. The Rainbow Bee-eater builds nests in sandy banks and digs tunnels approximately 90 cm long which lead to a nesting chamber, making it vulnerable to trampling by humans or dogs or predation by foxes.⁵⁹ Monitoring of Rainbow Bee-eater nesting sites through monthly inspections and the installation of fencing and signage around exposed nesting sites may decrease trampling of nests by humans or dogs.

Common Native Birds

The most common native birds observed in Warwick Open Space were a range of seasonal and resident nectar feeders such as honey eaters and wattle birds, opportunistic insectivores such as the Western Gerygone (*Gerygone fusca*), Striated Pardalote (*Pardalotus striatus*), Rufous Songlark (*Cincloramphus mathewsi*) and Weebill (*Smicrornis brevirostris*) as well as raptors such as the Australian Hobby (*Falco longipennis*).

Invertebrates

Invertebrates are animals without backbones such as insects, worms and molluscs. Invertebrates constitute more than 95% of all living animal species, with Australia having documented 100,000 species and an estimated 200,000 undescribed invertebrate species.⁶⁰ Some invertebrates are important indicators of ecosystem health, such as ants (seed dispersers), bees (pollinators) or spiders (top invertebrate predators).⁶¹

A total of 35 native invertebrate species were recorded in Warwick Open Space, as shown in **Appendix 6**. The endangered Graceful Sun Moth (*Synemon gratiosa*) has been recorded on site. Whilst the Graceful Sun Moth is Federally listed as endangered under the *Environment Protection and Biodiversity Conservation Act 1999*, it has recently been removed from the State listing under the *Wildlife Conservation Act 1950* as it is no longer considered vulnerable and is now ranked as Priority 4 fauna by the DPaW (refer to **Appendix 8** for conservation codes).

Warwick Open Space is also an important site for the unusual Western Jewel Butterfly (*Hypochrysops halyaetus*) and Sciron Skipper (*Trapezites sciron*).

The majority of the invertebrates identified were spiders (such as wolf spider, golden orb weaver spider, white-tailed spider, jumping spider and huntsman spider), ants (such as bull ant, meat ant and peaceful night ant) and beetles.

⁵⁹ Birdlife Australia (n.d.)

⁶⁰ DEC (n.d.b.)

⁶¹ V Framenau 2012, email, 9 July

Non-native Fauna

Non-native fauna impact native fauna and flora through predation, competition for food and shelter, spreading diseases and destroying habitat. These impacts can result in the diminishing or extinction of native species.⁶²

Non-native animals such as cats, foxes, rabbits, mice, birds, millipedes and bees inhabit the City's bushland, wetland and coastal areas.

Mammals

Non-native mammals that were recorded during field surveys, or evidence indicated their presence include European red fox (*Vulpes vulpes*), rabbit (*Oryctolagus cuniculus*), dog (*Canis lupus*), cat (*Felis catus*) and house mouse (*Mus Musculus*).

Several fox warrens have been identified in Warwick Open Space. Foxes (*Vulpes vulpes*) are common within the City's bushland areas and have caused the decline of many native birds, reptiles and small mammals.⁶³

Several rabbit warrens have been identified in Warwick Open Space. The rabbit (*Oryctolagus cuniculus*) is common within the City's coastal and bushland areas and has the potential to damage large areas of native vegetation. Rabbits also reduce the effectiveness of bushland rehabilitation activities by feeding on newly planted seedlings and provide a source of food for foxes.

Domestic animals such as dogs (*Canis lupus*) can also cause damage to the City's natural environment, particularly when exercised unleashed within natural areas. Dogs can chase and harass native fauna often resulting in stress and harm to the animals. Dogs can also inadvertently spread pathogens if they disturb the soil, particularly around trees. Some dog droppings contain harmful bacteria and nutrients.⁶⁴

Domestic cats (*Felis catus*) have the potential to cause significant environmental harm when enabled to roam within natural areas. Predation of wildlife by domestic cats is known to have serious impacts on the population of native mammals, reptiles and birds within bushland areas along the Swan Coastal Plain.

Birds

A total of 5 non-native species of birds have been recorded in Warwick Open Space including Rock Dove (*Columba livia*), Spotted Turtle-Dove (*Streptopelia chinensis*), Laughing Turtle-Dove (*Streptopelia senegalensis*), Laughing Kookaburra (*Dacelo novaeguineae*) and Rainbow Lorikeet (*Trichoglossus haematodus*), as shown in **Appendix 6**.

Invertebrates

Two non-native invertebrate species were recorded in Warwick Open Space, the European honey bee (*Apis mellifera*) and Portuguese millipede (*Ommatoiulus moreletii*).

Portuguese millipedes were first recorded in Western Australia in 1986 and are now widespread in the south-west of the State. They feed on organic matter such as leaf litter and are not known to impact native flora or fauna. Portuguese millipedes can reach high population levels and be a domestic nuisance when they invade homes and gardens.⁶⁵

⁶² DSEWPC (2012)

⁶³ DPI (2012)

⁶⁴ DEPI (2013)

⁶⁵ M. Widmer (2006)

Several European honey bee beehives have been identified on site. The European honey bee (*Apis mellifera*) is also common within the City's natural areas and may impact upon native flora and fauna through competing with native fauna (including native bees) for floral resources, disrupting natural pollination processes and displacing endemic wildlife from tree hollows. However, European honey bees are important to Australian horticulture and agricultural industries with approximately 65 percent of agricultural production in Australia being dependent on pollination by European honey bees.⁶⁶

Ecological Linkages

Naturally connected landscapes and ecosystems are generally healthier, protect a diversity of species, provide pathways for species movement and can store carbon more effectively than degraded landscapes.⁶⁷ In urban areas where there is engineered infrastructure dividing the landscape, it may be necessary to provide wildlife crossings such as underpasses, tunnels, viaducts or overpasses to enable wildlife movement.

Warwick Open Space is the southerly part of an ecological linkage thread with Yellagonga Regional Park and Neerabup National Park, as shown in **Figure 20**. Whilst Warwick Open Space is not physically connected to Yellagonga Regional Park, as it is separated by the suburb of Greenwood, it is still ecologically linked with movement from fauna (such as birds and insects) and flora (such as seeds and pollen). However, the lack of bushland connectivity may have a negative effect on the recruitment of native species and population genetics.

Within Warwick Open Space the bushland is fragmented due to Lloyd Drive running from north to south from Warwick Road to Beach Road and infrastructure such as Warwick Leisure Centre, Warwick Sports Centre and Warwick Senior High School.

Current Management Approach

The City of Joondalup is implementing a number of management actions to monitor native fauna and address the environmental impacts of domestic and pest animals within the City's natural areas. Monitoring of native fauna occurs through fauna surveys. Control of non-native fauna is undertaken annually within bushland, wetland and coastal areas. Control methods employed include biological and chemical control, trapping, baiting and exclusion methods such as fencing.

The City's current management practices have greatly reduced the incidence of pest animal populations within the City, however continued and coordinated action is required to ensure that populations remain at controllable numbers and that the impacts on natural areas remain at a minimum.

The City also promotes responsible pet ownership and encourages the community to ensure that domestic pets do not have a negative impact of the natural environment.

Recommended Fauna Management Actions:

To monitor and protect native fauna in Warwick Open Space, the following management actions are proposed:

⁶⁶ Rural Industries Research and Development Corporation (n.d.)

⁶⁷ NWCPAG (2012)

Action	Details
Fauna survey	Undertake a follow up fauna survey, in mid-late spring to supplement previous fauna survey undertaken, within 5 years.
Bat survey	Undertake a one week remote monitoring bat survey in summer to supplement previous one night bat survey undertaken in spring.
Installation of bat boxes	If bat survey indicates presence of bats, consider installing bat boxes to encourage bats to roost.
Artificial hollows	Investigate installation of artificial hollows in trees such as Tuart or Marri to encourage Carnaby's Black-Cockatoos or Forest Red-tailed Black Cockatoos to nest.
Rainbow Bee-eater nesting sites	Monitor Rainbow Bee-eater nesting sites through monthly inspections and install fencing and signage around exposed nesting sites to decrease trampling of nests by humans or dogs.
Invertebrates survey	Undertake targeted survey for invertebrates in spring to supplement previous opportunistic invertebrate survey undertaken, within 5 years.
Graceful Sun Moth monitoring	Support ongoing monitoring of the priority species Graceful Sun Moth (<i>Synemon gratiosa</i>).
Feral animal control	Remove feral bee hives (if accessible) and implement regular fox and rabbit control to reduce pressures on native fauna and flora.

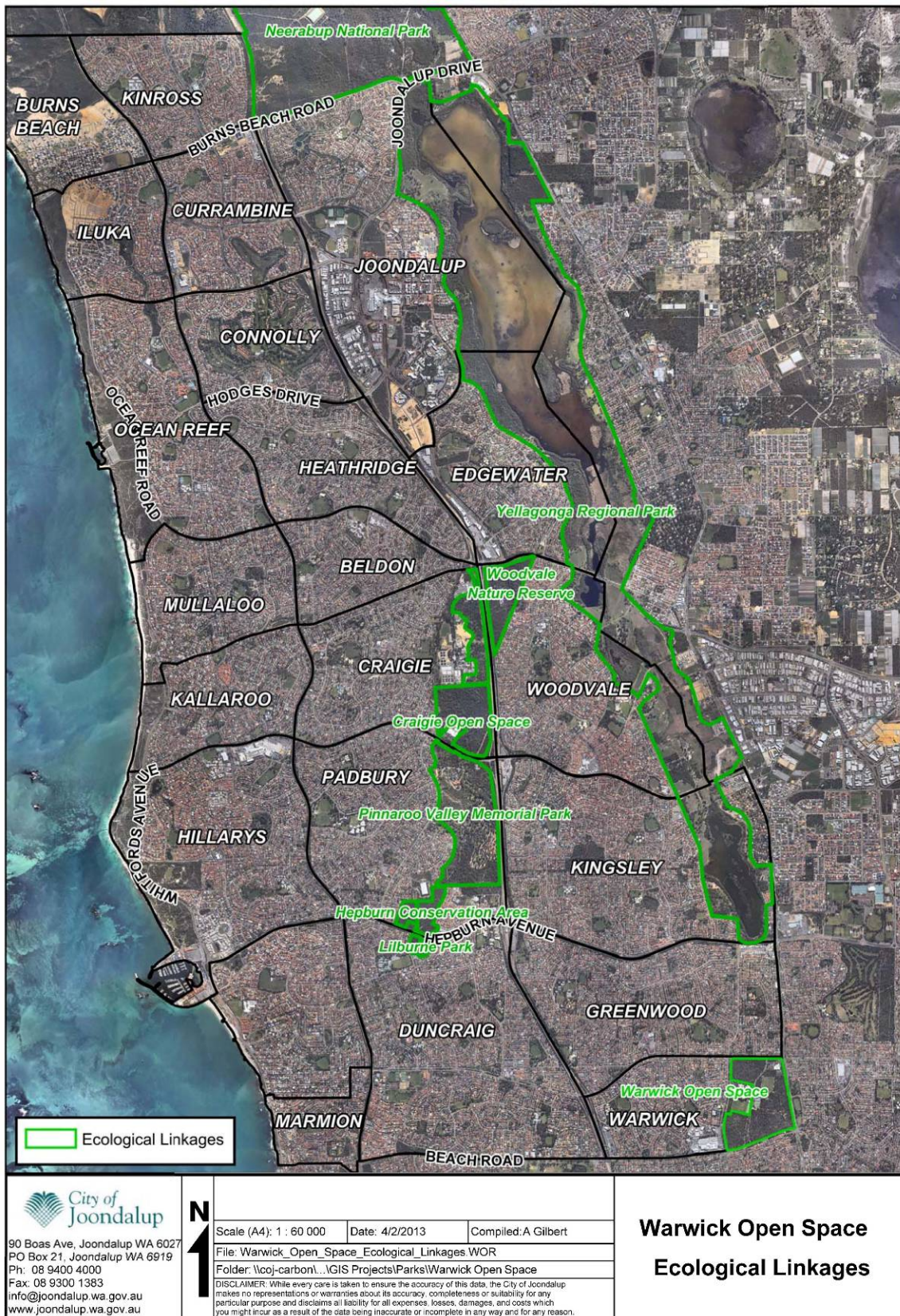


Figure 20: Ecological Linkages to Warwick Open Space

3.5 Social and Built Environment

History and Heritage

Warwick Open Space is not listed on any State or Federal Indigenous or non-Indigenous heritage inventory or register.

Social Value

The main uses of Warwick Open Space are for purposes such as walking, dog walking or cycling. Lloyd Drive in Warwick Open Space is a thoroughfare for people walking to and from Warwick Leisure Centre, Warwick Sports Centre and Warwick Senior High School. A user survey would provide information on the reasons why people visit Warwick Open Space, the number of people and frequency of visits and enable a more targeted environmental education campaign regarding bushland management.

The Friends of Warwick Bushland are a registered Friends Group since 1997 that aim to maintain and improve the condition of the vegetation that remains in Warwick Open Space and Warwick Senior High School. The Friends of Warwick Bushland undertake activities such as surveys, collecting seed, growing plants for revegetation of degraded areas, weed control, removal of rubbish, educational activities at the school, guided walks, displays or talks. The Friends of Warwick Bushland have accumulated a large amount of historical knowledge on the vegetation, flora and fauna on site.

Key external stakeholders for the management of Warwick Open Space include:

- DPaW;
- DFES (formerly Fire and Emergency Services Authority (FESA));
- Friends of Warwick Bushland;
- Warwick Senior High School;
- Warwick Leisure Centre; and
- Warwick Sports Centre.

Access and Infrastructure

Warwick Leisure Centre

Warwick Leisure Centre is located in the north-east of Warwick Open Space on the corner of Warwick Road and Wanneroo Road, as shown in **Figure 21** and **Figure 32**. Warwick Leisure Centre is a Sport and Leisure Stadium operated by the Churches of Christ Sport and Recreation Association Incorporated on behalf of the City of Joondalup. The Leisure Centre includes a crèche, kiosk, function room, dance studio, wet craft room, exercise room, two multi-purpose rooms and four indoor courts used for basketball, netball, volleyball, badminton and multi sports. In addition there are six outdoor courts which are used for netball and tennis. The facility is run seven days per week from 8.30am to 10.30pm.⁶⁸

⁶⁸ Warwick Leisure Centre (2010)



Figure 21: Warwick Leisure Centre

Warwick Sports Centre

Warwick Sports Centre is owned by City of Joondalup and leased by the Warwick Sports Centre Inc. which incorporates the Greenwood Tennis Club Inc., Perth Outlaws Softball Club Inc. and Warwick Bowling Club Inc, as shown in **Figure 22** and **Figure 32**. Warwick Leisure Centre includes 12 tennis courts, 4 bowling greens, an oval and clubrooms.



Figure 22: Warwick Sports Centre

Warwick Senior High School

Warwick Senior High School is a secondary school located at 355 Erindale Road, Warwick, as shown in **Figure 23** and **Figure 32**. Warwick Senior High School is surrounded by 1.5 ha of bushland and is situated on crown land. The school currently has 600 students from Year 8 to Year 12 and is equipped with buildings, a gymnasium, tennis, netball and basketball courts, playing field, open air amphitheatre and a swimming pool.⁶⁹ The management of the Warwick Senior High School bushland can directly effect the Warwick Open Space bushland through the potential transference of weeds or pathogens. Liaison with Warwick Senior High School could assist in aligning bushland management strategies across the whole site and increase awareness of the bushland ecological values.



