Lake McLarty Nature Reserve

Draft Management Plan 2005

Conservation Commission
WESTERN AUSTRALIA

GOVERNMENT OF WESTERN AUSTRALIA

DEPARTMENT OF Conservation AND LAND MANAGEMENT
Conserving the nature of WA

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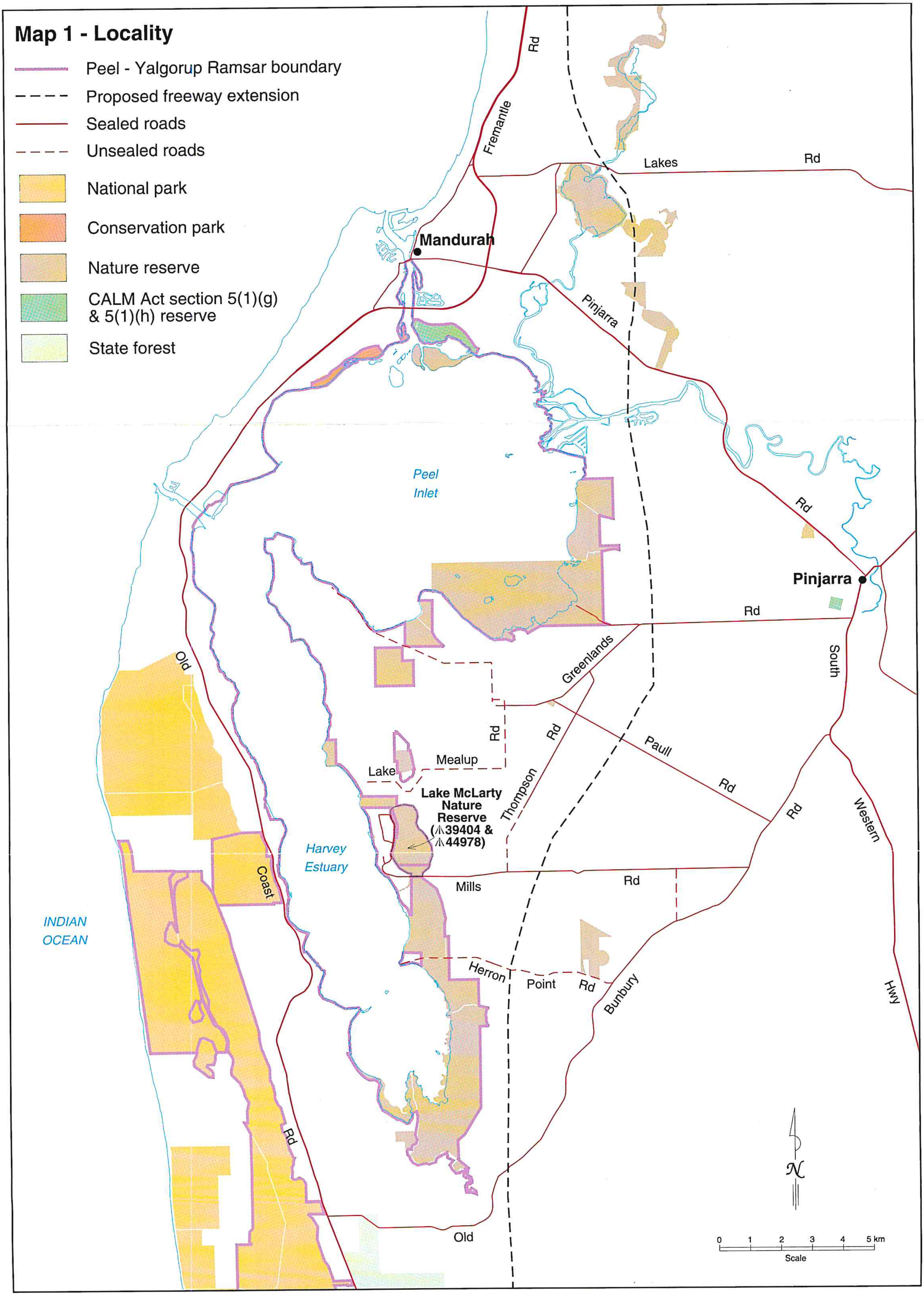

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Conservation park
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CALM Act section 5(1)(g) & 5(1)(h) reserve
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Mandurah
Pinjarra Rd
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Pinjarra
Rd
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South
Old
Rd
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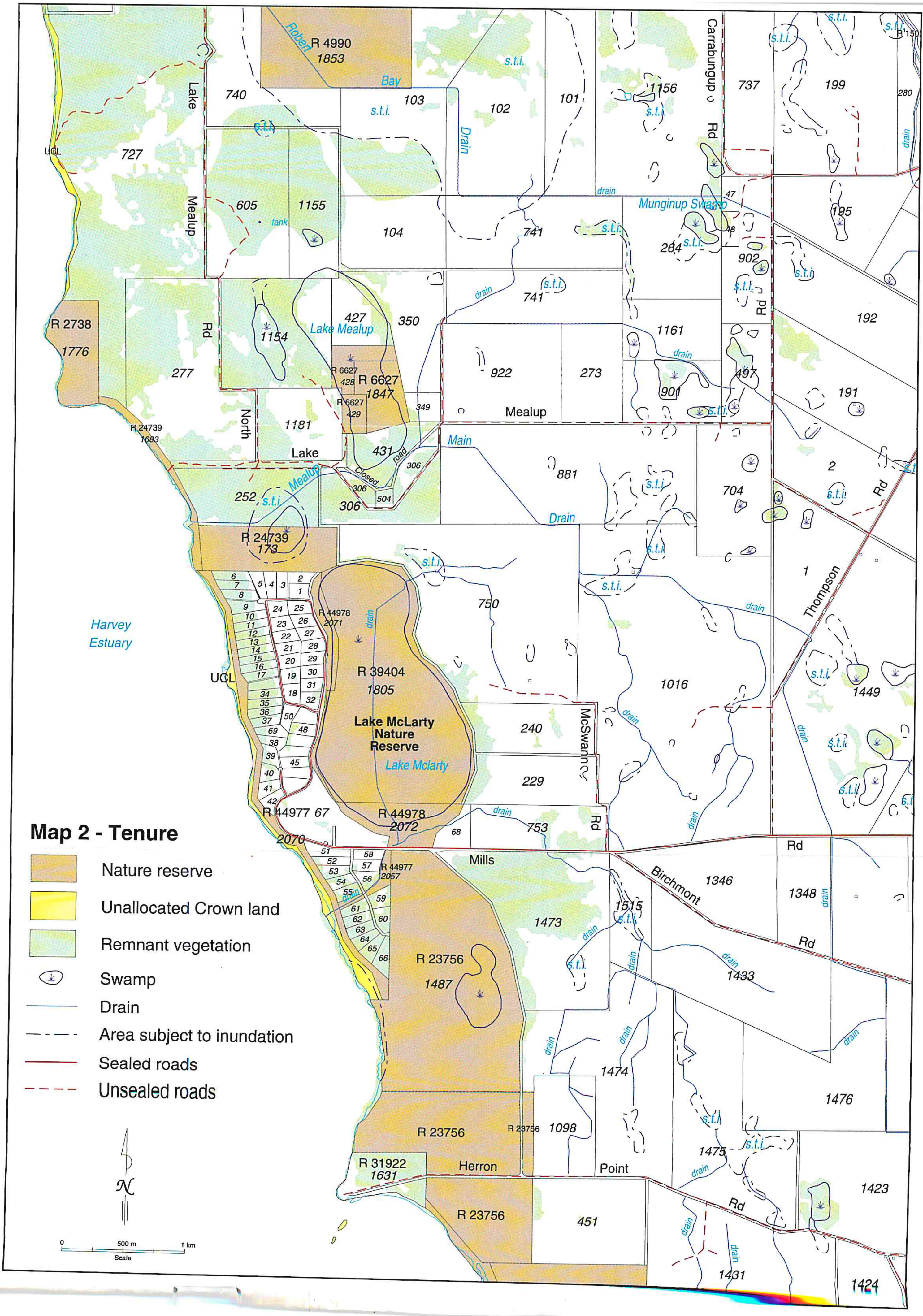
Lake McLarty Nature Reserve (A39404 & A44978)
Thompson
Rd
Western
Harvey Estuary
Coast
Mills
Rd
INDIAN OCEAN
Herron Point Rd
Bunbury
Hwy
Rd
Old
N
0 1 2 3 4 5 km
Scale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Carrabungup Rd
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McSwann Rd
Mills Rd
Birchmont Rd
Herron Point Rd
Closed road
UCL
R 4990 1853
R 2738 1776
R 6627 1847
R 24739 173
R 39404 1805
R 44978 2072
R 44977 67
R 23756 1487
R 31922 1631
0 500 m 1 km
Scale
N

PART A: INTRODUCTION

Lake McLarty Nature Reserve comprises two 'Class A' reserves of approximately 219 ha, gazetted for the purpose of the 'Conservation of Flora and Fauna'. It is vested in the Conservation Commission of Western Australia and managed by the Department of Conservation and Land Management (CALM). The reserve is located on the Swan Coastal Plain approximately 90 km south-east of Perth on the eastern side of the Harvey Estuary (Map 1), within the Shire of Murray.

Lake McLarty, a freshwater lake, is an integral part of the Peel - Yalgorup System, located south of Mandurah (CALM 1990). This system is one of the largest and most diverse estuarine complexes in Western Australia (WA) and includes examples of coastal saline, brackish and freshwater lakes, and marshes (such as Lakes Mealup, McLarty, Clifton and Preston). It is internationally important as a habitat and refuge site for waterbirds and is registered as part of the East Asian Australian Flyway Path under the China - Australia Migratory Bird Agreement (CAMBA). It was included on the List of Wetlands of International Importance in 1990 (Ramsar 1990). In addition, Lake McLarty, together with Lake Mealup and a connecting corridor, is listed on the Register of the National Estate (May 1990), primarily for their significance to waterbirds (Australian Heritage Commission 1990).

Lake McLarty is a key site in WA for birdwatching and provides significant landscape value in a region of increasing residential development. It is also an important site for educational and research opportunities.

1. PLANNING AREA

This management plan includes Reserve number 39404, which covers the majority of Lake McLarty, and Reserve number 44978, which encompasses the southern part of the lake. Therefore throughout the plan any reference to Lake McLarty Nature Reserve will include Reserve numbers 44978 and 39404, as shown in Map 2.

2. KEY VALUES

Maintaining or enhancing the key values of the reserve is the major focus of this management plan. The objectives and strategies in the plan are targeted to ensure this is achieved (see *Management Summary Table* at the end of this document). The way in which these values relate to the auditing of the management plan is detailed in *9. Performance Assessment*.

The outstanding values of the Lake McLarty Nature Reserve are those that contribute to the Ramsar listing. These values include that it:

- supports populations of bird species important for maintaining the biological diversity of the Swan Coastal Plain;
- provides a major refuge for migratory waterbirds, especially some rarer species favouring freshwater wetlands;

- is an internationally significant waterbird habitat which regularly supports one percent (or more) of the individuals in a population of at least six species of waterbird, including the Sharp-tailed Sandpiper, Red-necked Stint and Curlew Sandpiper[1]; and
- is a rare or unique example of a natural or near natural wetland, characteristic of those that were once widespread on the Swan Coastal Plain.

(Environment Australia 2001, 2005)

Other key values are:

- the importance of the reserve for the protection of threatened and priority flora and fauna species;
- vegetation communities representative of those once widespread on the Swan Coastal Plain; and
- the local 'ownership' and interest shown in Lake McLarty as demonstrated by the high level of volunteerism to undertake works and monitoring.

3. ECOLOGICAL CHARACTER[2]

Lake McLarty is one of the most ecologically important freshwater, seasonal lakes on the Swan Coastal Plain. It has been estimated that 80% of the original wetlands on the Plain have been either lost or seriously degraded due to filling, clearing and other land use impacts since European settlement (Balla 1996). The closed heath vegetation community around the lake is representative of communities that were once more extensive on the coastal plain. When flooded, this community is particularly important for moulting species such as the Eurasian Coot (*Fulica atra*). The emergent vegetation at Lake McLarty consists predominantly of some sedge margins which are important for breeding swans and other waterbirds. Small fragments of the introduced aquatic weed *Typha orientalis* also provide some habitat value.

Lake McLarty consistently supports a high number of waterbirds (Storey *et al.* 1997). The lake also supports a range of invertebrate species that provide an abundant food source to the numerous water and shorebirds that inhabit it. The current water regime at the lake creates suitable feeding habitats for palaearctic waders and is one of the few local lakes to support this pre-migration feeding (Craig *et al.* 2004). Over the past 25 years, the frequency with which over 20 000 waterbirds has been counted at Lake McLarty has increased.

