Native Vegetation Handbook for the Shire of Lake Grace

Bec Ryan

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Native Vegetation Handbook for the Shire of Lake Grace
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Bec Ryan

Mapping by Julie Wyland

Spatial Resource Information Group
Agriculture Western Australia

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The Native Vegetation Handbook for the Shire of Kulin is one of a series covering the agricultural region of Western Australia. Other Handbooks in the series include:

The Shire of Augusta-Margaret River
The Shire of Beverley
The Shire of Boyup Brook
The Shire of Bridgetown-Greenbushes
The Shire of Brookton
The Shire of Brookhill
The Shire of Bruce Rock
The Shire of Corrigin
The Shire of Cunderdin
The Shire of Dumbleyung
The Shire of Katanning
The Shire of Kellerberrin
The Shire of Kent
The Shire of Kojonup
The Shire of Kondinin
The Shire of Kulin
The Shire of Lake Grace
The Shire of Merredin
The Shire of Mingenew
The Shire of Narrogin
The Shire of Northam
The Shire of Pingelly
The Shire of Tammin
The Shire of Toodyay
The Shire of Trayning
The Shire of Wagin
The Shire of West Arthur

The Shire of Wickepin
The Shire of Williams
The Shire of Woodanilling
The Shire of Wyalkatchem
The Shire of York
1 Introduction

1.1 Purpose of this Handbook

The purpose of this handbook is to provide information to the people in the Shire of Lake Grace to assist in revegetation and management of remnant native vegetation within agricultural systems.

This handbook is one of a series describing the agricultural region of Western Australia. It has arisen from the demand for information from people in rural communities, land conservation districts, catchment groups and local government authorities. This information will benefit the regional, catchment or local management of remnant native vegetation within rural areas.

The management of agricultural land and native vegetation is closely related. Since they greatly influence one another, they should be managed together. For example native vegetation affects the hydrology of agricultural land, while nutrients and weeds can be transported from farmland to remnants of native vegetation.

This handbook provides land managers with information relating to the natural resources of the Shire of Lake Grace, including the landscape, geology, soils, drainage systems, native flora and fauna. Information about native flora and vegetation has been drawn from a variety of sources, including surveys that estimated the distribution of plant communities prior to clearing, recent surveys of privately owned remnants, herbarium collections, surveys of nature reserves and roadside surveys. Some of the problems relating to the management of these resources within the shire and ideas and community initiatives to solve these problems are also discussed. It is hoped that this information will contribute to the long term viability of the agricultural landscape and the conservation of native vegetation within the shire.

1.2 The Shire of Lake Grace

The Shire of Lake Grace covers an area of 1,031,972 hectares and is mostly located in the Avon River Catchment (see cover map).

Cadastral boundaries in the shire are shown in Figure 1, and the 2,057 kilometres of road network in the shire are shown in Figure 2. The major townsite in the shire is Lake Grace, with other smaller townships at Lake King, Varley and Newdegate. The population of the shire was 1,885 in 1994 (WA Municipal Directory, 1996).

Climate

The shire has a Mediterranean climate, with cool, moist winters and hot, dry summers. Lake Grace receives an average of 381 mm rainfall per annum. Average maximum temperatures range from 32.1 °C in January to 14.8 °C in July, and average minimum temperatures range from 14.8 °C in February to 5.3 °C in July-August.
Figure 2. Major and minor access roads in the Shire of Lake Grace
Natural Resource Zones
The south-west of Western Australia has been divided into districts (called Natural Resource Zones) by overlaying the boundaries of native vegetation types, river catchments/drainage basins and rainfall (Allison et al., 1993). Natural Resource Zones were designed to develop an understanding of natural boundaries in the landscape, in order to plan and make decisions that enable productive farming while ensuring that the environment is protected.

There are 84 zones, each one different from any other in terms of biological and physical characteristics. The 84 zones have a unique code of six characters, assembled according to the following order:

- The first two characters show the native vegetation type. There are nine regions defined by Dr John Beard that are characterised by areas of similar plant communities, soils, geology, landforms (hills, valleys and plains) and climate.

- The second two characters indicate the river catchment and drainage basin. There are 21 river catchments and drainage basins in the South West Land Division; some are major river catchments such as the Avon and Blackwood basins, while some are areas made up of several smaller catchments such as near Albany and Esperance.

- The last two characters denote the rainfall zone. The 500 mm, 700 mm and 1100 mm rainfall lines divide the South West Land Division into four rainfall zones.

The Shire of Lake Grace contains parts of three Natural Resource Zones (Figure 3).

<table>
<thead>
<tr>
<th>Number</th>
<th>Code [Vegetation, Catchment, Rainfall]</th>
</tr>
</thead>
<tbody>
<tr>
<td>68</td>
<td>RoAvR4</td>
</tr>
<tr>
<td>75</td>
<td>RoEsR4</td>
</tr>
<tr>
<td>80</td>
<td>EyAvR4</td>
</tr>
</tbody>
</table>

The majority of the shire lies within the Roe Botanical District (Ro, commonly known as the Mallee Region) with a small southeastern portion lying within the Eyre Botanical District (Ey). The majority of the shire is within the Avon River catchment (Av) except for a small portion which is in the Esperance Coast (Es) drainage basin. The shire receives less than 500 mm of rainfall each year (R4).
Agricultural production
The Australian Bureau of Statistics (ABS) agricultural survey found that in 1995-96 the 753,886.5 hectares of agricultural land in the shire was managed by 282 landholders. Over 287,500 hectares was sown with major cereal crops (Table 1a), and over 238,300 hectares was sown for pasture (Table 1b). Within the shire, approximately 830,600 head of livestock were raised (Table 2).

<table>
<thead>
<tr>
<th>Cereal</th>
<th>Area (ha)</th>
<th>Production (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>185,903.8</td>
<td>346,990.1</td>
</tr>
<tr>
<td>Oats (for grain)</td>
<td>8,928.2</td>
<td>15,399.6</td>
</tr>
<tr>
<td>Oats (for hay)</td>
<td>1,787.0</td>
<td>-</td>
</tr>
<tr>
<td>Barley</td>
<td>49,973.0</td>
<td>93,746.3</td>
</tr>
<tr>
<td>Lupins</td>
<td>39,952.0</td>
<td>-</td>
</tr>
<tr>
<td>Fieldpeas</td>
<td>1,002.0</td>
<td>-</td>
</tr>
</tbody>
</table>

*not lucerne

<table>
<thead>
<tr>
<th>Pasture</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lucerne</td>
<td>1,316.0</td>
</tr>
<tr>
<td>Pasture legumes*</td>
<td>27,669.0</td>
</tr>
<tr>
<td>Sown pasture*</td>
<td>209,348.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Livestock</th>
<th>Number of animals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheep</td>
<td>223,237</td>
</tr>
<tr>
<td>Lambs and hoggets</td>
<td>602,307</td>
</tr>
<tr>
<td>Dairy cattle</td>
<td>-</td>
</tr>
<tr>
<td>Meat cattle</td>
<td>2,583</td>
</tr>
<tr>
<td>Pigs</td>
<td>2,481</td>
</tr>
</tbody>
</table>

New industries
Diversification provides mangers of agricultural land with alternatives to traditional enterprises that may be both economically and environmentally beneficial. New industries that have recently been established in the Shire of Lake Grace include emu and yabby farming. The emu farm runs an oil rendering and filtering service and there are plans to erect a tourist shop on the property that would sell the oil, cosmetics and leather goods. Yabbies are sold to restaurants, exporters and individuals and WA Yabby Farms also manufacture a yabby dip that is available in many stores (Wheatbelt Development Commission, 1995).
Revegetation and remnant protection
The ABS agricultural survey in 1995-96 found that in that year there were at least 69,530 trees planted from seedlings in the Shire of Lake Grace, but none directly sown from seed. Planted trees were isolated with 614.6 km of fencing.

In that same year 6,710 hectares of remnant vegetation on private land was protected with 93.2 km of fencing, representing a large investment in land management. Between 1989 and 1997, the Remnant Vegetation Protection Scheme (RVPS) funded nearly 260 km of fencing in the shire to protect more than 4,000 hectares of remnant bush.

Land Conservation District Committee and Catchment Groups
There are five Land Conservation District Committees (LCDCs) in the shire: Lakes, Lake Bryde, Lake Grace, Pingaring and Newdegate. LCDCs formed because of community concern over increasing salinity in the shire and strive towards sustainable land management throughout the shire.

Catchment groups have formed where groups of neighbouring farmers work together to address landcare problems. There are many catchment groups active in the shire, including Tarin Rock, South Lake Grace, North Lake Grace
2 Natural Resources of the Shire of Lake Grace

2.1 Landscape

Landscape descriptions have been adapted from Reading the Remote, Landscape Characters of Western Australia, (CALM, 1994). This survey divided the State into a number of areas defined by their landscape character type. The Shire of Lake Grace is contained within the Merredin Plateau Landscape Character Sub-type.

The Shire of Lake Grace is dominated by expanses of cereal crops and open views over wide, shallow, undulating valleys of the ancient drainage channels. Valley systems are indistinct and waterbodies take the form of a series of saline wetlands or chains of expansive shallow salt lakes such as Lake Grace and Lake King. The edges of these wetlands are usually fringed with swamp sheoak (Casuarina obesa) and saltwater paperbark (Melaleuca cuticularis) with low succulent sapphire growing on moist salt flats. Adjacent trees are frequently dead and skeletonised, signifying the increasing salinity problem in the wheatbelt.

Pockets of remnant vegetation seldom interrupt the open views. Tall, smooth, pink-barked salmon gum (Eucalyptus salmonophloia) dominates the small patches of remnant woodland on the richer, pale loamy clay soils. Confined examples of sturdy, mottled silver inland wandoo (Eucalyptus capillosa) are scattered across the landscape or in small groups with redwood (Eucalyptus transcontinentalis), red morrel (Eucalyptus longicorns), gimlet (Eucalyptus salubris) and low bushy jam tree (Acacia acuminata) at the eastern border. The sparse understorey includes sheoaks (Allocasuarina fraseriana) and Acacias with occasional slender olive Banksias, flat-topped yate (Eucalyptus occidentalis) and bushy, roadside teatree (Leptospermum erubescens).

In remnant patches, on the sandplain where the soils are predominantly pale apricot to soft yellow sandy loams, there is a mallee-heath combination. This is dominated by Acacias, tamma (Allocasuarina campestris), broombush (Melaleuca uncinata) and honeymyrtles (Melaleuca). During springtime, the diverse heath areas are carpeted with colourful wildflowers.

Views over the low-lying, gently undulating landscape are of uninterrupted agricultural land with the occasional fenceline. Lines of remnant vegetation may sometimes be seen along roadsides, creeklines or property entrances. Isolated hills and granite outcrops are a distinct visual feature surrounded by the local topography. Dingo Rock, a granite formation surrounded by a low woodland, is an example of this.

A Digital Elevation Map illustrating the topography of the shire may be seen in Figure 4.
2.2 Geology

The Shire of Lake Grace is underlain by granite rocks covered by alluvial soil in the major valleys.

The eastern wheatbelt is underlain by the Yilgarn Block, a rigid continental mass composed mainly of Archaean gneiss and granite, with some altered volcanics and sediments. The Yilgarn Block is one of the oldest land masses on earth, and has been a relatively stable part of the earth’s crust for 2,400 million years.

Gneisses are hard crystalline banded rocks that were metamorphosed (affected by high pressure and temperatures) when they were several kilometres below the earth’s surface. The minerals present are commonly quartz and feldspars.

Granites are hard crystalline rocks which are also dominated by quartz and feldspars but have very few dark minerals and are not banded. Granites form when very large masses of molten rock are intruded (pushed up) into the earth’s crust, where the magma cools and crystallises.

Earth movements over millions of years have uplifted the basement rocks. Around 40 million years ago the eastern part of the Yilgarn Block lifted 300 m, tilting the western part of the block downwards towards the ocean. This produced two distinctive landscapes the Zone of Rejuvenated Drainage and the Zone of Ancient Drainage. Each broad zone has characteristic soils, landscapes and vegetation, but the boundaries between the zones are often indistinct and can merge over a distance of up to ten kilometres.

Zone of Rejuvenated Drainage
This zone is west of the Meckering line. The landscape has undergone much recent erosion (past 40 million years) and is dissected, forming steep, narrow valleys that contain rivers and creeklines that flow in winter. Small remnants of sandplain occur, often bordered by a scarp or breakaway.

Zone of Ancient Drainage
This zone is east of the Meckering line, and has experienced less erosion. The landscape consists of gently undulating plateau, with wide divides, long gentle slopes, and broad valleys that contain salt lakes. Dissection of the lateritic profile on the slope has resulted in the formation of hardsetting grey duplex soils with some loose, sandy surfaced duplex soils on the lower slopes (Lantzke and Fulton, 1993).

Over thousands of millions of years the Yilgarn Block has eroded into an almost flat landscape. Most of the rock basement is covered with a layer of soil, but there are occasional granite outcrops at the surface. These granite outcrops may be massive dome-shaped rocks, piles of tumbled boulders, or flat sheets at soil level. The rock surface may vary because of the mineral composition of the granite, from a smooth to a rough sculptured surface with fissures and cracks.
Granite rocks are impervious to water and concentrate runoff to give a greater effective rainfall at their base. Damp areas around granite rocks can be thought of as “refuges” where plants and animals that flourished during periods of wetter climates can persevere during arid periods (Hussey, 1998).

2.3 Soils

While the Yilgarn Block was eroding, a lateritic soil was being formed. This consisted of a sandy surface, a gravelly clay subsoil, underlying weathered mottled and pallid zone materials, and saprolite (McArthur, 1991). This laterite profile represents extremes in soil formation. In the past 2 million years, climate fluctuations have greatly altered the landscape, differentially eroding the surface of the Yilgarn Block. Erosion extended to different depths and exposed both weathered and unweathered materials which became soil parent materials. Physical, chemical and biological weathering of the parent material has led to soil formation. Much of the soils were washed away, transporting smaller clay particles into valleys and leaving sands and gravels higher in the landscape.

The distribution of soil-landscape systems of the Shire of Lake Grace is presented in Figure 5. These systems fall within the Zone of Ancient Drainage and are described below (Verboom and Galloway, unpublished). Further information is available from the Natural Resources Assessment Group (NRAG), Agriculture Western Australia, South Perth.

**Bilginger System** (Bi): Undulating low hills of lateritic plateau largely stripped by erosion, in southern areas of the Zone of Ancient Drainage. Gravelly and shallow duplex soils. Scrub heath & *Casuarina* thicket on old surface, Wandoo (*Eucalyptus wandoo*) and Gimlet on new surface.

**Carrajon System** (Cj): Broad flat valleys, in eastern areas of the Zone of Ancient Drainage. Calcareous loamy earths and shallow loamy duplexes are the principal soil types. Vegetation comprises wandoo, York gum (*Eucalyptus loxophleba*) and Allocasuarina woodlands.

**Dattening System** (Dn): Undulating to rolling low granite hills in the western Zone of Ancient Drainage. Main soils include grey shallow and deep sandy duplexes. Principal vegetation includes York gum with jam, Allocasuarina and wandoo woodlands.

**Damon System** (Dm): Lower slopes and foot slopes adjacent to salt lakes in the eastern Zone of Ancient Drainage. Loamy earth (mostly calcareous), grey sandy duplex and sandy earth are the main soil types.

**Hope System** (Ho): Broad valley floors on greenstone, in the eastern Zone of Ancient Drainage. Principal soils are grey sandy duplex (often alkaline) and loamy earth (usually calcareous).

**Hyden System** (Hy): Undulating to rolling low hills with granitic outcrops in the
Figure 5. Soil Landscape Systems in the Shire of Lake Grace

Legend:
- Kweikan System
- Nungarin System
- Kukerin System
- Bilgering System
- Kuender System
- Mauclairing System
- Carrajon System
- Lillian System
- Nesheeb System
- Meranda System
- Newdegate System
- Pingrup System
- Hope System
- Hyden System
- Jerramungup System
- Springfield System
- Lagan System
- Karlgarin System
- Daman System
- Dattening System

Note: Soil landscape systems presented here are based on preliminary surveys.
eastern Zone of Ancient Drainage. The main soil types are shallow sand, grey sandy duplex and brown sandy earth.

**Jerramungup System** (Jm): Gently undulating plateau, in the Jerramanugup Sandplain Zone, with grey sandy duplex (shallow and deep), alkaline grey shallow loamy duplex and saline wet soil. Mallee scrub.

**Karlgarin System** (Ka): Undulating low hills with granitic outcrops in the eastern Zone of Ancient Drainage. Shallow sand, grey sandy duplex and sandy earth.

**Kuender System** (Kd): Undulating low hills in the Zone of Ancient Drainage. Alkaline red shallow sandy and loamy duplexes, red or brown loamy or sandy earths. Gimlet, wandoo, salmon gum and mallee woodland.

**Kukerin System** (Kk): Gently undulating rises and narrow alluvial plains. Main soils types include grey deep sandy duplexes with sandy gravels and alkaline grey shallow sandy duplexes.

**Kwelkan System** (Kw): Occurs in undulating to rolling low hills with granite rock outcrops. The system has a low relief with gently to moderately inclined slopes. Stream channels are common. The main vegetation type is York gum and jam bushland. Major soils are gritty quartz sand to sandy loam formed in weathered granite and granite colluvium.

**Lagan System** (La): Salt lake chains, in the eastern Zone of Ancient Drainage, with salt lake soil and calcareous loamy earth. Mallee and red morrel (*Eucalyptus longicornis*) woodland and salt flats of saltbush (*Atriplex hymenotheca*), bluebush (*Atriplex paludosa*) and samphire (*Halosarcia* sp.) are the principal vegetation types.

**Lillian System** (Ln): Plain with occasional hills, in the south-eastern Zone of Ancient Drainage, with grey sandy duplex (mostly shallow), alkaline grey shallow duplex (sandy and loamy) and shallow gravel. Mallee scrub and heath.

**Maublaring System** (Mb): Undualting low hills of old lateritic plateau. Shallow and moderately deep sandy gravels. Scrub heath and casuarina thicket on old surface; wandoo and gimlet on new surface.


**Nesheeb System** (Ns): Very gently inclined foot slopes and lower slopes in the eastern Zone of Ancient Drainage. The main soil types are grey sandy duplex and sandy earth.

**Newdegate System** (Nw): Undulating rises, in the south-eastern Zone of Ancient Drainage, with grey sandy duplex (shallow and deep), alkaline grey shallow duplex (sandy and loamy) and shallow gravel.
Drainage, with grey sandy duplex (shallow and deep) and grey shallow loamy duplex (often alkaline). Salmon gum-gimlet-wandoow woodland and mallee scrub.

**Pingrup System (Pg):** Valley floor and salt lakes in the south-eastern Zone of Ancient Drainage, with alkaline grey shallow duplex (sandy and loamy), calcareous loamy earth, pale deep sand and saline wet soil. Salmon gum and flat-topped yate woodland (*Eucalyptus occidentalis*) and mallee are the principal vegetation types.

**Springfield System (Sp):** Undulating low hills in the southern area of the Zone of Ancient Drainage.
2.4 Wetlands

Wetlands are defined by the Wetlands Advisory Committee as “... areas of seasonally, intermittently or permanently waterlogged soils or inundated land whether natural or otherwise, fresh or saline, e.g. waterlogged soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries and tributaries”.

The Shire of Lake Grace lies within the Swan-Avon river system and associated salt-lake drainage network. It is contained within the Lockhart Catchment where drainage is poor, there are no major streams and local runoff accumulates in the salt lakes. The lakes are interconnected by very sluggish groundwater movement and only in very wet years do all the lakes join up and flow on the surface. Normally the lakes are sumps where water and salts accumulate. Evaporation rapidly removes exposed water, leaving broad expanses of crystalline salts.

Lake Grace North, Lake Grace South and Lake Chinocup are part of a salt lake system on the east of the Meckering Line. This lake chain lies along the floor of a broad shallow valley with a north-south trend. The lake chain converges near Jilakin Lake with three similar lake chains originating from near Lake Bryde, Lake Magenta and Lake Pallarup respectively. The resulting system gradually turns westward until after collecting several other chains from further east and north it becomes part of the Avon headwaters, near Beverley (McKenzie and Youngson, 1975).

The Shire of Lake Grace contains many wetland areas within its boundaries, many of which are located on private land. Figure 6 shows the major drainage systems in the Shire of Lake Grace. Wetlands include:

- Lake Grace, Lake Ace, Lake Biddy and Lake Cronin (described below).
- The Lake Magenta chain of wetlands includes Lake Romani, Magdhaba Lake, Lake Rafa, Lake Cobhan, Lake Morris, Lake Royston and Hall Lagoons, which then links north towards Lake Lockhart.
- Big Lake, lying between Lake Grace South and Lake Grace North.
- The scattered chain of small lakes near the town of Newdegate including Lake Stubbs, Lake Buchan, Lake Hill, Lake Austral, Eclipse Lake and Lake Tunney.
- The Lake King chain that begins in the south-east with Lake Pallarup, Lake Milarup and Lake Ronnerup and Lake King, then continues northwards to Lake Camm, Lake Fox and Lake Gulson, linking Lake King to Lake Varley in the Shire of Kulin.

The wetland chain of Chinocup Lake and Lake Pingrup in the Shire of Kent, with the associated Lake Dorothy, Lake Altham and Carinup Lakes, links northwards to join up with Lake Grace.

Lake Ace is a large, open, hypersaline, seasonal lake of 91.3 hectares. It is surrounded by a low open shrubland of samphire. Where the ground around the lake rises there are larger *Melaleuca* shrubs and in some areas a few *Eucalyptus* species.
Beyond this is an open eucalypt woodland (Halse et al., 1993).

**Lake Biddy** is a small, seasonal saline lake of about 7 hectares. It is surrounded by samphire marsh. There are small numbers of other species above the highwater mark. Isolated dead trees are around the margin of the lake and in the water, and there are two areas of dense dead saplings. On higher ground there is a belt of *Melaleuca* (Halse et al., 1993).

**Lake Cronin** is a small ephemeral lake of 4 hectares that contains fresh water. It is fringed with an extensive dense thicket of *Melaleuca* interspersed with occasional trees of the same species. There have been several years recently when the lake has been completely dry and covered with dense low vegetation (Halse et al., 1993).

**Lake Grace** is situated on shallow, flat-bottomed, undeveloped saline loams on riverine wash. The lakes are fringed by various saline duplex soils that are subject to periodic inundation, and support samphires including *Arthrocnemum* species. On drier rises *Melaleuca* shrubs can be found. The edges of the lakes that are downwind of the predominant wind (west and north-west winds) are generally surrounded by sand dunes or lunettes up to 10 m high (McKenzie and Youngson, 1975). In dry years, the sandy lake bottoms are carried downwind by wind erosion, and deposited on the lake’s edge. Thus the following wet season, the lake is be pushed westwards by the increasing deposits on the eastern edge that form the lunette. The rate of westward movement of the lake and its subsequent shape is determined by the underlying geology. For example, where there is granite the lake is forced around it giving it an irregular shape, or halted altogether.

**Lake Pellarup** is a large open hypersaline lake that is ephemeral and covers 900 hectares. It is situated in the Pellarup Nature Reserve (29860). Above the water mark there is a low samphire marsh. It is replaced on higher ground by an open shrubland of *Melaleuca* with an low understoire of salt tolerant shrubs. Away from the lake the shrubland is replaced by salmon gum woodland (Halse et al., 1993).

The wetlands of the wheatbelt have suffered enormous changes as a result of the rise of salty groundwater. Most of the wetlands in the Shire of Lake Grace have increased in salinity since the 1940s. These changes were quickly followed by the death of vegetation that fringed lakes and wetlands.

Many of the vertebrate animals that were once common to wetlands and the surrounding areas have now disappeared. These included waterbirds, reptiles, frogs, and the water-rat *Hydromys chrysogaster*. This could be a result of various factors, such as increased salinity of the wetlands, destruction of their habitat, decline of their prey and/or predation by introduced feral animals.

The Biological Survey Group of CALM’s Science Division is currently conducting a survey of 75 wetlands in the southern wheatbelt. Parameters studied include water chemistry, waterbirds, vegetation and aquatic invertebrates. This work is in conjunction with flora surveys under the Western Australia Salinity Action Plan.
2.5 Original Plant Communities

The descriptions of plant communities below are based on plant distribution studies by J.S. Beard. Beard described vegetation communities and their estimated extent prior to European settlement and the subsequent clearing of native bush for agriculture. Further details can be obtained from Beard (1979 and 1980). An estimation of the original distribution of the dominant vegetation types based on the work by Beard is illustrated in Figure 7 (Hopkins et al., 1996).

The Shire of Lake Grace contains vegetation types from two of Beard’s Vegetation Systems: the Corrigin and Hyden Vegetation Systems.

The Corrigin Vegetation System of the Avon Botanical District has a typical “outer wheatbelt” landscape. It is drained by the upper reaches of the Avon River. There is a well organised drainage pattern but dissection is shallow and slopes are gentle. The higher ground is capped by large patches of sand and laterite. While laterite usually appears at the surface of the edges of such sandplains, it rarely forms breakaways. There are some salt lakes near Yealering with halophytes on adjacent flats but not all bottomlands are saline. The vegetation consists of kwongan (thickets and heath) on sandplains, woodlands on slopes and flats, patches of intermittent mallee and teatree thickets and samphire in the bottomlands.

Kwongan
Kwongan vegetation occurs on yellow-brown loamy sand with about 80% laterite pebbles and local exposures of laterite pavement. Large patches of sand and laterite cap the higher ground, and while laterite usually appears at the surface at the edges of such sandplains it rarely forms breakaways. There is a great diversity of species that intermingle, tending to sort according to the predominance of laterite pebbles or sand in the soil profile.

Dominant species vary over the diverse understorey. In some parts open stands of 2-4 m tall tamma shrubs tower over 1 m tall Dryandra cirsiodes and other shrubs, with scattered taller mottlecah (Eucalyptus macrocarpa) and Hakea subsulcata. In other parts a 2-4 m thicket is equally dominated by tamma and H. subsulcata. Laterite favours Allocasuarina, Dryandra, Gastrolobium, Leptospermum and most Hakea species. Sand favours Actinostrobus, Banksia, Conospermum, Eremaea, Grevillea, Lambertia, Nuytsia and Verticordia. Acorn banksia (B. prionotes) may appear on deep sand, but is not found in a Banksia-Xylomelum alliance.

Mallee
Mallee species are predominantly black marlock (Eucalyptus reducata), ridge-fruit mallee (Eucalyptus incrassata), tall sand-mallee (Eucalyptus eremophila) and capped mallee (Eucalyptus pileata). These communities vary in height and density. A closed low-shrub understorey is usually present.
Vegetation shown is original natural vegetation presumed to have existed prior to European settlement.

Figure 7. Major Beard vegetation types in the Shire of Lake Grace.
Eucalypt woodland - low woodland
On laterite breakaways brown mallet is found. Powderbark wandoo is found in western reaches and is replaced by blue mallet in some localities. Covering the upper slopes below the sandplain are open stands of 16-20 m tall wandoo, with little understorey but scattered Gastrolobium crassifolium and Melaleuca laxiflora.

On middle slopes, 10-16 m tall York gum tends to stand over sparse, 4-6 m tall jam with scattered emergent salmon gum up to 20 m tall. There is a grass ground layer of Enneapgon caeruleascens. Jam may form low woodland without eucalypts. On flats with heavy soil salmon gum and red morrel occur.

Along major fresh-water creeks flooded gum is found with Callistemon phoeniceus. Where creeks are saline the vegetation changes to swamp sheoak (Casuarina obesa) and Melaleuca hamulosa, with the samphire Arthrocnemum bidens along the creek margins.

The Hyden Vegetation System in the Mallee Region of the Roe Botanical District is one of the largest components of the Roe District. The landscape is very gently undulating with wide flat valleys and long gentle slopes rising to broad interflues. The interflues are capped by residual laterite and sands of the prior surface, and rarely occur as breakaways. Soils are very variable and the highly mosaic character exhibited by the wheatbelt vegetation is even more pronounced, perhaps because of the gentle slopes. Plant cover varies in structure and composition every few metres. There is a characteristic catena comprising:
• kwongan (heath and thicket) on sandplains
• mallee on the slopes covering the bulk of the area
• mallee with patches of woodland on upper valley soils
• woodland on lower valley soils
• a mosaic of woodland, shrubland and samphire in saline areas

Woodland
Medium-height woodland occurs on the lower valley soils, consisting of York gum and jam, York gum and salmon gum, wandoo and gimlet, or gimlet and salmon gum. Height and density vary. Heights of up to 12-15 m are common, with salmon gum reaching 22 m, while some stands are less than 10 m tall and are classed as low woodland. Canopy cover ranges from 2 to 70%.
Understorey varies according to the overstorey species. York gum usually has a small 2-5 m tree layer of jam and sandalwood and a ground layer of sedges with annual grass and forbs in winter. Wandoo covers scattered shrubs, primarily *Gastrolobium crassifolium*. Salmon gum and gimlet commonly have a scattered tall shrub layer of *Melaleuca* species, or sometimes smaller scattered shrubs such as *Acacia erinacea* and *Templetonia sulcata* with a ground layer of pincushions (*Borya sphaerocephala*) and *Wilsonia humilis.*
Low woodland
Smaller trees or “marlocks” replace woodlands in the mallee; for example, silver mallet (*Eucalyptus ornata*) and blue mallet (*Eucalyptus gardneri*) replace brown mallet that occurs on laterite plateaux and breakaways further west. There are only small occurrences of brown mallet below the breakaway and not on laterite. On very heavy clay soils open-fruited mallee (*Eucalyptus annulata*) replaces gimlet.

