

# Warwick Open Space Bushland Management Plan





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# Acknowledgements

- Ms Karen Clarke, Dr Mark Brundrett and Mr David Pike, Friends of Warwick Bushland;
- Ms Tamara Kabat, Black-Cockatoo Conservation Officer, BirdLife Australia;
- Mr Les Holden, Station Officer, Department of Fire and Emergency Services (DFES);
- Mr Russell Passmore, Data Analyst – Operational Information Systems Branch, Department of Fire and Emergency Services (DFES); and
- Eco Logical Australia.

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.



# Acronyms

<b>Acronym / Abbreviation</b>	<b>Definition</b>
AHD	Australian Height Datum
BoM	Bureau of Meteorology
CALM	Department of Conservation and Land Management
the City	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
MRS	Metropolitan Region Scheme
NRM	Natural Resource Management
NWCPAG	National Wildlife Corridors Plan Advisory Group
SCC	Swan Catchment Council
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 have identified 217 native flora species (including one naturally occurring priority species and three naturally occurring significant species), 69 native fungi species, three native mammals, 64 native birds (including seven species of conservation significance), 16 native reptile species (including one species of conservation significance), two native amphibians, and 34 native invertebrates (including three 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 156 weed species (including four declared plants and one Weed of National Significance), five non-native mammals, five non-native birds and two 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, with the Joondalup City Centre being located 30 kilometres from the Perth Central Business District. The City covers an area of 96.5 square 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 Government of Western Australia.<sup>1, 2</sup>

### 1.3.1 Location

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).

### 1.3.2 History of the Site

#### Metropolitan Region Scheme

The Metropolitan Region Scheme (MRS) was established in 1962 by the then Metropolitan Regional Planning Authority. The MRS sets out the broad pattern of land use for the whole Perth Metropolitan Region. In 1963 Warwick Open Space was designated as an area of open space and in 1983 was rezoned as Parks and Recreation. The Parks and Recreation zoning refers to land with regional significance for ecological, recreation or landscape purposes. An amendment to the MRS was approved by the Western Australian Planning Commission in 2002 which removed approximately 2.3 hectares from Bush Forever site 202 with the area being rezoned as Public Purpose for use as the Warwick Senior High School.<sup>3</sup>

<sup>1</sup> Government of Western Australia (2000a)

<sup>2</sup> Government of Western Australia (2000b)

<sup>3</sup> City of Joondalup (2002)

## System 6 Conservation Reserve

During the late 1970's to early 1980's the Environmental Protection Authority undertook a state-wide assessment of bushland areas with an aim to designate specific areas of high conservation value as regional open space and regional parks. As part of the study geographical regions within Western Australia were divided into areas. System 6 refers to the area extending along the Swan Coastal Plain to Moore River and includes the Perth Metropolitan Region.<sup>4</sup>

In 1983 the then Department of Conservation and Environment released the Darling System – System 6 Report. Warwick Open Space was recommended as a regional open space area and was designated as System 6 Area M11. The report recommended that the site include areas for active recreation with the remainder of the site being set aside for conservation.<sup>5</sup>

In November 1989 the City of Wanneroo submitted concept plans for the development of Warwick Regional Open Space to include recreational areas. The proposal was subject to a Consultative Environmental Review (CER) under Part IV of the *Environmental Protection Act 1986*.

The Environmental Protection Authority considered that the impacts of the proposal were environmentally acceptable, provided:

- The proponent prepares a management plan for the landscaping of developments and for the areas proposed to be for conservation.
- Access to the conservation areas is restricted to pedestrians, with use of these areas to be education and passive recreation.<sup>6</sup>

## Bush Forever

In 2002 the State Government endorsed the Bush Forever Strategy as a means of seeking the appropriate protection and management of areas of regionally significant bushland within the Perth Metropolitan Region. The Western Australian Planning Commission designated Warwick Open Space as a Bush Forever site (202) due to the regionally significant bushland found within the site.

### 1.3.3 Land Tenure

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.

### 1.3.4 Current Land Uses

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, dog exercising or travel to and from the sporting facilities and Warwick Senior High School.

<sup>4</sup>Dooley and Pilgrim (2009)

<sup>5</sup>EPA and DEC (1983)

<sup>6</sup>EPA (1989)

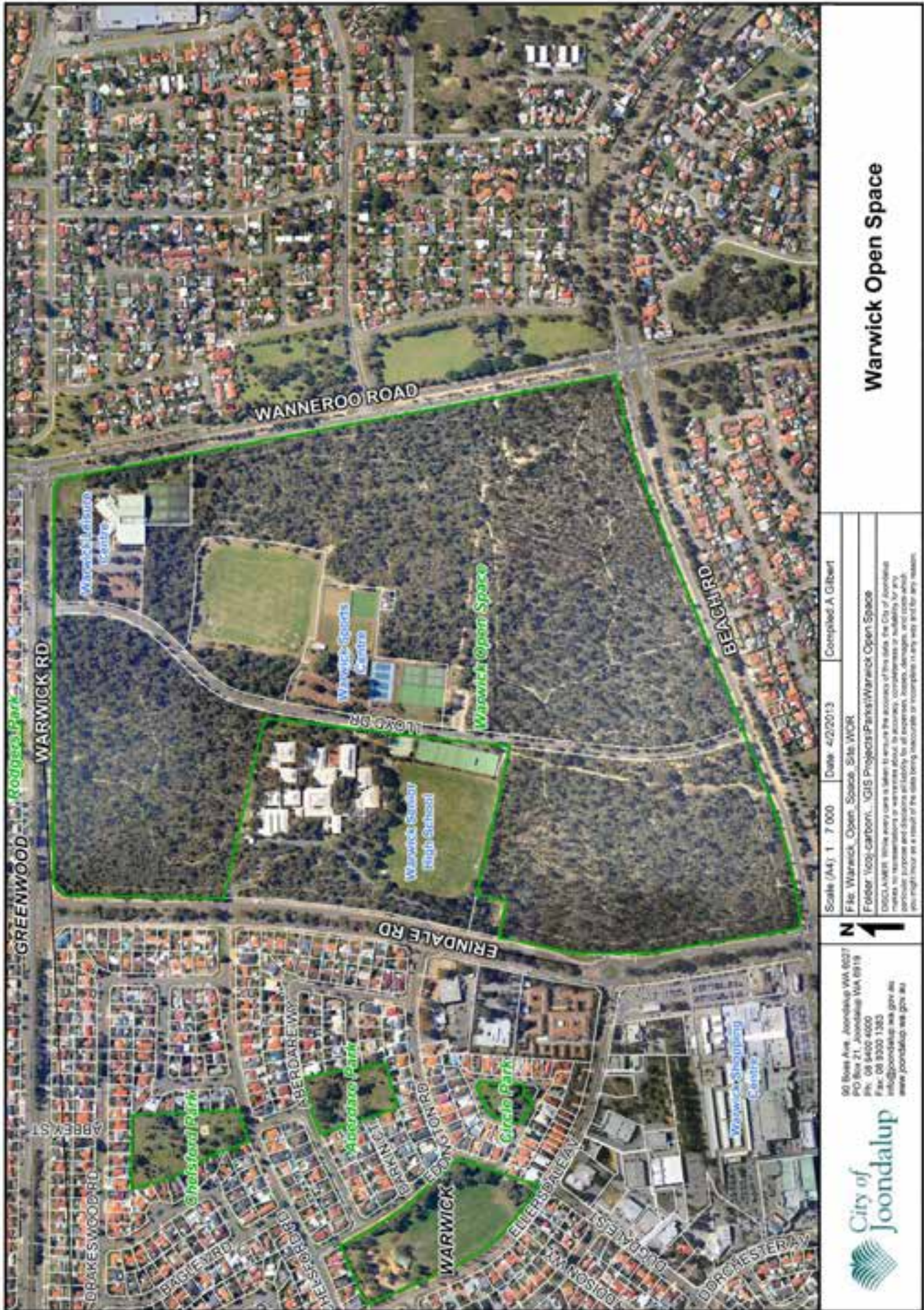


Figure 1: Location of Warwick Open Space in City of Joondalup





Figure 2: Map of Study Area





## 1.4 Objective and Aims

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

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.

## 1.5 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.
- Provide guidance to City employees, contractors and Friends Groups operating within Warwick Open Space.

## 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.

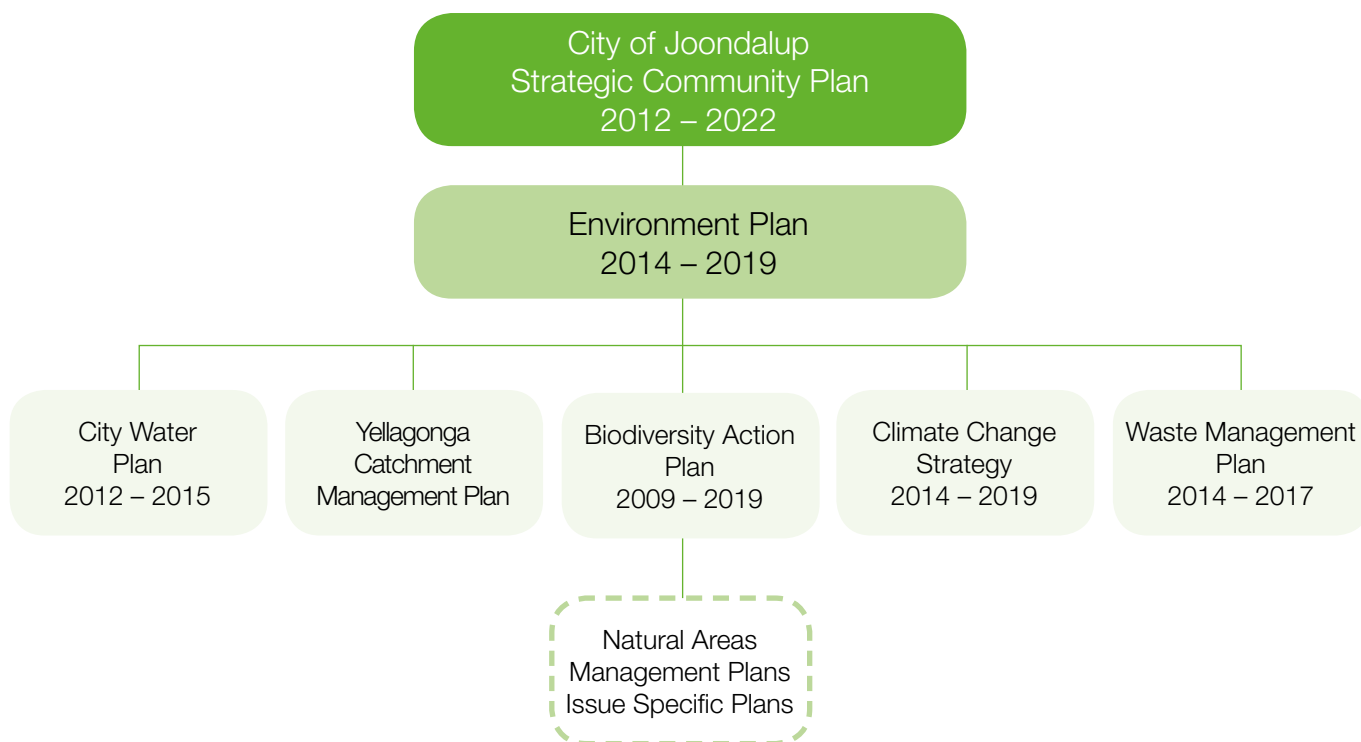
#### **Environment Plan**

The draft City of Joondalup *Environment Plan 2014–2019* 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****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 within Schedule 5 of the *District Planning Scheme No 2*. It is proposed to investigate incorporation of Warwick Open Space into *District Planning Scheme No. 3 Schedule 5* to assist in protecting native vegetation and ecosystems.

**City of Joondalup Animals Local Law 1999**

The purpose of this local law is to provide for the regulation, control and management of the keeping of animals within the City of Joondalup. In accordance with the local law, dogs can be exercised in all City public reserves, excluding road and street reserves and prohibited dog exercise areas.

Dogs can be exercised in Warwick Open Space and are encouraged to be under effective control by their owner. It is proposed to investigate amending the City of Joondalup *Animals Local Law 1999* to ensure that dogs remain on a leash at all times when within Warwick Open Space.

**City of Joondalup Pest Plant Local Law 2012**

Under the *Agriculture and Related Resources Protection Act 1976* and the *Local Government Act 1995*, the Council of the City of Joondalup made the *Pest Plant Local Law 2012* to require the owner or occupier of private land within the City of Joondalup district to destroy, eradicate or otherwise control pest plants within a specified time. Caltrop (*Tribulus terrestris*) is designated as a pest plant.

Caltrop has been identified in Warwick Open Space and is removed at the time of identification.



## 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 assessed all natural areas from 2004 onwards using the ecological criteria of the Natural Area Initial Assessment process, resulting in a priority ranking of natural areas. The City assesses major conservation, high priority and medium priority natural areas approximately every five to seven 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
- 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.

### 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*).<sup>7,8</sup>

##### ***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.

##### ***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.

<sup>7</sup> ELA (2013)

<sup>8</sup> Brundrett and Clarke (2004)

### **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*).<sup>9,10</sup>

### **Government of Western Australia "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). Three species in Warwick Open Space are listed as naturally occurring significant flora of the Perth Metropolitan Region; Waldjumi (*Jacksonia sericea*), *Conostylis aculeata* subsp *cygnorum* and Common Popflower (*Glischrocaryon aureum*). Three fauna species of conservation significance recorded in Warwick Open Space are the Speckled Stone Gecko (*Diplodactylus polyophthalmus*), Sciron Skipper (*Trapezites sciron*) and Western Jewel Butterfly (*Hypochrysops halyaetus*).<sup>9,11</sup>

### **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 Conservation and Land Management (CALM) (now 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.<sup>12</sup>

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

### **Swan Natural Resource Management Region Environmental Weed Census and Prioritisation 2008**

The Swan Catchment Council (SCC) and the Department of Parks and Wildlife (formerly the Department of Environment and Conservation) conducted an environmental weed assessment of over 900 weeds in the Swan Natural Resource Management (NRM) Region to identify the most threatening species, in order to prioritise works programs and effectively allocate resources. The assessment prioritises weed species using ratings of ecological impact, invasiveness, current and potential distribution in the region and recognised importance (existing classifications or its recognised weed potential elsewhere) as very high, high, medium, low, unknown and further assessment required.

Warwick Open Space contains 11 very high priority rated weeds and 18 high priority weeds in the Swan NRM Region Environmental Weed Assessment.

## **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 gratiosa*) and the migratory species Rainbow Bee-eater (*Merops ornatus*), Fork-tailed Swift (*Apus pacificus*) and Great Egret (*Ardea modesta*).<sup>13,14</sup>

### **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*).<sup>15</sup>

<sup>9</sup> ELA (2013)

<sup>10</sup> Clarke et. al. (2012)

<sup>11</sup> Brundrett and Clarke (2004)

<sup>12</sup> CALM (1999)

<sup>13</sup> ELA (2013)

<sup>14</sup> Clarke et. al. (2012)

<sup>15</sup> Brundrett and Clarke (2004)

### 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*).<sup>13,14</sup>



<sup>13</sup> ELA (2013)

<sup>14</sup> Clarke et. al. (2012)



# 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-Jarra-Marri woodland on sandy soils.<sup>16</sup> 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.<sup>17</sup>

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.<sup>18,19</sup> 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 of Aeolian sand over limestone.<sup>20</sup> The environmental geological characteristics of Warwick Open Space (predominantly sand with limestone close to the north-west corner) are shown in Figure 5.

