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Historical geography of Yellagonga Regional Park, Western Australia

Susan Ujma
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**HISTORICAL GEOGRAPHY OF YELLAGONGA REGIONAL PARK,
WESTERN AUSTRALIA**

A thesis submitted as a partial requirement for the award of

Bachelor of Arts Honours (Geography)

Faculty of Education and Arts

Edith Cowan University

Supervisor: Dr Hugo Bekle

Susan Ujma B.A.
Student Number: XXXXXXXXXX
January 2009

Abstract

The principle aim of this study was to reconstruct the land use history of the Yellagonga Regional Park wetland landscape. Located approximately twenty kilometres north of Perth, covering about 1400 hectares, the Park lies within the North-West Corridor of the metropolitan area.

This research, assisted by archival sources, demonstrates that prior to early European settlement the Yellagonga wetlands were quintessential summer hunting and gathering sites for the Nyoongar Aboriginal people. The wetlands were utilised for water, food gathering, hunting, corroborees and rituals that governed their tribal lives. Early European settlers, market gardeners, and later subdivision for urban development, have adversely transformed the Park over time. These pressures stem as a result of groundwater abstraction (bores), pollution, removal of native vegetation, invasion of weeds, stormwater drainage from residential and industrial areas, and more recently climate change, a global phenomenon. Consequently, the environmental quality of the Park has been undermined and it faces significant challenges for current and future management of its ecological and cultural values.

This study offers an ecological perspective on the Park's wetlands, chronologically measures the human footprint on its landscape, and maps the changes faced by the Park since the Aboriginal people's sustainable ecology and guardianship was removed. Research such as this is essential to ensure that disappearing wetland landscapes such as the Yellagonga Regional Park are maintained and protected. The information from this study might be applied to other localities and environments.

USE OF THESIS

The Use of Thesis statement is not included in this version of the thesis.

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Declaration

I certify that this thesis does not, to the best of my knowledge and belief:

- (i) incorporate without acknowledgement any material previously submitted for a degree or diploma in any institution of higher education;*
- (ii) contain any material previously published or written by another person except where due reference is made in the text; or*
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Signature**Date**

..... July 2009

CHAPTER 1 INTRODUCTION

1.1 Background to the Study

This study is concerned with the modification of wetlands in the Yellagonga Regional Park, which is located approximately twenty kilometres north of Perth (Figure 1.0). It also recognises the importance of the wetland system to the Nyoongar Aboriginal people. Covering about 1400 hectares, the Park is situated within the North-West Corridor of the Perth metropolitan area. In 1989, the State Government agreed to the establishment of the Park in order to provide the growing population of the North-West Corridor with many conservation and recreation opportunities.

Regional Parks are described as areas of regional open spaces that are identified by planning procedures as having regionally significant conservation, landscape and recreation values (Department of Conservation and Land Management 2003).

Within the Park there is a wide variety of ecosystems, including elevated forests, fringing woodlands, sedge lands and open water. Bushland areas have been fragmented in many places, and separated by developed parkland (Department of Conservation and Land Management 2003). The wetlands and natural bushland provide a backdrop to the Cities of Joondalup and Wanneroo. The Park encompasses some of the oldest and last remaining freshwater systems on the Swan Coastal Plain (Department of Conservation and Land Management 2003) and is of regional importance because of its natural, cultural and recreational resources within the rapidly developing surroundings.

Lakes Joondalup (the largest in the northern suburbs of Perth) and Goollelal (south of Lake Joondalup) are connected by the intermediate Walluburnup and Beenyup swamps, discussed in (Figures 1.1 & 1.2).

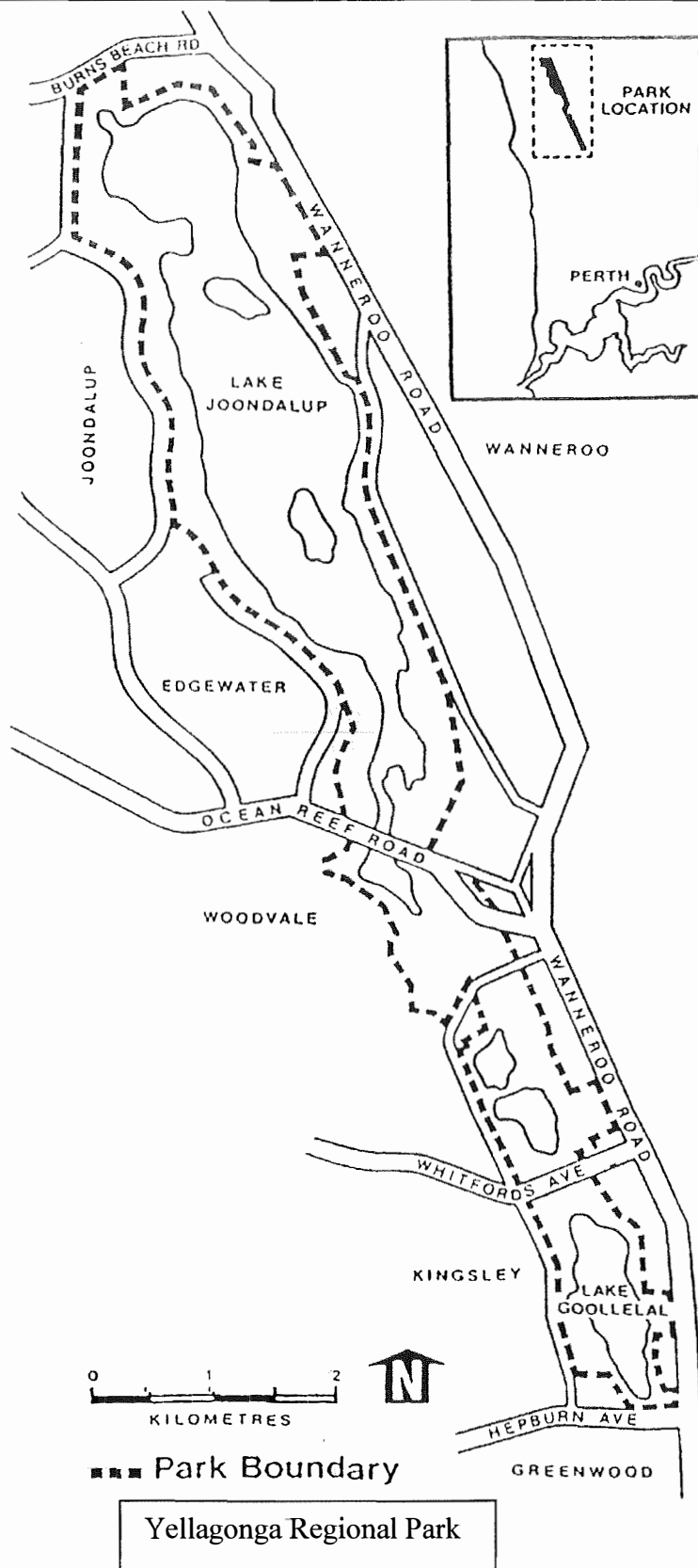


Figure 1.0
Location Map of Yellagonga Regional Park
 Source: *Wanneroo Times* 31 October 1989



Figure 1.1

Walluburnup Swamp Yellagonga Regional Park

Source: Sue Ujma, November 2008

Walluburnup swamp contains the oldest grown peat fill on the Swan Coastal Plain. The swamp is mostly degraded as the result of timber clearing, market gardening and horse and cattle grazing. To the right of the photograph is a row of olive trees approximately 160 years old, which were planted by the early European settlers. In the distance is the encroachment of urbanisation.



Figure 1.2

Beenyup Swamp Yellagonga Regional Park

Source: Sue Ujma, October 2008

Beenyup Swamp is the smaller of the two swamps with dense vegetation, representing a wildlife environment that has been relatively unchanged by humans. It is the richest site on the Swan Coastal Plain for invertebrate fauna. The walkway was erected to enable the public to observe and appreciate the natural beauty of the wetlands.

Lakes Joondalup and Goollelal are of national significance and are listed on the Australian Nature Conservation Agency's Directory of Important Wetlands and on the Register of the National Estate. Water in these Lakes is connected to the Gnangara Groundwater Mound, that also supplies public drinking requirements, agriculture and commercial water needs for Perth's metropolitan regions.

The significant modification of these wetlands is the result of a succession of physical and social events that have occurred since early European settlement. It will be shown that many of the early settlers did not appreciate or respect the uniqueness of the Australian flora and fauna. Their need to exploit these wetlands in the past has always taken precedence over conservation and environmental considerations. Wetlands were filled, or drained, because they posed an obstacle for agricultural and urban development. However, since the 1970s there has been a growing awareness of the value of wetlands and the ecosystems they support. Further encroachment from urbanisation and commercial development will require careful management of the Park in order to maintain the natural ecosystems and conservational values.

Many birds inhabit the woodland and wetlands areas of the Park. The wetlands also serve as an important breeding ground and summer refuge for a diverse bird population, some of which are trans-equatorial migratory wading birds. A number of migratory birds listed under the Japan-Australia Migratory Birds Agreement (JAMBA) (Department of Conservation and Land Management, 2003) and the China-Australia Migratory Birds Agreement (CAMBA) (DEC, 2003) have been sighted at the park.

There are many international, national, state and local agreements of relevance to the development of Perth's wetland and landscape ecosystems aimed at better conservation practices. These agreements support the conservation of migratory birds and their habitats, and include:

- The Ramsar Convention on Wetlands of International Importance (1981);
- The Bilateral Migratory Bird Agreements between Australia and the governments of Japan (1974 JAMBA), China (1986 CAMBA) and Republic of Korea (2002);
- The Commonwealth of Australia Environment Protection and Biodiversity Act 1999;
- A National Strategy for Ecologically Sustainable Development (1992);

- The State of the Environment Report (2007);
- The Yellagonga Regional Park Management Plan, 2003-2013; and
- The Yellagonga Integrated Catchment Management (YICM) Planning Project.

1.2 Significance of the Study

Wetlands have been called ‘ecological supermarkets’ because of their complex food webs and rich biodiversity (Mitsch & Gosselink, 2000). They are an integral part of our environment and a valuable and essential part of the natural landscape. The present study is intended to add to the existing body of knowledge regarding this important regional site.

A wetland may be defined as:

An area that is permanently, seasonally or intermittently waterlogged or inundated with fresh, saline, flowing or static water. It includes areas of marine water the depth of which at low tide does not exceed six metres
(Environmental Protection Authority, 2007, p. 310).

The aim of the research is to demonstrate that wetlands and swamps are important ecosystems for many reasons. They are essential breeding grounds for native birds, a summer refuge for trans-equatorial migratory wading birds (Bekle, 1979), and a natural habitat for unique native flora. Wetlands also comprise part of the hydrological and ecological processes and constitute a resource of great economic and cultural value. They provide opportunities for passive and active recreation and their loss would be substantial.

Balla (1994) notes that wetlands are recognised as being the most biologically productive and diverse ecosystems that not only change over days, months and years, but also over decades and centuries, diversifying and modifying in response to climatic cycles, storms and fires or human activities. Therefore, as the number of wetlands decrease, remaining wetlands are extremely valuable, not only to local but also to global environments. Social and environmental research, emphasises their importance, and provides information that enables the government authorities to restore degraded wetlands and protect and conserve those that remain intact. The research emphasises the educational opportunities for a better understanding of wetlands, their ecosystems and their interaction with regional groundwater, which assists with the development of strategies for wetland management to ensure an ecologically sustainable future.

About six per cent of wetlands of high conservation value on the Swan Coastal Plain were lost or degraded between 1996 and 2004. Also twenty-six per cent of important South West wetlands are currently being degraded (Environmental Protection Authority, 2007).

1.3 Purpose of the Study

The principal aim of this research was to reconstruct the wetland landscape and the land use history that has transformed the Park. This study emphasises the significance of the Park to the Aboriginal people that originally used this landscape. Lakes Joondalup and Goollelal were important camping sites for the local Nyoongar Aboriginal people. They used them for water, food gathering, tool making, hunting, corroborees and summer social life. They were ideal campsites due to their centrality within the Mooro district. These Lakes were an 'east west staging point between the foothills and the ocean, and a north south staging point between Mount Eliza (Kings Park) and Moore River' (Brittain, 1990, pp. 1-2).

In addition, the research examines the attitudes of early European settlers towards their new environment. The early European settlers brought with them a sense of place that originated in their homelands. These memories, experiences and understandings could not be easily transferred to the Australian landscape, which was strange and unyielding. This notion of a sense of place was used to explain why wetland environments were often misused and regarded as not being worthy of preservation (Seddon, 2004). Over several generations there has been a growing awareness of the importance of wetlands and the native flora and fauna, as a new sense of place has emerged. However, there are still threats of modification by human encroachment to wetlands remaining in the Park. The study demonstrates that the original Aboriginal people, early pioneers, southern European market gardeners, and the most recent suburban dwellers have all left their imprints on this landscape.

1.4. Review of Literature

There are numerous studies on wetlands in Australia (e.g. Congdon 1985; Bekle 1992; Brock Boon & Grant 1994; Giblett & Webb 1996; Seddon 2004) that testify to their uniqueness as habitats and healthy ecosystems for native flora and fauna. Wetlands also provide flood control by storing and retaining stormwater and runoff (Environmental Protection Authority, 2007). Sewerage and drainage infrastructure exists in a number of locations within the Park as discussed in Department of Conservation and Land Management Draft 2009-2014.

Local investigations must be considered in the context of global studies of wetlands (e.g. Mitsch & Gosselink 2000; Azous & Horner 2001; Gilman 1994; Yencken & Wilkinson, 2000) as local sustainability impacts global sustainability. Future management of the Park will be exposed to considerable pressure from urbanisation, population growth, demands on water and the effects of climate change.

The early European settlers did not enter an uninhabited landscape. Aboriginal people had made their homes on the Swan Coastal Plain for over fifty thousand years. Hallam (1981) noted that before European colonisation, the Aboriginal people moved to the wetlands of the study area during summer and autumn. They chose to frequent localities around swamps where fresh water was available, and where an abundance of native flora and fauna was to be found. Wetlands also acted as access tracks and trails providing valuable camping areas. Balla (1994) also recognised the importance of wetland systems to Aboriginal people, suggesting that they based their camps within areas close to wetland resources, which provided secure camping sites for food and water.

Since the time of the first European settlers, the natural vegetation of the Park has undergone many changes (Gentili, 1998). The early settlers cleared the fringing vegetation along the wetlands and planted introduced species of shrubs and trees. They also brought with them cattle and sheep from their homelands, which degraded much of the native landscape, through introduction of weed species, trampling of vegetation and soil compaction (May, 1994; Broome, 2001). Very few early settlers appreciated the ecological value of seasonal wetlands (Giblett & Webb 1996; Broome, 1994; Hallam, 1981). Seddon (2004) testified that a sense of place shows most clearly in the way the community feels about and uses the landscape (p. 262). He also noted that Western Australian preferences are still English and 'good Western Australian bush was dug up to plant roses' (p. 262).

As settlement intensified and suburbs were built, various urban planning reports relevant to the area were produced in an attempt to ensure an orderly and sustainable development. For example: Stephenson and Hepburn 1955; Perth Metropolitan Region Scheme (MRS) 1963; Corridor Plan 1970; Metroplan 1990; North-West Corridor Plan 1992; Network City 2004; Yellagonga Regional Park Management Plan 2003-2013.

All of these potential impacts may result in further changes to the environment and its delicate ecosystems, particularly the wetlands. Currently, all of the elements required for the conservation of the Park are under review. The Park is predominantly managed by the Department of the Environment and Conservation (DEC) and the Cities of Joondalup and Wanneroo.

