Herdsman Lake Regional Park

Draft Management Plan

2001 – 2011

City of Stirling
City Choice

Conservation Commission
WESTERN AUSTRALIA

DEPARTMENT OF
Conservation
AND LAND MANAGEMENT
Conserving the nature of WA

Herdsman Lake Regional Park

Draft Management Plan

2001 - 2011

Department of Conservation and Land Management

Conservation Commission of Western Australia

City of Stirling

Herdsman Lake Regional Park

2001 - 2011

PLANNING TEAM

This Plan was co-ordinated by ERM Mitchell McCotter working closely with the managers of Herdsman Lake Regional Park – the Department of Conservation and Land Management (CALM) and the City of Stirling.

Brendan Dooley	CALM
Tim Bowra	CALM
Jim Williamson	CALM
Greg Keighery	CALM
Brian Loughton	Water Corporation
Daniel Rajah	City of Stirling

What Do You Think?

We would like to know what you think of the proposals in this draft Management Plan, and encourage you to make a submission.

Why write a submission?

It is an opportunity to provide information, express your opinion, suggest alternatives and have a say on how we are proposing to manage the Herdsman Lake Regional Park over the next 10 years. If you prefer not to make your own submission, you could make a joint submission with others.

What makes an effective submission?

To ensure that your submission is as effective as possible:

- make it concise and clear;
- list your points according to the subject sections and page numbers in the Plan;
- say whether you agree or disagree with any or all of the objectives or recommendations, giving your reasons and sources of information; and
- suggest alternatives to deal with any issue with which you may disagree.

It is important to indicate those strategies and recommendations you agree with as well as those with which you disagree.

Give reasons for concerns and give support where appropriate. Information and constructive suggestions relating to your submission are most useful.

What criteria will be used in assessing your submission?

The draft management plan will be amended if a submission:

- provides additional resource information of direct relevance to management;
- provides additional information on affected user groups of direct relevance to management;
- indicates a change in or clarifies Government legislation, management commitment or management policy;
- proposes strategies that would better achieve management goals and objectives; or
- indicates omissions, inaccuracies or a lack of clarity.

The draft management plan will not be amended if a submission:

- clearly supports the draft proposals;
- offers a neutral statement or no change is sought;
- addresses issues beyond the scope of the Plan;
- makes points which are already in the Plan or were considered during Plan preparation;
- is one amongst several widely divergent viewpoints received on the topic and the recommendation of the Draft Plan is still considered the best option; or
- contributes options which are not feasible (generally due to some aspect of existing legislation or government policy).

What Happens To Your Submission?

All submissions will be summarised according to the topics discussed. The draft management plan will then be reviewed in the light of the submissions, according to criteria mentioned above. A summary of the submissions will be published along with the final management plan, including an indication of how the plan will be amended or not in response to the submission. If a submission is marked "CONFIDENTIAL" then the author will remain anonymous in the analysis of public submissions document.

Deadline

Submissions are welcome for three months after the date of release. For enquiries please ring CALM on (08) 9431 6500

Where to send your submission?

Written submissions should be sent to:

Executive Director
Department of Conservation and Land Management
PO Box 1535
FREMANTLE WA 6959

Attention: Regional Parks Co-ordinator;
Herdsman Lake Regional Park Management Plan

Where to obtain or view additional copies of this plan?

CALM
17 Dick Perry Avenue
Technology Park, Western Precinct
Kensington 6151
(08) 9334 0333

CALM – Regional Parks Unit
19-21 Phillimore Street
Fremantle
(08) 9431 6500

CALM – Perth District
5 Dundebar Road
Wanneroo 6065
(08) 9405 1222

WA Naturally
47 Henry Street
Fremantle WA 6160
(08) 9430 8600

City of Stirling
Civic Place
STIRLING WA 6021
Phone : 9345-8555
(viewing only)

Or visit CALM's NatureBase website at http://www.naturebase.net/national_parks

How to Use This Plan

This plan is divided into sections as set out in the table of contents. A goal is stated at the beginning of each section. Within each section are subsections. Each subsection begins with the objectives to be achieved by management, followed by a discussion of the main issues and then strategies, accompanied by the agencies responsible for achieving each objective and a priority rating. Priority ratings provide an indication of the relative importance of a strategy. The management agencies names have been abbreviated and a list of all abbreviations used and their meaning is listed in Appendix A. Key Performance Indicators are listed in the Plan and a Performance Audit Table outlining proposed timelines of key strategies is stated.

ACKNOWLEDGMENTS

Numerous individuals and groups have contributed valuable ideas and information in the preparation of this draft management plan and their efforts are gratefully acknowledged. In particular, the contributions of members of the planning team from within the Department of Conservation and Land Management, the City of Stirling, the Water Corporation, the Herdsman Lake Regional Park Community Advisory Committee and workshop attendees for this draft management plan have been most appreciated.

NOMENCLATURE

Inclusion of a name in this publication does not imply its approval by the relevant nomenclature authority.

THE CONSERVATION COMMISSION OF WESTERN AUSTRALIA AND THE DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT.

All national parks, conservation parks, nature reserves, and other similar reserves are placed in the care, control and management of the Conservation Commission of Western Australia. These reserves are managed on behalf of the Conservation Commission of Western Australia by the Department of Conservation and Land Management (CALM).

As the controlling body, the Conservation Commission of Western Australia is responsible for having management plans prepared for all lands that are vested in it. This plan is prepared by CALM and issued as a draft plan by the Conservation Commission of Western Australia for public comment prior to final approval by the Minister for the Environment.

Preface

Regional parks are areas of Region Open Space which are identified by planning procedures as having outstanding conservation, landscape and recreation values. Regional parks provide the opportunity for a consortium of management agencies and private landowners to develop co-ordinated planning and management strategies.

Regional parks were first proposed in the Stephenson - Hepburn Report of 1955 which was the basis of the Perth Metropolitan Region Scheme in 1963. Since then, State planning agencies have been acquiring land in anticipation of the time when regional parks would be formally created.

In 1997, the State government announced a commitment to introduce legislation to give regional parks legal standing and vesting in the former National Parks and Nature Conservation Authority, now the Conservation Commission of Western Australia. Eight regional parks were recognised as formal identities with the co-ordination of their management progressively transferred to CALM.

This draft management plan is a commitment by CALM and the City of Stirling to manage Herdsman Lake Regional Park. The role of CALM in managing the park is two-fold. Firstly, it is to manage the areas of the park that are vested in the Conservation Commission of Western Australia. Secondly, it is responsible for co-ordinating the management of the park. The latter is initiated through the preparation of this draft management plan. The City of Stirling will manage the areas vested in it.

Herdsman Lake Regional Park is important in terms of conservation values and the recreational opportunities it encompasses within a highly urbanised environment. This draft management plan, which is based on previous ecological, recreation and historical studies, as well as community input, seeks to establish a long-term vision, goals and management strategies for the Park.

While Herdsman Lake is a significant wetland and wildlife sanctuary located within the Perth metropolitan area, it faces a number of management problems such as polluted stormwater inputs affecting water quality and water levels, areas of disturbance, uncontrolled public access, weed invasion and the occurrence of fire.

This draft management plan cannot solve all of the ecological problems facing Herdsman Lake, especially those which are whole of catchment issues. Initiatives of Integrated Catchment Management will need to be established in the Herdsman Lake Catchment to co-ordinate water nutrient and water pollution management.

Work by the managing agencies with valuable assistance from volunteers such as local community groups, associations and schools has begun to reverse the negative impacts on the Park. It should be acknowledged however, that past and present activities of people make it impossible to reinstate a pristine natural environment for the Park. This draft management plan aims to protect the existing natural areas and provide for the restoration of degraded areas, whilst allowing for recreation activities that will not compromise the natural values of the Park.

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A. INTRODUCTION

1. Purpose and Status of the Management Plan

PURPOSE OF THE PLAN

The purpose of this draft management plan ("the Plan") is to provide broad direction for protection and enhancement of the conservation, recreation and landscape values of Herdsman Lake Regional Park ("the Park"). It will do this by developing strategies aimed at conserving the special features of the Park and providing for future community requirements. The Plan will help ensure the Park is managed appropriately and is capable of sustaining its high nature conservation and cultural values as well as use by the community.

Given the strategic nature of this Plan, more detailed planning (referred to as subsidiary plans) will be required prior to operations taking place within the Park (Section 40). Examples of subsidiary plans proposed in this Plan include a weed management plan, a rehabilitation plan and site development plans for specified Park areas (see Figure 1).

STATUS OF THE PLAN

This Plan provides statutory direction over all lands and waters of the Park vested in the Conservation Commission of Western Australia and managed by the Department of Conservation and Land Management (CALM). The Plan will act as an "umbrella" document co-ordinating existing plans for specific areas of the Park. Implementation of existing plans will need to be consistent with the overall direction of this Plan. Additionally, future plans for areas within the Park will need to be written in a manner to complement the Herdsman Lake Regional Park Management Plan.

The Conservation Commission of Western Australia and Western Australian Planning Commission (WAPC) endorse this Plan and acknowledge that CALM has the responsibility for co-ordinating the management of the Park. In consultation with CALM, the WAPC will use this Plan to assist with the assessment of development proposals on lands within and adjoining Herdsman Lake Regional Park. The strategies contained in this Plan have not yet been formally endorsed by the City of Stirling.

2. Regional Parks

WHAT IS A REGIONAL PARK?

Regional parks are areas of Region Open Space that are identified by planning procedures as having regionally significant conservation, landscape and recreation values. Regional parks are a land management category which provides the opportunity for a co-ordinated planning and management strategy by different land management agencies and private land owners.

Regional parks may comprise Crown lands placed in the care, control and management State government agencies and local governments as well as private lands where the agreement of the landowner is obtained.