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.<sup>21</sup>

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.<sup>21</sup>

There is no known risk of Acid Sulphate Soils in Warwick Open Space.<sup>19</sup> 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. Within the City of Joondalup, areas of high to moderate acid sulphate soil risk are predominantly in wetlands or areas adjacent to wetlands, as shown in Figure 6.<sup>21, 22</sup>

<sup>16</sup> ELA (2013)

<sup>17</sup> Bolland (1998)

<sup>18</sup> McArthur and Bettenay cited in Syrinx (2012)

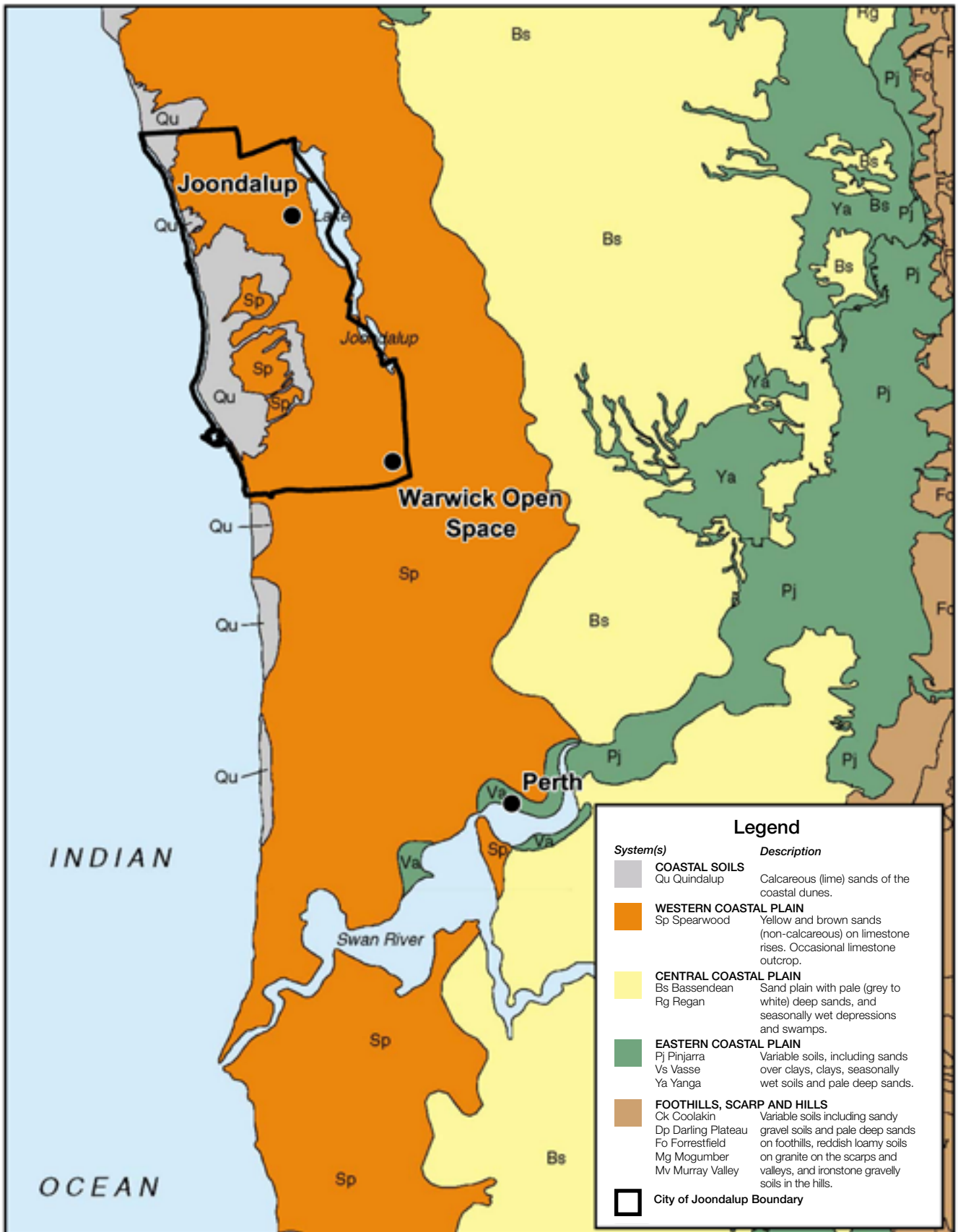
<sup>19</sup> DoW (2004)

<sup>20</sup> DAFWA cited in Eco Logical Australia (2013)

<sup>21</sup> DEC n.d.(a)

<sup>22</sup> Landgate (2006)

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



<p>90 Boas Ave, Joondalup WA 6027 PO Box 21, Joondalup WA 6919 Ph: 08 9400 4000 Fax: 08 9300 1383 info@joondalup.wa.gov.au www.joondalup.wa.gov.au</p>	<p><b>N</b></p> <p>Scale (A4): 1 : 200 000    Date: 15/10/2013    Compiled: A Gilbert</p> <p>File: Soil Landscapes Perth - WOS.wor</p> <p>Folder: \\coj-carbon\Spatial_Data_Server\GIS Projects\Soil Landscapes Perth</p> <p><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></p>	<p><b>Soil Landscape Systems Perth Metropolitan Area</b></p>	
			<p>City of Joondalup Boundary</p>
			<p>INDIAN OCEAN</p>

Figure 5: City of Joondalup Environmental Geology (sourced from Department of Mines and Petroleum 2013)

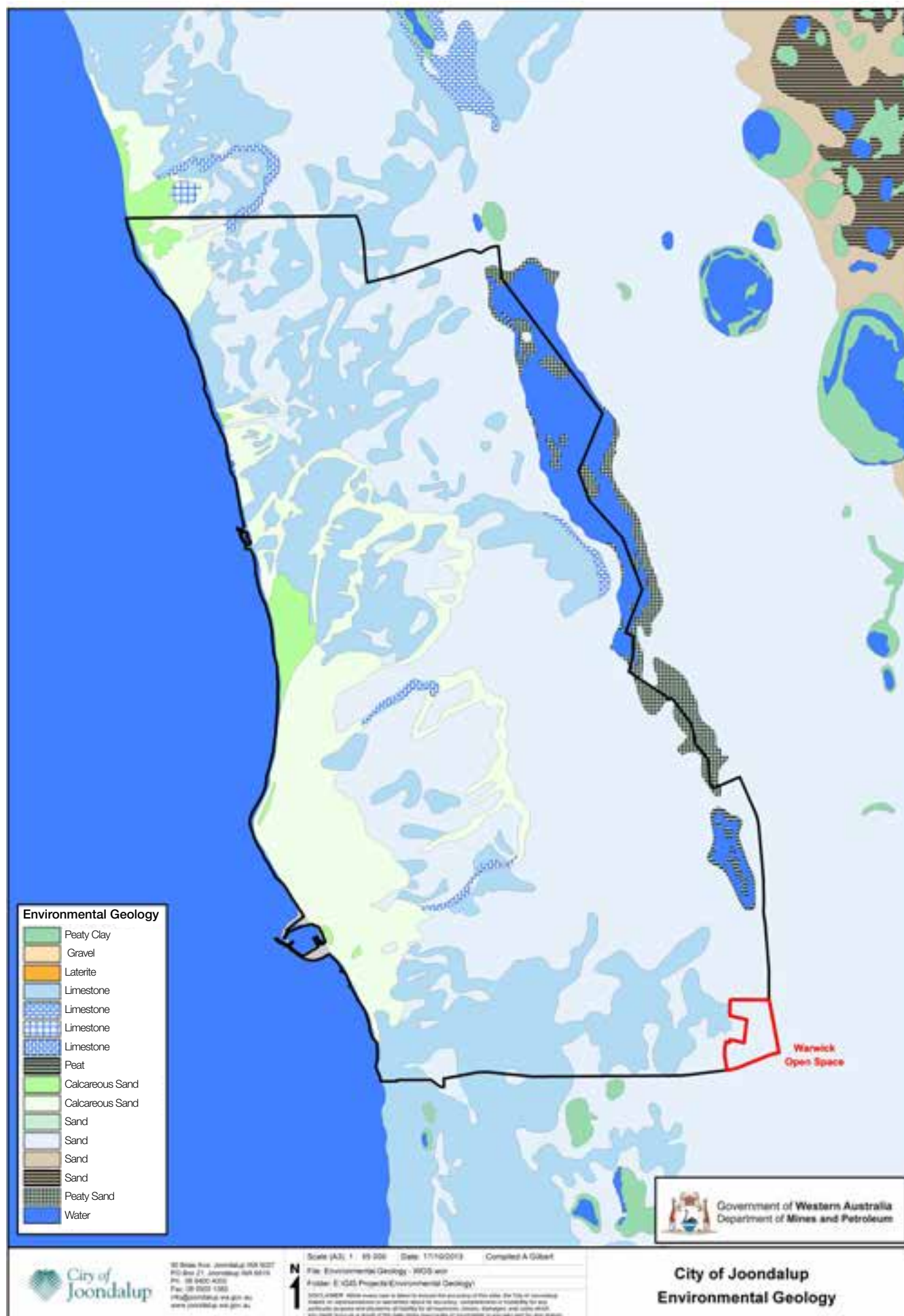
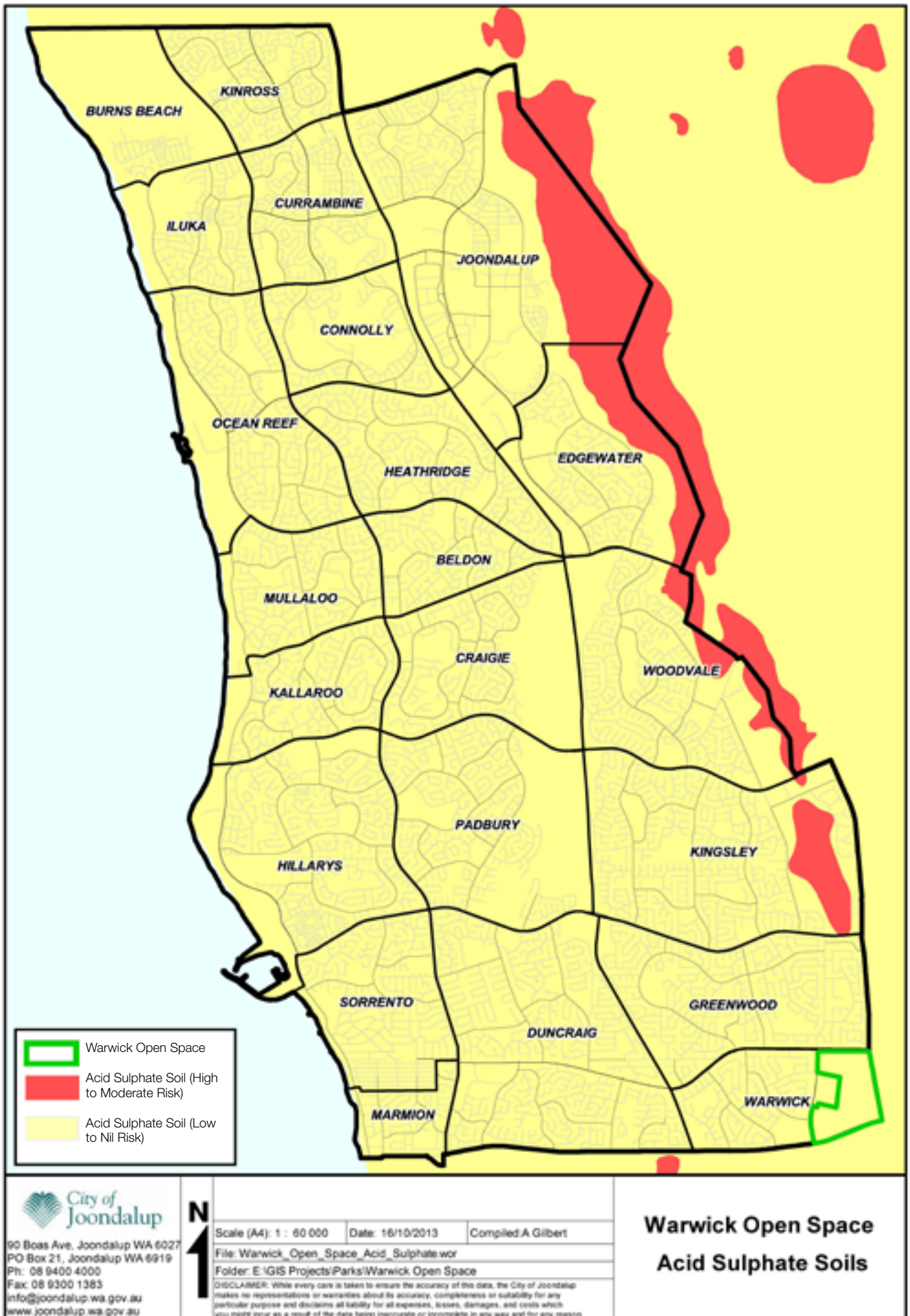




Figure 6: Warwick Open Space Acid Sulphate Soil Risk

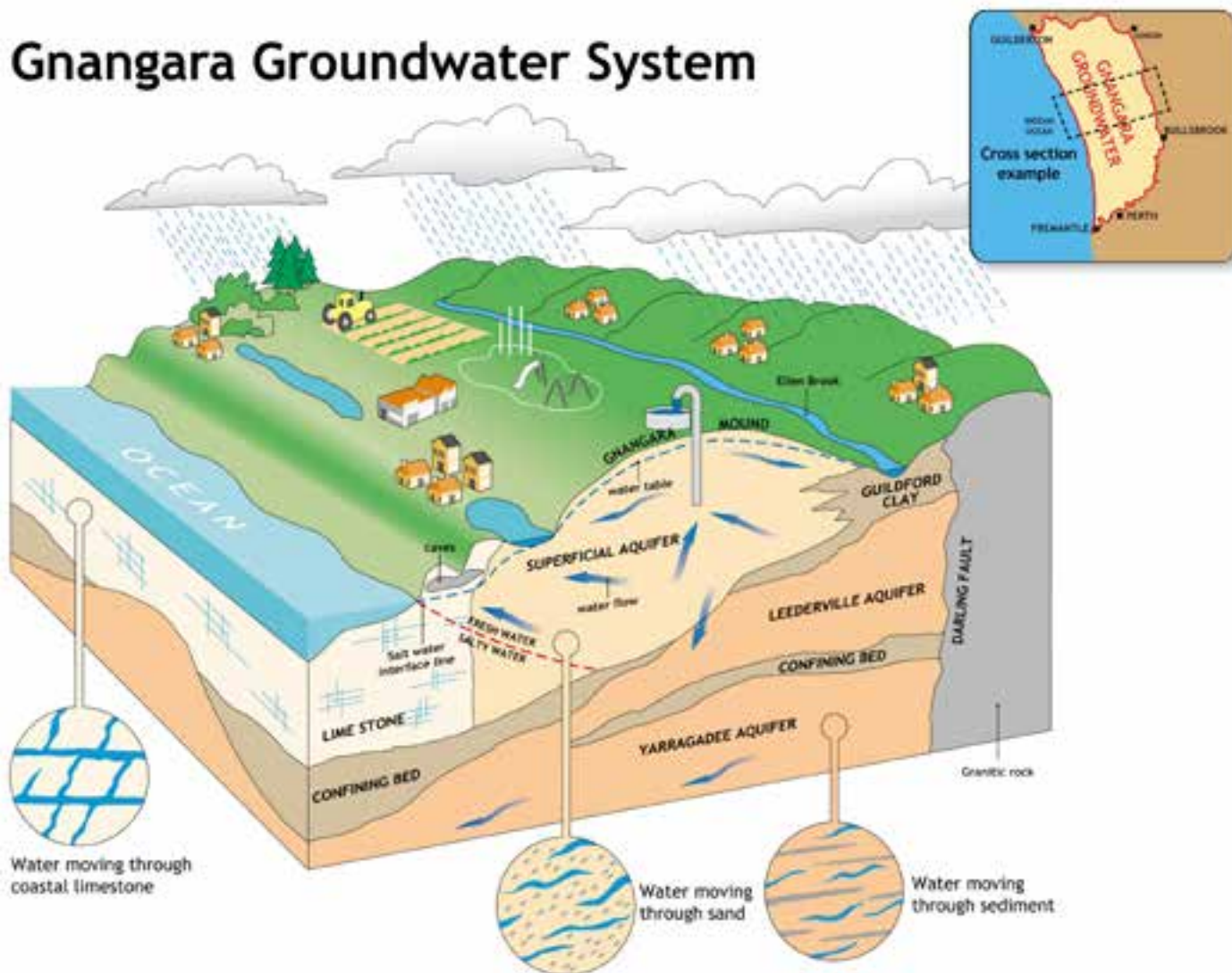


## 2.1.2 Hydrology

### Groundwater

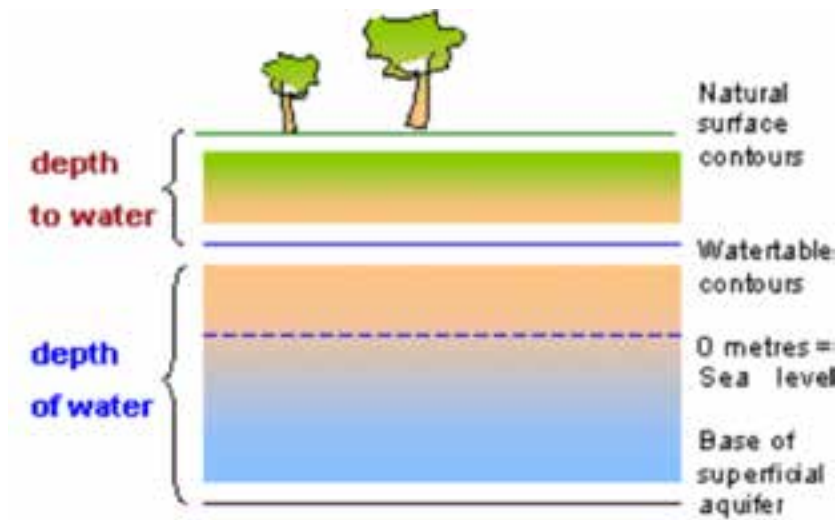
The City of Joondalup is located on Perth's largest source of groundwater, the Gnangara Groundwater System, comprising four main aquifers: superficial (shallow, unconfined), Mirrabooka (deeper, semi-confined), Leederville (deep, mostly confined) and the Yarragadee (deep, mostly confined). The Gnangara Mound extends across most of the superficial aquifer and refers to the water table creating a mound shape, as shown in Figure 7. Groundwater levels in the superficial aquifer have been declining over recent years due to pressure from extraction and the impacts of climate change.<sup>23</sup>

Figure 7: Gnangara Groundwater System (sourced from DoW n.d.)