The Yellagonga Regional Management Plan (2003-2013) was developed by DEC formerly Conservation and Land Management (CALM), in consultation with the Cities of Joondalup and Wanneroo, the Park's community advisory committee, local community groups and members of the public. The role of the Management Plan is to help ensure the Park is managed appropriately and is capable of sustaining its high nature conservation and cultural values (Department of Conservation and Land Management 2003, p. 1) The Park faces many critical management challenges, which originate from urban development, groundwater pollution, over abstraction (bores), invasion of weeds, rubbish dumping, feral animals and poor control of domestic pets. The Cities of Joondalup and Wanneroo have implemented various management strategies to address these problems arising from the declining health of Yellagonga wetlands

There is also a wide range of literature relating to the Gngangara Groundwater Mound, which is the largest and most important water resource in the Perth region (e.g. The Gngangara Mound Vegetation Stress Study 1992; Review of the Environmental Protection 1992; Gngangara Land Use and Water Management Strategy 2001; Department of Water Gngangara groundwater areas 2008).

1. 5. Theoretical Framework: The clash of Aboriginal and European uses of the landscape

European settlers and subsequent suburban dwellers brought with them memories and experiences that originated from their European homelands (Seddon, 2004). However, these memories and experiences could not be easily transferred to the Australian landscape. But they drew on their former experience to produce food they were familiar with and pursued the lifestyle they saw as most favourable. It is argued that early European settlers did not understand the complex interrelationship that existed between the Aboriginal inhabitants and their land.

Aboriginal land management was a systemic and well-managed use of the environment that had been refined through experience over thousands of years and was ecologically sustainable (May, 1994).

During the early years of settlement one visitor was moved to make the following odious comparison:

At home, a lake is known only as a sheet of water, which seldom or ever is dried up, and it is naturally associated in one's mind with pleasant and picturesque scenery, but here it is quite different there is an air of desolation about these lakes, which strikes the spectator at once. It is complete still life without one point of interest in it, as far as striking scenery goes, and totally different from anything I ever saw outside Australia

(*The Swan River News* 11 August 1847, p. 161).

The European settlers did not appreciate or respect the uniqueness of the native flora and fauna and set about transforming the landscape and wetlands into a more familiar European scene. Their rush to develop land for pastures and crops took precedence over conservation and environmental issues, which impacted on their judgement for this new and unfamiliar environment. They also did not understand the climatic variability of the landscape, as did the Aboriginal people. Once the guardianship of the Aboriginal people was displaced the Park was subjected to grazing, market gardening and urbanisation.

Environmental conservation issues were ignored by early European settlers and subsequent suburban dwellers because they did not understand that 'the natural complexity of many of these wetland communities, together with the system by which contrasting communities are locked together, contribute to the overall stability of these ecosystems' (Bekle, 1982, p.41). Early settlers displayed a lack of understanding of the seasonal fluctuations in the hydrological balance of wetland ecosystems.

This study takes as its focus the contrasting manner in which the Aboriginal people and European settlers used the environment and the difficulties that this clash engendered.

1. 6. Research Questions

This study will address the following research questions:

1. What was the historical involvement of the Aboriginal people in the area now known as Yellagonga Regional Park?
2. How has the present Yellagonga Regional Park area been reshaped by the sequence of European activities?
3. What are the present land-use and management concerns in Yellagonga Regional Park?

The following chapter outlines the methodology and research techniques.

CHAPTER 2 METHODOLOGY AND RESEARCH TECHNIQUES

2.1 Archival Sources

The writings and diaries of early explorers offer descriptions of Lakes Joondalup and Goollelal. Journals of explorer George Grey record excursions to the north of Perth (now known as Wanneroo). He described the nature of the landscape and the abundance of native flora and fauna. In 1838, he noted how he ‘saw some very good land,...plenty of good feed for cattle’. He strongly recommended it for settlement (cited in Russo, p. 115). However, had early explorers reported during hot summer months the information might well have been entirely different?

Early explorers, surveyors and settlers recorded Aboriginal words. Variations occurred depending on the pronunciation and interpretation, and how the meaning was being conveyed. It is not always possible to state with certainty the meaning of the name.

Current Name	Variations Over Time	Suggested Meaning
Beenyup (swamp)		Digging place (abundant native potatoes)
Goollelal (lake)	Kololalup, Koli, Cullalal	swamp, sheoak or place for camp
Joondalup (lake)	Boorarribup, Mooloore Doondalup	Place of Whiteness [limestone] or of Glistening [the lake], or Place of Freshwater Crayfish
Walluburnup (swamp)	Wallabuenup, Walaboonup	Open Space Between 2 Trees or Place of Fish and Wallaby or Fish in Lake
Wanneroo	Wanna, roo, Wanneru	Digging for Roots, The Place

Figure 2.0
Aboriginal place names in Yellagonga Regional Park
Source: Wanneroo Joondalup Yanchep 1998, p. 114; Chambers 1990, p.1.

Early archival information yields a multitude of ideas, opinions and assessments, which can be used to interpret and develop a chronological ecological perspective. This perspective can be used and compared with current information to gain a valuable insight into how and why modifications to the Park occurred.

The Local Studies Library, Joondalup contains resources reflecting all aspects of the history, culture and development of Wanneroo and the area (now known as Yellagonga Regional Park). Their mission is to create a picture of life in the region from 1834 to the present day. Items include: maps, oral history, books, photographs and journals

2.2 Published Research

Academic literary sources illustrate the writings and research of published and non-published academic books, papers and publications. These publications are essential and are the starting point for this study. They are the work of leading researchers who illustrate how attitudes of the day influenced, the development that modified the Park. Writers and researchers such as Hallam, 1979; Bekle, 1982; Seddon, 2004, testify to the fact that early exploration and development, as well as the attitudes of early settlers led to the wholesale destruction of wetlands and ecosystems in the Park as well as other wetlands in Australia. These academic writings can be used to gain a chronological history of the study area, namely the Park.

2.3 Government Plans and Publications

Government plans and publications such as reports, draft strategies, policies and town planning decisions provide valuable information relating to wetland management and conservation. These key agencies include The Environment Protection Authority; Water & Rivers Commission; Department of Planning & Infrastructure; and The Western Australian Planning Commission. These plans map the changes, as well as providing historical environmental and planning literature specific to the study area. They demonstrate the early and current effects of Government planning and policies and whether these addressed the Park's problems, and if so, how? These publications also provide records of all social, cultural and economical interaction between the environment and its human inhabitants.

Records of town planning and decisions affecting the Park were examined to better understand how and why development has taken the Park to its current status. For example, Network City Plan 2005 (developed by the Western Australian Planning Commission) sought to formally adopt the four previous plans (Stephenson & Hepburn, 1955, the Corridor Plan, 1970, Metroplan, 1990, and the Network City, 2004) in order to turn Perth's character into a world-class sustainable city: a more vibrant, compact and accessible city, with a unique sense of place, whilst examining implications of climate change and loss of biodiversity.

2.4 Maps, Photographs, Newspapers

A collection of old maps arranged in chronological order reveals the sequence of settlement patterns, flora and fauna, land use, as well as progressive sub-division of the study area. Old maps are also useful as they illustrate the irreversible damage caused by early European settlement and subsequent development.

Although maps may be fragile or illegible they can still provide valuable historical information. (Figure 2.1) shows a rough sketch of Lake Joondalup 1841-1846 from a survey of T. Watson with additions by J. Gregory. It appears the land is already being subdivided into large blocks

However, early maps and literature featuring European terminology can provide misleading information as flora names are written differently e.g. mahogany (jarrah) and tea tree (paperbark).

Photographs

Old photographs were located in archival libraries, council libraries, as well as academic publications. They provide a pictorial sequence of events in the study area. In the case of photographic comparisons the date/time must be recorded in order to ascertain different seasons and/or the year/time of day.

To supplement the use of old photographs the author has also taken a considerable number of photographs of the study area. Chapter 3 shows the introduction of exotic biota. This was not a random incident. Many areas of the Park are under threat by people discarding their garden rubbish. If allowed to continue it will have an adverse affect on the ecology of the Park.

Aerial photographs of the study area dating back to 1948 to the present day were obtained from the Department of Land Administration (Midland). Aerial photography reveals, with considerable accuracy, recent changes in plant communities, land use and the encroachment of urbanisation.

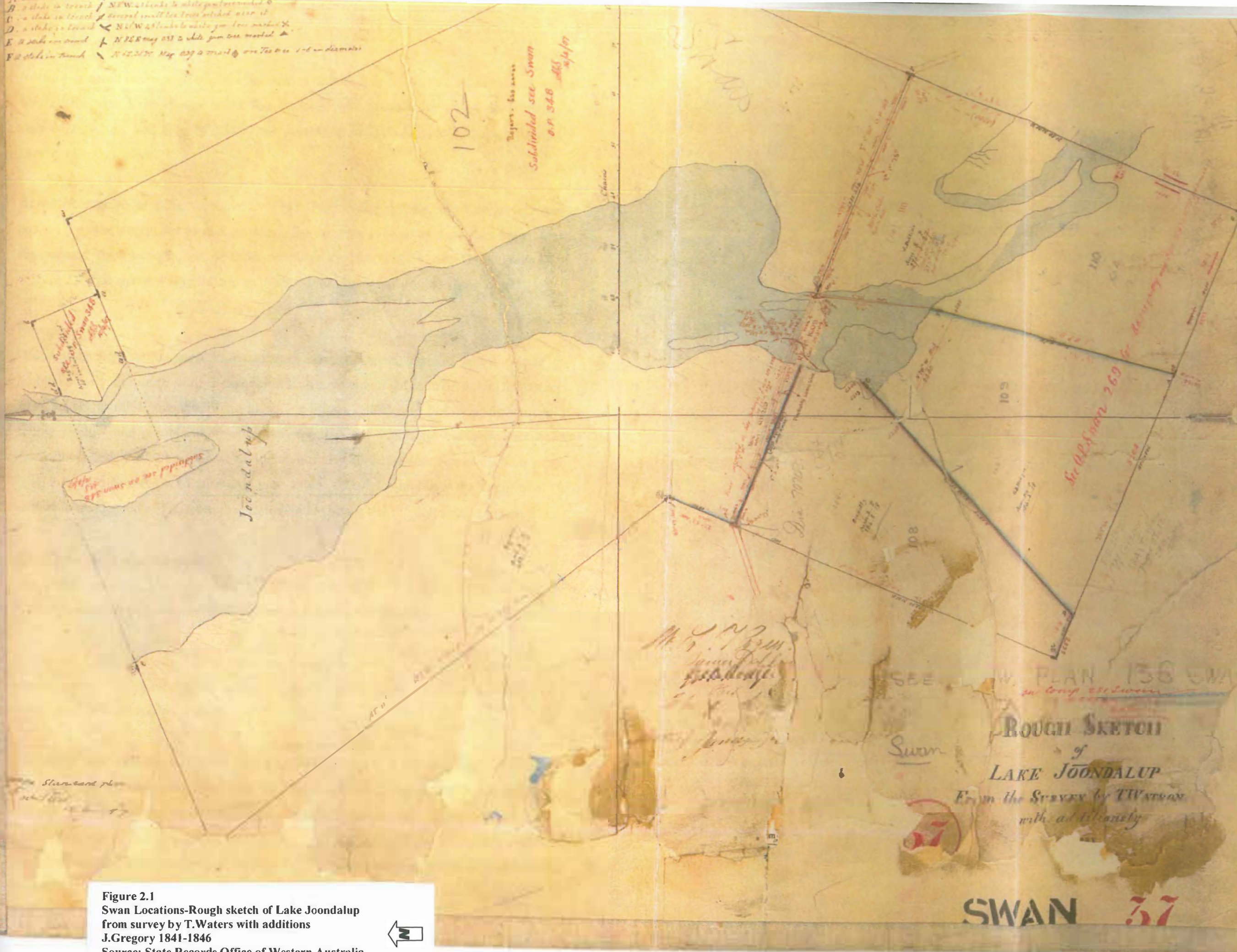


Figure 2.1
Swan Locations-Rough sketch of Lake Joondalup
from survey by T. Waters with additions
J. Gregory 1841-1846
Source: State Records Office of Western Australia
WAA: 42-Land and Surveys
WAS 236-Original Plans-District



In 1953 an aerial photograph of Lake Joondalup (Figure 2.2) shows that urbanisation has not reached the area. The change in 1998 is dramatic with urbanisation encroaching onto the very edges of the lake (Figure 2.3). Lake Joondalup in 2008 (Figure 2.4) shows the high density of urbanisation.

Aerial photograph of Lake Goollelal in 1948 (Figure 2.5) reveals no urban development around the lake except for market gardens. By the year 1988 market gardens have almost disappeared the encroachment of urbanisation is evident (2.6). Lake Goollelal in 2008 (Figure 2.7) has changed very little from the previous photograph, but for how long?

Newspapers

Old newspapers can be used to reconstruct past ecological changes and illustrate the problems early European settlers experienced. They contain early environmental opinions. Also, letters to the Editor describing harsh conditions, and due to isolation, difficulties in selling produce and provide information on exporting and importing vegetables and wood. The settlers used early newspapers to communicate with each other regarding their crops, opinions, and tips on how to raise crop production. They also highlight the inability of the settlers to understand and adapt to the Australian landscape and the unfamiliar climate.

2.5 Community organizations

The author has been a member for the last two years of the Wanneroo Historical Society. Monthly meetings were attended which were informative and interesting.

Friends of Yellagonga: Is a local volunteer group who have successfully completed weed control projects to minimise the impact of exotic biota. The author is a member and participated in weed control projects.

The author was formally invited on October 2007 to become a member of the Yellagonga Integrated Catchment Management (YICM) Planning Project Community Reference Group (CRG). YICM Planning Project applies an integrated and holistic approach in addressing land use impact on Yellagonga Regional Park. The CRG provides the community and other organizations with the opportunity to be effectively involved in the planning and management of the Park. The role of the members is to participate at meetings and working groups and assisting with the identification of issues concerning the Park.

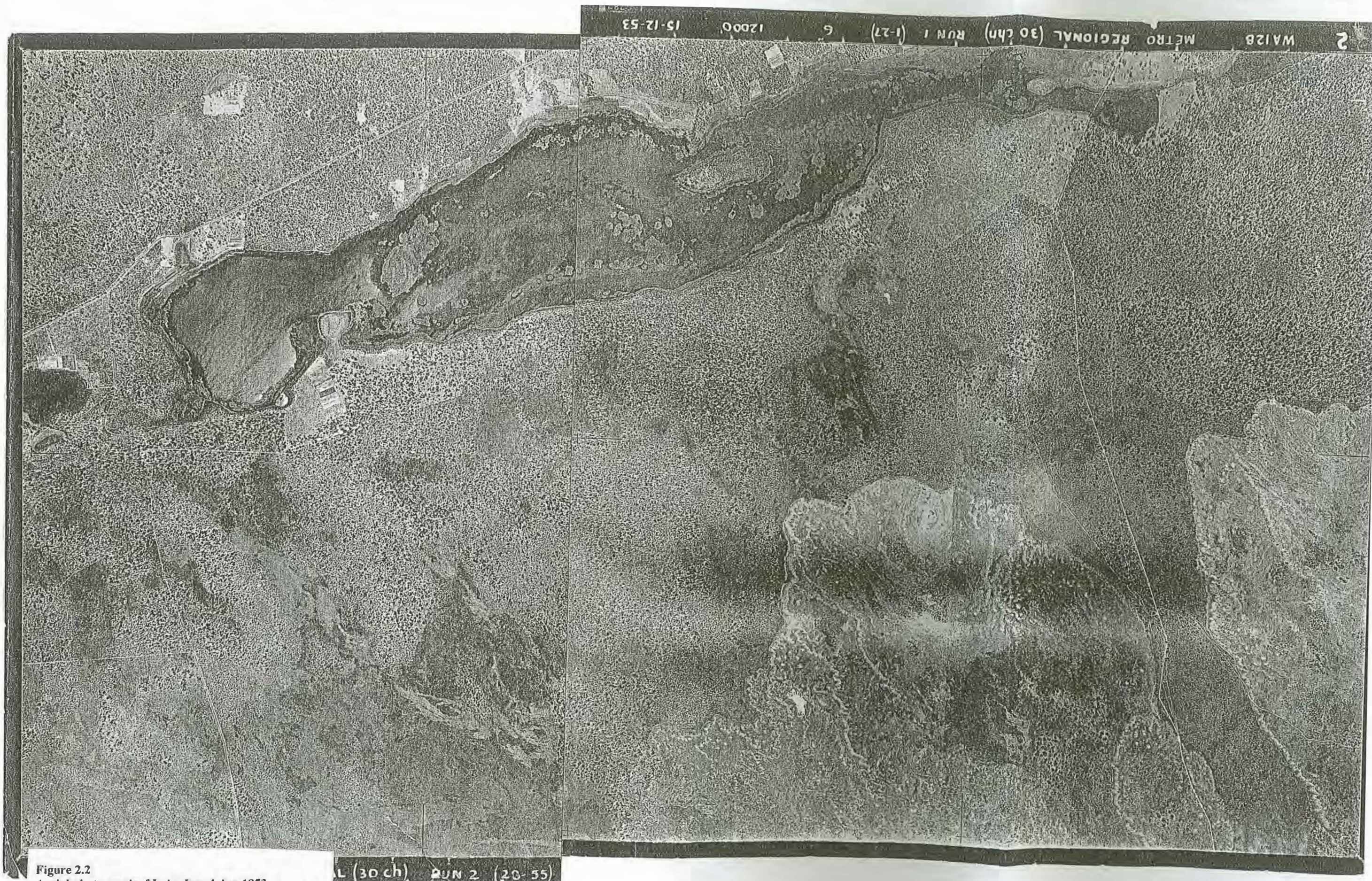


Figure 2.2
 Aerial photograph of Lake Joondalup 1953
 Scale: 1:2000
 Source: Landgate Western Australian Land
 Information





Figure 2.3
Aerial photograph of Lake Joondalup 1998
Scale: 1:20000
Note: urbanisation encroaching onto the very edges
of the lake.
Source: Landgate Western Australian Land
Information Authority.