Figure 23: Warwick Senior High School

Parking

Several car parks are available adjoining Warwick Leisure Centre, Warwick Sports Centre and Warwick Senior High School (see **Figure 32**). An informal car park is located at the southern end of the tennis courts which requires resurfacing as it currently pools water due to the uneven surface. There may also be some stormwater runoff from the car park to the adjacent vegetation which can contain pollutants.

Roads

Lloyd Drive is the main road dissecting Warwick Open Space. There are speed bumps located at frequent intervals along Lloyd Drive to slow down traffic, making it safer for movement of people and fauna.

⁶⁹ Department of Education (n.d.)

Utilities

Several public utilities operate within Warwick Open Space, as shown in **Figure 24**, **Figure 25** and **Figure 26**.

Power, Lighting and Telecommunications

Warwick Open Space contains power, lighting and telecommunications infrastructure as shown in **Figure 24**. Western Power are responsible for conducting vegetation pruning with at least two metres clearance for the distribution power line at Warwick Open Space as the surrounding vegetation is naturally occurring.⁷⁰ Vegetation pruning around the overhead power line is undertaken by Western Power approximately once every six months.

Water

Figure 25 outlines the Water Corporation hydrants and reticulation mains within and surrounding Warwick Open Space. The oval near the Warwick Sports Centre and the Warwick Senior High School and the grassed area near the tennis courts are irrigated. Some landscaped areas near infrastructure are also irrigated. Sprinklers are maintained as required to ensure that there is no spray into nearby bushland.

Sewerage

Figure 26 shows the Water Corporation sewerage infrastructure in place at Warwick Open Space. The Water Corporation maintain the sewerage infrastructure on an as required basis.

⁷⁰ Department of Commerce (2012)

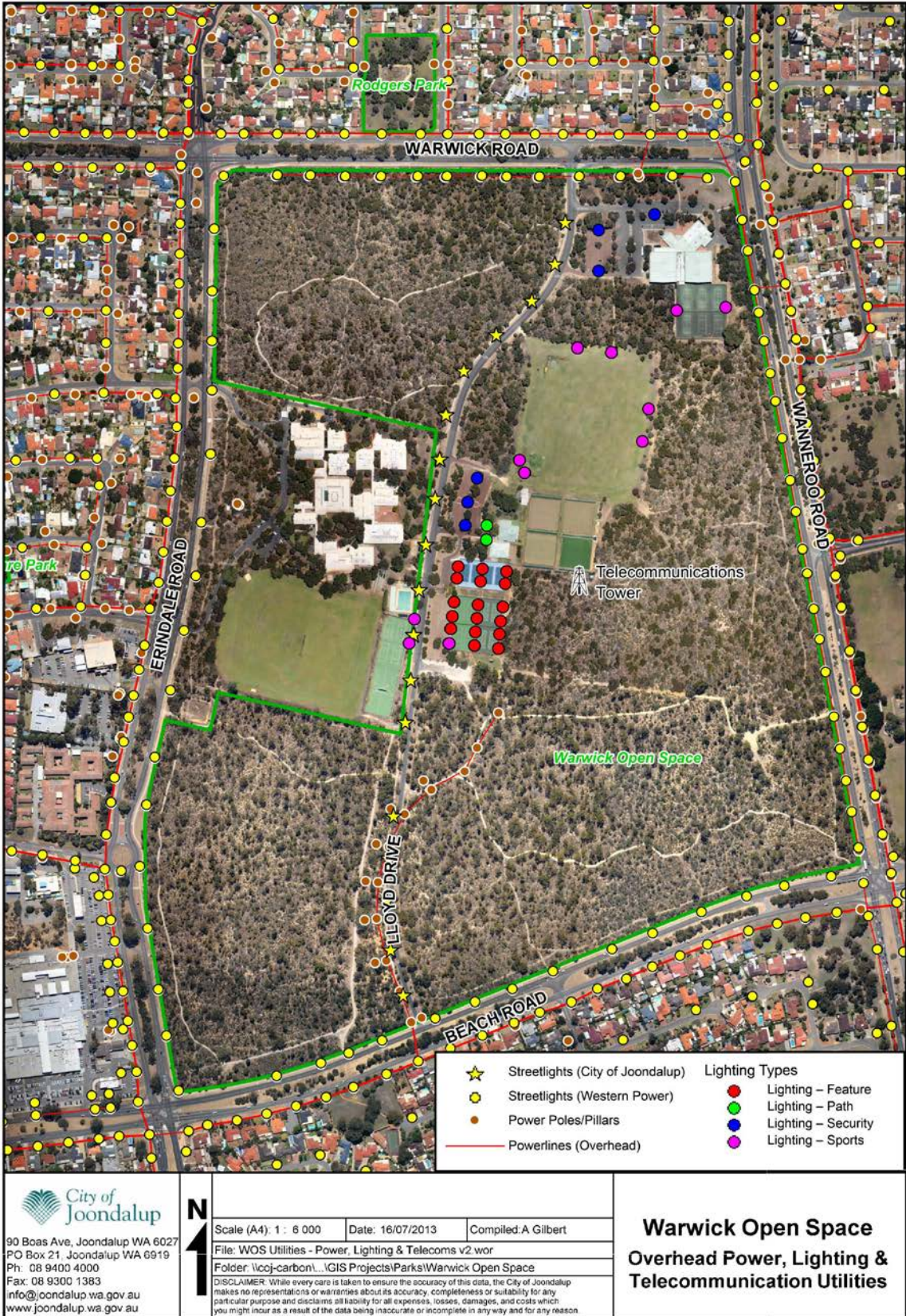


Figure 24: Warwick Open Space Power, Lighting and Telecommunications Utilities



Figure 25: Warwick Open Space Water Utilities



Figure 26: Warwick Open Space Sewerage Utilities

Conservation Fencing

Conservation fencing is used to restrict access and protect areas of bushland. Timber post and galvanized chain mesh fencing surrounds the outer perimeter of Warwick Open Space and along Lloyd Drive. (see **Figure 27** and **Figure 32**). Fencing also surrounds the sump and Warwick Senior High School located on site. Some of the fencing on site requires upgrading with plastic coated galvanized chain mesh. There are several small sections of bushland that require fencing to be installed within Warwick Open Space.

Fencing is inspected on a monthly basis and repairs are conducted as required.



Figure 27: Fencing at Warwick Open Space

Access Points

Access points allow people to enter natural areas that are fenced off and often give access to paths. There are numerous access points in Warwick Open Space, as shown in **Figure 32**. Some of these access points have turnstyle gates, whilst others have chained gates.

Paths and Trails

Paths in Warwick Open Space are used for pedestrian access, fire access ways and bushland management and maintenance purposes. The paths in Warwick Open Space are mostly used by pedestrians, dog walkers and cyclists. Lloyd Drive dissects the middle of Warwick Open Space and can be used to access Warwick Leisure Centre, Warwick Sports Centre and Warwick Senior High School as well being a thoroughfare between Beach Road and Warwick Road. The Warwick Open Space bushland is often used as a direct route from the Warwick Senior High School to the Centro Warwick Shopping Centre. There are several

limestone paths and sand paths in Warwick Open Space, as shown in **Figure 32**. There are also a few informal tracks. The use of informal tracks can spread and establish weeds and reduce the vegetation condition. The City's *Walkability Plan 2013-2018* includes a recommendation to 'identify a suitable location within Warwick Open Space for the installation of a dual-use pathway to connect surrounding schools and recreation facilities to the area'.⁷¹

Access and Inclusion

Four million Australians (20%) reported having a disability in the Survey of Disability, Ageing and Carers conducted in 2009. The study considers disability to include any impairments, activity limitations and participation restrictions which impede everyday activities for a period of at least 6 months. In 15 years time the number of West Australians with a disability is expected to increase from 1 in 5 people (20%) to 1 in 4 people (25%).

The City of Joondalup has an *Access and Inclusion Plan 2012-2014*, outlining that 'the City is committed to ensuring that its activities and services are inclusive of all members, including people with disabilities and their families or carers, and people from culturally and linguistically diverse backgrounds'.

It is difficult for people with a disability to access Warwick Open Space through the current gates or to use the limestone paths due to the uneven limestone surface. The *Walkability Plan 2013-18* includes a recommendation to 'maintain existing internal and external trails to meet trail useability and accessibility standards'.⁷¹

Signage

Signage is important to encourage community appreciation and inform the community of the ecological values of the site. There are numerous signs at Warwick Open Space on the corners of the site and near the main entrances, detailing information such as the name of the site, that it is a natural bush area and is owned by City of Joondalup. An example of one of the signs in Warwick Open Space is shown in **Figure 28**. There are also signs outlining the different infrastructure and facilities on site such as Warwick Leisure Centre, Warwick Sports Centre and Warwick Senior High School.

There is currently no interpretive or educational signage within Warwick Open Space. Interpretive signage uses maps to indicate trails. Educational signage increases awareness of the ecological values of the bushland. The City is developing a *Signage Strategy* in 2013/14 to enable the provision of information and interpretive messages within the City's natural areas. The *Signage Strategy* will be used to develop and install a Bushland Signage System.

⁷¹ CoJ (2013)



Figure 28: Warwick Open Space Signage

Toilets

A toilet block was previously located at the southern end of the tennis courts at Warwick Open Space. The toilet block was demolished in 2003 due to anti-social behaviour and vandalism. Some users of the public oval currently use the bushland for toilet purposes. Providing access to public toilet facilities near the public oval could protect the bushland from environmental impacts associated with toilet use.

Seating

Warwick Open Space contains several picnic tables and benches, located near sporting infrastructure such as the public oval and tennis courts, as shown in **Figure 29**.



Figure 29: Picnic tables at south end of tennis courts

Rubbish

Rubbish bins are generally installed in locations where people gather to socialise or undertake recreational activities. There is a general waste bin and a dog poop bin located on the corners of the public oval. The site often contains a small amount of rubbish, mainly on the edges of the vegetation and near sporting infrastructure. Dumping of rubbish frequently occurs on Lloyd Drive. Installation of an extra rubbish bin at an access way with high human traffic use may reduce the amount of rubbish disposed of in the Warwick Open Space bushland.

Rubbish is collected by the City on an as needed basis, sometimes in conjunction with hand weeding activities.

The City monitors the amount of waste present in Warwick Open Space on an annual basis. There has been a decrease in the amount of waste present within Warwick Open Space in 2011/12 due to targeted collections being conducted by the City of Joondalup while completing other works in the reserve (see **Figure 30**).

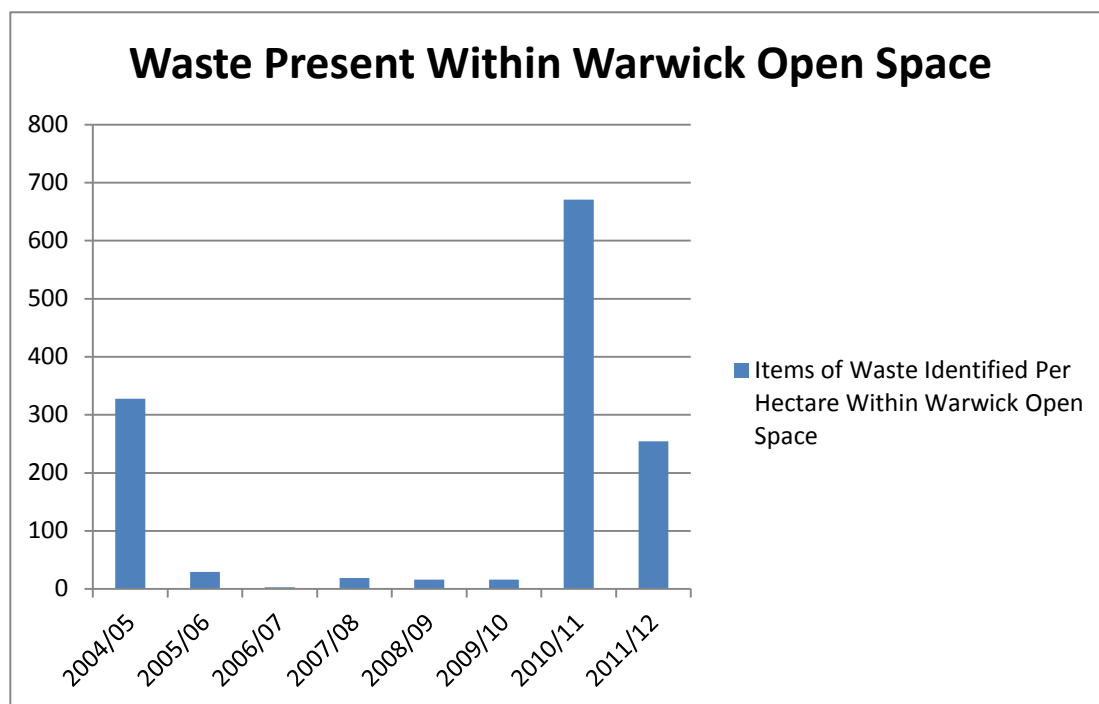


Figure 30: Amount of Waste Present within Warwick Open Space

Antisocial Behaviour

There is a history of cubby houses being built in Warwick Open Space with resulting rubbish surrounding it. Monthly inspections are conducted and cubbies are dismantled by City of Joondalup as required.

Water Sensitive Urban Design

Retrofitting the sump at Warwick Open Space could improve the water quality of stormwater being discharged and enhance the visual appeal of the current sump area, incorporating it into public open space.⁷² The fenced off sump at Warwick Open Space is on Erindale Road, near the corner of Eddington Road (see **Figure 31**). A Rainbow Bee-eater nest has been observed in the walls of the sump.

The City of Joondalup undertakes a City Sump Improvement Program as part of the capital works Stormwater Drainage Program utilising Water Sensitive Urban Design and water quality improvement principles. Water Sensitive Urban Design incorporates water supply, wastewater, stormwater and groundwater management, urban design and environmental protection into an integrated design of the urban water cycle.⁷³ The sump in Warwick Open Space could be included in the City Sump Improvement Program.

⁷² DoE (2004)

⁷³ JSCWSC (2009)



Figure 31: Fenced off Sump at Warwick Open Space

Recommended Social and Built Environment Management Actions:

To enhance the social and built environment in Warwick Open Space, the following management actions are proposed:

Action	Details
User survey	Conduct a user survey to provide information on the reasons why people visit Warwick Open Space, the number of people and frequency of visits and enable a more targeted environmental education campaign regarding bushland management.
Liaise with Warwick Senior High School	Liaise with Warwick Senior High School to ensure alignment of bushland management strategies.
Investigate resurfacing informal car park	Investigate viability of resurfacing informal car park at southern end of tennis courts to protect adjacent vegetation.
Install conservation fencing	Install conservation fencing on priority sections of the unfenced bushland in Warwick Open Space to restrict access and protect vegetation.
Upgrade conservation fencing	Upgrade conservation fencing on outer perimeter of Warwick Open Space and along Lloyd Drive to replace galvanized chain mesh with plastic coated galvanized chain mesh.
Maintain conservation fencing	Maintain conservation fencing on an as needed basis (informed by monthly inspections) to protect the native vegetation, flora and fauna from informal access.
Investigate closure and rehabilitation of informal tracks	Investigate closure and rehabilitation of informal tracks that are used infrequently to protect vegetation.