Low woodlands are sensitive to fire and regenerate from seed, forming even-aged stands of single-stemmed trees. The principal association is of silver mallet and blue mallet on laterite, with heavy cover and heights usually around 6-8 m. Old stands up to 16 m tall with sparse cover may also be found. Low woodland stands have understorey shrub species similar to that of mallee.

Mallee
A great variety of eucalypt species form mallee communities. They usually occur on gradational acid soils. True mallees are eucalypt species that resprout from rootstock after fire. Height varies and is probably related to the age of the stand; if fire is eliminated the vegetation may become a woodland. Most mallee stands are about 3-5 m tall with open cover, and have a dense understorey of sclerophyll shrubs 1-2 m tall.

Mallee heath
Mallee heaths are dominated by the spreading, straggly Burracoppin mallee (*Eucalyptus burracoppinensis*). They occur on gradational acid soils and also on uniform and neutral soils, with a yellow colour unlike other mallee soils. Numerous clumps of Burracoppin mallee are scattered over a heath-like understorey of many shrub species. Occasionally *Grevillea eriostachya* or *Hakea coriacea* stand above the mallee stratum. The upper layer of the mallee-heath ranges from 1-5 m tall, sometimes reaching 6-8 m. The lower heath layer may reach up to 1 m. Both layers vary in cover density.

Shrublands
Shrublands are thickets exceeding 2 m with dense canopy cover, dominated by *Allocasuarina acutivalvis* and/or tamma, *Acacia signata* or jam, or *Melaleuca lateriflora* and *M. acuminata* along a watercourse. An understorey is formed by numerous species but is relatively sparse.
Heath formations appear similar to other respects to shrublands – slightly shorter stratification and the same dominants especially *Allocasuarina acutivalvis* - but do not reach 2 m high. The general structure consists of an upper open layer of large shrubs less than 2 m tall and a lower closed layer of smaller shrubs, although occasionally only a low heath layer is present with no distinctive dominants. Mixed species, particularly Proteaceae, make up the upper layer without distinct patterns. However, *Dryandra cirsioidea* may be prominent over laterite.

**Rock outcrops**
Outcrop areas often carry very complex mosaics of several associations. On bare granite rock with moss (*Grimmea* species) and lichens (mostly *Parmelia* species) shallow soil layers support herbs such as pincushions and shrubs such as roadside teatree, *Dodonaea attenuata* and *Hibbertia enervia*. Where soil is deeper a mosaic of low woodland of wilyurwur (*Acacia lasiocalyx*) or thickets of tamma occur. Low woodland of jam frequently surrounds outcrops or forms the cover between expanses of granite pavement. All woodlands may be scattered with York gums.

**Breakaways**
The platform above the breakaway is covered by tamma thicket. The scree area is also covered by tamma except where a laterite scarp 1-2 m high is present, where the scree has a low woodland of brown mallet. Where breakaways are more pronounced, higher and steeper, the scarp and scree are almost bare of vegetation, while the outwash is sparsely vegetated with tall trees of *Callitris canescens* and shrubs such as *Melaleuca undulata* and *Grevillea huegelii*.

In the *Hyden Vegetation System* of the Eyre Botanical District of the South-western Botanical Province, the landscape is somewhat dissected. Large areas of residual sandplains do not occur and these are limited to relatively small patches on interfluves, while valleys are wide. Scrub heath occurs on the sandplain ridges, mallee on the middle slopes covering the bulk of the area, and sclerophyll woodland or mallee with woodland patches in the bottomlands. On the most saline sites teatree
scrub replaces woodland. Granite outcrops that occur throughout the area have their own characteristic vegetation.

**Scrub heath**

The * Allocasuarina* thicket formation associated with scrub heath occurs as small patches on lateritic soil. It consists of large shrubs over 1 m high of tamma, *A. acutivalvis*, *A. corniculata* and *A. pinasta*, and small shrubs 30-50 cm high of a variety of genera.

**Mallee**

In mallee the larger plants are exclusively eucalypts, with a dense mixed understorey of other genera. Small trees or “marlocks” 3-10 m tall occur locally in small patches, with the trees rising out of the mallee. Tall sand-mallee is the most common and consistent mallee species, with its associations changing locally. Around large granite rocks York gum are found, while coarse-leaved mallee (*Eucalyptus grossa*) occurs at the edge of rock outcrops. Swamp mallet occurs in low-lying, winter-wet places. Understorey is commonly dominated by *Melaleuca* species, forming a continuous layer with other species interspersed.

Figure 11 Profile of low mallee on the Hyden-Norseman Road.
Figure 12 Profile of tall mallee on the Hyden-Norseman Road

Sclerophyll woodland
The dominating eucalypts in sclerophyll woodland vary, and include salmon gum and gimlet; red morrel near salt lakes; and yorrel (*Eucalyptus gracilis*), Kondinin blackbutt (*E. kondininensis*) and swamp mallet (*E. spathulata*) in saline areas. The shrub layer is generally dominated by irregularly scattered, 3.5 m tall *Melaleuca pauperiflora*. In less saline areas, the ground layer consists of shrubs with a broombush habit and grasses, but in alkaline areas near lakes saltbush and greybush are dominant.

Teatree scrub
Teatree scrub replaces woodland in more saline areas and surrounds hypersaline sites that are either bare of vegetation or carry samphires. Several species of *Melaleuca* are represented, including broombush, *M. hamulosa*, *M. cymbofolia* and *M. thyoides*. There may be small eucalypts, especially swamp mallet and yorrel. Teatree scrubs often have a ground layer of samphire species.

Granite rocks
Most outcrops are bare and only covered with lichens. Pools of water that form in winter support numerous ephemeral lifeforms, such as microscopic plants, algae, diatoms and invertebrates. Patches of soil lodged in clefts are colonised by characteristic species that are usually confined to this habitat, such as wilyurwur, rock sheoak (*Allocasuarina huegeliana*) and *Lepidosperma* sedge species. Flat, sheltered rock outcrops are often colonised by pincushions and are surrounded by a zone of dense *Verticordia preissii*.

Communities that surround granite rocks include woodlands of York gum or rock sheoak, thickets of wilyurwur or jam, or mixed thickets of tamma, *Dodonea attenuata*, one-sided bottlebrush (*Calothamnus quadrifidus*) and *Melaleuca elliptica*. 
In *How to Manage Your Granite Outcrops*, Hussey (1998) suggests that the topography of the rock outcrop determines which plants and animals can survive on and around it, and creates sharply defined zones of different habitat (Table 3). A more varied rock will have more diverse habitats and will be able to support a wider range of wildlife.
Table 3: The large range in habitat types of granite outcrops support a variety of wildlife (Hussey, 1998).

<table>
<thead>
<tr>
<th>1. Rock Sheets</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Lichens, mosses and blue-green bacteria (dormant during the dry season).</td>
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<tr>
<td>• Invertebrates such as insects and spiders (active in wet season) and basking lizards.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Small Cracks and Crevices under Rocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Horizontal cracks shelter lizards, geckos and many invertebrates (e.g., ants, spiders).</td>
</tr>
<tr>
<td>• Vertical cracks provide root spaces for plants such as ferns, pincushions and shrubs.</td>
</tr>
<tr>
<td>• Cracks may channel and hold water.</td>
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<thead>
<tr>
<th>3. Holes and Caves under/among Tumbled Boulders</th>
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<tbody>
<tr>
<td>• Where light enters and fine soil collects delicate plants may grow.</td>
</tr>
<tr>
<td>• Large holes provide shelter for larger mammals such as echidnas, rock-wallahies and kangaroos and large reptiles such as goannas and carpet pythons.</td>
</tr>
<tr>
<td>• Smaller holes are used by smaller mammals such as dunnarts and native mice.</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>4. Rock Pools</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Shallow pools only hold water over winter, and support numerous microscopic plants, algae and diatoms; quillwort in mud; grassulass in drying edges.</td>
</tr>
<tr>
<td>• Water supports invertebrates (water-fleas, shrimp-like creatures, midge larvae), dragon-fly larvae and tadpoles.</td>
</tr>
<tr>
<td>• Deeper pools called ‘gnammas’ by Nyoongah people were an important water source.</td>
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<tr>
<th>5. Rock Meadows or Swards</th>
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<tbody>
<tr>
<td>• Meadow or ‘swards’ develop where soil accumulates in rock depressions or on shallow soil around the edge of the outcrop.</td>
</tr>
<tr>
<td>• Support different small plants that flower through the winter and spring, and have various mechanisms to survive the long hot summer, when soil is baked dry.</td>
</tr>
<tr>
<td>• Pincushions, lichens, moss, nancies, orchids, triggerplants and daisies.</td>
</tr>
<tr>
<td>• Habitat for many small invertebrates that supply food for frogs, lizards and birds.</td>
</tr>
<tr>
<td>• Favourite feeding places for rock-wallahies, bandicoots and kangaroos.</td>
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<thead>
<tr>
<th>6. Shrubby Islands on the Rock</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Islands of shrubs or trees may form where soil accumulates to any depth.</td>
</tr>
<tr>
<td>• Plants often gnarled, twisted and very old as their isolation protects them from fire.</td>
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</tbody>
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<table>
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<tr>
<th>7. Shrubby Thickets</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Dense shrubby thickets form where channelled water collects over the rock and the soil is deep enough.</td>
</tr>
<tr>
<td>• Common shrubs include teatrees, bottlebrush, honeymyrtles, tammas, heakes, grevilleas, wattles and occasionally mallees.</td>
</tr>
<tr>
<td>• Plants may produce copious nectar, an important food source for insects and birds.</td>
</tr>
<tr>
<td>• Dense thickets ideal nesting sites for small birds.</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>8. Sheoak Woodlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Rock sheoak is characteristic tree around granite outcrops, dropping thin branches (or ‘needles’) that carpet the ground and suppress other plants.</td>
</tr>
<tr>
<td>• Foraging woylies (or brush-tailed bettongs, Bettongia penicillata) may turn the soil and needle carpet while searching for fungi.</td>
</tr>
<tr>
<td>• Habitat for red-tailed phascogales, western rosellas and Port Lincoln ringnecks.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>9. Surrounding Woodlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Outcrops would have been surrounded by bushland of jarrah, wando, York gum, salmon gum or gimlet before clearing.</td>
</tr>
</tbody>
</table>
2.6 Current Vegetation

Since the arrival of Europeans over 150 years ago, native vegetation has been degraded in numerous ways as a result of altered land use throughout Western Australia. In the SouthWest Land Division, 85-95% of the native vegetation has been removed (Hamilton et al., 1991). This was an area with great native floral diversity. Therefore, the impact of clearing for broadscale agriculture has been significant. The most productive soils for farming were widely cleared, leaving little of the vegetation associated with these soils. The loss of native vegetation has been exacerbated by the inadequate coverage by nature reserves of all habitats and species found throughout Western Australia (CALM, 1992). Therefore, privately owned remnants of native vegetation in the agricultural areas of the south-west are an important component of the State’s biodiversity and a great conservation resource (Allison et al., 1993).

There are 1,216 bush remnants on private land in the Shire of Lake Grace. These remnants have been mapped from aerial photographs into three classes of condition (Beeston et al., 1994). The mapping classed all remnants in the Shire of Lake Grace in “remnant” condition. Of these bush remnants in the shire, 21% are greater than 50 hectares in area (Beeston et al., 1994).

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Remnant Vegetation:
- most closely reflects the natural state of vegetation for a given area,
- intact understorey,
- structurally diverse and complex,
- minimal disturbance by agents of human activity.

Modified Vegetation:
- degraded understorey,
- obvious human disturbance (clearing, mining, grazing),
- saline incursions.

Scattered Trees:
- cleared parkland, no understorey present,
- no canopy continuity,
- no significant chance of regeneration.

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Approximately 51% of the total area of the Shire of Lake Grace remains covered by relatively intact native vegetation (Table 4). Roughly 14% of private land is covered with intact native vegetation. The remaining 37% exists as public reserves, such as water reserves, Crown land and gravel pits, not all of which have a cover of native vegetation (Figure 13).
Table 4: The condition of remnant vegetation on private land in the Shire of Lake Grace (Beeston et al., 1994).

<table>
<thead>
<tr>
<th>Class</th>
<th>Area (ha)</th>
<th>% of Shire Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remnant Vegetation</td>
<td>147,613.7</td>
<td>14.3</td>
</tr>
<tr>
<td>Modified Vegetation</td>
<td>0.0</td>
<td>-</td>
</tr>
<tr>
<td>Scattered Trees</td>
<td>0.0</td>
<td>-</td>
</tr>
<tr>
<td>Private Land</td>
<td>147,613.7</td>
<td>14.3</td>
</tr>
<tr>
<td>Public Land</td>
<td>381237.9</td>
<td>36.9</td>
</tr>
<tr>
<td>Shire Area</td>
<td>1,031,972.0</td>
<td>-</td>
</tr>
</tbody>
</table>

Common names for major species are given in Appendix 1. Species found in the Shire of Lake Grace from 1970 to the present have been listed in Appendix 2. This brief list has been compiled from various sources, including reserve surveys found in Section 2.7. The list records the soil types that individual species have been observed in and indicates the general life-form of the plant: herb, shrub or tree.

Recent survey work
In 1992, Ted Griffin and Frans Mollemans undertook a botanical survey of the Shire of Lake Grace (Griffin, 1995). Of the bush remnants in the shire, 146 were surveyed briefly and four were surveyed in detail (numbers 16020, 13017, 15008 and 15009). This study found that 15% of all bush areas surveyed were fenced and nearly half of the 33 bush areas classed as “remnant vegetation” were fenced. The results of the detailed survey are included in Appendix 2. Copies of their findings are available by contacting the Spatial Resources Information Group, Agriculture Western Australia (08) 9368 3467.

In 1997, Gibson and Lyons surveyed the southern Forrestania greenstone belt. This narrow belt of undulating plains and abrupt ridges of banded ironstone stretches 70 km from Mt Holland south to Hatter Hill and lies 80 km east of Hyden. The greenstone and banded ironstone ranges are one of the common landforms of the eastern Goldfields. Much of the Forrestania vegetation system, and many of the sites in this survey fall within the Shire of Kondinin. There has been a long history of mineral exploration and mining in Forrestania, with three large mines operating at present at Forrestania, Middle Ironcap and Digger Rocks. Despite considerable mining and exploration activity in the area, the flora and vegetation is still very poorly known. Very little of the Forrestania vegetation system is currently reserved.

The Forrestania vegetation system lies within the Roe Botanical District, which consists of mallee vegetation with some eucalypt woodland in lower valleys, and scrub heath and Allocasuarina thicket on residual plateau soils. In the summer of 1993, a large wildfire swept through the northern Forrestania belt and consumed almost all vegetation from Mt Holland to Middle Ironcap. The survey by Gibson and Lyons focused on the unburnt southern portion between Middle Ironcap and Hatter Hill.
Appendix 3 lists the 232 native taxa identified in the survey. The flora and vegetation of the three Ironcaps (North, Middle and South) varies significantly. Two species of Declared Rare Flora, 16 priority listed species and a new species of *Stenanthemum* were found.

Six vegetation communities were identified by Gibson and Lyons (1997):

1. Shrublands and thickets with scattered emergent eucalypts most common on South Ironcap. This species-rich community is found on yellow sandy loam on ridge tops and slopes.
2. Thickets with scattered emergent eucalypts restricted to Hatter Hill and Middle Ironcap. This species-poor community occurs on sandy loams high in the landscape.
3. Dense *Allocasuarina-Melaleuca* thickets on ridges and side slopes in the Hatter Hill area. This extremely species-poor community occurs on very shallow red clay loams over massive bedrock and may represent a seral stage following fire.
4. Eucalypt woodland dominated by merrit. This community occurs on more fertile shallow orange-brown sandy loams on slopes and ridges with very low litter cover.
5. Mallee dominated by square-fruiting mallee from Middle and South Ironcaps. This community occurs on fertile orange-brown sandy loams and is restricted to colluvial flats in small valleys.
6. Eucalypt woodland dominated or co-dominated by merrit, gimlet and open-fruiting mallee. The understorey of this community is generally dominated by *Melaleuca* species and occurs on deeper clay soils with high litter cover.

The southern Forrestania is significantly richer in priority taxa than other goldfields ranges, that may be due to the unusual combination of geology and climate. Eight of the priority taxa found are endemic to the laterites of southern Forrestania.

The Biological Survey Group of CALM’s Science Division is conducting further survey work throughout the wheatbelt, under the Western Australia Salinity Action Plan. This study aims to investigate over 1,000 sites over the following years to produce a floristic and wetland survey at a regional scale.
2.7 Nature Reserves

There are 36 nature reserves in the Shire of Lake Grace that are vested in the National Parks and Nature Conservation Authority (NPNCA) for the conservation of flora and fauna, and are managed by the Department of Conservation and Land Management (CALM). In addition, there are a number of vested reserves under the control of the Shire and other authorities whose purpose may include conservation.

There are presently no management plans for any of the reserves in the Shire of Lake Grace.

Notes from surveys of some of the nature reserves in the shire are provided below, taken from CALM Katanning. Plant species found on each of the nature reserves are listed in Appendices 5 and 6. In addition, a brief description of the vegetation types within each area of the CALM-managed conservation estate in the Shire of Lake Grace can be found in Appendix 4.

**Breakaway Ridge Nature Reserve**

Breakaway Ridge Nature Reserve (29019) is a large C class reserve. Covering 3,323 hectares the reserve is the seventh largest nature reserve that falls within the shire. It contains a mixed vegetation including several eucalypts, *Hakeas* and *Grevilleas*. A list of some species that have been observed at the reserve by CALM officers can be found in Appendix 5.

**Crooks Nature Reserve**

Crooks Nature Reserve (32046) is an A class reserve of 585 hectares. This reserve includes small areas of flat granite exposures that serve as the only water catchment areas for the surrounding wildlife and shelter many reptile species. There are seven vegetation associations identified by Lambert (1977):

1. Tall mallee (5 m) of various eucalypts on undulating light sandy clay that covers 80% of the reserve. The understorey is up to 2m high and is dense in areas.
2. Open heath of *Allocasuarinas*.
3. Flat granite exposures sparsely vegetated with *Hakeas* and *Melaleucas*, and fringed by grasses, *Allocasuarinas* and *Acacias*.
4. Thickets of 3 m tall *Melaleucas*, usually associated with salmon gum and coarse-leafed mallee.
5. Small isolated areas of salmon gum dominating over jam and quandong.
6. Belt of 8 m tall merrit with gimlet and *Melaleucas*.
7. Compact and erect stands of gimlet associated with *Melaleucas*.

The plant list given in Appendix 5 is a compilation of species lists recorded at CALM’s Katanning District Office.

**Dragon Rocks Nature Reserve**

Dragon Rocks Nature Reserve is an A class reserve covering 32,219 hectares that is mostly within the Shire of Kulin, with about 14,000 hectares in the Shire of Lake
Grace. It was gazetted in 1979 after investigation initiated by a suggestion from Mr Richard J. Lane, then Secretary of Lake Grace Farmers Union. It is listed on the Register of the National Estate. The landscape consists of high-level, undulating, scrub-covered sandplains with laterite breakaways and ridges giving way to long, gradual slopes supporting mallee communities. There are many granite rock exposures that are typically surrounded by tamma scrub, including one named Dragon Rock after the presence of the ornate dragon lizard (*Amphibolurus ornatus*). Shallow drainage lines contain stands of salmon gum.

A biological survey conducted by McKenzie, Burbidge and Marchant in 1973 found 15 native fauna species, 59 birds, 19 reptiles and 4 frogs (Appendix 10). To retain the full diversity of fauna, all vegetation types found within the area needed to be adequately represented. The reserve was generally well vegetated and falls within the Avon and Stirling Botanical Districts. Table 4 shows the seven vegetation formations observed at the reserve, based on life-form and height and the density of foliage of the tallest strata (following Specht, 1970).

Coates (1991) surveyed the reserve and mapped 28 vegetation reserves including woodlands (8), mallee (7), kwongan (11) and lithic complexes such as granite and breakaways. A total of 563 native plant species were identified. Of these, 61 were undescribed, eight were declared rare flora and 13 were priority flora. These species are listed in Appendix 6. Coates suggested that Dragon Rocks Nature Reserve was “outstanding for its size, complexity of vegetation and diversity of flora”.
Table 4: The seven vegetation formations observed at Dragon Rocks (McKenzie et al., 1973).

<table>
<thead>
<tr>
<th>Vegetation Formation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woodland</td>
<td>Salmon gum on narrow belts of alluvial soil along well defined drainage lines running east-west from ridge. Associated shrubs include <em>Acacia merrallii</em>, <em>Boronia capitata</em>, and species of <em>Eremophila</em>, <em>Thryptomene</em> and <em>Santalum</em>. Morrel on more alkaline soils with poorer drainage.</td>
</tr>
<tr>
<td>Low Open Forest</td>
<td>White and blue mallet as small trees or marlocks 10 m, with well developed litter layer and sparse understorey, including <em>Eucalyptus incrassata</em>, <em>Melaleuca pungens</em>, <em>Acacia ericifolia</em>, <em>Hybanthus floribundus</em>, <em>Leptospermum erubescens</em> and <em>Pimelea suaveolens</em>. Occurs on gravelly rises, near breakaways.</td>
</tr>
<tr>
<td>Open Scrub</td>
<td>2-8 m high, medium dense and closely packed, <em>E. eremophila</em> common.</td>
</tr>
<tr>
<td>High Shrubland</td>
<td>Scattered <em>E. eremophila</em>, <em>E. redunca</em> and <em>E. albida</em>. Rich understorey (including Gastrolobium spinosum).</td>
</tr>
<tr>
<td>High Open Shrubland</td>
<td>Very scattered <em>E. eremophila</em>, <em>E. redunca</em> and <em>E. albida</em>, with heath understorey</td>
</tr>
<tr>
<td>Open Heath</td>
<td>Medium dense heath about 2 m tall, on gravel or sandy gravel, with tamarro common. This formation was richest in the number of species.</td>
</tr>
</tbody>
</table>
| Lithic Complexes     | Granitic outcrops form most of ridge.  
  - outcrop subsurface: dense cover of *Boyra sphaerocephala*, *Verticordia preissii*, and ephemeral and sedge species.  
  - soil thick: *Allocasuarina huegeliana*, *A. lasiocalyx*, *Melaleuca elliptica*, *M. radula*, *Calothamnus quadrifidus*, *Phyllanthus calycinus*.  
  - breakaways: brown mallet and the most northerly record of the south coast *Acrotiche ramiflora*. |

**Dunn Rock Nature Reserve**  
Dunn Rock Nature Reserve (36445) is a C class reserve that covers 27,349 hectares. There is a series of wetlands within the reserve, including Bennett's Lake which had a salinity level of approximately 33,000 ppm or 11 g/L (September 1984).

**Harris Nature Reserve**  
Harris Nature Reserve (32549) is an A class reserve that covers 3,605 hectares. The reserve contains a diverse flora; over 130 species have been observed. A list of some species that have been observed at the reserve by CALM officers can be found in Appendix 5.

**Heathland Nature Reserve**  
Heathland Nature Reserve (26762) is an A class reserve that covers 669 hectares.
Surface soils include white sands, loamy sands, and loams or sandy loams often with laterite. The predominant formations occurring on the reserve are heathlands and shrublands, with mallee formations occurring in belts and patches throughout the area. The heathlands and shrublands on the reserve are quite diverse in both structure and floristics. There are no nest hollows or weeds.

Burbidge (1981) identified nine vegetation associations on the reserve that can be summarised into the following groups:

1. Open shrub mallee of narrow-leaved red mallee over heath, dwarf scrub and sedges.
2. Shrub mallee of eucalypts over Melaleuca heath.
3. Scrub or heath of Acacia, Allocasuarina or Hakea over herbs or sedges.
4. Low woodland of merritt (Eucalyptus flocktoniae) and gimlet over Melaleuca scrub.

Adjoining the Heathland Nature Reserve is Reserve 17648, a water reserve that links Heathland to South Bunche Nature Reserve. Reserve 17648 provides a corridor between the two reserves for the movement of lizards and small animals. The vegetation is generally similar to that found in Heathlands, except for two additional vegetation associations: granite complex and salmon gum woodland.

Kathleen Nature Reserve
Kathleen Nature Reserve (20218) covers an area of 1,190 hectares. It is a C class reserve for the conservation of flora and fauna. A list of some species that have been recorded at the reserve by M. Graham from 1986 to 1988 can be found in Appendix 5.

Kuender Nature Reserve
Kuender Nature Reserve (29287) covers 383 hectares. The flat upland areas have grey-brown sandy loams, and lowland areas have off-white sandy soils. This well fenced reserve is generally undisturbed, although there is some weed invasion and evidence of past rubbish dumping. Nest hollows are poorly represented throughout this mallee dominated reserve. Despite this, there is a profusion of birds.

Atkins (1984) identified eight vegetation associations on the Kuender Nature Reserve:

1. York gum woodland over Melaleuca thicket and low scrub.
2. Open tree mallee of swamp mallet over Melaleuca thicket.
3. Open shrub mallee of swamp mallet, narrow-leaved red mallee and Eucalyptus conglobata with quandong over Melaleuca understorey.
4. Tall Melaleuca thicket over open low scrub, with emergent eucalyptus.
5. Melaleuca dense heath with an understorey of halophytes.
6. Melaleuca heath with Acacia isophylla.
7. Melaleuca scrub with emergent open tree mallee of eucalypts where the landform is high enough to avoid salt inundation.
8. Low heath of halophytes fringing the barren salt pans, and extending over low salty areas not subject to excessive inundation.
Lake Ace Nature Reserve
Lake Ace Nature Reserve (34522) is an A class reserve vested in the NPNCA for the conservation of flora and fauna. The 150.3 hectare reserve contains the large, open Lake Ace. This seasonal hypersaline lake covers 91.3 hectares and is surrounded by a low open shrubland of samphire (Halse et al., 1993). On the remaining vegetated area around the lake where the ground rises there are larger Melaleuca shrubs and in some areas a few Eucalyptus species. Beyond this there is an open eucalypt woodland.

Lake Biddy Nature Reserve
Lake Biddy Nature Reserve (17617) is a C class reserve vested in the NPNCA for the conservation of fauna. The reserve covers an area of 13.4 hectares, over 50% of which is the small Lake Biddy. The salinity level of this seasonal saline lake has been measured at 238 mS/m. The lake is surrounded by samphire marsh (Halse et al., 1993). Above the high water mark are a small number of other species. Isolated dead trees occur around the margin of the lake and in the water and there are two areas of dense dead saplings. On higher ground there is a belt of Melaleuca lanceolata. A list of species recorded at the reserve by K. Atkins, K. Wallace and M. Graham from 1980 to 1985 can be found in Appendix 5.

Lake Cronin Nature Reserve
Lake Cronin Nature Reserve (36526) is an A class reserve vested in the NPNCA for the conservation of flora and fauna. The reserve covers 13.1 hectares, 4 hectares of which is the small, ephemeral, fresh Lake Cronin. Lake Cronin is fringed with an extensive dense thicket of Melaleuca interspersed with occasional trees of the same species (Halse et al., 1993). In January 1988 the centre of the lake was dry and covered with a dense herbland. In October 1986 when the lake contained only 20 cm of water the grasses and sedges were also present.

Lake King Nature Reserve
The Lake King Nature Reserve combines two reserves. Reserve 24435 covers 47.3 hectares and Reserve 39422 covers 40,096 hectares. Both are A class reserves set aside for the conservation of flora and fauna.

Lakeland Nature Reserve
Lakeland Nature Reserve consists of reserves 29024 and 29025 and in total covers 1,785 hectares. It is reserved for the conservation of flora and fauna. The eastern half of the reserve contains a small wetland chain, north of Lake Bryde. Lakeland Nature Reserve is directly north of Reserve 29023 in the Shire of Kent. A list of species recorded at the reserve by K. Wallace (1982) and M. Graham (1987 to 1993) can be found in Appendix 5.

Lake Magenta Nature Reserve
Lake Magenta Nature Reserve (25113) is an A class reserve for the conservation of flora and fauna. It covers 107,812 hectares in total, but less than 20% of the reserve lies within the boundaries of the Shire of Lake Grace. The majority of the reserve is in the Shire of Kent.

Lockhart Nature Reserve
Lockhart Nature Reserve (28759) covers an area of 397 hectares. It contains a swampy lake situated in a low area of undulating sandy hills. There are scattered salmon gum mainly on the declining sandy slopes near the lake. Mallee dominates, except near the lake’s edge where Melaleuca is dominant. The understorey includes Hakea, Verticordia and Gastrolobium species.

McGlin Nature Reserve
McGlin Nature Reserve (18730) is set aside for the conservation of flora and fauna and covers 292 hectares. While there is no detailed survey of vegetation or flora, several species have been observed at the reserve (from CALM records from 1987 to 1998).

Mordette Nature Reserve
Mordette Nature Reserve (27887) is a C class reserve set aside for the conservation of flora and fauna, covering 374 hectares. A small area was cleared prior to 1988 but has since regenerated.