<sup>23</sup> City of Joondalup (2012a)

Some plant species at Warwick Open Space are likely to use groundwater as the depth to water is 9.5 to 29 metres. In general, some plant species (usually larger tree species) in the Perth metropolitan area within 10 metres of groundwater are likely to access the water table.<sup>24</sup> Depth to water is the depth from the natural surface contours to the water table (see Figure 8). Groundwater salinity at Warwick Open Space is fresh (0 – 500 TDS in mg/L).



**Figure 8: 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 9).

<sup>24</sup> A Paton (DoW) 2013, pers. comm., 26 March



Figure 9: Warwick Open Space Groundwater Monitoring Bore Location



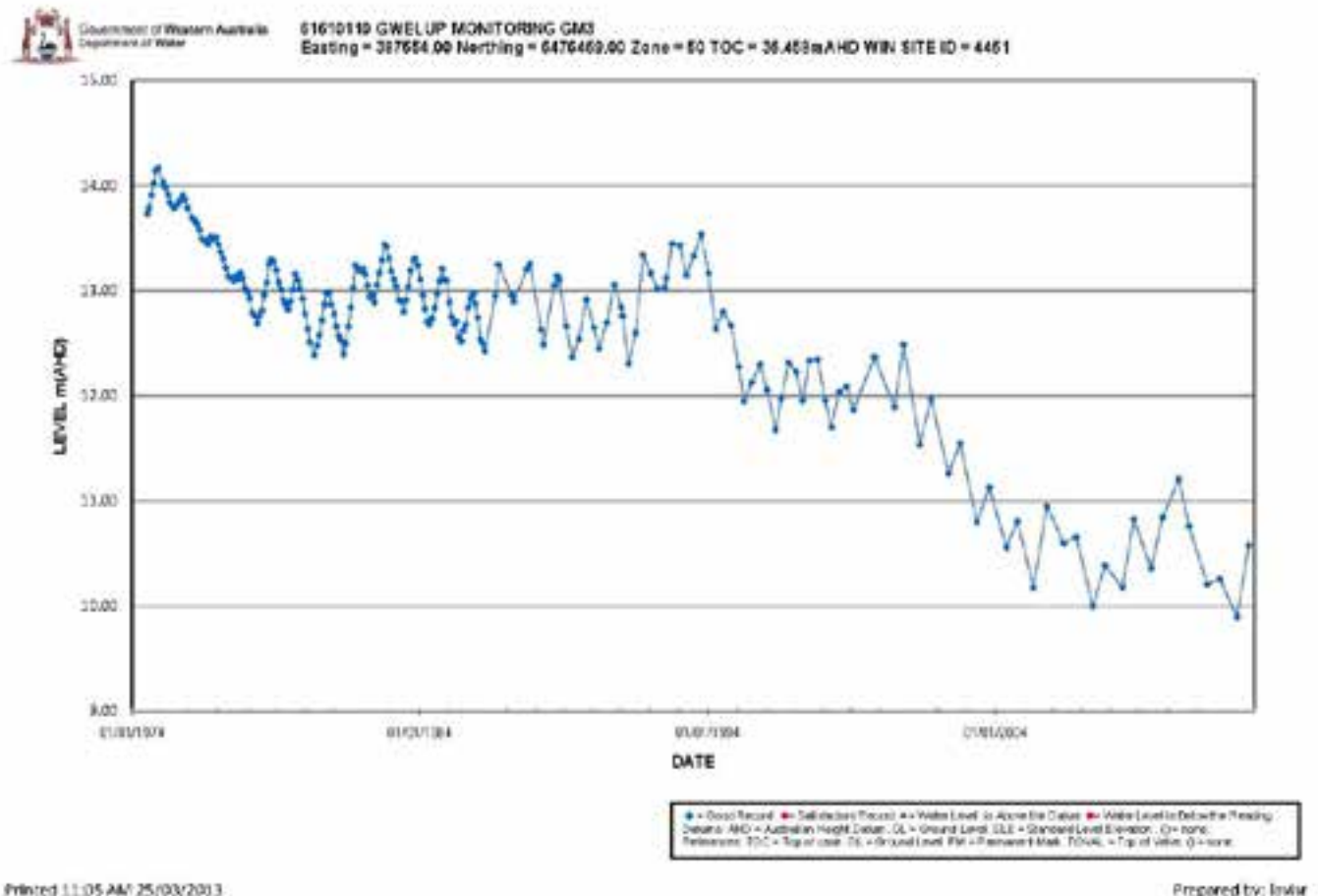
● Nearest Groundwater Monitoring Bore  
● Other Bores

 90 Boas Ave, Joondalup WA 6027 PO Box 21, Joondalup WA 6919 Ph: 08 9400 4000 Fax: 08 9300 1383 info@joondalup.wa.gov.au www.joondalup.wa.gov.au	<p><b>N</b></p>	Scale (A4): 1 : 6 500	Date: 25/03/2013	Compiled: A Gilbert
		File: Warwick_Open_Space_GWM.wor Folder: \\cpe-carbon1\IGIS Projects\Parks\Warwick Open Space 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.		
<h2>Warwick Open Space Groundwater Monitoring</h2>				



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 four metre lowering of the groundwater table over the past 40 years, largely due to increased groundwater abstraction, land use change and climatic change.<sup>25</sup> Figure 10 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).<sup>26</sup>

**Figure 10: 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.<sup>25</sup>

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.<sup>27</sup>

### 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 aquifer and prevent the spread of weeds, pollutants, pathogens and sediment to vegetation.<sup>28</sup>

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.<sup>29</sup>

Swales are broad, shallow channels that are grassed or vegetated and used to collect and convey stormwater flows, promote infiltration and removal of sediment.<sup>30</sup>

<sup>25</sup> Loomes and Freund (n.d.)  
<sup>26</sup> DoW (2013)

<sup>27</sup> DoW (2004)  
<sup>28</sup> DoE (2004)

<sup>29</sup> Grose and Hedgcock (n.d.)  
<sup>30</sup> DoW (2011)

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 11. The Erindale Road sump receives water from the Erindale Road Catchment (233,573 m<sup>2</sup> in area), whilst the swale on the corner of Warwick Road and Wanneroo Road receives water from the Warwick Leisure Centre Catchment (44,245 m<sup>2</sup> in area).



Figure 11: Warwick Open Space Drainage

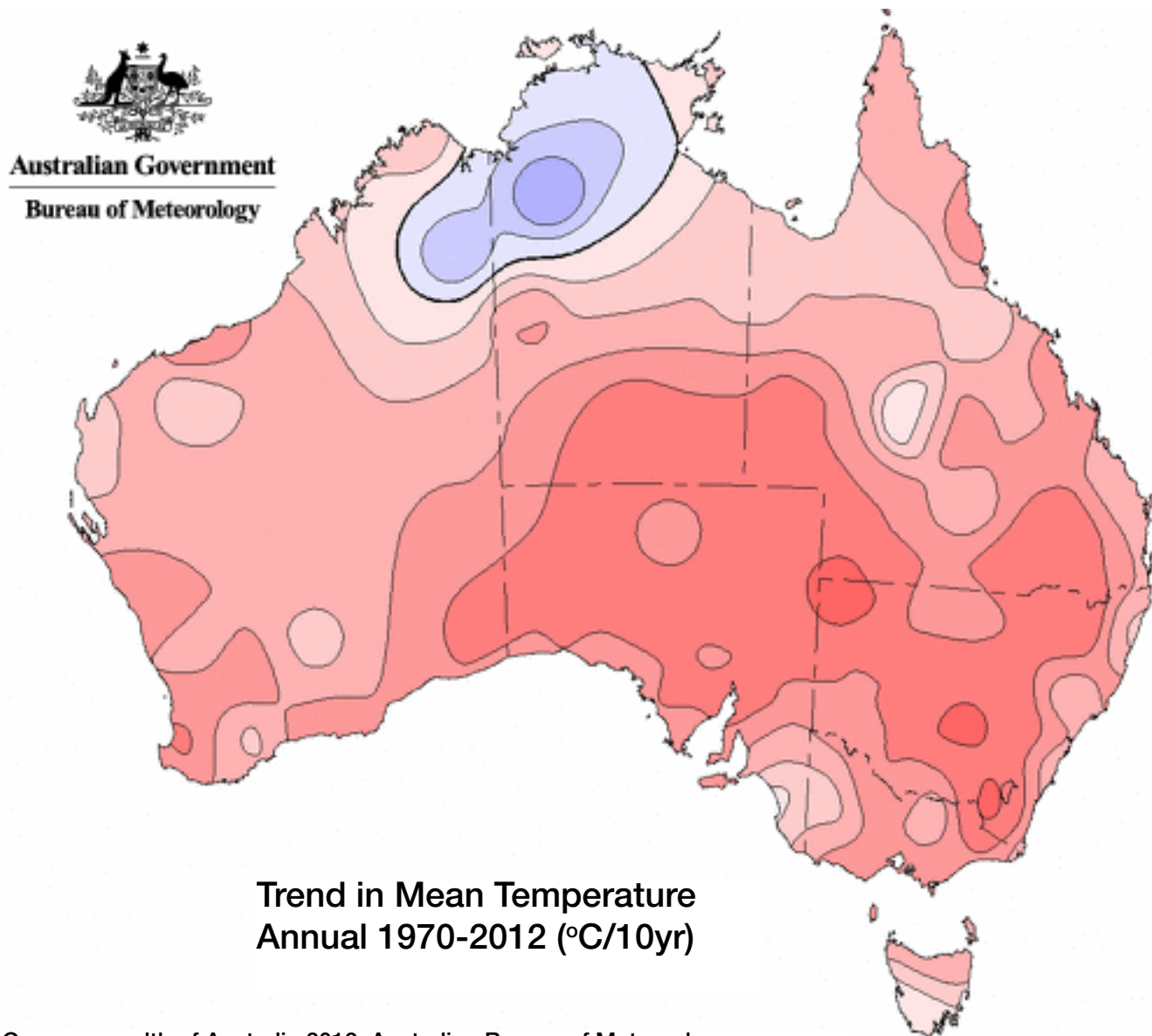




### 2.1.3 Climate Change

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.<sup>31</sup> Figure 12 shows the trend towards an increase in annual mean temperature for most of Australia over the last four decades.

**Figure 12: Annual Trend in Mean Temperature 1970-2012 (sourced from BoM 2013)**



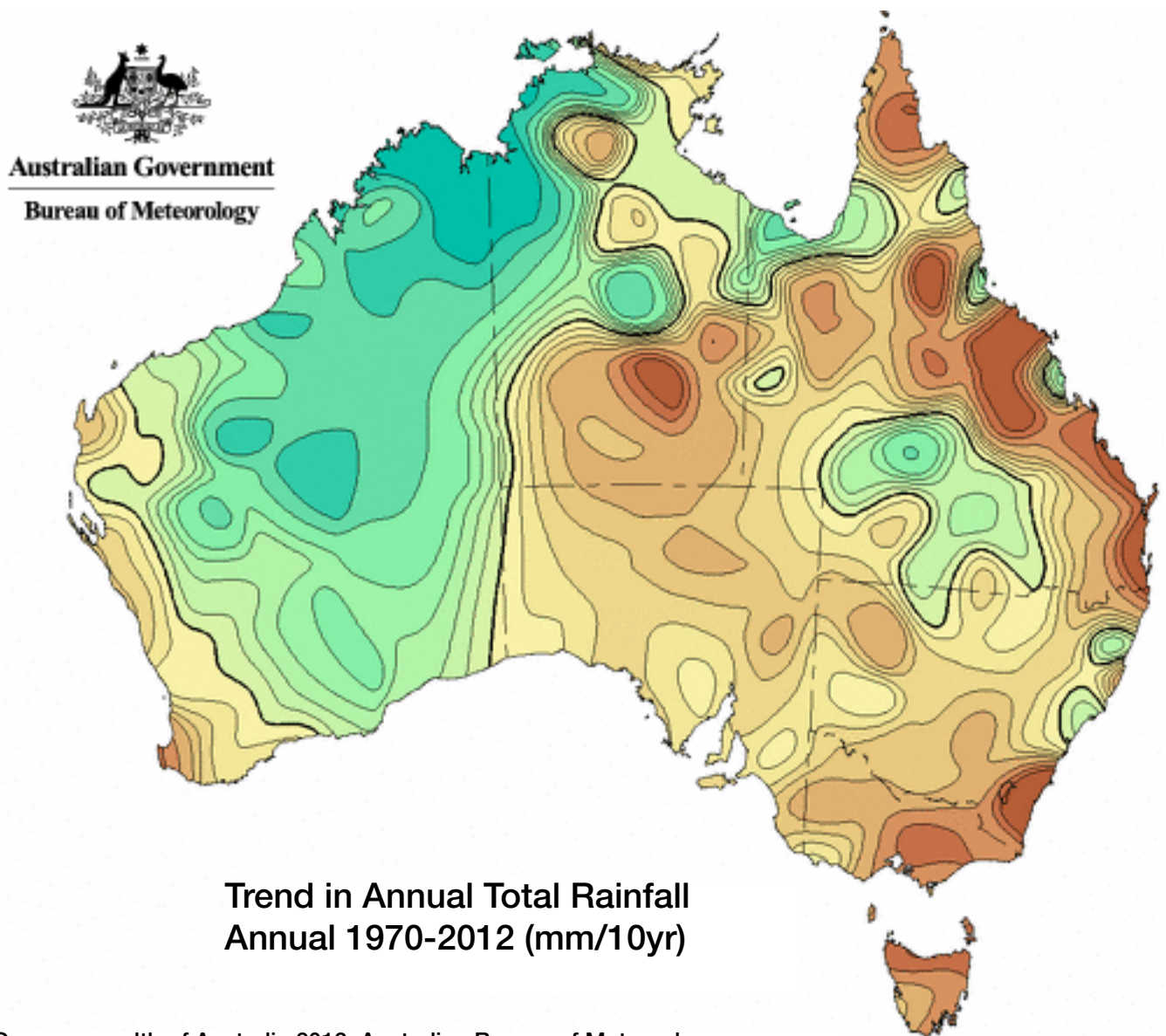
© Commonwealth of Australia 2013, Australian Bureau of Meteorology

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.<sup>31</sup>

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.<sup>31</sup> Figure 13 shows the decreasing trend in annual total rainfall for Perth over the past four decades.