Action	Details
Implement <i>Walkability Plan 2013-2018</i>	Implement recommendations from the <i>Walkability Plan 2013-2018</i> that are applicable to the management of Warwick Open Space.
Develop Signage Strategy	Develop a <i>Signage Strategy</i> to improve access and walkability and inform the development and implementation of a Bushland Signage System.
Investigate viability of access to public toilet facilities	Investigate viability of providing access to public toilet facilities near public oval.
Investigate installation of rubbish bin	Investigate installation of an additional rubbish bin in Warwick Open Space at an access way with high human traffic use and incorporate the bin into the City weekly bin emptying schedule.
Monitor and report waste	Monitor and report the amount of waste present in Warwick Open Space on an annual basis.
Dismantle cubby houses	Dismantle cubby houses as required to discourage the disposal of rubbish in the surrounding area.
Consider inclusion of sump in the City Sump Improvement Program	Consider viability of including Warwick Open Space sump in the City Sump Improvement Program to improve the water quality of the stormwater being discharged and enhance the visual appeal and community usability of the area.



Figure 32: Infrastructure at Warwick Open Space

3.6 Fire Management

Fire is an important natural feature of the Western Australian landscape. Fire helps to shape the diversity of plant communities with many native plants having developed fire-related adaptations over time, for example fire expedites many species to flower or germinate. Human activity such as accidents and arson have resulted in increased incidences of fire within many urban bushland reserves, which can have a negative effect on biodiversity and encourage growth of highly flammable and invasive weeds.

Bushfires are unplanned fires that can be caused by events such as lightning, planned burning operations, escape from industrial activities, damaged power transmission lines, discarded cigarette butts or deliberate arson. Bushfires can cause significant damage to people, property and the environment.⁷⁴

Management of Warwick Open Space is the responsibility of the City of Joondalup. The City of Joondalup has a “duty of care” to take all reasonable precautions to prevent any bushfire from spreading onto neighbouring property. The City of Joondalup does not currently have a prescribed burn management regime for the area.

DFES work with the community and government to prevent, prepare for, respond to and recover from a diverse range of emergencies.⁷⁵

Objectives

The objectives of fire management within Warwick Open Space are to:

- Protect life, property and environment in Warwick Senior High School, Warwick Leisure Centre, Warwick Sports Centre and adjacent residential areas.
- Fulfil obligations under the *Bushfires Act 1954*.
- Protect the ecological and amenity values of Warwick Open Space and Warwick Senior High School bushland.
- Protect landscape values (including flora and fauna) from uncontrolled fire and inappropriate suppression techniques.
- Reduce the frequency, impact and area of unplanned fires.
- Minimise the spread of disease and weeds during fire fighting operations and when establishing firebreaks.
- Minimise impacts on air quality.

Fire Risk

A fire fuel load assessment was conducted at Warwick Open Space in October 2012 which indicated that the site has a very high fuel load of 30 tonnes / ha. The fuel load assessment was undertaken according to the methodology from the FESA *Visual Fuel Load Guide for the Scrub Vegetation of the Swan Coastal Plain*.⁷⁶ Fuel load assessments are conducted annually at Warwick Open Space.

⁷⁴ EDOWA (2011)

⁷⁵ DFES (2013a)

⁷⁶ FESA (2007)

Fire Prevention

The City of Joondalup implements a number of on ground measures to reduce the risk of fire, including undertaking:

- Controlled access;
- Non-native flora species management;
- Fuel load assessment and management; and
- Maintenance and installation of fire access tracks (fire access ways and strategic firebreaks).

Weed control and maintenance of fire access tracks are conducted in accordance with the City's Annual Bushland Schedule. The City of Joondalup will develop a Fire Management Plan in 2013/14, outlining the City's strategy for assessing fire risk, prevention, response and recovery.

The DFES have developed a *Fire Pre-Plan for the Urban Bushland Area of Warwick Open Space*⁷⁷ including site specific information on ecologically sensitive areas, risk management strategies, hazards, communications plan and fire suppression strategy and tactics. The Fire Pre-Plan is updated by the DFES annually in conjunction with key stakeholders including City of Joondalup.

There are numerous water hydrants located around Warwick Open Space which are installed and maintained by the Water Corporation, as shown in **Figure 25**.

Fire Occurrences

There are periodic fires at Warwick Open Space, the majority of which are believed to be deliberately lit. The frequency of fires has lessened since 2007. This could be due to factors such as the DFES bushfire awareness campaigns. Fire occurrences at Warwick Open Space are detailed in **Table 3**. Monitoring of fire occurrences and detailing fire incidents and frequency through mapping and updating the City's Geographic Information System (GIS) layer could inform fire prevention actions.

Dates	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002
Fire Occurrences	7	9	3	7	17	30	20	23	20	13	30

Table 3: Fire Occurrences at Warwick Open Space (DFES 2013b)

Fire Response

The closest branch of the DFES is located at the Duncraig Fire Station on Hepburn Avenue in Duncraig and they are responsible for suppressing fires within Warwick Open Space. The Western Australia Police are responsible for the evacuation of residents and visitors, if required.

⁷⁷ DFES (n.d.)

Fire Recovery

Weed control is revised after fire incidents to aid regrowth by selecting appropriate chemicals, targeting weeds if safe to do so for new seedlings, and spraying grasses using backpacks.

Recommended Fire Management Actions:

To prevent fire occurrences and minimise the environmental impact of fire occurrences in Warwick Open Space, the following management actions are proposed:

Action	Details
Assess fire fuel load	Annually assess and report fire fuel load using the FESA <i>Visual Fuel Load Guide for the Scrub Vegetation of the Swan Coastal Plain</i> to inform fire prevention actions required.
Maintain fire access tracks and footpaths	Maintain fire access tracks and footpaths, including weed control and pruning of vegetation, by implementing Annual Bushland Schedule.
Develop and implement Fire Management Plan	Develop and implement a Fire Management Plan, outlining the City's strategy for assessing fire risk, prevention, response and recovery.
Monitor fire occurrences	Monitor fire occurrences through mapping and updating Geographic Information System (GIS) layers detailing fire incidents and frequency to inform fire prevention actions.
Revise weed control after fire incidents	Revise weed control after fire incidents to aid regrowth by selecting appropriate chemicals, targeting weeds if safe to do so for new seedlings, and spraying grasses using backpacks.

3.7 Education and Training

Environmental objectives cannot be achieved through the actions of the City alone; the community can also affect the local environment in both positive and negative ways. Environmental outcomes require the support of an engaged community that is aware and participating in environmental activities.

The community provides significant input into the protection and enhancement of the City's natural areas through the participation in environmental volunteer groups known as Friends Groups.

Current Management Approach

The City implements an Annual Environmental Education Program to address key environmental issues and encourage greater environmental stewardship by the community.

The City of Joondalup actively encourages participation within its community to raise awareness of key environmental issues within the City.

It is proposed that the City consider developing an Adopt a Bushland program for students from years 3 to 7 to provide an interactive bushland management program. The Adopt a Bushland program could be trialled with Warwick Senior High School.

The City of Joondalup Natural Areas Team currently conduct weekly plant identification training, including weed management. New members in the Natural Areas Team undertake training for the identification and management of pathogens.

Recommended Education and Training Management Actions:

To increase community awareness and training opportunities regarding natural areas management, the following actions are proposed:

Action	Details
Environmental Education Program	Implement initiatives of a 'Think Green Biodiversity' campaign (part of the Environmental Education Program) targeting environmental issues such as: <ul style="list-style-type: none"> • pathogens; • weeds; • fire; • flora and fauna awareness; • prevention of hand feeding wildlife; and • responsible pet ownership.
Support 'Friends of Warwick Bushland'	Support the 'Friends of Warwick Bushland' group and encourage community participation in the management of this natural area.
Consider developing Adopt a Bushland program	Consider developing an Adopt a Bushland program for students to provide an interactive bushland management program.
Natural Areas Team training	Conduct Natural Areas Team plant identification training, including weed management, to increase the effectiveness of weed control activities, as required.

4.0 Management Actions

4.1 Management Actions Summary

A summary of recommended management actions is outlined in Section 4.7.

4.2 Auditing and Inspections

Inspections of Warwick Open Space are conducted by the City of Joondalup once every 4 weeks.

4.3 Key Performance Indicators

The City annually reports against the following Key Performance Indicators relating to natural areas:

- Percentage density of priority environmental weeds.
- Incidence of foreign material within natural area / ha.

4.4 Routine Reporting

Assessing the management of Warwick Open Space will be undertaken through annually reporting progress against management of the completion of actions and Key Performance Indicators in this Plan.

4.5 Scientific Research and Monitoring

A Natural Areas Initial Assessment is to be conducted on Warwick Open Space every 5 years. The most recent assessment was conducted in 2011/12. The next assessment is to be conducted in 2016/17, prior to the review of the Warwick Open Space Bushland Management Plan.

Surveys in Warwick Open Space of flora, weeds, fungi, fauna, invertebrates, bats and the Graceful Sun Moth are to be conducted in 2015/16 and 2016/17.

Fire fuel load assessments of Warwick Open Space are to be undertaken annually.

4.6 Management Plan Review

The Warwick Open Space Bushland Management Plan is to be reviewed every 5 years. The next review is due in 2018/19.

4.7 Summary of Recommended Management Actions

Biodiversity Conservation Area	Recommended Management Action	Detail
Flora	Weed control	Undertake regular weed control by implementing Annual Bushland Schedule.
Flora	Monthly weed monitoring	Conduct monthly weed monitoring to establish the extent of weeds and to identify priority weed species.
Flora	Annual weed monitoring and reporting	Monitor and report on the density of priority environmental weeds in Warwick Open Space on an annual basis, using three transects.
Flora	Weed management on verges	Conduct weed management of weeds on verges within Warwick Open Space.
Flora	Develop <i>Weed Management Plan</i>	Development of <i>City of Joondalup Weed Management Plan</i> .
Flora	Implement <i>Weed Management Plan</i>	Implement recommendations relevant to Warwick Open Space from the <i>City of Joondalup Weed Management Plan</i> .
Flora	<i>District Planning Scheme No. 3 Schedule 5</i>	Investigate incorporation of Warwick Open Space into <i>District Planning Scheme No. 3 Schedule 5</i> through internal review process to assist in protecting native vegetation and ecosystems.
Flora	Revegetation	Conduct revegetation on degraded or completely degraded areas using local provenance species, as required.
Flora	Investigate planting Tuart trees	Investigate planting of Tuart trees (<i>Eucalyptus gomphocephala</i>) in Warwick Open Space.
Flora	Natural Areas Initial Assessment	Conduct five yearly Natural Areas Initial Assessment in spring.
Flora	Flora survey	Undertake a flora survey in spring, within 5 years.
Flora	Weed survey	Undertake weeds survey in winter, within 5 years.
Plant Diseases	Implement <i>Pathogen Management Plan</i>	Implement recommendations relevant to Warwick Open Space from the <i>Pathogen Management Plan</i> .
Fungi	Fungi survey	Undertake a fungi survey in autumn or winter after substantial rain, within 5 years.
Fauna	Feral animal control	Remove feral bee hive (if accessible) and implement regular fox and rabbit control.
Fauna	Graceful Sun Moth monitoring	Support ongoing monitoring of the priority species Graceful Sun Moth (<i>Synemon gratiosa</i>).
Fauna	Rainbow Bee-eater nesting sites	Monitor Rainbow Bee-eater nesting sites through monthly inspections and install fencing and signage around exposed nesting sites.
Fauna	Artificial hollows	Investigate installation of artificial hollows in trees such as Tuart or Marri.
Fauna	Fauna survey	Undertake a fauna survey in mid-late spring, within 5 years.
Fauna	Invertebrates survey	Undertake a targeted survey for invertebrates in spring, within 5 years.
Fauna	Bat survey	Undertake a one week remote monitoring bat survey in summer.
Fauna	Installation of bat boxes	If bat survey indicates presence of bats, consider installing bat boxes to encourage bats to roost.
Social and Built Environment	Monitor and report waste	Monitor and report the amount of waste present in Warwick Open Space on an annual basis.

Biodiversity Conservation Area	Recommended Management Action	Detail
Social and Built Environment	Investigate installation of rubbish bin	Investigate installation of an additional rubbish bin in Warwick Open Space at an access way with high human traffic use and incorporate the bin into the City weekly bin emptying schedule.
Social and Built Environment	Dismantle cubby houses	Dismantle cubby houses as required.
Social and Built Environment	Maintain conservation fencing	Maintain conservation fencing on an as needed basis (informed by monthly inspections).
Social and Built Environment	Install conservation fencing	Install conservation fencing on priority sections of the unfenced bushland in Warwick Open Space to restrict access and protect vegetation.
Social and Built Environment	Upgrade conservation fencing	Upgrade conservation fencing on outer perimeter of Warwick Open Space and along Lloyd Drive to replace galvanized chain mesh with plastic coated galvanized chain mesh.
Social and Built Environment	Develop <i>Signage Strategy</i>	Develop a <i>Signage Strategy</i> to improve access and walkability and inform the development and implementation of a Bushland Signage System.
Social and Built Environment	Develop Bushland Signage System	Develop Bushland Signage System.
Social and Built Environment	Implement Bushland Signage System	Implement recommendations relevant to Warwick Open Space from the Bushland Signage System.
Social and Built Environment	Implement <i>Walkability Plan 2013-2018</i>	Implement recommendations relevant to Warwick Open Space from the <i>Walkability Plan 2013-2018</i> .
Social and Built Environment	Liaise with Warwick Senior High School	Liaise with Warwick Senior High School to ensure alignment of bushland management strategies.
Social and Built Environment	User survey	Conduct a user survey to provide information on the usage of Warwick Open Space.
Social and Built Environment	Investigate resurfacing informal car park	Investigate viability of resurfacing informal car park at southern end of tennis courts to protect adjacent vegetation.
Social and Built Environment	Investigate viability of access to public toilet facilities	Investigate viability of providing access to public toilet facilities near public oval.
Social and Built Environment	Investigate closure and rehabilitation of informal tracks	Investigate closure and rehabilitation of informal tracks that are used infrequently to protect vegetation.
Social and Built Environment	Consider inclusion of sump in City Sump Improvement Program	Consider viability of including Warwick Open Space sump in the City Sump Improvement Program.
Fire Management	Maintain fire access tracks and footpaths	Maintain fire access tracks and footpaths, including weed control and pruning of vegetation by implementing Annual Bushland Schedule.
Fire Management	Assess and report on fire fuel load	Annually assess and report on fire fuel load.

Biodiversity Conservation Area	Recommended Management Action	Detail
Fire Management	Monitor fire occurrences	Map fire incidents and update GIS layer detailing fire incidents and frequency.
Fire Management	Revise weed control after fire incidents	Revise weed control after fire incidents.
Fire Management	Develop <i>Fire Management Plan</i>	Develop <i>Fire Management Plan</i> .
Fire Management	Implement <i>Fire Management Plan</i>	Implement recommendations relevant to Warwick Open Space from the <i>Fire Management Plan</i> .
Education and Training	Natural Areas Team Training	Conduct Natural Areas Team plant identification training, including weed management, as required.
Education and Training	Environmental Education Program	Implement initiatives of a 'Think Green Biodiversity' campaign (part of the Environmental Education Program) targeting environmental issues such as: <ul style="list-style-type: none"> • pathogens; • weeds; • fire; • flora and fauna awareness; • prevention of hand feeding wildlife; and • responsible pet ownership.
Education and Training	Support 'Friends of Warwick Bushland'	Support the 'Friends of Warwick Bushland' group and encourage community participation in the management of this natural area.
Education and Training	Consider developing Adopt a Bushland program	Consider developing an Adopt a Bushland program for students.