Coates (1988) observed four vegetation associations of the reserve:

1. Open tree mallee and low woodland over a scrub thicket of Melaleuca species. This variable association changes in density of both stratum.
2. A mosaic of vegetation surrounding the salt lakes, including a low heath on the lake edge, a low salt river gum forest, a Melaleuca heath and a low woodland over Melaleuca heath.
3. Granite outcrop, with low heath or tall grass in shallow soil pockets, and thickets of Allocasuarina or Melaleuca species on the borders of outcrops.
4. Shrub mallee over Melaleuca heath.

One Mile Rock Nature Reserve
One Mile Rock Nature Reserve (29864) covers an area of 865 hectares. The reserve contains a large number of plant species, including ten Hakeas, six Allocasuarinas, 11 Melaleucas and 11 eucalypts. While there has been no vegetation survey, a large number of plant species have been observed at the reserve, and are listed in Appendix 5 (from CALM Katanning records).

Pallarup Nature Reserve
Pallarup Nature Reserve (29860) is a 1,125 hectare, A class reserve vested in the NPNCA for the conservation of flora and fauna. Most of the reserve is covered by the 900 hectare Pallarup Lake, an open, ephemeral, hypersaline lake. Above the water mark of the lake is a low samphire marsh (Halse et al., 1993). This samphire marsh is replaced on higher ground by an open shrubland of Melaleucas, with an understorey of halophytes. Salmon gum woodland replaces the shrubland further away from the lake.

Rock View Nature Reserve
Rock View Nature Reserve (29617) is a reserve of 1,660 hectares located 10 km north-east of Lake Biddy and 6 km south of Dragon Rocks Nature Reserve. Rock View forms a chain of protected habitats for mobile species. The soil types in the
reserve include brown sands and yellow sands with some loam and sandy loam. Several outcrops of granite occur on the reserve and there is extensive shallow gravel.

Rock View Nature Reserve carries a diversity of shrub and mallee species, and representatives of typical wheatbelt flora found on granite rocks. Apart from some scattered white mallet, no tree forms occur (Wallace, 1979).

Four major vegetation types were observed on the Rock View Nature Reserve:

1. Mallee: Ten species of mallee were observed, usually in association with low shrubland or open heath.
2. Scrub: Allocasuarina dominated scrub associations.
3. Heaths: Most extensive formations, most consisted of a complex of species.
4. Lithic Complex: Granite lithic complexes with a variety of typical species.

South Buniche Nature Reserve
South Buniche Nature Reserve (26763) is an A class reserve set aside for the conservation of flora and fauna. The reserve covers 1,298 hectares. A list of species recorded at the reserve by M. Graham and Toole from 1985 to 1992 can be found in Appendix 5.

South Kuender Nature Reserve
South Kuender Nature Reserve (27902) covers 356 hectares and is vested in the NPNCA. A survey by Coates (1988) identified two major vegetation associations:

1. Open tree mallee and low woodland over scrub thicket of Melaleuca species. This association is very variable with changes in density of both stratum occurring over short distances. Trees and mallee form an upper stratum in most areas with a canopy ranging from 2 to 70%.
2. Surrounding the salt lakes is a mosaic of vegetation formations including low heath of Halosarcia lylei and H. halocnemoides; thicket of Melaleuca species; and low woodland of salt river gum (Eucalyptus sargenti), sometimes over low scrub or dwarf scrub.

Over 90 native plant species were recorded by Coates (1988). It was found to be relatively undisturbed with some weed invasion in areas adjacent to farmland. The vegetation associations of South Kuender Nature Reserve provide habitats for waterbirds and other fauna.
2.8 Roadsides

Roadsides can provide corridors between areas of remnant vegetation for the movement of wildlife. They are often the only remaining areas of some vegetation types, and occasionally contain threatened species.

Well vegetated roadsides are also beneficial to agriculture. They provide windbreaks to adjacent farmland and shelter for stock.

The Roadside Conservation Committee (RCC) was formed in 1985, having evolved from the Road Verge Conservation Committee that originated in 1969. The RCC conducts surveys and inventories of the flora conservation value of roadside conservation. The RCC relies on the involvement of local communities and uses a qualitative approach to determine vegetation structure.

There are 2,057 km of road throughout the Shire of Lake Grace (Figure 2). The RCC surveyed 246 km of roadside vegetation between 1987 and 1989, around 12% of the roads in the shire. Roads surveyed include:

- Biddy - Camm Road
- Geliard Road
- Gorge Rock - Lake Grace Road
- Lake Grace - Newdegate Road
- Lake Grace - Pingrup Road
- Macnamara Road
- Magenta Road
- West Kuender Road.
2.9 Flora

The international fame of the flora of Western Australia derives from its rich and colourful array of species and also from its uniqueness. The majority of species are found nowhere else in the world. In the south-west around 75% of the 6,000 species are confined to the region, giving it one of the highest levels of endemism in the world (Hopper et al., 1990). Investigations into the geographical distribution of Western Australia’s rare and threatened species have shown that they are concentrated in the wheatbelt and adjoining areas where there has been extensive clearing or modification of native vegetation.

The Shire of Lake Grace contains many unique plant species. Within the shire, several Declared Rare Flora and many Priority Flora species have been found. In addition, there is a rare localised population of flooded gum (*Eucalyptus rudis*) that occurs north of Lake Grace.

**Declared Rare Flora**

Most of Western Australia’s rare and threatened species have sporadic localised populations in the wild and are therefore vulnerable to accidental destruction. However, their protection poses little direct financial burden on the informed and interested land owner.

Declared Rare Flora are any protected flora that the Minister for Conservation and Land Management considers on botanical advice to be rare, in danger of extinction or otherwise in need of special protection. They are declared to ensure their continued survival in the wild. Once a taxon (species, subspecies or variety) has been gazetted as Declared Rare Flora no-one is permitted to take (gather, pluck, cut, pull up, destroy, dig up, remove or injure) it from wild populations anywhere in Western Australia without the special written consent of the Minister.

The following Declared Rare Flora have been reported within the Shire of Lake Grace (list supplied by the Department of Conservation and Land Management).

**Acacia auratiflora ms**
Found on verges vested in the shire, Railway Reserves vested in Westrail and unvested “stopping places”.

**Acacia lanuginophylla**
Found on land vested in the NPNCA for the conservation of flora and fauna and in the Minister for Water Resources for water, on Railway Reserve vested in Westrail and private land.

**Allocasuarina tortiramula (Twisted Sheoak)**
A dense canopied shrub to 2 m high with spreading twisted 7-toothed branchlets. Flowers in July to September. Grows on dense high heath on loam over granite. Found in Nature Reserves vested in the NPNCA.
**Bentleya spinescens**
Found on verges vested in the Main Roads Department, on recreational land vested in the shire and in the Minister for Water Resources for water and unvested vacant crown land.

**Caladenia hoffmanii** (Hoffman’s Spider Orchid)
An orchid up to 30 cm high with a solitary leaf that rises from the base of the hairy stem and a tapering labellum that is curled only at the tip. Orchids are characterised by their stamens and style combined into a column. Occurs under tall shrubs and sheoaks on and around large granite outcrops. Found on land vested in the NPNCA for the conservation of flora and fauna.

**Calectasia arnoldii ms**
Found on verges vested in the shire and on land vested in the NPNCA for conservation of flora and fauna.

**Eremophila subteretifolia ms**
Found on land vested in the NPNCA for conservation of flora and fauna.

**Eremophila veneta ms**
Found on Railway Reserves vested in Westrail.

**Eremophila verticillata** (Whorled Eremophila)
A low spreading shrub up to 80 cm high with erect branches and narrow appressed leaves. Plants are distinguished by a strong slightly offensive odour. Grows on brown powdery loam under open low eucalypt woodland. Found on verges vested in the Main Roads Department and on unvested vacant Crown land.

**Eucalyptus olivacea ms**
Found on private land and on land vested in the NPNCA for the conservation of flora and fauna.

**Grevillea involucrata** (Lake Varley Grevillea)
A spreading shrub up to 0.5 m tall with deeply divided leaves. Plants have a whorl of deep pink persistent bracts surrounding flowers that bloom from June to July. Grows on shallow sand over laterite in open heath. Found on private land, verges vested in the shire and on land vested in the NPNCA for the conservation of flora and fauna.

**Myriophyllum petraeum** (Granite Myriophyllum)
An unusual aquatic annual herb to 30 cm high with its emergent leaves longer than submerged ones. Flowering occurs from August to September. Plants are confined to ephemeral rock pools on granite outcrops. Found on land set aside for water vested in the Water Corporation.

**Thelymitra psammophila** (Sandplain Sun Orchid)
A small perennial herb to 20 cm tall with a single narrow leaf. Plants have one to three yellow flowers distinguished by their lack of red colouration, and blossom in September to October. Occurs in areas of low heath between the Stirling Range and
Ravensthorpe. Found on land vested in the NPNCA for the conservation of flora and fauna.

**Tribonanthes pururea** (Granite Pink)
A dwarf perennial herb to 4 cm high. It has solitary hairless tubular pinkish flowers that appear in August. Known only from seasonally saturated soil pockets on a few granite outcrops near Pingaring. Found on land vested in the NPNCA for the conservation of flora and fauna and on unvested vacant Crown land.

**Verticordia staminosa var. cylindracea**
Found on private land and on land set aside for water vested in the Water Corporation.

**Verticordia staminosa var. erecta**
Found on private land.

**Priority Flora**
Many Western Australian plants listed as rare, endangered or threatened by various authors are not gazetted asDeclared Rare Flora because of CALM’s stringent requirements for adequate field surveys to reliably assess conservation status (Hopper *et al.*, 1990). To provide some priorities for survey of these plants, CALM maintains a Reserve Flora List for species that have an uncertain conservation status and need more research, or have been surveyed but need to be monitored. This list ranks flora into 4 priority groups:

**Priority One** - Taxa that are known from one or a few populations (generally less than five) of this species, living on land under threat. These species are under consideration for declaration as Declared Rare Flora but are in need of urgent further survey.

**Priority Two** - Taxa that are known from one or a few (generally less than five) populations, at least some of which are not believed to be under immediate threat.

**Priority Three** - Taxa that are known from several populations, and are not believed to be under immediate threat.

**Priority Four** - Taxa that are considered to have been adequately surveyed and that, while being rare in Australia, are not currently threatened.

Once surveys have established the conservation status of Reserve List species, a number of them have either been gazetted as Declared Rare Flora, or have been found to be abundant and under no present threat.

The Shire of Lake Grace contains over 150 priority species on the Reserve List. Priority flora within and directly adjacent to the Shire are listed in Appendix 7.
Weeds
Weeds are any plants growing where they are not wanted. Introduced ("exotic") plants that replace the original native vegetation are environmental weeds and are undesirable from an ecological perspective but not necessarily from an economic one. Areas that have been long settled show the greatest number of weed species, especially if the site has been disturbed by grazing, logging, rubbish dumping, stock and vehicle movements.

Hussey and Wallace (1993) discuss how weeds can have a major effect on native vegetation:

- Competing directly with established native vegetation.
- Replacing diverse native vegetation communities with more uniform weed communities and thus decreasing species composition.
- Inhibiting the regeneration of native plants through competition.
- Altering the nutrient cycling of natural communities.
- Altering the soil acidity.
- Altering the fire hazard.
- Changing the resources available for fauna by changing habitats or food availability.

For more details on weed species and their methods of control, please refer to the articles listed in the Further Reading.
2.10 Fauna

Local extinctions have been caused by numerous human disturbances of the natural environment, including the broadscale clearing of natural bushland for agricultural production, the introduction of stock and feral animals (including both grazing and predatory species) and alterations to fire regimes. Such disturbances have caused the local extinction of nearly 40% of the 42 species of mammals recorded in the wheatbelt since European settlement. Mammals in the wheatbelt region thought to be at high risk of extinction include the numbat, the western mouse and the red-tailed phascogale. The following descriptions are taken from R. Strahan (1988) The Mammals of Australia.

The Numbat is strongly dependent on termites for food, and this restricts its habitat to areas where these insects are reasonably abundant. Its present habitat is eucalypt forest, particularly areas dominated by wandoo or jarrah, but it was earlier found in mulga woodland. These vegetation types provide the numbat with hollow logs and branches for its shelter. They also provide food and support for termites. The numbat sleeps at night and feeds by day, an unusual feature among marsupials and possibly a response to the activities of its prey. It is the only member of family Myrmecobiidae and the only marsupial adapted to feeding exclusively on colonial insects. Numbats are threatened by drought, predation by foxes and by too frequent burning of the habitat.

The Western Mouse is a nocturnal herbivore, with a diet of fibrous plant material. It has a mixture of dark grey and yellowish-buff fur with greyish-white below and white paws, measuring 90-110 mm long and weighing up to 50 g. The western mouse has been collected from habitats greater than 200 hectares with extremely variable vegetation, including sparse low shrubland, tall dense shrubland, sparse to dense scrub mallee and mid dense woodlands, but these sites are consistently on sandy clay loam or sandy loam, frequently with a mixture of gravel. Dominant upper vegetation includes species of Isopogon, Acacia, Casuarina, Melaleuca and Eucalyptus.

For a complete list of all mammals in the Katanning CALM region (within which the Shire of Lake Grace falls), see Appendix 8. Appendices 9 and 10 also list fauna and Appendix 11 lists bird species that have been observed in the shire.
Threatened Fauna

Threatened and Priority Fauna are afforded special protection under the Wildlife Conservation Act 1950 that is administered by CALM. There are two major categories of specially protected fauna: Threatened and Priority. Threatened Fauna are rare or likely to become extinct and are declared under Schedules 1 to 4 of the Act. In the Shire of Kulin, the following Threatened Fauna have been found:

**Schedule 1 - Fauna that are rare or likely to become extinct.**

- **Red-tailed Phascogale (Phascogale calura)**
  The red-tailed phascogale is largely aboreal, but appears to feed extensively on the ground, taking a wide range of insects, small birds and small mammals. It does not need to drink even during long periods of drought. It inhabits dense vegetation and has a preference for mature wandoo and rock sheoak communities, particularly when they are adjacent. Wandoo has an abundance of hollow logs and limbs that provide numerous nest sites, while the rock sheoak has an almost continuous canopy of the latter that provides easy passage through the foliage. Red-tailed phascogales are threatened by fire that destroys the mature vegetation alliances of wandoo-rock sheoak; and by predation by foxes and cats.

- **Chuditch (Dasyurus geoffroii)**
  The chuditch is a medium-sized predator and feeds on a wide variety of small mammals, birds, insects and carrion. It moves swiftly on the ground, climbs efficiently and digs or occupies existing holes in the ground. Activity is greatest around dawn and dusk. This Aboriginal name echoes the explosive call the chuditch makes when it is in an aggressive mood or is threatened. It is also known as the western quoll (Strahan, 1988).

- **Shortridge’s Mouse (Pseudomys shortridgei)**
  Shortridge’s mouse, also known as the heath rat, occurs almost exclusively in recently burnt, species-rich, dry heathlands. It is found in southwestern Victoria and has virtually disappeared from WA where it was originally discovered (Strahan, 1988). Shortridge’s mouse colonises patches of suitable heathland when the initial flush of growth after fire provides adequate cover and then disappears when important food species decline. The survival of the species requires a mosaic of areas of differing maturity. However, negative human impacts, such as reducing the size of bush remnants and imposing fire controls, have caused the disappearance of Shortridge’s mouse from much of its former range.

- **Malleeowil (Leipoa ocellata)**
  The big-footed malleeowil scratches soil and vegetation into a large mound to incubate their eggs. Males usually manage the mounds and control the incubating temperature by adding or removing material to the mound. A pair mates for life and inhabits a large territory. When pressed, malleeowils fly well but heavily. Malleeowils are camouflaged in open scrubby country by the black chest line that breaks up the bird’s pattern as it stands quietly among small mallee
eucalypt boughs.

- **Western Whipbird** (*Psophodes nigrogularis oberon*)
  The western whipbird is an elusive, olive-green bird with long, broad tail. It inhabits dense thickets of mallee scrub, spending most of its time on the ground or in low undergrowth where it feeds on insects. Nests are a well built cup of twigs, bark and grass and are usually well hidden among grasses. Eggs are blue with sparse spotting and are laid in pairs.

**Schedule 4 - Other specially protected fauna.**

- **Peregrine Falcon** (*Falco peregrinus*)
  Peregrine falcons prey on ground-dwelling small vertebrates and insects. They have powerful bills and kill their prey by severing the neck vertebrae with a bite. Peregrine falcons breed on rock ledges on cliffs or exposed rock ledges, tree hollows or in disused stick nests of other species. Falcons are among birds most severely affected by pesticides. DDT affects the shell gland, causing egg-shell thinning and reducing reproductive success.

**Priority Fauna**

Priority fauna are protected under the *Wildlife Conservation Act 1950*. Priority Fauna are under consideration for declaration as Threatened Fauna but need urgent survey and evaluation of conservation status. Priority Fauna are in need of special protection and are ranked into Priorities 1 to 4:

**Priority 1**  Taxa with few, poorly known populations on threatened lands, such as agricultural or pastoral lands, urban areas and active mineral leases.

**Priority 2**  Taxa with few, poorly known populations on lands that are not under immediate threat of habitat destruction or degradation, such as national parks, nature reserves, vacant Crown land and water reserves.

**Priority 3**  Taxa with several, poorly known populations, some on conservation lands and not believed to be under immediate threat.

**Priority 4**  Taxa that are in need of monitoring. These are considered to have been adequately surveyed and are not considered currently threatened, but could be if present circumstances change.

In the Shire of Lake Grace, five Priority Fauna have been found:

**Priority 3**  The native bee (*Hyaleus globuliferus*)
**Priority 4**  Western mouse (*Pseudomys occidentalis*)
**Priority 4**  Quenda (*Isoodon obscurus fusciventer*)
**Priority 4**  Hooded plover (*Thinornis rubricollis*)
**Priority 4**  Woylie or bush-tailed bettong (*Bettongia penicillata ogilbyi*)

38
Western Shield

Foxes and feral cats have contributed to the extinction of ten native mammals in Western Australia. Birds appear to have fared better, except for ground-dwelling or nesting species such as the ground parrot, bristle birds and the malleefowl. Native animals known to be preyed on by foxes and cats include the numbat, malleefowl, Gilberts potoroo, dibbler, western ground parrot, western swamp tortoise, python, chuditch, brush-tailed phascogale, bilby, mardo, quenda, western pygmy possum, brushtail possum, ringtail possum, woylie, western brush wallaby, quokka, water rat and southern bush rat.

Western Shield is a program designed to bring Western Australia’s wildlife back from extinction by targeting foxes and feral cats. There are three major elements of the program: increasing fox baiting; increasing research and operations for feral cat control; and returning native animals to former habitats. Dried meat baits are injected with 1080 poison (pronounced ten-e eighty), the manufactured version of the chemical compound sodium monofluoroacetate that occurs naturally in Western Australia in poison peas or Gastrolobium. Native animals have evolved with these poisonous peas and have developed high levels of tolerance to the poison, and are not harmed by the baits containing 1080 poison.

Baiting foxes, captive breeding and reintroduction programs have resulted in increases in populations and security of small mammals, including the numbat, chuditch and red-tailed phascogale.

Under the Western Shield program, fox baiting is conducted over nearly 200,000 hectares in the Shire of Lake Grace (Mal Graham, personal communication). At Dragon Rocks baiting is conducted every six weeks, while at Lake Magenta baits are distributed six times a year. Additional reserves may be included in the fox-baiting program in the near future, including Dunn Rock and Rock View. At the present, there is no baiting for feral cats, but investigation into the extent of feral cats is continuing.
Rabbit management

Wild rabbits (Oryctolagus cuniculus) are a serious pest within Australia. They are responsible for an estimated $600 million of economic damage per year, including production losses, extensive environmental damage and the cost of control (Coman, 1997). Rabbits grazing on tree seedlings and shrubs has caused a loss of vegetation resulting in the failure of natural regeneration and a gradual loss of mature trees. Rabbits encourage soil erosion by burrowing, removing vegetation and disturbing soil. They also compete with livestock for pasture. In addition, rabbits have contributed to the extinction of many native plant and animal species, and continue to threaten native birds, mammals and insects that rely on plants for food and shelter.

The Rabbit Calicivirus Disease (RCD) aims to control wild rabbit populations by reducing numbers to a level where long-term controls (such as myxomatosis) are more effective and cheaper. Other control measures that should be used in conjunction with RCD include warren destruction by ripping, removal of pest plants that provide shelter (such as gorse, blackberry and boxthorn), and fumigation of warrens so they will eventually collapse from lack of use. RCD was officially released in 24 shires of Western Australia in October 1996. It was not officially released in the Lake Grace Shire, but was confirmed to have spread naturally through the Shire by the spring of 1996.
3 Land Management and Degradation Issues

3.1 History

The wheatbelt of Western Australia has undergone extensive changes since the early 1900s when Europeans first settled the south-west of Australia. The most obvious change has been the removal of native vegetation for agricultural development, predominantly cereal cropping and growing of pasture grasses for stock (mainly sheep). The wheatbelt occupies about 14 million hectares of the south-west of Western Australia. Within this region, 13 million hectares of native vegetation has been removed, over half of this after 1945. The remaining native vegetation is now restricted to remnants of varying sizes, shapes, vegetation associations, isolation, ownership and history of land use (Saunders et al., 1987).

The extensive removal of native vegetation, its replacement by exotic species, and the fragmentation and isolation of the remaining vegetation has resulted in the widespread loss of indigenous species from the wheatbelt. Conservation of much of the original wheatbelt biota, particularly those that depend on native vegetation for all or part of their resources, now relies on maintaining remnant native vegetation.

3.2 Current Land Use

The dominant land use in the shire is agricultural production. The type of production practices depends mainly on rainfall, and mostly consist of farming properties with varying proportions of sheep grazing and cropping. A summary of agricultural production, revegetation activities, mining and other industries can be found on page 3.

3.3 Land Degradation

European settlement in the south-west of Western Australia and the subsequent clearing of native vegetation and its replacement with crops and pastures have given rise to various problems. These problems include land degradation, the loss of agricultural production and the loss of conservation values. The most obvious problems are associated with changes in hydrology, such as rising water tables that cause secondary salinity and waterlogging.

Rising water tables and salinity

Rising water tables are usually considered to be caused by increased recharge of groundwater. There is abundant evidence that clearing of deep-rooted perennial vegetation, and the introduction of shallow-rooted crops and pastures, has resulted in small increases in the rate of direct recharge from rainfall, and consequently the development of secondary salinity. A synthesis of WA salinity data found that 10% of the central and eastern wheatbelt was affected by salinity by 1994 (Ferdowsian et al., 1996). The extent of salinity is predicted to double in the next 15 to 25 years.
The development of secondary salinity requires both a source of salt and a transport process to move salt into the root zone of plants or to the soil surface. The major source of salt in the wheatbelt comes from the accumulation of salts from rainfall that originated off the coast of Western Australia. The salinity of rain is close to 10 mg/L on the west coast of WA, and over millions of years these salts have accumulated deep in the soil. When water tables rise, they redistribute the salts stored deep in the soil profile upwards. The evaporation and transpiration of such saline soil water in shallow water tables can further concentrate salts.

A soil is said to be saline when it contains a quantity of soluble salts that significantly reduces plant growth. Plants may experience water stress because the presence of salts in soil water lowers the partial free energy of water below that of salt-free water. This effect, known as osmosis, causes water to move out of the cell walls of plant roots into the more saline soil water. Hence water vacates the plant roots, causing water stress that can inhibit growth, cause wilting and eventually death of plants.

The number of hectares affected by salinity in the Shire of Lake Grace increased from 11,686 hectares in 1979 to 21,375 hectares in 1989, nearly a doubling of the land affected by salinity over ten years (George, 1990).

Biological methods used to decrease recharge and inhibit the increase in salinity include planting deep-rooted perennial vegetation, and adopting farming practices that utilise more water. While drainage and pumping methods can be used to drain limited areas of land, drainage water may be detrimental further down the catchment.

**Waterlogging**

A soil is waterlogged when it is completely saturated by water. Waterlogging results from poor internal and surface drainage, the inability of the soil to store much water and the low permeability of the subsoil. Waterlogging is exacerbated by the removal of deep-rooted perennial vegetation, rising water tables, cultivation and the compaction of soil by stock trampling and heavy machinery. It reduces plant growth, particularly where soils are affected by salinity.

Waterlogging is most prevalent in areas of above 400 mm annual rainfall. It is particularly common on duplex and clay soils in plains and valley floors with a high risk of inundation.

Waterlogging can be reduced by decreasing the amount of runoff entering the soil, and by improving the internal drainage of soil by surface or underground drainage lines. This can be achieved by increasing the uptake of water by plants and re-establishment of deep-rooted perennial vegetation. Contour banks can be used in some circumstances provided water can be disposed of safely.
Acidity

Soils in the Agricultural Zone of Western Australia are becoming more acidic as a result of farming practices, such as the use of ammonium-based fertilisers and clover pastures (non-legume). Acidification can inhibit the growth of roots of both native and pasture plants (State of the Environment Report, 1992).

Acidic soil can reduce plant cover because it leads to a very high availability of aluminium in soil that reduces or inhibits root growth. Consequently, acid soils are more susceptible to degradation by wind and water erosion and produce more salinity downhill than other soils.

Efforts to ameliorate soil acidity include the rotation of legume-based pastures with non-legume pastures, reduction in the use of chemical fertilisers, and the application of lime. It has also been found that acidification is less under deep-rooted perennial vegetation.

Soil compaction

Soil compaction by stock and heavy farm machinery is a major degradation problem experienced by many wheatbelt shires. Stock and heavy machinery compress the soil and prevent infiltration of both water and air, reducing root development. This results in reduced plant growth and an increase in wind and water erosion. It is possible to rectify this situation by deep ripping, using lighter farm machinery and restricting machinery traffic by applying minimum or zero tillage to establish crops. Fencing remnant vegetation will prevent stock causing soil compaction in the bush.

Wind erosion

The eastern wheatbelt is particularly susceptible to wind and water erosion due to the special hazards of summer and autumn thunderstorms, more frequent cropping and sparser vegetation cover.

Wind erosion is the removal of topsoil by the wind, and deposition downwind. Soil that is removed can be blown over crops; or into streams, rivers and lakes, polluting the waterbodies with sedimentation and nutrients.

Susceptibility to wind erosion is related to the moisture content of soils; wet soils do not blow. Wind erosion occurs on agricultural land in two periods: in late summer due to the grazing of dry pasture, and in early winter due to the cultivation of soil for cropping. Wind erosion results from the exposure of the soil by the destruction of ground cover, leaving the surface soil loose and fine, and strong winds. Plant cover is reduced by grazing, cultivation, burning, trampling, herbicides, drought, acidity and salinity. Soil may be loosened by trampling, weed control, cultivation, harrowing or seeding, and lack of rain after cultivation can leave the soil loose and powdery.
The three major processes of wind erosion are related to the size of the individual soil particles (Hunt and Gilkes, 1992). Surface creep is the rolling or sliding along the soil surface of large particles. Saltation is the bouncing of medium sized soil particles. Suspension is the movement of dust particles parallel to the ground surface and upward, that may be carried hundreds of kilometres.

Wind erosion can be reduced by appropriate grazing management, farming according to soil type, modifying tillage, direct seeding into stubble, and the establishment of windbreaks. Windbreaks present a barrier to wind movement and reduce wind velocity, help bind the soil thus making it less susceptible to wind damage, and trap drifting soil (Figure 14). Windbreaks should be several rows wide at right angles to the prevailing wind, and consist of a mix of both trees and understorey (Oates, 1995). If appropriately designed, windbreaks can also serve as wildlife corridors linking areas of native vegetation.

Figure 14: The effect of a windbreak on wind velocity. Wind is deflected upward by the trees and is slowed down even before reaching them. On the leeward side further reduction occurs, and the effect may be felt as far away as 20 times the height of the trees.

**Water erosion**

Water erosion results from surface runoff that reduces or prevents the infiltration of water into the soil. It results in fertility loss, reduced crop yield and siltation of waterways. There are six major factors that affect water erosion:

1. Rainfall and runoff - the amount of rainfall, its intensity, and the seasonal distribution.
2. Soil erodibility - the inherent erodibility of a soil, affected by its infiltration capacity and structural stability.
3. Length of slope – the greater the extension of the inclined area, the greater the concentration of the flooding water.
4. Slope gradient or steepness – a larger gradient increases the velocity of the water and the amount of water likely to run off.
5. Cover and management – the influence of cropping systems and management variables on soil loss, determined by the crop being grown, crop stage and tillage method.
6. Erosion control practice – reflects the benefits of contouring, strip cropping, alley farming and grassed waterways.
The three main types of water erosion are sheet, rill and gully. Sheet erosion is relatively uniform erosion from every part of the slope. Rill erosion is initiated when the water concentrates in tiny channels (rills) as it runs off the soil. Gully erosion creates deep channels that are formed by undermining and downward cutting and cannot be erased by cultivation. Although gully erosion looks more catastrophic, the less obvious sheet and rill erosion cause a greater total loss of soil.