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[1] see Waders and Waterbirds section in *14. Native Animals and Habitats*

[2] Ecological Character is defined in the Ramsar Convention (Resolution VII.10 of the 7th meeting of the Conference of the Contracting parties to the Convention), and under the EPBC Act as '...the sum of the biological, physical and chemical components of the wetland ecosystem, and their interactions, which maintain the wetland and its products, functions and attributes (Macintoch and Kennedy 2004)

Lake McLarty provides fresh water in summer for the birds of Peel Inlet and Harvey Estuary and supports a resident bird population, as well as a large number and variety of transequatorial shorebirds. In addition, occasional winter observations of Red-necked Stint (*Calidris ruficollis*), Curlew Sandpiper (*Calidris ferruginea*) and Common Greenshank (*Tringa nebularia*) indicate that, when suitable habitat is available at the lake, it also provides habitat for first year migrants who remain in Australia over the Austral winter (Craig *et al.* 2004). Lake McLarty regularly supports more than 1% of the total Australian/world population of two Australian resident wader species, the Red-necked Avocet (*Recurvirostra novaehollandiae*) (5.1% of the Australian population) and Red-capped Plover (*Charadrius ruficapillus*) (1.6%), which qualifies it as being of international significance under Ramsar guidelines. A total of 158 bird species have been recorded within the nature reserve, including 77 species of waterbirds, 30 and 35 of which are protected under the Japan - Australia Migratory Bird Agreement (JAMBA) and CAMBA (M. Singor, *pers. comm.*). In total, 38 wader species have been recorded at Lake McLarty (Craig *et al.* 2004), of which 28 species are migratory waders that use the lake on a seasonal basis (M. Singor *pers. comm.*). Lake McLarty is the only wetland in the broader Lake McLarty system (comprising Lake McLarty, an unnamed swamp immediately north-west, Mealup Lake, 'Robert Bay Swamp' and 'Carraburmup Swamp') in which the Ruff (*Philomachus pugnax*) regularly occurs (albeit in low numbers), and it is a major breeding area for cormorants in south-western Australia (Department of the Environment and Heritage 2000). Uncommon migratory shorebirds, such as the Long-toed Stint and Pectoral Sandpiper, rest at the lake and it is also occasionally a drought refuge for ducks on the Swan Coastal Plain.

4. REGIONAL CONTEXT

Lake McLarty is located within the Peel - Yalgorup System, which is one of only nine Ramsar sites currently recognised in WA (Ramsar 1990, Water and Rivers 2001). At 21 000 ha, it is also the largest Ramsar site in the south-west of WA (Weaving 1999). The Peel - Yalgorup System includes the Peel Inlet, Harvey Estuary, Lakes Mealup and McLarty and the Yalgorup Lakes (Lake Clifton, Lake Preston, Duck Pond, Boundary Lake, Lake Pollard, Martins Tank, Lake Yalgorup, Lake Hayward, North and South Newnham Lake) (Burbidge and Craig 1996b). Although not listed in its own right, Lake McLarty alone meets the Ramsar criteria for international significance with respect to waterbirds[3] (Burbidge and Craig 1996b).

The Peel - Yalgorup System is the most important area for waterbirds in south-western Australia, with more than 150 000 individuals recorded in February 1977 (Department of the

[3] Criterion 5: A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds. Criterion 6: A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.

Environment and Heritage 2000). The site is recognised as important habitat for species listed in JAMBA and CAMBA (Wetlands Conservation Society 1996), is an important regional resource for Western Australia, and is registered as part of the East Asian Australian Flyway Path under the CAMBA. The Peel - Yalgorup System has been placed on the Register of National Estate (West Australian Government 1992).

The catchment of the Peel Inlet and Harvey Estuary is 11 300 km^2 and is mostly cleared (Department of the Environment and Heritage 2000). Land uses surrounding Lake McLarty include:

- the Kooljerrenup Nature Reserve (Reserve number 23756), gazetted for the purpose of Conservation of Flora and Fauna, located to the south of the lake;
- Lake Mealup, which is located to the north of Lake McLarty, which is owned and managed by the Lake Mealup Preservation Society Inc (Lake Mealup Preservation Society Inc. 2003); and
- agricultural development zoned 'special rural' to the north-east, south-west and east, and residential development to the west.

The western side of the nature reserve is bordered by a rural - residential subdivision ('Birchmont Estate'). This subdivision has a minimum lot size of 2 ha with an emphasis on "merging of development with the landscape" (Shire of Murray 1996). In order to conserve the rural environment, the Shire has stipulated that all trees and vegetation shall be retained unless their removal is authorised by Council. Other conditions include the requirement for a 92 000 L water storage tank prior to house construction (minimising the requirement for groundwater extraction) and for all drainage water generated within the estate, whether from roads or the land, be contained on-site.

Threats to Lake McLarty from the surrounding catchment include continued residential development, subsequent groundwater extraction, and the addition of nutrients to the lake system via groundwater or surface runoff (Department of the Environment and Heritage 2000). The completion of the Peel Deviation of the Kwinana freeway to the east of the lake in 2008 will increase access to land within the catchment and facilitate further residential development, placing increased pressure on Lake McLarty (Western Australian Planning Commission 1997).

PART B: MANAGEMENT DIRECTIONS AND PURPOSE

5. VISION

The vision for Lake McLarty Nature Reserve is:

> *To be recognised by the community for its international significance as a wetland providing refuge for both migratory waders and local waterbirds, and where natural, cultural and aesthetic values are appreciated and protected. Natural systems and processes will continue to function, and habitats will be managed in partnership with the community to maintain the lake's Ramsar and other natural values.*

6. LAND TENURE

Lake McLarty is a Class A Nature Reserve (Reserve number 39404), covering an area of 184.37 ha. The adjoining Class A Nature Reserve (Reserve number 44978) of 34.73 ha was gazetted in 1997 for the Conservation of Flora and Fauna. It is vested in the Conservation Commission and managed by CALM.

A gazetted road reserve marks the eastern boundary of the reserve, although it is not used and is currently vegetated (Map 2). Due to the narrow vegetated buffer around the lake, CALM and the Conservation Commission believe the road reserve should be added to the conservation estate. Similarly, there is also a significant amount of vegetation on the private property adjacent to the eastern side of the nature reserve which effectively doubles the width of the vegetated buffer. While the Department will actively encourage landowners to retain and/or enhance native vegetation on their properties through voluntary agreements, consideration should be given to acquiring this area as a conservation offset if the current agricultural land is subdivided in future.

In addition to the legislative requirements described in *7. Legislative Framework*, the Conservation Commission and CALM will recommend that any future subdivisions will be subject to the principle of net conservation benefit, and that environmental conditions to minimise environmental impacts should be duly placed on proponents. This could include:

- minimum setbacks of 100 m from the high water mark of the lake for any development;
- retention or acquisition of native vegetation on private property contiguous with the reserve boundary;
- limits to bore extraction on adjacent private property (e.g. maximum draw of 500 kL/annum as per Birchmont subdivision);
- large on-site water storage capacity for any developments;
- physical separation of private subdivisions and the reserve by a vehicle access track/road and dog-proof fencing; and

- no public access to the reserve except at (1) clearly designated entrances through the fence and (2) on defined pathways.

7. LEGISLATIVE FRAMEWORK

Legislation and Policies

Nature reserves are created under the *Land Administration Act 1997*, vested in the Conservation Commission and managed by CALM. CALM has prepared this management plan in accordance with the legislative specifications of the *Conservation and Land Management Act 1984* (CALM Act). The objective for management plans for nature reserves as defined in section 56 of the CALM Act is *"to maintain and restore the natural environment and to protect, care for and promote the study of indigenous flora and fauna, and to preserve any feature of archaeological, historic or scientific interest".*

Under the CALM Act, the Department is responsible for administering the *Wildlife Conservation Act 1950* (Wildlife Conservation Act), which provides for the conservation and protection of indigenous flora and fauna on all lands and waters within the State.

Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) establishes a legislative framework that allows the Commonwealth to manage environmental protection through an assessment and approvals process, and biodiversity conservation through species and site listing, recovery and management planning. The ecological values of Ramsar wetlands are a matter of national environmental significance under this Act, as are migratory species listed under the Act, listed threatened species and ecological communities and the national heritage values of National Heritage places (Macintosh and Kennedy 2004).

The presence of the migratory birds protected under the JAMBA and CAMBA affords the planning area additional protection under the EPBC Act. Any action that has, will have, or is likely to have a significant impact on a matter of National Environmental Significance (such as Ramsar wetlands and migratory species listed under international treaties) is required to undergo an environmental assessment and approvals process. This is likely to include, for example, land subdivisions in the surrounding area.

The EPBC Act also established standards for managing Ramsar wetlands through the Australia Ramsar Management Principles, which are stated as regulations under the Act. The Act describes the principles and guidelines for the management of Ramsar wetlands (Environment Australia 2001).

Environmental Protection Act 1986

This Act provides for the prevention, control and abatement of pollution and environmental harm, and for the conservation,

preservation, protection, enhancement and management of the environment. Activities that impact on wetlands, such as filling, draining, mining, discharges or clearing, are prohibited without authorization under this Act.

Aboriginal Heritage Act 1972

All registered sites within the planning area are protected under the *Aboriginal Heritage Act 1972* (Aboriginal Heritage Act). This Act also ensures the protection of places and objects customarily used by, or traditional to, the original inhabitants of Australia. A register of such places and objects is maintained under the Act, however, all sites are protected under the Act whether they have been entered on the register or not.

Native Title Act 1993

The (Commonwealth) *Native Title Act 1993* requires that native title claimants and representative bodies be advised when a management plan is being prepared or major public works undertaken. The South-West Aboriginal Land and Sea Council is the native title representative body for the planning area and has a number of functions prescribed under the Native Title Act.

The following State and Commonwealth policies relate specifically to the management of wetlands.

Wetlands Policy of the Commonwealth Government of Australia 1997

This policy provides strategies to ensure that the activities of the Commonwealth Government promote the conservation, ecologically sustainable use and, where possible, enhancement of wetland functions. A principle aim is to ensure that the Commonwealth Government's actions are consistent with those expected under the Ramsar Convention and, in particular, to promote the adoption of Ramsar's 'wise use' principle for managing wetlands (ANCA 1997).

Wetlands Conservation Policy for Western Australia 1997

This policy is the result of the Government's recognition of the fundamental importance of conserving and managing wetlands in a sustainable manner. It outlines the Government's commitment to identifying, maintaining and managing the State's wetland resources, including the full range of wetland values, for the long term, and identifies the agencies involved and their responsibilities. Under this policy, a Wetlands Coordinating Committee was established, with representatives from various agencies and community conservation groups, to facilitate interaction between management agencies. This Committee is chaired by CALM and provides a forum for information exchange regarding the management of wetlands within WA.

Environmental Protection (Swan Coastal Plain Lakes) Policy 1992

This policy protects the environmental values of Lake McLarty and prohibits any unauthorised filling, mining, draining (into

and out of the wetland), effluent discharge and alteration of water levels. The policy affords the protection of the ecosystem health of approximately 1100 specified wetlands on the Swan Coastal Plain, including the protection of the ecological structure, function and processes of the wetland, as well as the protection of the beneficial uses including its use for study, education, recreation, aesthetic enjoyment and the benefit of the public generally (EPA 2004). The policy was prepared under the Environmental Protection Act and is currently under revision.

CALM Policies

CALM policies specifically mentioned in this plan relate to the management of weeds, fire, disease, rehabilitation, recreation and tourism and community involvement. These policies are listed in the *Reference* section and referred to throughout the document as appropriate.

8. OBLIGATIONS AND AGREEMENTS

Australia is a participant of, and signatory to, a number of important international conservation agreements that influence the management of Lake McLarty by promoting consistent standards of management for wetlands. In becoming signatory to such agreements, Australia is committed to fulfill certain obligations in managing important wetlands. These include the Convention on Wetlands, JAMBA, CAMBA, and the Convention on the Conservation of Migratory Species of Wild Animals.

The Convention on Wetlands (Ramsar, Iran 1971)

The Convention on Wetlands, (more commonly known as the Ramsar Convention), is an intergovernmental treaty dedicated to the conservation and 'wise use' of wetlands. It encourages Contracting Parties to designate sites containing representative, rare or unique wetland types, or that are important for conserving biological diversity to the list of Wetlands of International Importance (Ramsar sites). These sites need to be managed to ensure their species ecological values are maintained or improved. Australia became a Contracting Party in 1974. Lake McLarty, as part of the Peel - Yalgorup System Ramsar system, is included on this list.

The Peel - Yalgorup System Ramsar site meets four of the eight Ramsar criteria for listing, and in particular :

1. it includes the largest and most diverse estuarine complex in south-western Australia and also particularly good examples of coastal saline lakes and freshwater marshes;
2. it is one of only two locations in south-western Australia and one of very few in the world where living thrombolites (a type of microbialite, superficially similar in appearance to stromatolites) occur in hyposaline water;
3. it comprises the most important area for waterbirds in south-western Australia, supporting in excess of 20 000

waterbirds annually, with greater than 150 000 individuals recorded at one time (February 1977); and

4. it regularly supports 1% of the population of at least six shorebirds: Red-necked Avocet (*Recurvirostra novaehollandiae*), Red-necked Stint (*Calidris ruficollis*), Red-capped Plover (*Charadrius ruficapillus*), Banded Stilt (*Cladorhynchus leucocephalus*), Caspian Tern (*Sterna caspia*) and Fairy Tern (*Sterna nereis*).

Under the Ramsar Convention, contracting parties must be informed at the earliest possible time if the ecological character of any wetland in its territory and included in the list of wetlands has changed, is changing or is likely to change as the result of technological developments, pollution or other human interference.

Japan - Australia Migratory Bird Agreement (JAMBA)/ China - Australia Migratory Bird Agreement (CAMBA)

Australia has signed treaties with Japan and China to protect migratory birds. The JAMBA and CAMBA treaties provide for co-operation between the respective governments to protect migratory species and their habitats. Lake McLarty supports a total of 35 and 30 JAMBA/CAMBA species respectively, which places it as the fourth highest-ranking wetland for these species in south-western Australia (Burbidge and Craig 1996a). Lake McLarty is also the highest-ranking non-estuarine site for these species in the south-west (Burbidge and Craig 1996a).

Convention on the Conservation of Migratory Species of Wild Animals (Bonn, 1979)

The aim of the Convention on Migratory Species is to protect listed species across their entire migratory range. Australia has been a Range State[4] under this Convention since 1991. The Convention obligates contracting parties to take measures for the conservation of migratory species of wild animals listed under the Convention, and for which they are a range state. Migratory species listed under this Convention are a matter of national environmental significance under the EPBC Act's assessment and approval provisions.