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6.0 Appendices

Appendix 1 – Warwick Open Space Flora Species Lists

Appendix 2 – Warwick Open Space Key Flora Species

Appendix 3 - Conservation Codes for Western Australian Flora

Appendix 4 – Keighery Scale Definitions

Appendix 5 – Warwick Open Space High Priority Weed Species Management

Appendix 6 – Warwick Open Space Fauna Species Lists

Appendix 7 – Warwick Open Space Key Fauna Species

Appendix 8 – Conservation Codes for Western Australian Fauna

Appendix 9 – Warwick Open Space Fungi Species List

Appendix 10 – Warwick Open Space Key Fungi Species

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Warwick Open Space Flora Species List

P3 or P4 = listed by the DEC as a Priority species, S = significant flora of the Perth Metropolitan region (DEP 2000)

* = Weed of National Significance, # = Declared Plant, H = High priority weeds of the Environmental Weed Strategy for WA (DEC 1999)

Flora species list comparison of Warwick Open Space flora surveys

Family	Latin Name	Common Name	Introduced	Status	Recorded ELA (2012)	Recorded Brundrett & Clarke (2001 & 2004)	City of Joondalup Field Assessments (2005 & 2011)	City of Wanneroo (1995)
Aizoaceae	<i>Carpobrotus edulis</i>	Hottentot Fig	Y		Y	Y		Y
Aizoaceae	<i>Carpobrotus virescens</i>	Coastal Pigface					Y	
Aizoaceae	<i>Galenia pubescens</i>	Coastal Galenia	Y			Y		
Aizoaceae	<i>Tetragonia decumbens</i>	Sea Spinach	Y					
Amaranthaceae	<i>Ptilotus drummondii</i>	Narrowleaf Mulla Mulla				Y	Y	
Amaranthaceae	<i>Ptilotus manglesii</i>	Pom Poms			Y	Y		
Amaranthaceae	<i>Ptilotus polystachyus</i>	Prince of Wales Feather			Y	Y		
Anacardiaceae	<i>Schinus terebinthifolius</i>		Y			Y		
Anarthriaceae	<i>Lyginia barbata</i>						Y	
Anarthriaceae	<i>Lyginia imberbis</i>					Y		
Apiaceae	<i>Daucus glochidiatus</i>	Australian Carrot			Y	Y		
Apiaceae	<i>Eryngium pinnatifidum</i> (formerly <i>Eryngium rostratum</i>)	Blue Devils			Y	Y		Y
Apiaceae	<i>Foeniculum vulgare</i>	Fennel	Y			Y		
Apiaceae	<i>Homalosciadium homalocarpum</i>				Y			
Apiaceae	<i>Xanthosia huegelii</i>				Y	Y	Y	
Araliaceae	<i>Trachymene pilosa</i>	Native Parsnip			Y	Y		Y
Asparagaceae	<i>Agave americana</i>	Century Plant	Y			Y		
Asparagaceae	<i>Lachenalia bulbifera</i>		Y			Y		
Asparagaceae	<i>Lomandra caespitosa</i>	Tufted Mat Rush			Y	Y		Y

Family	Latin Name	Common Name	Introduced	Status	Recorded ELA (2012)	Recorded Brundrett & Clarke (2001 & 2004)	City of Joondalup Field Assessments (2005 & 2011)	City of Wanneroo (1995)
Asparagaceae	<i>Lomandra hermaphrodita</i>					Y		
Asparagaceae	<i>Lomandra maritima</i>					Y	Y	
Asparagaceae	<i>Lomandra nigricans</i>					Y		Y
Asparagaceae	<i>Lomandra preissii</i>					Y	Y	
Asparagaceae	<i>Lomandra</i> sp. (sterile)				Y			
Asparagaceae	<i>Lomandra suaveolens</i>					Y		
Asparagaceae	<i>Ornithogalum arabicum</i>	Lesser Cape Lily	Y			Y		
Asparagaceae	<i>Sowerbaea laxiflora</i>	Purple Tassels			Y	Y		
Asparagaceae	<i>Thysanotus arenarius</i>					Y		
Asparagaceae	<i>Thysanotus manglesianus</i>	Fringed Lily			Y	Y		Y
Asparagaceae	<i>Thysanotus</i> sp. scps					Y		
Asparagaceae	<i>Thysanotus</i> sp. sterile				Y			
Asparagaceae	<i>Thysanotus sparteus</i>					Y	Y	
Asparagaceae	<i>Thysanotus thyrsoideus</i>					Y		
Asparagaceae	<i>Thysanotus triandrus</i>					Y		Y
Asphodelaceae	<i>Trachyandra divaricata</i>	False Onion Weed	Y		Y	Y		
Asteraceae	<i>Arctotheca calendula</i>	Cape Weed	Y		Y	Y		
Asteraceae	<i>Asteridea pulverulenta</i>	Common Bristle Daisy				Y		Y
Asteraceae	<i>Centaurea melitensis</i>	Maltese Cockspur	Y			Y		
Asteraceae	<i>Chondrilla juncea</i>	Skeleton Weed	Y	#		Y		
Asteraceae	<i>Conyza sumatrensis</i> (formerly <i>Conyza albida</i>)	Broadleaf Fleabane				Y		
Asteraceae	<i>Cotula turbinata</i>	Funnel Weed	Y		Y	Y		
Asteraceae	<i>Craspedia</i>					Y		
Asteraceae	<i>Dimorphotheca ecklonis</i>		Y			Y	Y	

Family	Latin Name	Common Name	Introduced	Status	Recorded ELA (2012)	Recorded Brundrett & Clarke (2001 & 2004)	City of Joondalup Field Assessments (2005 & 2011)	City of Wanneroo (1995)
Asteraceae	<i>Dittrichia graveolens</i>	Stinkwort	Y			Y		
Asteraceae	<i>Euchiton sphaericus</i>					Y		
Asteraceae	<i>Gamochaeta coarctata</i>		Y			Y		
Asteraceae	<i>Gazania linearis</i>		Y		Y	Y	Y	
Asteraceae	<i>Hedypnois rhagadioloides</i> subsp. <i>cretica</i>		Y		Y			
Asteraceae	<i>Hypochaeris glabra</i>	Smooth Catsear	Y		Y	Y	Y	Y
Asteraceae	<i>Lactuca serriola</i>	Prickly Lettuce	Y					
Asteraceae	<i>Lagenophora huegelii</i>					Y		
Asteraceae	<i>Monoculus monstrosus</i> (formerly <i>Osteospermum clandestinum</i>)		Y		Y	Y		
Asteraceae	<i>Olearia axillaris</i>	Coastal Daisybush				Y		
Asteraceae	<i>Olearia elaeophila</i>					Y		
Asteraceae	<i>Ozothamnus cordatus</i>					Y	Y	
Asteraceae	<i>Podolepis gracilis</i>	Slender Podolepis			Y	Y		
Asteraceae	<i>Podotheca angustifolia</i>	Sticky Longheads				Y		
Asteraceae	<i>Podotheca chrysantha</i>	Yellow Podotheca				Y		
Asteraceae	<i>Podotheca gnaphalioides</i>	Golden Longheads			Y	Y		
Asteraceae	<i>Quinetia urvillei</i>				Y	Y		
Asteraceae	<i>Rhodanthe citrina</i> (formerly <i>Waitzia citrina</i>)					Y		
Asteraceae	<i>Senecio vulgaris</i>	Common Groundsel	Y			Y		
Asteraceae	<i>Sonchus oleraceus</i>	Common Sowthistle	Y		Y	Y	Y	
Asteraceae	<i>Urospermum picroides</i>	False Hawkbit	Y			Y		
Asteraceae	<i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>		Y		Y	Y		Y
Asteraceae	<i>Waitzia suaveolens</i>	Fragrant Waitzia				Y	Y	Y
Boraginaceae	<i>Echium plantagineum</i>	Paterson's Curse	Y	#		Y		

Family	Latin Name	Common Name	Introduced	Status	Recorded ELA (2012)	Recorded Brundrett & Clarke (2001 & 2004)	City of Joondalup Field Assessments (2005 & 2011)	City of Wanneroo (1995)
Brassicaceae	<i>Alyssum linifolium</i>	Flax-leaf Alyssum	Y			Y		
Brassicaceae	<i>Brassica tournefortii</i>	Mediterranean Turnip	Y	H		Y		
Brassicaceae	<i>Heliophila pusilla</i>		Y		Y	Y		
Brassicaceae	<i>Raphanus raphanistrum</i>	Wild Radish	Y		Y			
Caesalpiniaceae	<i>Ceratonia siliqua</i>	Carob Tree	Y			Y		
Campanulaceae	<i>Isotoma hypocrateriformis</i>	Woodbridge Poison				Y		
Campanulaceae	<i>Wahlenbergia capensis</i>	Cape Bluebell	Y		Y	Y		Y
Campanulaceae	<i>Wahlenbergia preissii</i>					Y		
Campanulaceae	<i>Lobelia tenuior</i>	Slender Lobelia			Y			
Caprifoliaceae	<i>Centranthus macrosiphon</i>	Spanish Valerian	Y		Y	Y		
Caryophyllaceae	<i>Cerastium glomeratum</i>	Mouse Ear Chickweed	Y			Y		
Caryophyllaceae	<i>Petrorhagia dubia</i> (formerly <i>Petrorhagia velutina</i>)	Hairy Pink	Y		Y	Y		Y
Caryophyllaceae	<i>Polycarpon tetraphyllum</i>	Fourleaf Allseed	Y			Y		
Caryophyllaceae	<i>Silene gallica</i>	French Catchfly	Y			Y		
Caryophyllaceae	<i>Silene gallica</i> var. <i>gallica</i>		Y		Y			
Caryophyllaceae	<i>Stellaria media</i>	Chickweed	Y			Y		
Casuarinaceae	<i>Allocasuarina fraseriana</i>	Sheoak			Y	Y	Y	Y
Casuarinaceae	<i>Allocasuarina humilis</i>	Dwarf Sheoak			Y	Y	Y	Y
Centropodiaceae	<i>Centropodia drummondiana</i>				Y	Y		
Colchicaceae	<i>Burchardia congesta</i> (formerly <i>Burchardia umbellata</i>)				Y	Y	Y	Y
Crassulaceae	<i>Crassula colorata</i>	Dense Stonecrop			Y	Y		Y
Crepidotaceae	<i>Tubaria ?serrulata</i>				Y			
Cupressaceae	<i>Callitris preissii</i>	Rottnest Island Pine	Y	Planted (S)	Y			

Family	Latin Name	Common Name	Introduced	Status	Recorded ELA (2012)	Recorded Brundrett & Clarke (2001 & 2004)	City of Joondalup Field Assessments (2005 & 2011)	City of Wanneroo (1995)
Cyperaceae	<i>Isolepis marginata</i>	Coarse Club-rush	Y		Y	Y		
Cyperaceae	<i>Lepidosperma angustatum</i>					Y		Y
Cyperaceae	<i>Lepidosperma gracile</i>	Slender Sword Sedge					Y	
Cyperaceae	<i>Lepidosperma leptostachyum</i>				Y			Y
Cyperaceae	<i>Lepidosperma pubisquameum</i>				Y			
Cyperaceae	<i>Lepidosperma sp.</i>					Y	Y	
Cyperaceae	<i>Lepidosperma squamatum</i>					Y		
Cyperaceae	<i>Lepidosperma striatum</i>				Y			
Cyperaceae	<i>Mesomelaena pseudostygia</i>				Y	Y	Y	
Cyperaceae	<i>Mesomelaena stygia</i>							Y
Cyperaceae	<i>Schoenus curvifolius</i>				Y	Y	Y	Y
Cyperaceae	<i>Schoenus grandiflorus</i>	Large Flowered Bogrush			Y	Y	Y	Y
Cyperaceae	<i>Tetraria octandra</i>					Y	Y	Y
Dasygogonaceae	<i>Calectasia cyanea</i>	Blue Tinsel Lily				Y		
Dasygogonaceae	<i>Calectasia narragara</i>					Y		
Dasygogonaceae	<i>Dasygogon bromeliifolius</i>	Pineapple Bush			Y	Y	Y	Y
Dilleniaceae	<i>Hibbertia huegelii</i>				Y	Y	Y	Y
Dilleniaceae	<i>Hibbertia hypericoides</i>	Yellow Buttercups			Y	Y	Y	Y
Dilleniaceae	<i>Hibbertia racemosa</i>	Stalked Guinea Flower			Y		Y	Y
Dilleniaceae	<i>Hibbertia subvaginata</i>					Y		
Droseraceae	<i>Drosera ?macrantha</i>					Y		
Droseraceae	<i>Drosera erythrorhiza</i> subsp. <i>Erythrorhiza</i>				Y	Y	Y	Y
Droseraceae	<i>Drosera macrantha</i>	Bridal Rainbow			Y			
Droseraceae	<i>Drosera menziesii</i>	Pink Rainbow				Y		

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Droseraceae	<i>Drosera paleacea</i>	Dwarf Sundew				Y	Y	
Droseraceae	<i>Drosera pallida</i>	Pale Rainbow			Y	Y		
Droseraceae	<i>Drosera platystigma</i>	Black-eyed Sundew			Y			
Droseraceae	<i>Drosera stolonifera</i>	Leafy Sundew				Y		Y
Ericaceae	<i>Astroloma ciliatum</i>	Candle Cranberry				Y		
Ericaceae	<i>Astroloma pallidum</i>	Kick Bush			Y	Y		
Ericaceae	<i>Conostephium pendulum</i>	Pearl Flower			Y	Y	Y	Y
Ericaceae	<i>Conostephium preisii</i>					Y	Y	Y
Ericaceae	<i>Leucopogon parviflorus</i>	Coast Beard-heath					Y	
Ericaceae	<i>Leucopogon propinquus</i>				Y	Y	Y	Y
Euphorbiaceae	<i>Euphorbia ?cyathophora</i>		Y			Y		
Euphorbiaceae	<i>Euphorbia peplus</i>	Petty Spurge	Y		Y	Y		
Euphorbiaceae	<i>Euphorbia terracina</i>	Geraldton Carnation Weed	Y	H	Y	Y		
Euphorbiaceae	<i>Monotaxis grandiflora</i>	Diamond of the Desert				Y		
Euphorbiaceae	<i>Monotaxis grandiflora</i> var. <i>grandiflora</i>				Y			
Euphorbiaceae	<i>Ricinocarpos glaucus</i>				Y	Y		
Euphorbiaceae	<i>Ricinocarpos tuberculatus</i>					Y		
Euphorbiaceae	<i>Ricinus communis</i>	Castor Oil Plant	Y			Y		
Fabaceae	<i>Acacia applanata</i>					Y		
Fabaceae	<i>Acacia baileyana</i>	Cootamundra Wattle	Y			Y		
Fabaceae	<i>Acacia cochlearis</i>	Rigid Wattle			Y	Y	Y	
Fabaceae	<i>Acacia cyclops</i>	Coastal Wattle			Y	Y		
Fabaceae	<i>Acacia dealbata</i>		Y			Y		
Fabaceae	<i>Acacia huegelii</i>					Y		
Fabaceae	<i>Acacia iteaphylla</i>		Y		Y	Y	Y	