As such regional parks could be comprised collectively of lands with a variety of tenures and reserve purposes. They could be a package of multi-purpose, multi-vested reserves drawn together for co-ordinated management by CALM. Herdsman Lake Regional Park for example consists of land comprising Crown reserves vested in the City of Stirling and the Conservation Commission of Western Australia as well as freehold land owned by the WAPC and private individuals.

Those lands that have been acquired by the WAPC for inclusion into the Park are now to be transferred to either the City of Stirling or the Conservation Commission of Western Australia for management as part of the Park.

It is intended that the overlaying regional park concept will be put in place while maintaining the high level of protection currently existing for lands already placed in the care, control and management of the Conservation Commission of Western Australia (such as nature reserves) that are found within regional parks.

THE REGIONAL PARK CONCEPT

The concept of Regional Open Space was first introduced to Western Australia by Stephenson - Hepburn Report in 1955, which recommended a statutory region plan be prepared for Perth which reserved private land required for future public purposes. In 1963 the Perth Metropolitan Region Scheme (MRS) was established and land was reserved for "Parks and Recreation." This land (subject to amendments of the MRS) has been gradually acquired by State planning authorities with the intention to protect open space of regional significance for conservation and recreation.

The Environmental Protection Authority's (EPA) Conservation through Reserves Report for Western Australia, The Darling System – System 6 (1983), identified areas with regionally significant conservation, landscape and recreation value. It also recommended areas of land to be managed as regional parks. A system of regional parks was envisaged which included the land reserved for "Parks and Recreation" in the MRS which surrounded Herdsman Lake (System Six Recommendation M43).

In 1989, the State government decided that the responsibility for regional park management be established within CALM and that the responsibility for planning the acquisition of lands for regional open space be retained by the Ministry for Planning (MfP) on behalf of the WAPC.

A task force report (1991) was prepared by the former Department of Planning and Urban Development (DPUD) and CALM outlining proposed administration, planning and management of regional open space.

The EPA's Red Book status report (1993) describes the transformation of regional parks from concept to reality as being difficult because of the range of land tenure involved and the funding requirements for continual management of the parks.

In June 1997, the State government announced a commitment to introduce legislation to give regional parks legal standing and vesting in the former National Parks and Nature Conservation Authority (NPNCA) now the Conservation Commission of Western Australia. The co-ordination of management of eight metropolitan regional parks would be progressively transferred to CALM.

REGIONAL PARK PLANNING

Planning for regional parks occurs at a number of levels. Regional park management plans are a part of a broad suite of planning undertaken by the relevant managing agencies. Figure 1 illustrates the planning levels typically undertaken for regional parks.

Source: ANZECC 2000.

Figure 1 – Regional Park Planning Hierarchy

3. Herdsman Lake Regional Park

The process of establishing Herdsman Lake Regional Park has evolved since the Stephenson - Hepburn Report (1955) which recommended that the Lake and surrounding area be reserved for Parks and Recreation. This was subsequently implemented in the 1963 Perth Metropolitan Region Scheme (MRPA, 1976).

In 1976, the Metropolitan Regional Planning Authority (MRPA) produced a "Plan for Herdsman Lake" which, after review by various organisations, was modified and officially adopted by the State government as a Concept Plan for Herdsman Lake. The general intent of the Concept Plan was to develop the Herdsman Lake area for conservation, wildlife, recreation and drainage management. Construction of a moat around the perimeter of the lake was proposed in order to separate the central wetland conservation area from the peripheral recreation area. It was envisaged that dredging the moat would supply sand fill for adjacent real estate developments and create open water for birdlife.

In 1985, the State Planning Commission (SPC) prepared Improvement Plan No. 21 for Herdsman Lake which updated the original Concept Plan and provided more detail. The Improvement Plan was gazetted in 1986 and provided the SPC with the mandate to complete all works proposed in the Concept Plan.

In 1988, a Public Environmental Review for the Floreat Lakes residential development which adjoins the Park to the north-west was completed in accordance with Improvement Plan No 21. This allowed for the dredging of the moat to be completed around the internal conservation area of Herdsman Lake.

In 1997, the State government proposed that a management plan for Herdsman Lake Regional Park be prepared by CALM in conjunction with the City of Stirling.

OVERVIEW

Herdsman Lake Regional Park is currently one of eight regional parks in the Perth metropolitan area. It is located approximately 7 kilometres north-west of the central business district of Perth (Figure 2) and is the largest wetland (approximately 400 hectares) within Perth's inner metropolitan region.

Herdsman Lake is part of a chain of wetlands that extends north to south parallel to the coast in the Spearwood Dune System. The Park comprises a variety of landscapes including permanent water bodies, seasonally dry wetlands and open parklands. Herdsman Lake contains an inner seasonally dry wetland (approximately160 hectares in area) dominated by bulrush (*Typha orientalis*) and an outer region containing three deep and permanent water bodies which have been formed by dredging operations.

In the past, areas of Herdsman Lake has been used for rubbish disposal, sanitary landfill and agriculture. Despite these impacts Herdsman Lake is an extremely important wetland on the Swan Coastal Plain, as it supports a wide diversity of wildlife species, serves as an important bird breeding ground and is a summer refuge for migratory birds.

Herdsman Lake is a catchment basin for the surrounding urban and industrial areas. The Lake is crossed by open channels which form part of the regional drainage system. Many smaller drains flow directly into the Lake from a catchment area which contains housing, light industry and market gardens (Clarke, Davis & Murray, 1990). The conservation values of the Park are threatened by increasing nutrients in the wetland system, consistent high water levels, weed invasion, industrial waste and road pollution and pressures from increased human use.

The moat within Herdsman Lake consists of four deep permanent water bodies (Floreat Waters, Industrial Lake, Powis Lake and Floreat Lakes – see Figure 10) joined by small channels restricting access to the central conservation area. The two large drains which carry water from Perth's northern suburbs across the Lake (Balgay Branch Drain and the Herdsman Main Drain) are isolated from the Lake proper by earth banks, however water does spill over the levees into the Lake during times of peak flow.

A range of recreation opportunities are provided for Park visitors. The natural features of the Herdsman Lake alongside the parklands of Maurice Hamer Park and Glendalough Open Space attract many people to the Park.

Many visitors to Herdsman Lake Regional Park are local residents who live nearby and use the Park for fitness and recreational purposes (Barnes, 1998). The urban development in close proximity to the Park has created external pressures on the Park. It will be the role of the Park managers, with support from the community, to implement this Plan to effectively manage these issues.

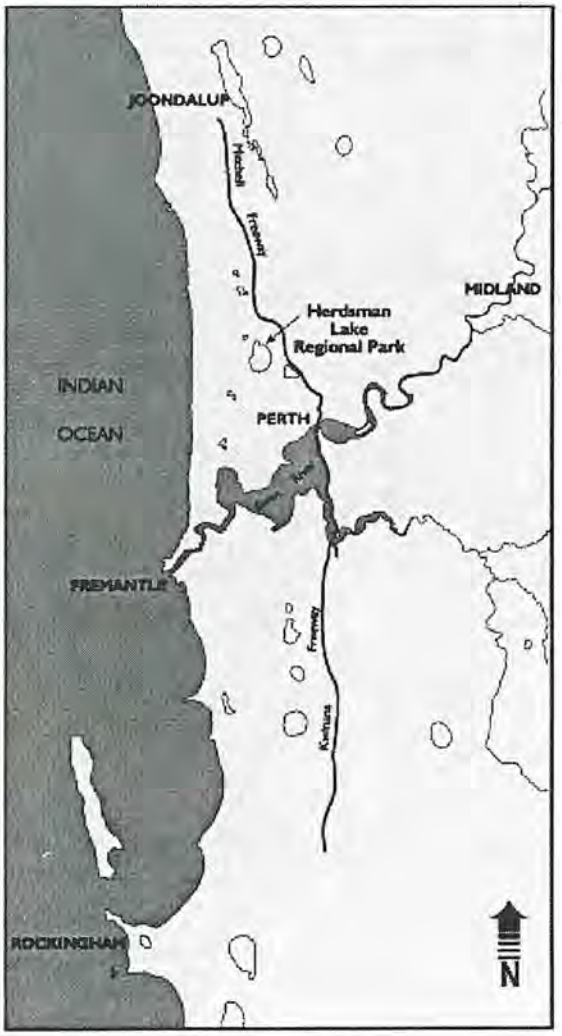

Figure 2 - Park Location

PARK VALUES

Natural Environment Value

Herdsman Lake Regional Park contains the largest wetland in the inner metropolitan area. It is one of the few remaining wetlands on the Swan Coastal Plain and has high nature conservation values, supporting a diversity of wildlife.

Herdsman Lake, the dominant feature of the Park, comprises a wide diversity of fauna habitats. The Lake and its surrounds are of importance as a bird breeding and summer refuge supporting many waterfowl, bushbirds and birds of prey (EPA, 1983). Over 100 species of birds have been recorded at Herdsman Lake, of which about one third breed at the lake (Curry, 1981). Some of these birds are transequatorial migratory waders. Such an abundance and diversity of birdlife in an urban setting is very uncommon and provides the opportunity for visitors to appreciate the wildlife and habitat values of the Park.

Cultural Heritage Value

Stone chips and flakes found on the higher ground to the north of Herdsman Lake indicate past Aboriginal use. Aboriginal people call the area Ngurgenboro and used it as a food source.

Declared Aboriginal sites within or near Herdsman Lake Regional Park are as follows:

- S02411 - Herdsman Lake;
- S00681 - Herdsman Lake North; and
- S00682 - Herdsman Lake North East.

The Herdsman Lake Settlers Cottage is of significant European heritage value. It provides an example of an early settler's cottage and has been acquired and renovated under the direction of the National Trust of WA. The National Trust has furnished the cottage in keeping with the era of the 1930s and established a small vegetable garden. An interpretive display has also been developed on the site presenting the social and natural history of Herdsman Lake.