9. PERFORMANCE ASSESSMENT

The Conservation Commission has the responsibility of auditing the implementation of this management plan and will measure the overall management performance and the effectiveness of it by assessing the Key Performance Indicators (KPIs) as listed in the *Management Summary Table*, and other parameters as appropriate. It is not efficient to measure all aspects of management given resource and technical

[4] A Range State is defined as any state that exercises jurisdiction over any part of the range of that migratory species, or a state, flag vessels of which are engaged outside national jurisdictional limits in taking that migratory species.

impediments—consequently, indicators will target 'key' components of the plan. Key performance indicators are the minimum set of indicators that enable major trends and impacts on values to be determined. In the case of this plan, it includes evaluation of a measure and target, reporting requirements and a management response to any target shortfall. These components provide a basis for adaptive management, whereby management is altered if necessary to meet a desired outcome.

The Department is responsible for providing information to the Conservation Commission to allow it to assess the success of the Department's management in meeting targets specified in the KPIs. The frequency of these reports will depend upon the requirements of each KPI, the satisfactory establishment of baseline information against which to audit, and any unforeseen changes to the environmental conditions. Where a report identifies a target shortfall, a response to the Conservation Commission is required. The response may identify factors that have led to the target shortfall, and propose alternative management actions where appropriate. The Conservation Commission will consider the Department's response on the target shortfall and evaluate the need for action in the context of its assessment and audit function under section 19(1)(g)(iii) of the CALM Act. The Conservation Commission will make the results of audits available to the public.

PART C: MANAGING THE NATURAL ENVIRONMENT

10. BIOGEOGRAPHY

The National Reserve System Program (NRS) was adopted to preserve Australia's native biodiversity on a regional scale, and initiate a protected reserve system that meets the world's best standards in terms of comprehensiveness, adequacy and representativeness (Thackway and Cresswell 1995). As a framework for developing this reserve system, the NRS initiated the Interim Biogeographic Regionalisation for Australia (IBRA), which provides a framework for conservation planning for a comprehensive, adequate and representative system of protected areas to conserve Australia's terrestrial biodiversity. The NRS divides Australia into 85 bioregions, each reflecting a unifying set of major environmental influences, which shape the occurrence of flora and fauna and their interaction with the physical environment. Twenty-six bioregions occur in WA (Environment Australia 2001).

Lake McLarty is located in the Swan Coastal Plain sub-region of the Swan Coastal Plain bioregion, a low-lying coastal plain, mainly covered with woodlands, which is dominated by banksia (*Banksia* spp.) or tuart (*Eucalyptus gomphocephala*) on sandy soils, swamp sheoak (*Allocasuarina obesa*) on outwash plains, and paperbarks (*Melaleuca* spp.) in swampy areas. In the east,

the plain rises and is dominated by jarrah (*E. marginata*) woodland, while the outwash plains, once dominated by swamp sheoak - marri (*Corymbia callophylla*) woodlands and paperbark shrublands, are extensive only in the south (Environment Australia 2000). At the time of writing this management plan, 10.23% of the Swan Coastal Plain sub-region was secure in conservation reserves (CALM 2003), and an additional 5.46% otherwise managed by CALM (mainly as State forest). Proposals in the *Forest Management Plan 2004-2013* (Conservation Commission of Western Australia 2004) will increase representation. The Swan Coastal Plain has the largest percentage of area cleared of any IBRA region in WA (Department of Conservation and Land Management 2003). Therefore it is vital to protect this reserve as it contains remnants of the native vegetation of this region.

The Peel - Yalgorup System is recognised as one of four internationally significant wetlands in the Swan Coastal Plain bioregion, with the smaller Lake McLarty System identified as one of 25 nationally important wetlands within the bioregion (CALM 2003).

11. GEOLOGY, LANDFORM AND SOILS

Lake McLarty is a shallow, oval, medium-sized, freshwater lake with a gently sloping bottom. Open water covers a maximum area of approximately 2.1 km (north to south) by 1.25 km (east to west) (Craig *et al.* 2004). The lake lies in a natural drainage depression within the coastal plains and is isolated from the eastern shoreline of the Harvey Estuary (distance of 600 m) by a vegetated fossil dune ridge (Craig *et al.* 2004).

The lake is part of the 'Bibra' suite of wetlands which occur as a linear belt near the interface of the Bassendean and Spearwood dune systems on the Swan Coastal Plain (Semeniuk 1988). The wetlands form as contact depressions with groundwater impounded against a Spearwood ridge (Environmental Capability 1995).

Lake McLarty is located within the Spearwood dune system and lies on the Cottesloe soil association. This association is characterised by shallow soils, with limestone frequently exposed near the surface (Western Australia Planning Commission 1997). The Spearwood dune system is classified as having moderate agricultural potential, although productivity relies on large quantities of groundwater and added nutrients, particularly nitrogen and phosphorus (Western Australia Planning Commission 1997).

The lake bed comprises a thin layer of silt which develops into a thicker layer (40 mm maximum) of silty mud at the northern end. This overlays a firm sand with shell fragment substrate (Craig *et al.* 2001).

Lake McLarty itself is classified as moderate to high risk of acid sulphate soils (Department of Environmental Protection 2004). The land surrounding the lake is classified as low risk in shallow soils (0-3 m) and moderate to high in soils greater than 3 m in depth (Department of Environmental Protection 2003).

Acid sulfate soils are naturally occurring soils and sediments that contain sulfide minerals, predominantly pyrite (an iron sulfide). Below the watertable in an undisturbed state, these soils are benign. However, if the soils are drained, excavated or exposed by lowering the water table, the sulfides will react with oxygen to form sulfuric acid (Department of Environmental Protection 2003). The acidic water which leaches from these soils is often high in arsenic and heavy metals. In addition, the oxidation of iron sulphide minerals (mainly pyrite) may make the soil extremely acidic (Appleyard 2005).

Disturbance of acid sulphate soils can cause ecological damage to aquatic and riparian ecosystems, contaminate groundwater with arsenic, aluminium and heavy metals and reduce agricultural productivity through metal contamination of soils (predominantly by aluminium) (Department of Environmental Protection 2003). Once disturbed it is very difficult to stop the soils generating acidity with disturbed sites continuing to discharge sulfuric acid and metals into the environment for centuries (Appleyard 2005).

The land on the eastern side of the Harvey Estuary has previously been considered unsuitable for rural living purposes, as it is low lying with a high water table. However, development is already occurring on the western side of Lake McLarty. This development will increase and demand for rural - residential subdivision on the eastern side of the lake is likely with completion of the Peel Deviation of the Kwinana Freeway.

There are currently no major threats to the soils or landforms of the nature reserve from active recreation as such activities are restricted to walking and nature appreciation.

12. WETLAND AND CATCHMENT PROTECTION

Hydrology

Lake McLarty, like the majority of the wetlands on the Swan Coastal Plain, is a surface expression of the groundwater with water levels rising and falling seasonally, depending on rainfall. Wetlands of the south-west of WA are influenced by a Mediterranean climate. Within this climate regime, water levels generally rise during the wetter winter months and decrease dramatically in summer. This seasonal hydrological cycle creates biological, chemical and physical characteristics unique to the wetlands of the Swan Coastal Plain.

There is no natural surface drainage system for much of the Swan Coastal Plain as rainfall on the sandy soils rapidly permeates through the soil to the groundwater (Western Australian Planning Commission 1996). Currently there are no streams flowing into the lake.

The general gradient of the groundwater drainage patterns in the Peel - Harvey Catchment are via the slow westerly movement of groundwater from the scarp to the sea. This is relatively consistent across the Swan Coastal Plain (Western Australian Planning Commission 1996). As evaporation and a

reduction in groundwater levels reduce the water levels in the lake, the gradient of the groundwater moves to re-fill the lake from the east and west.

The eastern side of the lake within the Bassendean dune system is low lying, flat, poorly drained with high groundwater conditions. The groundwater can rise to, or above, the surface and water-logging or flooding occurs. These groundwater conditions render the land less suitable for urban/housing development (Western Australian Planning Commission 1996). Traditional approaches to alleviate waterlogging/flooding use subsoil drainage to lower the groundwater in development areas. However this approach is not appropriate and policies have been introduced by the Department of Environment to prevent lowering of the groundwater table (Western Australian Planning Commission 1996).

Several drains that were initially constructed in the Lake McLarty area in the early 20th century have altered natural overland drainage into the lake. Drainage continued into the 1960s, when the drain on the southern side of the lake was constructed to allow the southern areas to be more viable for farming (G. Langley *pers. comm.*). The natural water system that ran into the lake from the east was blocked and diverted at time of drain construction. Prior to that time, much of the land surrounding the Lake was inundated. Currently there is one major drain associated with Lake McLarty. The drainage channel immediately to the south of the lake has been breached and diverted east-west. It is presumed that this channel was formed to reduce water levels in the lake and provide better conditions for pasture growth in adjacent areas (Environmental Capability 1995). The western section of the channel leads to the Harvey Estuary and the eastern section into farmland. In 1996 a weir was constructed on the western section of the channel to control water flow from the lake to the estuary, although it has never been opened. Apart from this recent change, the current hydrology regime has existed for at least 25 years (Craig *et al.* 2001).

Management of the drain and weir is the responsibility of CALM. Management of water resources within the Peel Harvey Catchment is the responsibility of the Department of Environment.

Managing Water Levels

Lake McLarty experiences a predominantly winter rainfall (approx. 880 mm/annum) and a high, mainly summer surface evaporation rate (approx. 1800 mm/annum). The lake is marginally seasonal, drying for 1-4 months of the year during the late summer and autumn months. The pattern of water level changes within the lake is predominantly dictated by local rains, both via a direct surface inflow and an increase in the water table (Craig *et al.* 2004).

The water levels of the lake have been monitored monthly on the western side of the lake by the Peel Preservation Group since 1996. Between 1996 and 2003, the average maximum

depth of the lake was 1 m (B. Bucktin, *pers. comm.*). Between 1996-1999, the maximum depth usually occurred between August and September. However, between the years of 2000 and 2003, maximum depth was recorded in October (B. Bucktin, *pers. comm.*). When water levels are high (even at the lowest observed peak level), the lake floods well into the *Melaleuca* fringe and inundates the pastures immediately to the south (Craig *et al.* 2001).

Generally, rainfall within the Peel - Harvey Catchment decreases markedly from October and is insufficient to provide inflow to the lake. This, in combination with a high rate of surface evaporation and a lowering of the water table (as a result of high summer temperatures), results in a gradual decrease in the water levels of the lake (Craig *et al.* 2004).

The cycle of inundation and drying of the lake has varied significantly over the years in which the lake has been monitored. In 1988, fringing shrubs were inundated in spring, the lake was shallow (most less than 0.3 m) by late summer and dry for at least one month in autumn (Craig *et al.* 2001). More recently (2002-2003), the lake dried much earlier (January to February) and remained dry for a longer period (approximately four months) (B. Bucktin *pers. comm.*). Summer drying aids in reducing nutrient cycling within the wetlands, thus reducing overall nutrient levels.

The timing of inundation and drying of Lake McLarty is important for bird species and bird numbers. Although the timing of lake drying was variable within the years of sampling, the low water levels and abundant food supply, required to ensure migratory waders build-up body weight, were maintained (Craig *et al.*, 2004).

The impacts of future development surrounding the lake on the lake hydrology is unknown, however there is potential for (a) an increase in groundwater extraction in the area surrounding the lake, (b) a reduction in natural groundwater inflows and (c) additional nutrients entering the lake, via the groundwater or as runoff. Changes in hydrology of the lake may result in premature drying or prolonged flooding, thus impacting on wader feeding habitat. Lake McLarty's current water regime creates suitable feeding habitats for palaearctic waders and is one of the few local lakes to support this pre-migration feeding (Craig *et al.* 2004).

Conditions for residential development surrounding the lake prohibit the lowering of groundwater by subsoil drainage, with cost implications for development (Western Australian Planning Commission 1996). The conditions of the 'special rural' subdivision to the west of the lake require all landowners to have a 92 000 L rainwater tank. As a comparison, the average volume of water used per day in the Perth metropolitan area in 2003/04 financial year was 294 L residential per capita consumption (Water Corporation 2004). Restrictions on groundwater extraction from domestic bores apply within the subdivision in relation to gardens and lawns, with a bore licence required from the Local Council. The flat topography and high

groundwater table make drainage an important consideration in planning for residential development around the lake.

Groundwater levels at Lake McLarty are currently monitored annually by the Department of Environment from a bore located to the south of the lake. The establishment of further monitoring bores within the subdivision and to the east of the lake is required to determine the impact of continued residential development on groundwater levels within the catchment.

Managing Water Quality

The water quality of Lake McLarty is influenced by groundwater and, during periods of high rainfall, runoff from surrounding land. Nutrients are added to the lake system as a result of runoff from surrounding land and due to the presence of cattle in the reserve. Water quality monitoring is currently undertaken on the western side of the lake every six months by a local school, with assistance from the Coolup Land Conservation District Committee.

Previously, monthly monitoring between 2001 and early 2004 indicated that the pH of the lake was within the normal range (7.0-8.5) (B. Bucktin *pers. comm.*) for a non-coloured wetland in southwestern Australia (Department of the Environment and Heritage 2000). Salinity of the lake was highly correlated with water depth, with the average highest salinity recorded in summer and the lowest in winter. The levels of salinity at the lake ranged from 1350 mg/L in spring to 9300 mg/L in late autumn. The presence of samphire (*Sarcocornia* spp.) at the lake is an indicator that it may be becoming more saline (See *Environmental Weeds*). Continued water quality monitoring at the lake is essential to establish patterns/cycles in the water quality of Lake McLarty over time. Monitoring of water depths, dissolved oxygen, pH, salinity, presence of macroinvertebrates as well as total nitrogen, phosphorus and chlorophyll-a would give a good indication of the health of the wetland system.