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Fabaceae	<i>Acacia lasiocarpa</i>	Panjang				Y		
Fabaceae	<i>Acacia longifolia</i>		Y			Y	Y	
Fabaceae	<i>Acacia podalyriifolia</i>		Y			Y		
Fabaceae	<i>Acacia pulchella</i> var. <i>glaberrima</i>				Y	Y	Y	Y
Fabaceae	<i>Acacia saligna</i> subsp. <i>saligna</i>				Y	Y	Y	Y
Fabaceae	<i>Acacia stenoptera</i>	Narrow Winged Wattle			Y	Y	Y	Y
Fabaceae	<i>Acacia trigonophylla</i>				Y	Y		
Fabaceae	<i>Acacia wildenowiana</i>	Grass Wattle				Y	Y	
Fabaceae	<i>Acacia xanthina</i>	White-stemmed Wattle					Y	
Fabaceae	<i>Bossiaea eriocarpa</i>	Common Brown Pea			Y	Y	Y	Y
Fabaceae	<i>Chamaecytisus palmensis</i>	Tagasaste	Y			Y		
Fabaceae	<i>Daviesia decurrens</i>	Prickly Bitter-pea						Y
Fabaceae	<i>Daviesia divaricata</i>	Marno			Y	Y	Y	Y
Fabaceae	<i>Daviesia nudiflora</i>				Y	Y	Y	Y
Fabaceae	<i>Daviesia triflora</i>				Y	Y	Y	Y
Fabaceae	<i>Gastrolobium capitatum</i> (formerly <i>Nemcia capitata</i>)				Y	Y	Y	Y
Fabaceae	<i>Genista monspessulana</i>		Y			Y		
Fabaceae	<i>Gompholobium tomentosum</i>	Hairy Yellow Pea			Y	Y	Y	Y
Fabaceae	<i>Hardenbergia comptoniana</i>	Native Wisteria			Y	Y	Y	Y
Fabaceae	<i>Hovea pungens</i>	Devil's Pins				Y	Y	
Fabaceae	<i>Hovea trisperma</i>	Common Hovea				Y	Y	
Fabaceae	<i>Isotropis cuneifolia</i>	Granny Bonnets			Y			
Fabaceae	<i>Isotropis cuneifolia</i> subsp. <i>cuneifolia</i>					Y		

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Fabaceae	<i>Jacksonia furcellata</i>	Grey Stinkwood			Y	Y	Y	
Fabaceae	<i>Jacksonia sericea</i>	Waldjumi		P4 , S	Y	Y	Y	Y
Fabaceae	<i>Jacksonia sternbergiana</i>	Stinkwood				Y		
Fabaceae	<i>Kennedia prostrata</i>	Scarlet Runner			Y	Y	Y	Y
Fabaceae	<i>Lathyrus tingitanus</i>	Tangier Pea	Y			Y		
Fabaceae	<i>Lupinus angustifolius</i>	Narrowleaf Lupin	Y			Y		
Fabaceae	<i>Lupinus cosentinii</i>	Blue Lupin	Y	H	Y	Y		
Fabaceae	<i>Medicago polymorpha</i>	Burr Medic	Y			Y		
Fabaceae	<i>Melilotus indicus</i>	Yellow Sweet Clover	Y			Y		
Fabaceae	<i>Ornithopus pinnatus</i>	Slender Serradella	Y		Y	Y		
Fabaceae	<i>Pultenaea reticulata</i>					Y		
Fabaceae	<i>Trifolium arvense</i>		Y			Y		
Fabaceae	<i>Trifolium campestre</i>	Hop Clover	Y		Y	Y		
Fabaceae	<i>Trifolium dubium</i>	Suckling Clover	Y			Y		
Fabaceae	<i>Trifolium repens</i>	White Clover	Y			Y		
Fabaceae	<i>Trifolium subterraneum</i>	Subterranean Clover	Y		Y			
Fabaceae	<i>Trifolium tomentosum</i>	Woolly Clover	Y			Y		
Fabaceae	<i>Vicia sativa</i>	Common Vetch	Y			Y		
Gentianaceae	<i>Centaurium erythraea</i>	Common Centaury	Y			Y		
Gentianaceae	<i>Cicendia filiformis</i>	Slender Cicendia	Y			Y		
Geraniaceae	<i>Erodium botrys</i>	Long Storksbill	Y		Y	Y		
Geraniaceae	<i>Erodium cicutarium</i>	Common Storksbill	Y			Y		
Geraniaceae	<i>Erodium cygnorum</i>	Blue Heronsbill	Y		Y			
Geraniaceae	<i>Erodium moschatum</i>	Musky Crowfoot	Y			Y		
Geraniaceae	<i>Pelargonium capitatum</i>	Rose Pelargonium	Y	H	Y	Y	Y	Y
Goodeniaceae	<i>Dampiera linearis</i>	Common Dampiera			Y	Y	Y	Y

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Goodeniaceae	<i>Scaevola canescens</i>	Grey Scaevola			Y	Y	Y	Y
Goodeniaceae	<i>Scaevola crassifolia</i>	Thick-Leaved Fanflower				Y		Y
Goodeniaceae	<i>Scaevola globulifera</i>						Y	
Goodeniaceae	<i>Scaevola paludosa</i>		Y	Planted (P2)				Y
Goodeniaceae	<i>Scaevola repens</i> var. <i>angustifolia</i>				Y		Y	
Goodeniaceae	<i>Scaevola repens</i> var. <i>repens</i>					Y		
Gyrostemonaceae	<i>Tersonia cyathiflora</i>	Button Creeper			Y	Y		
Haemodoraceae	<i>Anigozanthos humilis</i>	Catspaw			Y	Y		Y
Haemodoraceae	<i>Anigozanthos manglesii</i>	Mangles Kangaroo Paw			Y	Y	Y	Y
Haemodoraceae	<i>Conostylis aculeata</i> subsp. <i>cygnorum</i>			S	Y	Y	Y	Y
Haemodoraceae	<i>Conostylis candicans</i> subsp. <i>candicans</i>					Y		Y
Haemodoraceae	<i>Conostylis setigera</i>	Bristly Cottonhead			Y	Y	Y	Y
Haemodoraceae	<i>Haemodorum laxum</i>					Y		Y
Haemodoraceae	<i>Haemodorum paniculatum</i>	Mardja			Y	Y		
Haemodoraceae	<i>Haemodorum spicatum</i>	Mardja				Y	Y	Y
Haemodoraceae	<i>Phlebocarya ciliata</i>					Y		
Haloragaceae	<i>Glischrocaryon aureum</i>	Common Popflower		S		Y		
Hemerocallidaceae	<i>Agrostocrinum scabrum</i>	Blue Grass Lily				Y		Y
Hemerocallidaceae	<i>Caesia micrantha</i> (formerly <i>Caesia parviflora</i>)	Pale Grass-lily		S	Y	Y	Y	
Hemerocallidaceae	<i>Corynotheca micrantha</i>	Sand Lily			Y	Y	Y	
Hemerocallidaceae	<i>Dianella revoluta</i> var. <i>revoluta</i>				Y	Y	Y	Y
Hemerocallidaceae	<i>Tricoryne elatior</i>	Yellow Autumn Lily			Y	Y	Y	Y
Iridaceae	<i>Freesia alba</i> x <i>leichtlinii</i>		Y		Y	Y		

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Iridaceae	<i>Gladiolus angustus</i>	Long Tubed Painted Lady	Y			Y		
Iridaceae	<i>Gladiolus caryophyllaceus</i>	Wild Gladiolus	Y		Y	Y	Y	Y
Iridaceae	<i>Hesperantha falcata</i>		Y			Y		
Iridaceae	<i>Moraea flaccida</i> (formerly <i>Homeria flaccida</i>)	One-leaf Cape Tulip	Y	H, #	Y	Y	Y	
Iridaceae	<i>Orthrosanthus laxus</i> var. <i>laxus</i>	Morning Iris			Y	Y		
Iridaceae	<i>Patersonia occidentalis</i>	Purple Flag			Y	Y	Y	Y
Iridaceae	<i>Romulea flava</i>		Y			Y		
Iridaceae	<i>Romulea rosea</i>	Guildford Grass	Y	H	Y	Y		
Iridaceae	<i>Watsonia meriana</i> var. <i>meriana</i>	Watsonia	Y			Y		
Juncaceae	<i>Luzula meridionalis</i>	Field Woodrush				Y		
Juncaginaceae	<i>Triglochin centrocarpa</i>					Y		
Juncaginaceae	<i>Triglochin isingiana</i>				Y			
Juncaginaceae	<i>Triglochin</i> sp. A					Y		
Lamiaceae	<i>Hemiandra pungens</i>	Snakebush				Y		
Lamiaceae	<i>Lavandula stoechas</i>	Italian Lavender	Y			Y		
Lamiaceae	<i>Stachys arvensis</i>	Staggerweed	Y			Y		
Loranthaceae	<i>Nuytsia floribunda</i>	Christmas Tree			Y	Y		
Malvaceae	<i>Malva parviflora</i>	Marshmallow	Y		Y			
Meliaceae	<i>Melia azedarach</i>	White Cedar				Y		
Myrtaceae	<i>Agonis flexuosa</i>	Peppermint	Y	Planted (S)	Y			
Myrtaceae	<i>Calothamnus quadrifidus</i>	One-sided Bottlebrush			Y	Y	Y	
Myrtaceae	<i>Calothamnus sanguineus</i>	Silky-leaved Blood Flower				Y		
Myrtaceae	<i>Calytrix angulata</i>	Yellow Starflower				Y		Y

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Myrtaceae	<i>Calytrix flavescens</i>	Summer Starflower				Y		
Myrtaceae	<i>Calytrix fraseri</i>	Pink Summer Calytrix				Y		
Myrtaceae	<i>Chamelaucium uncinatum</i>	Geraldton Wax	Y		Y	Y	Y	
Myrtaceae	<i>Corymbia calophylla</i>	Marri			Y	Y	Y	
Myrtaceae	<i>Eremaea asterocarpa</i>					Y		
Myrtaceae	<i>Eremaea pauciflora</i>				Y	Y		
Myrtaceae	<i>Eucalyptus caesia</i>	Caesia	Y	Planted (P4)		Y		
Myrtaceae	<i>Eucalyptus gomphocephala</i>	Tuart			Y	Y	Y	Y
Myrtaceae	<i>Eucalyptus marginata</i> subsp. <i>marginata</i>	Jarrah			Y	Y	Y	Y
Myrtaceae	<i>Hypocalymma robustum</i>	Swan River Myrtle			Y	Y	Y	Y
Myrtaceae	<i>Leptospermum laevigatum</i>	Coast Teatree	Y	H	Y	Y	Y	
Myrtaceae	<i>Melaleuca lanceolata</i>	Rottnest Teatree	Y	Planted (S)			Y	
Myrtaceae	<i>Melaleuca systema</i> (formerly <i>Melaleuca acerosa</i>)					Y		Y
Myrtaceae	<i>Scholtzia</i> sp. (unidentified in previous survey)					Y		
Myrtaceae	<i>Thryptomene saxicola</i>	Rock Thryptomene				Y		
Oleaceae	<i>Olea europaea</i>	Olive	Y			Y		
Onagraceae	<i>Oenothera glazioviana</i>	Evening Primrose	Y			Y		
Onagraceae	<i>Oenothera</i> sp. (unidentified in previous survey)		Y			Y		
Orchidaceae	<i>Caladenia arenicola</i>				Y	Y		
Orchidaceae	<i>Caladenia discoidea</i>	Dancing Orchid				Y		
Orchidaceae	<i>Caladenia flava</i>	Cowslip Orchid			Y	Y		
Orchidaceae	<i>Caladenia latifolia</i>	Pink Fairy Orchid			Y	Y		
Orchidaceae	<i>Caladenia longicauda</i>	Common White Spider Orchid			Y			

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Orchidaceae	<i>Caladenia reptans</i>	Little Pink Fairy Orchid				Y		
Orchidaceae	<i>Cyanicula sericea</i>					Y		Y
Orchidaceae	<i>Disa bracteata</i> (formerly <i>Monodenia bracteata</i>)		Y			Y		
Orchidaceae	<i>Diuris corymbosa</i>					Y		
Orchidaceae	<i>Diuris magnifica</i>				Y			
Orchidaceae	<i>Elythranthera brunonis</i>	Purple Enamel Orchid			Y	Y		
Orchidaceae	<i>Eriochilus dilatatus</i>	White Bunny Orchid				Y		
Orchidaceae	<i>Leporella fimbriata</i>	Hare Orchid				Y		
Orchidaceae	<i>Leptoceras menziesii</i>					Y		
Orchidaceae	<i>Microtis media</i>	Tall Mignonette Orchid				Y		
Orchidaceae	<i>Paracaleana nigrita</i>	Flying Duck Orchid				Y		Y
Orchidaceae	<i>Pheladenia deformis</i> (formerly <i>Cyanicula deformis</i>)					Y		Y
Orchidaceae	<i>Prasophyllum elatum</i>	Tall Leek Orchid				Y		
Orchidaceae	<i>Prasophyllum giganteum</i>	Bronze Leek Orchid						Y
Orchidaceae	<i>Pterostylis recurva</i>	Jug Orchid				Y	Y	
Orchidaceae	<i>Pterostylis pyramidalis</i> (formerly <i>Pterostylis nana</i>)	Snail Orchid				Y		
Orchidaceae	<i>Pterostylis sanguinea</i>				Y	Y		
Orchidaceae	<i>Pterostylis vittata</i>	Banded Greenhood				Y		
Orchidaceae	<i>Pyrorchis nigricans</i>	Red Beaks			Y	Y	Y	
Orchidaceae	<i>Thelymitra fuscolutea</i>	Leopard Orchid				Y		
Orchidaceae	<i>Thelymitra macrophylla</i>					Y		
Orchidaceae	<i>Oenothera stricta</i>	Common Evening Primrose	Y			Y		

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Orobanchaceae	<i>Orobanche minor</i>	Lesser Broomrape				Y		
Oxalidaceae	<i>Oxalis incarnata</i>		Y			Y		
Oxalidaceae	<i>Oxalis pes-caprae</i>	Soursob	Y		Y	Y		
Oxalidaceae	<i>Oxalis purpurea</i>	Largeflower Wood Sorrel	Y			Y		
Papaveraceae	<i>Fumaria capreolata</i>	Whiteflower Fumitory	Y		Y	Y		
Phyllanthaceae	<i>Phyllanthus calycinus</i>	False Boronia			Y	Y	Y	
Phyllanthaceae	<i>Poranthera microphylla</i>	Small Poranthera			Y			
Phytolaccaceae	<i>Phytolacca octandra</i>	Red Ink Plant	Y			Y		
Pittosporaceae	<i>Billardiera fraseri</i> (formerly <i>Pronaya fraseri</i>)	Elegant Pronaya				Y		
Poaceae	<i>Aira caryophyllea</i>	Silvery Hairgrass	Y			Y		
Poaceae	<i>Aira cupaniana</i>	Silvery Hairgrass	Y		Y			
Poaceae	<i>Amphipogon turbinatus</i>				Y	Y		
Poaceae	<i>Austrostipa compressa</i>					Y		Y
Poaceae	<i>Austrostipa flavescens</i>					Y	Y	
Poaceae	<i>Avena barbata</i>	Bearded Oat	Y		Y	Y		
Poaceae	<i>Briza maxima</i>	Blowfly Grass	Y		Y	Y	Y	Y
Poaceae	<i>Briza minor</i>	Shivery Grass	Y		Y	Y		Y
Poaceae	<i>Bromus diandrus</i>	Great Brome	Y	H	Y			
Poaceae	<i>Bromus hordeaceus</i>	Soft Brome	Y			Y		Y
Poaceae	<i>Bromus madritensis</i>	Madrid Brome	Y			Y		Y
Poaceae	<i>Cenchrus echinatus</i>	Burrgrass	Y			Y		
Poaceae	<i>Cenchrus setaceus</i> (formerly <i>Pennisetum setaceaum</i>)	Fountain Grass	Y		Y	Y		
Poaceae	<i>Cortaderia selloana</i>	Pampas Grass	Y	H		Y		
Poaceae	<i>Cynodon dactylon</i>	Couch	Y			Y		