Landscape Values

Herdsman Lake Regional Park provides significant landscape value to the inner Metropolitan area of Perth.

Scenic views over the central wetland can be enjoyed from most sections of the Lake's edge. The Park's visual qualities are presented through a diversity of landscapes ranging from expansive views over open waters, to dense wetland rushes, fragments of remnant bushland and well maintained open grass parklands.

The high rise buildings of Perth's central business district also provide a scenic backdrop to the Park. The close proximity and imposing contrast of the city buildings against the Park's open spaces highlights the Park's impressive landscape qualities.

Additionally, the open space and waterbodies of the Park provide significant landscape amenity value within the developed urban and industrial surrounds.

Recreation Values

The Park provides for a range of recreation opportunities and its urban locality and accessibility enhances the area as a leisure resource. Of particular significance is the opportunity to recreate in a natural environment within an urban area. A variety of natural features such as the lake, wetlands and wildlife, provide visitors with a range of experiences and recreation opportunities. It is these features in a natural park setting that attract many people to the Park.

Herdsman Lake Regional Park contains a number of smaller recreation nodes offering a diversity of settings and a variety of facilities. These are illustrated in Figure 9 - Recreation Masterplan. The Park also presents recreation value in terms of interpreting its cultural heritage. The Herdsman Lake Settlers Cottage, located on the west side of the Park, presents the history of the Park and is open to visitors.

Commercial Values

There are opportunities for the establishment of commercial operations within Herdsman Lake Regional Park. These could range from seasonal refreshment stands at activity nodes around the Park, to a café or restaurant, to educational facilities providing a commercial component.

The Herdsman Park Business Centre is located adjacent to the Park on the eastern side of Jon Sanders Drive. Scope exists to develop commercial facilities in conjunction with the Business Centre either through funding or sponsoring arrangements.

Research Values

Herdsman Lake Regional Park has significant research and scientific values. On one hand, it contains rich, dynamic ecosystems with seasonal and periodic variations, subject to considerable external pressures and inputs. Conversely, however it has areas with recreational demand requiring an understanding of human use, landscape design, and changing social use of natural areas for recreation.

In particular, the extraction of technical data on wetland habitats, water quality and water levels make it an extremely valuable resource in gaining technical and managerial expertise that can be applied to other wetlands across the Swan Coastal Plain.

The Herdsman Lake Wildlife Centre, currently provides environmental education and information for schools and the general public. The opportunity exists to further develop this educational facility to promote a better understanding of urban wetlands. their ecosystems and the impacts of drainage systems in urban environments.

4. The Management Plan and Community Involvement

The Management Plan for Herdsman Lake Regional Park will be prepared in five phases:

1. The first phase was aimed at identifying the relevant planning and management issues. This was achieved by undertaking a literature review, analysing the existing condition of the Park and organising a community workshop. Public involvement in this phase was encouraged through newspaper articles and canvassing key stakeholders for the community workshop.

2. The second phase was the preparation of the draft Management Plan. This involved identifying values and preparing planning strategies to protect those values and address the issues identified in phase one. Within this phase CALM, the City of Stirling and the Water Corporation provided advice on the development of the Plan.

3. The third phase involved presenting the draft Plan for public comment. Its availability for review has been widely advertised, the draft will be open for public comment for a period of three months, after which public submissions will be analysed.

4. Phase four will cover the acknowledgement and analysis of public submissions.

5. The fifth phase will comprise the preparation of the final Management Plan incorporating issues or comments raised within the public submissions and comments State government agencies and the City of Stirling. The revised Plan will be submitted for approval by the Minister for the Environment.

B. PRINCIPAL MANAGEMENT DIRECTIONS

5. The Vision for the Park

The long-term vision for the Park is:

"Herdsman Lake Regional Park will be a quality wetland supporting a diversity of habitats. As a wildlife refuge it will be a successful example of human - wildlife interaction within an urban setting. The Park will be an exciting and diverse community space allowing for environmental education, cultural interpretation as well as sustainable recreation use."

GOALS

Goals have been set for each major part of the Plan, while objectives designed to achieve these goals have also been identified. The following management goals are proposed for the Park.

Conservation
Protect, conserve and enhance the Park's biota as well as its physical, cultural and landscape resources.

Recreation
Manage for recreation and leisure by providing high quality recreation opportunities which are compatible with the protection and enhancement of Park values.

Commercial
Allow for appropriate commercial and other uses within the Park that service visitor requirements, contribute to Park management and minimise impacts on Park values.

Research and Monitoring
Seek a better understanding of the natural, cultural and social environments, and the impacts of visitor use and Park management.

Community Relations
Promote informed appreciation of the Park's natural environment, cultural values and recreation opportunities and facilitate liaison with the community about its management.

Integration of Management
Develop and maintain integrated and co-ordinated management arrangements between the participating Park managers and planning authorities.

Strategy

1. **Manage the Park for conservation and allow recreation and other uses of the Park to occur to the extent that they do not impaire the values of the Park. (CALM, CS) [High]**

6. Management Policies

The objective is to integrate the policies of the management agencies to complement and support the vision for the Park.

Conservation Commission of Western Australia and CALM Management Policies
This plan is based on current Conservation Commission of Western Australia and CALM policies. These policies derive from legislation, principally the *Conservation and Land Management Act (1984)* and the *Wildlife Conservation Act (1950)*, and associated regulations. Policies are published and distributed throughout CALM as policy statements. They are available to the public on request. These policies, as they relate to this Park, cover aspects such as recreation, conservation and education.

City of Stirling
The management actions of the City of Stirling should reflect the intent of this Plan and will be co-ordinated by CALM. The City of Stirling will adopt the principles outlined in this Plan as policy for the future management of the Park.

Water Corporation
The actions of the Water Corporation in managing the main drain and branch drain systems affecting Herdsman Lake should reflect the intent of this Plan. The Water Corporation will adopt the principles outlined in this Plan as policy for managing their drainage requirements at Herdsman Lake.

Strategies

1. **Apply CALM and Conservation Commission of Western Australia policies that relate to recreation, conservation, community involvement, and research and monitoring in the Park. (CALM) [Ongoing]**

2. **Prepare a local government policy statement for implementation by Stirling City Council that reflects the principles outlined in this Management Plan. (CS) [High]**

3. **Prepare a policy statement for implementation by the Water Corporation that reflects the principles outlined in this Management Plan. (WC) [High]**

7. Park Boundary and Land Tenure

The objective is to ensure that the values of the Park are protected by security of tenure and reserve purpose.

PARK BOUNDARY

The Herdsman Lake Regional Park boundary has been determined by the Ministry for Planning (MfP) and reflects the existing Metropolitan Regional Scheme (MRS) under which the entire Park is reserved as Parks and Recreation. The existing Park boundary and land tenure at the date of this Plan is shown on Figure 3.

LAND TENURE

Land within the Park consists of reserves created under the *Land Administration Act 1997* (LAA) and placed in the care, control and management of a number of State government agencies and the City of Stirling as well as freehold land owned by government agencies and private individuals.

This Plan seeks to reserve land and place it in the care, control and management of either:

- the Conservation Commission of Western Australia; or
- the City of Stirling.

Crown reserves will be created in accordance with the management areas outlined in the Plan's Park Management Zones (Section 9).

Reserves to be placed in the care, control and management of the City of Stirling will have management orders under the LAA requiring local governments to comply with the Herdsman Lake Regional Park Management Plan. This will apply to Area 9 comprising Maurice Hamer Park (see Figure 4).

Transfer of government freehold land

Freehold lands owned by the WAPC will be converted into reserves under the LAA and placed in the care, control and management of the Conservation Commission of Western Australia or the City of Stirling and managed in accordance with this Plan.

Reserves created from WAPC freehold land and vested in the Conservation Commission of Western Australia will be afforded an appropriate purpose for the protection and enhancement of Park values and will be classified as class A under the LAA. As agreed to by the City of Stirling, reserves created from WAPC freehold land and placed in the care, control and management of local government will be reserved for the purpose of "Recreation" and afforded similar tenure arrangements as the Conservation Commission of Western Australia vested reserves (see Table 1). The City of Stirling has agreed to accept the vesting of areas 3 and 11 on the condition that appropriate funding is provided for infrastructure improvements to the areas.

Freehold land owned by State government agencies or local governments, including those currently servicing drainage or other similar requirements, will be afforded an appropriate reserve purpose and tenure arrangements consistent with the protection and enhancement of Park values.

Crown Reserves and Unallocated Crown Land

Existing Crown land reserved for utilities or services such as drainage will retain their existing reserve purpose and tenure arrangements. The purpose and tenure arrangements of other reserves within the Park will be reviewed and their extent and management may be modified using Table 1 and Figure 4 as a guide. For example, the purpose of Reserve 31906, which contains the Herdsman Lake Wildlife Centre, is proposed to be changed from a nature reserve to a conservation park.

Road reserves considered unnecessary by planning and management agencies will be investigated for inclusion into the gazetted area of the Park and managed by the appropriate agency.

Unallocated Crown land is to be created as reserves and transferred to either the Conservation Commission of Western Australia or the City of Stirling. These reserves will be afforded an appropriate reserve purpose and tenure arrangements under the LAA consistent with the protection and enhancement of Park values.

Future tenure arrangements for Reserve 28763 (Perth Horse and Pony Club) required further investigation and discussion between the City of Stirling and CALM.

Private property

This Plan is not the mechanism by which freehold land, held by private individuals, is to be acquired by the WAPC. The Ministry for Planning on behalf of the WAPC will continue its voluntary acquisition program within regional parks.

Until acquired by the WAPC these lands will remain protected under Perth's Metropolitan Region Scheme by their "Parks and Recreation" reservation.