Page 28 not present in the original

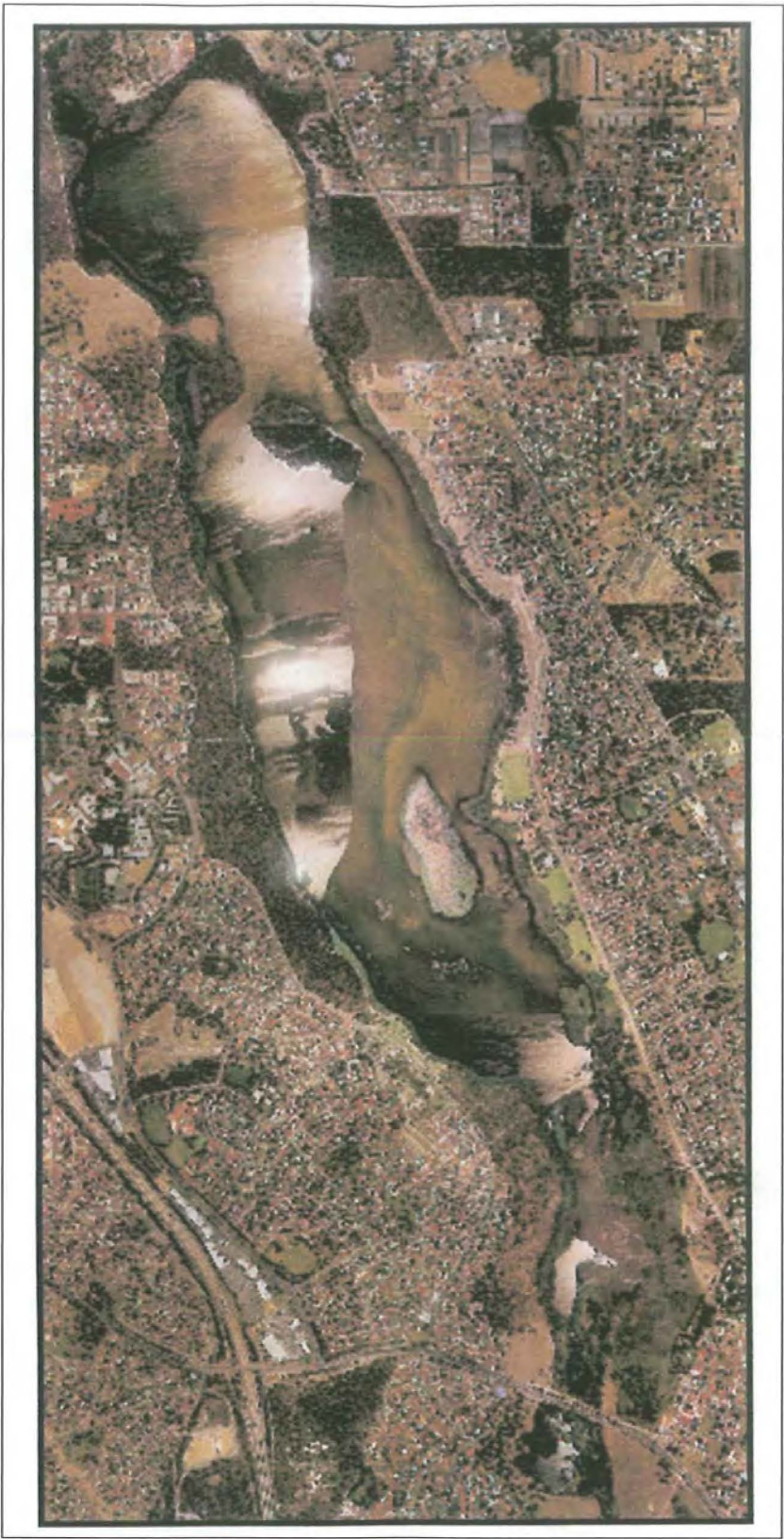


Figure 2.4
Lake Joondalup 2008
Note: High density housing
Source Landgate Western Australian
Land Information Authority





Figure 2.5
Lake Goollelal 1948
Note: No urbanisation around the
lake except for market gardens
Source: Landgate Western
Australian Land Information
Authority



Figure 2.6

Lake Goollelal 1988

**Note: encroachment of urbanization
around the lake**

**Source: Landgate Western Australian
Land Information Authority**



Figure 2.7
Lake Goollelal 2008
Further encroachment observed
since previous photograph (2.6)
Source: Landgate Western
Australian Authority



2.6 Oral Histories

To gain a human perspective of the study area several people were interviewed during the course of the study. Their interpretations and the information they provided are discussed in relevant chapters. The following people were interviewed during the course of this study:

1. Noel Nannup, Nyoongar Elder;
2. John Parrin, local and long time resident of Wanneroo; and
3. Members of the Wanneroo Historical Society.

The interviews were incorporated into the Methodology as a means of adding to the historical understanding of the park. However, the actual content recorded from the interviews was more generalised than anticipated.

2.7 Fieldwork

Field verification of past and present ecological changes can supply information both of ecological and historical value. The author spent considerable time photographing and observing the Park, during different seasons and at differing times of the day. This information will be discussed during the course of this study. While photographing wild orchids the surrounding area revealed a large termite mound, a fox's lair and the occasional kangaroo. A week after the visit fire raged through the area and a considerable part of the bush was destroyed. However, visiting the site a month later, it could be seen that new life was returning.

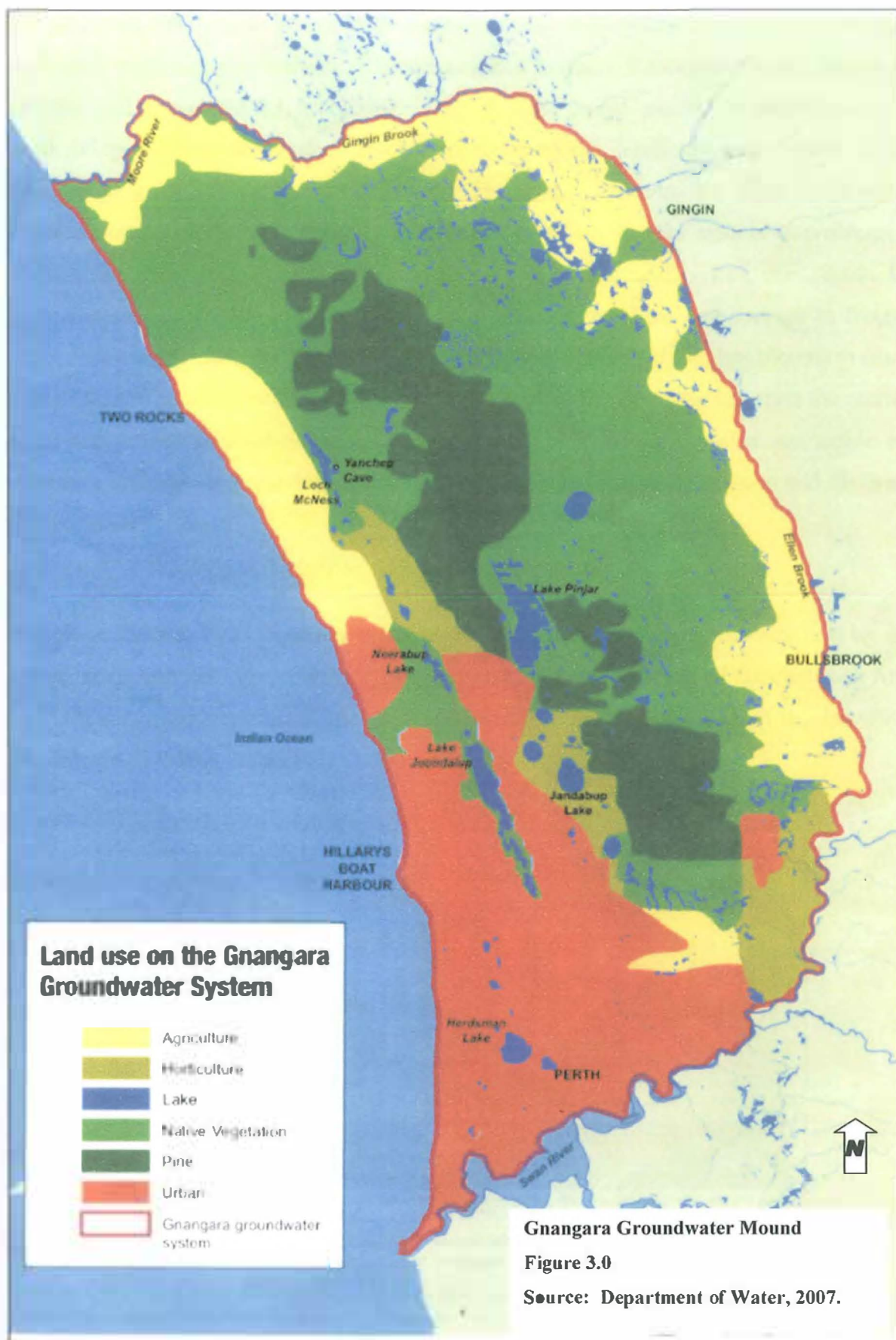
As discussed in Chapter 3 the invasion of exotic biota is steadily degrading the natural ecosystem in the wetland areas of the Park. The author photographed this major problem during field visits. Chapter 5 discusses the felling of numerous jarrah and tuart trees. Field studies confirm these areas have not recovered from early usage.

CHAPTER 3 THE STUDY AREA

Located approximately 20 kilometres north of Perth, the Park was established in 1989 and honours Yellagonga, the leader of the Mooro Aboriginal community at the time of early European settlement. The areas around Lake Joondalup form part of the Aboriginal people's 'Dreaming', which is their concept of spirituality. Balla (1994, p.11) recognised the importance of the wetland systems to the Aboriginal people. She stated: 'they act as a moist refuge in an arid environment in summer and autumn, and a source from which life radiates in winter and spring'.

The Park has a rich historical background for non-Aboriginal people as well, important sites include: Cockman House, Perry's Paddock, Wesleyan Mission School, Luisini Winery and Neil Hawkins Park. The Yaberoo Budjara trail (28 kilometres in length) links Lake Joondalup through to Neerabup National Park. The original trail was used by the local Aboriginal people to link the lakes and wetlands of the Swan Coastal Plain. The Park also encompasses some of the most important wetlands on the Swan Coastal Plain. Lakes Joondalup (the largest in the northern suburbs of Perth) and Goollelal (south of Lake Joondalup) are connected by the intermediate Walluburnup and Beenyp swamps. The wetlands and natural bushland support a wide variety of unique flora and fauna.

Landscapes range from the open water bodies of Lake Joondalup and Lake Goollelal to dense woodland areas, fringing paperbark forests and open parkland (Department of Conservation and Land Management 2003). These wetlands provide some of the largest permanent sources of fresh water on the Swan Coastal Plain. The wetlands of Lakes Joondalup and Goollelal are connected to the Gnangara Groundwater Mound, which also supplies public drinking water requirements, agriculture and commercial water needs for Perth's metropolitan regions (Figure 3.0).



Over the last fifty years, due to human pressure, the surrounding areas of the Park have undergone extensive urbanisation. The subdivisions include: Wanneroo (1950s), Edgewater (1980s) and Woodvale in the 1990s. These most recent phases of development, of subdividing blocks into smaller blocks, transformed the landscape and caused further fragmentation to the natural environment. The main threat to the Park is increased development resulting in the loss of surrounding vegetation, and the associated problems of biodiversity loss, altered hydrology and deteriorating water inlets. Past uses, roads and infrastructure are steadily degrading the natural ecosystems. Loss and damage to fringing vegetation due to residential development can increase the potential for algal blooms to occur in the lakes. The use of artificial fertilisers being applied to lawns also increases the nutrient loads and growth of algal bloom. These factors combined with the over abstraction and excessive drainage of groundwater have probably affected the water balance and the water quality of the wetlands

3.1. Climate

The Swan Coastal Plain experiences a typical Mediterranean climate, characterised by dry, hot summers and mild wet winters. Ninety per cent of the annual rainfall falls between April and October, which replenishes the lakes and swamps during these months (Congdon, 1986. Department of Water, 2008).

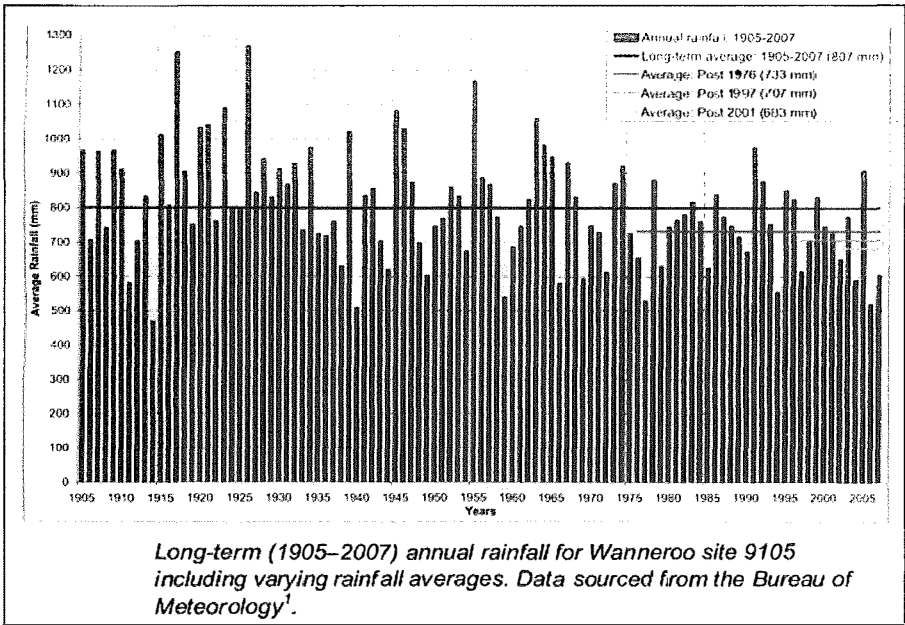


Figure 3.1
Source: Department of Water 2008.