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Poaceae	<i>Dichelachne crinita</i>	Longhair Plumegrass				Y		
Poaceae	<i>Ehrharta calycina</i>	Perennial Veldt Grass	Y	H	Y	Y	Y	Y
Poaceae	<i>Ehrharta longiflora</i>	Annual Veldt Grass	Y		Y	Y		
Poaceae	<i>Eragrostis curvula</i>	African Lovegrass	Y	H	Y	Y	Y	
Poaceae	<i>Hordeum leporinum</i>	Barley Grass	Y		Y	Y		
Poaceae	<i>Lagurus ovatus</i>	Hare's Tail Grass	Y	H		Y	Y	
Poaceae	<i>Lolium perenne</i>	Perennial Ryegrass	Y			Y		
Poaceae	<i>Melinis repens</i>		Y			Y		Y
Poaceae	<i>Microlaena stipoides</i>	Weeping Grass				Y		
Poaceae	<i>Pentameris airoides</i>	False Hairgrass	Y		Y			
Poaceae	<i>Pentameris pallida</i> (formerly <i>Pentaschistis thumbergii</i>)		Y			Y		Y
Poaceae	<i>Petrophile media</i>						Y	
Poaceae	<i>Poa annua</i>	Winter Grass	Y			Y		Y
Poaceae	<i>Poa porphyroclados</i>					Y		Y
Poaceae	<i>Polypogon monspeliensis</i>	Annual Beardgrass	Y			Y		Y
Poaceae	<i>Rytidosperma caespitosum</i> (formerly <i>Austrodanthonia caespitosa</i>)					Y		Y
Poaceae	<i>Rytidosperma occidentale</i>					Y	Y	
Poaceae	<i>Sporobolus africanus</i>	Parramatta Grass	Y			Y		
Poaceae	<i>Sporobolus ?indicus</i>		Y			Y		
Poaceae	<i>Stenotaphrum secundatum</i>	Buffalo Grass	Y			Y		
Poaceae	<i>Triticum aestivum</i>	Wheat	Y			Y		
Poaceae	<i>Vulpia fasciculata</i> (formerly <i>Vulpia membranacea</i>)		Y			Y		Y
Poaceae	<i>Vulpia myuros</i>	Rat's Tail Fescue	Y		Y	Y		





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Polygalaceae	<i>Comesperma calymega</i>	Blue-spike Milkwort				Y		Y
Polygalaceae	<i>Polygala myrtifolia</i>	Myrtleleaf Milkwort	Y			Y		
Polygonaceae	<i>Emex australis</i>	Doublegee	Y			Y		
Portulacaceae	<i>Calandrinia granulifera</i>	Pygmy Purslane			Y			
Portulacaceae	<i>Calandrinia</i> sp.					Y		
Primulaceae	<i>Lysimachia arvensis</i> (formerly <i>Anagalis arvensis</i>)	Pimpernel	Y		Y	Y		
Proteaceae	<i>Adenanthos cygnorum</i>	Common Woolly Bush				Y	Y	
Proteaceae	<i>Adenanthos sericeus</i>	Woolly Bush				Y		
Proteaceae	<i>Banksia attenuata</i>	Slender Banksia			Y	Y	Y	Y
Proteaceae	<i>Banksia dallanneyi</i> var. <i>dallanneyi</i> (formerly <i>Dryandra lindleyana</i>)				Y	Y		
Proteaceae	<i>Banksia grandis</i>	Bull Banksia			Y	Y		
Proteaceae	<i>Banksia nivea</i>	Honeypot Dryandra	Y			Y		Y
Proteaceae	<i>Banksia menziesii</i>	Firewood Banksia			Y	Y	Y	Y
Proteaceae	<i>Banksia prionotes</i>	Acorn Banksia			Y	Y	Y	
Proteaceae	<i>Banksia sessilis</i> (formerly known as <i>Dryandra sessilis</i>)	Parrot Bush				Y		
Proteaceae	<i>Conospermum stoechadis</i>	Common Smokebush				Y		
Proteaceae	<i>Conospermum triplinervium</i>	Tree Smokebush	Y	Planted (S)		Y		
Proteaceae	<i>Grevillea bipinnatifida</i>	Fuchsia Grevillea				Y		
Proteaceae	<i>Grevillea crithmifolia</i>				Y	Y		
Proteaceae	<i>Grevillea vestita</i> subsp. <i>vestita</i>				Y	Y	Y	Y
Proteaceae	<i>Hakea laurina</i>	Pincushion Hakea				Y		
Proteaceae	<i>Hakea lissocarpa</i>	Honey Bush				Y	Y	

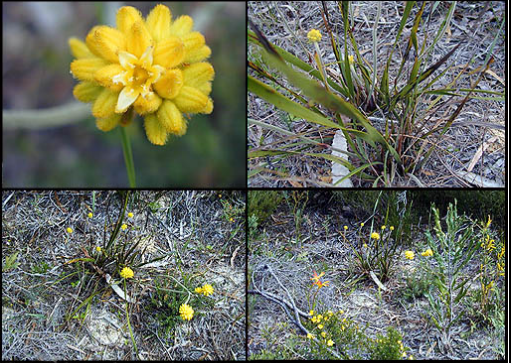



Family	Latin Name	Common Name	Introduced	Status	Recorded ELA (2012)	Recorded Brundrett & Clarke (2001 & 2004)	City of Joondalup Field Assessments (2005 & 2011)	City of Wanneroo (1995)
Proteaceae	<i>Hakea petiolaris</i>	Sea Urchin Hakea				Y		
Proteaceae	<i>Hakea prostrata</i>	Harsh Hakea			Y	Y		Y
Proteaceae	<i>Hakea ruscifolia</i>	Candle Hakea				Y		
Proteaceae	<i>Hakea trifurcata</i>	Two-leaf Hakea			Y	Y		
Proteaceae	<i>Persoonia saccata</i>	Snottygobble			Y	Y		
Proteaceae	<i>Petrophile brevifolia</i>				Y	Y		
Proteaceae	<i>Petrophile linearis</i>	Pixie Mops			Y	Y	Y	Y
Proteaceae	<i>Petrophile macrostachya</i>				Y	Y		Y
Proteaceae	<i>Stirlingia latifolia</i>	Blueboy			Y	Y	Y	Y
Proteaceae	<i>Synaphea spinulosa</i>					Y	Y	
Ranunculaceae	<i>Clematis linearifolia</i>					Y		Y
Restionaceae	<i>Alexgeorgea nitens</i>				Y	Y	Y	Y
Restionaceae	<i>Desmocladius asper</i>				Y			
Restionaceae	<i>Desmocladius fasciculatus</i>					Y		Y
Restionaceae	<i>Desmocladius flexuosus</i>				Y	Y	Y	Y
Restionaceae	<i>Hypolaena exsulca</i>					Y	Y	Y
Restionaceae	<i>Lepidobolus preissianus</i>				Y	Y		
Rhamnaceae	<i>Spyridium globulosum</i>	Basket Bush			Y			
Rhamnaceae	<i>Stenanthemum tridentatum</i> (formerly <i>Spyridium tridentatum</i>)					Y	Y	
Rubiaceae	<i>Galium divaricatum</i>					Y		
Rubiaceae	<i>Opercularia vaginata</i>	Dog Weed			Y	Y	Y	Y
Rutaceae	<i>Diplolaena dampieri</i>	Southern Diplolaena	Y	Planted (S)	Y	Y		
Rutaceae	<i>Philotheca spicata</i>	Pepper and Salt			Y	Y	Y	Y
Scrophulariaceae	<i>Dischisma capitatum</i>	Woolly-headed Dischisma	Y			Y		




Family	Latin Name	Common Name	Introduced	Status	Recorded ELA (2012)	Recorded Brundrett & Clarke (2001 & 2004)	City of Joondalup Field Assessments (2005 & 2011)	City of Wanneroo (1995)
Scrophulariaceae	<i>Phyllopodium cordatum</i>		Y			Y		
Solanaceae	<i>Solanum ?linnaeanum</i>	Apple of Sodom	Y			Y		
Solanaceae	<i>Solanum nigrum</i>	Black Berry Nightshade	Y		Y	Y		
Stylidiaceae	<i>Levenhookia stipitata</i>	Common Stylewort				Y		Y
Stylidiaceae	<i>Stylidium brunonianum</i>	Pink Fountain Triggerplant			Y	Y		Y
Stylidiaceae	<i>Stylidium calcaratum</i>	Book Triggerplant			Y	Y		Y
Stylidiaceae	<i>Stylidium carnosum</i>	Fleshy-leaved Triggerplant				Y		
Stylidiaceae	<i>Stylidium piliferum</i>	Common Butterfly Triggerplant				Y		
Stylidiaceae	<i>Stylidium repens</i>	Matted Triggerplant			Y	Y		Y
Stylidiaceae	<i>Stylidium schoenoides</i>	Cow Kicks				Y		Y
Thymelaeaceae	<i>Pimelea leucantha</i>				Y	Y		
Thymelaeaceae	<i>Pimelea sulphurea</i>	Yellow Banjine			Y	Y	Y	Y
Verbenaceae	<i>Lantana camara</i>	Common Lantana	Y	# *		Y		
Violaceae	<i>Hybanthus calycinus</i>	Wild Violet			Y	Y		
Xanthorrhoeaceae	<i>Xanthorrhoea preissii</i>	Grass tree			Y	Y	Y	Y
Zamiaceae	<i>Macrozamia fraseri</i>					Y		
Zamiaceae	<i>Macrozamia riedlei</i>	Zamia			Y	Y	Y	Y

Appendix 2 – Warwick Open Space Key Flora Species

Threatened and Significant Flora at Warwick Open Space





Name	Common Name	Conservation Code	Image
<i>Agonis flexuosa</i>	Peppermint	Significant Flora of the Perth Metropolitan Region (not naturally occurring on site)	 <p data-bbox="949 712 1474 752"><i>Agonis flexuosa</i> Photos: K.C. Richardson (WA Herbarium n.d.)</p>
<i>Caesia micrantha</i>	Pale Grass-lily	Significant Flora of the Perth Metropolitan Region	 <p data-bbox="949 1120 1474 1189"><i>Caesia micrantha</i> Photos: B.A. Fuhrer and K.R. Thiele (WA Herbarium n.d.)</p>
<i>Callitris preissii</i>	Rottneest Island Pine	Significant Flora of the Perth Metropolitan Region (not naturally occurring on site)	 <p data-bbox="949 1552 1474 1599"><i>Callitris preissii</i> Photos: R. Davis (WA Herbarium n.d.)</p>
<i>Conospermum triplinervium</i>	Tree Smokebush	Significant Flora of the Perth Metropolitan Region (not naturally occurring on site)	 <p data-bbox="949 1962 1474 2013"><i>Conospermum triplinervium</i> Photos: M. Hislop (WA Herbarium n.d.)</p>





Name	Common Name	Conservation Code	Image
<i>Conostylis aculeata</i> subsp <i>cygnorum</i>		Significant Flora of the Perth Metropolitan Region	 <p data-bbox="951 555 1465 600"><i>Conostylis aculeata</i> subsp. <i>cygnorum</i> Photos: K.C. Richardson Photo: K.C. Richardson (WA Herbarium n.d.)</p>
<i>Diplolaena dampieri</i>	Southern Diplolaena	Significant Flora of the Perth Metropolitan Region (not naturally occurring on site)	 <p data-bbox="951 967 1465 1012"><i>Diplolaena dampieri</i> Photo: E. Wajon Photo: E. Wajon (WA Herbarium n.d.)</p>
<i>Eucalyptus caesia</i>	Caesia	Priority 4 (DPAW) (not naturally occurring on site)	 <p data-bbox="951 1379 1465 1447"><i>Eucalyptus caesia</i> Photos: M.I. Blackwell, S.D. Hopper & K. McCreery Photos: M.I. Blackwell, S.D. Hopper and K. McCreery (WA Herbarium n.d.)</p>
<i>Glischrocaryon aureum</i>	Common Popflower	Significant Flora of the Perth Metropolitan Region	 <p data-bbox="951 1814 1465 1877"><i>Glischrocaryon aureum</i> Photos: H. Bennett, B.A. Fuhrer & K.R. Thiele Photos: H. Bennett, B.A. Fuhrer and K.R. Thiele (WA Herbarium n.d.)</p>





Name	Common Name	Conservation Code	Image
<i>Jacksonia sericea</i>	Waldjumi	Priority 4 (DPaW), Significant Flora of the Perth Metropolitan Region	
<i>Melaleuca lanceolata</i>	Rottnest Teatree	Significant Flora of the Perth Metropolitan Region (not naturally occurring on site)	 <p data-bbox="949 936 1463 1003"><i>Melaleuca lanceolata</i> Photos: K. Richardson & K.R. Thiele Photos: K. Richardson and K.R. Thiele (WA Herbarium n.d.)</p>
<i>Scaevola paludosa</i>		Priority 2 (DPaW) (not naturally occurring on site)	 <p data-bbox="949 1272 1463 1344"><i>Scaevola paludosa</i> Photos: H. Bowler & I.R. Dixon Photos: H. Bowler and I.R. Dixon (WA Herbarium n.d.)</p>




Note: For further explanations on Conservation Codes, refer to **Appendix 3**.