This Plan will not direct the management of privately owned freehold land held by individuals in the Park. However, when the land is acquired by the WAPC, management will be in accordance with the Plan's Park Management Zones (Section 9).

Access by Park visitors to areas of private property owned by individuals in the Park is not available until it is acquired by the WAPC. Negotiated settlements are required in order to obtain the remainder of private land within the Park boundary.

Priority should be placed on acquiring the portion of Lot 41 Pearson Street, Churchlands reserved for Parks and Recreation under the Metropolitan Region Scheme. This would enable access to be upgraded in the north-eastern section of the Park (see Section 27 – Recreation Masterplan) and allow for the completion of the moat (see Section 13 – Geomorphology and Soils).

Strategies

1. **Create reserves to be placed in the care, control and management of the relevant managing agency using Table 1 and Figure 4 as a guide. (DOLA, WAPC, MfP, Conservation Commission of Western Australia, CALM, CS) [Medium]**

2. **Establish management orders for reserves to be placed in the care, control and management of the City of Stirling requiring compliance with this Plan. (DOLA) [Medium]**

3. **Adopt the Park boundary as shown on Figure 3. (MfP, CALM, CS) [High]**

4. **Seek to acquire the remainder of the private land within the Park as soon as practicable from willing landowners. Priority should be placed on acquiring the portion of Lot 41 Pearson Street, Churchlands reserved for Parks and Recreation under the Metropolitan Region Scheme. (WAPC) [High]**

5. **Investigate the closure of road reserves considered unnecessary by the planning and management agencies within the boundary of the Park and include them in the gazetted area of the Park. (CALM, CS) [Medium]**

8. Legislative Amendments and Interim Management

The objectives are to provide for the long-term legislative protection of the Park and to ensure that interim management arrangements facilitate appropriate management of the Park.

INTERIM MANAGEMENT ARRANGEMENTS

Prior to the gazettal of the final Plan and subsequent transfer of lands to the appropriate managing agencies, there is a need to clearly define interim management arrangements between the land managing agencies involved in the Park.

CALM will co-ordinate the interim management of Herdsman Lake Regional Park by Joint Management Agreements prepared for Crown lands and freehold lands controlled by State or local government agencies involved in the Park.

A Regional Park Joint Management Agreement for interim Park management may comprise either:

- a Section 16 Agreement of the *CALM Act*; and/or
- a Memorandum of Understanding;

Interim management of WAPC owned land

Section 16 of the *CALM Act (1984)* allows the Department of Conservation and Land Management to enter into agreements for the management of private land.

Since June 1997, when the management responsibility for regional parks was progressively transferred to CALM, the WAPC and CALM agreed to enter into a Section 16 agreement under the *CALM Act (1984)*. This formal agreement has been completed and is an interim management arrangement prior to the land being placed in the care, control and management of the Conservation Commission of Western Australia or the City of Stirling.

The agreement includes all WAPC lands within regional parks with the exception of those leased to local governments.

On lands owned by the WAPC, CALM can utilise the WAPC (Reserved Land) regulations administered by the Ministry for Planning.

Interim management of Crown land and freehold land controlled by government agencies

Local governments and State government agencies will be responsible for managing lands under their control. An overall integrated approach to the interim management of Herdsman Lake Regional Park will be co-ordinated by CALM.

Interim management arrangements regarding freehold land owned by individuals

Where individuals own private lands within the Park, they are responsible for its management. CALM may seek formal management arrangements with individual private landowners within the Park.

LEGISLATIVE AMENDMENTS

The *CALM Act (1984)* will need to be altered to specifically include the management of regional parks. The management of regional parks may be included as a function of the CALM Act.

Strategies

1. **Implement the Management Agreement under Section 16 of the *CALM Act (1984)* with the WAPC. (CALM, WAPC, Conservation Commission of Western Australia) [High]**

2. **Prepare interagency joint management agreements for interim park management for areas controlled by State or local government. (CALM, Conservation Commission of Western Australia, CS) [High]**

3. **Amend the *CALM Act (1984)* to provide for regional parks. (CALM) [Medium]**

9. Park Management Zones

The objective is to adopt a management zoning system that protects conservation values, provides for appropriate recreation and other uses, and provides for efficient management of the Park.

Management zones are a framework for protecting the Park by minimising existing and potential conflicts between uses and activities. They provide a broad guide to the public uses and management activities which are appropriate in certain Park areas and indicate which management objectives have priority in a given area. A clear zoning scheme will also help to communicate management intentions to the public.

The management zones and areas for the Park are illustrated in Figure 4. They provide a guide for the future vesting of Park areas. However, given there are numerous service and utility reserves in the Park, they should not be used as a detailed schedule for changing land tenure arrangements in the Park.

Three zones have been identified for managing the Park:

a) Conservation and Protection;
b) Natural Environment Use; and
c) Recreation.

Refer to Table 1 for the management emphasis and acceptable uses and facilities within each zone.

The zoning scheme does not direct the management of privately owned freehold land held by individuals in the Park. However, when the land is acquired by the WAPC, management will be in accordance with the Plan's Park Management Zones.

Strategies:

1. **Base future management of the Park on the zoning plan. (CALM, CS) [Ongoing]**