<sup>31</sup> City of Joondalup (2012a)

Figure 13: Trend in Annual Total Rainfall 1970-2012 (mm/10yr) (sourced from BoM 2013)



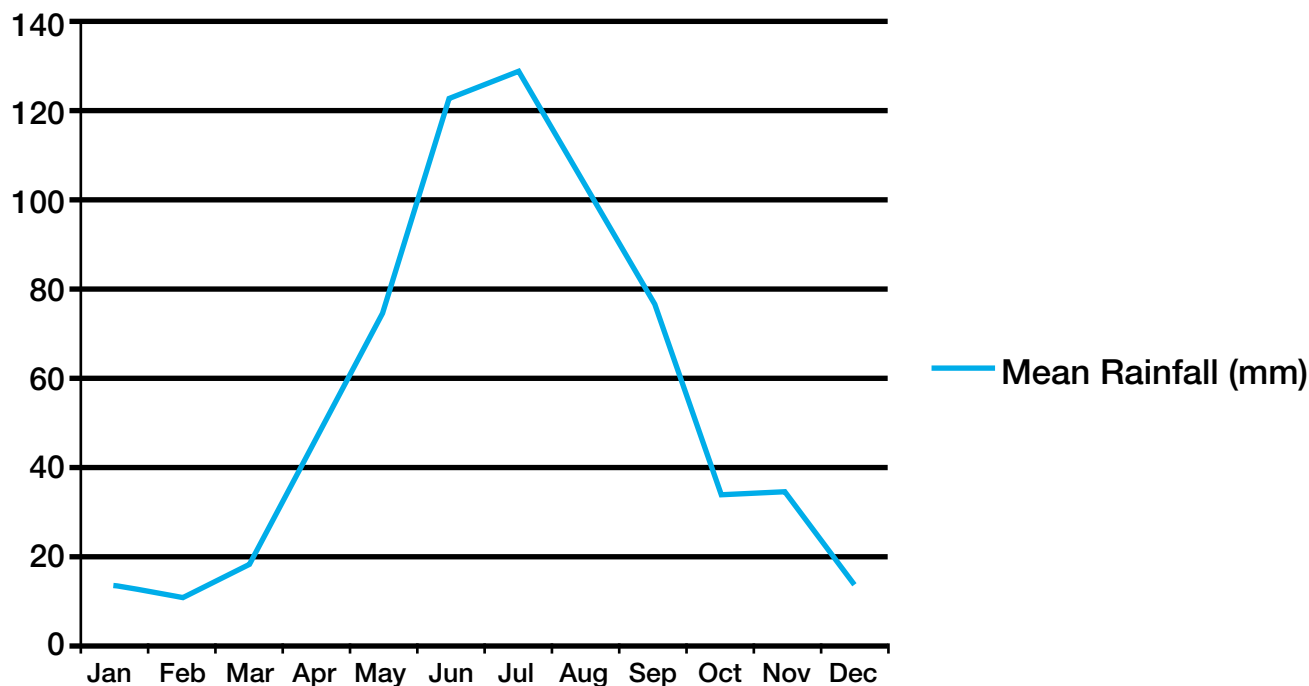
The City of Joondalup experiences a Mediterranean climate of hot dry summers with an average temperature of 31 degrees during the day and mild wet winters with an average day time temperature of 18 degrees. The average annual rainfall from 2002 to 2012 was 679mm. Approximately 80 percent of the annual rain falls between the months of May and September, as shown in Figure 14.<sup>32</sup>

<sup>32</sup> BoM (2013)



Figure 14: Mean Rainfall Recorded at Perth Airport Weather Station 2002-2012 (sourced from BoM 2013)

## Mean Rainfall in Perth (2002 - 2012)



### 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 15). This complex consists of predominantly open forest of *Eucalyptus gomphocephala* – *Eucalyptus marginata* – *Eucalyptus calophylla* and woodland of *Eucalyptus marginata* – *Banksia* species.<sup>33</sup>

The State Government has established targets under Bush Forever which aim to protect at least 10% of each vegetation complex<sup>34</sup> in the Perth Metropolitan Region to achieve a comprehensive representation of all the ecological communities originally occurring in the region.<sup>35</sup>

Approximately 18% (6,735 ha) of the original extent of Karrakatta Complex – Central and South vegetation complex remains within the Perth and Peel region, with 5% (350 ha) of this remaining vegetation existing within the City of Joondalup.

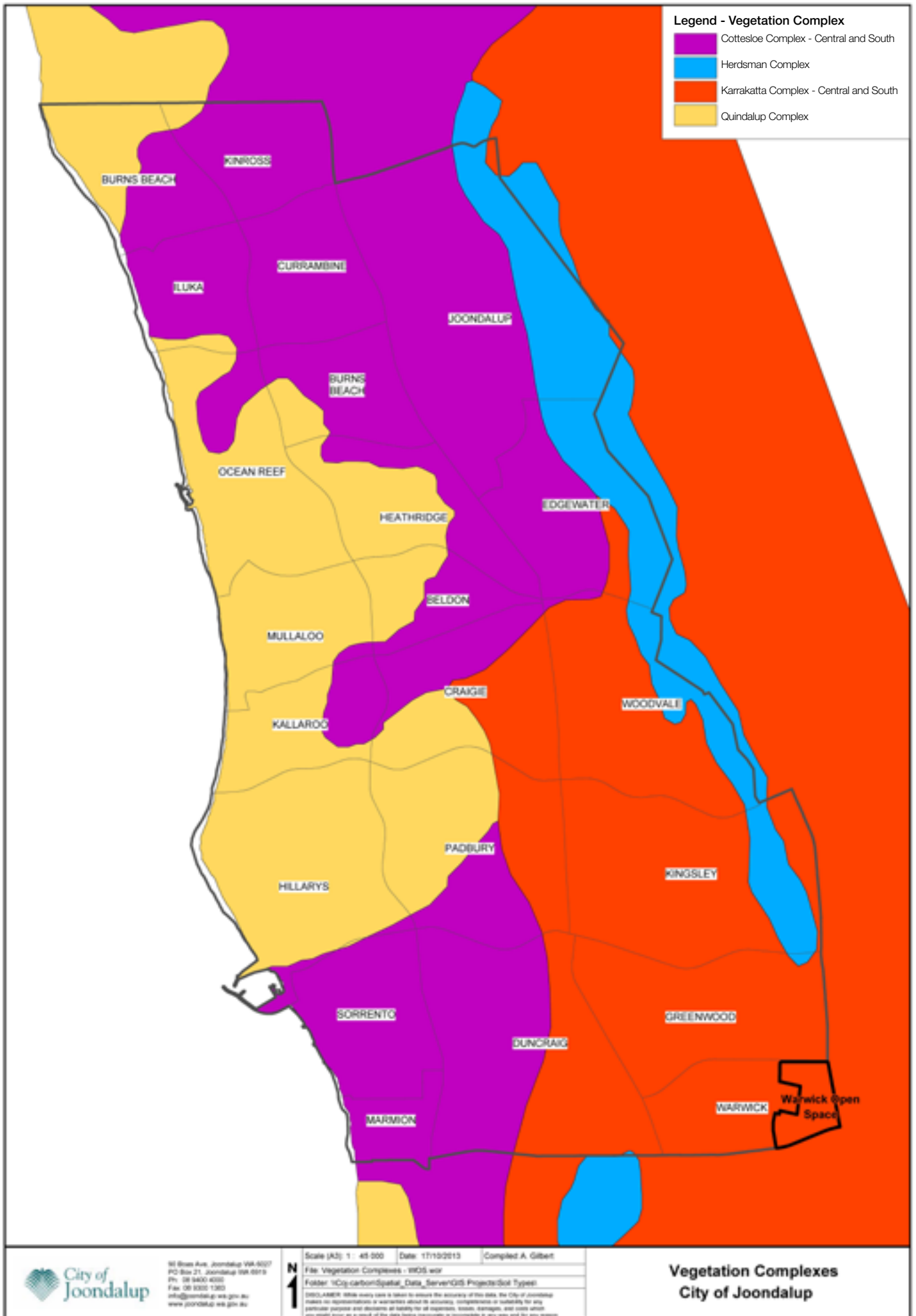
Due to the limited extent of the Karrakatta Complex – Central and South vegetation complex remaining within the Perth Metropolitan Region, it is important to retain bushland within Warwick Open Space for its conservation value.

<sup>33</sup> Heddle et. al. cited in Eco Logical Australia (2013)

<sup>34</sup> Department of Planning (2000)

<sup>35</sup> WALGA (2010)

Figure 15: 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.<sup>36</sup> Whilst FCTs can be a useful way of describing groups of flora species, or defining Threatened or Priority Ecological Communities on the Swan Coastal Plain, 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 16:

**Table 1: Vegetation Communities at Warwick Open Space**

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%).

No Threatened or Priority Ecological Communities were identified within Warwick Open Space or in nearby bushland.<sup>36</sup>

## 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 to 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 17.

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 may be partly attributed to the amount of bush fires that have occurred at Warwick Open Space over the past 12 months.

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

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

<sup>36</sup> ELA (2013)



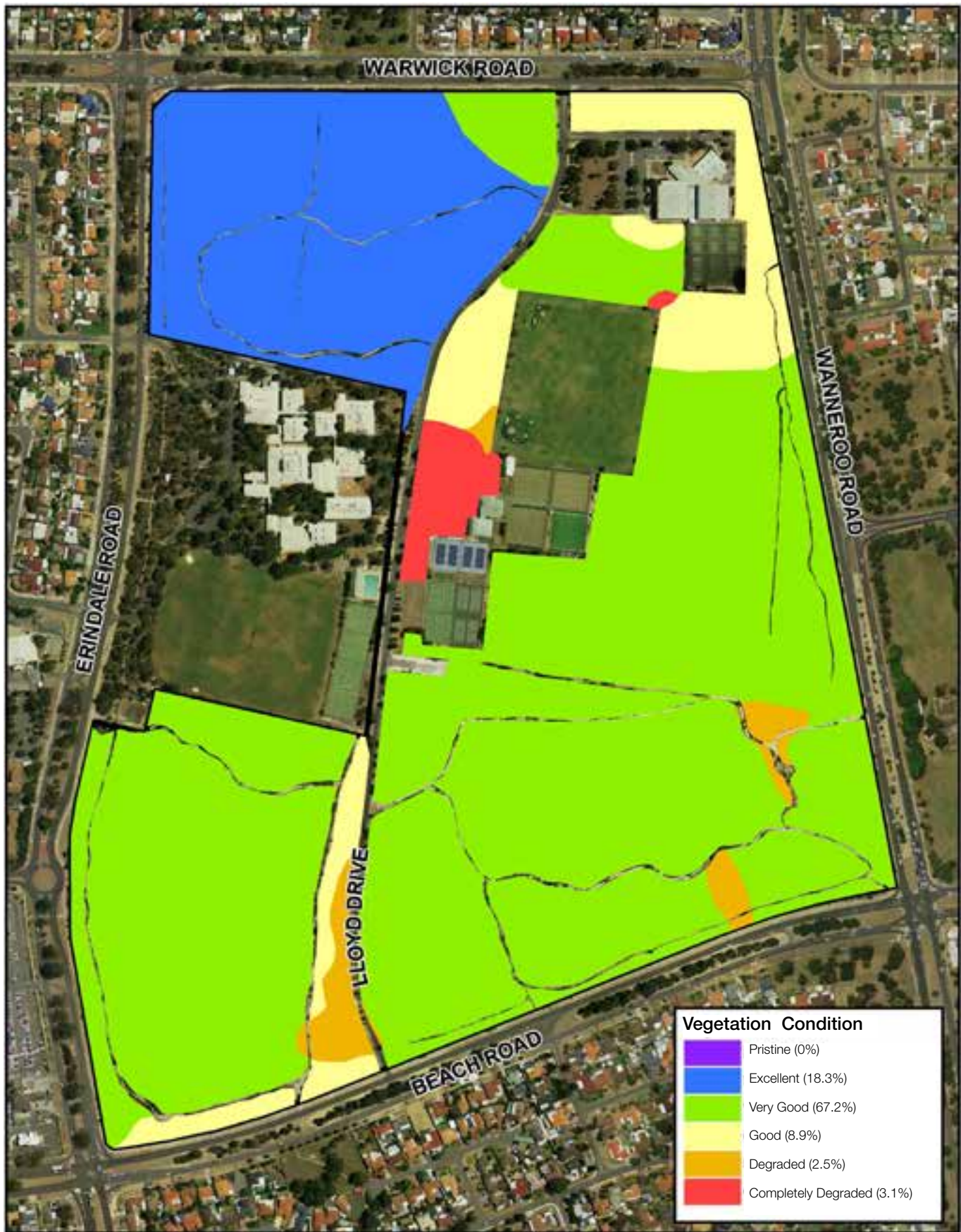
Figure 16: Warwick Open Space Vegetation Communities (sourced from ELA 2013)



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Figure 17: Warwick Open Space Vegetation Condition – September 2012 (sourced from ELA 2013)



Vegetation Condition	
	Pristine (0%)
	Excellent (18.3%)
	Very Good (67.2%)
	Good (8.9%)
	Degraded (2.5%)
	Completely Degraded (3.1%)

City of Joondalup  
 90 Bees Ave, Joondalup WA 6027  
 PO Box 21, Joondalup WA 6919  
 Ph: 08 9400 4000  
 Fax: 08 9300 1383  
 info@joondalup.wa.gov.au  
 www.joondalup.wa.gov.au

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**Warwick Open Space**  
**Vegetation Condition**

# 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<sup>37</sup>
- control of pests and diseases
- supporting seed dispersal and pollination
- providing a genetic store from which we can benefit in the future<sup>38</sup>
- a number of recreational and cultural experiences.<sup>39</sup>

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
- 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.<sup>40</sup>

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.

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 373 flora species on site, including 217 (58%) native species and 156 (42%) introduced species. The optimal time for surveying is spring for native flora and winter for weeds.

<sup>37</sup> Burbidge (2004)

<sup>38</sup> Millennium Ecosystem Assessment (2005)

<sup>39</sup> City of Joondalup (2012b)

<sup>40</sup> Conservation International (2012)



## 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 217 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*.

Three species in Warwick Open Space are listed as naturally occurring significant flora of the Perth Metropolitan Region, Waldjumi (*Jacksonia sericea*), *Conostylis aculeata* subsp *cygnorum* and Common Popflower (*Glischrocaryon aureum*).<sup>41,42</sup>

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*).<sup>43</sup> The threatened and significant flora species recorded in Warwick Open Space are shown in Appendix 2.

Tuart trees occur in Warwick Open Space. Mature Tuart trees (*Eucalyptus gomphocephala*) provide nesting hollows for Carnaby's Black Cockatoos. Tuarts take 200 years to develop hollows that are a suitable size for nesting.<sup>44</sup> 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.<sup>45</sup> 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

Weeds are 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
- increase fuel loads for fires
- impact negatively on fauna and flora and their habitats
- compete with native species for space, water and nutrients.<sup>46</sup>

Over 28,000 known alien plant species have been introduced to Australia with approximately 10% now being established in the environment.<sup>47</sup> Garden plants are the main source of Australia's weeds, accounting for 66% of recognised weed species.<sup>46</sup>

A total of 156 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*), One-leaf Cape Tulip (*Moraea flaccida*) and Smooth Catsear (*Hypochaeris glabra*).<sup>48</sup>

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.<sup>48,49</sup> Twelve weed species recorded in Warwick Open Space were rated as high priority in the Environmental Weed Strategy for WA (1999). Eleven very high priority rated weeds and eighteen high priority weeds in the Swan NRM Region Environmental Weed Assessment (2008) were recorded in Warwick Open Space. Key weed species existing at Warwick Open Space are shown in Appendix 2.

## 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.

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.

<sup>41</sup> ELA (2013)

<sup>42</sup> Brundrett and Clarke (2004)

<sup>43</sup> Bishop et al. (2012)

<sup>44</sup> DEC (2010)

<sup>45</sup> Matusick, Hardy and Ruthrof (2012)

<sup>46</sup> DSEWPC (2012)

<sup>47</sup> Groves, Boden and Lonsdale (2005)

<sup>48</sup> ELA (2013)

<sup>49</sup> Brundrett and Clarke (2004)

- On ground weed control, including prioritisation of natural areas and priority weeds to target.
- Community education initiatives.
- Fire prevention measures.

Weed inspections are conducted monthly at Warwick Open Space to establish the extent and distribution of weed species and to identify priority weeds. Weed monitoring of the number of species of Veldt Grass is conducted annually using three 10m x 10m quadrats in the southern end of Warwick Open Space, to determine the effectiveness of weed control measures. Natural Areas Initial Assessments are conducted approximately every five 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.<sup>50</sup> The outcomes from weed inspections and monitoring inform on ground weed management programs. The vegetation condition assessment (see Figure 17) also informs weed management as the vegetation in the best condition can be prioritised for weed control.