Increased residential development has the potential to increase nutrient runoff, from fertilizers and effluent disposal systems, thus affecting the water quality of the lake. Fertilisers have been applied to the land surrounding the lake to maintain pasture growth for cattle. Under the conditions of the Birchmont subdivision on the western side of the lake, the breeding or keeping of stock will not be permitted without the written approval of Shire of Murray in consultation with the Department of Agriculture. Given the soil structure, the western side of the lake is more able to sustain this land use than the eastern side.

A condition of the surrounding development is that any drainage waters generated within the subdivision will be contained on-site. In addition, public education through local and State Government agencies could assist in reducing over-fertilising and loss of nutrients to drainage. Environmental Capability (1995) advised that surrounding developments should be required to have alternative effluent disposal systems

rather than conventional septic tanks and leach drains.

Establishing new and maintaining existing buffer vegetation is vital in assisting in maintaining and improving water quality. A buffer will act as a filter and store for nutrients, as well as providing a physical barrier between the lake and surrounding development to problem insects such as midges. To maximise buffers around the lake, fringing vegetation should be re-established in degraded areas such as the western and southern shorelines. Similarly, the Department should seek to (1) add the vegetated road reserve to the east of the nature reserve, and (2) liaise with landowners around the lake to maintain any existing vegetation on their private property. Consideration should also be given to acquiring remnant vegetation on the eastern side of the lake as a conservation offset if agricultural land is subdivided in future.

Many of the ecological problems facing Lake McLarty and other lakes on the coastal plain relate to whole of catchment issues, with most of the 11 300 km^2 catchment of the Peel Inlet and Harvey Estuary being cleared (Department of the Environment and Heritage 2000). Appropriate management of groundwater quality and level is required throughout the Peel Harvey Catchment in order to ensure the health of Lake McLarty and the ecosystems it supports. Therefore involvement by the Shire of Murray, Department of Environment and CALM is required to manage the whole catchment.

13. NATIVE PLANTS AND PLANT COMMUNITIES

The vegetation communities of the Lake McLarty Nature Reserve have been identified as representative of types once more extensive on the coastal plain which are now of restricted occurrence elsewhere. However, the vegetation surrounding Lake McLarty within the nature reserve has changed considerably over the last 55 years.

Between the years of 1951 and 1967 sections of the nature reserve near the Birchmont homestead were farmed. The southern section of the lake was cleared, burnt and ploughed for crops. This area was fenced and cattle grazed the remainder of the southern regions of the lake. During this time the western side of the lake was densely covered with bulrushes (species unknown) and the remainder of the lake was open water (G. Langley *pers. comm.*).

In 1981, a study of the lake indicated that the emergent vegetation comprised extensive stands of introduced bulrush (*Typha orientalis*) in the open water areas and broad areas of Baumea (including *B. articulata*) sedges along the margins (Craig *et al.* 2001). At this time, areas of open water only occurred at the north and south ends of the lake and the overgrowth of bulrush was considered a possible threat. A narrow fringe of low shrubs and paperbarks was most extensive at the northern end (Jaensch 1988). Little bottom vegetation was recorded at the lake until autumn 1997, when extensive growth, predominantly duckweed (*Lemna* sp.), was observed (Craig *et al.* 2004).

Gibson *et al.* (1994) classified the Lake McLarty Nature Reserve as a vegetation type representative of deeper wetlands (seasonally inundated to 1 m), dominated by species such as flooded gum (*Eucalyptus rudis*), freshwater paperbark (*Melaleuca rhaphiophylla*) and Robin Redbreast bush (*M. lateritia*). Average species richness was very low which was thought to reflect the long period of inundation of this wetland.

By 2001, it was reported that the lake floor was almost barren, with only fragments of *T. orientalis* remaining (Craig *et al.* 2001). Sedge margins had essentially disappeared, although strikes were recurring temporarily as the water receded in late summer (Craig *et al.* 2001). Since the reduction in sedges, sparse/short ephemeral grasses and weeds had colonized the newly exposed lake areas. The events contributing to the loss of sedges and reeds at the lake are not known.

The survey by Craig *et al.* (2001) describes stands of banbar (*Melaleuca teretifolia*) and freshwater paperbark fringing the northern and eastern margins of the lake, with an understorey of *Typha orientalis* in places. The south-western corner of the lake is dominated by pasture and the mid-western shore an open eucalypt woodland with a grass understorey (Craig *et al.* 2001). Davis (2000) recorded Tuart woodlands on higher ground further from the lake.

A general survey of the lake's vegetation undertaken in 2004 listed approximately 30 plant species. This survey identified banbar as the dominant species within the fringing vegetation (R. Kerslake *pers. comm.*). Large tuarts and flooded gums persist on the western side, with swamp peppermints (*Agonis linearifolia*) and tuarts located on the eastern side of the lake. Other species present include spearwood (*Kunzea ericifolia*), freshwater paperbark, golden-wreath wattle (*Acacia saligna*), peppermint (*Agonis flexuosa*) and sheoaks (*Allocasuarina* spp.). Two species of orchid, pink fairy (*Caladenia latifolia*) and cowslip (*Caladenia flava*) were observed in the southern and northern regions of the nature reserve respectively. Emergent sedges and rushes were located on the western and eastern sides of the lake, predominantly *Juncus kraussi* and native and introduced bulrush species, with a proportion of the *Typha orientalis* located in the centre of the lake (R. Kerslake *pers. comm.*). T. orientalis was also present in disturbed areas of the lake, such as the southern and eastern sides. Agricultural grasses and legumes found on neighbouring farms were recorded on the eastern and southern areas of the lake (see *Environmental Weeds*).

The western side of the lake has been highly degraded as a result of historical land use, with almost all original vegetation removed. In July 2003, this area was fenced and rehabilitated with native species grown from seed collected from the area. This rehabilitation to restore the fringing wetland vegetation was undertaken by the Peel Preservation Group, in conjunction with Pinjarra High School. Rehabilitation has been successful with planted species becoming established and regeneration of native species occurring (see *25. Rehabilitation*), although weeds remain a problem. The presence of significant areas of

marine couch (*Sporobolus virginicus*), a native ground cover, within this rehabilitation area is encouraging and likely a result of the exclusion of stock.

All native flora in Western Australia is protected under the Wildlife Conservation Act. Protected flora that is likely to become extinct or is rare or otherwise in need of special protection can be declared to be 'rare flora' under section 23F of the Wildlife Conservation Act, and is currently managed in accordance with CALM's proposed *Policy Statement No. 9 - Conserving Threatened Species and Ecological Communities* (subject to final consultation). In addition, species that do not meet criteria for listing as threatened because of insufficient information, have been recently removed from the threatened list, or are near threatened and require monitoring are placed on the Department's Priority Flora list. Species on this list are grouped into Priority categories 1 through to 5 (where 1 is of highest priority).

There are no known records of rare or priority flora in the Lake McLarty Nature Reserve. However, two declared rare flora, one Priority 1[5], four Priority 3, three Priority 4 (rare taxa) species and two Threatened Ecological Communities (TECs) (one vulnerable and one endangered) are located in the adjacent Kooljerrenup Nature Reserve to the south. The Austin Bay Nature Reserve to the north of Lake McLarty also supports two TECs (vulnerable) and the McLarty Nature Reserve (A247329), to the north of Lake McLarty, contains closed heath which supports the uncommon plant species *Brachyloma pressii* (Department of the Environment and Heritage 2003).

14. NATIVE ANIMALS AND HABITATS

Lakes McLarty and Mealup provide fresh water in summer for the birds of Peel - Yalgorup Inlet and Harvey Estuary and support a resident bird population (Department of Conservation and Environment 1978). The bed of Lake McLarty supports areas of sedge, which are important for breeding swans and other waterbirds (Department of the Environment and Heritage 2003). In late spring to early summer, over 20 000 birds have been observed on a single day (Craig *et al.* 2004). In addition, the lake supports a high diversity of invertebrate fauna (Davis 2000).

The Wildlife Conservation Act provides for the Minister for the Environment to declare native species as "...fauna which is likely to become extinct, or is rare, or otherwise in need of special protection." Four species recorded at Lake McLarty-Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), Forest

[5] Priority 1 species (poorly known taxa) are those that are known from one or a few (generally <5) populations which are under threat.

Priority 3 species (poorly known taxa) are those that are known from several populations and are not believed to be under immediate threat.

Priority 4 species (rare taxa) are those considered to have been adequately surveyed and while being rare (in Australia) are not currently threatened by any identifiable factors.

Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), the Australasian Bittern[6] and the Peregrine Falcon (*Falco peregrinus*)-are afforded such protection. CALM's proposed *Policy Statement No. 9 - Conserving Threatened Species and Ecological Communities* (subject to final consultation) also provides for the recognition of 'priority' species. The masked owl (*Tyto novaehollandiae*) is classified a Priority 3 species (taxa with several, poorly-known populations, some on conservation lands). This classification identifies that additional research is required to determine true conservation status.

The chuditch (*Dasyurus geoffroii*), which is also classified as 'rare or likely to become extinct', is found in the Kooljerrenup Nature Reserve to the south of Lake McLarty.

Invertebrates

Invertebrates are an essential component of wetland food webs, comprising much of the diet of waterbirds and waders. In addition, they may act as indicators for assessment of wetland health (Davis *et al.* 1993).

In the summer of 2000, an informal survey of the invertebrates was conducted at Lake McLarty (Davis 2000). Prior to this study, there had been no previous surveys conducted of invertebrates in or around the Lake. Invertebrates were sampled from five locations around the lake so as to include free-swimming invertebrates from shallow and deep water, and core samples from throughout the lake. A total of 46 species of invertebrates were identified, seven species from the orders Ostracoda, Zygoptera and Diptera. These seven species were considered important due to their abundance in the lake and role in the food webs that exist within the lake community, providing abundant food for the numerous waterbirds and shorebirds that inhabit Lake McLarty (Davis 2000). The more abundant and dominant species present were considered to provide a large proportion of bird diets over summer.

Further studies of the invertebrates at Lake McLarty are required as the previous survey was only undertaken at one point in time and the relative quality or health of the lake is difficult to establish. Summer sampling would also understate the number of invertebrate species present (Davis 2000). However, the productivity of the aquatic invertebrate fauna is considered high and capable of supporting a large waterbird population (Craig *et al.* 2004). It was hypothesised that the large numbers of birds present on the lake during summer months may be attributed to the abundant life that exists in the lake sediment and shallow waters near the lake edges, such as Chironomid (midge) larvae, other Diptera (fly) larvae and Coleoptera (beetle) larvae and adults (Davis 2000). The energy resources provided by invertebrates found in the lake are used by estuarine, inland and migratory birds.

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[6] Since the reduction in emergent vegetation, the Australasian Bittern has not been recorded at Lake McLarty (M. Craig *pers. comm.*)

The use of bio-indicators from single invertebrate orders may provide a useful means of biological monitoring (Environmental Protection Authority 1987). Species such as damselfly nymphs (*Xanthagrion erythroneurum*), aquatic beetles (*Berosus* spp.) and biting midge larvae (Ceratopogonidae), which are associated with healthy urban lakes, are present at Lake McLarty. These species are sensitive to changes in water quality and their abundance is a direct indication of the water quality status (Environmental Protection Authority 1987).

Waders and Waterbirds

A total of 158 bird species have been recorded within the nature reserve, including 77 species of waterbirds, 30 and 35 of which are protected under the JAMBA and CAMBA respectively (M. Singor, *pers. comm.*). Thirty-eight wader species have been recorded at Lake McLarty (Craig *et al.* 2004), of which 28 species are migratory waders that use the lake on a seasonal basis (M. Singor *pers. comm.*). Recent high number of waterbirds counted at the lake include 39 249 birds on 27 December 2002 and 31 256 on 16 January 2003 (M. Singor, *pers. comm.*). Lake McLarty is known to be an excellent place to observe waders in summer and is one of the best sites in south-western Australia.

Lake McLarty is internationally significant for populations of at least six wader species: Black-winged Stilt (*Himantopus himantopus*), Curlew Sandpiper (*Calidris ferruginea*), Red-necked Avocet (Recurvirostra novaehollandiae), Red-capped Plover (*Charadrius ruficapillus*), Red-necked Stint (*Calidris ruficollis*) and Sharp-tailed Sandpiper (*Calidris acuminata*) (M. Singor, *pers.comm.*). It meets the criterion for national significance for at least three species: Marsh Sandpiper (*Tringa ategnatilis*), Common Greenshank (*Tringa nebularia*) and Wood Sandpiper (*Tringa glareola*). Long-toed Stint (*Calidris subminuta*) and Pectoral Sandpiper (*Calidris melanotos*) do not have a minimum count criteria, although based on recent counts, Lake McLarty is nationally significant for the former species. It has the highest counts of Pectoral Sandpipers for Australia (M. Singor *pers. comm.*, Burbidge and Craig 1996b). Lake McLarty is regionally significant for at least 15 species of waterbirds. In addition, 14 waterbird species have been recorded breeding at various times at the lake between 1983 and 2002 (M. Singor *pers. comm.*, Burbidge and Craig 1996b).