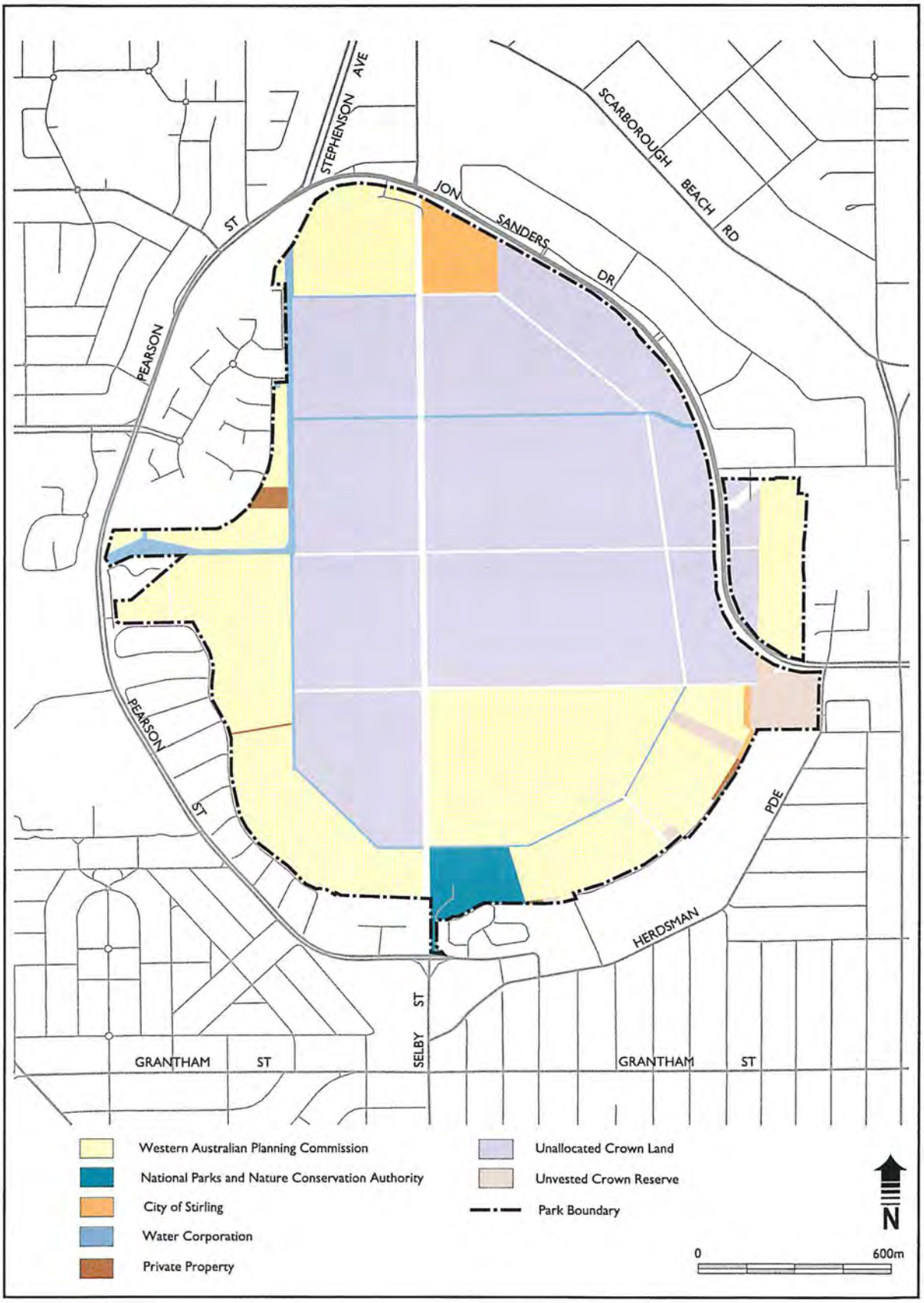

Figure 3 - Existing Land Tenure and Park Boundary

Figure 4 - Management Zones and Areas

Table 1 - Management Zones

Management Zone	Plan Area	Management Agency	Reserve Purpose	Management Emphasis	Acceptable Uses and Facilities
Conservation and Protection	Area 12	CALM	Conservation Park	The management emphasis of this zone is to protect and where possible enhance the conservation values and landscape qualities of the Park. Priority will be given to maintaining the natural state of Conservation and Protection areas with a minimum of impairment. Visible evidence of management will be minimal.	Restricted public access to the central conservation area. Unauthorised watercraft and vehicles prohibited. Development of facilities such as boardwalks and observation platforms are acceptable in certain locations (see Section 27 - Recreation Masterplan). Rehabilitation of fringing vegetation. Protection and enhancement of natural habitats to ensure survival of wetland ecosystems. Education and research uses allowed.
Natural Environment Uses	Area 4 Area 8	CALM CALM	Conservation Park Conservation Park	The management emphasis is to provide for appropriate uses of the natural environment. Areas will be managed jointly for public use, conservation and enhancement of flora and fauna, and improvement of landscape qualities. Public use must be compatible with the assigned purpose of the relevant reserve. Visible evidence of management may be moderate to high. Management will encourage uses and develop facilities that promote conservation and education.	Public access primarily by walking trails and cycle paths. Some development of facilities necessary. These may include education nodes and facilities associated with visitor nodes. The provision of facilities will depend on the values of an area. Rehabilitation and habitat protection may be necessary.
Recreation	Area 1 Area 2 Area 3 Area 5 Area 6 Area 7 Area 9 Area 10 Area 11	CALM CALM City of Stirling CALM City of Stirling CALM CALM National Trust City of Stirling	Conservation Park Recreation Conservation Park Recreation Conservation Park Conservation Park Heritage Purposes Recreation	The prime emphasis of management will be to provide a variety of recreation opportunities. The type and scale of facilities provided will depend on the values of any given area, community demand for recreation and the appropriate management of the Park. Management involves minimising the impact of visitor activities through the sensitive placement and provision of access and facilities as well as through the provision of information and interpretive material. Visible evidence of management may be high.	Public use may be high in these areas. Predominantly passive recreation pursuits, allowing for Park service and picnic facility development. Commercial concessions may be considered appropriate within this management zone. Rehabilitation, landscaping and reticulation of areas may be necessary.

10. Integrated Management of the Park

The objective is to provide an integrated management framework for the Park which provides for the effective involvement of the managing agencies.

THE PARK MANAGEMENT STRUCTURE

The joint managers of the Park are CALM and the City of Stirling. Their areas of responsibility are set out in the previous section on management zones. It is proposed that once this Plan is gazetted, management will be in accordance with the strategies outlined in this Plan. The Plan will act as an interagency agreement for the Park's management between the City of Stirling and CALM.

CALM will be responsible for managing areas of the Park vested in the Conservation Commission of Western Australia. The State government has considered CALM the most appropriate agency to provide a strong integrated framework for management of complex conservation and recreation areas. As such the overall co-ordination of management for Herdsman Lake Regional Park is CALM's responsibility. The City of Stirling will manage areas of the Park to be vested in them in accordance with the strategies outlined in this Plan.

Close co-operation is required by the management agencies and the community for this Plan to be implemented efficiently and effectively. Management decisions will involve input and negotiation between the land management agencies. Joint working parties comprising representatives from CALM, the City of Stirling and other State government agencies (for example the Water Corporation and the National Trust) will be established to facilitate the preparation of detailed subsidiary plans for the Park.

Interagency agreements will be required to allow Park managers to co-ordinate and maintain consistency in the application and enforcement of regulations. The agreements will enable the Park managers to enforce regulations of other agencies throughout the Park.

Responsibility for overall planning and acquisition of lands for regional parks and regional open space is retained by the WAPC.

A common management direction

The establishment of a management structure, common goals and agreement on priorities are necessary for safeguarding the Park where a number of land owners, the general public and interest groups are involved. This Plan has been written in conjunction with the proposed land managers, and comments are being sought from the public on the draft in order to establish a common management direction. Community involvement and community education are important components in achieving the management goals set out in this Plan.

Strategies

1. **Establish, where appropriate, joint working parties representing the relevant managing agencies for specific implementation plans. (CALM, CS) [High]**

2. **Consult with the City of Stirling when preparing the annual works program and five year implementation plan. (CALM, CS) [High]**

3. **Prepare interagency agreements that provide Park management with the authority to regulate in all areas of the Park (e.g. City of Stirling rangers controlling dogs on CALM managed estate). (CALM, Conservation Commission of Western Australia, CS) [High]**

11. Key Performance Indicators

The objective is to set key performance indicators in order to measure the overall effectiveness or otherwise of management in relation to protection and enhancement of Park values.

Defining key performance indicators in management plans reflects the need for the Park managers to take an outcome-based approach from which the effectiveness of management can be assessed. Key performance indicators relate specifically to the management targets for key ecological and social values.

Key performance indicators for Herdsman Lake Regional Park are:

- Wetland health;
- Fauna populations and species diversity;
- Bushland condition;
- Cultural heritage;
- Visitor satisfaction; and
- Integrated Management.

(see Table 2 - Summary of Key Performance Indicators)

Key performance indicators are important in defining the monitoring programs to be set up for the Park. They also underpin the audit process of this Plan (see Section 43).

Strategies

1. **Establish baseline information to initiate the process of monitoring the Key Performance Indicators through implementation plans such as weed management and rehabilitation plans. (CALM) [High]**

2. **Develop an integrated program of survey, research and monitoring within the Park, focusing on the key performance indicators. (CALM, CS [High]**

3. **Audit and measure the overall effectiveness of Park management based on the key performance indicators (see Section 43). (Conservation Commission of Western Australia) [Ongoing]**

Table 2 - Key Performance Indicators

Key Values	Key Objectives	Key Performance Indicators	Key Management Targets	Key Management Strategies
The wetland ecosystem of Herdsman Lake.	To manage water regimes affecting the Park in a manner that complements Water and Rivers Commission policies and enhances the conservation, recreation and cultural values of the Park.	Wetland health - • nutrients and chlorophyll-a concentrations; • the presence of blue-green algae cells; and • diversity of macro-invertebrates and the avian community structure.	To be determined following the gathering of baseline information.	14.1 14.7
Herdsman Lake is a significant bird breeding area and summer refuge for transequatorial migratory waders and has an abundance and diversity of birdlife.	To maintain viable populations and the current diversity of avian fauna species in the Park.	Avian fauna populations, community structure and species diversity.	No decline in the current populations, community structure and diversity of selected avian fauna species in the Park.	16.1
The diversity of wildlife and fauna habitats including the flora and vegetation which form the habitats.	To protect, conserve, and rehabilitate the flora and vegetation in the Park.	Bushland condition – • assessment of bushland condition; • priority weed species; and • changes to vegetation communities.	Increase the areas of bushland condition assessed as good – excellent within the Park; and reduce the area of priority weeds in the Park, as identified in the weed management plan.	17.1 21.1
The Park provides opportunities for a wide range of recreation activities. Of particular significance is the opportunity to recreate in natural environments close to urban areas.	To ensure that visitor use is sustainable, and to maintain acceptable levels of visitor satisfaction.	Visitor satisfaction and visitor numbers.	Maintain an overall trend of positive visitor satisfaction.	26.1 26.3 29.1
The opportunity to recreate safely in the Park while experiencing the diversity of Park settings.	To enhance the safety of visitors in the Park.	Visitor risk.	Remove or mitigate all identified high risk sites or facilities in the Park.	31.1
The Park's conservation, recreation and landscape values.	To provide an integrated management framework for the Park which provides for the effective involvement of the managing agencies.	Integrated Management.	Not applicable.	7.1 10.3

C. CONSERVATION

12. Conservation Goal

Protect, conserve and enhance the Park's biota as well as its physical, cultural and landscape resources.

13. Geomorphology and Soils

The objective is to protect and maintain the existing geomorphologic and soil associations of the Park.

GEOMORPHOLOGY AND SOILS

Herdsman Lake forms an interdunal depression in the Spearwood Dune system which comprises Quaternary-aged sediments parallel to the coast. The soils underlying the Park are of the Karrakatta soil association of this dune system (Seddon, 1972). Karrakatta soils are deep yellow brown sands. Within the Karrakatta association the larger swamp areas are classified as the Herdsman unit. The soils of this unit are black organic sands, peaty loams, black clays and true peats (DCE, 1980).

Teakle and Southern (1937) recognised three general soil types in Herdsman Lake: colloidal to peaty sands and loams around the Lake margins; acid to strongly acid colloidal, pulpy peats; and marly peats of the colloidal pulpy type formed as a result of mollusc and crustacean decomposition.

As described by Churchill (1956), Herdsman Lake was probably a large body of standing water that has gradually filled with sediment over time. The continued presence of water in the Lake has led to the formation of a "basin peat" throughout the lakebed and much of its surrounds. Peat has not been accumulating in recent times as its formation generally requires wetter conditions with higher rainfall and greater groundwater input. Different types of peat have been laid down in the Lake basin indicating that they have been formed under varying conditions of inundation.

Two key threats to protecting the geomorphologic and soil associations of the Park have been identified:

1. Dredging and reclamation activities; and
2. Erosion;

Dredging and reclamation activities

During past dredging and reclamation activities both topsoil and peat have been removed from the Lake. The peat and in some areas peaty-sands, have been used within the Park to reclaim public open space areas, create islands and to re-line the submerged sand profiles exposed in the moats by dredging. Sand and topsoil have been used to provide a surface covering areas of open space. Soil inside the moat has not been disturbed (Maunsell and Partners, 1989).

During dredging and reclamation, some changes to the levels of ground reclaimed with peat will occur with time due to consolidation. This has already occurred to some extent, resulting in subsidence of reclaimed areas around the Park. Jon Sanders Drive is also showing the effects of consolidation (Maunsell and Partners, 1989).

Another feature of the soils of Herdsman Lake is the structural instability of backfilled peat areas. This is an important consideration in planning and constructing facilities around the periphery of the Lake.

Future dredging requirements adjoining Floreat Waters to the north is illustrated in Figure 5. This dredging will finalise the moat at Herdsman Lake and is in accordance with Improvement Plan No. 21 prepared by the former State Planning Commission.