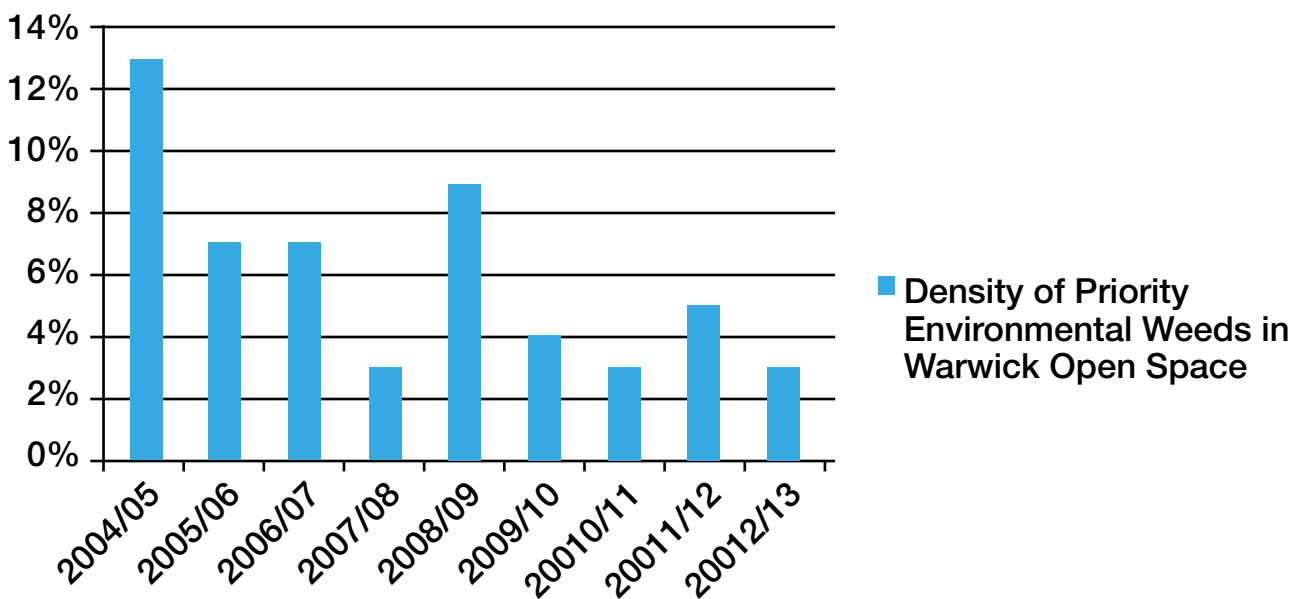
The City monitors the density of priority environmental weeds in Warwick Open Space on an annual basis, measured on three transects within the reserve. There has been a decrease in weed density in 2012/13, compared to 2011/12, due to increased weed control measures (see Figure 18).

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

- Weed species listed within Friends of Warwick Bushland List of Priority 1 Weeds Requiring Mapping (2012).
- Weed species listed as a Weed of National Significance (WONS) under the National Weeds Strategy (1997).
- The weed species is listed as a Declared Plant according to the Department of Agriculture and Food WA (2010).
- The weed species is a High Priority Weed according to the Environmental Weed Strategy for WA (DEC 1999).
- The weed species is listed as Very High Priority or High Priority Weed according to the Swan NRM Region Environmental Weed Assessment (Bettink and Keighery 2008).
- The weed species is listed as a pest plant under the City's *Pest Plant Local Law 2012*.
- The City of Joondalup has determined that the weed species poses a major threat to vegetation.
- The City of Joondalup has determined that the weed species poses a major threat to the structure of vegetation communities.
- The City of Joondalup has determined that the weed species is likely to contribute to a high fuel load, for example grasses.

Identified priority weeds and their recommended weed treatment methodology is detailed in Appendix 5, which is used for the City of Joondalup on ground management of weeds.

**Figure 18: Density of Priority Environmental Weeds in Warwick Open Space**



<sup>50</sup> WALGA (n.d.)

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 and surrounding 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.

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)
- 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 been recorded at Warwick Open Space.



Caltrop (*Tribulus terrestris*)



## 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 five years.
Weed survey	Undertake a follow up weed survey in winter to supplement previous weed survey undertaken in spring, within five 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 City of Joondalup <i>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.

## 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.<sup>51</sup> 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.<sup>52</sup> Many native plants have beneficial partnerships with fungi, for example eucalypts, wattles and orchids. Fungi also provide food and/or habitat for fauna such as bandicoots and beetles.<sup>53</sup>

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 69 recorded 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 Project Warwick Workshop Fungi Report (2005) was also utilised to inform the development of this Plan.

### Fungi

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

<sup>51</sup> Bougher (2009)

<sup>52</sup> Robinson (n.d.)

<sup>53</sup> DEC (n.d.b)

### Current Management Approach

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

### 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.<sup>54</sup>

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.<sup>54</sup>

*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.<sup>54</sup>

*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.<sup>54</sup>

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



<sup>54</sup> City of Joondalup (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.<sup>54</sup>

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 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.<sup>55</sup> 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 five 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.

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 have been three native mammals, 64 native birds (including seven species of conservation significance), 16 native reptile species (including one species of conservation significance), two native amphibians, and 34 native invertebrates (including three species of conservation significance) recorded. In addition, five non-native mammals, five non-native birds and two non-native invertebrates have been identified at Warwick Open Space. The optimal time for surveying is spring for native flora and winter for weeds.

<sup>54</sup> City of Joondalup (2012c)

<sup>55</sup> Arbor Carbon (2012)



## 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.<sup>56</sup>

### Mammals

Three native mammals were recorded at Warwick Open Space, the Western Grey Kangaroo, Gould's Wattleed Bat and White-striped 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 Wattleed Bat (*Chalinolobus gouldii*) and the White-striped Bat (*Austronomus australis*) are microbats and two 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.<sup>57</sup> A comprehensive bat survey would require a one week remote monitoring bat survey during summer.<sup>58</sup> Bats can be encouraged to roost in the area by installing bat boxes.

### 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

Two native amphibians were recorded at Warwick Open Space, the Turtle Frog (*Myobatrachus gouldii*) and the Quacking Frog (*Crinia Georgiana*). The Turtle Frog is relatively common on the coastal plain and is one of the few frogs that does not undergo the tadpole stage and can inhabit sandy areas without free standing water.<sup>59</sup>

### Birds

A total of 63 native birds have been recorded as occurring in Warwick Open Space, including the endangered Carnaby's Black-Cockatoo (*Calyptrorhynchus latirostris*) and the vulnerable Forest Red-tailed Black Cockatoo (*Calyptrorhynchus banksii naso*) and Baudin's Black Cockatoo (*Calyptrorhynchus 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.<sup>60</sup> 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.<sup>61</sup>

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.<sup>62</sup>

<sup>56</sup> DSEWPC (2012)

<sup>57</sup> DEC (2007)

<sup>58</sup> J Tonga (2012), pers. comm., 6 July

<sup>59</sup> WA Museum (2010a)

<sup>60</sup> T Labat (2012), email, 20 June

<sup>61</sup> DEC (2011a)

<sup>62</sup> DEC (2011b)

## 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 other native species such as Sheoak (*Allocasuarina fraseriana*) and Snottygobble (*Persoonia saccata*) and introduced species such as White Cedar (*Melia azedarach*). Forest Red-tailed Black Cockatoos have been found to nest in hollows of trees such as Jarrah and Marri which are found 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.<sup>63</sup>

## 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 90cm long which lead to a nesting chamber, making it vulnerable to trampling by humans or dogs or predation by foxes.<sup>64</sup> 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 (*Smicromis 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.<sup>65</sup> Some invertebrates are important indicators of ecosystem health, such as ants (seed dispersers), bees (pollinators) or spiders (top invertebrate predators).<sup>66</sup>

A total of 34 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 uncommon Western Jewel Butterfly (*Hypochrysops halyaetus*) and Sciron Skipper (*Trapezites sciron*).

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

<sup>63</sup> WA Museum (2010b)

<sup>64</sup> Birdlife Australia (n.d.)

<sup>65</sup> DEC (n.d.b.)

<sup>66</sup> 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.<sup>67</sup>

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.<sup>68</sup>

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. Dog droppings, if not removed, contribute a significant amount of nutrients to the site, encouraging weed growth and potentially polluting groundwater. Some dog droppings contain harmful bacteria.<sup>69</sup>

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 five 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.<sup>70</sup>

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.<sup>71</sup>

## 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.<sup>72</sup> 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.

<sup>67</sup> DSEWPC (2012)

<sup>68</sup> DPI (2012)

<sup>69</sup> DEPI (2013)

<sup>70</sup> M. Widmer (2006)

<sup>71</sup> Rural Industries Research and Development Corporation (n.d.)

<sup>72</sup> NWCPAG (2012)



## 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.

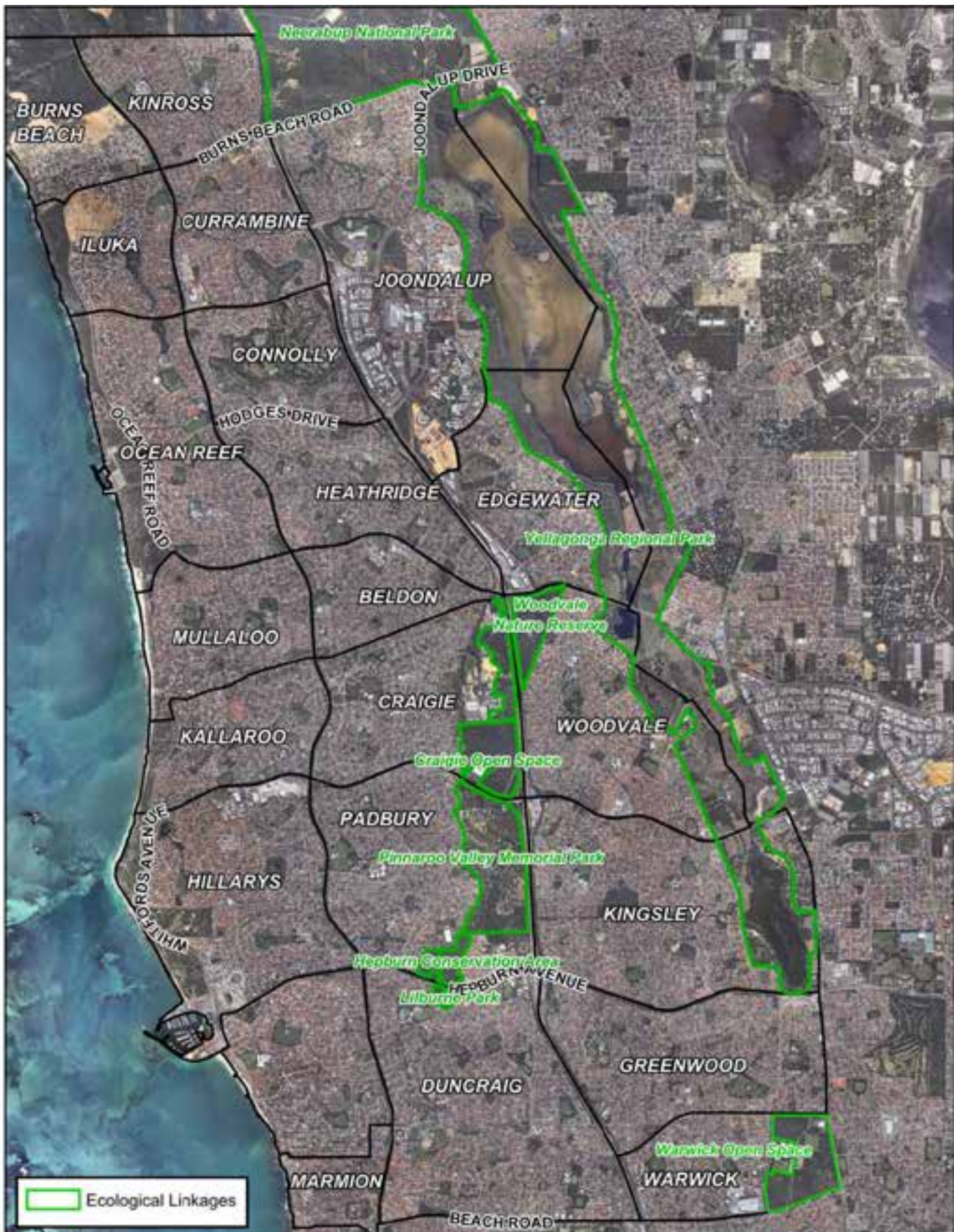
The City also promotes responsible pet ownership and encourages the community to ensure that domestic pets do not have a negative impact on the natural environment.

## Recommended Fauna Management Actions:

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

Action	Details
City of Joondalup Animals Local Law 1999	Investigate amending the City of Joondalup <i>Animals Local Law 1999</i> to ensure that dogs remain on leads at all times when within Warwick Open Space.
Fauna survey	Undertake a follow up fauna survey, in mid-late spring to supplement the previous fauna survey undertaken, within five 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 five 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



<p>90 Boas Ave, Joondalup WA 6027                  PO Box 21, Joondalup WA 6019                  Ph: 08 9400 4000                  Fax: 08 9300 1383                  info@joondalup.wa.gov.au                  www.joondalup.wa.gov.au</p>	<p><b>N</b></p>	Scale (A4): 1 : 60 000     Date: 4/2/2013     Compiled: A Gilbert	<p><b>Warwick Open Space Ecological Linkages</b></p>
		File: Warwick_Open_Space_Ecological_Linkages WOR	
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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>	



## 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 exercising 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. User surveys 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 site usage and vegetation, flora, fungi 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
- 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.<sup>73</sup>

**Figure 21: Warwick Leisure Centre**



<sup>73</sup> Warwick Leisure Centre (2010)



## 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, four 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.<sup>74</sup> 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.

<sup>74</sup> Department of Education (n.d.)

**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 is stormwater runoff from the car park to the adjacent vegetation which can contain pollutants and weed seeds.

### **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.

### **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.<sup>75</sup> 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.

<sup>75</sup> Department of Commerce (2012)



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



<p>60 Boas Ave, Joondalup WA 6027          PO Box 21, Joondalup WA 6919          Ph: 08 9400 4000          Fax: 08 9000 1383          info@joondalup.wa.gov.au          www.joondalup.wa.gov.au</p>	<p><b>N</b></p>	<p>Scale (A4): 1 : 6 000    Date: 16/07/2013    Compiled A Gilbert</p>	<p><b>Warwick Open Space          Overhead Power, Lighting &amp;          Telecommunication Utilities</b></p>
		<p>File: WOS Utilities - Power, Lighting &amp; Telecoms v2.wor          Folder: \ccj-carbon\... \GIS Projects\Parks\Warwick Open Space</p> <p><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 of any way and for any reason.</small></p>	



Figure 25: Warwick Open Space Water Utilities



	Hydrant (Public)
	Reticulation Main

City of Joondalup  
 90 Boas Ave, Joondalup WA 6027  
 PO Box 21, Joondalup WA 6919  
 Ph: 08 9400 4000  
 Fax: 08 9300 1383  
 info@joondalup.wa.gov.au  
 www.joondalup.wa.gov.au





<b>N</b> <b>1</b>	Scale (A4): 1 : 6 000	Date: 2/04/2013	Compiled A Gilbert
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	Folder: \\ccj-carbon1...IGIS Projects\Parts\Warwick Open Space		
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**Warwick Open Space**  
**Water Utilities**



Figure 26: Warwick Open Space Sewerage Utilities



	Manhole
	Connection
	Rising Main
	Gravity Pipe

  
 60 Boas Ave, Joondalup WA 6027  
 PO Box 21, Joondalup WA 6919  
 Ph: 08 9400 4000  
 Fax: 08 9000 1383  
 info@joondalup.wa.gov.au  
 www.joondalup.wa.gov.au

<b>N</b> <b>1</b>	Scale (A4): 1 : 6 000	Date: 2/04/2013	Compiled A Gilbert
	File: WOS Utilities - Sewerage.wpr		
	Folder: \ccj-carbon\...IGIS Projects\Parks\Warwick Open Space		
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**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 on the Perimeter of 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 vehicular gates, farm gates or 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 recommendations 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' and 'review access points to natural bushland areas utilising "crime prevention through environmental design" principles'. The principles of "crime prevention through environmental design" rely on the ability to influence offender decisions that precede criminal acts by enhancing the perceived risk of being caught; and hence, deterring criminal activities.<sup>76</sup>

<sup>76</sup> City of Joondalup (2013)



## 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 six months. In 15 years time the number of West Australians with a disability is expected to increase from one in five people (20%) to one in four 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’.<sup>76</sup>

## 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 managed 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.

**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.

<sup>76</sup> City of Joondalup (2013)