However, the water balance is affected by direct evaporation, which occurs from soil, vegetation (mainly through leaves) and waterbodies. The mean daily evaporation is highest during the summer months, and then decreasing until midwinter, with the lowest mean value during July. The Perth region has the highest number of hours of sunshine per year of any Australian capital city (Riggert, 1978). Monthly climate summary 'Perth dazzled by record 11.9 sunshine hours in November 2002' (Bureau of Meteorology, 2002). The overheating of the land gives rise to a sea breeze named by the early European settlers the 'Fremantle Doctor' (Seddon, 1972).

3.2. Landforms and Soils

The landforms within Yellagonga Regional Park are of similar geological features as found elsewhere on the Swan Coastal Plain. They were formed from large sand dunes that over time have become consolidated and stabilised with vegetation. The Park is characterised by 'high elevation sloping dunes separated by low elevation interdunal depressions occupied by the wetlands' (Upton & Kinnear, 1997, p. 3). The Park is situated within the coastal limestone belt of the Swan Coastal Plain. This Quaternary dune system corresponds to the geomorphic element of permeable, aeolian sands known as the Spearwood Dune System (Upton & Kinnear, 1997, p. 7).

Three different soil types are present within Yellagonga Regional Park:

1. Cottesloe Soil Association
2. Karrakatta Soil Association.
3. Beonaddy Soil Association

The Cottesloe Soil Association consists of shallow yellow and brown neutral soils over limestone outcrops, and lies to the west of the Karrakatta Soil Association. Collectively the Karrakatta and Cottesloe sands are known as Spearwood sands. (Gentilli, 1998; Seddon, 2004). (Figure 3.2)

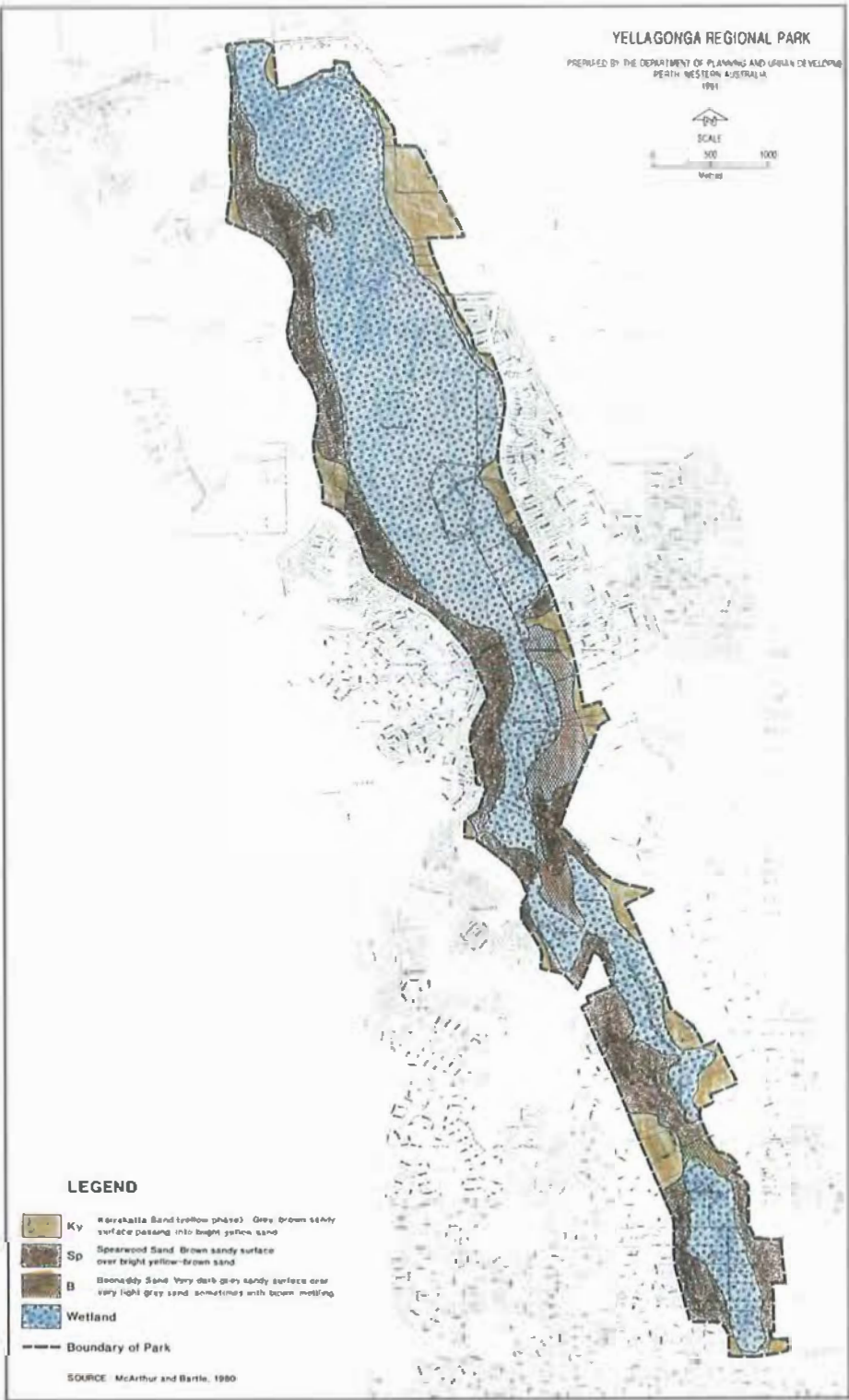


Figure 3.2
Three types of soils in Yellagonga Regional Park
Source: Department of Planning and Urban Development
Note: Colours selected by author

The Karrakatta Soil Association consists of deep leached yellow and brown sands overlying limestone which usually found within three metres of the surface, this occurs to the east of Walluburnup Swamp and the western perimeter of the regional open space. These sands support a tall open forest of tuart, (*Eucalyptus gomphocephala*), jarrah, (*Eucalyptus marginata*), and marri (*Eucalyptus calophylla*) (Seddon, 1972, p.11). Between Beenyup and Walluburnup swamps there is a fringe of Beonaddy sand. This has a dark grey surface layer, becoming lighter at a depth, with brown mottling caused by decayed infiltrated humus. It is often to be found in low-lying flat areas adjacent to lakes and swamps (Heddle 1980; Upton & Kinnear 1997).

3.3. Vegetation and Habitats.

The vegetation in and around the Park has been subjected to extensive alteration from the time of early European settlement. However, there are still pockets of original community vegetation remaining that are characteristic of the Spearwood Dune System. They represent those once widespread on the Swan Coastal Plain. Many of the trees we see today on the western boundary of the Park were growing before European settlement.

There are possibly four plant communities in the study area. These include the Eucalyptus Woodland Community, which occurs at the eastern perimeter of the Park on Karrakatta sand. The Woodland Community on Cottesloe sand and around the water's edge is the Fringe Community. The fourth is the Swamp Community in the swamps (Brittain, 1990, p. 16). Amongst the dominant canopy species in these plant communities are the following:

- Paperbark, (*Melaleuca raphiophylla*), Flooded Gum (*Eucalyptus rudis*);
- Jarrah (*Eucalyptus marginata*);
- Marri (*Eucalyptus calophylla*); and
- Tuart (*Eucalyptus gomphocephala*).

For example, tuart is the only large tree wholly restricted to the Swan Coastal Plain in a long narrow belt along the Coastal limestone. The timber of the Tuart is very hard and dense (Seddon, 2004).

Jarrah is common on the Swan Coastal Plain and is the dominant eucalypt on the Karrakatta Soil Association. Many trees have survived for more than three hundred years and are thus 'a link with the Aboriginal landscape' (Seddon, 1972, p.120). Its timber is known for its toughness, durability and resistance to termites, which makes it ideal for telegraph poles, fences, floors and furniture. During the nineteenth century Jarrah was known as Swan River mahogany, and valued as a cabinet wood. It is also well adapted to fire; the timber tends to char rather than burn (Seddon, 2004). Jarrah was also used as road making material during early European settlement. Vast areas of Jarrah were felled and this would have had a significant impact on the ecological balance of the study area.

The farmers regarded Marri as an indication of relatively good agricultural soil. It is most common on well-drained wetter soils; however, the flooded gum (*Eucalyptus rudis*) takes over as the soil becomes more poorly drained. The paperbark grows in water during the winter, but above the water line in the summer months (Seddon 2004).

3.4. Weed Invasion

Since European settlement there have been major invasions of introduced weed species, which have impacted on the Park. Environmental weeds are steadily degrading the natural ecosystems and unless they are controlled it will lead to the demise of the natural vegetation. Weeds have been defined as plants that establish themselves in natural ecosystems. These include herbs, grasses, shrubs, trees and aquatic plants. Weeds have the potential to dominate and simplify natural ecosystems. They grow fast and out-compete native plants (some examples listed page 41).

Weeds are spread by wind, water, birds, vehicles and dumping of garden rubbish containing seeds and plant material. Garden plants account for sixty-six per cent of recognised weed species (State of Environment p. 100). Since early European settlement about one quarter of plant species on the Swan Coastal Plain have been introduced from elsewhere (Ripley & Rowland, 1995). Accordingly, early nostalgic settlers brought garden plants and seeds from their homelands to develop gardens that reminded them of home.



Figure 3.3

Introduced Exotic Biota: Nasturtium (*Tropaeolum majus*)

Source: Sue Ujma, October 2008.

Dumping of exotic biota from surrounding urbanisation at Lake Goollelal

Exotic plants can inhibit the native plant vegetation and create a risk of invasion of the wetland areas. Continuing weed invasion is steadily degrading natural ecosystems in the Park, making it almost impossible to restore degraded sites to their natural habitat. In some sections of the Park the understorey has been largely replaced by Veld Grass (*Ehrharta calycina*). Also Couch grass (*Cynodon dactylon*) is vigorously invading wetland fringes in many areas. Other major weeds include: Arum Lily (*Zantedeschia aethiopica*), Fennel (*Foeniculum vulgare*), Cape Tulip (*Homeria miniata*). (Department of Conservation and Land Management 2003).

To protect native bushland from weed invasion the general public should be educated on the disposal of garden rubbish and grass clippings at designated council sites and green-waste pickups. Local residents should also be encouraged to grow native plants as they increase the biodiversity, stop degradation and provide food and habitats for native birds and insects. The Cities of Joondalup and Wanneroo are working together to encourage residents and business to restore the distinctive flora of the Park.

3.5 Flowering Plants

Orchids are a natural treasure in Western Australia and they are protected plants, formerly abundant in the metropolitan area but are now becoming scarce (Gardner 1995). Many are extremely beautiful and their appeal is universal. Some of the wildflower orchids located in the Park follow:

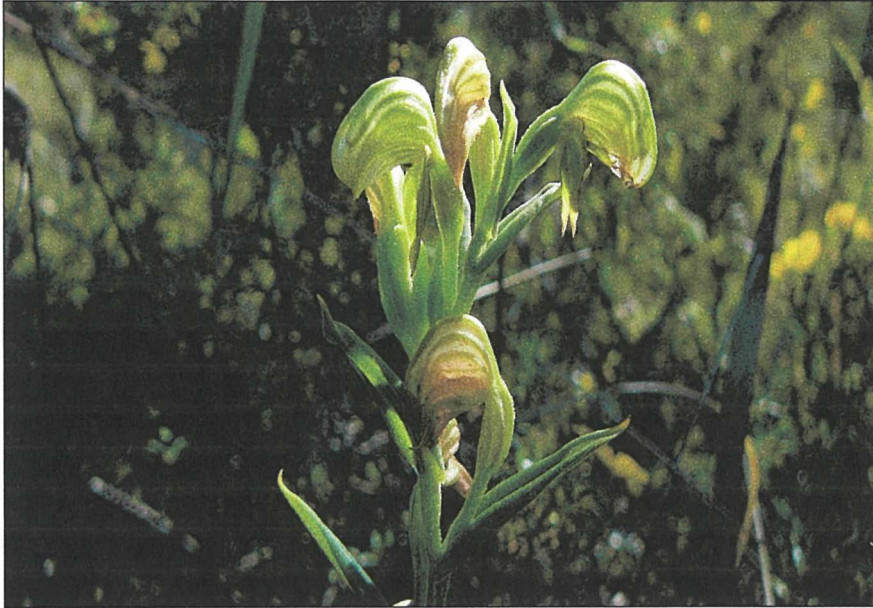


Figure 3.4
Coastal Banded Greenhood orchid (*Pterostylis sanguinea*)
Source: Sue Ujma, (October 2008) Yellagonga Regional Park

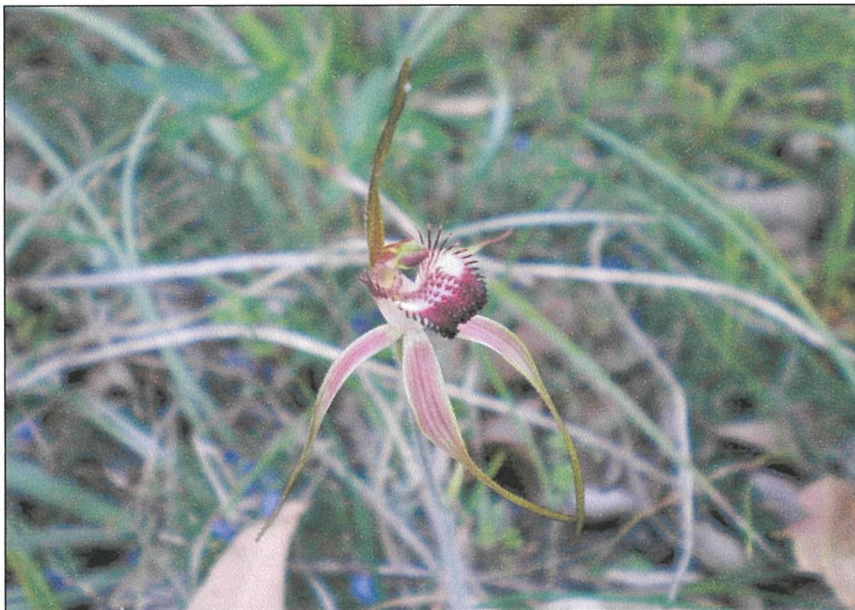


Figure 3.5
Leaping Spider orchid (*Caladenia macrostylis*)
Source: Sue Ujma, (October 2008), Yellagonga Regional Park



Figure 3.6

Donkey orchid (*Diuris corymbosa*)

Source: Sue Ujma, (October 2008), Yellagonga Regional Park



Figure 3.7

Cowslip orchid (*Caladenia flava*)

Source: Sue Ujma, (October 2008), Yellagonga Regional Park



Figure 3.8
Pink Fairy orchid (*Caladenia latifolia*)
Source: Sue Ujma, (October 2008), Yellagonga Regional Park

3.6 Waterbirds

The most spectacular inhabitants of the wetlands are the many varied waterbirds, which inhabit them. Wetlands serve as an important breeding ground and summer refuge for a diverse waterbird population. The following species are located within the study area.