The number of birds visiting the lake has increased since documented monitoring commenced in the early 1980s. Since an extensive survey of the waders and waterbirds at Lake McLarty was conducted by Jaensch *et al.* (1988) between 1981-85, the ecology of the lake has been significantly modified with the loss of extensive *T. orientalis* beds and *Baumea* sedge margins, leaving open water and mudflats (Craig *et al.* 2001). The disappearance of the lake's emergent vegetation has had an impact on the species of birds that visit the lake (Craig *et al.* 2001). For example the Australasian Bittern (*Botaurus poiciloptilus*) no longer occurs at the lake and the Little

Grassbirds (*Megalurus gramineus*), crakes and Australian Reed Warblers (*Acrocephalus australis*) have become less common as the emergent vegetation has disappeared. However, although the diversity of species may have decreased slightly, the overall numbers of birds visiting Lake McLarty has increased since this original survey (from the late 1990s onwards).

Lake McLarty currently provides a range of habitats that support a variety of bird species at different times of the year. Habitats such as low rushland interspersed with areas of open water or mud are important for feeding by Long-toed Stints, Wood Sandpipers, other uncommon waders, egrets and herons (Jaensch *et al.* 1988). Exposed mudflats are an essential habitat and feeding ground for migratory waders (Craig *et al.* 2004), which use the lake as a mid-term and post-departure feeding site (Craig *et al.* 2004). Between the drying out of the lake and its re-filling as a result of the winter rains, the wader species present are restricted to Australian resident species such as the Black-winged Stilt (Craig *et al.* 2004). High water levels exclude migratory waders and as a result, these birds do not use the lake until weeks or months after their arrival in the area.

The southern part of the lake is consistently used by a large number of waterbirds, such as the Glossy Ibis (*Plegadis falcinellus*), Yellow-billed Spoonbill (*Platalea flavipes*) and Royal Spoonbill (*Platalea regia*)[7], including migratory shorebirds (A.N. Burbidge *pers. comm.*). Resident Australian waders and migratory northern hemisphere species differ in their utilization of the lake, but both use the lake as a non-breeding feeding ground and refuge area (Craig *et al.* 2004).

To ensure the continued presence and diversity of birds that utilise Lake McLarty, it is essential to protect the range of habitats that the lake provides. This could entail, for example, controlling the amount of both *T. orientalis* and native emergent rushes and sedges to prevent excessive[8] encroachment onto the lakebed. Reducing grass/weed levels surrounding the lake is also vital to ensure that exposed mudflats remain available for utilisation by wading birds.

Cattle have grazed the lake shores since the 1880s, and cattle from neighbouring properties continue to do so on an *ad hoc* basis. CALM has informally allowed this practice to continue as the cattle reduce the level of grasses surrounding the lake and have (over a period of many years) effectively created habitat for a range of waterbirds (such as the Long-toed Stint). Based on the knowledge gained from research elsewhere (e.g. Nilsson *et al.* 1982, Nilsson 1985), the current grazing regime is likely to

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[7] These species did not originally occur in the south-west and have gradually extended their ranges since late in the 19th century as a result (probably) of human-induced changes to habitat and climate change.

[8] Note that native emergent rushes and sedges provide valuable habitat for certain species (e.g. Australasian Bittern, Australian Reed Warbler) and management will aim to provide some areas of suitable habitat.

pose less danger to the continued survival of, and inhabitance by, these species than would the immediate cessation of all grazing, the effect of which is currently unknown. The Department will continue to allow grazing to prevent loss of mudflat habitats until the impacts or other management options (to maintain habitat) are assessed. These options include (a) regular slashing/mowing of the grass and (b) application of herbicide. Although it is proposed to trial different methods during the life of the management plan, there are constraints associated with slashing and herbicide application-the former is labour intensive, expensive and requires frequent management action while the latter must be carefully applied to prevent impacts on off-target species. For example, most herbicides should not be used near waterways and those that can, such as glyphosate, have been demonstrated to be slightly toxic to birds, fish, invertebrates and mammals in laboratory studies (U.S. Department of Agriculture, Forest Services 1995) and should not be used with surfactants.

Consequently, closely monitored and restricted cattle grazing within the nature reserve will be allowed to continue in the short-term, until an effective, alternative method of reducing grass levels is found. The effect on the wader species at Lake McLarty is likely to depend on the frequency and intensity of grazing. A cattle density of 2.5 stocking units/ha (1 adult cow = 1 stocking unit, 2 weaners = 1 stocking unit) is suggested in order to create an optimal shorebird habitat of 3-4 cm grass height (B. Rutherford *pers. comm.*). Investigations into the impact of cattle within the nature reserve are also required (see *16. Introduced and Other Problem and Animals*).

A decline in the numbers of Long-toed Stint, Wood Sandpiper and to a lesser extent Pectoral Sandpiper and Ruff has been recorded recently (Craig *et al.* 2004). However, the reduction in these species has not been restricted to Lake McLarty, with the Long-toed Stint and Wood Sandpiper showing a marked decline over the whole of the Swan Coastal Plain including Forrestdale Lake, Kogolup Lake and Thomsons Lake (Craig *et al.* 2004).

The opening of the Dawesville Channel in April 1994 significantly changed the water levels of the Peel-Harvey Estuary, thus reducing the accessibility of mudflats to smaller waders (Craig *et al.* 2004). This change may have contributed to the significant increase in numbers of Red-necked Stint and Sharp-tailed Sandpiper at Lake McLarty (Craig *et al.* 2004). In addition, adverse environmental changes at wetlands in surrounding areas (such as the increase in salinity at Lake Mealup) may have contributed to the change in bird numbers. Disturbances from the Peel - Harvey Estuary such as power boats, jet-skis, fishing, crabbing and other recreational activities may have an impact on use of the lake by waterbirds. Given these impacts, and increasing salinity levels in Lake Mealup, there is greater emphasis on the regional importance of Lake McLarty for the resident bird population. Increased development and associated impacts (e.g. increased in nutrient run-off, utilisation of groundwater resources, disturbance from people and pets) within the Lake McLarty catchment area has

the potential to significantly impact on this important wetland ecosystem. These factors need to be considered when developing management strategies for this wetland ecosystem.

15. ENVIRONMENTAL WEEDS

The *Environmental Weed Strategy for Western Australia* (CALM 1999) describes environmental weeds as "... plants that establish themselves in natural ecosystems and proceed to modify natural processes, usually adversely, resulting in decline of the communities they invade". Weeds displace indigenous plants, particularly on disturbed sites, by competing with them for light, nutrients and water. Some of their other impacts include the prevention of seedling recruitment, changes to soil nutrients, and changes to the abundance of indigenous fauna. They can also have a significant adverse impact on other conservation values by altering animal habitats, harboring pests and diseases, and increasing fire hazard or changing fire regimes.

The Environmental Weed Strategy provides an integrated approach to weed management and rates environmental weeds as high, moderate, mild and low according to their potential invasiveness, distribution and environmental impacts. This rating system provides the basis for identifying control strategies, with the highest rated species and species that pose a threat to conservation values within the reserve, being the focus for weed management (see *Management Summary Table*). Further guidance for management is provided by *Policy Statement No. 14 - Weeds on CALM Lands* (CALM 1986a).

As the inter-relationship between soil disturbance, weed invasion and native plants is complex, weed control should be undertaken in a strategic and integrated manner with guidance from the *Environmental Weed Strategy for Western Australia*. Rehabilitation of areas following weed removal is important to prevent re-invasion of weed species (see *25. Rehabilitation*).

A total of 13 weed species were identified during a survey within the Lake McLarty Nature Reserve in 2005 (R. Kerslake *pers. comm.*). According to the *Environmental Weed Strategy for Western Australia*, two of these species are High impact species (see below), seven Moderate, two Low, and two either unlisted or not rated (CALM 1999). Many of these weeds are pasture grasses and legumes that have encroached from neighbouring farm properties. The majority of the 13 weed species are located on the eastern side of the lake in areas where cattle have been allowed to graze. The spread of these weed species has been facilitated by the presence of cattle in the reserve. In addition, the increasing spread of goosefoot (*Chenopodium pumilio*) and the presence of samphire (*Sarconia* spp.) are indicators that these areas may becoming more saline. Goosefoot is spreading extensively on the northern edge of the nature reserve which is a concern for management.

Great brome grass (*Bromus diandrus*) and the introduced bulrush *Typha orientalis* are rated as high priority weed species and pose the greatest threat to native vegetation in the reserve.

To date there have been no major control programs undertaken for either of these weeds. Great brome is a serious weed of pastures and crops in southern WA (Hussey *et al.* 1997). Introduced bulrush is an aggressive colonizer in disturbed wetlands in the Swan Coastal Plain (Hussey *et al.* 1997) and has the potential to reduce the area of open water and exposed mudflats at Lake McLarty.

Exposed mudflats around Lake McLarty are an essential habitat and feeding ground for migratory waders. Colonisation and spread of *T. orientalis* around Lake McLarty has the potential to significantly displace and change fringing vegetation and hence alter waterbird habitat. To ensure the continued presence of such waterbirds at Lake McLarty, it is essential that the amount of *T. orientalis* be controlled to prevent encroachment onto the lakebed or lake edges. In addition, as the lake dries in the summer months, the bulrush dries creating a significant fire hazard. The current distribution *T. orientalis* around the lake provides shelter, nesting sites and a food source for birds and other wildlife, and acts as a buffer to nutrient input. Therefore its complete removal needs to be carefully considered and integrated with revegetation strategies incorporating *Typha* species endemic to the region.

Unlike Lake Mealup to the north where *T. orientalis* dominates the main lakebed, the distribution of *T. orientalis* at Lake McLarty is predominantly confined to the eastern and northern edges of the lake and is not currently considered a major threat. It is not clear why Lake McLarty has a reduced infestation of *T. orientalis* compared to Lake Mealup, although water levels may influence the current distribution patterns. Lake McLarty is generally deeper and holds water for a longer period throughout the year than Lake Mealup, which may reduce conditions favourable for the establishment of *T. orientalis* (P. Wilmot *pers. comm.*). Mapping and monitoring the distribution of *T. orientalis* at Lake McLarty and initiation of appropriate control methods is required to ensure waterbird habitat is not lost (see management summary table).

Weeds that are, or may be, a problem to agriculture or the environment can be 'declared' under the *Agriculture and Related Resources Protection Act 1976*. This Act stipulates that landholders with declared plants on their property are obliged to control them, although it also preserves the Department's right to determine priorities and the level of control according to resources. Cotton bush (*Gomphocarpus fruticosus*), a declared weed, was located in a small clump on the north-western side of the lake close to the road during the 2005 survey. Control and ongoing monitoring of the presence of this weed throughout the reserve is required.

Pasture grasses dominate the terrestrial weeds at Lake McLarty, particularly in the more disturbed areas (western and southern sides) surrounding the lake. This is the result of use for rural activities and cattle grazing since the 1880s (see *Native Animals and Habitats*).

Priorities for weed control within the reserve are based on the

principles and rankings of the *Environmental Weed Strategy for Western Australia*, as well as their potential impacts on biodiversity at a local level. Other local concerns such as ongoing maintenance to limit the return of species previously controlled are also considered.

Rehabilitation of the western side of the lake will facilitate the re-establishment of native species in place of the numerous weed species that have dominated this area in the recent past. Strategies for the management of priority environmental weeds at Lake McLarty are outlined in the management summary table.

16. INTRODUCED AND OTHER PROBLEM ANIMALS

Problem animals are those species that have the potential to cause serious impact on natural systems through direct effects such as predation, habitat destruction, competition for food and territory, introduction of disease and through environmental degradation (i.e. overgrazing). Problem animals can be either native species that are impacting on natural or agricultural values, or feral animals that are introduced species that have become established as wild or naturalized populations. CALM is in the process of developing a control plan for introduced and other problem animals which will be implemented across reserves on the Swan Coastal Plain.

Feral animals such as cats, rabbits and foxes as well as domestic pets (cats and dogs) pose a threat to the ecosystems within the Lake McLarty Nature Reserve. There are also a number of acclimatised 'native' species present in the nature reserve that might compete with native fauna for nest hollows, such as Rainbow Lorikeets (*Trichoglossus haematodus*), Galahs (*Cacatua roseicapilla*), and corellas (both long-billed and little) (*C tenuirostris* and *C. sanguinea*) [9]. These species, and feral bee colonies, will be controlled when and as necessary in accordance with operational priorities, but at the time of writing this plan, were not deemed to be a significant problem at Lake McLarty.

A strategic approach to the management of any pest animal or assemblage of pest animals should be based on four key activities (after Braysher 1993):

- defining the level of damage to identified values and the reduction in pest animal density required to reduce or prevent the damage;
- developing clear objectives in terms of the desired conservation outcome, and developing options for pest animal management (e.g. local eradication, strategic management, crisis management and no management);

[9] Galahs, Little Corellas and Long-billed Corellas are native species formerly not found on the Swan Coastal Plain. Rainbow Lorikeets are an eastern Australia species.

- implementing the favoured option-large-scale (regional) approaches to pest animal management is usually most effective but requires co-ordinated action by both private and Government land managers.

- monitoring/evaluating the plan to assess the efficiency of any specific control operation.

Cats and foxes are efficient predators and can have a devastating effect on native fauna (Water and Rivers Commission 2001). Historically oblong turtles (*Chelodina oblonga*) were prolific at Lake McLarty but appear to have largely disappeared-foxes have been reported to dig up hibernating turtles (Craig *et al.* 2004) and may be a major contributor to their demise.

Feral cats are present within the reserve and the extent of their impact is not known. The potential of cats (both feral and domestic) to prey on waterbirds, particularly hatchlings, is a significant concern. Rabbits are also present in the reserve and can inhibit the regeneration of native plants, hindering the re-establishment of understorey species or grazing on planted seedlings.