3.4 Clearing

The Shire of Lake Grace has been greatly cleared. A small area of original native vegetation cover remains on privately owned land. Much of the native vegetation that remains was set aside by the government as Crown reserves, water catchments and sites of gravel extraction. Many of these small patches of native vegetation were designated by the government as conservation reserves in the 1960s and 1970s. However, their conservation value varies; most patches of vegetation that are now conservation reserves are fragmented and represent only a very small percentage of the region’s vegetative cover.

Current clearing guidelines recommend that for an area receiving an annual rainfall of 500 mm or less (such as the Shire of Lake Grace), the minimum proportion of native vegetation considered necessary to uptake sufficient groundwater to ensure water tables remain stable is 20% (Holm, 1994). Currently the shire has 59% remnant native vegetation cover, but only 26% of private land is covered with native vegetation (Beeston et al., 1994).

The State government and local government authorities have undertaken several actions to address the clearing of native vegetation. Clearing of vegetation on private land is currently under the control of the Soil and Land Conservation Act. This Act requires all landholders to give notice of their intent to clear land greater than one hectare to the Commissioner of Soil Conservation, and to advertise in the West Australian newspaper. The guidelines for assessing notices of intent are aimed at preventing further land degradation problems (Select Committee into Land Conservation, 1992). In addition, many local government authorities have implemented planning schemes that give them scope to effectively control the clearing of land.
3.5 Revegetation

Revegetation of trees and shrubs is being undertaken in some areas of the wheatbelt as part of the solution to land degradation and loss of water quality. Revegetation is carried out for a variety of reasons (Lefroy et al., 1991):

- to reclaim already degraded areas
- to prevent further degradation, such as wind and water erosion, salinity and waterlogging
- to beautify the landscape
- to provide habitat for wildlife
- to increase the productivity of farm land by providing windbreaks and shelter belts for plants and animals
- to provide a future renewable source of income, such as firewood, honey and wildflowers.

A barrier to replanting in the past has been a lack of information about revegetation methods and what to plant. Many people are now focusing on local native plants for the following reasons:

- a large choice of species enables matching of plants to sites and revegetation goals
- introduced plants may become weeds
- the natural combination of local plants maintains biodiversity, provides natural habitat values and is probably best for local fauna
- local species provide regional identity
- local species appear to be robust in the long term.

It is hoped that this handbook, with its list of species for different landscape types and references to other sources of information, will encourage the use of local plants throughout the Shire of Lake Grace.

The Revegetation Guide to the Central Wheatbelt by Lefroy, Hobbs and Atkins (1991) attempts to address land degradation problems by providing an understanding of soils and matching plants to soils. This resource book is particularly useful because it provides colour photographs of many of the recommended plants and revegetation hints.
3.6 Managing Existing Vegetation

Protecting existing vegetation is often easier, and is considered to be a greater priority than revegetation. These remnants of natural systems will be the building blocks for future revegetation. The survival of existing bushland, which is often in small fragmented patches, is affected by a number of different factors including:

- grazing by stock in unfenced bush (passive clearing)
- changes in hydrology
- increased exposure to the elements
- increased fertiliser regimes
- herbicides
- pests and weed invasion.

Native plants are often choked or covered by fast growing introduced plants that become weeds when they escape from pastures or gardens. Weeds compete with native vegetation for nutrients and water, increase the risk of fire and often do not provide the food and shelter that native fauna need.

Specific recommendations for managing existing vegetation are provided in *Managing your Bushland: A Guide for Western Australian Landowners* (Hussey and Wallace, 1993).
4 Bringing it all Together

4.1 Landcare Progress

The Lake Grace Land Conservation District Committee (LCDC) has been active for over four years (Ron Lay, personal communication), and was gazetted in 1996. It has been successful in receiving funding grants particularly in recent years, with projects including the Swan-Avon ICM funded tree planting in 1997. There has also been great interest in farm planning in the Lake Grace LCD. There has also been some activity on farms to drill piezometers for groundwater monitoring. Catchment groups include:

- South Lake Grace: major focus of activity for tree planting and fencing in 1998. Received funding from NHT in 1997-98 for “South Lake Grace - a demonstration catchment”, valued at $104,800.
- South Tarin Rock: received funding from the Swan Avon ICM in 1997 for tree planting in “Arty’s Creek Management Project”, valued at $8,350.
- North Lake Grace.

The Lake Bryde LCDC has been active since 1991, when the group was formed by more than 70 farmers. The group was successful in attracting support from the Natural Heritage Trust in 1995-6 for the project “Drainage Feasibility Study for the Lake Bryde Catchment”. This project investigated an engineering option to divert saline water away from the fresh Lake Bryde and alleviate flooding of adjacent farmland. Activities have included developing a monitoring program using piezometers and an investigation of the ground and surface water hydrology. This has included monitoring water quality and quantity draining into the lake and the assessment of hydrological impacts of a drainage diversion on downstream reserves and the water table near the lake. There has also been extensive tree planting, with more than 120,000 trees planted in the past seven years. The Lake Bryde LCDC has applied for funding from the NHT in 1998-9 to support the project “Saving Lake Bryde - the catchment approach”.

The Lakes LCDC formed in 1993 and was gazetted in 1996. It incorporates the eastern side of the Shire of Lake Grace. It has had success in the past in attracting external funding. While there are many individual efforts in the area to revegetate farmland and change cropping practices, group activity has declined over the last few years.

The Newdegate LCDC formed in 1992 and has been successful in attracting support and funding from diverse sources such as:

- Greening WA: grant in 1994 for a saltland vegetation demonstration, valued at $1,950.
- Swan-Avon ICM Community Grants: grant in 1998 for their project “Working with Windbreaks”, valued at $9,300.
In 1994, the Newdegate LCDC received the largest amount of funding for fencing of remnant vegetation through the Remnant Vegetation Protection Scheme (RVPS). The group established a Saltbush Clones project in 1996 as a source of saltbush cuttings to landholders in the area. Seedlings are propagated from cuttings and have been selected for desirable characteristics based on productivity, palatability (or lack of) and tolerance to waterlogging. Since 1996, the Newdegate LCDC has presented an annual “Newdegate Landcare Achiever Award” at the Newdegate Field Day for outstanding landcare activities.

The Pingaring LCDC has been active for over ten years (Ian Wyatt, personal communication). Activities have included a bus tour of Wickepin catchment and Lake Toolibin and tree planting along the railway line. The group has received funding grants in the past for projects including:

- State Landcare Program: grant in 1989 for the installation of 30 piezometers to demonstrate and monitor fluctuations in the local water-table, valued at $2,670.
- National Soil Conservation Program: grant for the purchase of a tree-planting machine for use by members of the group in catchment and individual landcare activities to share with Lake Grace and Kondinin LCDCs, valued at $10,000.
- Swan-Avon ICM: grant in 1997 for the project “Reclaiming Sandplain Seeps”, valued at $12,708.

The Lake Grace, Lake Bryde, Newdegate, Pingaring and the Lakes LCDCs are always interested in hearing from anyone who is interested in forming or joining a local catchment group.

The establishment and support of catchment groups and LCDCs in the shire has been facilitated by a succession of NLP Project Officers and staff of Agriculture WA since 1988. Under the “Catchment Planning Officer - Lake Grace Shire” project funded by the NLP, 16 catchment plans, more than 220 farm plans and various other publications were produced over three years. This activity was continued in the NLP project “Sustainable Farming Systems in the Eastern Wheatbelt - Lockhart Component”, including the establishment of nine new catchment groups and farm planning in ten catchments of the east and west lake chains (Pontin, 1998). Currently, the shire is supported by a Community Landcare Coordinator, based at Agriculture WA in Lake Grace.

The “Lake Grace Landcare Survey 1996” was conducted to measure landcare attitudes and practices of landholders (Curtin et al., 1996). Ninety-eight farmers were randomly selected from the Shires of Kondinin, Kulin, Lake Grace, Kent and eastern Dumbleyung. When asked what were the main factors inhibiting people from carrying out more landcare activities, 61% suggested a lack of money or financial incentive, 11% stated a lack of time, while 8% thought it was not neccessary. Table 5 presents a portion of the main results from the survey.
Table 5: Respondents’ answers to landcare questions from the “Lake Grace Landcare Survey 1996” (summarised from Curtin et al., 1996).

<table>
<thead>
<tr>
<th>Issue</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shire and LCDs</td>
<td>52% did not know what LCDC they were administered by.</td>
</tr>
<tr>
<td>Catchment Groups</td>
<td>58% previously been involved in a catchment group. 49% had a farm plan, and 69% of these had started to implement the farm plan.</td>
</tr>
<tr>
<td>Remnant Vegetation</td>
<td>Each farm had an average of 10% of remnant vegetation 55% of farm remnants were fenced 58% had self-funded fencing of remnants</td>
</tr>
<tr>
<td>Wind/Water Erosion</td>
<td>3% considered water erosion was major problem</td>
</tr>
<tr>
<td></td>
<td>Farm protected with earthwork structures:</td>
</tr>
<tr>
<td></td>
<td>• 22% had more than half of their farm protected</td>
</tr>
<tr>
<td></td>
<td>• 30% had between 10 and 50% protected</td>
</tr>
<tr>
<td></td>
<td>• 32% had no banks</td>
</tr>
<tr>
<td></td>
<td>10% considered wind erosion was major problem, 28% slight problem, 51% not a problem.</td>
</tr>
<tr>
<td></td>
<td>To control wind erosion:</td>
</tr>
<tr>
<td></td>
<td>• 85% used grazing management</td>
</tr>
<tr>
<td></td>
<td>• 72% used stubble retention</td>
</tr>
<tr>
<td></td>
<td>• 48% used wind breaks</td>
</tr>
<tr>
<td></td>
<td>• 27% used no till</td>
</tr>
<tr>
<td></td>
<td>• 20% used fencing off</td>
</tr>
<tr>
<td>Salinity/Groundwater</td>
<td>Average area of salinity was 6% of farm.</td>
</tr>
<tr>
<td></td>
<td>Salinity on farm:</td>
</tr>
<tr>
<td></td>
<td>• 29% had none</td>
</tr>
<tr>
<td></td>
<td>• 10% had more than 30% affected</td>
</tr>
<tr>
<td></td>
<td>• 2% had more than half affected</td>
</tr>
<tr>
<td></td>
<td>54% thought the amount of salinity on their farm would not change in next 10 years.</td>
</tr>
<tr>
<td></td>
<td>To control rising groundwater:</td>
</tr>
<tr>
<td></td>
<td>• 59% used revegetation</td>
</tr>
<tr>
<td></td>
<td>• 43% used contour banks</td>
</tr>
<tr>
<td></td>
<td>• 19% used salt bush/fodder shrubs</td>
</tr>
<tr>
<td></td>
<td>• 12 % used deep drains</td>
</tr>
<tr>
<td></td>
<td>• 11 % used high yielding crops</td>
</tr>
<tr>
<td></td>
<td>• 6% used perennial grasses</td>
</tr>
<tr>
<td></td>
<td>• 5% used lucerne</td>
</tr>
<tr>
<td></td>
<td>31% monitor groundwater levels on farm.</td>
</tr>
<tr>
<td>Tree Planting</td>
<td>Average of 1061 trees planted per farm per year.</td>
</tr>
<tr>
<td></td>
<td>Number of trees planted per year:</td>
</tr>
<tr>
<td></td>
<td>• 3% planted over 5000</td>
</tr>
<tr>
<td></td>
<td>• 20% planted 1000-5000</td>
</tr>
<tr>
<td></td>
<td>• 43% planted 1-1000</td>
</tr>
<tr>
<td></td>
<td>• 34% planted none</td>
</tr>
<tr>
<td></td>
<td>Location of tree planting:</td>
</tr>
<tr>
<td></td>
<td>• 43% along fence lines</td>
</tr>
<tr>
<td></td>
<td>• 35% as windbreaks</td>
</tr>
<tr>
<td></td>
<td>• 32% along creek lines</td>
</tr>
<tr>
<td></td>
<td>• 4% as corridors linking remnants</td>
</tr>
<tr>
<td>Issue</td>
<td>Results</td>
</tr>
<tr>
<td>------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Soil Acidity | 70% test pH on farm.  
               | 71% considered soil acidity as no problem at present.  
               | 28% considered soil acidity as slight to major problem. |
The level of tree planting activity in the Shire of Lake Grace can be gauged from the sale of seedlings from local nurseries. The Newdegate Nusery supplies a wide area from Newdegate to Hyden, and produced an estimated 300,000 tree seedlings in 1998. These seedlings included a mixture of both trees and understorey species, such as *Eucalyptus*, *Allocasuarina*, *Melaleuca*, *Acacia* and *Callistemon* (Table 6). Most of the seedlings sold by the nursery are salt tolerant and are used specifically for land remediation activities. While there has been little demand for oil mallees, the nursery has the capacity to provide such seedlings in the future.

**Table 6**: A breakdown of the number of major species grown in 1998 by the Newdegate Nursery.

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Notes</th>
<th>Number of Seedlings</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Casuarina obesa</em></td>
<td>Swamp sheoak</td>
<td>moisture and salt tolerant</td>
<td>13,440</td>
</tr>
<tr>
<td><em>E. camaldulensis</em></td>
<td>River red gum</td>
<td>drought and frost resistant</td>
<td>11,520</td>
</tr>
<tr>
<td><em>E. eremophila</em></td>
<td>Tall Sand Mallee</td>
<td>drought and frost resistant</td>
<td>13,440</td>
</tr>
<tr>
<td><em>E. kondininensis</em></td>
<td>Kondinin blackbutt</td>
<td>very salt tolerant</td>
<td>13,440</td>
</tr>
<tr>
<td><em>E. lehmani</em></td>
<td>Bushy yate</td>
<td>reasonably fast growing, drought and frost resistant</td>
<td>13,440</td>
</tr>
<tr>
<td><em>E. leucoxylon rosea</em></td>
<td>Pink-flowered yellow gum</td>
<td>very hardy</td>
<td>13,440</td>
</tr>
<tr>
<td><em>E. loxophleba</em></td>
<td>York gum</td>
<td>slightly salt tolerant</td>
<td>11,520</td>
</tr>
<tr>
<td><em>E. occidentalis</em></td>
<td>Flat-topped yate</td>
<td>salt and frost tolerant</td>
<td>33,600</td>
</tr>
<tr>
<td><em>E. platypus platypus</em></td>
<td>Inland Moort</td>
<td></td>
<td>13,440</td>
</tr>
<tr>
<td><em>E. sargentii</em></td>
<td>Salt river gum</td>
<td>salt tolerant, drought and frost resistant</td>
<td>40,320</td>
</tr>
<tr>
<td><em>E. spathulata</em></td>
<td>Swamp mallet</td>
<td>salt tolerant, moderately drought and frost resistant</td>
<td>40,320</td>
</tr>
<tr>
<td><em>E. stricklandii</em></td>
<td>Stricklands gum</td>
<td>salt tolerant, very drought and frost resistant</td>
<td>13,440</td>
</tr>
<tr>
<td><em>M. cuticularis</em></td>
<td>Saltwater paperbark</td>
<td>salt tolerant</td>
<td>11,520</td>
</tr>
<tr>
<td><em>M. hamulosa</em></td>
<td></td>
<td>along watercourses</td>
<td>11,520</td>
</tr>
<tr>
<td><em>M. uncinata</em></td>
<td>Broom honeymyrtle</td>
<td>moisture gaining sites</td>
<td>11,520</td>
</tr>
</tbody>
</table>

4.2 Past and Future Projects

During the past six years there has been significant landcare activity in the Shire of Lake Grace. Thousands of trees have been planted through individual and community efforts, and in 1995 nearly 70,000 seedlings were planted. The Lake Grace community has not relied solely on external funding to conduct landcare or bushcare activities. For example, farmers have erected the majority of the fencing around bush remnants without external funding assistance.
The **Newdegate Rare Flora Volunteers** formed in 1991 to assist CALM with rare flora work. The group received a regional natural resources kit from Greening WA in 1994. Plant specimens for the Newdegate herbarium are collected on rare flora excursions, and the herbarium now houses more than 400 specimens. While the group’s focus is on monitoring known populations of rare flora, new populations have been discovered. The Newdegate Volunteers became involved with CALM’s Western Shield in 1997, monitoring food sources at animal capture sites.

The **Lake Grace LCDC** received $37,000 from the NHT for tree planting and fencing in 1998, particularly in the South Lake Grace Catchment. This project also aims to drill ten piezometers throughout the South Lake Grace Catchment in order to measure the groundwater height and monitor the effect of the tree planting.

The **Pingaring LCDC** has recently undertaken a project that aims to reclaim sandplain seeps in the catchment. Small seeps on hills that are associated with waterlogging will be ameliorated by planting trees above the seepage patches. Such patches are generally 2-3 hectares, and the seedlings will be fenced for protection from grazing. The group has received assistance from the Swan-Avon Catchment Group, which has contributed 50% of the cost of seedlings and fencing material.

The **Sustainable Seed Banks Project** aims to establish a resource base of local provenance seeds of native vegetation to be used in local revegetation activities. The project is jointly funded by Greening WA and the Natural Heritage Trust. By the end of 1998 the project aims to establish 25 seed banks and 12 seed orchards throughout the agricultural region that will be community owned and operated. Greening WA will provide community groups involved in the project with materials, technical advice and training in plant identification, seed collection and orchard establishment.

### 4.3 Landcare Support

There are a number of groups and funding bodies that provide support for landcare activities, in addition to the LCDCs and catchment groups.

The **Avon Working Group** was established in 1995. The group provides financial, human and technical resources to undertake catchment planning, farm planning and demonstration of rehabilitation techniques that tackle soil and water degradation problems.

A list of programs of support and/or funding aimed at land and nature conservation and the contact details are found in Appendix 12.
4.4 Future Directions

There are several activities complementary to conventional agriculture that can generate extra dollars to supplement farming incomes. Many Western Australian farmers are earning money by capturing economic benefits from selected sustainable uses of remnant vegetation. Possible sustainable economic uses of remnant vegetation include:

- Wildflowers
- Ecotourism (camping, nature trails)
- Native plant seed collection
- Timber for fences and structures
- Firewood
- Brushwood
- Honey production (and other apiary products)
- Tree fruits
- Essential oils
- Charcoal
- Tannins
- Stock and crop shelter
- Water quality and salinity control
- Soil stabilisation (against wind and water erosion)
- Insect control (by resident insectivores)

Table 7 presents a comparison with the returns of several remnant vegetation enterprises to returns from conventional agriculture. When making such comparisons, four issues should be considered:

1. Not all farms are suitable or capable of achieving these returns. Factors that affect this suitability include soil type, climate, composition of the bush, distance to market, and accessibility to main tourist routes.
2. Many remnants were deliberately left because they were located on areas that have poorer soils or were difficult to clear. Such areas were deemed unsuitable for conventional agriculture, but returns from remnant vegetation enterprises on this “unproductive” land may provide additional income.
3. Many remnant bush activities take place when there is a lull in conventional farm activities. Therefore returns from remnant vegetation enterprises can be viewed as an additional source of farm returns.
4. The economic returns from remnant vegetation enterprises do not include indirect environmental benefits, such as:
   - Stock and crop shelter,
   - Soil stabilisation against wind and water erosion,
   - Water conservation and salinity control, and
   - Natural pest control from resident insectivores.
Table 7: The net cash operating returns for sustainable vegetation enterprises in the Western Australian wheatbelt compared to net cash returns from conventional agricultural enterprises (1992-93). Adapted from ACIL (1993).

<table>
<thead>
<tr>
<th>Use</th>
<th>$ per operator day worked</th>
<th>$ per hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wildflower production</td>
<td>Up to 248</td>
<td>124-232</td>
</tr>
<tr>
<td>Ecotourism</td>
<td>50-90</td>
<td>5-1,500</td>
</tr>
<tr>
<td>Timber products</td>
<td>Fence posts</td>
<td>NA</td>
</tr>
<tr>
<td>Firewood</td>
<td>63</td>
<td>21</td>
</tr>
<tr>
<td>Brushwood</td>
<td>NA</td>
<td>10-100</td>
</tr>
<tr>
<td>Native plant seed collection</td>
<td>16-120</td>
<td>NA</td>
</tr>
<tr>
<td>Cropping</td>
<td>NA</td>
<td>150-244</td>
</tr>
<tr>
<td>Sheep (1992-93)</td>
<td>NA</td>
<td>12-31</td>
</tr>
<tr>
<td>(long term)</td>
<td>NA</td>
<td>26-95</td>
</tr>
</tbody>
</table>

Remnant vegetation beautifies the property landscape and improves the resale value of a property. Even if there is no current economic use of the remnant vegetation, it provides the opportunity in the future to make these returns and realise the economic benefits. This can be particularly important during periods of cyclical downturn in farming activities. Future generations can benefit from the flexibility that remnant bush provides, particularly if new products are developed that require raw materials sourced from native plants. For example, researchers from an American drug company investigated tail bush (*Anthocercis littorea*), a common plant in coastal scrub, to see if a chemical it contains could be useful as a drug for the treatment of AIDS (*West Australian*, 1990).

Many of the endangered plants of Western Australia have yet to be investigated for their economic or other uses. Some are well established in cultivation as attractive garden plants and are sold in nurseries (*Hopper et al.*, 1990), for example:

- *Acacia guinnetii*
- *Eremophila denticulata*
- *Eucalyptus rhodantha*
- *Kennedia macrophylla*

**Bushfoods**

There is a huge variety of native plants with edible parts in Western Australia (Table 8). Bushfoods have been shown to be highly nutritious, more so than their farmed European relatives. Bushfoods have created great interest in restaurants, catering and food manufacturing. Some bushfoods are more readily available to consumers than others. For further information, see the reading list and contact information. *Australian Bush Foods* magazine is published bimonthly and contains current information about growing, purchasing and preparation of bushfoods.
The management of native vegetation can serve two purposes: restoration and landcare, and commercial production. Both objectives support the management of the whole ecosystem, from trees and shrubs to herbs and grasses. In recognising the value of our own home-grown resources, there is potential to create unique international markets for Australian products, with a range of cultural, social, economic and environmental benefits (Council of Aboriginal Reconciliation, 1994).

Table 8: Examples of bushfoods that may occur naturally or could be cultivated in the eastern wheatbelt. Adapted from J. Robins (1996) *Wild Lime*.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Species Name</th>
<th>Uses</th>
<th>Growing Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bush Tomato</td>
<td><em>Solanum centrale</em></td>
<td>Dried ripe fruit with spicy piquant flavour used as spice or flavouring rather than as a tomato.</td>
<td>Small hardy shrubs widely dispersed throughout inland Australia, in sandy warm and dry conditions.</td>
</tr>
<tr>
<td>Quandong</td>
<td><em>Santalum acuminatum</em></td>
<td>Fleshy fruit is made into jam and stewed fruit, similar to apricots.</td>
<td>Found throughout the wheatbelt.</td>
</tr>
<tr>
<td>Bush Cucumber</td>
<td><em>Cucumis melo</em> subsp <em>agrestis</em></td>
<td>Ripe flesh inside the green cucumber fruit, smaller version of traditional cucumbers.</td>
<td>Grows extensively in wild throughout the outback.</td>
</tr>
<tr>
<td>Appleberry (Karrawang)</td>
<td><em>Billardiera scandens,</em> <em>B. cymosa,</em> <em>B. longiflora.</em></td>
<td>Berry fruit is dull forest green in colour (like Kiwi fruit), tasty raw, or cooked as sauce for pork, veal and chicken.</td>
<td>Coastal forests of QLD and south-west WA.</td>
</tr>
<tr>
<td>Samphire</td>
<td><em>Sarcocornia quiqueflora</em></td>
<td>Succulent fleshy stems used as vegetable and a salt substitute.</td>
<td>Coastal and inland.</td>
</tr>
<tr>
<td>Cumbungi (Bulrush)</td>
<td><em>Typha domingensis,</em> <em>T. orientalis.</em></td>
<td>Shoots used in salads or steamed like artichokes, stems like leek, pollen like saffron with nutty flavour.</td>
<td>Throughout all Australian States along waterbodies.</td>
</tr>
<tr>
<td>Wattleseed</td>
<td>various <em>Acacia</em> species</td>
<td>Pods are steamed or roasted, ground then used in baking, ice-cream and savoury sauces.</td>
<td>Throughout Australia.</td>
</tr>
</tbody>
</table>
5 Local Contacts

Lake Grace Community Landcare Coordinator.
Arletta Ralph
C/- Agriculture WA, Lake Grace 6353.
Telephone: (08) 9865 1205    Fax: (08) 9865 1282

Lake Grace Land Conservation District Committee.
Chairman: Ron Lay. Telephone (08) 9865 1318.
C/O Lakes Link Telecentre, PO Box 177, Lake Grace WA 6353.

Lake Bryde Land Conservation District Committee.
Chairman: David Rosenberg  Telephone (08) 9820 6031.
Secretary: Wayne Smart        Telephone (08) 9820 6012.

Lakes Land Conservation District Committee.
Secretary: Stephen Metcalf.
Telephone (08) 9875 1045.

Newdegate Land Conservation District Committee.
Chairman: Michael Lloyd       Telephone (08) 9871 2041.  Fax: (08) 9871 2062.

Pingaring Land Conservation District Committee.
Secretary: Ian Wyatt. PO Box 13, Pingaring 6357.
Telephone (08) 9886 8060.

South Lake Grace Catchment Group.
Ron Lay, PO Box 4, Lake Grace WA 6353.
Telephone (08) 9865 1318.

Shire of Lake Grace.
Stubbs Street, PO Box 50, Lake Grace 6353
Telephone (08) 9865 1105.  Fax (08) 9865 1109.

Newdegate Rare Flora Volunteers.
Anne Rick.
Telephone (08) 9820 6048.  Fax (08) 9820 6047.

Avon Working Group.
Northam AgWA District Office,
Northam WA 6401.
Telephone (08) 9690 2000.

Avon Catchment Network.
Wellington Street, Northam. PO Box 311, Northam WA 6401.
Telephone (08) 9622 7600.  Fax: (08) 9662 7611.
Newdegate Nusery  
Box 112, Newdegate WA 6355.  
Telephone (08) 9871 1576.

Dunroven Tree Nusery  
PO Box 154, Kulin WA 6365.  
Telephone/Fax (08) 9880 4047.

Department of Conservation and Land Management.  
Katanning District Office.  
56 Clive Street, Katanning 6317.  
Telephone (08) 9821 1296.

Agriculture Western Australia.  
Stubbs Street, Lake Grace 6353.  
Telephone (08) 9865 1205 Fax: (08) 9865 1282.

Indigenous Mallee Corporation.  
PO Box 86, Kondinin 6367.

Kings Park and Botanic Garden – General Enquiries  
Fraser Ave, West Perth  
Phone: (08) 9480 3600

Refer to Appendix 12 for funding program contacts.
6 References


CALM (1994). *Reading the Remote, Landscape Characters of Western Australia*, Department of Conservation and Land Management, Como.


Management.

Council for Aboriginal Reconciliation (1994) *Valuing Cultures, Key Issues Paper No. 3*, AGPS.


Griffin, E. A. (1995) *Distribution and Ecological Significance of On-Farm Bush Remnants in the Southern Wheatbelt Region of Western Australia Phase II*, Division of Regional Operations, Agriculture Western Australia, Perth.


Holm, A. (1994) *Procedures for the Administration and Assessment of Clearing and Protection of Native Vegetation in Western Australia*, Agriculture Western Australia, South Perth.


7 Further Reading

Rural nature conservation


Bush regeneration, remnant vegetation and weeds


Additional information about weed issues in Western Australia from Information Notes, available from the Agricultural Protection Board, Agriculture WA.


**Seed growing and collection**


Seabrook, J. *Seeds of the Future. How to Establish a Native Seed Orchard*, WA Wildflower Society - Eastern Hills Branch, Western Australia.

**Direct seeding**


**Farm Investigation**

Revegetation


Revegetation Expert Software (REX) (1996) Copyright CALM, Agriculture Western Australia, Greening WA and Robin Road Software, Direct order on 1800 244 060. Cost is less than $100.


Wetlands


Whole farm planning

Plant identification


Blackall, W.E. and Grieve, B.J. (1974) *How to Know Western Australian Wildflowers*, Parts 1, 2 and 3, University of Western Australia Press, Nedlands.


Erikson *et al.*, (1973) *Flowers and Plants of Western Australia*, Reed, NSW.


George, A.S. *The Banksia Book*, Kangaroo Press, NSW.


Hoffman, N. and Brown, A. *Orchids of South-West Australia*, University of Western Australia Press, Perth.