Waders and shorebirds



Figure 3.9
Sacred Ibis (*Threskiornis aethiopicus*)
Source: Gary Tate, Lake Goollelal, Yellagonga Regional Park



Figure 3.10
Great Egret (*Egretta alba*)
Source: Gary Tate, Picnic Cove, Yellagonga Regional Park

Deep water and diving birds

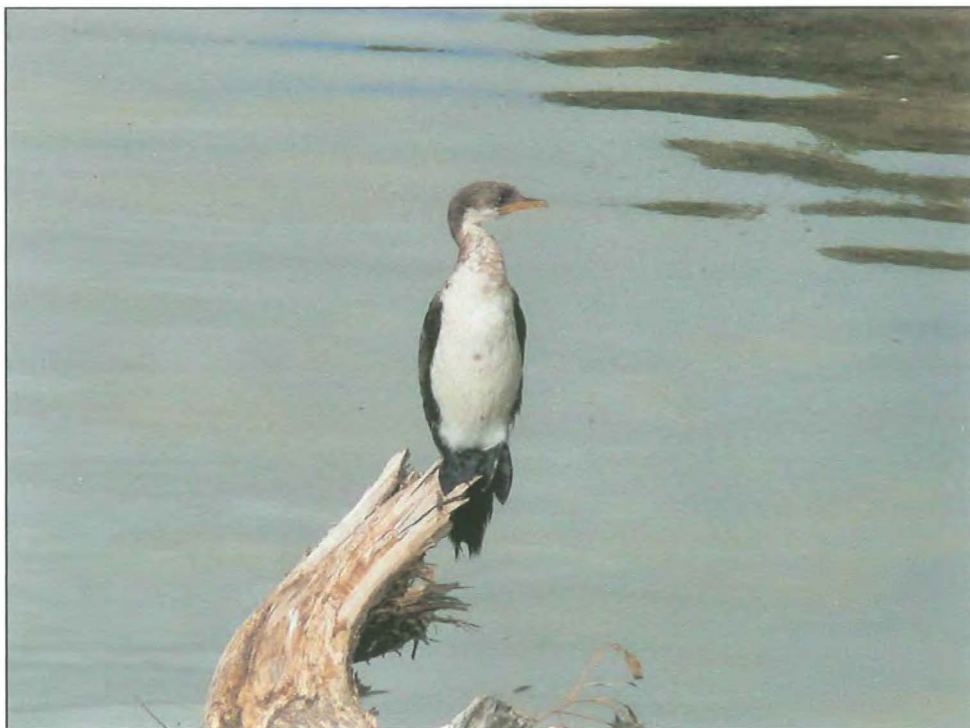


Figure 3.11
Little Pied Cormorant (*Phalacrocorax varius*)
Source: Gary Tate, Neil Hawkins Park, Yellagonga Regional Park



Figure 3.12
Blue-billed Duck (*Oxyura australis*)
Source: Gary Tate, Lake Goollelal, Yellagonga Regional Park

Shallow water feeders



Figure 3.13
Blue-winged Shoveller (*Anas rhynchos*) Left to right Female/Male
Source: Gary Tate, Neil Hawkins Park, Yellagonga Regional Park



Figure 3.14

Grey Teal (*Anas gracilis*)

Source: Gary Tate, Neil Hawkins Park, Lake Joondalup, Yellagonga Regional Park

3.7 Notable Terrestrial Fauna



Figure 3.15

Carnaby's Cockatoo (*Calyptorhynchus latirostris*)

Source: Gary Tate, Lake Goollelal, Yellagonga Regional Park



Figure 3.16

Rainbow Bee-Eater (*Merops ornatus*)

Source: Gary Tate, Beenyup Swamp Yellagonga Regional Park

3.8. Other Aquatic Fauna

The Long-necked Turtle (*Chelodina oblongata*) is found in permanent wetlands and spends most of their time submerged for long periods. The turtle is carnivorous, feeding on fish, molluscs and crustaceans. The female lays her eggs in the soil on the dry slopes around the wetland. Eggs and hatchlings fall prey to foxes and feral cats and are also an important seasonal food source for many water birds, which utilise the lakes. Many are killed on roads built too close to wetlands (Bush; Maryan; Brown-Cooper; Robinson, 1995).



Figure 3.17

Long-necked Turtle (*Chelodina oblonga*)

Source: Gary Tate, Neil Hawkins Park, Yellagonga Regional Park

3.9 Reptiles

Yellagonga Regional Park has only two recorded highly venomous snakes, which live around the swampy, and less disturbed areas, the Western Tiger (*Notechis scutatus occidentalis*) and Dugite snake (*Pseudonaja affinis*). They feed principally on frogs, although lizards, mammals and young birds are also taken. All snakes are accomplished swimmers and shelter beneath logs, low shrubs and abandoned rabbit burrows. Snakes and other reptiles help maintain balance within wetland ecosystems.



Figure 3.18

Western Tiger Snake (*Notechis scutatus occidentalis*)

Source: Garry Tate, Lake Goollelal Yellagonga Regional Park



Figure 3.19

Dugite (*Pseudonaja affinis*)

Source: Gary Tate, Lake Goollelal Yellagonga Regional Park

3.10 Mammals

Kangaroos are among the strangest of all mammals. The female carries her young in a pouch until it is able to fend for itself. They are specialised for hopping as their greatly developed hind limbs and tail are contrasted with reduced forelegs. The main component of their diet is grass (Dawson, 1998).



Figure 3.20
Male/ Female Western Grey Kangaroo (*Macropus fuliginosus*)
Source: Gary Tate, South of Picnic Cove Lake Joondalup
Note: Joey in pouch.

3.11 Water and Wetlands

The wetlands of Lakes Joondalup and Goollelal are connected by the intermediate Walluburnup and Beenyup swamps. Lake Goollelal, to the south of Lake Joondalup, is ten metres higher topographically. When levels are high water from Beenyup Swamp flows into the southern end of Lake Joondalup. The water flows to the Lake via a culvert under Ocean Reef Road. The greatest source of surface water for these wetlands is derived from rainfall; this presents a significant addition to the lakes' water input and nutrient balance (Congdon, 1986). Wetlands within the Park are also connected to the Gnangara Groundwater Mound, (Figure 18) which supplies the public water requirements, agriculture and commercial water needs for Perth's metropolitan regions. The Gnangara Groundwater Mound is so named because the aquifer forms a mound beneath the land surface, which rises to approximately seventy metres above sea level (Figure 31.0) (Department of Water 2008).

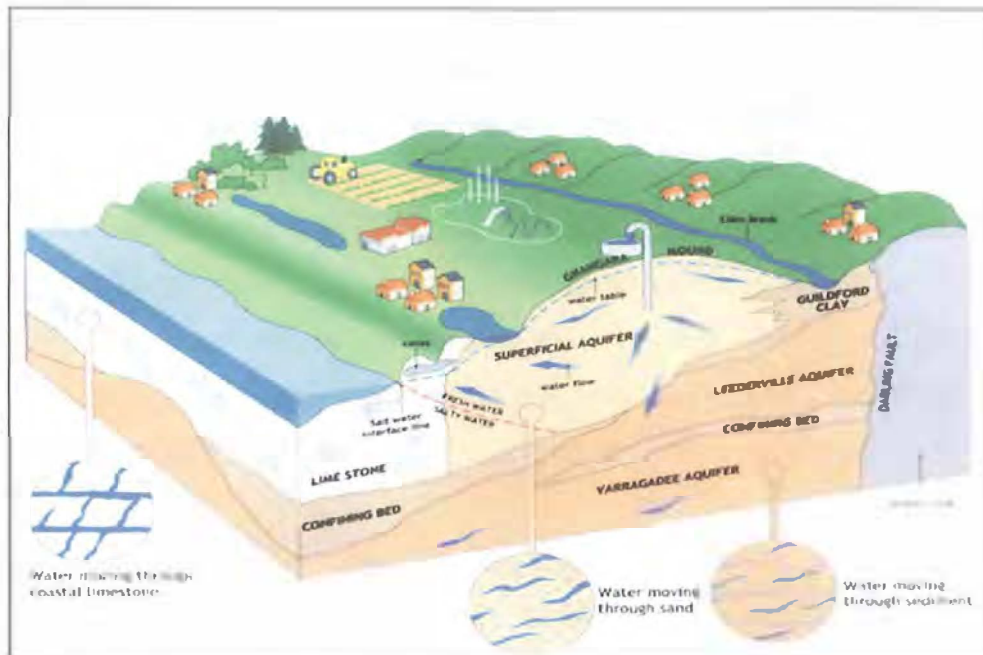


Figure 3.21
The Gngangara Groundwater System
Source: Department of Water 2008

Recharge of the aquifer primarily occurs in the winter months as rainfall seeps through the soils to become part of the Gngangara Groundwater system. The reliability of the Gngangara groundwater system for water supply depends directly on rainfall. Figure 3.1 shows total annual rainfall including varying rainfall averages for Wanneroo town site from 1905 to 2007. Groundwater levels across the mound have been declining since the 1970s due to the drying climate, extraction (bores), direct evaporation, changes in land use, and transpiration by vegetation, and groundwater overflow (Department of Water, 2008).

CHAPTER 4 TRADITIONAL ABORIGINAL LAND MANAGEMENT

4.1. The Aboriginal people's Sustainable Land Management

The Aboriginal people of the Swan Coastal Plain lived in one of the richest areas of the Australian continent. The Aboriginal cultural and linguistic group known as 'Nyoongar' or 'Nyungar' meaning 'the people' had custodianship of different areas of the land around the Swan River Colony. During this period, sub-clans and family groups shared the land. They erected no permanent buildings and lived as nomadic hunter-gatherers, moving with the seasons; therefore there was no competition for ownership of the land (Gilks, 1972). According to Seddon (1972), research shows that prior to European settlement there were several small, closely-knit Aboriginal groups around the Swan River Colony.

Their population density was established by the availability of water, food and other resources. To the north of the Swan River was the Mooro district tribal group of twenty-eight people led by Yellagonga (uncle of Yagan) who was later killed by early European settlers. Their territory stretched from Moore River in the north to the Swan River in the south, Mount Eliza (Kings Park) was their main camp (Figure 4.0). Midgegooroo was the tribal elder of a group of twenty-eight persons in Beelair. Mundi was the elder of a group in Beeloo with thirty-two persons (Seddon, 1972, pp. 188-9).

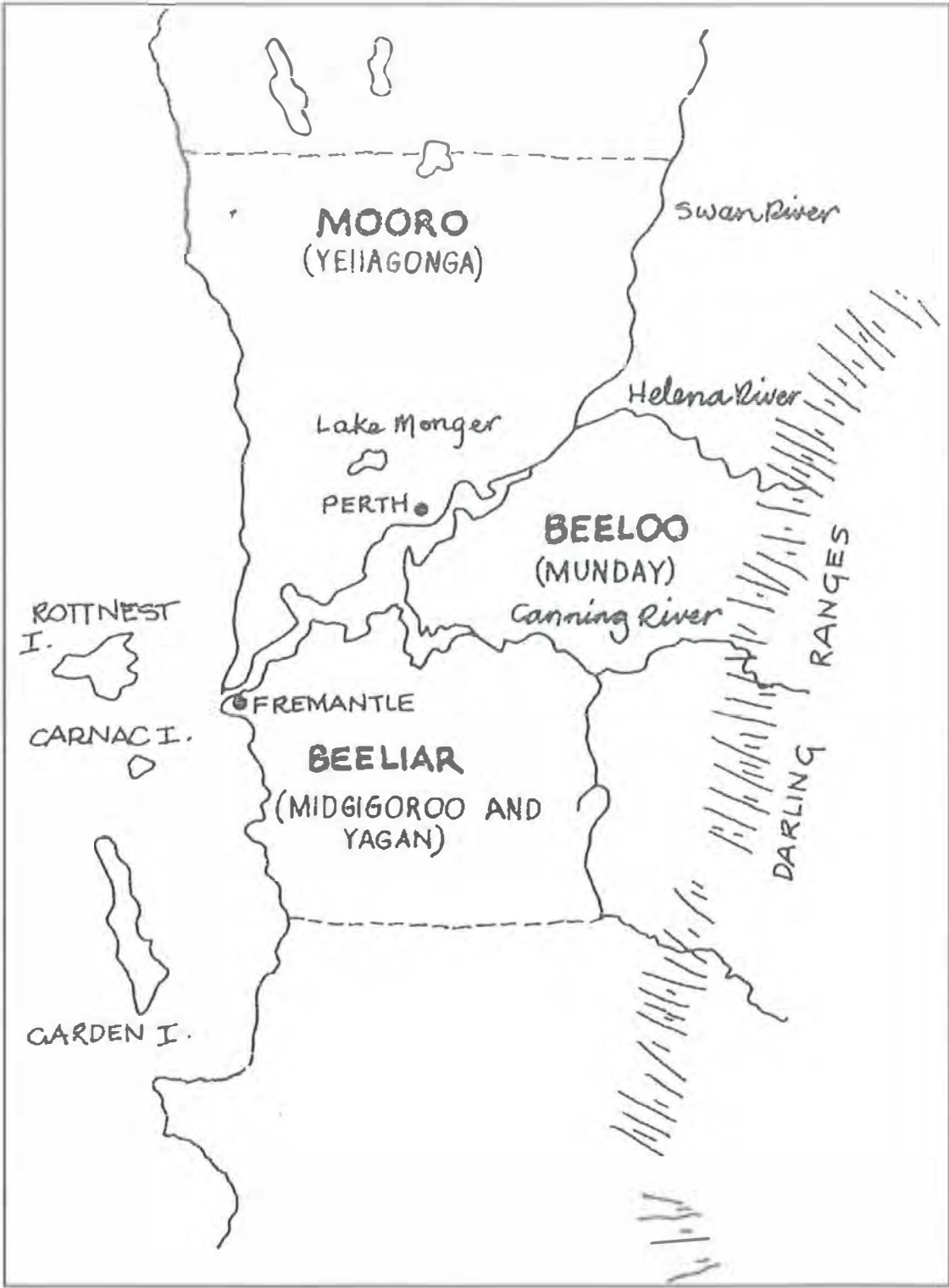


Figure 4.0
Sketch (not to scale) showing native tribal districts around Perth according to the researches of Robert Menli Lyon in 1832
Source: Seddon, (1972).

With the arrival of the early European settlers, Mooro district tribal group led by Yellagonga were pushed further north from Mt. Eliza (Kings Park) to Lake Monger. They later withdrew to Lake Joondalup campsite. This open space is located between the southern tip of Lake Joondalup and the northern end of Walluburnup and Beenyup swamps, now known as Perry's Paddock. It has a strong historical and cultural significance to both Aboriginal and non-aboriginal people. However, Britain (1990) suggests that they did not remain on the Joondalup camping site after 1829, due to the subdivision of their land into pastoral leases and the establishment of the Wesleyan Mission Farm in 1844. A bronze plaque is all that remains of the Mission School (Figure 4.1).



Figure 4.1
Wesleyan Mission Farm 1844-1852 on the shores of Lake Goollelal
 Source: Sue Ujma, January 2009

The permanent presence of European settlement in Yellagonga's territory had a devastating effect on his people. Yellagonga was reduced to begging from the settlers and his untimely death on 10 June 1843 was by drowning (Brittain, 1987, p. 44). *Perth Gazette* printed a brief obituary:

Death of the King of Perth

The mild amiable Yellagonga acknowledged by the natives as the possessor of vast tracts of land between Perth and Fremantle, is no more. He fell from a rock on the river's bank, and was drowned.

(Cited in Green, 1984, p. 51).

The Aboriginal people were semi-nomadic hunter-gatherers collecting a diverse range of natural food within certain territorial boundaries, which they believed their spiritual Ancestors established (Broome, 2001). Aboriginal people were familiar with every detail of their section of land. As hunter-gatherers they moved across their land in accordance with the seasonal changes and the detailed knowledge of the variation of the natural plant and animal resources that were readily available. Their diet was variable according to the following seasons (Figure 4.2).