Key Weed Species at Warwick Open Space

Name	Common Name	Conservation Code	Image
<i>Brassica tournefortii</i>	Mediterranean Turnip	High priority (DPaW Environmental Weed Strategy for WA)	 <p>Photos: K.C. Richardson and J.F. Smith (WA Herbarium n.d.)</p>
<i>Bromus diandrus</i>	Great Brome	High priority (DPaW Environmental Weed Strategy for WA)	 <p><i>Bromus diandrus</i> Photos: L. Fontanini and K.C. Richardson (WA Herbarium n.d.)</p>
<i>Chondrilla juncea</i>	Skeleton Weed	Declared Weed (DAFWA)	 <p><i>Chondrilla juncea</i> Photos: B. Hoskins and J. Dodd (WA Herbarium n.d.)</p>
<i>Cortaderia selloana</i>	Pampas Grass	High priority (DPaW Environmental Weed Strategy for WA)	 <p><i>Cortaderia selloana</i> Photo: R. Randall Photos: R. Randall (WA Herbarium n.d.)</p>

Name	Common Name	Conservation Code	Image
<i>Echium plantagineum</i>	Paterson's Curse	Declared Weed (DAFWA)	 <p data-bbox="932 566 1461 611"><i>Echium plantagineum</i> Photos: J. Dodd and R. Knox (WA Herbarium n.d.)</p>
<i>Ehrharta calycina</i>	Perennial Veldt Grass	High priority (DPaW Environmental Weed Strategy for WA)	 <p data-bbox="932 1070 1342 1093">Photos: S.M. Armstrong (WA Herbarium n.d.)</p>
<i>Eragrostis curvula</i>	African Lovegrass	High priority (DPaW Environmental Weed Strategy for WA)	 <p data-bbox="932 1462 1461 1512">Photos: L. Fontanini and R. Randall (WA Herbarium n.d.)</p>
<i>Euphorbia terracina</i>	Geraldton Carnation Weed	High priority (DPaW Environmental Weed Strategy for WA)	

Name	Common Name	Conservation Code	Image
<i>Lagurus ovatus</i>	Hare's Tail Grass	High priority (DPaW Environmental Weed Strategy for WA)	 <p data-bbox="930 577 1465 645"><i>Lagurus ovatus</i> Photos: U. Bell, K. Richardson & R. Robson Photos: U. Bell, K. Richardson and R. Robson (WA Herbarium n.d.)</p>
<i>Lantana camara</i>	Common Lantana	Declared Weed (DAFWA); Weed of National Significance (Commonwealth of Australia)	 <p data-bbox="930 1081 1465 1104">Photo: Department of Agriculture and Food 2010</p>
<i>Leptospermum laevigatum</i>	Coast Teatree	High priority (DPaW Environmental Weed Strategy for WA)	 <p data-bbox="930 1485 1465 1529"><i>Leptospermum laevigatum</i> Photos: K.C. Richardson Photos: K.C. Richardson (WA Herbarium n.d.)</p>
<i>Lupinus cosentinii</i>	Blue Lupin	High priority (DPaW Environmental Weed Strategy for WA)	 <p data-bbox="930 1910 1465 1951">Photos: J. Dodd and J.F. Smith (WA Herbarium n.d.)</p>

Name	Common Name	Conservation Code	Image
<i>Moraea flaccida</i>	One-leaf Cape Tulip	Declared Weed, (DAFWA); High priority (DPaW Environmental Weed Strategy for WA)	 <p data-bbox="933 421 1460 481"><i>Moraea flaccida</i> Photos: R. Knox and K.C. Richardson (WA Herbarium n.d.)</p>
<i>Pelargonium capitatum</i>	Rose Pelargonium	High priority (DPaW Environmental Weed Strategy for WA)	
<i>Romulea rosea</i>	Guildford Grass	High priority (DPaW Environmental Weed Strategy for WA)	 <p data-bbox="933 1131 1460 1209"><i>Romulea rosea</i> Photos: J. Dodd, K. Richardson & K.R. Thiele (WA Herbarium n.d.)</p>

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Appendix 3 – Conservation Codes for Western Australian Flora

Australian *Environment Protection and Biodiversity Conservation Act 1999* Threatened Flora Codes

Category	Code	Description
Extinct	EX	Species not definitely located in the wild during the past 50 years.
Extinct in the wild	EW	Species known to survive only in captivity.
Critically Endangered	CR	Species facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	EN	Species facing a very high risk of extinction in the wild in the near future.
Vulnerable	VU	Species facing a very high risk of extinction in the wild in the medium-term future.
Conservation Dependent	CO	Species whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent species would be classed as Vulnerable or more severely threatened.

WA *Wildlife Conservation Act 1950* Rare Flora Schedules

Category	Code	Description
Schedule 1	S1	Extant species (known to be living in a wild state).
Schedule 2	S2	Species which is presumed extinct.

WA Department of Environment and Conservation and WA Herbarium Flora Conservation Codes

Category	Code	Description
Threatened Flora	T	Declared Rare Flora — Extant (known to be living in a wild state)
Presumed Extinct Flora	X	Declared Rare Flora — Extinct
Priority One	P1	Poorly-known species on threatened lands
Priority Two	P2	Poorly-known species on conservation lands
Priority Three	P3	Poorly-known species on some on conservation lands
Priority Four	P4	Rare, near threatened and other species in need of monitoring.
Priority Five	P5	Conservation dependent species.

Note: species not listed under the WA *Wildlife Conservation Act 1950*, but for which there is some concern.

Appendix 4 – Keighery Scale Definitions

Vegetation Condition	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non- aggressive species.
Very Good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

(Sourced from Keighery 1994)

Appendix 5 – Warwick Open Space High Priority Weed Species Management

Latin Name	Common Name	Type of Weed	Status/Notes	Treatment Type	Optimal Treatment Timing
<i>Acacia iteaphylla</i>	Flinders Ranges Wattle	Trees and shrubs		Cut and paint	March to July
<i>Acacia longifolia</i>	Sydney Golden Wattle	Trees and shrubs		Cut and paint	March to August
<i>Acacia trigonophylla</i>		Trees and shrubs	Planted on site	Cut and paint	March to August
<i>Agave americana</i>	Century Plant	Trees and shrubs		Triclopyr/Picloram	November to January
<i>Avena barbata</i>	Bearded Oat	Grasses		Quizalofop	July to October
<i>Banksia prionotes</i>	Acorn Banksia (Wheatbelt form)	Trees and shrubs	Planted on site	Cut and paint	March to August
<i>Brassica tournefortii</i>	Mediterranean Turnip	Herbs	High priority (EWSWA)	Hand weeding	August to September
<i>Bromus diandrus</i>	Great Brome	Grasses	High priority (EWSWA)	Glyphosate, Quizalofop	June to August
<i>Calothamnus quadrifidus</i>	One-sided Bottlebrush	Trees and shrubs		Cut and paint	March to July
<i>Carpobrotus edulis</i>	Hottentot Fig	Herbs		Hand weeding	All year
<i>Cenchrus setaceus</i>	Fountain Grass	Grasses		Hand weeding	November to December
<i>Chamelaucium uncinatum</i>	Geraldton Wax	Trees and shrubs		Hand weeding	All year
<i>Chondrilla juncea</i>	Skeleton Weed	Herbs	Declared plant	Managed by DPaW	August to October
<i>Cortaderia selloana</i>	Pampas Grass	Grasses	High priority (EWSWA)	Glyphosate	July to November
<i>Cynodon dactylon</i>	Couch	Grasses		Glyphosate, Quizalofop	November to February
<i>Echium plantagineum</i>	Paterson's Curse	Herbs	Declared plant	Glyphosate, Metsulfuron	May to September
<i>Ehrharta calycina</i>	Perennial Veldt Grass	Grasses	High priority (EWSWA)	Quizalofop	June to August
<i>Ehrharta longiflora</i>	Annual Veldt Grass	Grasses		Quizalofop	August to October
<i>Eragrostis curvula</i>	African Lovegrass	Grasses	High priority (EWSWA)	Glyphosate	November to May
<i>Euphorbia terracina</i>	Geraldton Carnation Weed	Herbs	High priority (EWSWA)	Triasulfuron, Hand weeding	June to August spray, June to November hand weeding
<i>Freesia alba x leichtlinii</i>	Freesia Hybrid	Herbs		Metsulfuron	July to August
<i>Gazania linearis</i>	Gazania	Herbs		Glyphosate, Hand weeding	June to December spray, All year hand weeding
<i>Gladiolus angustus</i>	Long Tubed Painted Lady	Herbs		Metsulfuron	July to August
<i>Gladiolus caryophyllaceus</i>	Wild Gladiolus	Herbs		Hand weeding, hand wipe with Metsulfuron	July to September
<i>Hesperantha falcata</i>		Herbs		Metsulfuron	August to September
<i>Lachenalia bulbifera</i>	Red Soldiers	Herbs		Metsulfuron	August to September

Appendix 5 – Warwick Open Space High Priority Weed Species Management

Latin Name	Common Name	Type of Weed	Status/Notes	Treatment Type	Optimal Treatment Timing
<i>Lagurus ovatus</i>	Hare's Tail Grass	Grasses	High priority (EWSWA)	Glyphosate	June to August
<i>Lantana camara</i>	Common Lantana	Trees and shrubs	Weed of national significance, Declared plant	Cut and paint	March to May
<i>Leptospermum laevigatum</i>	Coast Teatree	Trees and shrubs	High priority (EWSWA)	Cut and paint	July to October
<i>Lupinus cosentinii</i>	Blue Lupin	Herbs	High priority (EWSWA)	Hand weeding	June to September
<i>Melinis repens</i>	Red Natal Grass	Grasses		Glyphosate	November to December
<i>Moraea flaccida</i>	One-leaf Cape Tulip	Herbs	Declared plant, High priority (EWSWA)	Metsulfuron	July to August
<i>Pelargonium capitatum</i>	Rose Pelargonium	Herbs	High priority (EWSWA)	Glyphosate, Metsulfuron, Hand weeding	June to October
<i>Raphanus raphanistrum</i>	Wild Radish	Herbs		Hand weeding	June to December
<i>Romulea rosea</i>	Guildford Grass	Grasses	High priority (EWSWA)	Not targeted due to small size of each plant being impractical for current resources	-
<i>Schinus terebinthifolius</i>	Japanese Pepper	Trees and shrubs		Triclopyr/Picloram, Hand weeding	December to February
<i>Trachyandra divaricata</i>	False Onion Weed	Herbs		Glyphosate, Metsulfuron, Hand weeding	June to August spraying, All year hand weeding

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Warwick Open Space Recorded Fauna Species List

TAXA			CONSERVATION STATUS				SOURCE						
FAMILY	SCIENTIFIC NAME	COMMON NAME	EPBC Act	WC Act	DEC	INTRODUCED	Protected Matters Search Tool	DEC Threatened Fauna Database ¹	Nature Map ²	ELA Survey (2012)	How & Dell (2000)	Clarke, K Friends of Warwick Bushland (2012)	CoJ Field Assessments (2005 & 2011)
Mammals													
Canidae	<i>Canis lupus</i>	Dog				X							+
Canidae	<i>Vulpes vulpes</i>	European Red Fox				X	•			+			+
Felidae	<i>Felis catus</i>	Cat				X	•						+
Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit				X	•			+			+
Macropodidae	<i>Macropus fuliginosus</i>	Western Grey Kangaroo								+			
Muridae	<i>Mus musculus</i>	House Mouse				X				+			
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat							•	+			
Reptiles													
Agamidae	<i>Pogona minor minor</i>	Western Bearded Dragon							•		+		
Geckonidae	<i>Christinus marmoratus</i>	Marbled Gecko							•	+			
	<i>Diplodactylus polyophthalmus</i>	Speckled Stone Gecko							•		+		
Pygopodidae	<i>Aprasia repens</i>	Sand-Plain Worm-Lizard							•	+	+		
Scincidae	<i>Cryptoblepharus buchananii</i>	Snake-eyed Skink							•	+	+		
	<i>Ctenotus fallens</i>	West-coast Striped Skink							•	+	+		
	<i>Hemiergis quadrilineata</i>	Two-toed Earless Skink							•	+			
	<i>Lerista elegans</i>	Elegant Burrowing Skink							•		+		
	<i>Lerista praepedita</i>	Worm Lerista							•		+		
	<i>Menetia greyii</i>	Common Dwarf Skink							•	+	+		

TAXA			CONSERVATION STATUS				SOURCE						
FAMILY	SCIENTIFIC NAME	COMMON NAME	EPBC Act	WC Act	DEC	INTRODUCED	Protected Matters Search Tool	DEC Threatened Fauna Database ¹	Nature Map ²	ELA Survey (2012)	How & Dell (2000)	Clarke. K Friends of Warwick Bushland (2012)	CoJ Field Assessments (2005 & 2011)
	<i>Morethia obscura</i>	Shrubland Morethia Skink							•	+	+		
	<i>Tiliqua rugosa</i>	Bobtail Skink								+	+		+
Typhlopidae	<i>Ramphotyphlops australis</i>	Southern Blind Snake							•	+			
Amphibians													
Myobatrachidae	<i>Myobatrachus gouldii</i>	Turtle Frog							•	+			
Birds													
Acanthizidae	<i>Acanthiza apicalis</i>	Inland Thornbill							•			+	
	<i>Acanthiza inornata</i>	Western Thornbill							•			+	
	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill							•			+	
	<i>Gerygone fusca</i>	Western Gerygone							•	+		+	+
	<i>Smicromnis brevirostris</i>	Weebill							•	+		+	
Accipitridae	<i>Accipiter fasciatus</i>	Brown Goshawk							•	+		+	+
	<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk							•			+	
	<i>Elanus axillaris</i>	Black-shouldered Kite										+	
	<i>Haliastur sphenurus</i>	Whistling Kite							•	+			+
	<i>Hieraaetus morphnoides</i>	Little Eagle										+	
Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet nightjar								+			
Anatidae	<i>Anas superciliosa</i>	Pacific Black Duck							•	+			
	<i>Chenonetta jubata</i>	Australian Wood Duck							•			+	
	<i>Tadorna tadornoides</i>	Australian Shelduck							•			+	+
Apodidae	<i>Apus pacificus</i>	Fork-tailed Swift	M	S3			•	•				+	
	<i>Ardea modesta</i>	Great Egret		S3			•	•				+	

TAXA			CONSERVATION STATUS				SOURCE						
FAMILY	SCIENTIFIC NAME	COMMON NAME	EPBC Act	WC Act	DEC	INTRODUCED	Protected Matters Search Tool	DEC Threatened Fauna Database ¹	Nature Map ²	ELA Survey (2012)	How & Dell (2000)	Clarke. K Friends of Warwick Bushland (2012)	CoJ Field Assessments (2005 & 2011)
Ardeidae	<i>Cracticus torquatus</i>	Grey Butcherbird							•	+		+	
	<i>Gymnorhina tibicen</i>	Australian Magpie							•	+		+	+
Burhinidae	<i>Burhinus grallarius</i>	Bush Stone-curlew						•	•			+	
Cacatuidae	<i>Calyptorhynchus baudinii</i>	Baudin's Black Cockatoo	VU	S1	EN							+	
	<i>Calyptorhynchus latirostris</i>	Carnaby's Black-cockatoo	EN	S1	EN		•	•	•	+		+	+
	<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black Cockatoo	VU	S1	VU			•		+			
	<i>Cacatua pastinator</i>	Western Long-billed Corella							•			+	
	<i>Cacatua sanguinea</i>	Little Corella							•	+		+	
	<i>Eolophus roseicapilla</i>	Galah								+		+	
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike							•	+		+	
Columbidae	<i>Columba livia</i>	Rock Dove (feral pigeon)				X			•			+	
	<i>Streptopelia chinensis</i>	Spotted Turtle-Dove				X			•	+		+	
	<i>Streptopelia senegalensis</i>	Laughing Turtle-Dove				X			•	+		+	
Corvidae	<i>Corvus coronoides</i>	Australian Raven							•	+		+	
Cuculidae	<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo							•			+	
	<i>Chrysococcyx basalis</i>	Horsfield's Bronze-Cuckoo										+	
	<i>Cuculus pallidus</i>	Pallid Cuckoo										+	
Dicruridae	<i>Grallina cyanoleuca</i>	Magpie-lark							•			+	

TAXA			CONSERVATION STATUS				SOURCE						
FAMILY	SCIENTIFIC NAME	COMMON NAME	EPBC Act	WC Act	DEC	INTRODUCED	Protected Matters Search Tool	DEC Threatened Fauna Database ¹	Nature Map ²	ELA Survey (2012)	How & Dell (2000)	Clarke. K Friends of Warwick Bushland (2012)	CoJ Field Assessments (2005 & 2011)
Falconidae	<i>Falco cenchroides</i>	Australian Kestrel							•			+	
	<i>Falco longipennis</i>	Australian Hobby							•	+		+	
	<i>Falco peregrinus</i>	Peregrine Falcon		S4				•				+	
Halcyonidae	<i>Dacelo novaeguineae</i>	Laughing Kookaburra				X			•	+		+	
	<i>Todiramphus sanctus</i>	Sacred Kingfisher							•			+	
Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow							•			+	
	<i>Hirundo nigricans</i>	Tree Martin										+	
Maluridae	<i>Malurus splendens</i>	Splendid Fairy Wren							•			+	
Meliphagidae	<i>Anthochaera lunulata</i>	Western Wattlebird							•	+			
	<i>Anthochaera carunculata</i>	Red Wattlebird							•	+		+	+
	<i>Acanthorhynchus superciliosus</i>	Western Spinebill							•			+	
	<i>Lichenostomus virescens</i>	Singing Honeyeater							•	+		+	
	<i>Lichmera indistincta</i>	Brown Honeyeater							•	+		+	+
	<i>Manorina flavigula</i>	Yellow-throated Miner							•			+	
	<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater							•			+	
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater	M	S3			•	•	•	+		+	
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella							•			+	
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-thrush										+	
	<i>Pachycephala rufiventris</i>	Rufous Whistler							•	+		+	
Pardalotidae	<i>Paradalotus punctatus</i>	Spotted Pardalote										+	
	<i>Pardalotus striatus</i>	Striated Pardalote							•	+		+	
Phalacrocoracida	<i>Phalacrocorax carbo</i>	Great Cormorant							•			+	
Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth							•			+	