Control of foxes, feral cats and rabbits is not currently undertaken at the reserve. Baiting to control these animals within the reserve is not considered appropriate due to the close proximity of surrounding residential development and the small size of the reserve. Control programs covering a larger area, inclusive of Kooljerrenup and Mealup Nature Reserves and possibly surrounding agricultural land (in collaboration with landowners), may be considered in the future as such programs are currently being undertaken at Lake Mealup but with limited success (National Heritage Trust 2003).

Under the CALM Regulations, dogs are not allowed on to the reserve without lawful authority. In the case of Lake McLarty, this is consistent with protection of the natural values of the lake, in particular the high number of waterbirds. A dog-resistant fence exists between the lake and the subdivision on the western side of Lake McLarty in order to reduce the impact of straying domestic dogs. The effectiveness of the fence to exclude dogs may need to be improved during the life of the plan. In addition, an education program informing the public of the impact of dogs and cats on waterbirds is required. One such program was established in 2005 by members of local community groups (such as the Peel Preservation Group and Coolup Land Conservation District Committees and local Shires) and individuals associated with the Shorebird Conservation Project.

Cattle grazing has occurred within the reserve since the 1880s and continues in parts of the southern half of the lake. This activity has been occurring without a formal leasing arrangement and is not generally permitted within a nature reserve. Although cattle can adversely impact wetland ecosystems by eroding wetland banks, contributing to the introduction of weeds and nutrients, grazing and trampling native vegetation and compacting soil, in the case of Lake McLarty they have also created habitat for waterbirds (see *14.*

Native Animals and Habitats). Therefore controlled cattle grazing will be allowed to continue in the nature reserve under a formal lease/licence, with cattle restricted to (i) specified areas in the southern and south-eastern part of the reserve and (ii) seasonal use, until the impact of this activity on the wetland system can be established. The lessee will be required to construct temporary fencing to contain the cattle and stipulations on the number of cattle permitted within the reserve will be outlined as part of the lease arrangements. Allowing controlled grazing to occur within sections of the nature reserve will aid in determining the impact of cattle in the short-term on:

- waterbird populations;
- control of pasture grasses; and
- general vegetation and wetland health.

This will enable long-term decisions to be made about the ongoing use of cattle as a management tool in the nature reserve.

Midges and Mosquitoes

Midges and mosquitoes are natural components of aquatic ecosystems on the Swan Coastal Plain, although nutrient enrichment promotes higher densities of larvae. As poor water quality of a wetland can be attributed to factors occurring throughout the catchment, management of midges and mosquitoes is undertaken on a case-by-case basis in conjunction with local government.

Midges breed in wetlands, intertidal areas and the edges of streams and rivers. Midge swarms from wetlands occur during spring and summer and can affect residents up to a kilometre from the wetlands. Midges are not currently a problem at Lake McLarty; however, with increased residential development surrounding the lake problems may arise in the future.

Chemical control can be used for short-term reduction in midge numbers. Monitoring of midge larvae is carried out by local governments to determine the timing of larvicide treatments and to assess the effectiveness of treatments. In the long-term, restoring wetland health will reduce midge numbers.

Mosquitoes are native insects that breed in salt, brackish or fresh water. The species of mosquito present within freshwater and saltwater systems vary. Unlike mosquito species found associated with saltmarshes (e.g. *Aedes camptorhynchus*), species of freshwater mosquito are not commonly known for carrying mosquito-borne diseases such as Ross River Virus (S. Harrington *pers. comm.*). Lake McLarty is therefore unlikely to support large populations of mosquitoes vectoring viruses and to date has not been subject to aerial spraying to reduce numbers (D. Eastwell *pers. comm.*). Nevertheless, Lake McLarty is monitored for mosquito larvae and adult mosquitoes by the Shire of Murray. A mosquito monitoring site is located

at the western end of Mills Rd, south of Lake McLarty (Environmental Capability 1995). This site has recorded high numbers of *A. camptorhynchus* in the vicinity of the trapping site and *A. clelandi*, *A. camptorhynchus* and *Culex* sp. in the trap. These mosquitoes favour warm shallow water in shaded areas at the periphery of wetlands in which to breed (Environmental Capability 1995).

Mosquito numbers will continue to be actively monitored at Lake McLarty and spraying programs may be considered if problems arise with increasing numbers of residents in the area. However, records from elsewhere show that spraying has led to wader mortalities (Craig *et al.* 2004).

The Conservation Commission opposes, in principle, mosquito control on nature reserves, Ramsar wetland sites and other wetlands with high conservation value. However, it does recognise that mosquito control adjacent to residential areas is sometimes necessary to reduce the risk of mosquito borne diseases (such as Ross River Virus and Australian Encephalitis) or to reduce an extreme nuisance.

With an increase in the population surrounding the lake and nearby Harvey Estuary, there is a possibility of future pressure for control of mosquitoes and midges at their known breeding sites. The establishment of an adequate vegetation buffer between the lake and surrounding development will reduce the impact of these pest insects on residents (Bowen *et al.* 2002).

17. DISEASE

Infection of native vegetation with *Phytophthora cinnamomi* results in the destruction of susceptible species and a dramatic change in vegetation community structure. This introduced soil-borne plant pathogen kills a range of susceptible plant species, particularly those belonging to the families Proteaceae, Myrtaceae, Epacridaceae and Papilionaceae (Dieback Working Group 2002). The result is not only a loss of vegetation communities but of habitat and food sources for native animals.

A disease interpretation assessment was conducted at Lake McLarty Nature Reserve and McLarty Nature Reserve in October 2004. This assessment identified: (i) whether the nature reserves were 'interpretable' for symptoms of the presence of disease (particularly *P. cinnamomi*) and if the area was interpretable, (ii) the diseased and protectable (disease-free) areas were identified and mapped (Lake McLarty Nature Reserve only).

The entire Lake McLarty Nature Reserve and sections of the McLarty Nature Reserve were identified as 'uninterpretable' for the presence of *P. cinnamomi*. Uninterpretable areas are those dominated by resistant vegetation, such as freshwater paperbark. These resistant species 'shade out' susceptible plant species making it impossible to interpret whether disease is present.

The preliminary assessment of McLarty Nature Reserve did identify large interpretable areas. Within these interpretable areas, it was identified that *Armillaria* sp. was present. However, this fungus is native to the area and will not pose a

significant threat to the health of the vegetation unless the environmental conditions within or surrounding the reserve are changed to favour the spread of the fungus.

Dieback management within the nature reserves will occur in accordance with CALM's *Policy Statement 3 - Management of Phytophthora and disease caused by it* (CALM 1998). It is recommended that a disease survey be undertaken within the McLarty Nature Reserve to the north of the lake to identify and map areas of dieback and protectable areas. This will ensure that these dieback infested areas are appropriately managed, particularly regarding the disturbance or movement of infected soil, and do not impact adversely on the Lake McLarty Nature Reserve.

18. FIRE

Some wetlands have adapted to a natural cycle of burning. However, in the case of Lake McLarty, wildfire is a significant threat both to the natural values of the nature reserve and to adjoining properties. Disturbance by wildfire could lead to the invasion of agricultural weeds (a major problem in many reserves with narrow buffers), preventing the regeneration of native species. Wildlife could also lead to an increase in *Typha orientalis* across the lakebed-this species is highly flammable, persists and spreads after fire, and large infestations constitute a major fire hazard.

In the event of a fire within the nature reserve, CALM is guided by the provisions of the *Bush Fires Act 1954*. The Department plays a support role through the provision of an environmental officer and information on significant floral species and communities. CALM may assist FESA, in association with the Shire of Murray (Fire Protection Officers, Bushfire Volunteers) on incident control teams and is responsible for pre- and post-suppression works. No prescribed burning currently takes place within the Lake McLarty Nature Reserve and is not proposed for the future.

CALM maintains a firebreak for emergency access along the southern boundary in conjunction with the 50 m fuel reduced buffer. A concrete tank and bore is located on the south-western corner of the reserve to provide water for fire-fighting purposes.

PART D: MANAGING CULTURAL HERITAGE

19. INDIGENOUS HERITAGE

The conservation of indigenous heritage is important in maintaining the identity, health and well being of Indigenous people (Australian Heritage Commission 2002). In WA, the *Aboriginal Heritage Act 1972* protects places and objects customarily used by, or traditional to, the original inhabitants of Australia. A register of such places and objects is maintained under the Act, however all sites are protected under the Act

regardless of whether they have been entered on the register.

A key issue for management is to ensure that Aboriginal sites are protected from damage, and that obligations are fulfilled according to the Aboriginal Heritage Act and the Commonwealth *Native Title Act 1993* before any planning or public works occur. The latter act requires CALM to notify Aboriginal representative bodies and Native title claimants of any intended public work or management plan.

Although an extensive study of the area has not yet been undertaken, there are no known Aboriginal sites within the Lake McLarty Nature Reserve. However, nearby sites within the Peel Inlet/ Harvey Estuary region include Warrangup Spring, Stony Point, Herron Point and Island Point. These sites are known to have been Aboriginal camping grounds.

20. NON-INDIGENOUS HERITAGE

Lake McLarty was named after one of the first and most prominent pioneering families of the Murray District. John McLarty was originally a tenant farmer in the 1840s, and later a building contractor and one of Pinjarra's first publicans.

In 1860 John and his wife, Mary Ann, built the 'Blythewood Homestead' which is still located south of Pinjarra (Craig *et al.* 2004). John McLarty developed a cattle business centered on Blythewood and other properties in the district. McLarty was given the contract to build the seawall behind the Peninsula Hotel (Mandurah) in 1872 in an attempt to keep the sea entrance to the Peel Inlet open (Craig *et al.*, 2004). In the 1870s, Edward McLarty, son of John and Mary Ann, established the significant homestead property of Edenvale in Pinjarra which, like the Blythewood Homestead, still exists today (H. Burgess *pers comm.*). In 1972 the Old Blythewood homestead was given to the National Trust (Department of the Environment and Heritage 2005).

Lake McLarty and its surrounds have had a history of farming for an extended period of time. In 1848 Arthur Birch established his farm besides a wetland known as 'Big Lake', now known as Lake McLarty. By the 1870s Birch had built a limestone cottage next to the lake, which he named 'Birchmont' and by 1880 Birch held 1000 acres of freehold land and leased 70 000 acres of Crown land between Harvey Estuary and the Peel Inlet. In addition to growing wheat, the family had 2000 sheep, 100 cattle and bred horses (about 500 on the property) (Craig *et al.* 2004). In the days of the homestead, the household water supply was provided by a spring near the homestead (Richards 1978). Since the 1880s, the south and south-western side of the lake have been used for rural activities (feed stock and irrigated market gardens) (Richards 1978).

The old Birchmont Homestead still stands, located on a small rise close to the south-west boundary of the lake. The homestead remains in private ownership and is historically significant as a good example of the early settlement in the area and is listed on the Shire of Murray's Municipal Heritage Inventory (Heritage Council of WA 2004), although this

provides it with limited statutory protection.

The land immediately surrounding the Lake McLarty Nature Reserve, which was subject to farming development soon after European settlement, is currently extensively cleared. The land on the eastern side of the lake is used for grazing a small number of cattle, some of which still range the surroundings of the lake (Craig *et al.* 2001). Approximately 22 ha of the original farmland surrounding the old homestead and the remaining property has been sold and sub-divided by developers. An application to subdivide the homestead property of 26 ha into 10 lots is currently being considered.

PART E: MANAGING FOR VISITORS

21. VISITOR OPPORTUNITIES

As a nature reserve, Lake McLarty is gazetted for the purpose of conservation of the natural environment, the protection, care and study of indigenous flora and fauna, and the preservation of any feature of archaeological, historic or scientific interest.

The Department's *Policy Statement 18 - Recreation, Tourism and Visitor Services* (subject to final consultation) outlines the Department's principles, operational guidelines, procedures and administrative controls in relation to facilitating recreation and tourism on the public conservation estate. This management plan follows the policies outlined in Policy Statement 18. As such, only low impact recreation is permitted, and then only when it does not adversely affect the natural values and ecosystems of the reserve.

Increased visitor use resulting from residential development around Lake McLarty will need to be carefully managed. The natural values of the reserve provide opportunities for nature appreciation, bird watching and environmental education, and this will remain the focus for recreation activities during the life of this management plan.

22. VISITOR USE

Visitor use at Lake McLarty is expected to increase over the life of the management plan as residential development on adjoining land progresses and the area becomes more accessible with the completion of the Peel Deviation Freeway to the east of the lake in 2008. This will place added pressure on the conservation values of the reserve and will be considered and planned for through this management plan (see *23. Access*).

Birdwatching and nature appreciation

The importance of Lake McLarty as a place of refuge and feeding for nationally and internationally significant waterbird species attracts birdwatchers from around Australia and the world, with birdwatching being the main recreational pursuit in the reserve. The southern and western sides are the easiest access points for birdwatching.

To facilitate birdwatching and nature study at the reserve, a bird hide is proposed for construction on the southern side of the lake. This is to be complemented by educational information at the site. Other provisions, such as defined access points, are required to ensure the wetland ecosystem is not adversely impacted upon by birdwatchers.

Walking

With an increase in the population immediately surrounding the lake, there is likely to be increasing pressure to provide opportunities for walking within the reserve. However, disturbance to waterbirds from walkers is a major concern—to overcome this potential problem it is proposed to limit access to designated entrances through the fence and to defined pathways away from the water's edge (including firebreaks to the north of the lake). Opportunities for bushwalking also exist in nearby Kooljerrenup Nature Reserve to the south.

23. ACCESS

Access to Lake McLarty is provided for passive recreational uses (such as birdwatching and nature appreciation), as well as for management and emergency vehicles. Designated access points are required to provide protection for the conservation of flora and fauna of the reserve.