## 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

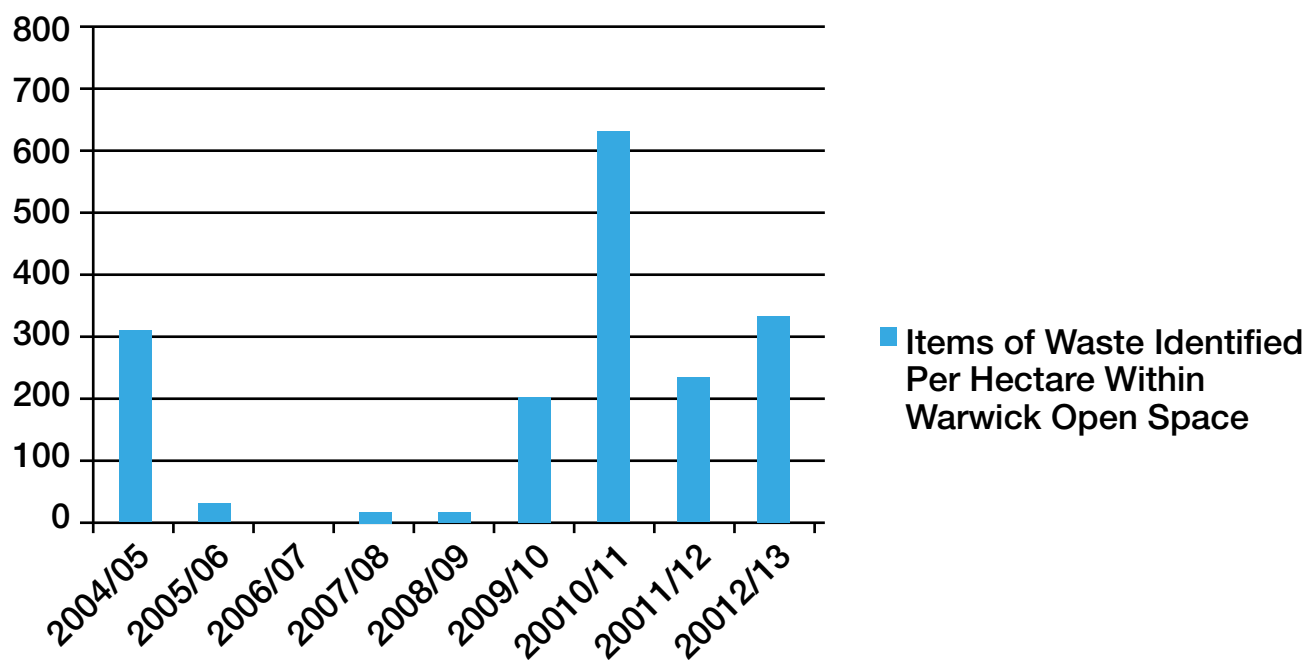
Rubbish bins are generally installed in locations where people gather to socialise or undertake recreational activities. There is a general waste bin and a dog poop bin located on the corners of the public oval. The site often contains a small amount of rubbish, mainly on the edges of the vegetation and near sporting infrastructure. Dumping of rubbish frequently occurs on Lloyd Drive and in the bushland. 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, measured on three transects within the reserve. There has been an increase in the amount of waste present within Warwick Open Space in 2012/13 as compared to 2011/12, due to a decrease in 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.<sup>77</sup> 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.<sup>78</sup> The sump in Warwick Open Space could be included in the City Sump Improvement Program.

<sup>77</sup> DoE (2004)

<sup>78</sup> 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 user surveys, as required, 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.
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.



Action	Details
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.<sup>79</sup>

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.<sup>80</sup>

#### 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 by the City of Joondalup 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*.<sup>81</sup> Fuel load assessments are conducted annually at Warwick Open Space and the results used to inform fire management of the site.

#### Fire Prevention

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

- Controlled access
- Weed species management
- Fuel load assessment and management
- 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*<sup>82</sup> 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 public water hydrants located around Warwick Open Space which are installed and maintained by the Water Corporation, as shown in Figure 25.

<sup>79</sup> EDOWA (2011)

<sup>81</sup> FESA (2007)

<sup>80</sup> DFES (2013a)

<sup>82</sup> DFES (n.d.)

## 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	10	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, predominantly to the west of Lloyd Drive. Wangara Fire Station is responsible for suppressing fires within Warwick Open Space to the east of Lloyd Drive. The Western Australia Police are responsible for the evacuation of residents and visitors, if required.

## 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 weedy 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 weedy 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 year 7 students at Warwick Senior High School.



The City of Joondalup Natural Areas Team currently conduct regular plant identification training, including weed management. New members in the Natural Areas Team undertake training for the 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"> <li>• pathogens</li> <li>• weeds</li> <li>• fire</li> <li>• flora, fungi and fauna awareness</li> <li>• prevention of hand feeding wildlife</li> <li>• responsible pet ownership.</li> </ul>
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 regular Natural Areas Team plant identification training, including weed management, to increase the effectiveness of weed control activities, as required.



Rainbow Bee-eater (*Merops ornatus*)

# 4.0 Management Actions

## 4.1 Management Actions Summary

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

## 4.2 Inspections

Inspections of Warwick Open Space are conducted by the City of Joondalup once every four 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 recommended management 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 five 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 five 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 City of Joondalup <i>Weed Management Plan</i> .



Biodiversity Conservation Area	Recommended Management Action	Detail
Flora	Implement <i>Weed Management Plan</i>	Implement recommendations relevant to Warwick Open Space from the City of Joondalup <i>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 five years.
Flora	Weed survey	Undertake weeds survey in winter, within five 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 five years.
Fauna	City of Joondalup <i>Animals Local Law 1999</i>	Investigate amending the City of Joondalup <i>Animals Local Law 1999</i> to ensure that dogs remain on leads at all times when within Warwick Open Space.
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 five years.
Fauna	Invertebrates survey	Undertake a targeted survey for invertebrates in spring, within five 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.
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.

Biodiversity Conservation Area	Recommended Management Action	Detail
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 surveys	Conduct user surveys, as required, 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.
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"> <li>• pathogens</li> <li>• weeds</li> <li>• fire</li> <li>• flora, fungi and fauna awareness</li> <li>• prevention of hand feeding wildlife</li> <li>• responsible pet ownership.</li> </ul>
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.





Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*)  
Photo: Raana Scott

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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 Fungi Species



# Appendix 1 – Warwick Open Space Flora Species List

## Status

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 under the National Weeds Strategy 1997
#	Declared Plant (DAFWA 2010)
Pest	Pest plant under City of Joondalup <i>Pest Plant Local Law 2012</i>
H (EWSWA)	High priority weeds of the Environmental Weed Strategy for WA (DEC 1999)
VH (Swan)	Very high priority weeds of the Swan NRM Region Environmental Weed Assessment (Bettink and Keighery 2008)
H (Swan)	High priority weeds of the Swan NRM Region Environmental Weed Assessment (Bettink and Keighery 2008)

## 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 & 2013)	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		
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	VH (Swan)		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>Homaloscladium 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	H (Swan)		Y		
Asparagaceae	<i>Lomandra caespitosa</i>	Tufted Mat Rush			Y	Y		Y
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>Ornithogalum arabicum</i>	Lesser Cape Lily	Y			Y		
Asparagaceae	<i>Sowerbaea laxiflora</i>	Purple Tassels			Y	Y		
Asparagaceae	<i>Thysanotus arenarius</i>					Y		



Family	Latin Name	Common Name	Introduced	Status	Recorded ELA (2012)	Recorded Brundrett & Clarke (2001, 2004 & 2013)	City of Joondalup Field Assessments (2005 & 2011)	City of Wanneroo (1995)
Asparagaceae	<i>Thysanotus manglesianus</i>	Fringed Lily			Y	Y		Y
Asparagaceae	<i>Thysanotus sparteus</i>					Y	Y	
Asparagaceae	<i>Thysanotus thyrsoides</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	H (Swan)	Y	Y		
Asteraceae	<i>Asteridea pulverulenta</i>	Common Bristle Daisy				Y		Y
Asteraceae	<i>Centaurea melitensis</i>	Maltese Cockspur	Y	H (Swan)		Y		
Asteraceae	<i>Chondrilla juncea</i>	Skeleton Weed	Y	#		Y		
Asteraceae	<i>Conyza sumatrensis</i> (formerly <i>Conyza albida</i> )	Broadleaf Fleabane	Y			Y		
Asteraceae	<i>Cotula turbinata</i>	Funnel Weed	Y		Y	Y		
Asteraceae	<i>Craspedia variabilis</i>					Y		
Asteraceae	<i>Dimorphotheca ecklonis</i>		Y			Y	Y	
Asteraceae	<i>Dittrichia graveolens</i>	Stinkwort	Y			Y		
Asteraceae	<i>Euchiton sphaericus</i>					Y		
Asteraceae	<i>Gamochoaeta 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>Hypochoeris glabra</i>	Smooth Catsear	Y	H (Swan)	Y	Y	Y	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>Pithocarpa cordata</i>					Y	Y	
Asteraceae	<i>Podolepis gracilis</i>	Slender Podolepis			Y	Y		

Family	Latin Name	Common Name	Introduced	Status	Recorded ELA (2012)	Recorded Brundrett & Clarke (2001, 2004 & 2013)	City of Joondalup Field Assessments (2005 & 2011)	City of Wanneroo (1995)
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> )							
Asteraceae	<i>Senecio vulgaris</i>	Common Groundsel	Y			Y		
Asteraceae	<i>Siloxerus humifusus</i>	Procumbent Siloxerus				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	H (Swan), #		Y		
Brassicaceae	<i>Alyssum linifolium</i>	Flax-leaf Alyssum	Y			Y		
Brassicaceae	<i>Brassica tournefortii</i>	Mediterranean Turnip	Y	H (EWSWA), H (Swan)		Y		
Brassicaceae	<i>Heliophila pusilla</i>		Y		Y	Y		
Brassicaceae	<i>Raphanus raphanistrum</i>	Wild Radish	Y		Y			
Caesalpinaceae	<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 macrocephalus</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

Family	Latin Name	Common Name	Introduced	Status	Recorded ELA (2012)	Recorded Brundrett & Clarke (2001, 2004 & 2013)	City of Joondalup Field Assessments (2005 & 2011)	City of Wanneroo (1995)
Caryophyllaceae	<i>Polycarpon tetraphyllum</i>	Fourleaf Aliseed	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>Centrolepis 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
Cupressaceae	<i>Callitris preissii</i>	Rottneest Island Pine	Y	Planted	Y			
Cyperaceae	<i>Isolepis marginata</i>	Coarse Club-rush	Y		Y	Y		
Cyperaceae	<i>Lepidosperma leptostachyum</i>				Y			Y
Cyperaceae	<i>Lepidosperma pubisquamum</i>				Y			
Cyperaceae	<i>Lepidosperma squamatum</i>					Y		
Cyperaceae	<i>Lepidosperma striatum</i>				Y			
Cyperaceae	<i>Mesomelaena pseudostygia</i>				Y	Y	Y	Y
Cyperaceae	<i>Schoenus curvifolius</i>				Y	Y	Y	Y
Cyperaceae	<i>Schoenus grandiflorus</i>	Large Flowered Bogrush			Y	Y	Y	Y
Cyperaceae	<i>Tetragia octandra</i>					Y	Y	Y
Dasyopogonaceae	<i>Calectasia narragara</i>					Y		
Dasyopogonaceae	<i>Dasyopogon 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	Y
Droseraceae	<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>				Y	Y	Y	Y
Droseraceae	<i>Drosera macrantha</i>	Bridal Rainbow			Y	Y		



Family	Latin Name	Common Name	Introduced	Status	Recorded ELA (2012)	Recorded Brundrett & Clarke (2001, 2004 & 2013)	City of Joondalup Field Assessments (2005 & 2011)	City of Wanneroo (1995)
Droseraceae	<i>Drosera menziesii</i>	Pink Rainbow				Y		
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	Y	
Ericaceae	<i>Leucopogon propinquus</i>				Y		Y	Y
Euphorbiaceae	<i>Euphorbia ?cyathophora</i>		Y			Y		
Euphorbiaceae	<i>Euphorbia pepus</i>	Petty Spurge	Y	H (Swan)	Y	Y		
Euphorbiaceae	<i>Euphorbia terracina</i>	Geraldton Carnation Weed	Y	H (EWSWA), VH (Swan)	Y	Y		
Euphorbiaceae	<i>Monotaxis grandiflora</i> var. <i>grandiflora</i>				Y	Y		
Euphorbiaceae	<i>Ricinocarpos glaucus</i>				Y	Y		
Euphorbiaceae	<i>Ricinocarpos tuberculatus</i>		Y			Y		
Euphorbiaceae	<i>Ricinus communis</i>	Castor Oil Plant	Y			Y		
Fabaceae	<i>Acacia appplanata</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	

Family	Latin Name	Common Name	Introduced	Status	Recorded ELA (2012)	Recorded Brundrett & Clarke (2001, 2004 & 2013)	City of Joondalup Field Assessments (2005 & 2011)	City of Wanneroo (1995)
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>	Prickly Moses	Y	Planted		Y	Y	Y
Fabaceae	<i>Acacia pulchella</i> var. <i>glaberrima</i>				Y	Y		
Fabaceae	<i>Acacia saligna</i>	Orange Wattle				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	Y		
Fabaceae	<i>Acacia wildenowiana</i>	Grass Wattle				Y	Y	
Fabaceae	<i>Acacia xanthina</i>	White-stemmed Wattle				Y	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	VH (Swan)		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	Y	
Fabaceae	<i>Hovea trisperma</i>	Common Hovea				Y	Y	
Fabaceae	<i>Hovea trisperma</i> var. <i>trisperma</i>					Y		
Fabaceae	<i>Isatropis cuneifolia</i>	Granny Bonnets			Y			

Family	Latin Name	Common Name	Introduced	Status	Recorded ELA (2012)	Recorded Brundrett & Clarke (2001, 2004 & 2013)	City of Joondalup Field Assessments (2005 & 2011)	City of Wanneroo (1995)
Fabaceae	<i>Isotropis cuneifolia</i> subsp. <i>cuneifolia</i>					Y		
Fabaceae	<i>Jacksonia calcicola</i>					Y		
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 (EWSWA)	Y	Y		
Fabaceae	<i>Medicago polymorpha</i>	Burr Medic	Y			Y		
Fabaceae	<i>Mellilotus indicus</i>	Yellow Sweet Clover	Y			Y		
Fabaceae	<i>Ornithopus pinnatus</i>	Slender Serradella	Y		Y	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	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	Y		
Geraniaceae	<i>Erodium moschatum</i>	Musky Crowfoot	Y			Y		



Family	Latin Name	Common Name	Introduced	Status	Recorded ELA (2012)	Recorded Brundrett & Clarke (2001, 2004 & 2013)	City of Joondalup Field Assessments (2005 & 2011)	City of Wanneroo (1995)
Geraniaceae	<i>Pelargonium capitatum</i>	Rose Pelargonium	Y	H (EWSWA)	Y	Y	Y	Y
Goodeniaceae	<i>Dampiera linearis</i>	Common Dampiera			Y	Y	Y	Y
Goodeniaceae	<i>Scaevola canescens</i>	Grey Scaevola			Y	Y	Y	Y
Goodeniaceae	<i>Scaevola globulifera</i>						Y	
Goodeniaceae	<i>Scaevola nitida</i>	Shining Fanflower				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		
Haemodraceae	<i>Anigozanthos humilis</i>	Catspaw			Y	Y		Y
Haemodraceae	<i>Anigozanthos manglesii</i>	Mangles Kangaroo Paw			Y	Y	Y	Y
Haemodraceae	<i>Conostylis aculeata</i>	Prickly Conostylis				Y		Y
Haemodraceae	<i>Conostylis aculeata</i> subsp. <i>cygnorum</i>			S	Y		Y	
Haemodraceae	<i>Conostylis candicans</i> subsp. <i>candicans</i>		Y			Y		Y
Haemodraceae	<i>Conostylis setigera</i>	Bristly Cottonhead			Y	Y	Y	Y
Haemodraceae	<i>Haemodorum laxum</i>					Y		Y
Haemodraceae	<i>Haemodorum paniculatum</i>	Mardja			Y	Y		
Haemodraceae	<i>Haemodorum spicatum</i>	Mardja				Y	Y	Y
Haemodraceae	<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			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

Family	Latin Name	Common Name	Introduced	Status	Recorded ELA (2012)	Recorded Brundrett & Clarke (2001, 2004 & 2013)	City of Joondalup Field Assessments (2005 & 2011)	City of Wanneroo (1995)
Iridaceae	<i>Freesia alba x leichtlinii</i>		Y	VH (Swan)	Y	Y		
Iridaceae	<i>Gladiolus angustus</i>	Long Tubed Painted Lady	Y	H (Swan)		Y		
Iridaceae	<i>Gladiolus caryophyllaceus</i>	Wild Gladiolus	Y		Y	Y	Y	Y
Iridaceae	<i>Hesperantha falcata</i>		Y	H (Swan)		Y		
Iridaceae	<i>Moraea flaccida</i> (formerly <i>Homeria flaccida</i> )	One-leaf Cape Tulip	Y	H (EWSWA), VH (Swan), #	Y	Y	Y	
Iridaceae	<i>Orthranthus 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 (EWSWA)	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			
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			Y		
Myrtaceae	<i>Agonis flexuosa</i>	Peppermint	Y	Planted	Y			
Myrtaceae	<i>Calothamnus quadrifidus</i>	One-sided Bottlebrush	Y		Y	Y	Y	
Myrtaceae	<i>Calothamnus sanguineus</i>	Silky-leaved Blood Flower				Y		
Myrtaceae	<i>Calytrix angulata</i>	Yellow Starflower				Y		Y