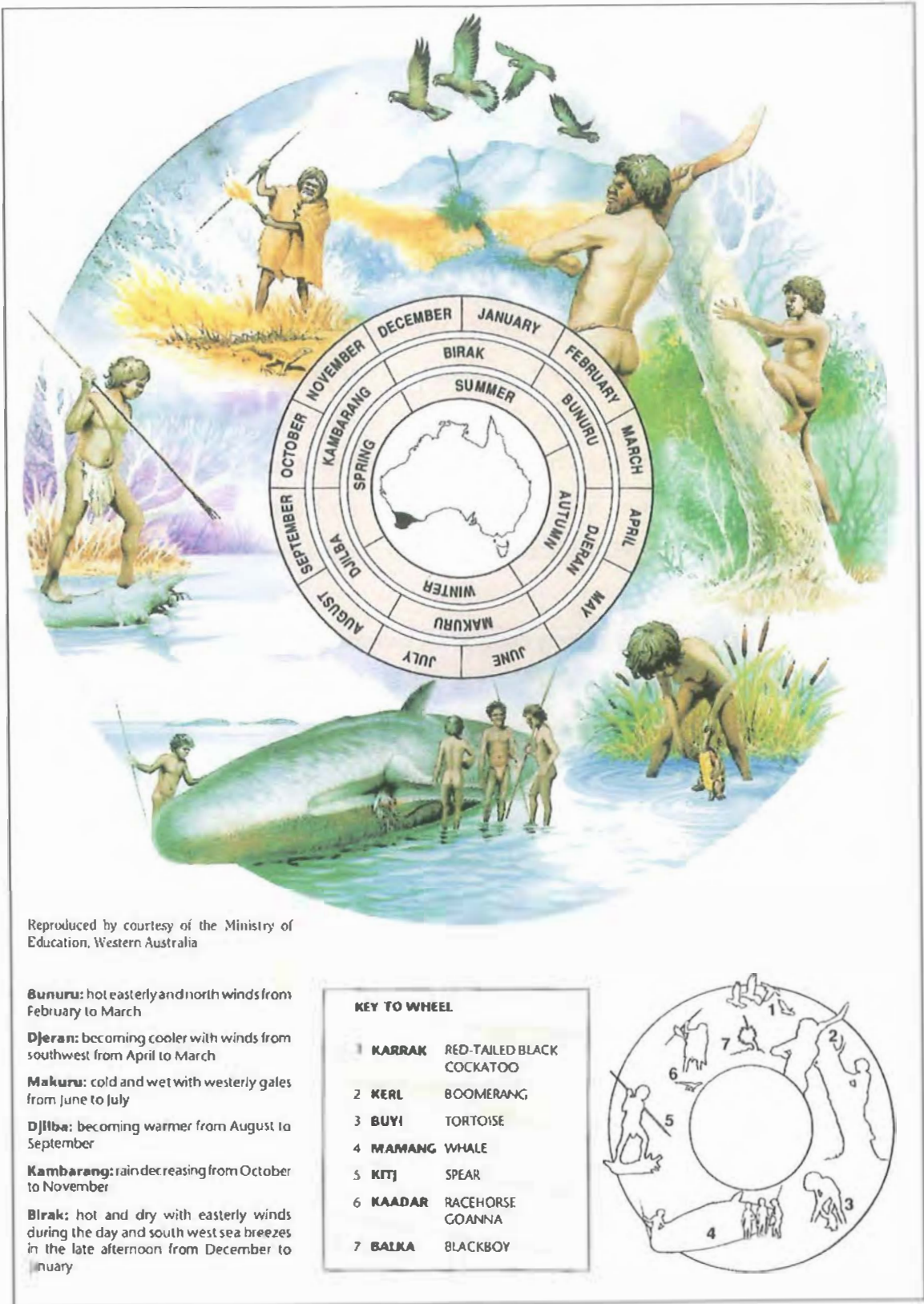


Figure 4.2
Seasonal Aboriginal peoples food calendar
Source: Bindon; & Walley, (1992).

The term 'calendar' is used to describe the temporal divisions of a year (Clarke, 2003, p. 112). They did not plant or cultivate cereal crops, nor did they herd sheep or cattle, but relied entirely on food which they gathered from the sea, riverbanks, lakes and the land (Broome, 2001).

They developed skills from an early age, which enabled them to creep up unnoticed to within spearing or boomerang distance of grazing herbivores, such as kangaroos and emus. When hunting animals they knew how to interpret all tracks and how to imitate the sound these creatures make (Berndt & Berndt, 1992). Although Aboriginal men were extremely efficient hunters, they sometimes failed to catch their difficult quarry. Therefore the tribe relied on the women's food supply of yams, fruits, vegetables, seeds and small animals (Dingle, 1988). Aided by digging sticks made from natural materials, and bush skills, women made their contribution to the food supply which ensured their survival (Broome, 1994).

George Fletcher Moore in 1834, recorded Aboriginal people making bread 'out of the root of the flag which they called *yandyett*. It tasted like a cake of oatmeal. They peel the root, roast and pound it, and bake it. The root is as thick as your finger and a foot long' (p. 220).

Their adaptation and survival was based on a detailed understanding of nature and natural phenomena (Bourke & Bourke, 1994). For generations they fished and harvested food from a rich variety of plant and animal foods found in the wetlands and surrounding areas. They developed an extremely efficient system of managing the land and its natural resources, rather than modifying it to suit them. They gathered sufficient food for their immediate use, always leaving enough behind to ensure their propagation into the future: they managed their resources to good advantage (Lofgren, 1988). Some of the food sources the Aboriginal people located in the Park include the following:

Flora/Fauna	Food Source
Rhizomes of bulrushes, <i>Typha angustifolia</i> ; the native name is Yanget, from which the name 'Yanchep' is derived.	When harvested they are eaten raw or roasted in the ashes to make a type of bread. Replanted undersized tubes to encourage a future crop.
Cycad fruit (<i>Macrozamia reidlii</i>)	Extensive processing to leach out the poison.
Grasstree (<i>Xanthorrhoea preissii</i>)	Then baked into cakes. When soaked in water can be used as a drink.
Trans-equatorial migratory shore birds.	Good food source.
Fish, yabbies, fresh water mussels and freshwater crayfish.	Good food source. Crayfish were cooked whole on hot coals.
Ducks, swans, ibis, egrets, herons, spoonbills and swamp hens.	In breeding season eggs were collected. Good food source.
Kangaroos, Possums and Brush Wallaby.	These were trapped and speared. An excellent food source. Skins were used as blankets. Bones were used for sewing skins together.
Frogs	Wetland food source for Aboriginal people also for snakes and birds, water rats. However, frogs are becoming endangered due to climate change, pollution and loss of habitat.
Freshwater turtles (yarrigan).	Cooked in their shells they are considered a delicacy. Eggs were dug up and eaten. They are also food for other wetland users e.g. Fish, birds and goannas.

Wetlands as a food source for Aboriginal people in Yellagonga Regional Park

Figure 4.3

Sources: Clarke, 2003, p. 129. Erbacher, 1998, pp. 27-45.

Having an intimate knowledge of their surroundings; the Aboriginal people lived and moved within their tribal territory. However, they would gather to observe ceremonies and rituals that governed their tribal life, which was based on sufficiency and sharing (Broome, 2001).

Anthropologists Catherine and Ronald Berndt (1992) wrote about the harmony and balance Aboriginal people had with their lives and the total environment:

They were intimately familiar with everything within it, and the life they led demanded that they should have this detailed knowledge. They also believed that they shared the same life-essence with all the natural species and elements within that environment.

Their social world was expanded to include the natural world. Conversely, their natural world was humanized, and this was true for the land as such (p. 137).

4.2. End of Aboriginal people's land management practices

However, when the early European settlers arrived they saw the land and its people as an economic commodity to be exploited, bought and sold (Broome, 1994). The early settlers did not understand the importance of the hunter-gatherer movement across the land or the way it related to the availability of food supply according to the seasons. They were ignorant of Aboriginal people's cultural and spiritual matters, which led them to misunderstand their movement as aimless and wandering. Aboriginal land management was a systematic and well-managed use of the environment that had been refined through experience over thousands of years. Aboriginal people only took from the land what nature provided; therefore an ecological balance was maintained (May, 1994).

Before European settlement Aboriginal people, the original custodians of the land, had evolved a pattern of life that was well suited to their environment. 'Aboriginal people saw the land religiously, as an intimate part of themselves and all life' (Broome, 1994, p. 36). Land is the core of Aboriginal spirituality. One figure of particular significance in Aboriginal mythology is the 'waugal', because of its association with the landscape, water, lakes and swamps, the sea and caves. According to the Aboriginal people a mythological creature created the valley of the Swan River. It was shaped like a snake or crocodile and left traces of its journey from the hills to the ocean in the forms of curves and windings of the river (Bourke, 1987).

Because of the semi-nomadic nature of their occupancy there was minimal disturbance to the environment. However, they did influence the environment by the use of fire stick burning, which they used to increase the productivity of their environment (Cameron, 1981).

Sir Thomas Mitchell in 1839 observed the relationship between the Aboriginal people and their environment. He noted:

Fire, grass and kangaroos, and the human inhabitants, seem all dependent on each other for existence in Australia...Fire is necessary to burn the grass, and form those open forests...the native applies the fire to the grass at certain seasons, in order that a young green crop may subsequently spring up, and so attract and enable him to kill or take the kangaroo with nets.
(Mitchell, 1848, p. 412).

George Fletcher Moore (1894), one of the earliest settlers on the Swan Coastal Plain observed. 'The natives in summer set fire to the grass and dry herbage, and after the fire has passed over the ground, you could hardly find as much green food as you could feed a rabbit, till herbage has time to grow again' (p. 219). Fire kept the country open and inadvertently prepared the land for early European settlers. Explorer George Grey interpreted the use of fire to improve root resources as a 'sort of cultivation' (Hallam, 1979, p.14). Fire was important to Aboriginal traditional life. Captain James Stirling, the first Governor and founder of the Swan River Colony noted that the openness of the landscape was maintained and enhanced prior to European settlement by land management practice of the Aboriginal people and their 'firestick farming' (Cameron, 1981, p. 20).

Firestick farming was the systematic burning of the land in a 'mosaic pattern'. This had the effect of flushing out game and rejuvenating plant growth as well as increasing food production (e.g. some plants need fire to germinate) and allowing birds and mammals to flourish. Burning also releases nutrients back into the soil as required for agriculture. Fire also enabled people to travel more easily over less densely covered terrain (Bourke & Bourke 1994). However, the burning of the underbrush brought them into conflict with the settlers. Houses, crops and cattle were destroyed. Since European settlement the cessation of the fire-stick burning regime has led to some perennial shrubs and grasses (maintained through regular burning), being lost in many areas. The weeds are now choking the wetlands as will be discussed in further detail in chapter three.

At the beginning of European settlement the relationship between Aborigines and the early European settlers was amicable. In Aboriginal culture people share everything, but they could not understand the Western concepts of ownership, or theft. Aboriginal people considered it their right to gather flora and fauna found within their 'traditional estates' (Clarke, 2007, p. 136). This led to the breakdown of relations between the two groups, which ultimately led to conflict.

Misunderstandings were also exacerbated by language difficulties and competing demand for the land that supported their livelihoods. Crops were planted and cattle were allowed to graze by the early European settlers. Introduced sheep and cattle destroyed the ground cover on which the natural food of the Aboriginal people relied. Bush creatures were shot because they ate the food needed for stock pastures.

Grazing animals damaged the wetlands and left the rivers and streams choked with silt. The early European settlers destroyed the balance between humans' and nature forever and contributed to the progressive fragmentation of the wetlands and its life support systems.

Chapter five describes the transitional period from Aboriginal to early European land management practices.

CHAPTER 5 TRANSITIONAL PERIOD FROM THE ABORIGINAL PEOPLE'S LAND MANAGEMENT – EARLY EUROPEAN PRACTICES.

5.1 Early European land use

The first European settlers arrived at the Swan River Colony on 1 June 1829. By 29 September of the same year, the first grants of rural lands along the Swan River were given to the European settlers and a new era of land clearance, exploitation of resources and the gradual fragmentation of ecosystems had begun. The transitional period from Aboriginal to early European land management practices began in 1838 with the early European settlers subdividing the land into pastoral leases and utilising the natural resources. Cattlemen found the land suitable for grazing and utilised the wetlands during cattle droving. A trail developed to the western side of Lake Joondalup (now known as Neil Hawkins Park) was once a watering point for stock. The trail became known as the Northern Stock Route to Moore River and beyond. (Figure 5.0). As the stock increased, the area around the study area was used for grazing which damaged the wetlands and left lakes choked with silt (Gilks, 1977).

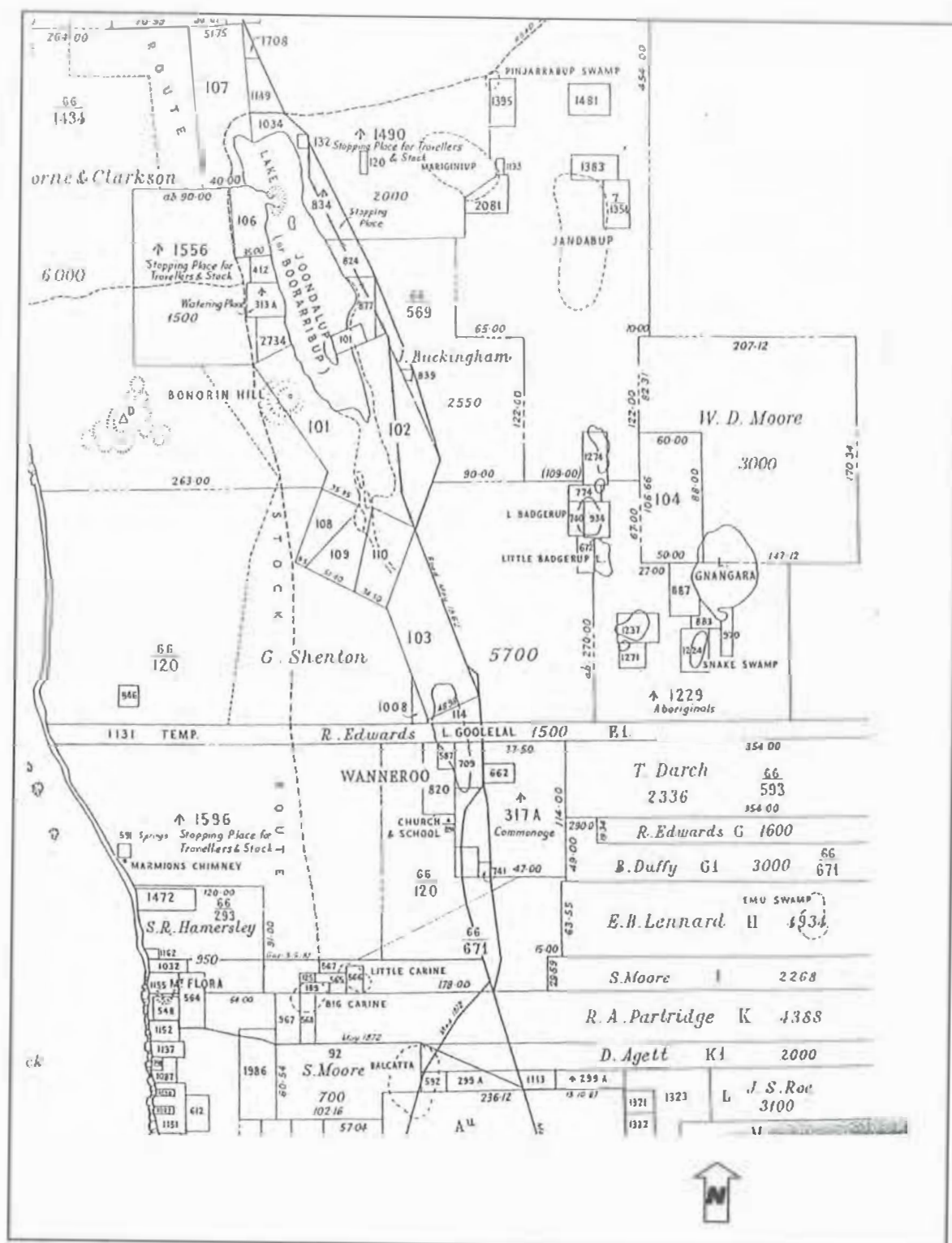


Figure 5.0
 Stock Route passing along the western edge of Lake Joondalup-----
 Sketch (not to scale)
 Source: Chambers, 1991, p. xvii

5.2 Early Wanneroo and Lakes Joondalup and Goollelal

In 1837 the Surveyor General, John Septimus Roe, sent Thomas Watson 'to perform by contract a survey of the entire boundaries of the lakes...in the hope that it would draw a population towards the spot' (Russo, 1998, p.115). However, due to access difficulties, the area now known as Wanneroo remained relatively underdeveloped, as it had no rivers, and its lakes were too far apart to act as waterways (Aris, 1997).

The first known descriptive vision of any part of the Wanneroo area was by explorer Lieutenant (later Sir) George Grey:

We were sitting on a gently rising ground, which slopes away gradually to a picturesque lake surrounded by wooded hills whilst the moon shone so brightly on the lake, that the distance was perfectly clear and we could distinctly see the large flocks of wildfowl as they passed over our heads, and then splashed into the water, darkening and agitating its silvery surface (Grey, 1841, p. 297).