General Reading


Department of Conservation and Land Management (1994) *Reading the Remote, Landscape Characters of Western Australia*, CALM.


aff  allied to (Latin affinis); affinity is used for undescribed species that are very similar to named species yet different enough to be kept as a separate taxa.

alkaline soil  any soil that has pH > 7. Usually applied to surface layer or root zone but may be used to characterise any horizon or soil sample.

appressed  pressed closely against another part (e.g. leaves against stem).

arboreal  living in a tree or trees; as opposed to terrestrial, living on the ground;
aquatic, living in water; amphibious, living on land and in the water; marine, living in the ocean.

basic rock  an igneous rock composed chiefly of dark-coloured minerals; relatively rich in iron, magnesium and/or calcium and with a relatively low silica content.

breakaway  the steep slope, usually not very high, where an old landscape is being cut away by wind and water erosion.

buffering capacity  the ability of a soil to resist changes in pH. Commonly determined by the presence of clay and humus.

calcareous soil  soil containing sufficient calcium carbonate (often with magnesium carbonate) to effervesce visibly when treated with cold 0.1 N hydrochloric acid.

carnivore  organism that feeds on animals

catena  sequence of soils of about the same age, derived from similar parent material, and occurring under similar climatic conditions, but having different characteristics because of variation in relief and in drainage.

contour  imagery line connecting points of equal elevation on the surface of the soil.

coppice  shoot developed from dormant bud of the main trunk of a shrub or tree.

crust  surface layer on soils that is much more compact, hard and brittle when dry than the materials immediately beneath it, ranging in thickness from a few millimetres to 3 cm.

cultivation  tillage operation used in preparing land for seeding or transplanting or later for weed control and for loosening the soil.

deciduous plant  plant that sheds all its leaves every year at a certain season.

endemic  found only in restricted, localised areas; peculiar to the state or country and not native elsewhere.

ephemeral  for waterbodies: holds water throughout the year in less than 20% of years, and frequently does not receive inflow. For plants: a short-lived annual plant.

eutrophication  process of aging of lakes whereby aquatic plants are abundant and waters are deficient in oxygen. The process is usually accelerated by the enrichment of waters with surface runoff containing nitrogen and phosphorus.

fertility, soil quality  of a soil that enables it to produce essential chemical elements in quantities and proportions for the growth of specified plants.

fertiliser  any organic or inorganic material of natural or synthetic origin added to a soil to supply certain elements essential to the growth of plants.

glabrous  having a shining surface without hairs.

granite  coarse-grained rock containing a high proportion of quartz and feldspar,
with some mica.

**greenstone** compact, dark green altered or metamorphic basic igneous rock, that owes its colour to chlorite, actinolite or epidite (green-coloured minerals).

**groundwater** subsurface water in the zone of saturation that is free to move under the influence of gravity.

**habitat** the natural environment of a plant or animal

**halophyte** plant that requires or tolerates a saline environment.

**heath** low scrub about 0.5 m high, with scattered taller shrubs standing out above it. Heath is very widespread but the plant species vary according to the locality. The taller shrubs that can grow to about 4 m can include Acacias, Banksias, Allocasuarinas, etc.

**herbicide** chemical that kills plants or inhibits their growth; intended for weed control.

**herbivore** plant-eating animal.

**horizon, soil** layer of soil approximately parallel to the soil surface, with different properties and characteristics from adjacent layers below or above it.

**humus** the stable fraction of the soil organic matter remaining after the major portions of added plant and animal residues have decomposed. Usually it is dark in colour.

**igneous rock** rock that solidified from molten or partly molten material (e.g. from a magma). Igneous rocks are one of the three main rock classes, the others being metamorphic and sedimentary.

**infiltration** the downward entry of water into the soil.

**insecticide** chemical that kills insects.

**kwongan** indigenous term for the Western Australian sandplain and its vegetation. The vegetation consists of broombush thickets, scrub-heath and mallee-heath; the term could be extended to cover all types of sclerophyll shrubland.

**labellum** modified lower petal of orchids often referred to as the lip or tongue.

**laterite** iron-rich subsoil layer found in highly weathered tropical soil that, when exposed and allowed to dry becomes very hard and will not soften when rewetted. When erosion removes the overlying layers, the laterite is exposed and a virtual pavement exists.

**legume** pod-bearing member of the Leguminosae family, one of the most important and widely distributed plant families. Includes many valuable food and forage species such as peas, beans, peanuts, clovers and alfalfas. Nearly all legumes are associated with nitrogen-fixing organisms.

**lichen** an association between an algae or cyanobacterium and a fungus. Usually the partners of a lichen are unable to live apart.

**lignotuber** swollen, woody structure at the base of many eucalypts containing dormant buds.

**lime** in strict chemical terms, calcium oxide (CaO). In practical terms, a material used to neutralise soil and acidity containing the carbonates, oxides and/or hydroxides of calcium and/or magnesium.

**loamy** intermediate in texture and properties between fine-textured and coarse-textured soils. Includes all textural classes with the words loam or loamy as a part of the class name, such as clay loam or loamy sand.
mallee  mallee communities are formed by a great variety of eucalypt species, and are distinguished from low woodlands by coppicing species that resprout from rootstock (lignotuber) after fire and hence are multi-stemmed. Most mallee stands are about 3-5 m tall with open cover, and have a dense understorey of sclerophyll shrubs 1-2 m tall.

metamorphic rock  rock derived from pre-existing rocks by mineralogical, chemical and/or structural changes in response to changes (e.g. temperature, pressure) that occur deep in the earth’s crust.

morphological  referring to form or shape of an organism and its parts.

ms  manuscript name, used to differentiate undescribed species within a particular genera.

mulch  any material such as straw, sawdust, leaves, plastic film and loose soil that is spread upon the surface of the soil to protect the soil and plant roots from the effects of evaporation, raindrops, soil crusting, freezing, etc.

nitrogen fixation  the biological conversion of elemental nitrogen (N₂) to organic combinations or to forms readily utilised in biological processes.

parent material  the unconsolidated and more or less chemical weathered mineral or organic matter from which the upper and most weathered horizons of the soils are developed.

permanent  when a waterbody holds water throughout the year in 80% of years.

physiographic  pertaining to the science of physical geography or geomorphology.

piezometers  tubes (usually of PVC) of varying diameter, with perforated sections or screens, inserted in the ground to varying depths. Sand placed around the screens allows water to enter, the screens being sealed at the top with bentonite (a clay). The level to which water rises in the piezometer is a measure of the groundwater pressure at the screen depth.

saline  a soil is saline when it contains such a quantity of soluble salts that plant growth is significantly reduced.

samphire  an individual or community of plants that are adapted to saline soil; usually low growing succulent or herbaceous species.

scarp  the steeply sloped side of a ridge or plateau.

scat  faecal pellet.

sclerophyll  pertaining to plants with tough leathery leaves.

seasonal  when a waterbody holds water throughout the year in 61-80% of years.

secondary salinity  when large areas of previously productive land become so saline that crop production is seriously reduced or impossible. Differentiated from primary salinity, shown by soils that are believed to have been saline for thousands of years as a result of natural landscape processes.

sedimentary rock  layered rock resulting from the consolidation of sediment. Examples include sandstone and coal.

semi-permanent  when a waterbody holds water throughout the year in 21-60% of years, and receives inflow in most years.

soil conservation  combination of all management and land-use methods that safeguard the soil against depletion or deterioration caused by nature and/or humans.

stratum  distinct range of vegetation, such as overstorey and understorey.
subspecies (subsp) taxonomic term for a group consisting of individuals within a species that have distinguishing characteristics separating them from other members and forming a breeding group, but that can still interbreed with other members of the species. A synonym for subspecies is variety.

tammar scrub comprising Allocasuarinas, Eucalypts and Dryandras.

taxon (plural taxa) any defined unit (e.g. species, genus, family) in the classification of living organisms.

taxonomy the study of the rules, principles and practice of classifying living organisms.

variety taxonomic group below the species level, used in different senses by different specialists.

waterlogged saturated with water.

water table upper surface of groundwater or that level below which the soil is saturated with water. The height of the water table varies seasonally according to the amount of percolation occurring.

weathering process of disintegration and decay of rock. There are three types of weathering: Physical, e.g. cracking caused by continual heating and cooling of rocks; Chemical, e.g. caused by weak acid formed by carbon dioxide from the air dissolving in rain water; and Biological, e.g. the action of plant roots, moss and lichens that combines both physical and chemical action.

wodjil scrub containing various species of Acacia.
Appendix 1. List of common names and associated scientific names.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acorn Banksia</td>
<td>Banksia prionotes</td>
</tr>
<tr>
<td>Blackbutt</td>
<td>Eucalyptus patens</td>
</tr>
<tr>
<td>Black Marlock</td>
<td>Eucalyptus reducna</td>
</tr>
<tr>
<td>Black Morrel</td>
<td>Eucalyptus melanoxylon</td>
</tr>
<tr>
<td>Blue Mallet</td>
<td>Eucalyptus gardneri</td>
</tr>
<tr>
<td>Bluebush</td>
<td>Atriplex paludosa</td>
</tr>
<tr>
<td>Boorabin Mallee</td>
<td>Eucalyptus platycorys</td>
</tr>
<tr>
<td>Boree</td>
<td>Melaleuca species</td>
</tr>
<tr>
<td>Broombush</td>
<td>Melaleuca uncinata</td>
</tr>
<tr>
<td>Brown Mallet</td>
<td>Eucalyptus astringens</td>
</tr>
<tr>
<td>Bull Banksia</td>
<td>Banksia grandis</td>
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<td>Bullich</td>
<td>Eucalyptus megacarpa</td>
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<td>Burracoppin Mallee</td>
<td>Eucalyptus burracoppinensis</td>
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<td>Butter Gum</td>
<td>Eucalyptus laeliae</td>
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<td>Capped Mallee</td>
<td>Eucalyptus pileata</td>
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<tr>
<td>Chittick</td>
<td>Lambertia inermis</td>
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<tr>
<td>Christmas Tree</td>
<td>Nyctysia floribunda</td>
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<tr>
<td>Coarse-leafed Mallee</td>
<td>Eucalyptus grossa</td>
</tr>
<tr>
<td>Coastal Blackbut</td>
<td>Eucalyptus toditiana (also known as Pricklybark)</td>
</tr>
<tr>
<td>Comet Vale Mallee</td>
<td>Eucalyptus brachycorys</td>
</tr>
<tr>
<td>Drummond’s Mallee</td>
<td>Eucalyptus drummondii</td>
</tr>
<tr>
<td>Flat-topped Yate</td>
<td>Eucalyptus occidentalis</td>
</tr>
<tr>
<td>Flooded Gum</td>
<td>Eucalyptus rudis</td>
</tr>
<tr>
<td>Frog Mallee</td>
<td>Eucalyptus phaenophylla</td>
</tr>
<tr>
<td>Gimlet</td>
<td>Eucalyptus salubris</td>
</tr>
<tr>
<td>Goblet Mallee</td>
<td>Eucalyptus merrickiae</td>
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<tr>
<td>Golden Wattle</td>
<td>Acacia pycnantha</td>
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<tr>
<td>Golden Wreath Wattle</td>
<td>Acacia saligna</td>
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<tr>
<td>Goldfields Blackbut</td>
<td>Eucalyptus lesouefii</td>
</tr>
<tr>
<td>Grass Trees</td>
<td>Kingia or Xanthorrhoea species</td>
</tr>
<tr>
<td>Greybush</td>
<td>Cratystylis conopephala</td>
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<tr>
<td>Gungurru</td>
<td>Eucalyptus caesia</td>
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<tr>
<td>Harsh Hakea</td>
<td>Hakea prostrata</td>
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<td>Honey-myrtles</td>
<td>Melaleuca species</td>
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<tr>
<td>Hook-leafed Mallee</td>
<td>Eucalyptus uncinata</td>
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<td>Hook-leaf Thryptomene</td>
<td>Thryptomene australis</td>
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<tr>
<td>Jam</td>
<td>Acacia acuminata</td>
</tr>
<tr>
<td>Jarrah</td>
<td>Eucalyptus marginata</td>
</tr>
<tr>
<td>Kangaroo Paws</td>
<td>Anigozanthos species</td>
</tr>
<tr>
<td>Karri</td>
<td>Eucalyptus diversicolor</td>
</tr>
<tr>
<td>Kerosene Bush species</td>
<td>Dryandra species</td>
</tr>
<tr>
<td>Kondinin Blackbut</td>
<td>Eucalyptus kondininensis</td>
</tr>
<tr>
<td>Laterite Mallee</td>
<td>Eucalyptus lateritica</td>
</tr>
<tr>
<td>Lesser Bottlebrush</td>
<td>Callistemon phoeniceus</td>
</tr>
<tr>
<td>Common Name</td>
<td>Scientific Name</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Manna Wattle or Gum</td>
<td>Acacia microbotrya</td>
</tr>
<tr>
<td>Marri</td>
<td>Corymbia calophylla</td>
</tr>
<tr>
<td>Merrit</td>
<td>Eucalyptus flocktoniae</td>
</tr>
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<td>Mirret</td>
<td>Eucalyptus celastroides</td>
</tr>
<tr>
<td>Moort</td>
<td>Eucalyptus platypus</td>
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<tr>
<td>Mottelcah</td>
<td>Eucalyptus macrocarpa</td>
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<tr>
<td>Mountain Gum</td>
<td>Eucalyptus haematoxyylon</td>
</tr>
<tr>
<td>Mulga</td>
<td>Acacia aneura</td>
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<tr>
<td>Narrow-leafed Red Mallee</td>
<td>Eucalyptus foecunda</td>
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<tr>
<td>Native Pine</td>
<td>Callitris preissii</td>
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<tr>
<td>Needle Tree</td>
<td>Hakea preissii</td>
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<td>Open-fruited Mallee</td>
<td>Eucalyptus annulata</td>
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<td>Paperbarks</td>
<td>Melaleuca species</td>
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<tr>
<td>Peppermint Tree</td>
<td>Agonis flexuosa</td>
</tr>
<tr>
<td>Pincushion Hakea</td>
<td>Hakea laurina</td>
</tr>
<tr>
<td>Pincushions</td>
<td>Borya spaerocephala, and other Borya species.</td>
</tr>
<tr>
<td>Poison Peas</td>
<td>Gastrolobium species</td>
</tr>
<tr>
<td>Powderbark Wandoor</td>
<td>Eucalyptus accedens</td>
</tr>
<tr>
<td>Prickly Moses</td>
<td>Acacia pulchella</td>
</tr>
<tr>
<td>Pricklybark</td>
<td>Eucalyptus toditiana</td>
</tr>
<tr>
<td>Quandong</td>
<td>Santalum acuminatum</td>
</tr>
<tr>
<td>Red-flowered Mallee</td>
<td>Eucalyptus erythronema</td>
</tr>
<tr>
<td>Red Mallee (narrow-leafed)</td>
<td>Eucalyptus foecunda</td>
</tr>
<tr>
<td>Red Morrel</td>
<td>Eucalyptus longicornis</td>
</tr>
<tr>
<td>Redwood</td>
<td>Eucalyptus transcontinentalis</td>
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<tr>
<td>Reeds</td>
<td>Restionaceae species</td>
</tr>
<tr>
<td>Ridge-fruited (or Lerp) Mallee</td>
<td>Eucalyptus incrassata</td>
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<tr>
<td>River Gum</td>
<td>Eucalyptus camaldulensis</td>
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<td>River Red Gum</td>
<td>see River Gum</td>
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<td>Roadside Teatree</td>
<td>Leptospermum erubescens</td>
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<td>Rottnest Teatree</td>
<td>Melaleuca lanceolata</td>
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<td>Rushes</td>
<td>Juncus species</td>
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<td>Salmon gum</td>
<td>Eucalyptus salmonophloia</td>
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<tr>
<td>Saltbush</td>
<td>Atriplex hymenotheca and other Atriplex species</td>
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<tr>
<td>Salt River Gum/Mallet</td>
<td>Eucalyptus sargentii</td>
</tr>
<tr>
<td>Salt-water Paperbark</td>
<td>Melaleuca cuticularis</td>
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<tr>
<td>Samphire</td>
<td>Halosarcia species</td>
</tr>
<tr>
<td>Sandalwood</td>
<td>Santalum spicatum</td>
</tr>
<tr>
<td>Sedges</td>
<td>Cyperaceae family</td>
</tr>
<tr>
<td>Sheoak</td>
<td>Allocasuarina fraseriana</td>
</tr>
<tr>
<td>Sheoak (Rock)</td>
<td>Allocasuarina huegeliana</td>
</tr>
<tr>
<td>Sheoak (Swamp)</td>
<td>Casuarina obesa</td>
</tr>
<tr>
<td>Silver Inland Wandoor</td>
<td>Eucalyptus capillosa</td>
</tr>
<tr>
<td>Silver Mallee</td>
<td>Eucalyptus crucis</td>
</tr>
<tr>
<td>Silver Mallet</td>
<td>Eucalyptus ornata</td>
</tr>
<tr>
<td>Slender Banksia</td>
<td>Banksia attenuata</td>
</tr>
<tr>
<td>Common Name</td>
<td>Scientific Name</td>
</tr>
<tr>
<td>------------------------</td>
<td>---------------------------------------------------------------------------------</td>
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<tr>
<td>Snap and Rattle</td>
<td><em>Eucalyptus celastroides</em> (also known as Mirret)</td>
</tr>
<tr>
<td>Spinifex</td>
<td><em>Triodia species</em></td>
</tr>
<tr>
<td>Square-fruited Mallee</td>
<td><em>Eucalyptus calycogona</em></td>
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<tr>
<td>Stiff-leafed Mallee</td>
<td><em>Eucalyptus rigidula</em></td>
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<tr>
<td>Sugar Gum</td>
<td><em>Eucalyptus cladoalcyx</em></td>
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<tr>
<td>Swamp Banksia</td>
<td><em>Banksia littoralis</em></td>
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<tr>
<td>Swamp Mallet</td>
<td><em>Eucalyptus spathulata</em></td>
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<tr>
<td>Swamp Oak</td>
<td><em>Casuarina obesa</em> (also known as Swamp sheoak)</td>
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<tr>
<td>Swamp Teatree</td>
<td><em>Melaleuca preissiana</em></td>
</tr>
<tr>
<td>Swamp Yate</td>
<td><em>Eucalyptus occidentalis</em></td>
</tr>
<tr>
<td>Tall Sand-Mallee</td>
<td><em>Eucalyptus eremophila</em></td>
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<td>Tallerack</td>
<td><em>Eucalyptus tetragona</em></td>
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<td>Tamma</td>
<td><em>Allocasuarina campestris</em></td>
</tr>
<tr>
<td>Teatree</td>
<td><em>Leptospermum species</em></td>
</tr>
<tr>
<td>Tuart</td>
<td><em>Eucalyptus gomphocephala</em></td>
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<tr>
<td>Wait-a-while</td>
<td><em>Acacia colletoides</em></td>
</tr>
<tr>
<td>Wandoo, White or Silver Gum</td>
<td><em>Eucalyptus wandoo</em> (see Brooker and Hopper, 1991)</td>
</tr>
<tr>
<td>Wattle</td>
<td><em>Acacia species</em></td>
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<tr>
<td>White Mallet</td>
<td><em>Eucalyptus falcata</em></td>
</tr>
<tr>
<td>White-leafed Mallee</td>
<td><em>Eucalyptus albida</em></td>
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<tr>
<td>Woody Pear</td>
<td><em>Xylomelum angustifolium</em></td>
</tr>
<tr>
<td>Yarri</td>
<td><em>Eucalyptus patens</em></td>
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<tr>
<td>Yate</td>
<td><em>Eucalyptus occidentalis</em></td>
</tr>
<tr>
<td>York Gum</td>
<td><em>Eucalyptus loxophleba</em></td>
</tr>
<tr>
<td>York Road Poison</td>
<td><em>Gastrolobium calycinum</em></td>
</tr>
<tr>
<td>Yorreell</td>
<td><em>Eucalyptus gracilis</em> (or sometimes <em>E. yilgarnensis</em>)</td>
</tr>
<tr>
<td>Zamia</td>
<td><em>Macrozamia reidlei</em></td>
</tr>
</tbody>
</table>
Appendix 2. Detailed botanical information for four bush remnants

This appendix lists information from sites surveyed in detail during the study: E. A. Griffin (1995) Distribution and Ecological Significance of On-Farm Bush Remnants in the Southern Wheatbelt Region of Western Australia Phase II, Agriculture Western Australia. Please refer to Figure 13 for locations.

1. Survey of site LG16020

Lake Grace Shire [LG16] Hyden SI50-04 1:250 000

Surveyed: 14.08.92
Location: 97 km SE of Hyden, 22.5 km SE of Varley, and 12 km NE of Lake Camm; 32°54'15''S, 119°43'00''E, 340 m.

a Allocasuarina spp. (A. corniculata and A. acutivalvis) scrub heath.
b Allocasuarina acutivalvis scrub over heath.
c Melaleuca spp. (M. lateriflora, M. uncinata and M. scabra) low scrub/heath community.
d Mallee over Melaleuca spp. Scrub.
e Tree mallee Eucalyptus over tall (= 3 m) teatree (Melaleuca) community.

LG16020 Species List

<table>
<thead>
<tr>
<th>Acacia aff lineolata</th>
<th>Cryptandra parvifolia</th>
<th>Melaleuca aff cuneata</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acacia bidentata</td>
<td>Dampiera juncea</td>
<td>Melaleuca holosericea</td>
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<tr>
<td>Acacia microneura</td>
<td>Dampiera sp.</td>
<td>Melaleuca sp.</td>
</tr>
<tr>
<td>Acacia sulcata var</td>
<td>Drosera huegeli</td>
<td>Melaleuca urceolaris</td>
</tr>
<tr>
<td>platyphylla</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acacia var planoconvexa</td>
<td>Eucalyptus pileata</td>
<td>Mirbella spinosa</td>
</tr>
<tr>
<td>Anthocercis microphylla</td>
<td>Eucalyptus sp (spathulata gp)</td>
<td>Olearia rudis</td>
</tr>
<tr>
<td>Astartea aff heteranthera</td>
<td>Gahnia ancistrophylla</td>
<td></td>
</tr>
<tr>
<td>Astroloma epacridis</td>
<td>Glischrocyon aureum</td>
<td></td>
</tr>
<tr>
<td>Baeckeal sp</td>
<td>Goodenia incana</td>
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<tr>
<td>Beaufortia empetrifolia</td>
<td>Goodenia scapigera</td>
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<tr>
<td>Beaufortia schaieri</td>
<td>Grevillea concinna</td>
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</tr>
<tr>
<td>Bentleya diminuta</td>
<td>Grevillea pectinata</td>
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</tr>
<tr>
<td>Beyeria brevifolia</td>
<td>Grevillea sp.</td>
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<tr>
<td>Boronia sp.</td>
<td>Hakea commutata</td>
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</tr>
<tr>
<td>Cassytha sp.</td>
<td>Isopogon scabriusculus</td>
<td></td>
</tr>
<tr>
<td>Coleanthera ?myrtoides</td>
<td>Leptospermum roei</td>
<td></td>
</tr>
<tr>
<td>Conospermum brownii</td>
<td>Leucopogon sp.</td>
<td></td>
</tr>
<tr>
<td>hughelli</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conostylis ?aurea</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2. Survey of site LG13017

Lake Grace Shire [LG13] Hyden SI50-04 1:250 000

Surveyed: 20.08.92
Location: 3 km E of Holt Rock South Road, 21 km SSW of Varley, 17 km NE of Lake Camm (Town/Site) and 76.5 km SE of Hyden; 32°58’30”S, 119°25’15”E; 330 m; (Pinnizza).

Area is 600 ha; permitted to clear by WADA and will leave only the drainage areas, the rocky ridges and an area in the SW corner.

LG13017 Species List

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Fungal Species</th>
<th>Plant Name</th>
<th>Fungal Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acacia microneura</td>
<td>fungi</td>
<td>Gastrolobium crassifolium</td>
<td>Petrophile divaricata</td>
</tr>
<tr>
<td>Acacia multisepicata</td>
<td></td>
<td>Gastrolobium parvifolium</td>
<td>Petrophile heterophylla</td>
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<tr>
<td>Acacia sp.</td>
<td></td>
<td>Hakea marginata</td>
<td>Petrophile rigida</td>
</tr>
<tr>
<td>Actinobole uliginosum</td>
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<td>Hakea scoparia</td>
<td>Petrophile seminuda</td>
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<tr>
<td>Adenanthos ?flavidiflorus</td>
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<td>Hakea sp.</td>
<td>Phebalium microphyllum</td>
</tr>
<tr>
<td>Adenanthos argyreus</td>
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<td>Hibbertia aff stricta</td>
<td>Pimelea angustifolia</td>
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<tr>
<td>Andersonia carinata</td>
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<td>Hibbertia enervia</td>
<td>Pimelea sulphurea</td>
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<td>Andersonia parvifolia</td>
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<td>Lasiopetalum sp.</td>
<td>Pterostylis vittata</td>
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<tr>
<td>Baeckea preissiana</td>
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<td>Leucopogon conostephioides</td>
<td>Poranthera microphylla</td>
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<tr>
<td>Beaufortia micrantha</td>
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<td>Leucopogon hamulosus</td>
<td>Pultenaea sp.</td>
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<tr>
<td>Beyeria lechenaultii</td>
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<td>Leucopogon sp.</td>
<td>Rinzia sp.</td>
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<tr>
<td>Boronia fastigiata</td>
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<td>Lepidobolus chaetocephalus</td>
<td>Rinzea tenufolia</td>
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<tr>
<td>Boronia ramosa</td>
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<td>Lepidobolus sp</td>
<td>Scaevola sp.</td>
</tr>
<tr>
<td>Calothamnus lateralis</td>
<td></td>
<td>Leptospermum roei</td>
<td>Schoenus sp.</td>
</tr>
<tr>
<td>Cassytha sp</td>
<td></td>
<td>Lepidosperma tenuifolium</td>
<td>Stackhousia scoparia</td>
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<tr>
<td>Chamelaucium ciliatum</td>
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<td>Leptospermum erubescens</td>
<td>Stylidium piliferum</td>
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<tr>
<td>Cladonia sp.</td>
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<td>Melaleuca cuneata</td>
<td>Stylidium sp.</td>
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<tr>
<td>Conospermum amoenum</td>
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<td>Melaleuca glaberrima</td>
<td>Synaphea spinulosa</td>
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<tr>
<td>Cryptandra nutans</td>
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<td>Melaleuca pentagona</td>
<td>Synaphea sp.</td>
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<tr>
<td>Dampiera eriocephala</td>
<td></td>
<td>Melaleuca sp.</td>
<td>Synaphea spinulosa</td>
</tr>
<tr>
<td>Dampiera spicata</td>
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<td>Melaleuca urceolaris</td>
<td>Templetonia aculeata</td>
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<tr>
<td>Daviesia ?preissii</td>
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<td>Mesomelaena stygia</td>
<td>Verticordia grandiflora</td>
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<tr>
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<td>Micromyrtus obovata</td>
<td>Verticordia humilis</td>
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<td>Micromyrtus ciliata</td>
<td>Xanthoparmelia sp.</td>
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<tr>
<td>Dillwynia uncinata</td>
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<td>Mirbelia floribunda</td>
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<tr>
<td>Drosera sp.</td>
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<td>Olax benthamiana</td>
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<tr>
<td>Eucalyptus sp.</td>
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</table>
3. Survey of site LG15008

Lake Grace Shire [LG15] Newdegate SI50-08 1:250 000

Surveyed: 21.08.92
Location: East side of Old Ravensthorpe Road, 43 km SE of Newdegate; also abutting the west margin of the SW corner of the Dunn Rock Nature Reserve; 33°20'52''S, 119°23'08''E; c. 370 m.

LG15008 Species List

b species list
Acacia bidentata
Adenantheros glabrescens
Astartea sp.
Beaufortia micrantha
Boronia sp.
Anthocercis microphylla
Chameliaucium aff ciliatum
subsp glabrescens
Coleanthera ?myrtoides
Conostephiwm pendulum
Conostylis argentea
Cryptandra sp.
Darwinia sp.
Dillwynia divaricata
Eucalyptus aff rigens
Eucalyptus nr rigida
Eucalyptus scyphocalyx
Grevillea hapolanta
Grevillea pauciflora

Grevillea sp.
Grevillea inrichata
Hakea strumosa
Hibbertia enervia
Leptomeria pauciflora
Leucopogon sp.
Logania buxfolia
Melaleuca basicephala
Melaleuca sp.
Melaleuca urceolaris
Persoonia teretifolia
Pterostylis vittata
Pultenaea sp.
Restio sp.
Rinzia tenuiflora
Thysanotus ?mangelisianus

c species list
Acacia bilaora
Agonis spathulata
Bossiaea preissii
Calothamnus aff gracilis
Cassvha sp.
Chameliaucium
megalopetalum
Chorizema uncinatum
Conostylis sp.
Dampiera juncea
Gastrolobium crassifolium
Hibbertia enervia
Isopogon brevifolia
Pseudanthus sp.
Pultenaea sp.
Rinizia sp.

4. Survey of site LG15009

Lake Grace Shire [LG15] Newdegate SI50-08 1:250 000

Surveyed: 21.08.92
Location: Along the Lake Magenta Road, 17.3 km by road south of the junction of Giles and Page Roads; also 52.5 km SSE of Newdegate, and 55.5 km NNE of Jerramungup; 33°31'35''S, 119°54'45''E; c. 305 m.
<table>
<thead>
<tr>
<th>Species List</th>
<th>Species List</th>
<th>Species List</th>
</tr>
</thead>
<tbody>
<tr>
<td>a species list</td>
<td>b species list</td>
<td>d species list</td>
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<td>Boronia coerulescens</td>
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<td>Leucopogon dielsianus</td>
<td>Kunzea jucunda</td>
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<td>Nemcia sp.</td>
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<td>Acacia assimilis</td>
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<td>Schoenus sp.</td>
<td>Aphiella brizula</td>
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<td>Rinzia fumana</td>
<td>Schoenus unispiculatus</td>
<td>Astroloba epacridis</td>
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<td>a/b species list</td>
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<td>Chthonocephalus pseudavax</td>
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<td>Chthonocephalus pygmaeus</td>
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<td>Crassula colorata</td>
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<td>Olearia passerinoides</td>
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<td>Parentucellia sp.</td>
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<td>Sparthochloa scirpoidea</td>
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</table>
Appendix 3. Flora species observed on the southern Forrestania greenstone belt.