Family	Latin Name	Common Name	Introduced	Status	Recorded ELA (2012)	Recorded Brundrett & Clarke (2001, 2004 & 2013)	City of Joondalup Field Assessments (2005 & 2011)	City of Wanneroo (1995)
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		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 (EWSWA), VH (Swan)	Y	Y	Y	
Myrtaceae	<i>Melaleuca lanceolata</i>	Rottnest Teatree	Y	Planted, H (Swan)			Y	
Myrtaceae	<i>Melaleuca systena</i> (formerly <i>Melaleuca acerosa</i> )		Y			Y		Y
Myrtaceae	<i>Scholtzia involucrata</i>	Spiked Scholtzia	Y			Y		
Myrtaceae	<i>Thryptomene saxicola</i>	Rock Thryptomene	Y			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		
Onagraceae	<i>Oenothera stricta</i>	Common Evening Primrose	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		



Family	Latin Name	Common Name	Introduced	Status	Recorded ELA (2012)	Recorded Brundrett & Clarke (2001, 2004 & 2013)	City of Joondalup Field Assessments (2005 & 2011)	City of Wanneroo (1995)
Orchidaceae	<i>Caladenia latifolia</i>	Pink Fairy Orchid			Y	Y		
Orchidaceae	<i>Caladenia longicauda</i>	Common White Spider Orchid			Y			
Orchidaceae	<i>Disa bracteata</i> (formerly <i>Monodenia bracteata</i> )		Y			Y		
Orchidaceae	<i>Diuris magnifica</i>				Y	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>Pheladenia deformis</i> (formerly <i>Cyanicula deformis</i> )					Y		Y
Orchidaceae	<i>Prasophyllum elatum</i>	Tall Leek Orchid				Y		
Orchidaceae	<i>Pterostylis</i> sp. short sepals							
Orchidaceae	<i>Pterostylis recurva</i>	Jug Orchid				Y		
Orchidaceae	<i>Pterostylis pyramidalis</i> (formerly <i>Pterostylis nana</i> )	Snail Orchid				Y		
Orchidaceae	<i>Pterostylis sanguinea</i>				Y	Y		
Orchidaceae	<i>Pyrorchis nigricans</i>	Red Beaks			Y	Y		
Orchidaceae	<i>Thelymitra crinita</i>	Blue Lady Orchid				Y		
Orchidaceae	<i>Thelymitra fuscolutea</i>	Leopard Orchid				Y		
Orchidaceae	<i>Thelymitra macrophylla</i>					Y		
Orchidaceae	<i>Thelymitra vulgaris</i>					Y		
Orobanchaceae	<i>Orobancha minor</i>	Lesser Broomrape	Y			Y		
Oxalidaceae	<i>Oxalis incarnata</i>		Y			Y		
Oxalidaceae	<i>Oxalis pes-caprae</i>	Soursob	Y	H (Swan)	Y	Y		
Oxalidaceae	<i>Oxalis purpurea</i>	Largeflower Wood Sorrel	Y			Y		

Family	Latin Name	Common Name	Introduced	Status	Recorded ELA (2012)	Recorded Brundrett & Clarke (2001, 2004 & 2013)	City of Joondalup Field Assessments (2005 & 2011)	City of Wanneroo (1995)
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	VH (Swan)	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 (EWSWA), VH (Swan)	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 setaceum</i> )	Fountain Grass	Y		Y	Y		
Poaceae	<i>Cortaderia selloana</i>	Pampas Grass	Y	H (EWSWA), VH (Swan)		Y		
Poaceae	<i>Cynodon dactylon</i>	Couch	Y	VH (Swan)		Y		
Poaceae	<i>Dichelachne crinita</i>	Longhair Plumegrass				Y		
Poaceae	<i>Ehrharta calycina</i>	Perennial Veldt Grass	Y	H (EWSWA), VH (Swan)	Y	Y	Y	Y

Family	Latin Name	Common Name	Introduced	Status	Recorded ELA (2012)	Recorded Brundrett & Clarke (2001, 2004 & 2013)	City of Joondalup Field Assessments (2005 & 2011)	City of Wanneroo (1995)
Poaceae	<i>Ehrharta longiflora</i>	Annual Veldt Grass	Y		Y	Y		
Poaceae	<i>Eragrostis curvula</i>	African Lovegrass	Y	H (EWSWA), H (Swan)	Y	Y	Y	
Poaceae	<i>Hordeum leporinum</i>	Barley Grass	Y	H (Swan)	Y	Y		
Poaceae	<i>Lagurus ovatus</i>	Hare's Tail Grass	Y	H (EWSWA), H (Swan)		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>Poa annua</i>	Winter Grass	Y			Y		Y
Poaceae	<i>Poa drummondiana</i>	Knotted Poa				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	H (Swan)		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		
Polygalaceae	<i>Comesperma calymega</i>	Blue-spike Milkwort				Y		Y



Family	Latin Name	Common Name	Introduced	Status	Recorded ELA (2012)	Recorded Brundrett & Clarke (2001, 2004 & 2013)	City of Joondalup Field Assessments (2005 & 2011)	City of Wanneroo (1995)
Polygalaceae	<i>Polygala myrtifolia</i>	Myrtleleaf Milkwort	Y	H (Swan)		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			Y		
Proteaceae	<i>Banksia attenuata</i>	Slender Banksia			Y	Y	Y	Y
Proteaceae	<i>Banksia dallanneyi</i>					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 menziesii</i>	Firewood Banksia			Y	Y	Y	Y
Proteaceae	<i>Banksia prionotes</i>	Acorn Banksia	Y		Y	Y	Y	
Proteaceae	<i>Banksia sessilis</i> (formerly known as <i>Dryandra sessilis</i> )	Parrot Bush				Y		
Proteaceae	<i>Conospermum stoehadis</i>	Common Smokebush				Y		
Proteaceae	<i>Conospermum triplinervium</i>	Tree Smokebush	Y	Planted		Y		
Proteaceae	<i>Grevillea bipinnatifida</i>	Fuchsia Grevillea	Y			Y		
Proteaceae	<i>Grevillea crithmifolia</i>		Y		Y	Y		
Proteaceae	<i>Grevillea vestita</i> subsp. <i>vestita</i>				Y	Y	Y	Y
Proteaceae	<i>Hakea laurina</i>	Pincushion Hakea	Y			Y		
Proteaceae	<i>Hakea lissocarpa</i>	Honey Bush				Y	Y	
Proteaceae	<i>Hakea petiolaris</i>	Sea Urchin Hakea	Y			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	Y		




Family	Latin Name	Common Name	Introduced	Status	Recorded ELA (2012)	Recorded Brundrett & Clarke (2001, 2004 & 2013)	City of Joondalup Field Assessments (2005 & 2011)	City of Wanneroo (1995)
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 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 notiale</i> subsp. <i>chamelum</i>					Y	Y	
Rubiaceae	<i>Galium divaricatum</i>		Y			Y		
Rubiaceae	<i>Opercularia vaginata</i>	Dog Weed			Y	Y	Y	Y
Rutaceae	<i>Diplolaena dampieri</i>	Southern Diplolaena	Y	Planted	Y	Y		
Rutaceae	<i>Philothea spicata</i>	Pepper and Salt			Y	Y	Y	Y
Scrophulariaceae	<i>Dischisma capitatum</i>	Woolly-headed Dischisma	Y			Y		
Scrophulariaceae	<i>Phyllopodium cordatum</i>		Y			Y		
Solanaceae	<i>Solanum ?linnaeanum</i>	Apple of Sodom	Y	H (Swan)		Y		
Solanaceae	<i>Solanum nigrum</i>	Black Berry Nightshade	Y		Y	Y		
Styliaceae	<i>Levenhookia stipitata</i>	Common Stylewort				Y		Y
Styliaceae	<i>Styidium brunonianum</i>	Pink Fountain Triggerplant			Y	Y		Y
Styliaceae	<i>Styidium calcaratum</i>	Book Triggerplant			Y	Y		Y

Family	Latin Name	Common Name	Introduced	Status	Recorded ELA (2012)	Recorded Brundrett & Clarke (2001, 2004 & 2013)	City of Joondalup Field Assessments (2005 & 2011)	City of Wanneroo (1995)
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 riedlei</i>	Zamia			Y	Y	Y	Y
Zygophyllaceae	<i>Tribulus terrestris</i>	Caltrop	Y	Pest		Y		







# Appendix 2 – Warwick Open Space Key Flora Species





## Threatened and Significant Flora at Warwick Open Space

Name	Common Name	Conservation Code	Image
<i>Conostylis aculeata</i> subsp <i>cygnorum</i>		Significant Flora of the Perth Metropolitan Region	 <p>Photo: K.C. Richardson (WA Herbarium n.d.)</p>
<i>Glischrocaryon ureum</i>	Common Popflower	Significant Flora of the Perth Metropolitan Region	 <p>Photos: H. Bennett, B.A. Fuhrer and K.R. Thiele (WA Herbarium n.d.)</p>
<i>Jacksonia sericea</i>	Waldjumi	Priority 4 (DPaW), Significant Flora of the Perth Metropolitan Region	 <p>Photo: I.R. Dixon (WA Herbarium n.d.)</p>


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




Examples of Priority 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); High priority (Swan NRM Region Enviro Weed Assessment)	 <p data-bbox="954 600 1433 660">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); Very high priority (Swan NRM Region Enviro Weed Assessment)	 <p data-bbox="954 1059 1433 1120">Photos: L. Fontanini and K.C. Richardson (WA Herbarium n.d.)</p>
<i>Chondrilla juncea</i>	Skeleton Weed	Declared Weed (DAFWA)	 <p data-bbox="954 1523 1433 1583">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); Very high priority (Swan NRM Region Enviro Weed Assessment)	 <p data-bbox="954 1915 1433 1948"><i>Cortaderia selloana</i> Photo: R. Randall</p> <p data-bbox="954 1960 1433 1993">Photos: R. Randall (WA Herbarium n.d.)</p>

Name	Common Name	Conservation Code	Image
<i>Echium plantagineum</i>	Paterson's Curse	Declared Weed (DAFWA); High priority (Swan NRM Region Enviro Weed Assessment)	 <p>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); Very high priority (Swan NRM Region Enviro Weed Assessment)	 <p>Photos: S.M. Armstrong (WA Herbarium n.d.)</p>
<i>Eragrostis curvula</i>	African Lovegrass	High priority (DPaW Environmental Weed Strategy for WA); High priority (Swan NRM Region Enviro Weed Assessment)	 <p>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); Very high priority (Swan NRM Region Enviro Weed Assessment)	 <p>Photos: J.Dodd and K.R. Thiele (WA Herbarium n.d.)</p>



Name	Common Name	Conservation Code	Image
<i>Lagurus ovatus</i>	Hare's Tail Grass	High priority (DPaW Environmental Weed Strategy for WA); High priority (Swan NRM Region Enviro Weed Assessment)	 <p data-bbox="954 526 1441 600">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="954 974 1441 1048">Photo: Department of Agriculture and Food 2010</p>
<i>Leptospermum laevigatum</i>	Coast Teatree	High priority (DPaW Environmental Weed Strategy for WA); Very high priority (Swan NRM Region Enviro Weed Assessment)	 <p data-bbox="954 1422 1441 1496">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="954 1870 1441 1953">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); Very high priority (Swan NRM Region Enviro Weed Assessment)	 <p>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>Photos: J. Dodd, K. Richardson and K.R. Thiele (WA Herbarium n.d.)</p>

# 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 (WA Herbarium)
<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>Arctotheca calendula</i>	Cape Weed	Herbs	High priority (Swan)	Glyphosate	June to November
<i>Avena barbata</i>	Bearded Oat	Grasses	Very high priority (Swan)	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), High priority (Swan)	Hand weeding	August to September
<i>Bromus diandrus</i>	Great Brome	Grasses	High priority (EWSWA), Very high priority (Swan)	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>Centaurea melitensis</i>	Maltese Cockspur	Herbs	High priority (Swan)	Not targeted as rarely found	September to March
<i>Chamaelucium 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), Very high priority (Swan)	Glyphosate	July to November
<i>Cynodon dactylon</i>	Couch	Grasses	Very high priority (Swan)	Glyphosate, Quizalofop	November to February
<i>Echium plantagineum</i>	Paterson's Curse	Herbs	Declared plant, High priority (Swan)	Glyphosate, Metsulfuron	May to September

Latin Name	Common Name	Type of Weed	Status/Notes	Treatment Type	Optimal Treatment Timing (WA Herbarium)
<i>Ehrharta calycina</i>	Perennial Veldt Grass	Grasses	High priority (EWSWA), Very high priority (Swan)	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), High priority (Swan)	Glyphosate	November to May
<i>Euphorbia peplus</i>	Petty Spurge	Herbs	High priority (Swan)	Glyphosate, Metsulfuron	May to November
<i>Euphorbia terracina</i>	Geraldton Carnation Weed	Herbs	High priority (EWSWA), Very high priority (Swan)	Triasulfuron, Hand weeding	June to August spray, June to November hand weeding
<i>Freesia alba x leichthlinii</i>	Freesia Hybrid	Herbs	Very high priority (Swan)	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	High priority (Swan)	Metsulfuron	July to August
<i>Genista monspessulana</i>		Shrub	Very high priority (Swan)	Hand weeding, Glyphosate	June to November
<i>Gladiolus caryophyllaceus</i>	Wild Gladiolus	Herbs		Hand weeding, hand wipe with Metsulfuron	July to September
<i>Hesperantha falcata</i>		Herbs	High priority (Swan)	Metsulfuron	August to September
<i>Hordeum leporinum</i>	Barley Grass	Grasses	High priority (Swan)	Hand weeding, Quizalofop	May to August
<i>Hypochoeris glabra</i>	Smooth Catsear	Herbs	High priority (Swan)	Hand weeding, Glyphosate	May to October
<i>Lachenalia bulbifera</i>	Red Soldiers	Herbs	High priority (Swan)	Metsulfuron	August to September
<i>Lactuca serriola</i>	Prickly Lettuce	Herbs	High priority (Swan)	Hand weeding, Glyphosate	June to March
<i>Lagurus ovatus</i>	Hare's Tail Grass	Grasses	High priority (EWSWA), High priority (Swan)	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), Very high priority (Swan)	Cut and paint	July to October
<i>Lupinus cosentinii</i>	Blue Lupin	Herbs	High priority (EWSWA)	Hand weeding	June to September
<i>Melaleuca lanceolata</i>	Rottneest Teatree	Trees and shrubs	High priority (Swan)	Glyphosate, Cut and pain	January to December
<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), Very high priority (Swan)	Metsulfuron	July to August



Latin Name	Common Name	Type of Weed	Status/Notes	Treatment Type	Optimal Treatment Timing (WA Herbarium)
<i>Oxalis pes-caprae</i>	Soursob	Herbs	High priority (Swan)	Metsulfuron, Glyphosate	June to July
<i>Pelargonium capitatum</i>	Rose Pelargonium	Herbs	High priority (EWSWA)	Glyphosate, Metsulfuron, Hand weeding	June to October
<i>Polygala myrtifolia</i>	Myrtleleaf Milkwort	Trees and shrubs	High priority (Swan)	Hand weeding	June to November
<i>Raphanus raphanistrum</i>	Wild Radish	Herbs		Hand weeding	June to December
<i>Romulea rosea</i>	Guldford 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	Very high priority (Swan)	Triclopyr/Picloram, Hand weeding	December to February
<i>Solanum linnaeanum</i>	Apple of Sodom	Trees and shrubs	High priority (Swan)	Glyphosate, Cut and pain	January to December
<i>Stenotaphrum secundatum</i>	Buffalo Grass	Grasses	High priority (Swan)	Glyphosate, Quizalofop	November to May
<i>Trachyantra divaricata</i>	False Onion Weed	Herbs		Glyphosate, Metsulfuron, Hand weeding	June to August spraying, All year hand weeding
<i>Tribulus terrestris</i>	Caltrop	Herbs	Pest plant	Hand weeding	January to December

**Note: The Warwick Open Space High Priority Weed Species Management table was created using the following criteria:**

- Weed species listed within Friends of Warwick Bushland List of Priority 1 Weeds Requiring Mapping (2012)
- Weed species listed as a Weed of National Significance (WONS) under the National Weeds Strategy (1997)
- The weed species is listed as a Declared Plant according to the Department of Agriculture and Food WA (2010)
- The weed species is a High Priority Weed according to the Environmental Weed Strategy for WA (DEC 1999)
- The weed species is listed as Very High Priority or High Priority Weed according to the Swan NRM Region Environmental Weed Assessment (Bettink and Keighery 2008)
- The weed species is listed as a pest plant under the City's *Pest Plant Local Law 2012*
- The City of Joondalup has determined that the weed species poses a major threat to vegetation
- The City of Joondalup has determined that the weed species poses a major threat to the structure of vegetation communities
- The City of Joondalup has determined that the weed species is likely to contribute to a high fuel load, for example grasses.