He describes meeting with the Aboriginal people of the area:

Upon a trip in a northerly direction...we reached a lake distant about fifteen miles from Perth, and called by the natives Moolooore. the horses were scarcely tethered and our fire made, when four more natives joined the party...they brought us a present of twenty-seven fresh-water tortoises...They said that although the lake was called Moolooore, the name of the land we were sitting on was Doon-da-lup (Grey, 1841, p. 292).

During the early days of colonisation the district of Wanneroo represented an outer region of the Swan River Colony. Where the name Wanneroo came from is unclear. Early explorers, surveyors and early European settlers recorded Aboriginal words. Therefore it seems likely that it is derived from two Aboriginal words 'Wanna' meaning 'Aboriginal women digging for roots' and 'roo' signifying 'the place of' thus 'Wanneroo'. However, there was some confusion over the spelling as it was often spelt as 'Wanneru'. Therefore on May 15 1953 the Government Gazette changed the name from 'Wanneru' to Wanneroo (Chambers, 1991, p. 1).

The Journals of George Grey (1841) also gives the following description of his travels on 20 April 1838 in which he refers to Lake Joondalup:

The country through which we were travelling is intersected by a long line of lakes, which run nearly parallel to the sea for a distance of about forty-five miles...we suddenly came out on the bed of a dried up swamp, looking like a desert of white sand studded with reeds. The form of natives were seen wandering about this, one mile from us, who were searching for frog's...Anxious questions were put by the men, as to their distance from Perth, and the natives all told them they would see it the next morning, "whilst the sun was still small"...(pp. 89-92).

For the present Nyoongar Aboriginal people Lake Joondalup still retains a cultural and mythological significance, as it forms part of their Dreaming. In the Dreamtime a spirit woman stepped into the swamp and left a footprint, which is now the lake. She also left some strands of her hair and the legend has it that during a full moon she comes out of the water and appears to be standing on the lake. Lake Joondalup is often referred to as the 'water that glistens' (City of Joondalup, nd).

From 1828 to 1838 Aboriginal people, cattlemen and investors shared the land now known as Yellagonga Regional Park. Although they did not establish any permanent settlement or plant crops they used the land for sustenance (Gilks, 1977).

The first fragmentation of the wetlands began with the early European settlers who explored the area for good grazing and eventually took up 1400 acres of land around Lakes Joondalup and Goollelal. However, the owners do not appear to have permanently lived there. It was never their plan to settle, their main objective was to secure land for speculation. It was part of the 'land-grabbing syndrome', mainly carried out by the well-off early settlers (Russo, 1998, p. 115). 'They sought to grab extensive parcels of land to gain political and economic power and have a life they had, or would like to have had, in England' (Russo & Schmitt, 1987, p. 10). However, in the early years of settlement farming in Wanneroo was not regarded as a viable proposition because of its isolation from Perth. Despite the distance, land was purchased, and by 1838 a small number of settlers were living and working in Wanneroo.

Lakes Joondalup and Goollelal provided both fresh water and peaty soils around their margins. However, before cultivation was possible large areas of vegetation had to be cleared. With the clearance of the land it became common practice to burn scrub from around homestead sites and areas for cultivation, destroying much of the native bushland. Clearing of the heavily timbered areas were time consuming and made heavy demands on labour. English tools brought with them were not suitable against the hard woods.

Therefore new methods had to be found to deal with the problem. 'Ringbarking' became the accepted method for removal of trees, this was done in winter and spring and the trees were felled the following spring. The accepted method was to stack light brushwood at the base of ringbarked trees and set it alight (Cameron, 1981).

It was not until 2 September 1847 any attempt to control burning by legislation was implemented. Fire bans were imposed from 30 September to 1 April (Cameron, 1981, p. 121). Apparently smoke haze covered the coastal plain throughout the summer months. Although fire represented progress in production techniques, it shows how little the early settlers appreciated or respected the Australian native flora and fauna.

As land in Perth became more expensive, potential land buyers looked for cheaper land in Wanneroo. Cheap lakeside land, good quality bore water, peaty quality of the soil and excellent water-holding capacity made it an attractive proposition for the new settlers (Gilks, 1977).

In 1893 the study area was recorded as an agricultural settlement. Land clearance commenced in the same year with the first permanent settlers utilising the natural resources on the shores of Lakes Joondalup and Goollelal for market gardening and dairying.

Eight farmers and four farmer-glaziers were recorded as residents. They were men with limited capital who bought cheap land to established 'small peasant agricultural type holdings' on the peaty soils (Gilks, 1977, p. 90).

For example there were two main types of market gardens, those established on sandy soil and those established in the swamps. The black and naturally fertile swamp soil kept its moisture throughout the year; however, the use of large machinery was impossible, due to the cultivated areas being divided into beds with channels separating each bed. Therefore work had to be completed by digging with spades, or small ploughs. (Gilks, 1977).

The early settlers first became truly aware of the land around Lakes Joondalup and Goollelal as described in the *Inquirer and Commercial News* on 7 January 1903:

Farming property Wanneroo Road

Freehold lands magnificent swamp and grazing lands 18 miles from Perth, area 1.118 acres. Well fenced and improved. 30 acres of rich swampland, grow anything.

By the year 1903 there were thirty-seven market gardens situated around the shores of Lakes Joondalup and Goollelal in a 'peasant-agricultural' pattern of smallholdings (Gilks, 1977, p. 31). According to Simpson's 1903 map (Figure 5.2) land subdivision around the Lakes shows that 'apart from two substantial blocks of Crown land, all the surroundings right up to the water's edge were in private hands' (Gentilli, 1998, p. 297). The settlers cleared the surrounding bush and in some areas actually impinged onto the lakes and swamps changing their configuration and the extent of open water.



Figure 5.1

Cattle grazing on the shores of Lake Joondalup. c.1920

Note: Fence line on edge of lake, which enables cattle to feed and graze close to water

Source: Reference Library Joondalup P00647

During the latter half of the nineteenth century the farming community grew, gradually changing the nature of the land around the two lakes. Permanent buildings were erected for habitation. The planting of non-native crops altered the landscape and native ecosystem. Cattle were allowed to graze and waterholes were fenced off thus limiting the amount of grazing needed for kangaroos and other native fauna. As a consequence of this displacement, local Aboriginals found their traditional way of life compromised and relocated in search of a more favourable environment (Gilks, 1977). Some moved further north to Moore River whilst others made an attempt at integration, engaging in occasional work for the settlers. Aboriginal burning practices were discontinued and following the introduction of exotic biota the ecology of the area was irrevocably altered (Haebich, 1988).

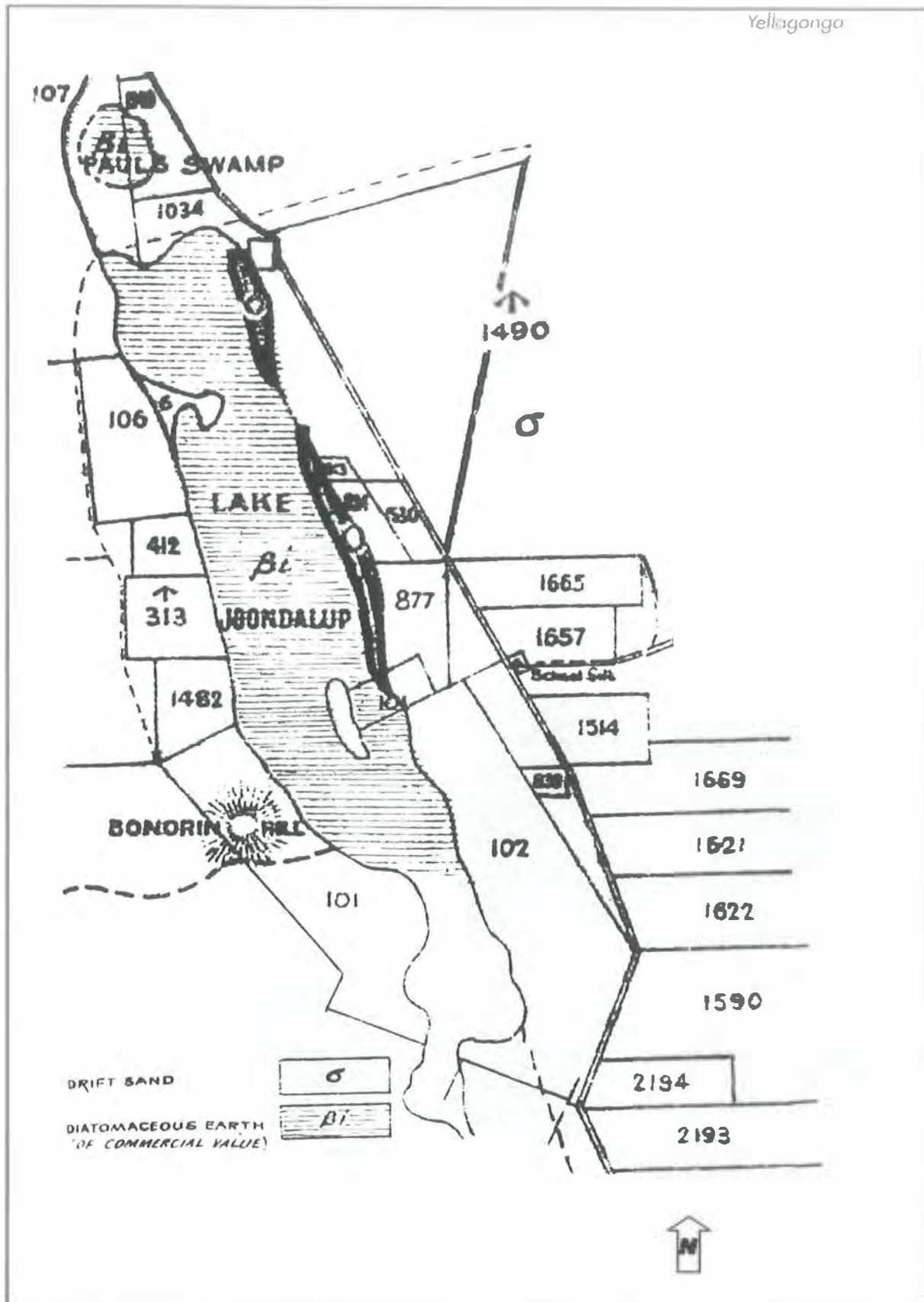


Figure 5.2
 'Simpson's Map' 1903
 Sketch: (not to scale)
 Source: Gentilli, 1998, p.299.

Apart from stockowners, a number of early settlers took advantage of the jarrah (sometimes known as Swan River mahogany) and tuart found in the study area. The natural bushland of the area was ideal for the formation of a timber industry. Timber was cut for firewood; fence post, roadblocks and building material. On the eastern side of the Lakes numerous jarrah and tuart trees were also felled for timber to build houses and the construction of wooden boxes for produce from the local market gardens. Although most of the wood was used locally, a considerable quantity was exported (Gilks, 1977). This would have had a considerably effect on the ecological balance of the bushland.

During the years 1838 to 1901, new ventures were begun. Other settlers also made a living from the natural vegetation. These were the ‘palm-wool’ pickers who collected the soft down-like material found at the base of the Zamia Palm (*Macrozamia reidlii*), which was made into pillows and mattresses (Figure 5.3). However, these people were itinerants, and as the demand for their produce lessened they sought employment elsewhere. Using these natural resources they made few changes to the ecological balance of the environment (Menchetti, 1972; Gilks, 1977).



Figure 5.3

Soft down-like material found at the base of the Zamia Palm (*Macrozamia reidlii*)
The material is very soft to the touch but full of insects.

Source: Sue Ujma, (September, 2008). Near the lookout at Neil Hawkins Park

As settlement around Lakes Joondalup and Goollelal continued, better access to Perth and the markets was essential. There was a need to break down the isolation from surrounding districts and provide residents with access to their homes. Distance from the markets presented problems with the selling of local produce. The sandy tract to Perth made travel difficult. In an attempt to overcome this isolation a 'block road' (Figure 29.0) constructed of jarrah was commenced (Daniel, nd).

In 1862 Wanneroo Road was gazetted and after earning their ticket-of-leave twenty convicts were employed to build the road from 1871 to 1875. They could not leave the district and had to pay a small percentage of their wages to repay their fare out from England (Gratte, 1990). The surface was constructed of jarrah cut from surrounding areas. These blocks were laid with sand poured in between them. The road was 2.7 metres in width and the jarrah blocks were approximately 45 cms in diameter and 20 cms thick. They were laid in straight lines to match the tracks of the vehicles wheels however, although it made travel possible it made for uncomfortable travelling (Daniel, nd).



Figure 5.4

Jarrah wooden blocks being laid in Wanneroo Road, 1902 south of Wanneroo town site. Note the basic equipment used for felling the jarrah trees and constructing the road.

Source: Joondalup Local History Library (No: 2-24).

By 1872, land grants had been taken up around most of the lakes. Life was extremely hard for the early European settlers. Carmelo (Agnello) Grincerì 1891-1964 recalled her experiences on arriving in Wanneroo from her birthplace Italy:

When we came to Australia there was nothing, it was all bush, all desert, Wanneroo Road was made of wooden stumps, there were no roads, and no houses. We lived in houses made of bags, when the wind blew it would take everything away.

Personal communication, utilising oral sources. (John Grincerì, 2003).

The lake system proved ideal for agricultural purposes and the market gardening industry intensified. New types of artificial fertilisers became available and changed the soil, which made it capable of supporting successful crops (Gilks, 1977). However, the use of artificial fertilisers, associated with agricultural development, resulted in the contamination of groundwater and surface run-off of nutrient rich water. It increased the nutrients loads, and algal bloom occurred (Balla, 1994). Mechanised equipment dug irrigation channels, bores were drilled and water pumped to the sandy hillside areas. The introduction of tractors increased production and cut down on manpower. Market gardeners were adapting to new mechanisation advances (Gilks, 1977).

An interesting feature at the western edges of Lake Joondalup is the subterranean water flow that has formed channels and caves through the limestone. Following high water levels in the late 1920s, a record high water-table level flooded market gardens around the lakes. Local market gardeners shored-up the caves on the north-west shore of Lake Joondalup on the understanding the lake would drain into the sea through a labyrinth of caves (Figure 5.6) Ruscoe, 1975; Bekle, 1979). This action was symbolic of the prevailing attitudes to the environment. Wetlands were exploited for economic potential and the water balance of the lake water was manipulated to suit human settlement. Although the channel remains today its effects are insignificant.



Figure: 5.5

Source: Susanne Koepke, (September 2008)

Caves on the northwest shores of Lake Joondalup excavated by early settlers to drain water from Lake Joondalup through a labyrinth of caves to the sea. The timber for the cave would have been cut down from surrounding areas.

In the 1920s, the next movement to Wanneroo was by the southern European migrants, with family names like Sinagra, Ariti, Conti, Villanova, Luisini and Parin. They were looking for cheap land and making their homes in Wanneroo. Today many streets in Wanneroo are named after these early pioneers. The land was situated on well-drained sandy hillside soil, which required irrigation to make it productive. The wetland areas around Wanneroo became major production centres for fresh fruit and vegetables.

For example, Italian migrant Ezio Luisini planted the first commercial vineyard on the eastern slopes of Lake Goollelal and established a winery in 1924. Fertilisers changed the well-drained sandy soil into a type of soil capable of producing high quality grapes (Gilks, 1977). The origins and operation of the winery and its role in the development of Wanneroo is closely tied to the life of the Italian community and their market gardens (Palassis Architects, 1996, p.1). The winery reflects the predominant activity, which flourished in the area until the 1960s when it succumbed to urban development.

However, the future of the winery site looks promising. The National Trust is proposing to restore the site to include a museum, restaurant and an environment centre (Department of Conservation and Land Management).