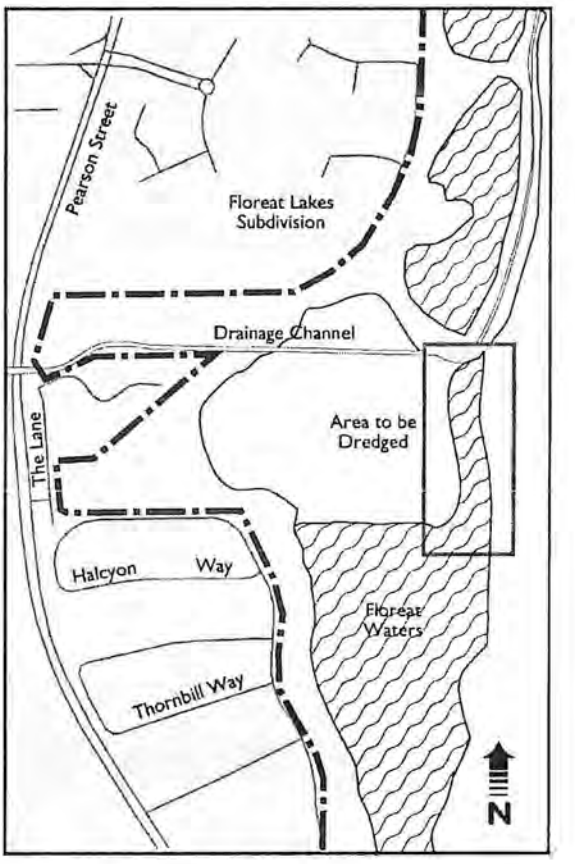

Figure 5 - Future Dredging Requirements

Erosion

Erosion is impacting upon the Park in a number of different ways. First, it is a localised problem occurring along the banks of wetland areas where uncontrolled access has caused damage to fringing vegetation.

Second, wind erosion is impacting upon the north-west section of the Park where a large stockpile of sand from previous dredging operations is stored adjacent to the Park (within the Floreat Lakes residential development site). Sand from the stockpile and the general development site is being blown into the Park thereby

impacting on natural systems and causing inconvenience to Park visitors. The wind erosion is particularly a concern for the National Trust as the sand is affecting the heritage values of the Settlers Cottage.

Soil contaminants

An issue, which needs to be considered in the management of the Park, is the presence of contaminants in the soil.

Research has been conducted on the level of pesticides within the Lake's sediments. The Herdsman Lake Pesticide Study (Davis and Garland, 1986) investigated the affects of the 1986 Argentine ant treatment program at the Lake. This study, plus additional sampling by CALM between 1986 and 1988, revealed dieldrin, chlordane, dichloro-diphenyl-trichoroethane (DDT) and heptachlor in the Lake's sediment and water.

Importantly, the study results indicated:

- both the surface waters and sediments of the bed of Herdsman Lake contained detectable levels of DDT and dieldrin, that were not applied during the 1986 spraying program, suggesting that the compounds detected are residues from previous spraying programs at the Lake (prior to 1970) or within the catchments of the drains that enter the Lake; and

- the presence of pesticides in Mosquito Fish (*Gambusia holbrooki*), Swamphens and Little Grassbirds indicates the bio accumulation of pesticides is occurring within aquatic food chains within the Lake. (The presence of high levels of pesticides within the Lakes sediments indicates that bio accumulation may continue to occur with the possible transfer of pesticides into the food chain when sediment dwelling organisms are consumed by other invertebrates, fish or waterfowl).

Pesticide presence in sediments is a function of both the chemical structure of the soil and the intrinsic stability of the pesticide. Heavy clays for example retain pesticides and nutrients much longer than lighter sandier soils. The high organic content in the peaty soils of Herdsman Lake also increases pesticide and nutrient persistence.

The ability of soils to take up pesticides and nutrients has important implications for water quality since a portion of the pesticides and nutrients in standing waters can be absorbed into the soil. Given Herdsman Lake sediments are peaty and generally have a very high organic content, it would be expected that they act as a significant pesticide and nutrient sink.

Strategies

1. **Facilitate discussions to achieve the completion of the Floreat Lakes residential development allowing the proponent to finalise the moat and utilise the stockpile of sand adjoining the Park in the north-west section. (MfP, CALM) [High]**

2. **Where relevant undertake a soil analysis for the presence of pesticides and to ascertain soil stability prior to the development of significant facilities. (CALM, CS) [Ongoing]**

3. **Restrict access to areas at risk from erosion by implementing the Recreation Masterplan (Section 27) and providing signs and information (Sections 30 and 39). (CALM, CS) [Ongoing]**

4. **Monitor pesticides levels in the soil and water as part of a water monitoring program (see Section 14). (CALM, WC, CS)**

14. The Lake and Wetlands

The objective is to manage water regimes affecting the Park in a manner that complements Water and Rivers Commission policies and enhances the conservation, recreation and cultural values of the Park.

Prior to the 1920s Herdsman Lake was primarily an expression of the groundwater with a considerable inflow of groundwater along its northern and north eastern boundaries from the Gnangara mound. In winter the water level of the Lake rose as the underlying aquifer was recharged, and in summer the Lake slowly dried out due to evaporation. Herdsman Lake flooded to depths of up to two metres in winter (Beckle, 1981), and had dried out to a "wet and puggy" condition by the end of each summer (Teakle and Southern, 1937). Surface runoff was only a minor contributor to the Lake's water level.

The current situation however, is vastly different as the Lake now receives inputs from both local and branch drain systems and acts as a compensating basin for drainage waters from surrounding areas (Clarke, Davis, Murray, 1990). The Lake continues to receive groundwater from the Gnangara mound.

In discussing water management for Herdsman Lake it is necessary to briefly review past planning for the Park. As discussed earlier, in 1985, the State Planning Commission (SPC) prepared Improvement Plan No. 21 for Herdsman Lake. The Improvement Plan was gazetted in 1986 and provided the SPC with the mandate to complete all works proposed in the original Concept Plan for the Park in 1976.

The Floreat Lakes residential development which adjoins the Park to the north-west was designed in accordance with Improvement Plan No 21 which allowed for the dredging of the moat to be completed around the

internal conservation area of Herdsman Lake. The Department of Environmental Protection formally assessed the development and a number of ministerial conditions were placed on the development for it to proceed. One of the conditions is as follows:

"Prior to completion of the Floreat Lakes development, an overall water management plan for Herdsman Lake shall be prepared by the State Planning Commission in consultation with CALM, the Water Corporation, and the City of Stirling, to the satisfaction of the Environmental Protection Authority" (EPA, 1988). This plan is yet to be prepared.

The objective of the overall water management plan will be to provide a system of monitoring, reporting and containment of pollution events. The plan will detail management procedures for the containment of a pollution event in the immediate locality so that remedial measures can then be applied and the extent of the pollution contained (within either the drains or the moat areas) (EPA, 1988).

The containment of any pollution event is based on three factors:

1. That all responsible authorities have a detailed knowledge of the system.
2. That the necessary materials are available, or structures constructed, to block off piped or open drains when required anywhere within the catchment.
3. That a co-ordinating and reporting system be established.

It is proposed that drains and moat be physically divided into cells. At the connection points water control structures will be constructed. The structures will permit the control of the water within any cell or between any cell. Thus any pollution event can be contained or directed to the most appropriate area for remedial treatment (EPA, 1988).

Additionally, the overall water management plan will investigate nutrient stripping basins and other pollution containment devises within the Park.

WATER LEVELS

Herdsman Lake functions as a drainage compensation basin for a catchment area that is approximately 3000ha and extends about 10 kilometres in a north easterly direction (see Figure 6).

In discussing the management of water levels it is necessary to identify the drainage water discharge points into Herdsman Lake. There are numerous local government stormwater drains that discharge directly in the Lake. Additionally, Flynn Street Branch Drain and the Herdsman Parade Branch Drain (managed by the Water Corporation) also discharge directly into the Lake (see Figure 10).

The Herdsman Main Drain, the Osborne Park Branch Drain and the Balgay Branch Drain were constructed to transfer stormwater from the Herdsman Lake catchment area, through Herdsman Lake, for discharge into the Indian Ocean at Floreat Beach. Discharge from these drains into Herdsman Lake, however, occurs via:

1. overtopping of the levee banks; and
2. through a control structure on the Balgay Branch Drain at the eastern end of Herdsman Lake that has the potential to allow control of discharges into and out of the northern and southern sections of the Lake system. The structure does not appear to be functioning adequately with some flows from the Balgay Branch Drain by-passing the structure and discharging directly into the Lake system.

The Lake also receives water through groundwater movement.

A key issue in managing water levels in Herdsman Lake is the use of structures to control water movement between the Osborne Park Branch Drain and the Balgay Branch Drain and the Lake system and vice-versa. This will be investigated through the preparation of an overall water management plan for Herdsman Lake.

With the input of additional stormwater into the Lake system, there is potential for significant long-term changes in the water levels of Herdsman Lake that will pose a major threat to the Lake's ecosystem. Changes to water levels in wetlands may influence the germination, survival and composition of particular fringing vegetation associations and of non-local species such as bulrush (*Typha orientalis*). Additionally, changes in the lake environment would favour some fauna species at the expense of others due to their different breeding and feeding requirements.

A permanent increase in the water level at the Lake would probably result in an increase in the area of open water while much of the shallow water and mudflats used by wading birds would be lost. Additionally, the rise in water level would probably result in the loss of rush beds used by some species of birds for breeding.

Alternatively, if water levels were to fall permanently at the Lake, preventing the central wetland area from flooding in winter, there would be a substantial loss of birds that require seasonally inundated wetland areas for habitat. Only species that use the deeper areas of the moat, principally swans and ducks would remain common.

The responsibility for monitoring water levels is with the Water and Rivers Commission. Groundwater levels vary from above the Lake water level (to the north-east) to below the Lake water level (to the south-east). Groundwater contours are shown in Figure 6.