TAXA		Conservation Status					Source							
Family	Scientific Name	Common Name	EPBC Act	WC Act	DEC / Bush Forever	Introduced	Protected Matters Search Tool	DEC Threatened Fauna Database <sup>1</sup>	Nature Map <sup>2</sup>	ELA Survey (2012)	How & Dell (2000)	Clarke, K Friends of Warwick Bushland (2012)	CoJ Field Assessments (2005 & 2011)	
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							•	+	+			
	<i>Morethia obscura</i>	Shrubland Morethia Skink							•	+	+			
	<i>Tiliqua rugosa</i>	Bobtail Skink								+	+		+	
	Typhlopidae	<i>Ramphotyphlops australis</i>	Southern Blind Snake							•	+			
		<i>Varanus gouldii</i>	Gould's Monitor										+	
<b>Amphibians</b>														
Myobatrachidae	<i>Crinia Georgiana</i>	Quacking Frog										+		
	<i>Myobatrachus gouldii</i>	Turtle Frog							•	+				



TAXA		Conservation Status						Source					
Family	Scientific Name	Common Name	EPBC Act	WC Act	DEC / Bush Forever	Introduced	Protected Matters Search Tool	DEC Threatened Fauna Database <sup>1</sup>	Nature Map <sup>2</sup>	ELA Survey (2012)	How & Dell (2000)	Clarke, K Friends of Warwick Bushland (2012)	CoJ Field Assessments (2005 & 2011)
<b>Birds</b>													
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>Smicromis 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>Aegothales cristatus</i>	Australian Owllet nightjar								+			
Anatidae	<i>Anas superciliosa</i>	Pacific Black Duck							•	+			
	<i>Chenonetta jubata</i>	Australian Wood Duck							•			+	
	<i>Tadorna tadornoides</i>	Australian Shelduck							•			+	+

TAXA			Conservation Status					Source					
Family	Scientific Name	Common Name	EPBC Act	WC Act	DEC / Bush Forever	Introduced	Protected Matters Search Tool	DEC Threatened Fauna Database <sup>1</sup>	Nature Map <sup>2</sup>	ELA Survey (2012)	How & Dell (2000)	Clarke, K Friends of Warwick Bushland (2012)	CoJ Field Assessments (2005 & 2011)
Apodidae	<i>Apus pacificus</i>	Fork-tailed Swift	M	S3			•	•				+	
	<i>Ardea modesta</i>	Great Egret		S3			•	•				+	
Ardeidae	<i>Cracticus torquatus</i>	Grey Butcherbird							•	+		+	
	<i>Gymnorhina tibicen</i>	Australian Magpie							•	+		+	+
Burhinidae	<i>Burhinus grallarius</i>	Bush Stone-curllew						•	•			+	
Cacatuidae	<i>Calyptorhynchus bawdinii</i>	Bawdin'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			•	+		+	

TAXA			Conservation Status						Source				
Family	Scientific Name	Common Name	EPBC Act	WC Act	DEC / Bush Forever	Introduced	Protected Matters Search Tool	DEC Threatened Fauna Database <sup>1</sup>	Nature Map <sup>2</sup>	ELA Survey (2012)	How & Dell (2000)	Clarke, K Friends of Warwick Bushland (2012)	CoJ Field Assessments (2005 & 2011)
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							•			+	
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										+	
	<i>Malurus splendens</i>	Splendid Fairy Wren							•			+	



TAXA		Conservation Status					Source						
Family	Scientific Name	Common Name	EPBC Act	WC Act	DEC / Bush Forever	Introduced	Protected Matters Search Tool	DEC Threatened Fauna Database <sup>1</sup>	Nature Map <sup>2</sup>	ELA Survey (2012)	How & Dell (2000)	Clarke, K Friends of Warwick Bushland (2012)	CoJ Field Assessments (2005 & 2011)
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							•			+	
	<i>Merops ornatus</i>	Rainbow Bee-eater		M	S3				•	+		+	
	<i>Daphoenositta chrysoptera</i>	Varied Sittella							•			+	
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-thrush										+	
	<i>Pachycephala rufiventris</i>	Rufous Whistler							•	+		+	
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote										+	
	<i>Pardalotus striatus</i>	Striated Pardalote							•	+		+	
	<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 / Bush Forever	Introduced	Protected Matters Search Tool	DEC Threatened Fauna Database <sup>1</sup>	Nature Map <sup>2</sup>	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 semitorquatus</i>	Twenty-eight Parrot								+			
	<i>Polytelis anthopeplus</i>	Regent Parrot										+	
	<i>Trichoglossus haematodus</i>	Rainbow Lorikeet				X			•	+		+	+
	<i>Purpureicephalus spurius</i>	Red-capped Parrot								+		+	+
	<i>Rhipidura leucophrys</i>	Willie Wagtail							•			+	
	<i>Rhipidura albiscapa</i>	Grey Fantail								+		+	
	<i>Ninox novaeseelandiae</i>	Southern Boobook Owl								+		+	
	<i>Tyto alba</i>	Barn Owl										+	
Threskiornithidae	<i>Turnix velox</i>	Little Buttonquail							+				
Zosteropidae	<i>Zosterops lateralis</i>	Silvereye									+		
<b>Invertebrates</b>													
Apidae	<i>Apis mellifera</i>	European honey bee				X							+
Castniidae	<i>Synemon gratiosa</i>	Graceful Sun-moth	EN		P4			•	•			+	

TAXA		Conservation Status					Source						
Family	Scientific Name	Common Name	EPBC Act	WC Act	DEC / Bush Forever	Introduced	Protected Matters Search Tool	DEC Threatened Fauna Database <sup>1</sup>	Nature Map <sup>2</sup>	ELA Survey (2012)	How & Dell (2000)	Clarke, K Friends of Warwick Bushland (2012)	CoJ Field Assessments (2005 & 2011)
Hesperidae	<i>Trapezites sciron</i>	Sciron Skipper			RC							+	
Lycaenidae	<i>Hypochorysops halyaetus</i>	Western Jewel Butterfly			RC							+	

**Notes:**

<sup>2</sup> 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.

RC = species of regional conservation significance under Bush Forever.




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

<b>Ants</b>
Formicidae
<ul style="list-style-type: none"> <li>• Bull Ant - <i>Myrmecia</i> sp. (species unknown)</li> <li>• Meat Ant – <i>Iridomyrmex</i> sp. (species unknown)</li> <li>• Small black ant sp. 1 (species unknown)</li> <li>• Small black ant sp. 2 (species unknown)</li> <li>• Small black ant sp. 3 arboreal (species unknown)</li> <li>• Peaceful night ant (species unknown)</li> </ul>
<b>Bees and wasps</b>
<ul style="list-style-type: none"> <li>• European Honey Bee - <i>Apis</i> sp. (species unknown)</li> <li>• Wasp (species and family unknown)</li> </ul>
<b>Beetles</b>
Coleoptera
<ul style="list-style-type: none"> <li>• Beetle sp. 1 (species unknown)</li> <li>• Beetle sp. 2 (species unknown)</li> </ul>
Geotrupidae
<ul style="list-style-type: none"> <li>• Beetle sp. 3 (species unknown)</li> </ul>
Curculionidae
<ul style="list-style-type: none"> <li>• Weevil species 1</li> <li>• Weevil species 2</li> </ul>
<b>Centipedes</b>
<ul style="list-style-type: none"> <li>• Centipede (species and family unknown)</li> </ul>
<b>Cockroaches and termites (family and species unknown)</b>
<ul style="list-style-type: none"> <li>• Cockroach</li> <li>• Termite</li> </ul>
<b>Crickets and grasshoppers</b>
<ul style="list-style-type: none"> <li>• Grass hopper</li> <li>• Cricket</li> </ul>
<b>Earwigs</b>
<ul style="list-style-type: none"> <li>• Native earwig - <i>Gonolabis michaelsoni</i></li> </ul>
<b>Flies</b>
Muscidae
<ul style="list-style-type: none"> <li>• Australian Bush Fly - <i>Musca vetustissima</i></li> </ul>
<b>Millipedes</b>
Julidae
<ul style="list-style-type: none"> <li>• Portugese Millipede - <i>Ommatoiulus moreleti</i></li> </ul>
<b>Moths (family and species unknown)</b>
<ul style="list-style-type: none"> <li>• Moth species sp. 1</li> <li>• Moth species sp. 2</li> </ul>





<b>Scorpions</b>
Buthidae
<ul style="list-style-type: none"> <li>• Scorpion species 1 (species unknown)</li> </ul>
<b>Slaters</b>
Porcellionidae
<ul style="list-style-type: none"> <li>• <i>Porcellio</i> sp. (species unknown)</li> </ul>
<b>Spiders</b>
Lycosidae
<ul style="list-style-type: none"> <li>• Wolf spider species 1</li> <li>• Wold spider species 2</li> </ul>
Nephilidae
<ul style="list-style-type: none"> <li>• Golden Orb Weaver</li> </ul>
Salticidae
<ul style="list-style-type: none"> <li>• Jumping spider (species unknown)</li> </ul>
Sparasidae
<ul style="list-style-type: none"> <li>• Huntsman spider (species unknown)</li> </ul>
Unknown family (web builders)
<ul style="list-style-type: none"> <li>• Spider 1 (species unknown)</li> <li>• Spider 2 (species unknown)</li> </ul>
Mygalomorphae
<ul style="list-style-type: none"> <li>• Trapdoor spider (species and family unknown)</li> </ul>



# 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="954 936 1139 965">Photo: Bill Betts</p>
<i>Diplodactylus polyophthalmus</i>	Speckled Stone Gecko	Regional Conservation Significance (Bush Forever)	 <p data-bbox="954 1305 1342 1335">Photo: Henry Cook (arod.com.au)</p>
<i>Trapezites sciron</i>	Sciron Skipper	Regional Conservation Significance (Bush Forever)	 <p data-bbox="954 1697 1185 1727">Photo: Geoff Walker</p>




Name	Common Name	Conservation Code	Image
<i>Hypochrysops halyaetus</i>	Western Jewel Butterfly	Regional Conservation Significance (Bush Forever)	 <p data-bbox="1027 510 1262 539">Photo: Geoff Walker</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="954 555 1337 589">Photo: Encyclopedia of Life (n.d.)</p>
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	 <p data-bbox="954 1093 1337 1155">Photo: K Vang and W Dabrowka (Birdlife Australia n.d.)</p>
<i>Mus musculus</i>	House Mouse	 <p data-bbox="954 1532 1345 1565">Photo: Roar Solheim (IUCN 2012)</p>
<i>Ommatoiulus moreleti</i>	Portuguese Millipede	 <p data-bbox="954 2011 1278 2074">Photo: Robert Mesibov Australian Government n.d.)</p>



Name	Common Name	Image
<i>Oryctolagus cuniculus</i>	Rabbit	 <p data-bbox="1027 551 1490 584">Photo: Vilda-Rollin Verlinde (IUCN 2012)</p>
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	 <p data-bbox="1027 1344 1406 1408">Photo: K Vang and W Dabrowka (Birdlife Australia n.d.)</p>
<i>Vulpes vulpes</i>	European Red Fox	 <p data-bbox="1027 1762 1425 1827">Photo: Centre for Fortean Zoology Australia (2010)</p>

# Appendix 8 – Conservation Codes for Western Australian Fauna

## Australian Environment Protection and Biodiversity Conservation Act 1999 Threatened Fauna Codes

Category	Code	Description
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"> <li>• The Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animal) for which Australia is a range state;</li> <li>• 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</li> <li>• 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).</li> </ul>

## WA Department of Environment and Conservation Priority Fauna Codes

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.

# Appendix 9 – 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)	Warwick Open Space Collections Florabase
<i>Aleurodiscus</i> sp.	Orange Aleurodiscus		Y	
<i>Amanita albobimbrata</i>				Y
<i>Amanita</i> sp.			Y	
<i>Athelia</i> sp.				Y
<i>Bisporella</i> sp.			Y	
<i>Bjerkandera adusta</i>			Y	Y
<i>Botryobasidium</i> sp.				Y
<i>Byssomerulius corium</i>	Bysso Skin Fungus		Y	
<i>Calocera guepinioides</i>	Scotsman's Beard		Y	
? <i>Cantharellula</i> sp.				Y
<i>Clitocybe semiocculta</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>Coprinopsis stangliana</i>	Western Australian Magpie Fungus			Y
<i>Cortinarius</i> sp.			Y	Y
<i>Crepidotus</i> sp.			Y	
<i>Dermocybe clelandii</i>			Y	
<i>Entoloma</i> sp.			Y	
<i>Exidia</i> sp.			Y	Y
<i>Exidiopsis</i> sp.				Y
<i>Fayodia</i> ? sp.			Y	
<i>Galerina</i> sp.			Y	
<i>Genus</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>Hohenbuehelia</i> sp.				Y
<i>Inocybe</i> sp.			Y	Y
<i>Laccaria canaliculata</i>				Y
<i>Laccaria</i> sp.			Y	
<i>Lepiota</i> sp.			Y	
<i>Marasmius</i> sp.			Y	
<i>Mycena</i> sp.			Y	
<i>Phlebia subceracea</i> (formerly <i>Mycoacia subceracea</i> )	Golden Splash Tooth			Y
<i>Myxomycete</i> sp.	Slime Mould		Y	



Latin Name	Common Name	Recorded ELA (2012)	Perth Urban Bushland Fungi Workshop (2005)	Warwick Open Space Collections Florabase
<i>Omphalina ericetorum</i>			Y	
<i>Omphalotus nidiformis</i>	Ghost Fungus		Y	
<i>Peniophora</i> sp.			Y	
<i>Perenniporia cf. fraxinea</i>				Y
<i>Phanerochaete</i> sp.				Y
<i>Phlebiella / Trechispora</i> sp.				Y
<i>Pholiota communis</i>	Common Pholiota	Y	Y	
<i>Physarum pusillum</i>				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>Repetobasidium</i> sp.				Y
<i>Resupinatus</i> sp.				Y
<i>Resupinatus cinerascens</i>			Y	
<i>Rhodocollybia</i> sp.			Y	
<i>Schizophyllum commune</i>	Split Gill Fungus		Y	
<i>Schizopora</i> sp.			Y	
<i>Scleroderma cepa</i>	Earthballs	Y	Y	
<i>Secotium</i> sp.				Y
<i>Sistotrema cf. coroniferus</i>				Y
<i>Sistotrema</i> sp.				Y
<i>Stereum</i> sp.			Y	
<i>Tubaria serrulata</i>	Common Tubaria			Y
<i>Tubaria</i> sp.			Y	
<i>Tubulicrinis</i> sp.				Y
Unknown Agaric			Y	
Unknown Ascomycete			Y	
Unknown Resupinate			Y	
<i>Volvariella speciosa</i>	Common Rosegill		Y	

# Appendix 10 – Warwick Open Space Fungi Species

## Examples of Fungi Species at Warwick Open Space

Name	Common Name	Image
<i>Calocera guepinioides</i>	Scotsman's Beard	 <p data-bbox="1027 763 1453 792">Photo: N.L. Bougher (Bougher 2009)</p>
<i>Gymnopilus allantopus</i>	Golden Wood Fungus	 <p data-bbox="1027 1220 1453 1249">Photo: N.L. Bougher (Bougher 2009)</p>
<i>Pycnoporus coccineus</i>	Scarlet Bracket Fungus	 <p data-bbox="1027 1657 1453 1686">Photo: N.L. Bougher (Bougher 2009)</p>







*Trapezites sciron*  
Photo: Geoff Walker



**T: 08 9400 4000**

**F: 08 9300 1383**

Boas Avenue Joondalup WA 6027

PO Box 21 Joondalup WA 6919

**[joondalup.wa.gov.au](http://joondalup.wa.gov.au)**

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