Access to the reserve for pedestrians and birdwatchers is currently restricted to two points: a gate located on the western side of the lake and another gate to the south of the lake off Mills Road. There are currently no designated pedestrian tracks within the reserve, and many parts of the lake are inaccessible during winter. The firebreaks and management tracks are gated and provide access for management and emergency vehicles only. Vehicular access to the southern part of the reserve to allow off-road parking may be considered if and when future subdivisions occur.

The use of recreational watercraft (including model boats) in the lake is prohibited. However the use of canoes for education, research, and management purposes by approved users will continue to be allowed.

PART F: MANAGING SUSTAINABLE RESOURCE USE

24. SCIENTIFIC AND RESEARCH USE

There are many opportunities for research within the reserve, including studies of water quality and levels, invertebrates and particularly waterbirds. The Peel Preservation Group currently monitors water levels monthly. Birdwatchers also visit the site monthly to monitor bird species presence and numbers. The Shire of Murray conducts mosquito larvae testing as required. Research by universities and other community groups will

continue to be encouraged and supported by the Department.

It is appropriate that research and monitoring programs involve a wide range of people and groups. The involvement of volunteers, educational institutions and individual researchers can reduce the costs of such programs and assist in providing information to both management and the broader community. However, it is important that all research undertaken in the reserve is coordinated by the Department, as this will ensure an integrated approach, avoid duplication, minimise impacts and enable projects to be prioritised.

25. REHABILITATION

Rehabilitation is the establishment of a stable, self-regulating ecosystem following disturbances, consistent with the purpose for which the area is managed. The Department's *Policy Statement No. 10 - Rehabilitation of Disturbed Land* (CALM 1986) provides guidelines for the rehabilitation of lands managed by the Department based on the following principles:

- manage (as far as possible) to avoid disturbance;
- rehabilitation should be the last option in a series of management decisions designed to protect environmental values; and
- rehabilitation should aim to restore original values and help to enhance all potential uses provided the priority uses are not adversely affected.

In 2003, the western side of the lake was rehabilitated by the Peel Preservation Group in conjunction with a Southern Peel Partnership Landcare Project ('*Crossing the Boundaries*') and a local school. The project aimed to re-connect the existing native fringing vegetation in the south with that in the north by rehabilitating an area along the western boundary. This section of the lake was chosen for rehabilitation as it was anticipated that the lake and surrounds would be exposed to human and domestic animal intrusion in the near future, particularly from the subdivision along its western borders.

The rehabilitation area of 2.3 ha was fenced to be kangaroo and emu friendly, but restrictive of dogs and cattle. Seed collected at the site was used to propagate species for planting (K. Wilson, *pers. comm.*). The rehabilitation has been successful with both planted species and natural revegetation establishing well, facilitated by the exclusion of cattle. Monitoring of the success of the rehabilitation and degree of weed establishment will continue be carried out by CALM and the Peel Preservation Group.

Further rehabilitation will be required on the southern and south-eastern sides of the reserve when restrictions on cattle access are in place. Any rehabilitation activity at the nature reserve should only include local native plant species and soils that are free of Phytophthora and other plant diseases. CALM welcomes community input and involvement in rehabilitation projects at the nature reserve (see *27. Working with the Community*).

PART G: INVOLVING THE COMMUNITY

26. INFORMATION, EDUCATION AND INTERPRETATION

Lake McLarty Nature Reserve provides a valuable opportunity for improving community awareness about wetland ecosystems and the values of Ramsar-listed wetlands. An effective information, education and interpretation program is vital to achieve the vision and objectives of maintaining, enhancing and communicating reserve values.

In 2004, Lake McLarty was one of 10 priority shorebird sites selected across Australia for a range of community-driven shorebird conservation projects. The Shorebird Conservation Project was funded by the National Heritage Trust and coordinated by World Wildlife Fund Australia. The project, run over 4 years, aimed to:

- increase the awareness, understanding and involvement by communities in conservation of shorebird habitat and where possible enable communities to conserve and wisely manage important shorebird sites;
- prepare a site communication plan, brochures and appropriate educational signage for the reserve;
- implement a more detailed monitoring program; and
- organise guided tours and information evenings about the wetland.

The program will concentrate on raising awareness about the reserve's conservation values, particularly those that contribute to its Ramsar listing, potential human impacts, and positive action visitors can take to support management of the reserves and of other wetlands.

Educational facilities at the reserve are limited to an information sign located on the western side of the lake. Given the importance of the site as waterbird habitat, it is a high priority to upgrade the signs for the purpose of public education and interpretation to assist in achieving conservation objectives. This may be undertaken as part of the Shorebird Conservation Project. In addition, it is recommended that a visitor viewing platform/ bird hide be constructed on the southern side of the lake. This structure could then support further interpretative signs and information on the values of reserve. Any signs will incorporate an explanation of the Ramsar Convention.

The proximity of Lake McLarty to the estuary increases the potential for visitors to be exposed to mosquitoes that have a high possibility of carrying RRV. As mosquitoes are an essential part of the ecosystem of the lake and mosquito control has the potential to jeopardise the conservation values, the Conservation Commission and CALM would prefer not to take measures to reduce mosquito numbers. Increasing visitor awareness may help reduce the incidence of infection.

27. WORKING WITH THE COMMUNITY

Community involvement is an integral component of the Department's operations. The community, as groups or individuals, is encouraged to be involved in both the planning and management of Lake McLarty Nature Reserve.

Lake McLarty Nature Reserve is highly valued by the local community and several community groups within the region are dedicated to conservation of the reserve. These groups have played an active role in the planning and management of this reserve. Such groups include the Peel Preservation Group, Coolup Land Conservation District Committee, the *Crossing the Boundaries* - Southern Peel-Harvey Landcare Project and local schools.

At the draft stage of this management plan, opportunity exists for interested community members and organizations to comment on the proposed management of the reserve either by written submission or by making a submission on the Department's webpage (www.naturebase.net/haveyoursay/index.html).

Ongoing community support is essential for the successful implementation of this management plan. CALM has a formal policy and administrative framework for volunteer activities—*Policy Statement No. 15 - Community Involvement (Public Participation and Volunteers* (CALM 1991)—which includes initiatives to provide more volunteer opportunities and training to volunteers and to CALM staff and their management of volunteers. Volunteer activities are encouraged and supported at Lake McLarty, and community groups, local schools and universities are encouraged to take part in volunteer activities such as waterbird surveys, water monitoring, rehabilitation, and interpretation and education. CALM will seek to co-ordinate community groups to facilitate such work.

PART H: IMPLEMENTING AND EVALUATING THE PLAN

The strategies outlined in the plan will be built into the works program of CALM's Swan Coastal District, which is responsible for the day-to-day management of the reserve.

The Conservation Commission will assess the effectiveness of this management plan via regular audits of KPIs or other mechanisms as deemed necessary. KPIs for this management plan are listed in the management summary table.

It is recommended that an audit of the management plan be undertaken and consideration given to the preparation of a new plan (incorporating McLarty and Kooljerrenup nature reserves) to tie in with the construction of the Peel Deviation freeway bypass.

28. TERM OF THE PLAN

In accordance with the CALM Act, the term of this plan is for a

period of 10 years from the date the plan is approved by the Minister for the Environment. At the end of the 10-year period, the plan will be reviewed with full public consultation and then re-submitted to the Minister for approval. The CALM Act also specifies that in the event of such a revision not occurring by the end of the plan's specified life span, the plan will remain in force in its original form, unless it is either revoked by the Minister or a new plan is approved. Revisions or amendments to the plan are allowed under Section 61 of the CALM Act.

The Conservation Commission may initiate a review of the management plan before the 10-year term expires. Should significant changes to this plan be required, public comment on the proposed amendments will be sought.

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B. Rutherford - Project Officer, Shorebird Conservation Project.

M. Singor - Birds Australia.

P. Wilmot - Mealup Preservation Society.

K. Wilson - Landcare Development Officer, Southern Peel-Harvey Landcare Project.

Acknowledgements

This draft management plan was prepared by Tania Jackson from CALM's Management Planning Unit. Many people provided valuable assistance, in particular:

- Daryl Moncrieff, Murray Love and Dave Mitchell from CALM;
- Bill Rutherford from the Shorebird Conservation Project;
- members of the Peel Preservation Group;
- Ray Kerslake from the Department of Agriculture;
- Marcus Sinclair from Birds Australia; and
- Kim Wilson from Southern Peel - Harvey Landcare Project

Brian Bucktin also provided valuable data on water quality and levels at Lake McLarty for the period 2000-2004.

LAKE MCLARTY NATURE RESERVE MANAGEMENT SUMMARY TABLE

KEY POINTS	OBJECTIVES AND STRATEGIES	KEY PERFORMANCE INDICATORS*		
		PERFORMANCE MEASURE	TARGET	REPORTING REQUIREMENTS
PART B. MANAGEMENT DIRECTIONS AND PURPOSE				
LAND TENURE • The lake comprises a very large proportion of the reserve, and consequently the buffer around the lake is small. • The conservation values of the lake are subject to external influences such as surrounding land use. It is probable that pressure for subdivisions will increase in future.	**OBJECTIVE** To protect the values of the reserve by securing areas of greatest value into the conservation estate. **THIS WILL BE ACHIEVED BY:** • Securing additions to the reserve wherever possible, including the road reserve on the eastern side of the lake. • Negotiating conservation offsets with developers should further subdivisions be approved. • Seeking to enter into voluntary agreements with reserve neighbours to protect remnant vegetation.			

KEY POINTS	OBJECTIVES AND STRATEGIES	KEY PERFORMANCE INDICATORS*		
		PERFORMANCE MEASURE	TARGET	REPORTING REQUIREMENTS
PART C. MANAGING THE NATURAL ENVIRONMENT				
WETLAND AND CATCHMENT MANAGEMENT				
MANAGING WATER LEVELS • Lake McLarty is a surface expression of groundwater that has formed where the water table intersects with the ground surface. Therefore, the lake's water levels are directly affected by management of the regional groundwater system. • The pattern of water level changes within the lake are also dictated by local rains. The lake is marginally ephemeral and dries for 1-4 months of the year. • Groundwater, and subsequently wetland water levels, may be under threat as a result of a combination of dry climate and groundwater abstractions in surrounding areas. • Management of the groundwater resource within the Peel-Harvey Catchment is the responsibility of the Department of Environment.	**OBJECTIVE** To maintain a water level regime that supports the lake's water-dependent ecosystems and meets the needs of the range of waterbirds that use the lake. **THIS WILL BE ACHIEVED BY:** 1. Liaising with the Department of Environment and the Water Corporation regarding the monitoring and maintenance of water levels. 2. Liaising with the Department of Environment to establish at least two more water monitoring bores in the area surrounding the lake. 3. Working cooperatively with the water agencies to ensure that the management of the lake's water levels considers waterbird and other fauna habitats.	Changes in groundwater levels.	No significant change to the current hydrology of the lake (including seasonal patterns).	Every five years

WETLAND AND CATCHMENT MANAGEMENT (CONTINUED)				
MANAGING WATER QUALITY • Factors such as nutrient runoff from surrounding residential and rural land influence the water quality of Lake McLarty. • The Water Corporation's District Office, via the local school, monitors water quality within the lake.	**OBJECTIVE** To maintain a healthy aquatic ecosystem, thereby ensuring the provision of a feeding ground and refuge for waterbirds and protection of the reserve's ecological values. **THIS WILL BE ACHIEVED BY:** 1. Supporting the local school and Water Corporation in continuing to monitor the water quality (including dissolved oxygen, pH, salinity, total nitrogen and phosphorus, and macro-invertebrates) of the lake. 2. Continuing to liaise with the Department of Environment and the Water Corporation to ensure the management of water quality considers waterbird and other fauna habitats. 3. Continuing to re-establish buffer vegetation surrounding the lake. 4. Working cooperatively with state and local government authorities regarding the management of surface and subsurface drainage. 5. Maintaining CALM's role on the Harvey Catchment Council.	Changes in abundance, species diversity and structure of naturally occurring aquatic macro-invertebrate populations. Changes in salinity and total nitrogen and phosphorus levels of the lake.	No decline in the abundance or diversity of naturally occurring aquatic macro-invertebrate populations based on 2000 levels. No significant increase in the salinity or changes in levels of total nitrogen and phosphorus in the lake.	Every five years Every five years

KEY POINTS	OBJECTIVES AND STRATEGIES	KEY PERFORMANCE INDICATORS*		
		PERFORMANCE MEASURE	TARGET	REPORTING REQUIREMENTS
NATIVE ANIMALS AND HABITATS				
• Lake McLarty, within the Peel-Yalgorup System, was designated to the List of Wetlands of International Importance under the Convention on Wetlands (Ramsar, Iran, 1971). It is also listed in the Directory of Important Wetlands in Australia (as part of the McLarty System). • It is an important breeding ground for local birds, and supports 30 and 35 species protected under the Japan–Australia Migratory Birds Agreement (JAMBA) and the China–Australia Migratory Birds Agreement (CAMBA) respectively and is a summer refuge for 28 migratory wader species. • A total of 158 bird species have been recorded at the lake, including 77 species of waterbirds, and supports four specially protected species and two priority fauna species.	OBJECTIVES 1. To conserve indigenous fauna, with an emphasis on threatened and priority species and those protected by international agreements. 2. To conserve and enhance the reserve for waterbirds as per the management requirements for Ramsar-listed wetlands. THIS WILL BE ACHIEVED BY: 1. Maintaining shorebird habitat by controlling the type and structure of shoreline vegetation by: • allowing cattle grazing to continue under a formal lease/licence, with cattle restricted to (i) specified areas in the southern and south-eastern part of the reserve and (ii) seasonal use, until the impact of this activity on the wetland system can be established. • requiring the lessee to construct temporary fencing to contain the cattle and stipulating the number of cattle permitted within the reserve as part of the lease arrangements.	Number of migratory waterbirds utilising the lake as a summer refuge and feeding ground. Changes in species diversity and species composition of migratory waders.	Subject to natural variations, no decline in the number of migratory waterbirds visiting lake. Subject to natural variations, maintain or increase the species diversity and species composition of migratory birds from 2005 levels.	Every three years. Every three years.