In summary, the volumes of water entering the Lake and the relative significance of different sources of input are unknown (Clarke *et al.* 1990). Water enters the Lake via local and branch drains, direct runoff, rainfall and as groundwater. It leaves the Lake via evaporation, evapotranspiration, outflow to the groundwater and possibly through the Herdsman Main Drain. Water movement, the drainage requirements of the Water Corporation, pollution containment as well as managing water levels for conservation purposes will be explored through the Overall Water Management Plan.

WATER QUALITY

The four open water bodies within Herdsman Lake (Powis Lake, Floreat Waters, Industrial Lake and Floreat Lakes) appear to be generally intermediate in nutrient enrichment. Water quality testing by Clarke, Davis, Murray (1990) indicates higher levels of nutrient enrichment at Floreat Waters than the other water bodies.

The higher nutrient levels in Floreat Waters were attributed to the aging process of the deep water body and also to a probable higher nutrient input loading in comparison with the other deep water bodies within the Herdsman Lake System (Clarke *et al.* 1990).

Testing has revealed thermal stratification occurred in Industrial Lake in 1983 and 1984. If large amounts of nutrients are added to the water column severe algal problems may result (Clarke *et al.* 1990).

The Water Corporation has, in the past, conducted water quality monitoring within the main drain system. Nutrient concentrations in the various drains were frequently very high, indicating that they may be a significant source of nutrients into the Lake's system. Data suggested that flushing of nutrients into the Lakes from the catchment by the first winter rains may result in an increased nutrient load in autumn and early winter (Clarke *et al.* 1990).

For further and more detailed information on water quality measurements for Herdsman Lake please refer to the Herdsman Lake water Quality Study completed by Clarke, Davis, Murray (1990).

Figure 6 - Groundwater Flow and Catchment Boundary

The adverse effects of nutrient enriched wetlands include algal blooms, the abundance of non-biting midges, algal toxicity and loss of amenity through odours and fouling of the shoreline.

The concentrations of the organochlorine pesticides dieldrin, chlordane, and heptachlor recorded in Herdsman Lake during 1982 and in a detailed pesticide study from 1986-1988, exceeded the maximum levels recommended for the protection of aquatic fauna. High levels recorded in inflowing drains indicate that surface inflows play a large part in delivering pesticides to the Lake (Clarke *et al.* 1990).

High concentrations of pesticides detected in fish and waterfowls resident at the Lake, and the low numbers of predatory invertebrates recorded at the Lake, are considered to indicate that the aquatic food chains have been affected by high pesticide concentrations. Probable sources of pesticides include the Argentine ant control program (which ended in 1986) and commercial and domestic pesticide applications within the catchment (Clarke *et al.* 1990).

The Lake also receives contaminants through natural groundwater flow, drain flow, and direct runoff (Clarke *et al.* 1990). The likely major sources of pollutants include local domestic pesticide, herbicide and fertiliser use, industrial wastes poured or flushed into drains; and incomplete fuel combustion products and particulate lead from roadways. Therefore, a major threat to the wetland ecosystems of the Park is pollutants or other hazardous material entering the Park through the inflowing stormwater or branch drain systems. As mentioned earlier, a response strategy for emergency pollution spills that may impact upon the Park and catchment management initiatives will be a part of the overall water management plan for the Park.

Limited water quality data available from samples taken during the 1990s indicate that the water quality problems associated with the Herdsman Lake system and water discharging through the Water Corporation's drainage system are continuing.

When dealing with emergencies apart from fire (such as floods or chemical spills) the managing agencies are currently guided by the Western Australian Hazardous Materials Emergency Management Plan (FESA, 1998).

Integrated Catchment Management (ICM) is a process to help co-ordinate the management of water quality issues on a whole of catchment basis. While ICM is referred to in the City of Stirling's Wetland Protection Policy, the City currently does not have a catchment management plan for Herdsman Lake. In order to improve the water quality in the Lake it is important that the City of Stirling with assistance from the Water Corporation and CALM seeks to establish initiatives of ICM in managing the catchment of Herdsman Lake. This in turn will help reduce pollution and nutrients entering the Lake as well as reduce midge populations in the Park.

Another important consideration in water quality management is the protection of semi-aquatic fringing vegetation that helps to maintain water quality by reducing the influx of nutrients through filtration and

storage. The use of semi-aquatic fringing vegetation for trapping nutrients in drainage management is discussed in Section 32.

The feeding of water birds is a common recreation pursuit that has localised effects on water quality. Birds congregate in large numbers, which allows uneaten food and faeces to sink to the bottom of the lake. As a result, increased nutrient loading of the water occurs and blooms of algae may develop. Artificial feeding also has an adverse effect on the health of birds and will be discouraged (Section 16).

HEALTH OF THE WETLAND ECOSYSTEM

The number of species of predatory invertebrate recorded at a wetland can be used as an indication of the state of the aquatic food chain (Rolls et al. 1990). An assessment of the health of the wetland ecosystems can be undertaken by considering higher taxonomic levels of invertebrates such as genus and family, rather than needing to identify organisms to the level of species. This type of assessment (rapid bio-assessment) means the costs of assessing wetland health is reduced and allows for the possible involvement of community or school groups in assessment. Davis (1998) published a guide to wetland invertebrates of Southwestern Australia that provides appropriate taxonomic keys for assessment.

Indicators of wetland health include:

- nutrients and chlorophyll-a concentrations;
- the presence of blue-green algae cells,
- macro-invertebrates and the avian community structure.

These indicators will be monitored as Key Performance Indicators (see Section 11).

Strategies

1. **Prepare an overall water management plan for Herdsman Lake. The plan will:**
   - **define pollution containment devices and strategies;**
   - **develop emergency pollution response procedures;**
   - **estimate water volumes entering and leaving the Lake;**
   - **detail drainage requirements of the Water Corporation;**
   - **investigate managing water levels for the protection of wildlife habitat and other conservation values. (DEP, CALM, CS, WRC, WC, MfP, Sherwood Overseas). [High]**

2. **Adopt management practices throughout the Park that do not add nutrients and pollutants to the wetland system. For example, fertilisation and irrigation management practices are to be based on minimal nutrient loss and irrigation run-off. (CALM, CS) [High]**

3. **Use interpretative and educational material to inform Park visitors and surrounding residents that certain fertilisers can have adverse effects on water quality within the Park by allowing nutrients to leach into the groundwater. (CALM, CS, WC) [Medium]**

4. **Protect and re-establish rush beds of local species and fringing vegetation in disturbed areas (Section 21). (CALM, CS) [High]**

5. **Prepare an integrated catchment management plan for the Herdsman Lake catchment area aimed at reducing the sources of nutrients and pollution affecting the Lake. (CS, WC, CALM) [Medium]**

6. **Prepare and undertake a monitoring program to gather baseline information on the Key Performance Indicators of Wetland Health and relevant heavy metals and pollutants at selected sites in the Park. (CALM, CS) [High].**

15. Flora and Vegetation

To protect, conserve, and rehabilitate the flora and vegetation in the Park.

The vegetation of Herdsman Lake has changed a great deal since European settlement. Reports by early European settlers describe the Lake as an area of open water with fringing rushes and fresh water paperbarks (*Melaleuca rhaphiophylla*) giving way to swamp banksia (*Banksia littoralis*) and flooded gum (*Eucalyptus rudis*) with an understorey of shrubs (Bekle, 1981).

The Park has become very much isolated due to the loss of surrounding local vegetation and increased development. Considerable conservation gains however, can be made through integrated and co-ordinated weed control and rehabilitation operations. Additionally, the use of local species in landscaping projects around the Park as well as planning for corridors and links between the Park and other conservation areas can help to increase the Park's ecological integrity (see Section 24 – Greenway Corridors and Links).

There has been no Declared Rare Flora recorded in the Park.

The existing flora and vegetation communities of the Park can be described in terms of upland vegetation, wetland vegetation and aquatic flora.

UPLAND VEGETATION

Significant disturbances and other activities in the past such as agriculture, market gardening, drainage schemes, land filling and fire have removed much of the original upland vegetation within the Park. Upland areas of the Park are characterised by open parkland areas with isolated remnant trees. In recent times, however, extensive planting programs concentrated on the north-eastern banks of Herdsman Lake have included species such as flooded gum, orange wattle (*Acacia saligna*) and swishbush (*Viminaria juncea*).

The key threats to the these communities and assemblages are as follows:

- weeds;
- unplanned fire;
- importation of soil; and
- insects.

Weeds

Weeds are a major problem in the Park and require immediate action by the managing agencies. Measures (including the preparation of an integrated Weed Management and Rehabilitation Plan) for the control of weeds in the Park are discussed in Section 17.

Unplanned fire

Increased urban development around the Park and greater visitor use of the Park is likely to increase the incidence of unplanned fire. Refer to Section 18 for the management of fire within the Park.

Importation of soil

The importation of soil into the Park will be restricted. When it is necessary to import soil into the Park, it is important that the soil is free of Phytophthora dieback and weed seed, and is similar to the natural soil types of the area. Measures for the control of Phytophthora dieback and weeds are discussed below.

Insects

A number of flooded gum (*Eucalyptus rudis*) around Herdsman Lake (especially along Jon Sanders Drive) are in an unhealthy condition for much of the year. Their poor condition is attributed to being attacked by a range of leaf-eating insects. Research is being undertaken in the Park and at other locations throughout the south west of the State to investigate whether the disturbance is a natural phenomenon or human induced.

The willful damage to vegetation in upland areas has been a problem in the past. All native flora is protected by the *Wildlife Conservation Act (1950)*. Any incidences of willful damage to vegetation in the Park should be investigated and appropriate action taken.