This plant list is taken from ‘Floristic Survey of Middle and Southern Ironcap, Digger Rocks and Hatter Hill of the eastern Goldfields of Western Australia’ by Neil Gibson and Michael Lyons, 1997. Only native species are included here.

<table>
<thead>
<tr>
<th>AMARANTHACEAE</th>
<th>CHENOPODIACEAE</th>
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<td><em>Ptilotus holosericeus</em></td>
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<td></td>
<td><em>Sclerolaeca diacantha</em></td>
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<td><strong>ANTHERICACEAE</strong></td>
<td><strong>CHLOANTHACEAE</strong></td>
</tr>
<tr>
<td><em>Thysanotus patersonii</em></td>
<td><em>Cyanostegia lanceolata</em></td>
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<td><strong>APIACEAE</strong></td>
<td><strong>CRASSULACEAE</strong></td>
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<td><em>Crassula colorata</em></td>
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<td><em>Hydrocotyle rugulosa</em></td>
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<tr>
<td><em>Platysce maxwellii</em></td>
<td><em>Callitris canescens</em></td>
</tr>
<tr>
<td><em>Trachymene ornata</em></td>
<td><em>Callitris preissii subsp. verrucosa</em></td>
</tr>
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<td><strong>APOCYNEACEAE</strong></td>
<td><strong>CUPRESSACEAE</strong></td>
</tr>
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<td><em>Callitris roei</em></td>
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<td><strong>ASTERACEAE</strong></td>
<td><strong>CYPERACEAE</strong></td>
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<td><em>Lepidoperma aff. brunonianum</em></td>
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<td><em>Blennospora drummondii</em></td>
<td><em>Schoenus nanus</em></td>
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<td><em>Brachyscome perpusilla</em></td>
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<tr>
<td><em>Hyalo sperma demissum</em></td>
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<td><em>Isoetopsis gramminifolia</em></td>
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</tr>
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<td><em>Podoplepis tepperi</em></td>
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<td><em>Hibbertia pungens</em></td>
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<td><em>Hibbertia rostellata complex</em></td>
</tr>
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<td><em>Senecio hispidulus</em></td>
<td></td>
</tr>
<tr>
<td><strong>BORAGINACEAE</strong></td>
<td><strong>DILLENIACEAE</strong></td>
</tr>
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<td></td>
</tr>
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<td><em>Halgania lavandulacea</em></td>
<td><em>Hibbertia aff. eatoniace</em></td>
</tr>
<tr>
<td><strong>CAESALPINIACEAE</strong></td>
<td><strong>DROSERACEAE</strong></td>
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<td><em>Drosera browniana</em></td>
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<td><strong>CASUARINACEAE</strong></td>
<td><em>Drosera glanduligera</em></td>
</tr>
<tr>
<td>* Allocasuarina acutivalvis*</td>
<td><em>Drosera lowriei</em></td>
</tr>
<tr>
<td>* Allocasuarina campestris*</td>
<td><em>Drosera macrantha</em></td>
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<td><strong>EPACDRIDACEAE</strong></td>
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<td><strong>CENTROLEPODACEAE</strong></td>
<td><strong>EUPHORBIACEAE</strong></td>
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<td><em>Beyeria brevifolia</em></td>
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<td><strong>GERANIACEAE</strong></td>
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<td><em>Pelargonium havlasae</em></td>
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</table>
GOODENIACEAE
Dampiera angulata
Goodenia pinifolia
Scaevola spinifera

HAEMODORACEAE
Conostylis argentea

JUNCAGINACEAE
Triglochin calcitrumpum

LAMIACEAE
Hemigenia teretiscula
Microcorys obovata
Westringia cephalantha
Westringia rigida

LAURACEAE
Cassya australis
Cassya glabella
Cassya melanthera
Cassya racemosa

LOGANIACEAE
Logania perryana

MIMOSACEAE
Acacia adremani
Acacia binata
Acacia brachyphylla var. brachyphylla
Acacia castanostega ms
Acacia deficiens ms
Acacia erinacea
Acacia evenulosa ms
Acacia hemeleus
Acacia heterochroma subsp. robertii
Acacia merrilii x polishroma hybrid
Acacia nelipotricha
Acacia merrilii
Acacia polishroma
Acacia singula
Acacia sulcata var. platyphylla
Acacia uncinella

MYOPORACEAE
Eremophila decipiens subsp. decipiens ms
Eremophila psilocalyx

MYRTACEAE
Astartea ambigua
Beaufortia micrantha
Beaufortia schaueri
Calothamnus quadrifidus
Calytrix brevisetia subsp. stipulosa
Chameleauncium ciliatum
Eucalyptus ssp. oleosa
Eucalyptus ssp. calycogona
Eucalyptus argyrepa
Eucalyptus calycogona
Eucalyptus conglobata
Eucalyptus cylindrica
Eucalyptus densa subsp. densa
Eucalyptus eremophila
Eucalyptus flocktoniae
Eucalyptus gratiae
Eucalyptus grossa
Eucalyptus livida
Eucalyptus longicornis
Eucalyptus loxophleba subsp. lissophloia
Eucalyptus olivina
Eucalyptus phaenophylly subsp. interjacens
Eucalyptus pileata
Eucalyptus salmonophloia
Eucalyptus xalibris
Eucalyptus transcontinentalis
Eucalyptus yilgarnensis
Euryomyrtus leptospermoideis ms
Leptospermum fastigiatum
Melaleuca acuminata subsp. acuminata ms
Melaleuca adnata
Melaleuca aganthosmoids
Melaleuca cardiophylla
Melaleuca clifortioides
Melaleuca cordata
Melaleuca coronicarca
Melaleuca curella
Melaleuca lateriflora subsp. lateriflora ms
Melaleuca pauperiflora subsp. pauperiflora
Melaleuca pentagona
Melaleuca phoidophylla ms
Melaleuca pungens
Melaleuca teuthidoides
Melaleuca uncinatorf
Micromyrus racemosa
Thryptomeone kochii
Verticordia chrysanthi

ORCHIDACEAE
Caladenia flaccida ms
Caladenia microchila ms
Caladenia saccharata
Caladenia sigmoidea
Diuris laxiflora
Eriochilus dilatatus
Microtis media subsp. media
Pterostylis aff nana (Fawn Snail Orchid)
Pterostylis aff aspera (Dwarf Shell Orchid)
Pterostylis aff barbara (Dwarf Bird Orchid)
Pterostylis mutica
Pterostylis picta
Pterostylis recurva
Pterostylis sanguinea
Eucalyptus annulata
PAPILIONACEAE
Daviesia benthamii subsp. acanthoclona
Daviesia euryloba ms
Daviesia nematophylla
Gastrolobium parviflorum
Gastrolobium spinosum
Pultenaea arida
Templetonia sulcata

PITTOSPORACEAE
Bentleya diminuta
Billardiera coriacea

PLANTAGINACEAE
Plantago aff hispidula

POACEAE
Austrostipa elegantissima
Austrostipa platycarpa
Danthonia caespitosa

Neurachne alopecuroidea
Plectranche rigida

POLYGALACEAE
Comesperma volubile

PORTULACACEAE
Calandrinia corrigioloides

PROTEACEAE
Adenanthos argyreus
Banksia elegans
Banksia laevigata subsp. fuscolutea
Banksia sphaeroarpa var. dolichostyla
Dryandra pallida
Dryandra viscosa
Grevillea acuaria
Grevillea cagiana
Grevillea huegelii
Grevillea insignis subsp. elliotii
Grevillea luffitzii
Grevillea nematophylla
Grevillea paniculata
Hakea commutata
Hakea erecta
Hakea multilinata
Hakea scoparia
Hakea subsulcata
Isopogon gardneri
Isopogon scabriusculus subsp. stenophyllus
Persoonia helix
Petrophile circinata
Petrophile glauca
Petrophile stricta
Synapheia interioris

Thelymitra aff macrophyllum
RHAMNACEAE
Cryptandra intonsa
Cryptandra minutifolia subsp. minutifolia
Cryptandra myriantha
Cryptandra wilsonii
Stenantherum sp. Southern Ironcap
Trymalium myrtillus subsp. myrtillus

RUBIACEAE
Opecularia hispidula

RUTACEAE
Boronia inornata subsp. leptophylla
Boronia revoluta
Drummondia hassellii
Microcybe albiflora
Phebalium ambiguus
Phebalium brachycalyx
Phebalium filifolium
Phebalium tuberculatum x canaliculatum
intergrade
Phebalium tuberculatum

SANTALACEAE
Exocarpus aphyllus
Santalum acuminatum

SAPINDACEAE
Dodonaea bursariifolia
Dodonaea ceratocarpa
Dodonaea pinifolia
Dodonaea ptarmicaefolia
Dodonaea stenozyga
Dodonaea viscosa subsp. angustissima

STACKHOUSSIACEAE
Stackhousia monogyna

STERCULIACEAE
Lasiopetalum sp. Ironcaps

STYLIDIACEAE
Stylium breviscapum
Stylium sequnctus ms

ZYGOPHYLLACEAE
Zygophyllum ovatum
Appendix 4. Vegetation types occurring in each parcel of the CALM-managed conservation estate in the Shire of Lake Grace.


Percentages indicate the proportion of the total reserve area covered by each vegetation type. Where there is no percentage recorded the reserve is covered solely by the vegetation type indicated.

Key:  F&F = Conservation of Flora and Fauna  
F&F & W = Conservation of Flora and Fauna and Water  
NF = Conservation of Native Flora

<table>
<thead>
<tr>
<th>Name</th>
<th>Number</th>
<th>Class</th>
<th>Area</th>
<th>Purpose</th>
<th>Vegetation</th>
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84
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<th>Name</th>
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<th>Class</th>
<th>Area</th>
<th>Purpose</th>
<th>Vegetation</th>
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<td>Mosaic of shrublands (mallee scrub, redwood and black marlock) with medium woodland (salmon gum)</td>
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<td>Shrublands (tallerack mallee-heath)</td>
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<td>Mosaic of shrublands (mallee scrub and redwood) with medium woodland (salmon gum and morrel)</td>
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<td>Bare areas (rock outcrops)</td>
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<td>Silver Wattle Hill</td>
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### Un-Named Nature Reserves in the Shire of Lake Grace (numerical order)

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<tr>
<th>Name</th>
<th>Number</th>
<th>Class</th>
<th>Area</th>
<th>Purpose</th>
<th>Vegetation</th>
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<td>Shrublands (mallee scrub and black marlock)</td>
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<td>476</td>
<td>Shrublands (mallee scrub, redwood and black marlock)</td>
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<td>Mosaic of shrublands (mallee scrub, redwood and black marlock) with medium woodland (wando and gimlet)</td>
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</tbody>
</table>
Appendix 5. Flora species observed on Nature Reserves in the Shire of Lake Grace.

These lists are taken from reserve surveys from a variety of authors, as indicated in the reserve descriptions in Section 2.4.

**Breakaway Ridge Nature Reserve**
- Allocasuarina campestris
- Allocasuarina pinaster
- Banksia media
- Callitris preissii var verrucosa
- Callitris roei
- Dampiera linearis
- Eucalyptus astringens
- Eucalyptus tetragona
- Grevillea cagiana
- Grevillea neglecta
- Grevillea prostrata
- Hakea incressata
- Hakea lissocraphe
- Hakea laurina
- Hakea trifureata
- Lechenaultia formosa
- Melaleuca uncinata
- Santalum acuminatum

**Crooks Nature Reserve**
- Acacia acuminata
- Acacia assimilis
- Acacia erinacea
- Acacia lasiocalyx
- Allocasuarina acutivalvis
- Allocasuarina campestris
- Allocasuarina corniculata
- Allocasuarina thuyoides
- Arctotheca calendula
- Callitris roei
- Callitris verrucosa
- Calothamnus pinifolius
- Drosera macrantha
- Eucalyptus albida
- Eucalyptus astringens
- Eucalyptus calcoligone
- Eucalyptus eremophila
- Eucalyptus flocktoniae
- Eucalyptus grossa
- Eucalyptus loxophleba
- Eucalyptus pileata
- Eucalyptus redunca
- Eucalyptus salmonophloia
- Eucalyptus salubris
- Eucalyptus spathulata
- Hakea lissocraphe
- Hakea petiolaris
- Hypochoeris radicata
- Isotoma hypocrateriformis
- Leptospermum erubescens
- Limelia aeruginosa
- Malva parviflora
- Melaleuca cordata
- Melaleuca elliptica
- Melaleuca uncinata
- Melaleuca undulata
- Santalum acuminatum
- Thryptomene australis
- Vetricordia picta

**Dragon Rocks Nature Reserve (see also Appendix 6)**
- Acacia ericifolia
- Acacia lasiocalyx
- Acacia merrallii
- Acrotiche ramiflora
- Allocasuarina campestris
- Allocasuarina huegeliana
- Eucalyptus gardneri
- Eucalyptus incressata
- Eucalyptus redunca
- Gastrolobium spinosum
- Hybanthus floribundus
- Leptospermum erubescens
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<th>Melaleuca elliptica</th>
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<td>Boyra sphaerocephala</td>
<td>Melaleuca pungens</td>
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<tr>
<td>Calothamnus quadridifus</td>
<td>Melaleuca radula</td>
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<tr>
<td>Eucalyptus astringens</td>
<td>Phyllanthus calycinus</td>
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<tr>
<td>Eucalyptus emerophila</td>
<td>Pimelea suavelons</td>
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<tr>
<td>Eucalyptus falcata</td>
<td>Verticordia prissii</td>
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**Harris Nature Reserve**

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<td>Acacia intricata</td>
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<td>Hakea commutata</td>
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<td>Allocasuarina campestris</td>
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<td>Helichrysum leptophyllum</td>
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<td>Beaufortia micrantha</td>
<td>Hibbertia pungens</td>
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<td>Billardiera bicolor</td>
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<td>Caladenia filamentosa var denticulata</td>
<td>Isopogon scabriusculus</td>
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<td>Caladenia flava</td>
<td>Jacksonia racemosa</td>
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<td>Callitris preissii var verrucosa</td>
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<tr>
<td>Callitris roei</td>
<td>Lepidosperma leptostachyum</td>
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<td>Caliothamnus quadridifus</td>
<td>Lepidosperma viscidum</td>
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<td>Calytrix ciliata</td>
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<td>Diuris longifolia</td>
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<td>Melaleuca subtrigona</td>
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Dodonaea ptarmicifolia  Melaleuca uncinata
Dryandra armata    Melaleuca undulata
Dryandra cirsioides  Melaleuca urceolaris
Dryandra drummondii  Mesomelaeva stygia
Elytranthera brunennis  Mirbelia pungens
Eremophila species  Mirbelia spinosa
Eucalyptus albida  Oxylobium parviflorum var stenocarpum
Eucalyptus anceps  Petrophile divaricata
Eucalyptus depauperata  Petrophile ericifolia
Eucalyptus eremophila  Petrophile media
Eucalyptus flocktoniae  Petrophile seminuda
Eucalyptus grossa  Petrophile trifida
Eucalyptus longicornis  Pimelea aeruginosa
Eucalyptus loxophleba  Platsyace effusa
Eucalyptus occidentalis  Psammomoya choretroides
Eucalyptus ovularis  Santalum acuminatum
Eucalyptus phenophylla  Snapheia petiolaris
Eucalyptus salmonophloia  Templetonia sulcata
Eucalyptus spathulata  Tricoryne eliator
Eucalyptus transcontinentalis  Ursinia anthemoides
Exocarpus aphyllus  Verticordia brownii
Gahnia ancistrophylla  Verticordia chrysanthia
Gastrolobium parviflorum  Verticordia roei
Gastrolobium spinosum  Xanthorrhoea species

Heathland Nature Reserve
Acacia acuminata  Eucalyptus redunca
Acacia assimilis  Eucalyptus salubris
Acacia hemiteles  Gastrolobium spinosum
Acacia ixophylla  Grevillea caigiana
Acacia multispicata  Hakea crassifolia
Adenanthes argyrea  Hakea erecta
Adenanthes flaviflorus  Hakea falcata
Allocasuarina acutivalvis  Hakea incrassata
Allocasuarina corniculata  Hakea multilineata
Allocasuarina microstachya  Hakea platysperma
Banksia sphaeroarpa  Isopogon buxifolius
Banksia sphaeroarpa subsp caesia  Isopogon polypephalus
Banksia violacea  Isopogon scabriosculus
Borya sphaerocephala  Isopogon teretifolius
Callitris preissii subsp verrucosa  Isopogon villosus
Callitris verrucosa  Leptospermum erubescens
Dryandra afl cirsioides  Lobelia gibbosa
Dryandra erythrocephala  Melaleuca concinna
Eremaea pauciflora  Melaleuca cuneata
Eucalyptus albida  Mesomelaena uncinata
Eucalyptus calycogona  Petrophile ericifolia
Eucalyptus flocktoniae  Phebalium filifolium
Eucalyptus foecunda
Eucalyptus loxophleba
Eucalyptus occidentalis
Eucalyptus pheanophylla
Eucalyptus pileata
**Water Reserve 17648 (adjacent)**
Acacia lasiocalyx
Allocasuarina huegeliana
Dodonaea attenuata

Phebalium tuberculosum
Santalum acuminatum
Santalum murrayanum
Thelymitra macrophylla
Verticordia spicata

Eucalyptus salmonophloia
Melaleuca elliptica

**Kathleen Nature Reserve**
Acacia consobrina ms
Allocasuarina acutivalvis
Banksia elderiana
Balksia violacea

Grevillea pauciflora
Hibbertia gracilipes
Melaleuca uncinata
Santalum acuminatum

**Kuender Nature Reserve**
Acacia chrysella
Acacia dielsii
Acacia erinacea
Acacia graffiana
Acacia hemiteles
Acacia ixiophylla
Acacia lepton eura
Aira caryophylea
Bossiaea leptacantha
Cassytha melantha
Conostephium preissii
Darwinia diosmoides
Daviesia benthamii
Dianella revoluta
Eremophila decipiens
Eucalyptus annulata
Eucalyptus calycogona
Eucalyptus conglobata
Eucalyptus foecunda
Eucalyptus gracilis
Eucalyptus loxophleba
Eucalyptus salmonophloia
Eucalyptus sargenti
Eucalyptus spathulata

Exocarpus aphyllus
Grevillea huegelii
Hakea kippistiana
Hakea preissii
Hordeum murinum
Leptospermum erubescens
Lomandra effusa
Melaleuca acuminata
Melaleuca adnata
Melaleuca hamulosa
Melaleuca laterifolia
Melaleuca thyoides
Melaleuca uncinata
Melaleuca urceolaris
Olearia muelleri
Rhogodia spinescens
Santalum acuminatum
Sarcocornia quiqueflora
Sarcozoma praecox
Scava vola spinescens
Solanum hystrix
Templetonia sulcata
Thysanotus patersonii

**Lake Ace Nature Reserve**
Acacia aff densiflora
Acacia aff polichroa
Acacia redolens

Gtrostemon prostratus
Halosarcia halocnemoides
Halosarcia pergranulata

91
Acrotiche patula
Allocasuarina acuaria
Atriplex species
Banksia eldeiana
Callitris preissii var verrucosa
Carpobrotus sp.
Conospermum brownii
Eremophila serpens
Eremophila subteretifolia
Eucalyptus eremophila
Grevillea armigera
Grevillea prostrata

Isopogon axillaris
Lawrencia squamata
Lycium austral
Melaleuca apodocephala
Myoporum deserti
Persoonia dillwynioides
Persoonia tortifolia
Phebalium filifolium
Sarcocornia quinquflora
Scaevola bursariifolia
Wilsonia rotundifolia

Lake Biddy Nature Reserve

Acacia erinacea
Acacia hemiteles
Acacia merrallii
Artostheca calendula
Atriplex paludosa
Atriplex paludosa subsp. baudinii
Caladenia polychroma
Cryptandra glabriflora
Daviesia benthamii
Dianella revoluta
Dodonea attenuata
Enchylaena tomentosa
Eremophila decipiens
Eucalyptus anulata
Eucalyptus calycogona
Eucalyptus focktoniae
Eucalyptus gracilis
Eucalyptus kondininensis
Eucalyptus longicornis
Eucalyptus salubris
Exocarpos aphyllus
Gahnia ancistrophylla
Grevillea acuaria
Halosarcia doleiformis
Halosarcia pergranulata
Hypochoeris glabra
Melaleuca acuminata
Melaleuca adnata
Melaleuca lanceolata
Melaleuca lateriflora
Melaleuca preissiana
Melaleuca thyoides
Olearia muelleri
Phebalium tuberculatum
Pterostylis aff. rufa
Pterostylis mutica
Rhagodia preissii
Santalum acuminatum
Sarcozoma praecox
Stipa variabilis
Templetonia sulcata
Thysanotus patersonii

Lake Bryde

Acacia erinacea
Actinobole uliginosum
Artostheca calendula
Amphibromus neesii
Atriplex cinerea
Atriplex paludosa
Calandrinia calyptrata
Calotis hispidula
Carpobrotus edulis
Cassytha melantha

Melaleuca halmaturorum
Melaleuca lanceolata
Melaleuca lateriflora
Melaleuca strobophylla
Melaleuca thyoides
Melaleuca uncinata
Mesembryanthemum nodiflorum
Millotia tenuifolia
Morgania floribunda
Muehlenbeckia horrida ms
Cotula cotuloides
Crassula colorata
Danthonia setacea
Dodonaea stenozyga
Eleocharis acuta
Eucalyptus flocktoniae
Eucalyptus kondininensis
Eucalyptus occidentalis
Gahnia ancistrophylla
Goodenia viscida
Glycyrrhiza acahanthocarpa
Hordeum leporinum
Hypochaeris glabra
Lepidium rotundum
Lepidosperma brunonianum
Lomandra effusa
Lomandra micrantha
Loxocarya aspera ms
Melaleuca adnata

Olearia meulleri
Olearia revoluta
Pimelea argentea
Pittosporum phylliraeoides
Rhagodia drummondii
Rhagodia preissii
Rhodanthe pygmaea
Santalum acuminatum
Schismus barbatus
Senecio glossanthus
Senecio lartus
Stipa puberula
Taraxacum officinale
Tecticornia verrucosa
Templetonia sulpata
Thysanotus patersonii
Tripterococcus brunonii
Wahlenbergia preissii
Waitzia acuminata

East Lake Bryde
Acacia erinacea
Agrotis avencacea
Alyogyne hakeifolia
Arctotheca calendula
Atriplex cinerea
Atriplex paludosa
Bromus hordeaceus
Bulbine semibracteata
Calandrinia calyprata
Cassytha melantha
Centrolepis polygyna
Cotula bipinnata
Crassula peduncularis
Crassula sieberiana
Danthonia setacea
Daucus glochidiatus
Disphyma crassifolium
Epilobium billardierianum
Eucalyptus occidentalis
Gnaphalium sphaericum
Halosarcia pergranulata
Hordeum leporinum
Hypochaeris glabra
Melaleuca acuminata

Melaleuca adenostyla
Melaleuca halmaturorum
Melaleuca lateriflora
Melaleuca scabra
Melaleuca sparsiflora
Melaleuca strobophylla
Melaleuca uncinata
Muehlenbeckia adpressa
Muehlenbeckia horrida ms
Pentaechistis aroides
Periballia minuta
Podotheca gnaphalioiodes
Pseudognaphalium leuto-album
Puccinellia stricta
Schismus barbatus
Senecio glossanthus
Senecio quadridentatus
Spergularia diandra
Taraxacum officinale
Tecticornia verrucosa
Triglochin centrocarpa
Ursinia anthemoides
Vulpia myuros
Waitzia acuminata

Lake Cronin Nature Reserve
Amphibromus neesii

Goodenia viscida
| Eleocharis acuta | Melaleuca lanceolata |
| Glycyrrhiza acanthocarpa | Morgania floribunda |

**Lake King Nature Reserve**

| Acacia chrysellia | Grevillea pectinata |
| Acacia erinacea | Lepidosperma drummondii |
| Acacia hemitaeles | Lomandra effusa |
| Acacia merrallii | Melaleuca acuminata |
| Alyxia buxifolia | Melaleuca adnata |
| Calacenia sigmoidea | Melaleuca hamulosa |
| Cassia nemopila | Melaleuca holosericea |
| Cassytha melantha | Melaleuca lateritifolia |
| Choretrum glomeratum | Melaleuca laxiflora |
| Daviesia benthamii | Melaleuca undulata |
| Dodonaea stenozygia | Olearia muelleri |
| Duanella revoluta | Olearia revoluta |
| Enchylaena tomentosa | Pittosporum phylliraeoides |
| Eremophilia decipiens | Pterostylis vittata |
| Eucalyptus annullata | Rhagodia preissii |
| Eucalyptus eremophila | Santalum acuminatum |
| Eucalyptus flocktoniae | Scaevola spinescens |
| Eucalyptus pileata | Sollya heterophylla |
| Eucalyptus salmonophloia | Stipa elegansissima |
| Eucalyptus salubris | Templetonia sulcata |
| Grevillea huegeli | Thysanotus patersonii |

**Lakeland Nature Reserve**

| Acacia chrysellia | Eucalyptus salmonophloia |
| Allocasuarina acutifolius | Eucalyptus salubris |
| Allocasuarina corniculata | Eucalyptus spathulata |
| Alyxia buxifolia | Grevillea huegeli |
| Banksia violacea | Hakea crassifolia |
| Caladenia filamentosa var tentaculata | Hakea cygna |
| Callitris roei | Hakea lissocarpa |
| Callitris verrucosa | Hakea multilineata |
| Drosera macrantha | Isopogon cuneatus |
| Dryandra erythrocephala | Isopogon polycephalus |
| Eremaea pauciflora | Lysinema ciliatum |
| Eucalyptus calycogona | Melaleuca concinna |
| Eucalyptus eremophila | Melaleuca uncinata |
| Eucalyptus flocktoniae | Melaleuca undulata |
| Eucalyptus loxophleba | Petrophile ericifolia |
| Eucalyptus occidentalis | Pittosporum phylliraeoides |
| Eucalyptus redunca | Santalum acuminatum |
McGlin Nature Reserve
Allocasuarina activalvis
Allocasuarina campestris
Banksia sphaerocarpa var. caesia
Banksia violacea
Callitris preissii var verrucosa
Callitris roei
Calothamnus quadrifidus

Daviesia elongata subsp. implena
Gastrolobium spinosum
Hakea multilineata
Hakea scoparia
Petrophile teretifolium
Santalum acuminatum

Mordette Nature Reserve
Acacia ancistrophylla
Acacia chryssella
Acacia erinacea
Acacia hemiteles
Acacia merrallii
Acacia resinomarginea
Allocasuarina campestris
Allocasuarina huegeliana
Alyxia buxifolia
Angianthus tomentosus
Atriplex exilifolia
Atriplex hymenotherca
Atriplex paludosa subsp baudinii
Baeckeaa crispiflora
Borya sparocephala
Bossiaea leptocantha
Calandrinia eremaea
Calocephalus angiantorides
Calytris leschenaultii
Cassia pleurocarpa
Clematis microphylla
Comesperma integerrimum
Cotula coronopifolia
Cotula cotuloides
Dampiera lavandulae
Darwinia dosmoide
Dianella revoluta
Didymanthus roei
Dodonaea stenozygia
Dodonaea viscosa
Enchyela lanata
Eremophila drummondii
Eremophila maculata
Eucalyptus australis
Eucalyptus hypochlarymydea
Eucalyptus myriaden
Eucalyptus pileata
Eucalyptus salubris

Helipterum cotula
Helipterum gracile
Hibbertia rupicola
Kunzea pulchella
Lepidobolus chaetocephalus
Lepidosperma drummondii
Leptosperma roei
Lobelia heterophylla
Loxocarya aspera (ms)
Lycium australe
Maireana brevifolia
Melaleuca acuminata
Melaleuca aff lanceolata
Melaleuca elliptica
Melaleuca halmaturorum (ms)
Melaleuca lateriflora
Melaleuca laxiflora
Melaleuca thyoides
Melaleuca uncinata
Melaleuca urceolaris
Melaleuca viminea
Microcybe multiflora
Neurachne alopecuroidea
Olearia axillaris
Persoonia teretifolia
Podolepis lessonii
Podotheca angustifolia
Popolepis lessonii
Ptilotus manglesii
Ptilotus spathulatus
Rhagodia drummondii
Santalum acuminatum
Scaevola spinescens
Spartochloa scirpoidea
Stackhousia huegelii
Stylium bulbiferum
Stylium calcaratum
Stylium piliferum
Eucalyptus sargentii  
Eucalyptus spathulata  
Exocarpos aphyllus  
Grevillea armigera  
Grevillea tridentifera  
Gunniopsis intermedia  
Hakea kippistiana  
Hakea preissii  
Halgania preissiana  
Halosarcia lepidosperma  
Halosarcia microphylla  
Helichrysum filifolium  
Helichrysum leucopsdium  

Stypandra glauca  
Styphelia intertexta  
Templetonia sulcata  
Thelymitra antennifera  
Thryptomene australis  
Trachymene pilosa  
Ursinia anthemoides  
Verticordia aft preissii  
Verticordia densiflora  
Waitzia acuminata  
Waitzia aureum  
Westringia damperia  
Wilsonia humilis  