• The main threats to the native fauna and fauna habitats are changes in hydrology (water levels and water quality), environmental weeds, unplanned fire, and predation by foxes and cats.	• trialling alternative methods of grass control to maintain suitable shorebird habitat. 2. Allowing/actively encouraging areas of emergent native vegetation to re-establish to encourage particular species (e.g. Australasian Bittern, Australian Reed Warbler). 3. Protecting native fauna from introduced and other problem animals through appropriate control regimes where necessary (see *Introduced and other Problem Animals*). 4. Encouraging and supporting groups (e.g. Birds Australia, community groups, tertiary institutions) to undertake specific research and/or monitoring projects within the reserve. 5. Supporting the preparation and implementation of recovery plans for any threatened fauna species that are identified in the reserve.			

KEY POINTS	OBJECTIVES AND STRATEGIES	KEY PERFORMANCE INDICATORS*		
		PERFORMANCE MEASURE	TARGET	REPORTING REQUIREMENTS
NATIVE PLANTS AND PLANT COMMUNITIES				
• Vegetation communities in the reserve are representative of those once widespread on the Swan Coastal Plain that have now been significantly cleared. • The main threats to the vegetation are water levels and quality, environmental weeds, human disturbance (including pets), cattle grazing and fire.	**OBJECTIVE** To conserve indigenous plant species and communities, particularly threatened and priority species. **THIS WILL BE ACHIEVED BY:** 1. Identifying and conserving vegetation and flora that is rare, threatened or in need of special consideration. 2. Maintaining vegetation biodiversity by reducing threatening processes. 3. Maintaining the variety of habitats that are available at the lake to support diversity of bird species, including encouraging some areas of emergent native vegetation to re-establish to provide habitat for targeted bird species (e.g. Australian Reed Warbler). 4. Rehabilitating degraded areas around the lake to restore a vegetation buffer. 5. Maintaining fences within the reserve to ensure that cattle grazing occurs only in designated areas.	Density and diversity of native vegetation. Changes in range of habitats available.	An improvement in the density and diversity of understorey vegetation from 2005 levels. Maintain or increase the variety of habitats available at the lake from 2005 levels.	Every five years. Every five years.

ENVIRONMENTAL WEEDS				
• Thirteen weed species have been identified within the reserve. As rated in the *Environmental Weed Strategy for Western Australia* two species are rated as High and seven as Moderate according to their impact on biodiversity. • *Typha orientalis* has the potential to further reduce the area of open water at Lake McLarty. Although its current distribution is limited, *Typha* has been widespread on the lakebed previously and may again become a management issue. • Other weed species threatening reserve values include cottonbush (a declared weed), Brome Grass (high priority weed species) and goosefoot.	**OBJECTIVE** To prevent species loss and community decline from weed invasion. **THIS WILL BE ACHIEVED BY:** 1. Controlling environmental weeds rated as high or moderate in the *Environmental Weed Strategy for Western Australia*. 2. Mapping and annually monitoring the distribution of *T. orientalis* and immediately controlling new satellite clumps. 3. Trialling different cost effective methods to control *T. orientalis* to determine the most effective method for Lake McLarty.	Changes in abundance and distribution of priority environmental weeds as identified in the *Environmental Weed Strategy for Western Australia*.	No increase in the abundance and distribution of high and moderate rated environmental weeds from 2005 levels.	Every three years.

KEY POINTS	OBJECTIVES AND STRATEGIES	KEY PERFORMANCE INDICATORS*		
		PERFORMANCE MEASURE	TARGET	REPORTING REQUIREMENTS
INTRODUCED AND OTHER PROBLEM ANIMALS				
• Problem animals associated with the reserve include foxes, cats (feral and domestic), dogs and rabbits. • Foxes and cats may pose a threat to native fauna, and it is thought that foxes may have been a major cause of decline in the local population of oblong turtles. • Cattle grazing has occurred within the reserve since the 1880s and continues in the eastern and southern regions of the reserve. • Mosquito and midge breeding within the lake is a potential problem for future residents. The Shire of Murray monitors mosquito larvae numbers adjacent to Lake McLarty.	OBJECTIVE To prevent and, where possible, negate the impacts of problem animals on the reserve's values. THIS WILL BE ACHIEVED BY: 1. Preparing a control program for problem animals based on the following criteria: a. existing and potential impact of the species; b. the efficiency and effectiveness of control measures; c. availability of resources; and d. the capacity for long-term monitoring of the population. 2. Establishing a formal lease/licence to allow cattle grazing in the reserve (see *Native Animals and Habitats*). 3. Reinforcing the vegetation buffer around the lake to negate potential problems with midges and mosquitoes. 4. Referring proposals to spray for midge and mosquito control to the Conservation Commission.	Changes in the numbers of mosquitoes trapped within the reserve.	No significant increase in the mosquito populations present at the lake.	Every five years.

	5. Increasing community awareness of the need to keep domestic animals out of the reserve, and increasing the effectiveness of the dog-resistant fence on the western side of the lake if necessary.			
DISEASE				
• Lake McLarty Nature Reserve is 'uninterpretable' for the presence of *Phytophthora cinnamomi*, however sections of the McLarty Nature Reserve are 'interpretable' and susceptible to this pathogen. • The disease could have an impact on revegetation programs in the reserve if the species planted are vulnerable to the disease. • *P. cinnamomi* can be spread by humans, vehicles and animals moving infested soil and plant material.	**OBJECTIVE:** To minimise the impact, and prevent further spread, of *Phytophthora cinnamomi.* **THIS WILL BE ACHIEVED BY:** 1. Surveying the adjoining McLarty Nature Reserve for *P. cinnamomi* infection and quarantining affected areas. 2. Reducing the risk of introducing and spreading the disease to uninfected areas by limiting access to affected areas, and ensuring appropriate hygiene standards for machinery and vehicles when undertaking works within the reserve. 3. Ensuring soils and other materials brought into the reserve are free of *P. cinnamomi*. 4. Raising community awareness of the impacts and management issues associated with dieback (see *Involving the Community*)			

KEY POINTS	OBJECTIVES AND STRATEGIES	KEY PERFORMANCE INDICATORS*		
		PERFORMANCE MEASURE	TARGET	REPORTING REQUIREMENTS
FIRE				
• Wildfire is a significant threat to the natural values of the reserve, and to adjoining properties. • Fires in small reserves surrounded by agricultural land usually promote weed invasion. • Fire management at Lake McLarty will be guided by CALM's Fire Management Policy. • Fire suppression in the reserve is the responsibility of FESA, whilst CALM is responsible for pre and post-suppression works. • Large infestations of introduced bulrush are fire hazard.	**OBJECTIVE:** To protect the biodiversity of the reserve, as well as people and property, by minimising the impact of wildfire. **THIS WILL BE ACHIEVED BY:** 1. Minimising the area of *Typha* infestations to prevent the build up of fuel. 2. Maintaining the concrete tank and bore on the western side of the lake for fire fighting purposes. 3. Ensuring that access for fire protection purposes are considered when any subdivisions are proposed. 4. Considering selective prescribed burning only for the protection of specially protected, threatened or priority species.			

PART D. MANAGING CULTURAL HERITAGE

INDIGENOUS AND NON-INDIGENOUS HERITAGE

• There are no known Aboriginal sites in the reserve, although registered sites exist within the Peel Inlet/Harvey Estuary area.	**OBJECTIVE** To protect the reserve's cultural heritage. **THIS WILL BE ACHIEVED BY:** 1. Notifying relevant Native title claimants and authorities when proposing to undertake public works in registered heritage sites. 2. Ensuring management activities do not impact upon cultural heritage values. 3. Collating information on cultural heritage sites and adding them to the register on CALM's RATIS database.			

KEY POINTS	OBJECTIVES AND STRATEGIES	KEY PERFORMANCE INDICATORS*		
		PERFORMANCE MEASURE	TARGET	REPORTING REQUIREMENTS
PART E. MANAGING FOR VISITORS				
Visitor Use and Opportunities				
• The most popular visitor uses at the reserve are bird watching and nature appreciation. • Facilities are limited to an information board on the western side of the lake.	**OBJECTIVE:** To provide for passive, low impact visitor uses that are consistent with the reserve's purpose and values, and which minimise conflicts between visitors. **THIS WILL BE ACHIEVED BY:** 1. Promoting visitor use that is consistent with the protection and promotion of the reserve's values. 2. Restricting birdwatching activities to designated access points, including the proposed bird hide on the southern side of the lake.			

VISITOR ACCESS				
• Access to the reserve is limited to gates located on the western and southern sides of the lake. Walkers also use management tracks and firebreaks within the reserve. • Canoe access on the lake is only permitted for management and scientific research purposes.	**OBJECTIVE** To provide safe and convenient access within the reserve, for visitors and management, that is consistent with reserve values. **THIS WILL BE ACHIEVED BY:** 1. Providing designated access points to the reserve to facilitate bird watching activities. 2. Installing an information sign at each of the access points. 3. Continuing to permit access on management tracks and firebreaks unless otherwise signposted. 4. Pending future subdivisions, considering upgrading vehicle access to the south of the lake off Mills Road to allow off-road parking. 5. Prohibiting the use of recreational watercraft (including model boats) in the lake, and allow the use of canoes only for education, research and managerial purposes by approved users.			

KEY POINTS	OBJECTIVES AND STRATEGIES	KEY PERFORMANCE INDICATORS*		
		PERFORMANCE MEASURE	TARGET	REPORTING REQUIREMENTS
PART F. MANAGING SUSTAINABLE RESOURCE USE				
SCIENTIFIC RESEARCH AND USE				
• Data collected at the reserve includes monthly water levels, bird counts and mosquito larvae counts. Opportunities exist for further studies to complement proposals in this management plan. • All research should be co-ordinated by CALM.	**OBJECTIVES** 1. To increase knowledge and understanding of flora, fauna and natural processes to provide for better management of the reserve and to monitor the success or otherwise of this management plan. 2. To support and promote external research that will assist in the implementation of the management plan, including monitoring for ecological change. **THIS WILL BE ACHIEVED BY:** 1. Encouraging the participation of volunteers, educational institutions and other organisations to take part in research projects within the reserve. 2. Supporting, and where possible, seeking grant applications to encourage scientific research and monitoring within the reserve.	Research within the reserve is conducted according to Departmental priorities and Government initiatives, and to assist with the performance assessment for this management plan.	Research undertaken is that which has been deemed a high priority.	Every five years.

REHABILITATION				
• Degradation and loss of natural vegetation, particularly on the western side of the lake, has occurred historically as a result of farming practises and cattle grazing. • Cattle grazing continues to occur within the reserve under an informal arrangement. • Rehabilitation of the western side of the lake was undertaken in 2004 using native species grown from seed collected from the reserve	**OBJECTIVE** To restore degraded areas of the reserve to a condition resembling the natural environment. **THIS WILL BE ACHIEVED BY:** 1. Rehabilitating with plants that have been propagated from seeds and cuttings collected either from within the reserve or from provenance from the Swan Coastal Plain. 2. Coordinating rehabilitation works with weed control, fire protection and cattle exclusion. 3. Encouraging members of the local community, community groups and schools to participate in rehabilitation works, and to seek external funding for such works. 4. Ensuring mulch and soil used in rehabilitation works does not contain unwanted seeds or plant diseases. 5. Encouraging natural regeneration as much as possible by managing grazing pressure from cattle and rabbits.	Change in the area of land rehabilitated within the reserve.	Land in the southern and western parts of the reserve satisfactorily rehabilitated.	Every five years.

KEY POINTS	OBJECTIVES AND STRATEGIES	KEY PERFORMANCE INDICATORS*		
		PERFORMANCE MEASURE	TARGET	REPORTING REQUIREMENTS
PART G. INVOLVING THE COMMUNITY				
INFORMATION, EDUCATION AND INTERPRETATION				
• Information, education and interpretation provide targeted communication with the public. • It is important for the effective implementation of the management plan that community understanding and support is fostered • There is limited community awareness of Lake McLarty's importance as a nationally and internationally significant wetland for waterbirds.	**OBJECTIVES** 1. To increase community awareness, appreciation and understanding of the reserve's values, and to gain support for management practices. 2. To increase community awareness, appreciation and understanding of Lake McLarty's national and international importance for waterbirds. **THIS WILL BE ACHIEVED BY:** 1. Continuing to encourage, promote and support volunteers and community groups with essential resources to help them carry out their activities. 2. Providing information to visitors on reserve values and issues such as its importance for migratory waterbirds, visitor safety, permitted activities and regulations.			

WORKING WITH THE COMMUNITY				
• Community involvement is an integral component of the Department's operations. • Community groups and individuals are encouraged to be involved in the management of Lake McLarty. • Community support is essential for the successful implementation of this management plan.	**OBJECTIVE** To facilitate effective community involvement in the management of the reserve. **THIS WILL BE ACHIEVED BY:** 1. Involving the community in the implementation of this management plan.	Change in the numbers of volunteers hours contributed to reserve management.	20% increase in the numbers of volunteer hours contributed to the management of the reserve from 2005 levels.	Every five years.

Note: the response to target shortfall for each of the key performance indicators is for the Department to investigate the cause and report to the Conservation Commission for action.