As in the time of Aboriginal occupancy and early European settlement, co-existence at first appeared to be possible. Farmers and the subdivision for residential use were able to exist with each other. However, as the demand for housing land grew, suburban homeowners were gradually displacing the farmer. It was no longer economically viable for the farmer to retain land for farming (Gilks, 1977). With rising land rates and improved road transport, market gardeners moved out of the district to seek cheaper land elsewhere.

In the 1960s and early 1970s a new era in the history of Wanneroo began with people seeking permanent residence in the district. They were mainly young families seeking cheap housing within travelling distance of their work in the Perth metropolitan area. With the development of arterial roads and the provision of public transport, business and job opportunities the area became an attractive place to live. The aim was to plan a city with urban energy and cultural vitality.

By 1975 land that was previously used for crop production had been re-zoned urban residential land and became part of the suburban extension (Gilks, 1977). Market gardens that were established adjacent to the wetlands continued until the resumption of the land by the Government in 1979 (Gentilli, 1998).

Chapter 6 discusses changes in planning from 1955 to the present, examining how the Western Australian Government proposes to manage and regulate metropolitan expansion in the future.

CHAPTER 6 SUBURBAN DEVELOPMENT AND PLANNING

The purpose of this chapter is to provide an overview of planning strategies that have influenced the development of the locality surrounding Yellagonga Regional Park. It will be discussed whether the implementation of these specific plans have had a detrimental effect on the delicate ecosystems that exist in the Park.

6.1. The Stephenson and Hepburn Plan, 1955

During the 1950s and 1960s the main problem for the Western Australian Government was how to manage and regulate metropolitan expansion. In 1952, Professor Gordon Stephenson and Town Planning Commissioner J.A Hepburn formulated a planning scheme for the Metropolitan Region. 'It is recommended that a statutory region plan be prepared for Perth which reserved private land required for future public purposes' (Department of Conservation and Land Management, 2003 p. 1). Stephenson-Hepburn Report was subsequently published in the 1955. It projected community needs for the Metropolitan Region over the next fifty years. In 1963, the Perth Metropolitan Region Scheme (MRS) was established and land was reserved for 'Parks and Recreation' (Department of Conservation and Land Management, 2003).

In retrospect, it appears the Stephenson and Hepburn Report (*circa* 1955) failed to anticipate the high level of growth in the northwest metropolitan region throughout the 1960's, a time of substantial economic growth arising from the "increasing industrial development backed by thriving agricultural development and a well planned migration programme"(Jarvis, 1979, p.123). As a direct consequence, the plan failed to meet planning needs of the era.

6.2. The Corridor Plan, 1970

In 1970 The Metropolitan Region Planning Authority (MRPA) released the 'Corridor Plan' for Perth. The City of Joondalup was identified as the new sub-regional centre to be established to serve the North-West Corridor. The plan identified the North-West Corridor as a major growth area for the Perth metropolitan area. It was envisaged that the Corridor Plan was to be the framework, which intended to guide future urban expansion in the Perth Metropolitan Region over the next twenty years.

Between the corridors there would be large non-urban wedges suitable for agricultural or recreational uses (Metropolitan Region Planning Authority, 1972). It was felt that the establishment of a continuous regional open space system had the potential for conserving the flora and fauna environments. Also included in the proposal was the protection of the lakes and native flora and fauna to conserve the unique character of the area. In 1975 the land (now known as Yellagonga Regional Park) was reserved as 'Parks and Recreation'. The Corridor Plan has remained the foundation of all-successive planning.

As discussed in chapter 5 the character of Wanneroo has always in the past been influenced by its isolation. However, during the 1970s there was an influx of people seeking cheaper affordable land. Demands for change produced a wider variety of living styles and environments. As the pressure for housing grew there was the need to develop arterial roads and the provision of transport. The introduction of new transport arteries to the north provided unique opportunities for residential, commercial and retail development. It was anticipated that if industrial development took place, people would more likely seek to live closer to their work. As a result of various planning initiatives the area experienced a steady population increase.

In many respects the Corridor Plan achieved its objectives. However, it did not foresee the substantial commercial development throughout the inner suburbs, which resulted in the intrusion into residential areas and most importantly the study area. For example, high levels of nutrients and toxic input of chemicals, which enter the lakes through stormwater drains has a detrimental affect on the delicate ecosystems of wetlands. The wetlands in the study area have/are being affected by the high level of nutrients and toxic input of chemicals entering the Wangara Sump from the industrial area adjacent to the Park.

6.3. The Metroplan, 1990

Metroplan provides a general framework for growth and change and was adapted from the draft Metropolitan Strategy 1987. The 1990 Metroplan provided for some alterations and important extensions to the Corridor Plan and sets broad parameters for growth to the year 2021. It involved the community and organizations that submitted their comments and concerns on the draft strategy. In 1990 Metroplan took over from the Corridor Plan and provided a general framework for growth and change into the twenty-first century (Department of Planning and Urban Development, 1990).

It is important that the conservation of the wetlands and the natural bushlands in the Park are met. The major aim of the Metroplan was to link the far-sighted planning of the past through to the future and build a sustainable, healthy, prosperous, economically efficient, socially just and culturally strong metropolitan region (DPUD, 1991, p. 2).

Even though the Plan endeavoured to be up to date and relevant to the needs of the Perth Metropolitan Region by regular reviews and status reports, it was quickly superseded by the North-West Corridor Plan.

6.4. The North-West Corridor Plan, 1991

In 1992, the North-West Corridor Plan provided a comprehensive approach to planning and development within the Corridor; e.g. employment, residential development and conservation and protection of the environment. The Plan is an extension of current metropolitan planning strategy and previous structure plans for the North-West Corridor. One of the objectives of the Plan was to achieve a good quality urban and natural environment, which is sustainable in the long-term.

The Plan provided for a continuous open space link connecting Lakes Joondalup and Goollelal (now known as Yellagonga Regional Park) to ensure that the conservation of wetlands and bushlands are met. Corridors are required to restore natural linkage between remnants of native vegetation that were formerly continuous. Heritage trails were developed and the protection of Aboriginal sites taken into account. Planning will continue to take these scenic and environmental qualities into account. It is acknowledged that these plans take into account the importance of wetlands. However, increased development will cause further fragmentation resulting in the loss of surrounding vegetation.

The Plan was intended to provide the framework for the development of the Corridor to the year 2021 (Hatt, 1992). As most Plans are not long lasting, or prove to be unable to respond to unforeseen changes in the economy and demography of the city, as experienced in relation to the Stephenson-Hepburn plan, they are replaced by a newly developed plan. At this time the new plan proposed called for a Network City approach.

6.5. The Network City Plan 2004

The Network City – a milestone in metropolitan planning plan (2004) superseded Metroplan. It is a comprehensive approach to land use and water management of wetlands.

It is designed to minimise activities so that habitats, animals and plants that benefit from water or are potentially affected by land use activities are protected and (in the case of habitats) restored. The Network City Community Plan was created to involve the community in decision-making. It involved a huge community forum, entitled 'Dialogue with the City' September 2003, which included thousands of community members.

The key proponent of the Plan is to advocate participative decision-making at a local and regional level (Department for Planning and Infrastructure, 2004). The Network City plan aims to move to the next phase and establish 'clear, concise directions and objectives for the future' (Network City, 2003, p. 3).

The above Plans aimed to provide housing, business and job opportunities, and recreational facilities as well as protect wetlands, biodiversity and ensure protected areas remained as pockets of sustainability. The study area became an attractive place to live with the trend in recent years to create smaller building lots to achieve a more compact settlement pattern. The aim was to plan a city with urban energy and cultural vitality and to protect and enhance the natural environment, open spaces and heritage. However, further high-density urbanisation of areas adjacent to the wetlands in the study area will transform it into a suburban landscape with loss of species diversity. Also the use of artificial fertilisers is associated to the contamination of groundwater and surface run-off.

As discussed, consecutive decades of intensive urbanisation and commercial development throughout the Northwest metropolitan corridor have resulted in extensive clearing of bushland for urbanisation and commercial use. Also since the 1970s the Gngangara ground water system has been declining due to climate change, extraction (bores) direct evaporation, urbanisation, and groundwater overflow and unless this issue is addressed it will become a major problem in the future.

When initially proposed all plans addressed the important conservation issues. However, some of the approved urban developments would seem to fall short of the proposed strategies as observed in (Figure 6.0). This development is huge and situated approximately one hundred metres from the shores of Lake Goollelal (whereas the recommended buffer zone for wetlands of importance is two hundred metres). To protect the integrity and diversity of the Park buffer zones should be strictly observed as they provide a vegetation screen which blocks urban intrusion and allows a range of vegetation associations to be re-established.



Figure 6.0
Development in progress opposite Lake Goollelal
 Source: Sue Ujma January 2009

Increased development will cause further fragmentation resulting in the loss of surrounding vegetation around the Lakes. The Park also faces many critical management challenges, arising from increased urban development, groundwater pollution, rubbish dumping, over abstraction (bores) and the use of artificial fertilisers. Adequate water resources are essential to the future of the study area. Extensive urbanisation has had a serious impact on both the quantity and quality of water resources.

Although, at the time the Plan's aims were thought to be well directed and considered, and appeared to achieve adequate social, economic and political goals, they in-fact, fell short in some aspects. A clear example of this relates to the current situation surrounding the over-abstraction of water from the Gngangara Water Mound that is resulting in the drying of local wetlands resulting in the deterioration of native vegetation in these areas.

All the wetland conservation, protection laws, regulations and management plans will not protect the Park until ongoing community and appropriate government and local authority involvement is increased to ensure an ecologically sustainable wetland environment. As urban growth increases its importance as a remnant of the natural landscape will no doubt increase.

Chapter seven outlines the conclusions of this study.

CHAPTER 7 CONCLUSION

Since early European settlement more than eighty per cent of the original wetlands on the Swan Coastal Plain have been destroyed. The remaining wetlands are heavily modified and no longer in their natural state. The Park has also experienced drastic changes to the original landscape, maintained and conserved by the local Nyoongar Aboriginal people. It is difficult to estimate the impact humans have had on the global extent of wetlands (Mitsch & Gosselink) but the impact in the Yellagonga Regional Park has been demonstrated in this study. Future exacerbation by impending climate change, episodic droughts, the general lack of rainfall and water going into wetlands has highlighted the plight and the importance of these important wetlands, with no guarantee that future losses will not be experienced, despite local, State, and Commonwealth planning. Although wetland conservation, protection laws, regulations and management plans have been developed they have not prevented further biodiversity losses experienced in the study area.

This study provides a local perspective of the consequences of future development, within the Park and its surrounding environments. Regular field visits by the author demonstrated that there are still opportunities for adverse effects on the remaining wetlands in the Park, which will transform it into a suburban landscape with impoverished species diversity. Any effects to the flora and fauna in the Park and surrounding environments will be detrimental to their very existence.

7.1 Research Questions Revisited

Question one addressed the historical involvement of the Aboriginal people in Yellagonga Regional Park. In 1990 the Park was named to honour Yellagonga, the leader of the Mooro Aboriginal people who inhabited the region at the time of early European settlement. For the present day Nyoongar Aboriginal people the study area still retains a cultural and mythological significance as it is intricately linked to their Dreamtime stories of Ancestral beings. They also believed that they shared the same life-essence with all the natural species and elements within that environment. Their spiritual attachment with nature extended to the wetlands. Wetlands also acted as access tracks and trails providing valuable camping sites for food and water.

It has been demonstrated by archival sources that the original inhabitants, the Aboriginals, locally known as Nyoongars, practised a sustainable lifestyle that was well suited to their environment and was ecologically sustainable. Rather than modifying the land to suit them, the Nyoongar people developed an extremely efficient system of managing the land and its natural resources. Taking only from the land what nature provided maintained the landscape's ecological balance. However, they did influence the environment by the use of fire stick burning which they used to increase the productivity of their environment. This inadvertently prepared the land for the early European settlers. Some aspects of the traditional management practised by the Nyoongar Aboriginal people as discussed by early explorers' and European settlers and provided in this study, provide insights for contemporary sustainable management.

Question two demonstrates that by tracing the historical sequence of landowners it was possible to identify a pattern of development in the study area. Over the last one hundred years there has been a rapid decline in the water quality, and the condition of the natural environment of the Park. Early settlers displayed a lack of understanding of the seasonal fluctuations in the hydrological balance of wetland ecosystems. Land clearance, subdivision and urbanisation, severe drought and increased private groundwater abstraction (bores) and pollutants have all had an impact on the water levels and the native flora and fauna that rely on the wetlands for their existence. Today the boundary effects on the Park from surrounding urban development pose significant challenges. Therefore, this study recommends the reversal of this trend by restoring the natural environment and water quality wherever possible. Importantly it further recommends a return, at least in part, to the practices of the traditional landowners in consultation with Elders in the future development of planning and management strategies for the Park.

Question three examined a number of present land use and management concerns in Yellagonga Regional Park. Many of these concerns originate from the surrounding water catchment area, urban development, population growth, groundwater pollution, demands on water, and the effects of climate change. Also the loss and damage to fringing vegetation due to residential development increases the potential for algal bloom to occur. These most recent phases of development have contributed in part to the progressive fragmentation of the study area and its life support systems.

Other issues affecting the Park include the partial demise of native vegetation and the invasion of weeds. However, local volunteer group Friends of Yellagonga have successfully completed weed control projects to minimise the impact of environmental weeds by using methods compatible with the conservation of the natural environment. They have planted local native species of reed, rush and trees as revegetation.

The study demonstrates that the original Aboriginal people, early pioneers, European market gardeners, and the most recent suburban dwellers have all left their imprints on the landscape. However, Aboriginal people only took from the land what nature provided. The initial fragmentation of the land began with the early settlers bringing sheep and cattle from their homelands. As the stock increased, the area around the lakes was used for grazing which damaged the wetlands. The planting of non-native crops by the European market gardeners altered the landscape and native ecosystem. Recent suburban dwellers are causing further fragmentation of the study area. Population growth, groundwater pollution, demands on water, excessive use of artificial fertiliser is detrimental to the delicate ecosystem of the study area.

7.2. Recommendations

It is essential that remaining healthy wetland ecosystems in the Park are maintained and protected. This will require increased ongoing community and appropriate government and local authority involvement and the intervention with a time scale of far-reaching decisions that extends well beyond the immediate future. Currently, the Cities of Joondalup and Wanneroo are working together through Yellagonga Integrated Catchment Management (YICM) Planning Project to address land use impacts on the Park. Their planning processes seek to integrate the views of all sectors of the government and the community.

For public involvement in the Park to succeed, it is important to develop educational programmes for both adults and children. Schools should be encouraged to participate in maintaining and protecting wetlands as an educational resource. Also community newspapers are well placed to play an important role in wetland conservation. By publishing regular articles on the study area, it will raise the level of community understanding and maintain awareness.

Although it is important that the general public have access to the Park, the effects are sometimes detrimental to its values. Recreational impacts on the wetlands include trampling of vegetation, bank erosion, pollution and disturbance of wildlife. Buffer zones are an effective solution in managing these impacts. The Water and Rivers Commission recommends a minimum of fifty-metre buffer zone around the wetlands. However, more realistically wetlands that are of significant conservation value, such as the Park, require a buffer zone of two hundred metres (Water & Rivers Commission, 2000). When enhancing the aesthetic and recreational values of wetlands, buffer zones can provide a vegetation screen which blocks urban intrusion. One of the most acceptable and useful ways of protecting the integrity and diversity of a wildlife and wetland habitat is to allow a range of vegetation associations to be re-established. Where possible, this study recommends local native species should be used in landscape planting.

It is recommended that current wildlife corridors be maintained. They enhance wildlife conservation in disturbed environments and assist animals in their movements through the landscape, and provide shelter, nesting sites and refuge for native fauna. They also maintain populations within developed areas (Bennett, 1990).

Adoption of the above measures can go a long way to assist with the conservation and preservation of the species diversity of the remaining wetlands in the Park. However, they are only a small part of the bigger picture, which is exacerbated by what happens in environments adjoining the study area. It is recommended that further studies be conducted to measure the impact of land use within the broader catchment of Yellagonga Regional Park.

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