One Mile Rock Nature Reserve  

Acacia lasiocalyx  
Acacia nodiflora  
Allocasuarina acutivalvis  
Allocasuarina campestris  
Allocasuarina huegeliana  
Allocasuarina humilis  
Allocasuarina microstachya  
Allocasuarina scleroclada  
Andersonia parvifolia  
Angianthus tomentosus  
Anthotium rubiflorum  
Argyroglottis turbinata  
Aristida contorta  
Asteridea atririxoides  
Astroloma serratifoliun  
Atriplex halocnemoides  
Baeckea crispiflora  
Banksia elderiana  
Bassia diacantha  
Beaufortia micrantha  
Beaufortia schaueri  
Beyeria leschenaultii  
Billardiera angustifolia  
Boronia inconspicua  
Boronia inornata  
Borya spahocephala  
Brachyca roxiei  
Burtonia conferta  
Caladenia flava  
Calectasia cuanea  
Callitris caescens  
Callitris preissii  
Callitris roei  

Hakea subsulcata  
Helipterum tenellum  
Hemigenia eutaxioides  
Isopogon buxifolius  
Isopogon scabriusculuc  
Isotoma hypocrateriformis  
Isotoma scapigera  
Isotropis drummondii  
Juncus pallidus  
Lawrenzia diffusa  
Leptomeria preissiana  
Leptosema chambersii  
Leptospermum erubescens  
Leucopogon corynocarpus  
Leucopogon cuneifolius  
Logania buxifolia  
Logania flaviflora  
Lomandra mucronata  
Lysinina ciliatum  
Maireana brevifolia  
Maireana erioclada  
Melaleuca conferta  
Melaleuca cordata  
Melaleuca eleuterostachya  
Melaleuca elliptica  
Melaleuca hamulosa  
Melaleuca lateriflora  
Melaleuca laxiflora  
Melaleuca scabra  
Melaleuca thyoides  
Melaleuca uncinata  
Melaleuca undulata  
Microcorys exserta
Calothamnus quadrifidus
Calytrix brachyphylla
Cassia cardiasperma
Cassytha melantha
Chamelaucium pauciflorum
Cheilanthes tenuifolia
Coleanthera myrtoides
Comesperma volubile
Conospermum brownii
Conostylis androstemma
Cooperockia strophiolata
Cryptandra parvifolia
Dampiera lavandulacea
Darwinia diosmoides
Daucus glochiadiatus
Daviesia acanthoclona
Daviesia uniflora
Dodonaea amblyophylla
Dodonaea attenuata
Dodonaea bursariifolia
Dodonaea caespitosa
Dodonaea ptarmicafolia
Dryandra erythroccephala
Eriostemon rhomboideus
Eucalyptus annulata
Eucalyptus deflexa
Eucalyptus eremophila
Eucalyptus flocktoniae
Eucalyptus foecunda
Eucalyptus occidentalis
Eucalyptus pileata
Eucalyptus redunca
Eucalyptus salubris
Eucalyptus spathulata
Eucalyptus tetragonosa
Exocarpos aphyllus
Exocarpos sparteus
Frankenia drummondii
Gahnia ancistrophylla
Gastrolobium crassifolium
Glossosigrama drummondii
Grevillea concinna
Grevillea didymobotrya
Grevillea eriostachya
Grevillea eryngioides
Grevillea huegelii
Grevillea incrassata
Grevillea pauciflora
Grevillea pectinata
Microcybe albiflora
Microcybe pauciflora
Microtis unifolia
Mirbelia spinosa
Neurachne alopecuroidea
Olax benthamiana
Olearia muelleri
Oxylabium tetragonophyllum
Parapholis incurva
Persoonia stiata
Persoonia tortifolia
Petrophile seminuda
Phebalium filiflorium
Phebalium maxwellii var obovatum
Phebalium tuberculosem
Pimelea imbricata
Podolepis capillaris
Podotheca angustifolia
Prasophyllum elatum
Prasophyllum triangulare
Psammomoya choretroides
Pterostylis recurva
Pterostylis vittata
Ptilotus holosericeus
Ptilotus spathulatus
Pultenaea conferta
Rhogodia preissii
Santalum acuminatum
Santalum murrayanum
Scaevola spinescens
Senecio glossanthus
Spiculaceae ciliata
Stackhousea huegelii
Stipa elegantissima
Stylidium breviscapum
Stylidium dichotomum
Stylidium pilitferum
Stylidium repens
Stypandra imbricata
Synaphea polymorpha
Templetonia sulcata
Thelymitra nuda
Thomasia petalocalyx
Thysanotus patersonii
Triodia scariosa
Verticordia brownii
Verticordia chrysanthra
Verticordia desiflora
Verticordia pennigera
Hakea commutata  Verticordia picta
Hakea corymbosa  Verticordia plumosa
Hakea incrassata  Verticordia roei
Hakea lissocarpha  Waitzia paniculata
Hakea marginata  Waitzia suaveolens
Hakea meisneriana  Westringia cephalantha
Hakea multilineata  Westringia rigida
Hakea preissii  Wilsonia humilis
Hakea scorparia

Pallarup Nature Reserve
Acacia chrysella  Eucalyptus redunca
Acacia erinacea  Eucalyptus salmonophloia
Acacia laesiocalyx  Eucalyptus tetragona
Acacia ligulata  Gastrolobium reticulatum
Acacia saligna  Glischrocyon aureum
Adenanthera glabrescens subsp glabrescens  Grevillea huegelii
Allocasuarina campestris  Grevillea pauciflora
Allocasuarina corniculata  Grevillea prostrata
Allocasuarina huegeliana  Hakea corymbosa
Alyxia buxifolia  Hakea sphaerocephala
Angiozanthus bicolor  Halosarcia halocnemoides
Angiozanthus rufus  Halosarcia lepidasperma
Atriplex bunburyana  Halosarcia lylei
Atriplex paludosa subsp cordata  Hibbertia gaetilipes
Bankia blechnifolia  Kunzea pulchella
Bankia elideriana  Leptospermum erubescens
Bankia gardneri var hiemalis  Maireana oppositifolia
Bankia media  Melaleuca adnata
Borya sphaerocephala  Melaleuca aff halmaturorum
Cacia microbotrya  Melaleuca aff acuminata
Caladenia deformis  Melaleuca elliptica
Caladenia saccharata  Melaleuca pentagona
Calytrix leschenaultii  Melaleuca subfalcata
Cassyth glabella  Melaleuca thyoides
Conostylis argentea  Melaleuca uncinata
Cyanicula deformis  Microtis media subsp media
Daviesia benthamii  Phebalium microphylhum
Dodonaea ptarmicifolia  Pierostylis mutiea
Dodonaea viscosa  Santalum acuminatum
Eremophila decipiens  Santalum murrayanum
Eremophila subteretifolia  Santalum spicatum
Eriochilus dialatus subsp undulatus  Scaevola depauperata
Eucalyptus aff dissimiliar  Stipa elongantissima
Eucalyptus decipiens  Templetonia sulcata
Eucalyptus foecunda  Thysanotus aff lavanduliflora
Eucalyptus incrassata  Verticordia brownii
Eucalyptus kondininensis  Verticordia densiflora
Eucalyptus occidentalis  Verticordia pholidophylla
Eucalyptus perangusta  Westringia dampieri

Rock View Nature Reserve
Acacia glaucoptera  Eucalyptus pileata
Acacia lasiocalyx  Eucalyptus redunca
Acacia leptoneura  Eucalyptus spathulata
Adenantheros sericeus  Gastrolobium spinosum
Allocasuarina acutivalvis  Grevillea excelsior
Allocasuarina campestris  Grevillea shuttleworthiana
Allocasuarina coriculata  Hakea crassifolia
Allocasuarina humilis  Hakea falcata
Allocasuarina microstachya  Hakea incrassata
Baeceka leptoneura  Hakea lissocarpha
Banksia sparoecarpa var caesia  Hakea multilineata
Banksia violacea  Hakea petiolaris
Beaufortia micrantha  Isopogon polycephalus
Caladenia saccharata  Isopogon villosus
Callitris morrisonii  Leptomaria preissiana
Callitris preissii var verrucosa  Leptospermum erubescens
Callitris roei  Leptospermum spinescens
Callitris verrucosa  Lysinema ciliatum
Calothamnus quadrifidus  Melaleuca cordata
Daviesia elongata subsp simplex  Melaleuca elliptica
Drosera macrantha  Melaleuca laxiflora
Dryandra erythrocephala  Melaleuca radula
Dryandra pteridifolia  Melaleuca scabra
Dryandra sessilis  Melaleuca uncinata
Eucalyptus albida  Melaleuca undulata
Eucalyptus anceps  Mesomelaena uncinata
Eucalyptus calyceogona  Petrophile divaricata
Eucalyptus eremophila  Petrophile ericifolia
Eucalyptus falcata  Petrophile trifida
Eucalyptus flocktoniae  Pimelia serruginosa
Eucalyptus foecunda  Santalum acuminatum
Eucalyptus grossa  Santalum murrayanum
Eucalyptus incrassata  Thryptomene australis

Silver Wattle Nature Reserve
Allocasuarina acutivalvis  Grevillea eryyngioides
Allocasuarina campestris  Grevillea prostrata
Allocasuarina humilis  Hakea bacterii
Allocasuarina pinaster  Hakea ferruginia
 Banksia violacea  Hakea incrassata
 Callitris roei  Hakea lissocarpha
 Daviesia incrassata  Hakea multilineata
 Dryandra drummondii  Hakea trifurcata

99
<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
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<tbody>
<tr>
<td>Eucalyptus astringens</td>
<td>Lysinema ciliatum</td>
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<td>Eucalyptus salmonophloia</td>
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<td>Eucalyptus tetragona</td>
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<td>Gastrolobium spinosum</td>
<td>Xanthorrhoea nana</td>
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**South Bunche Nature Reserve**

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<td>Andersonia a/l carinata</td>
<td>Lasiopetalum molle</td>
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<td>Banksia sphaerocarpa var caesia</td>
<td>Lysinema ciliatum</td>
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<td>Callitris roei</td>
<td>Melaleuca uncinata</td>
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<td>Callitris verrucosa</td>
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<td>Dryandra sessilis</td>
<td>Synaphea petiolaris</td>
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<td>Eucalyptus occidentalis</td>
<td>Verticordia integra</td>
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<td>Gastrolobium spinosum</td>
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**South Kuender Nature Reserve**

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<td>Acacia hemiteles</td>
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<td>Acacia merrallii</td>
<td>Helichrysum leucopsidium</td>
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<td>Helipterum gracile</td>
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<td>Angianthus iomentosus</td>
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<td>Astartea heteranthera</td>
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Eucalyptus salubris  
Eucalyptus sargentii  
Eucalyptus spathulata  
Exocarpos aphyllus  
Frankenia pauciflora  
Gahnia ancistrophylla  
Gnephosis tridens  
Gunniopsis intermedia  
Hakea arida  
Hakea kippistiana  
Hakea preissii  

Sclerostegia moniliformis  
Senecio quadridentatus  
Stipa elegantissima  
Styphelia intertexta  
Templetonia sulcata  
Thysanotus patersonii  
Trachymene pilosa  
Ursinia anthemoides  
Waitzia aureum  
Waitzia paniculata  
Wilsonia humilis
Appendix 6. Flora observed on Dragon Rocks Nature Reserve.

This plant list is taken from ‘Flora and Vegetation Survey of Dragon Rocks Nature Reserve (No. A 36128)’ by Anne Coates, 1992. Only native species are included here.

**PTERIDOPHYTA (ferns)**

**ADIANTAEEAE**
- Cheilanthes austrotenifolia
- Cheilanthes distans

**GYMNOSPERMAE**

**CUPRESSACEAE**
- Callitris canescens
- Callitris preissii subsp verrucosa
- Callitris roei

**MONOCOTYLEDONAE**

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<td>Lexocarya parthenica ms</td>
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**HYPOXIDACEAE**

- Hypoxis glabella
- Hypoxis occidentalis

**IRIDACEAE**

- Patersonia juncea

**COLCHICACEAE**

- Wurmbea sinora

**HAEMODORACEAE**

- Anigozanthos humilis
- Conostylis aculeata subsp aculeata
- Conostylis argentea
- Conostylis petrophiloides
- Conostylis setigera
- Conostylis villosa

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<th>XANTHORRHOEACEAE</th>
<th>ORCHIDACEAE (continued)</th>
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<td>CASUARINACEAE</td>
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<td>Senecio laetus subp dissectfolius</td>
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<td>Vittadinia australasica</td>
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CRASSULACEAE
Crassula colorata

DILLENIACEAE
Hibbertia crassifolia
Hibbertia erinacea
Hibbertia exasperata
Hibbertia glomerosa
Hibbertia gracilipes
Hibbertia sp. mucronata
Hibbertia recurvifolia
Hibbertia rupicola

DROSERACEAE
Drosera androsacea ms
Drosera barbiger a
Drosera leucobasta
Drosera macrantha subsp. planchonii
Drosera pycnoblasta
Drosera stricticulis
Drosera subhirtella subsp. subhirtella
Drosera zonaria

EPACRIDACEAE
Acrotiche patula
Andersonia lehmanniana subsp. pubescens
Andersonia parvifolia
Astroloma epacridis
Astroloma recurvum ms
Astroloma serratifolium
Coleanthera myrtoides
Leucopogon constestio rhoides
Leucopogon crassifolius
Leucopogon cuneifolius
Leucopogon dielsianus
Leucopogon hamulosus
Leucopogon minutifolius
Leucopogon obtusatus
Leucopogon oxycedrus
Leucopogon ozothamnoides
Leucopogon tamminensis
Lysinema ciliatum
Styphelia tenuiflora

EUPHORBIACEAE
Beyeria brevifolia
Montaxis grandiflora
Phyllanthus calycinus
Ricinocarpus glaucus
Stachysemnon polyandrus

GERANIACEAE
Pelargonium havlasea

GOODENIACEAE
Anthotium rubriflorum
Coopernookia stroppiolata
Dampiera angulata

GOODENIACEAE
Dampiera eriocephala
Dampiera heteroptera
Dampiera haematotricha
Dampiera lavandulacea
Dampiera obliqua
Dampiera oligophylla
Dampiera oligophylla subsp. juncea
Dampiera welsiana
Goodenia caerulea
Goodenia incana
Goodenia pinifolia
Goodenia scapigera
Goodenia watsonii
Lechenaultia biloba
Lechenaultia formosa
Scaevola helmsii
Scaevola spinescens
Velleia trinervis

GYROSTEMONACEAE
Gyrostemon subnudus

HALORAGACEAE
Glischrocyron aureum
Glischrocyron flavescens

LAMIACEAE
Microcorys ericifolia
Microcorys obovata
Microcorys subcanescens
Westringia cephalanatha
Westringia rigida

LAURACEAE
Cassytha melanthera
Cassytha pomiformis

LOBELIACEAE
Isotoma hypocrateriformis
Lobelia rorifolia

LOGANIACEAE
Logania flaviflora
Logania tortuosa

MIMOSACEAE
Acacia acanthoclada
Acacia acuminata
Acacia acutata
Acacia assimilis
Acacia assimilis subsp. atroviridis
Acacia beauverdiana
Acacia bidentat
Acacia brumalis ms
Acacia brachyclada
Acacia chryselia
Acacia chrysocephala
MIMOSACEAE (continued)
Acacia chrysophoda
Acacia ephedroides
Acacia erinacea
Acacia intricata
Acacia latialyx
Acacia lastiocarpa var. sedifolia
Acacia lastiocarpa var. bracteolata
Acacia leptopetala
Acacia leptospermoides subsp. leptospermoides
Acacia merinthophora
Acacia merrallii
Acacia microbotrya
Acacia mimica ms
Acacia moirii subsp recurvistipula
Acacia multisepca
Acacia myrtifolia
Acacia newbyi
Acacia pulchella var. glaberrima
Acacia pulchella var. goodbyi
Acacia pygmemphala
Acacia rostellata ms
Acacia saligna
Acacia sedifolia subsp pulvinata
Acacia shuttleworthii
Acacia spathalata subsp recurva
Acacia spathalata subsp. spathalata
Acacia sulphata var platypylla
Acacia tetanophylla Dragon Rocks Variant
Acacia trigonophylla
Acacia uncinella
Acacia unifissilis
Acacia verricula

MYOPOROACEAE
Eremophila decipiens
Eremophila drummondii

MYRTACEAE
Baeckea cristaflora
Baeckea cryptandroides
Baeckea preissiana
Beaufortia bracteosa
Beaufortia interstans
Beaufortia micrantha
Beaufortia orbifolia
Beaufortia schauei
Callistemon phoeniceus
Calothamnus huegelli
Calothamnus quadrifidus
Calothrix breviseta subsp stipulosa
Calothrix leschenaultii
Calothrix simplex subsp suboppositifolia
Calothrix stipulosa
Calothrix strigosa
Calothrix violacea
Chamelaucluim ciliatum
Chamelaucluim pauciflorum subsp pauciflorum

MYRTACEAE (continued)
Chamelaucluim naviculum ms
Eremea pauciflora
Eucalyptus albida
Eucalyptus anceps
Eucalyptus astringens
Eucalyptus argyrocaulon ms
Eucalyptus calycogona
Eucalyptus capillosa subsp polyclada
Eucalyptus cealoides
Eucalyptus densa
Eucalyptus dissimulata
Eucalyptus eremophila
Eucalyptus flocktoniae
Eucalyptus gardneri
Eucalyptus hypocalyymdea subsp ecdysiastes
Eucalyptus incrassata
Eucalyptus loxophleba
Eucalyptus longicornis
Eucalyptus microschema
Eucalyptus occidentalis
Eucalyptus olivacea ms
Eucalyptus ornata
Eucalyptus phaeophylla
Eucalyptus pileata
Eucalyptus plauroicalis
Eucalyptus salmonophalloa
Eucalyptus salubris
Eucalyptus spathulata
Eucalyptus sporadicus ms
Eucalyptus ait transcontinentalis
Kunzea jucunda
Kunzea micromera
Kunzea preissiana
Kunzea pulchella
Leptospermum erubescens
Leptospermum incanum
Leptospermum inelegans
Leptospermum nitens
Leptospermum spinescens
Melaleuca acuminata
Melaleuca adnata
Melaleuca cordata
Melaleuca coronica subsp coronica ms
Melaleuca depauperata
Melaleuca elliptica
Melaleuca eleuterostachya
Melaleuca fissurata ms
Melaleuca fulgens
Melaleuca hamulosa
Melaleuca h panorana ms
Melaleuca lateriflora
Melaleuca laxiflora
Melaleuca lecanantha ms
Melaleuca leptospermoides
Melaleuca pentagona
Melaleuca platycalyx
Melaleuca pungens
MYRTACEAE (continued)
Melaleuca scabra
Melaleuca seritata
Melaleuca spicigera
Melaleuca subtrigona
Melaleuca uncinata
Micromyrtus obovata
Micromyrtus racemosa var. latifolia
Regelia inops
Thryptomene australis
Verticordia acerosa var. pressii
Verticordia chrysanthi
Verticordia chrysanthella
Verticordia densiflora var. cespitosa
Verticordia eterocephala
Verticordia gracilis
Verticordia habrantha
Verticordia inclusa
Verticordia integra
Verticordia multiflora subsp. multiflora
Verticordia multiflora subsp. solax
Verticordia pennigera
Verticordia picta
Verticordia plumosa var. incrassata
Verticordia roei
Verticordia serrata
Verticordia tumida
Verticordia tumida subsp. therogana

OLACACEAE
Olax benthamiana

PAPILIONACEAE
Bossiaea concinna
Bossiaea preissii
Bossiaea walkeri
Chorizema aciculare
Daviesia abnormis
Daviesia audax ms
Daviesia benthami
Daviesia hakeoides
Daviesia intricata ms
Daviesia lancifolia
Daviesia patens ms
Daviesia rhombifolia
Daviesia spiralis
Daviesia uncinata ms
Daviesia uniflora
Dillwynia uncinata
Gastrolobium crassifolium
Gastrolobium densifolium
Gastrolobium parviflorum
Gastrolobium spinosum
Gastrolobium spinosum var. crassifolium
Gompholobium aristatum
Gompholobium gompholobioides
Isotropis drummondii
Jacksonia condensata

PAPILIONACEAE (continued)
Jacksonia racemosa
Mirbelia dilatata
Mirbelia floribunda
Mirbelia ramulosa
Mirbelia spinosa
Nemcia carinata
Nemcia hookeri
Nemcia punctata
Pultenaea neurocalyx
Pultenaea aff. verruculosa
Templetonia sulcata
Urodon dasyphyllos ms

PITTOSPORACEAE
Cheiranthera filifolia var. filifolia
Pittosporum phylliraeoides var. microcarpa

POLYGALACEAE
Comesperma calycomega
Comesperma drummondii
Comesperma scoparium
Comesperma volubile

POLYGONACEAE
Muehlenbeckia adpressa

PORTULACACEAE
Calandrinia eremae

PROTEACEAE
Adenanthos argyrius
Adenanthos flaviflorus
Bankia audax
Bankia elderiana
Bankia sparoecarpa var. caesia
Bankia violacea
Conospermum bracteosum
Conospermum croninae ms
Conospermum filifolium ms
Conospermum stoechosidis
Dryandra cirsioides
Dryandra drummondii
Dryandra erythrophylla
Dryandra ferruginea
Dryandra aff. nivea
Grevillea cagiana
Grevillea eriostachya
Grevillea eringoides
Grevillea didymobotrya subsp. didymobotrya
Grevillea haplantha
Grevillea hughellii
Grevillea integrifolia subsp. biiformis
Grevillea integrifolia subsp. shuttleworthiana
Grevillea involucrata
Grevillea oligantha
Grevillea petrophiloides
Grevillea pilosa
PROTEACEAE (continued)
Grevillea prostrata
Grevillea teretifolia
Grevillea wittweri
Haakea corymbosa
Haakea crassifolia
Haakea cygna subsp cygna
Haakea erecta
Haakea gilbertii
Haakea horrida
Haakea incassata
Haakea lissocarpha
Haakea marginata
Haakea meisneriana
Haakea multilineata
Haakea newbeyana
Haakea obliqua
Haakea petiolaris
Haakea prostrata
Haakea scoparia
Haakea strumosa
Haakea subsulcata
Haakea trifurcata
Isopogon aff buxifolius
Isopogon divergens
Isopogon aff formosus
Isopogon scabriusculus
Isopogon teretifolius
Isopogon villosus
Persoonia corticea
Persoonia diadenia
Persoonia hakeiformis
Persoonia quinquenervis
Persoonia striata
Persoonia trinervis
Petrophile cirknata
Petrophile ericifolia
Petrophile longifolia
Petrophile seminuda
Petrophile squamata
Petrophile trifida
Stirlingia simplex
Synaphea aff spinulosa

RUTACEAE
Boronia coerulescens
Boronia crassifolia
Boronia crenulata var crenulata
Boronia subsessilis
Drummondia hassellii var hassellii
Eriostemon gardneri
Microcybe multiflora var baccharoides
Phebalium ambiguum
Phebalium filifolium
Phebalium lepidotum
Phebalium tuberculatum
Phebalium tuberculatum var megaphyllum

SANTALACEAE
Exocarpos aphyllus
Exocarpos sparteus
Leptomeria pauciflora
Leptomeria preissiana
Santalum acuminatum
Santalum murrayanum

SAPINDACEAE
Dodonaea amblyophylla
Dodonaea bursariifolia
Dodonaea caespitosa
Dodonaea pinifolia
Dodonaea ptarmicaefolia
Dodonaea viscosa subsp angustissima

STACKHOUSIAEACEAE
Stackhousia monogyna
Stackhousia muricata
Stackhousia scoparia
Tripterococcus brunonis

STERCULLIACEAE
Lasiopetalum indutum
Lasiopetalum microcarpium
Lysiosepalum involucratum

STYLIDIACEAE
Levenhookia pauciflora
Levenhookia pusilla
Stylium breviscapum
Stylium calcaratum
Stylium dichotomum
Stylium leptophyllum
Stylium luteum subsp olavatum
Stylium neglectum
Stylium nungarinense
Stylium piliferum
Stylium piliferum subsp minor
Stylium repens
Stylium sacculatum ms
Stylium schoenoides
Stylium squamellosum
THYMELAEACEAE
Pimelea aeruginosa
Pimelea angustifolia
Pimelea argentea
Pimelea brevifolia
Pimelea graniticola
Pimelea imbricata var piligera
Pimelea suaveolens subsp flava
Pimelea sulphurea

VIOLACEAE
Hybanthus floribundus
Appendix 7. Priority Flora within or near the Shire of Lake Grace.
Source: CALM, South Perth.

Priority 1 Flora

Acacia diminuta ms
Acacia mutabilis subsp stipulifera ms
Acacia schlerophylla var teretiuscula
Acacia tetraneura ms
Astur-tea sp. Jerdacuttup (A. Strid 21898)
Bossiaea strigillosa
Drosera grievei
Drosera salina
Dryandra corvijuga
Eutaxia sp. Hatter Hill (K.R. Newbey 6532) ms
Frankenia glomerata
Gastrolobium propinquum
Goodenia integerrima
Grevillea luffitzi
Guichenotia anota ms
Guichenotia apetala
Hakea cygna subsp needlei
Hydrocotyle hexaperta ms

Hydrocotyle muriculata
Lasiopetalum sp. Ironcaps (P.G. Wilson 70^*^4
Melaleuca agathosmioides
Melaleuca sculponeata
Microcybe pauciflora subsp grandis ms
Mirabella densiflora
Muehlenbeckia horrida subsp abdita
Phebalium drummondii
Pimelea halophila
Ptilotus caespitosus
Spyridium glaucum
Stylidium pulviniforme
Stylidium sejunctum
Styphelia pulchella
Thysanotus acerosiflorus
Thysanotus lavanduliflorus
Thysanotus sabulosus
Trymalium myrtillus subsp pungens

Priority 2 Species

Acacia castanostegia ms
Acacia drewiana subsp minor
Acacia heterochroa subsp robertii
Acacia laricina var. crassifolia ms
Acacia schlerophylla var pilosa ms
Acacia tuberculata ms
Acrotiche patula
Asturtia clavifolia
Astroloma microphyllum
Bentleya diminuta
Blennospora phlegmatocarpa
Caladenia caesarea subsp multiflora
Caladenia melanema ms
Conostylis seorsiflora subsp Nyabing (A. Coates s.n.)
Cryptandra dielsii ms
Cryptandra inconspicua ms
Dampiera orchardii
Daviesia elongata subsp impexa
Daviesia lineata
Daviesia rhizomata
Daviesia tortuosa
Dryandra epimicta
Dryandra erythrocephala var inopinata

Eriostemon cymbiformis
Eucalyptus angustissima subsp quaerenda
Eucalyptus microchema
Eucalyptus mimica ms
Fitzillia axilliflora
Gastrolobium rigidum
Gastrolobium densifolium
Gonocarpus ericifolius
Goodenia trichophylla
Grevillea wittiweri
Guichenotia asteriskos ms
Haegiela tatei
Kulinia eludens ms
Levehookia pulcherrima
Micromyrtus racemosa var latifolia ms
Millitia steetziana
Nemcia effusa
Olearis laciniifolia
Persoonia brevivachis
Persoonia hakeiformis
Rinzia affinis
Synaphea canaliculata
Synaphea flexuosa
Priority 2 Species (continued)
Dryandra foliosissima  
Dryandra idiogenes  

Priority 3 Species
Acacia bifaria  
Acacia brachyphylla var recurvata  
Acacia durabilis  
Acacia glaucissima ms  
Acacia heterochroa subsp heterochroa  
Acacia mutabilis subsp rhynochophylla ms  
Acacia obesa  
Acacia phlebopetala var phlebopetala  
Acacia pinguiculosa subsp pinguiculosa ms  
Acacia repanda  
Acacia sedifolia subsp. pulvinata ms  
Acacia singulata  
Acacia tetraptera ms  
Acacia undosa  
Adenanthis gracilipes  
Baeckea sp. Hyden (J.M. Brown 141)  
Boronia oxyantha var brevicalyx  
Boronia penicillata  
Bossiaea divaricata  
Calatix nematoclada  
Chorisema trigonium  
Cryptandra polyclada subsp polyclada  
Daviesia uncinata  
Dickstrylis glauca  
Dryandra ferruginea subsp chelomacarpa  
Dryandra ferruginea subsp flavescens  

Priority 4 Species
Banksia laevigata subsp. laevigata  
Calamphoneus inflatus ms  
Daviesia purpusascens  
Dryandra porrecta  
Eremophila serpens  
Eucalyptus caesia subsp caesia  
Eucalyptus deflexa  
Eucalyptus georgei subsp fulgida  
Grevillea asteriscosa

Synapheia parviflora  
Synapheia tripartita  

Dryandra praemorsa var praemorsa  
Dryandra viscidula  
Dryandra xylothemelia  
Eucalyptus continens ms  
Eucalyptus depauperata  
Eucalyptus exigua  
Grevillea aneura  
Grevillea fulgens  
Grevillea insignis subsp elliotii  
Grevillea newbeyi  
Grevillea pilosa subsp redacta  
Gyrostemon prostratus  
Jacksonia elongata ms  
Lasiopetalum fitzgibbonii  
Melaleuca polycephala  
Microseris scapigera  
Monotoca leucantha  
Pimelea graniticola  
Scarocarpinia globosa  
Schoenus calcutus  
Siegfriedia darwinoides  
Spyridium mucronatum subsp recurvum  
Stylium pseudohirsutum  
Synapheia bifurcata  
Thysanotus cymosus  
Verticordia gracilis

Grevillea prostrata  
Melaleuca cliffortioides  
Melaleuca fissurata  
Pimelea physodes  
Rinzia crassifolia  
Thysanotus glaucus  
Verticordia integra  
Verticordia mult flora subsp multiflora
Appendix 8. Mammals of the CALM Katanning District.