TAXA			CONSERVATION STATUS				SOURCE						
FAMILY	SCIENTIFIC NAME	COMMON NAME	EPBC Act	WC Act	DEC	INTRODUCED	Protected Matters Search Tool	DEC Threatened Fauna Database ¹	Nature Map ²	ELA Survey (2012)	How & Dell (2000)	Clarke. K Friends of Warwick Bushland (2012)	CoJ Field Assessments (2005 & 2011)
Psittacidae	<i>Barnardius zonarius</i>	Australian Ringneck								+		+	
	<i>Neophema elegans</i>	Elegant Parrot										+	
	<i>Platycercus zonarius</i>	Twenty-eight Parrot								+			
	<i>Polytelis anthopeplus</i>	Regent Parrot										+	
	<i>Trichoglossus haematodus</i>	Rainbow Lorikeet				X			•	+		+	+
	<i>Purpureicephalus spurius</i>	Red-capped Parrot								+		+	+
Rhipiduridae	<i>Rhipidura leucophrys</i>	Willie Wagtail							•			+	
	<i>Rhipidura albiscapa</i>	Grey Fantail								+		+	
Strigidae	<i>Ninox novaeseelandiae</i>	Southern Boobook Owl								+		+	
Threskiornithidae	<i>Tyto alba</i>	Barn Owl										+	
Turnicidae	<i>Turnix velox</i>	Little Buttonquail								+			
Zosteropidae	<i>Zosterops lateralis.</i>	Silvereye							•			+	
Invertebrates													
Apidae	<i>Apis mellifera</i>	European honey bee				X							+
Castniidae	<i>Synemon gratiosa</i>	Graceful Sun-moth	EN		P4				•	•		+	
Hesperiidae	<i>Trapezites sciron</i>	Sciron Skipper										+	
Lycaenidae	<i>Hypochrysops halyaetus</i>	Western Jewel Butterfly										+	

² excludes seabirds, marine mammals, locally extinct species and erroneous records for the Project area.

+ Recorded during survey.

• = listed within database search for respective survey but not recorded during that survey.

X = introduced species.

EN = listed as Endangered under the EPBC Act or WC Act.

VU = listed as Vulnerable under the EPBC Act or WC Act.

S1 = fauna that are rare or is likely to become extinct under the WC Act.

S3 = migratory birds protected under an international agreement under the WC Act.

S4 = other specially protected fauna under the WC Act.

M = listed as Migratory species under the EPBC Act.

P3 = known from few specimens or records and need urgent survey and evaluation of conservation status.

P4 = not currently threatened but could if present circumstances change. These taxa are usually represented on conservation lands.

P5 = not considered threatened but subject to a specific conservation program.

Warwick Open Space Invertebrates recorded opportunistically (Eco Logical Australia 2012)

Ants

Formicidae

- Bull Ant - *Myrmecia* sp. (species unknown)
- Meat Ant – *Iridomyrmex* sp. (species unknown)
- Small black ant sp. 1 (species unknown)
- Small black ant sp. 2 (species unknown)
- Small black ant sp. 3 arboreal (species unknown)
- Peaceful night ant (species unknown)

Bees and wasps

- European Bee - *Apis* sp. (species unknown)
- Wasp (species and family unknown)

Beetles

Coleoptera

- Beetle sp. 1 (species unknown)
- Beetle sp. 2 (species unknown)

Geotrupidae

- Beetle sp. 3 (species unknown)

Curculionidae

- Weevil species 1
- Weevil species 2

Centipedes

- Centipede (species and family unknown)

Cockroaches and termites (family and species unknown)

- Cockroach
- Termite

Crickets and grasshoppers

- Grass hopper
- Cricket

Earwigs

- Native earwig - *Gonolabis michaelsoni*

Flies

Muscidae

- Australian Bush Fly - *Musca vetustissima*

Millipedes

Julidae

- Portugese Millipede - *Ommatoiulus moreleti*

Moths (family and species unknown)

- Moth species sp. 1
- Moth species sp. 2

Scorpions

Buthidae

- Scorpion species 1 (species unknown)

Slaters

Porcellionidae

- *Porcellio* sp. (species unknown)

Spiders

Lycosidae

- Wolf spider species 1
- Wold spider species 2

Nephilidae

- Golden Orb Weaver

Salticidae

- Jumping spider (species unknown)

Sparasidae

- Huntsman spider (species unknown)

Unknown family (web builders)





- Spider 1 (species unknown)
- Spider 2 (species unknown)




Mygalomorphae

- Trapdoor spider (species and family unknown)

Appendix 7 – Warwick Open Space Key Fauna Species





Threatened and Priority Fauna at Warwick Open Space




Name	Common Name	Conservation Code	Image
<i>Ardea modesta</i>	Great Egret	Schedule 3 (<i>Wildlife Conservation Act</i>)	 <p>Photo: Bill Betts</p>
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black-Cockatoo	Schedule 1 (<i>Wildlife Conservation Act</i>), Vulnerable (DPaW and EPBC)	 <p>Photo: Rick Dawson (DPaW)</p>
<i>Calyptorhynchus baudinii</i>	Baudin's Black-Cockatoo	Schedule 1 (<i>Wildlife Conservation Act</i>), Vulnerable (EPBC), Endangered (IUCN and DPaW)	 <p>Photo: Rick Dawson (DPaW)</p>
<i>Calyptorhynchus latirostris</i>	Carnaby's Black-Cockatoo	Schedule 1 (<i>Wildlife Conservation Act</i>), Endangered (IUCN, DPaW and EPBC)	 <p>Photo: Raana Scott</p>


Name	Common Name	Conservation Code	Image
<i>Merops ornatus</i>	Rainbow Bee-eater	Schedule 3 (<i>Wildlife Conservation Act</i>), Migratory (EPBC)	
<i>Falco peregrinus</i>	Peregrine Falcon	Schedule 4 (<i>Wildlife Conservation Act</i>), Migratory (EPBC)	 <p data-bbox="927 1003 1082 1025">Photo: Bill Betts</p>
<i>Synemon gratiosa</i>	Graceful Sun Moth	Endangered (EPBC), Priority 4 (DPaW)	

Note: For further explanations on Conservation Codes, refer to **Appendix 7**.

Key Introduced Fauna at Warwick Open Space

Name	Common Name	Image
<i>Apis mellifera</i>	European Honey Bee	 <p data-bbox="831 712 1150 734">Photo: Encyclopedia of Life (n.d.)</p>
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	 <p data-bbox="831 1167 1361 1193">Photo: K Vang and W Dabrowka (Birdlife Australia n.d.)</p>
<i>Macropus fuliginosus</i>	Western Grey Kangaroo	 <p data-bbox="831 1496 1173 1518">Photo: Evelyne Clarke (IUCN 2012)</p>
<i>Mus musculus</i>	House Mouse	 <p data-bbox="831 1960 1157 1977">Photo: Roar Solheim (IUCN 2012)</p>

Name	Common Name	Image
<i>Ommatoiulus moreleti</i>	Portuguese Millipede	 <p data-bbox="837 705 1292 728">Photo: Robert Mesibov (Australian Government n.d.)</p>
<i>Oryctolagus cuniculus</i>	Rabbit	 <p data-bbox="837 1243 1173 1265">Photo: Vilda-Rollin Verlinde (IUCN 2012)</p>
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	 <p data-bbox="837 1747 1197 1769">Photo: K Vang and W Dabrowka (Birdlife Australia n.d.)</p>

Name	Common Name	Image
<i>Vulpes vulpes</i>	European Red Fox	 <p data-bbox="837 604 1316 629">Photo: Centre for Fortean Zoology Australia (2010)</p>

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Appendix 8 – Conservation Codes for Western Australian Fauna

Australian Environment Protection and Biodiversity Conservation Act 1999 Threatened Fauna Codes

Category	Code	Description
Extinct	EX	Species not definitely located in the wild during the past 50 years.
Extinct in the wild	EW	Species known to survive only in captivity.
Critically Endangered	CR	Species facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	EN	Species facing a very high risk of extinction in the wild in the near future.
Vulnerable	VU	Species facing a very high risk of extinction in the wild in the medium-term future.
Near Threatened	NT	Species that risk becoming Vulnerable in the wild.
Conservation Dependent	CO	Species whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent species would be classed as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Known)	DD	Species suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern	LC	Species that are not threatened.
Migratory	M	Species are defined as migratory if they are listed in an international agreement approved by the Commonwealth Environment Minister, including: <ul style="list-style-type: none"> • The Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animal) for which Australia is a range state; • The agreement between the Government of Australian and the Government of the People's Republic of China for the Protection of Migratory Birds and their environment (CAMBA); or • The agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA).

WA Wildlife Conservation Act 1950 Threatened Fauna Schedules

Category	Code	Description
Schedule 1	S1	Fauna which is rare or likely to become extinct.
Schedule 2	S2	Fauna which is presumed extinct.
Schedule 3	S3	Migratory birds protected under an international agreement
Schedule 4	S4	Fauna that is otherwise in need of special protection

WA Department of Environment and Conservation Priority Fauna Codes

Category	Code
Priority 1	Poorly known species on threatened lands.
Priority 2	Poorly known species on conservation lands.
Priority 3	Poorly known species some on conservation lands.
Priority 4	Rare, near threatened and other species in need of monitoring.
Priority 5	Conservation dependent species.

Note: species not listed under the WA *Wildlife Conservation Act 1950*, but for which there is some concern.

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Warwick Open Space Fungi Species List




Fungi species list comparison of Warwick Open Space fungi surveys

LATIN NAME	COMMON NAME	RECORDED ELA (2012)	PERTH URBAN BUSHLAND FUNGI WORKSHOP (2005)
<i>Aleurodiscus</i> sp.	Orange Aleurodiscus		Y
<i>Amanita</i> sp.			Y
<i>Bisporella</i> sp.			Y
<i>Bjerkandera adusta</i>			Y
<i>Byssomerulius corium</i>	Bysso Skin Fungus		Y
<i>Calocera guepinioides</i>	Scotsman's Beard		Y
<i>Clitocybe semioculta</i>	Shy Funnel Cap		Y
<i>Clitocybe</i> sp.			Y
<i>Coltricia cinnamomea</i>	Tough Cinnamon Fungus		Y
<i>Colus pusillus</i>	Red Fingers		Y
<i>Cortinarius</i> sp.			Y
<i>Crepidotus</i> sp.			Y
<i>Dermocybe clelandii</i>			Y
<i>Entoloma</i> sp.			Y
<i>Exidia</i> sp.			Y
<i>Fayodia</i> ? sp.			Y
<i>Galerina</i> sp.			Y
<i>Gymnopilus allantopus</i>	Golden Wood Fungus		Y
<i>Gymnopilus</i> sp.			Y
<i>Harknessia uromycoides</i>	Tuart Nut Fungus		Y
<i>Inocybe</i> sp.			Y
<i>Laccaria</i> sp.			Y
<i>Lepiota</i> sp.			Y
<i>Marasmius</i> sp.			Y
<i>Mycena</i> sp.			Y
<i>Myxomycete</i> sp.	Slime Mould		Y
<i>Omphalina ericetorum</i>			Y
<i>Omphalotus nidiformis</i>	Ghost Fungus		Y
<i>Peniophora</i> sp.			Y
<i>Pholiota communis</i>	Common Pholiota	Y	Y
<i>Physarum viride</i>	Slime Mould		Y
<i>Pisolithus</i> sp.	Dog Poo Fungus		Y
<i>Plectania</i> sp.			Y
<i>Poria</i> sp.			Y
<i>Postia</i> sp.			Y
<i>Pycnoporus coccineus</i>	Scarlet Bracket Fungus	Y	
<i>Ramaria</i> sp.			Y
<i>Resupinatus cinerascens</i>			Y
<i>Rhodocollybia</i> sp.			Y

LATIN NAME	COMMON NAME	RECORDED ELA (2012)	PERTH URBAN BUSHLAND FUNGI WORKSHOP (2005)
<i>Schizophyllum commune</i>	Split Gill Fungus		Y
<i>Schizopora</i> sp.			Y
<i>Scleroderma cepa</i>	Earthballs	Y	Y
<i>Stereum</i> sp.			Y
<i>Tubaria</i> sp.			Y
Unknown Agaric			Y
Unknown Ascomycete			Y
Unknown Resupinate			Y
<i>Volvariella speciosa</i>	Common Rosegill		Y

Appendix 10 – Warwick Open Space Key Fungi Species

Examples of Fungi Species at Warwick Open Space

Name	Common Name	Image
<i>Calocera guepinioides</i>	Scotsman's Beard	 <p>© N.L. Bougher</p> <p>Photo: N.L. Bougher (Bougher 2009)</p>
<i>Gymnopilus allantopus</i>	Golden Wood Fungus	 <p>© Neale L. Bougher</p> <p>Photo: N.L. Bougher (Bougher 2009)</p>
<i>Pycnoporus coccineus</i>	Scarlet Bracket Fungus	 <p>© N.L. Bougher</p> <p>Photo: N.L. Bougher (Bougher 2009)</p>

Draft Warwick Open Space Bushland Management Plan Community Consultation and Communication Plan

Purpose of the Consultation

- To obtain feedback from key stakeholders regarding the City of Joondalup Draft Warwick Open Space Bushland Management Plan.

Who will be consulted?

- Key stakeholders including:
 - Local Members of Parliament;
 - Friends of Warwick Bushland;
 - Warwick Senior High School;
 - Warwick Leisure Centre;
 - Warwick Sports Centre;
 - Department of Parks and Wildlife;
 - Department of Planning (Bush Forever); and
 - Department of Fire and Emergency Services.

How will they be consulted?

Key stakeholders will receive:

- A personally addressed letter explaining the purpose and objectives of the Draft Warwick Open Space Bushland Management Plan;
- A Feedback Form;
- A copy of the Draft Warwick Open Space Bushland Management Plan; and
- Reply-paid envelope.

Electronic copies of the Draft Warwick Open Space Bushland Management Plan will be supplied on request.

Anonymity

It will be a requirement for respondents to include their name and address in order for the Feedback Form to be accepted as a valid response. This will be stated on the Feedback Form.

Date of Commencement and Duration of Consultation

- Following endorsement by Council, targeted consultation will commence on 26 August 2013 for 21 days.
- The mail-out to key stakeholders will commence 26 August 2013.
- Length of advertising period will be 21 days commencing 26 August 2013.

Summary of Documents Required for the Consultation

- Hard copy of Draft Warwick Open Space Bushland Management Plan;
- Covering letters to key stakeholders;
- Electronic copy of the Draft Warwick Open Space Bushland Management Plan;
- Hard copy Feedback Form; and
- Reply-paid envelopes.