This appendix lists information from Sanders and Harold (1991) *An Inventory of Mammals, Amphibians and Reptiles in the Wheatbelt Region of Western Australia*, Department of Conservation and Land Management; and from the Department of Conservation and Land Management Katanning District Office (unpublished records).

Conservation Status Key
- **AR**: At risk within the region.
- **E**: Extinct throughout its former range.
- **ER**: Extinct within the region.
- **G1**: Gazetted as Schedule 1 under the Wildlife Conservation Act 1950.
- **NR**: Not recorded in the region since 1980.
- **PO**: Possibly occurring in the region but not yet recorded.
- **RP**: Have population mainly within the region.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Conservation Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ash-grey Mouse</td>
<td><em>Pseudomys albocinereus</em></td>
<td>ER, G1</td>
</tr>
<tr>
<td>Barred Bandicoot</td>
<td><em>Perameles bougainville</em></td>
<td></td>
</tr>
<tr>
<td>Bat</td>
<td><em>Eptesicus finlaysoni</em></td>
<td></td>
</tr>
<tr>
<td>Bat</td>
<td><em>Fallosirellus mackenziei</em></td>
<td></td>
</tr>
<tr>
<td>Bilby</td>
<td><em>Macrotis lagotis</em></td>
<td>ER, G1</td>
</tr>
<tr>
<td>Blunt-faced Mouse</td>
<td><em>Pseudomys shortridgei</em></td>
<td>G1, AR</td>
</tr>
<tr>
<td>Brown Bandicoot</td>
<td><em>Isoodon obesulus fusciventer</em></td>
<td>G1, AR</td>
</tr>
<tr>
<td>Brown hopping Mouse</td>
<td><em>Notomys alexis</em></td>
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</tr>
<tr>
<td>Brush-tailed Phascogale</td>
<td><em>Phascogale tapoatafa</em></td>
<td></td>
</tr>
<tr>
<td>Brush-tailed Possum</td>
<td><em>Trichosurus vulpecula</em></td>
<td></td>
</tr>
<tr>
<td>Burrowing Rat-Kangaroo</td>
<td><em>Bettongia lesueur</em></td>
<td>ER, G1</td>
</tr>
<tr>
<td>Chocolate Wattled Bat</td>
<td><em>Chalinolobus morio</em></td>
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<tr>
<td>Chudditch</td>
<td><em>Dasyurus geoffroii</em></td>
<td>G1, AR</td>
</tr>
<tr>
<td>Common Dunnart</td>
<td><em>Sminthopsis gilberti</em></td>
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</tr>
<tr>
<td>Common Dunnart</td>
<td><em>Sminthopsis griseoventer</em></td>
<td>PO, NR</td>
</tr>
<tr>
<td>Common Ringtail Possum</td>
<td><em>Pseudocheirus peregrinus occidentalis</em></td>
<td>G1, AR, NR</td>
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<tr>
<td>Crescent Nail-tailed Wallaby</td>
<td><em>Onychogalea lunata</em></td>
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<tr>
<td>Dingo</td>
<td><em>Canis familiaris</em></td>
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</tr>
<tr>
<td>Echidna</td>
<td><em>Tachyglossus aculeatus</em></td>
<td></td>
</tr>
<tr>
<td>Fan-tailed Dunnart</td>
<td><em>Sminthopsis crassicaudata</em></td>
<td></td>
</tr>
<tr>
<td>Gould’s Long-eared Bat</td>
<td><em>Nyctophilus gouldi</em></td>
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</tr>
<tr>
<td>Greater Long-eared Bat</td>
<td><em>Nyctophilus major</em></td>
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<td>Honey Possum</td>
<td><em>Tarsipes rostratus</em></td>
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<tr>
<td>Kultarr</td>
<td><em>Antichinimys laniger</em></td>
<td>NR</td>
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<tr>
<td>Lesser Long-eared Bat</td>
<td><em>Nyctophilus geoffroyi</em></td>
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<tr>
<td>Little Mastiff Bat</td>
<td><em>Mormopterus planiceps</em></td>
<td>NR</td>
</tr>
<tr>
<td>Mardo</td>
<td><em>Anthechius flaviceps</em></td>
<td>NR</td>
</tr>
<tr>
<td>Mitchell’s Hopping-mouse</td>
<td><em>Notomys mitchelli</em></td>
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</tr>
<tr>
<td>Numbat</td>
<td><em>Myrmecobius fasciatus</em></td>
<td>G1, AR</td>
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111
<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Conservation Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red-tailed Phascogale</td>
<td><em>Phascogale calura</em></td>
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<tr>
<td>South-west Pygmy Possum</td>
<td><em>Cercartetus concinnus</em></td>
<td>G1, AR</td>
</tr>
<tr>
<td>Tammar Wallaby</td>
<td><em>Macropus eugenii</em></td>
<td>G1, AR</td>
</tr>
<tr>
<td>Water Rat</td>
<td><em>Hydromys chrysogaster</em></td>
<td>NR</td>
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<tr>
<td>Western Broad-nosed Bat</td>
<td><em>Scoiorepens balstoni</em></td>
<td>NR</td>
</tr>
<tr>
<td>Western Brush Wallaby</td>
<td><em>Macropus irma</em></td>
<td>G1, AR, RP</td>
</tr>
<tr>
<td>Western Grey Kangaroo</td>
<td><em>Macropus fuliginosus</em></td>
<td>G1, AR, RP</td>
</tr>
<tr>
<td>Western Mouse</td>
<td><em>Pseudomys occidentalis</em></td>
<td>G1, AR, RP</td>
</tr>
<tr>
<td>White Striped Bat</td>
<td><em>Tadarida australis</em></td>
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<tr>
<td>White-tailed Dunnart</td>
<td><em>Sminthopsis granulipes</em></td>
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<tr>
<td>Woylie</td>
<td><em>Bettonogia penicillata</em></td>
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</table>

This appendix lists fauna recorded at Nature Reserves in the Shire of Lake Grace by staff of the Katanning District office of CALM between 1984 and 1990.

### Mammals

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Nature Reserve observation</th>
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<tbody>
<tr>
<td>Western Grey Kangaroo</td>
<td><em>Macropus fuliginosus</em></td>
<td>Breakaway Ridge, Crooks, Dunn Rock, Harris, Kuender, Lake Biddy, Lakeland, Lockhart, McGlin, Mordette, One Mile Rock, Rock View, Silver Wattle Hill, South Buniche, South Kuender</td>
</tr>
<tr>
<td>Western Brush Wallaby</td>
<td><em>Macropus irma</em></td>
<td>Breakaway Ridge, Dunn Rock, Harris, Lockhart, McGlin, One Mile Rock, Rock View</td>
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<tr>
<td>Euro, Common Wallaroo</td>
<td><em>Macropus robustus</em></td>
<td>South Buniche</td>
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<tr>
<td>Brush-tailed Possum</td>
<td><em>Trichosurus vulpecula</em></td>
<td>Lake Biddy</td>
</tr>
<tr>
<td>Echidna</td>
<td><em>Tachyglossus aculeatus</em></td>
<td>Crooks, Dunn Rock, Lake Biddy, Lockhart, Rock View</td>
</tr>
<tr>
<td>Dalgyte or Bilby</td>
<td><em>Macrotis lagotis</em></td>
<td>McGlin</td>
</tr>
<tr>
<td>Western Mouse</td>
<td><em>Pseudomys occidentalis</em></td>
<td>Harris</td>
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</table>

### Reptiles

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Nature Reserve observation</th>
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<tbody>
<tr>
<td>Bobtail</td>
<td><em>Tiliqua rugosa</em></td>
<td>Crooks, Dunn Rock, Harris, Kuender, Lake Biddy, Lakeland</td>
</tr>
<tr>
<td>Dragon Lizard</td>
<td><em>Amphibolurus maculatus</em></td>
<td>Rock View</td>
</tr>
<tr>
<td>Dragon Lizard</td>
<td><em>Ctenophorus salinarum</em></td>
<td>Mordette</td>
</tr>
<tr>
<td>Fraseri Legless Lizard</td>
<td><em>Delma fraseri</em></td>
<td>Lake Biddy</td>
</tr>
<tr>
<td>Gecko</td>
<td><em>Gehyra variegata</em></td>
<td>Crooks</td>
</tr>
<tr>
<td>Legless Lizard</td>
<td><em>Delma australis</em></td>
<td>Harris</td>
</tr>
<tr>
<td>Ornate Dragon Lizard</td>
<td><em>Ctenophorus ornatus</em></td>
<td>Crooks, Rock View, Dunn Rock</td>
</tr>
<tr>
<td>Skink</td>
<td><em>Lerista distinguenda</em></td>
<td>Dunn Rock</td>
</tr>
<tr>
<td>Skink</td>
<td><em>Morethia obscura</em></td>
<td>Dunn Rock, Harris, Lake Biddy</td>
</tr>
<tr>
<td>Western Bluetongued Lizard</td>
<td><em>Tiliqua occipitalis</em></td>
<td>Breakaway Ridge, Harris, Lakeland, Rock View, South Kuender</td>
</tr>
<tr>
<td>Snake</td>
<td><em>Rhinoplocephalus nigricans</em></td>
<td>Harris</td>
</tr>
<tr>
<td>Gould’s Snake</td>
<td><em>Rhinoplocephalus gouldii</em></td>
<td>Harris</td>
</tr>
<tr>
<td>Common Name</td>
<td>Scientific Name</td>
<td>Nature Reserve observation</td>
</tr>
<tr>
<td>---------------------------</td>
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<tr>
<td>Black-faced Cuckoo-shrike</td>
<td><em>Coracina novaehollandiae</em></td>
<td>Rock View</td>
</tr>
<tr>
<td>Blue Wren (sp uncertain)</td>
<td><em>? Malurus pulcherrimus</em></td>
<td>Rock View</td>
</tr>
<tr>
<td>Brown Honeyeater</td>
<td><em>Lichmera indistincta</em></td>
<td>Rock View</td>
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<tr>
<td>Brown Thornbill</td>
<td><em>Acanthiza pusilla</em></td>
<td>Rock View</td>
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<tr>
<td>Brown-headed Honeyeater</td>
<td><em>Melithreptus brevirostris</em></td>
<td>Rock View</td>
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<tr>
<td>Common Bronzewing</td>
<td><em>Phaps chalcoptera</em></td>
<td>Rock View</td>
</tr>
<tr>
<td>Emu</td>
<td><em>Dromaius novaehollandiae</em></td>
<td>Rock View</td>
</tr>
<tr>
<td>Grey Butcherbird</td>
<td><em>Cracticus torquatus</em></td>
<td>Rock View</td>
</tr>
<tr>
<td>Mallee-fowl</td>
<td><em>Leipoa ocellata</em></td>
<td>Rock View</td>
</tr>
<tr>
<td>Purple-gaped Honeyeater</td>
<td><em>Lichenostromus cratius</em></td>
<td>Rock View</td>
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<tr>
<td>Red Wattlebird</td>
<td><em>Anthochaera carunculata</em></td>
<td>Rock View</td>
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<tr>
<td>Richard’s Pipit</td>
<td><em>Anthus novaeseelandiae</em></td>
<td>Rock View</td>
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<tr>
<td>Southern Boobook</td>
<td><em>Ninox novaeseelandiae</em></td>
<td>Rock View</td>
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<tr>
<td>Tawny-crowned Honeyeater</td>
<td><em>Phylidonyris melanops</em></td>
<td>Rock View</td>
</tr>
<tr>
<td>Western Magpie</td>
<td><em>Gymnorhina tibicen race dorsalis</em></td>
<td>Rock View</td>
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<tr>
<td>Western Yellow Robin</td>
<td><em>Eopsaltria griseogularis</em></td>
<td>Rock View</td>
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<tr>
<td>White-browed Scrubwren</td>
<td><em>Sericornis frontalis</em></td>
<td>Rock View</td>
</tr>
<tr>
<td>White-eared Honeyeater</td>
<td><em>Lichenostomus leucotis</em></td>
<td>Rock View</td>
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<tr>
<td>White-fronted Chat</td>
<td><em>Ephthianura albifrons</em></td>
<td>Rock View</td>
</tr>
<tr>
<td>Willie Wagtail</td>
<td><em>Rhipidura leucophyrs</em></td>
<td>Rock View</td>
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</table>
Appendix 10. Native fauna observed at Dragon Rocks Nature Reserve.


Mammals

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
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<tr>
<td>BURRAMYIDAE</td>
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<tr>
<td>Western Pygmy Possum</td>
<td>Cercartetus concinnus</td>
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<tr>
<td>DASYURIIDAE</td>
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<tr>
<td>Kultarr</td>
<td>Antechinomys laniger spenceri</td>
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<tr>
<td>Ningaui</td>
<td>Ningaui yvonnae</td>
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<td>Phascogale calura</td>
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<td>Common Dunnart</td>
<td>Sminthopsis murina</td>
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<tr>
<td>Fat-tailed Dunnart</td>
<td>Sminthopsis crassicaudata</td>
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<td>MACROPODIDAE</td>
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</tr>
<tr>
<td>Western Grey Kangaroo</td>
<td>Macropus fuliginosus</td>
</tr>
<tr>
<td>Western Brush Wallaby</td>
<td>Macropus irma</td>
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<td>MURIDAE</td>
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<tr>
<td>Spinifex Hopping-mouse</td>
<td>Notomys alexis</td>
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<td>Mitchell’s Hopping-mouse</td>
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<td>Western Mouse</td>
<td>Pseudomys occidentalis</td>
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<td>PHALANGERIDAE</td>
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<td>Common Brushtail Possum</td>
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<td>TACHYGLOSSIDAE</td>
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<td>Short-beaked Echidna</td>
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<td>VESPERTILIONIDAE</td>
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<td>Gould’s Wattled Bat</td>
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<td>King River Eptesicus</td>
<td>Eptesicus regulus</td>
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<tr>
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**Reptiles**

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<td><strong>GEKKONIDAE (Geckoes)</strong></td>
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<td>Tree Dtella</td>
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<td>Thick-tailed Gecko</td>
<td><em>Phyllurus mili</em></td>
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<tr>
<td>Clawless Gecko</td>
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<td>Western Spiny-tailed Gecko</td>
<td><em>Diplodactylus spinigerus</em></td>
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<tr>
<td>Wood Gecko</td>
<td><em>Diplodactylus granariensis</em></td>
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<tr>
<td>Reticulated Velvet Gecko</td>
<td><em>Oedura reticulata</em></td>
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<tr>
<td>Marbled Gecko</td>
<td><em>Phylloidactylus marmoratus</em> marmoratus</td>
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<tr>
<td><strong>PYGOPODIDAE (Legless Lizards)</strong></td>
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<td>Burton’s Snake-Lizard</td>
<td><em>Lialis burtonis</em></td>
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<td><em>Delma australis</em></td>
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<td><strong>AGAMIDAE (Dragon Lizards)</strong></td>
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<td><em>Ergenia multiscutata bos</em></td>
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<td><em>Lerista distinguenda</em></td>
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<td></td>
<td><em>Morethia obscura</em></td>
</tr>
<tr>
<td>Western Blue-tongued Lizard</td>
<td><em>Tiliqua occipitalis</em></td>
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<tr>
<td>Shingle-backed Lizard</td>
<td><em>Tiliqua rugosa rugosa</em></td>
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<td><strong>ELAPIDAE</strong></td>
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<tr>
<td>Gould’s Snake</td>
<td><em>Rhinoplocephalus gouldii</em></td>
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<tr>
<td><strong>TYPHLOPIDAE (Blind Snakes)</strong></td>
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<td><em>Rhamphobyphlops australis</em></td>
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### Amphibians

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<tr>
<td>LEPTODACTYLIDAE</td>
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<tr>
<td>Turtle Frog</td>
<td><em>Myobatrachus gouldii</em></td>
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<tr>
<td></td>
<td><em>Pseudophryne guentheri</em></td>
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<tr>
<td></td>
<td><em>Ranidella pseudinsignifera</em></td>
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### Birds

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<td>ANATIDAE</td>
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<tr>
<td>Maned Duck (Wood Duck)</td>
<td><em>Chenonetta jubata</em></td>
</tr>
<tr>
<td>Australian Shelduck</td>
<td><em>Tadorna tadornoides</em></td>
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<tr>
<td>(Mountain Duck)</td>
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</tr>
<tr>
<td>ACCIPITRIDAE</td>
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<tr>
<td>Collared Sparrowhawk</td>
<td><em>Accipiter cirrhocephalus</em></td>
</tr>
<tr>
<td>Brown Goshawk</td>
<td><em>Accipiter fasciatus</em></td>
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<tr>
<td>Wedge-tailed Eagle</td>
<td><em>Aquila audax</em></td>
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Appendix 11. Birds observed in the Shire of Lake Grace

This Appendix lists birds observed in the Shire from 1997 to 1998 by Alex Hollick, Landcare Development Officer, Agriculture WA, Lake Grace.

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<tr>
<td>Yellow-rumped Thornbill</td>
<td><em>Acanthiza chrysorrhoa</em></td>
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<td>Yellow-throated Miner</td>
<td><em>Manorina flavigula</em></td>
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Appendix 12. Land and Nature Conservation Programs.

Natural Heritage Trust
The Natural Heritage Trust (NHT) was established in 1996 and aims to take an integrated, long-term approach to the conservation and sustainable management of land, water and biodiversity. It seeks to foster cooperation between the Commonwealth, State and local governments and the community. Assistance through the NHT is delivered at a number of levels: community groups, regional strategies, national partnerships and the Commonwealth. The community groups component contains five programs:

- Bushcare (formerly the National Vegetation Initiative)
- National Landcare Program
- Murray-Darling 2001
- National Rivercare Initiative
- National Wetlands Program

Contact and further information:
John Holly, NHT Coordinator, Agriculture Western Australia, PO Box Y3455, East St Georges Tce, Perth WA 6832.
Telephone: (08) 9325 0000.

Bushcare
Bushcare, formerly known as the National Vegetation Initiative (NVI), commenced in 1997 and is part of the NHT. It aims to address Australia’s land and water degradation problems. The primary objective of Bushcare is to reverse the long term decline in the extent and quality of Australia’s native vegetation through:

- conservation of remnant vegetation
- conservation of biodiversity
- restoration (through revegetation) of environmental values and productive capacities of degraded land and water.

Bushcare builds on the work of former vegetation programs including One Billion Trees and Save the Bush.

Contact and further information:
Keith Claymore, Bushcare Coordinator, Department of Conservation and Land Management, Locked Bag 104, Bentley Delivery Centre, WA 6983.
Telephone (08) 9334 0333.
National Landcare Program
The National Landcare Program (NLP) is a component of the NHT. The aim of the NLP is to encourage community groups to responsibly manage and conserve land, water, biological biodiversity and cultural heritage in their area. The program provides funds to government agencies, education institutions, research institutions, landcare and other community groups for soil conservation projects. Emphasis is given to fostering cooperation and coordination between government agencies and people in the community working on land degradation problems. The NLP evolved in 1991 from the National Soil Conservation Program (NSCP), established by the Federal Government in 1983 with the aim of developing and implementing a national strategy for the rehabilitation and sustainable use of Australia’s land and water resources.

Contact and further information:
Natalie Moore, Agriculture Western Australia, PO Box Y3455, East St Georges Tce, Perth WA 6832. Telephone: (08) 9325 0000.

State Landcare Program
The State Landcare Program (SLP) was introduced by the Western Australian State Government in 1987 to support LCDCs and catchment groups in combating land degradation problems in rural areas. Financial support is provided to LCDCs to undertake projects in catchment planning, demonstrate conservation practices and for communications and training. There are two major programs in the SLP the Remnant Vegetation Protection Scheme and the State Revegetation Scheme.

Contact and further information:
SLP Coordinator, Agriculture Western Australia, PO Box Y3455, East St Georges Tce, Perth WA 6832. Telephone (08) 9325 0000.

Remnant Vegetation Protection Scheme
The Remnant Vegetation Protection Scheme (RVPS) was introduced in 1988 to enhance soil and nature conservation through the protection of native vegetation on agricultural land. CALM and AgWA jointly administer the scheme, with AgWA as the lead agency. The scheme provides a subsidy towards the cost of fencing for native vegetation on farms, with landowners giving an understanding by covenant on title that the fenced vegetation will be managed for nature conservation for a period of at least thirty years.

To receive a subsidy, the area to be fenced must be at least five hectares, in good condition or be able to be rehabilitated to good condition. The condition of the vegetation is regularly monitored by conducting botanical surveys. This provides both an objective measure of the long term success of the scheme, and the opportunity for landowners to improve their management practices by providing them with a measure of the impact of their activities.
Contact and further information:
RVPS Coordinator, Agriculture Western Australia, PO Box Y3455, East St Georges Tce, Perth WA 6832. Telephone (08) 9325 0000.

Roadside Conservation Committee
The Roadside Conservation Committee (RCC) was established by the Western Australian Government in 1985 to coordinate and promote conservation and the effective management of rail and roadside conservation. The programme is administered by CALM and relevant data is administered by the Main Roads Department. In 1989, the RCC organised an assessment of roadside vegetation involving community volunteers on a shire basis, using a proforma designed by the RCC (Hussey, 1991), and has completed Roadside Conservation Value Maps for 24 shires in the wheatbelt. The RCC has begun a similar survey of roadside vegetation within the Shire of Lake Grace, but has not completed a map.

Contact and further information:
Neville Walliss, Roadside Conservation Committee, Department of Conservation and Land Management, Locked Bag 104, Bentley Delivery Centre, WA 6983. Telephone (08) 9334 0404.

Land for Wildlife
Land for Wildlife is a voluntary scheme that aims to encourage and assist private landholders to provide habitats for wildlife on their property. Started in 1996, Land for Wildlife is free and has no legal binds or limitation on property size or use for registration.

Land for Wildlife offers:
- on-site advice to individual landholders that apply for Land for Wildlife registration;
- contact with like-minded landholders, through publications, field days and other activities;
- regular newsletters and more detailed publications;
- help to create healthy ecosystems;
- contacts, such as where to find local plant seedlings; and
- information about other forms of assistance and incentives.

With full registration, the landholders receive a sign for the property free of charge that displays a numbat, knob-tailed gecko and pink rainbow plant. This acknowledges the efforts being made for wildlife conservation.

Contact and further information:
Penny Hussey (Coordinator), Land for Wildlife, Wildlife Branch, Department of Conservation and Land Management, Hayman Road, Como. Locked Bag 104, Bentley Delivery Centre, WA 6983. Telephone (08) 9334 00530. Fax (08) 334 0278
Avon Working Group
The Avon Working Group is an incorporated body that was formed in 1995. The group consists of nine community representatives from the Yilgarn, Lockhart and Avon Sub-catchments and the Avon River Management Authority. Senior members of natural resource and regional agencies work in partnership with the group and provide technical support. The major aim of the Avon Working Group is to improve regional prospects for present and future generations by ensuring there is sustainable use, enhancement and conservation of natural resources across the Avon River Basin. The group coordinates Integrated Catchment Management projects, determines regional priorities, manages State and Federal funds, provides information and advice to the Natural Heritage Trust and plans for improved land and water management.

The Avon Working Group offers Community Grants to groups and individuals for landcare and flora/fauna conservation activities in the Avon Catchment. The aim of the grants program is to catalyse and support a change in catchment management practices to ensure the sustainable use of natural resources. The grants also reduce the burden to the community of the financial and productive risk of developing and implementing new and innovative management techniques.

The grants program has been split equally between two funding categories:

1. Small grants to a maximum value of $10,000 for groups or individuals.
2. Much larger grant up to $50,000 per grant for community groups to develop and implement priority aspects of their catchment plans.

Contact and further information:
Andrew Huffer (Executive Officer), Avon Working Group, Agriculture WA Northam District Office, Northam WA 6401.
Telephone (08) 9690 2000.

Avon Catchment Network
The Avon Catchment Network is the information arm of the Avon Working Group, and is a project funded by the NHT. Operating since 1997, the Network provides and collects information on natural resource management in the Avon Catchment, and acts as a contact point for individuals and groups within the catchment.

Contact and further information:
Avon Catchment Network Coordinator, Wellington Street, PO Box 311, Northam WA 6401. Telephone (08) 9622 7600. Fax: (08) 9662 7611.
Website at http://www.au/
Community Conservation Grants
The Minister for the Environment The Hon. Cheryl Edwards offers Community Conservation Grants for projects that involve the conservation of fauna, flora and/or land rehabilitation of environmental benefit. Applications are open to individuals, local community groups or organisations, and may be in association with a State or local government authority. Grants are provided for materials, equipment hire, purchase of specialist or essential equipment (must be non-capital and each item less than $500) and services. Projects can include environmental inventories and surveys, preparation and implementation of an environmental management plan (including on-ground works). The assessment panel includes representatives of the Department of Environmental Protection and CALM. The closing date for applications is in December of each year. There are two funding categories:

1. Delegated Organisations: to assist major environmental organisations coordinate and undertake environmental projects. A total of $80,000 was distributed in 1998.
2. Direct Grants: for ‘grass-root’ community organisations and individuals to undertake on-ground projects, particularly for works on public land. These grants generally range between $500 to $5,000, and the total funding provided in 1998 was $85,000.

Contact and further information:
Paul Biggs (Community Conservation Grants Coordinator), Office of the Minister for the Environment, 18th Floor Allendale Square, 77 St George’s Terrace, Perth WA 6000. Telephone (08) 421 7777.

World Wide Fund for Nature (WWF)
The WWF (formerly the World Wildlife Fund) is a national, non-profit conservation group that conducts many activities in the wheatbelt. The $50,000 Community Grants Programme provides support to group projects aimed at the protection of threatened species. Such community conservation activities can receive up to $5,000 assistance from the WWF. The next round of applications is expected to be in February/March 1999, and groups are encouraged to begin preparing their applications. The WWF has employed a Wheatbelt Biodiversity Officer who will actively aid the incorporation of biodiversity issues into wheatbelt land management.

The Threatened Species Network is a community-based program of WWF and the Endangered Species Program of the Biodiversity Group of Environment Australia. The emphasis is on increasing public awareness, empowering the community, and providing links between those that work on the conservation of threatened species and ecological communities. In particular, the Threatened Species Network works with the Mallee Fowl Group, monitoring the abundance and distribution of mallee fowl throughout the wheatbelt. The group will commence monitoring mallee fowl in the Lake Magenta area in the Shire of Lake Grace in 1998, and invites volunteers to assist in this long-term monitoring programme.
Contact and further information:

Gordon Reid Foundation for Conservation
The Gordon Reid Foundation for Conservation aims to provide funds or other support for the purpose of enhancing community involvement in conservation within Western Australia. The objective of the Foundation is to encourage and sustain action by community organisations in conserving and restoring indigenous plants, animals and micro-organisms and their natural environments. Applications can be made throughout the year by non-profit groups, who must be incorporated if seeking more than $5,000. One million dollars each year are provided for:

- conservation of the Western Australian environment through projects that have integrated, sustainable outcomes, with emphasis on native flora and fauna;
- identification and conservation of critical habitats and ecosystems;
- conservation of rare, threatened and endangered species in WA;
- public education and awareness of environmental issues in WA; and
- research or other studies into other matters related to the above.

Contact and further information:
Michael Sandford (Executive Officer), Gordon Reid Foundation for Conservation, Lotteries Commission, 74 Walters Drive, PO Box 1113, Osborne Park, WA 6917. Telephone (08) 9340 5270.

Greening Western Australia
Greening Western Australia is a member of Greening Australia, and offers various forms of assistance with conservation activities.

Greening WA has recently employed Bushcare Coordinators for the Lockhart and Yilgarn who are based in Community Landcare Centres in Jerramungup and Southern Cross.

Contact and further information:
Greening Western Australia, Fremantle Gaol, 10-12 The Terrace, Fremantle, WA 6160. Telephone (08) 9335 8933, Fax (08) 9335 9203. email: landcare@iinet.net.au
Matt Inman, Jerramungup: (08) 9835 1127.
Clinton, Southern Cross: (08) 9049 1001.
Australian Trust for Conservation Volunteers (ATCV)
ATCV is a national, non-profit, non-political community based organisation that seeks to assist landholders with practical conservation projects. ATCV works with major environmental agencies, non-government organisations, community groups and individuals to provide real environmental and heritage conservation outcomes. Projects include fencing, tree planting, seed collection, flora and fauna surveys, walking trail construction and maintenance, and environmental monitoring. ATCV can supply teams of up to ten volunteers with an ATCV team leader to coordinate and supervise volunteers and liaise with project managers.

Contact and further information:
Australian Trust for Conservation Volunteers, 216 Queen Victoria Street, PO Box 188, North Fremantle, WA 6159. Telephone (08) 9339 3902.