Phytophthora dieback, an oomycete or 'water mould' refers to the deadly plant disease caused by the pathogen *Phytophthora cinnamoni* and is considered to be a significant threat to a number of vegetation communities on the Swan Coastal Plain. No sampling for Phytophthora has been undertaken in the Park, however, it not considered to be a major threat as existing plant communities in the Park have few susceptible upland species e.g. jarrah, banksias and grasstrees (*Xanthorrhoea*). Phytophthora dieback could have an impact on revegetation programs in the Park if the species planted are vulnerable to the disease. The risk of impact from Phytophthora dieback can be reduced by modifying activities that spread the pathogen, or by controlling access to high priority area. Modifying activities may involve cleaning machinery, vehicles or footwear, scheduling activities for dry soil conditions, or using materials that are free of *Phytophthora cinnamoni*. Controlling access may involve track rationalisation, upgrading tracks, or restricting the access of off road or management vehicles (Dieback Working Group 2000).

WETLAND VEGETATION

In addition to the threats identified for upland vegetation, key threats to the wetland vegetation in the Park include:

- invasion of Bulrush; and
- water quality and water levels in Herdsman Lake.

Bulrush

Given the aggressive nature of bulrush (*Typha orientalis*), very little remains of the original Lake fringing vegetation. Only fragments of a once extensive fringe of paperbarks and flooded gums remain on the western and southern portions of the Lake edge with local rushes extending beneath the overstorey in limited areas.

The central area of Herdsman Lake, except for the moat, is almost entirely covered by bulrush. Disturbance and other activities in the past have allowed the bulrush to invade much of the Lake with only small dense thickets of the jointed twig-rush (*Baumea articulata*) found mainly on the eastern side.

Elevated ground within the central area supports isolated freshwater paperbarks. Those areas within the central conservation area not covered by bulrush are seasonally inundated, covered by water in winter and grasses in summer, refer to Figure 7.

The continued invasion of bulrush is a major threat to the ecological systems of the Park, not only in out-competing local plant species but it also constitutes a significant fire risk in late summer and early autumn when most of the mature leaves have died (see Section 18). The management of bulrush is discussed in Section 17 – Weeds.

Water quality and water levels in Herdsman Lake

As described in Section 14, the management of water quality and water levels are key issues in the context of conserving the natural process associated with the fringing wetland vegetation communities.

AQUATIC FLORA

The shallow margins of the moat support rooted angiosperms such as fennel pondweed (*Potomogeton pectinatus*) and the prickly waternymph (*Najas marina*). The fruiting bodies of fennel pondweed serve as a food

source for waterfowl. The water bodies within Herdsman Lake also contain a mixture of planktonic, benthic and filamentous algae.

A significant threat to the local aquatic flora of Herdsman Lake are the outbreaks of blue-green algae blooms, which are common during late summer. The presence of blue-green algae blooms is an indication of excessive nutrients in the water (Maunsell and Partners, 1989). Managing excessive nutrients in the water bodies of the Park is discussed in Section 14 – The Lakes and Wetlands).

Strategies

1. **Ensure local species are used for landscape and amenity plantings within the Park. If non-local species are required they should not include invasive species. (CALM, CS) [Medium]**

2. **Reduce the risk of introducing Phytophthora dieback in the Park by:**
   - **limiting access to areas sensitive to infection;**
   - **ensuring appropriate hygiene standards for machinery when undertaking works within the Park; and**
   - **using clean soil, which is free of dieback and weeds, and similar to the natural soil types of the area when it is necessary to import soil into the Park. (CALM, CS) [Ongoing]**

3. **Investigate any willful damage to vegetation in the Park and where appropriate offenders should be prosecuted. (CALM, CS) [High]**

4. **Provide interpretive material to local residents encouraging them to plant local species in areas surrounding the Park (Section 39). (CALM, CS) [Medium]**

5. **Develop and implement a targeted and integrated monitoring program of bushland condition, changes to vegetation communities and weed proliferation. (CALM, CS) [High]**

Figure 7 - Park Vegetation

16. Fauna

The objective is to maintain biodiversity of the indigenous fauna species in the Park and, if feasible, reintroduce species lost from the Park.

The main threats to fauna within the Park are the loss and fragmentation of habitat which can be attributed to:

- weeds (Section 17);
- wildfire (Section 18);
- changing water levels and water quality (Section 14);
- competition and predation by introduced animals and pets (Section 20); and
- inappropriate recreation activities (Section 27).

Additionally, the loss of native habitat surrounding the Park has impacted significantly on the fauna of the Park. Many native animals are killed or injured on the roads servicing the surrounding urban and industrial development. Greenway corridors and other links between the Park and adjoining areas of ecological significance are important to help maintain the diversity and vigour of the Park's ecological systems (Section 24).

AVIAN FAUNA

Avian fauna in the Park has been surveyed by the Royal Australasian Ornithologists Union recording 107 bird species (RAOU - 1996D). There is a good assemblage of waterbirds at Herdsman Lake which is an important feeding site for birds of prey.

The abundance of bird species recorded at Herdsman Lake results largely from the mosaic of habitats present (Curry, 1981). The important components of the mosaic are:

- deep, open water (approx. 1.5 - 2.5 metres);
- shallow water, seasonally inundated areas (including mud flats and sedge lands);
- grassy banks of drains and the shoreline;
- dense stands of rushes; and
- trees.

The occurrence of particular birds changes according to season. Areas in the central wetland in summer provide habitat for bird species such as White-Fronted Chats (*Ephthianura albifrons*) and Richard's Pipits (*Anthus novaeseelandiae*), while in winter, these areas are covered by deeper water and are used by ducks and other water birds (Maunsell and Partners, 1989).

Two species of birds recorded at Herdsman Lake Regional Park are listed as threatened species and specially protected under the *Wildlife Conservation Act 1950*. The Australian Bittern (*Botaurus poiciloptilus*) is considered rare or likely to become extinct, while the Peregrine Falcon (*Falco peregrinus*) is listed as otherwise in need of special protection.

A number of migratory birds listed under the Japan-Australia Migratory Birds Agreement (JAMBA) and the China-Australia Migratory Birds Agreement (CAMBA) have been sighted at the Park. Australia is a signatory to these two international agreements which support the conservation of migratory birds and their habitats. The intent of the JAMBA and CAMBA migratory bird agreements will be applied in the management of the Park.

Waterbirds

Herdsman Lake contains the most varied and easily observed waterbird fauna of any Lake in south-western Australia. It is also an important breeding site with at least 20 species breeding there, and provides an excellent opportunity to see birds nesting or raising broods (Maunsell and Partners, 1989).

Curry (1981) undertook an extensive survey of birds at Herdsman Lake and found that the Lake is a major breeding area for the Black Swan (*Cygnus atratus*), Purple Swamphen (*Porphyrio porphyrio*), Little Grassbird (*Megalurus gramineus*) and Clamorous Reed-Warblers (*Acrocephalus stentoreus*). It is one of the few wetlands in south-western Australia where Little Bitterns (*Ixobrychus minutus*) breed, preferring dense bulrush stands. Particularly visible are the three grebe species - the Australasian Grebe (*Tachybaptus novaehollandiae*), Hoary-headed Grebe (*Poliocephalus poliocephalus*) and Great Crested Grebe (*Podiceps cristatus*) - which construct floating nests on the open water. Eurasian Coots (*Fulica atra*) also breed in abundance. Three bird species, which are rarely found breeding in the south-west, the Blue-billed Duck (*Oxyura australis*), Hardheads (*Aythya australis*) and the Australasian Shoveler (*Anas rhynchotis*) nest at Herdsman Lake. Pink-eared Ducks (*Malacorhynchus membranaceus*), Musk Ducks (*Biziura lobata*) and Dusky Moorhens (*Gallinula tenebrosa*) are also present at the Lake.

Herdsman Lake is also used regularly by small numbers of freshwater migratory waders such as Sharp-tailed Sandpipers (*Calidris acuminata*), Greenshanks (*Tringa nebularia*), Wood Sandpiper (*Tringa glareola*) and Long-toed Stints (*Calidris subminuta*) (Curry, 1981). Long-toed Stints are uncommon in the area and their occurrence at Herdsman Lake is significant.

Several Australian waders also occur in the Park and four of them, the Black-fronted Plover (*Charadrius melanops*), Red-kneed Dotterel (*Erythrogonys cinctus*), Red-capped Plover (*Charadrius ruficollis*) and Black-winged Stilt (*Himantopus himantopus*) have been recorded breeding (Curry, 1981).

From a conservation viewpoint, the occurrence of species such as the Buff-banded Rail (*Rallus phillippensis*), Baillon's Crake (*Porzana pusilla*), Australian Crake

(*Porzana fluminea*) and Spotless Crake (*Porzana tabuensis*) is important but these birds rarely present themselves to recreational birdwatchers (Curry, 1981).

Other birds

Grassland areas around the periphery of the Lake, together with sparsely vegetated areas within the central region, are used as hunting grounds for birds of prey. Ten species have been observed, including the Black-Shouldered Kite (*Elanus axillaris*), Peregrine Falcon (*Falco peregrinus*) and Brown Goshawk (Accipiter fasciatus) and aerial insectivores including the Tree Martin (*Hirundo nigricans*) and the Welcome Swallow (*Hirundo neoxena*). The Marsh Harrier (*Circus aeruginosous*) breeds at Herdsman Lake (Curry, 1981).

A number of issues threaten the avian fauna and their habitat within the Park. These threats include fire (Section18), pets and introduced animals (Section 20) as well as forms of intensive recreation activity (Sections 27 and 28). It is also acknowledged that other issues such as weeds (Section 17) are impacting negatively upon the habitat values of the Park. Additionally, the control of water levels at Herdsman Lake is critical to the preservation of habitat (Section 14).

Given the above threatening processes and the potential disturbance to birds during breeding seasons, visitors will be restricted from accessing the central conservation area. Visitor use for the Park will be guided by the Recreation Masterplan (Section 27) and protection of the central wetland area will be increased by finalising the construction of the moat (Section 13), which will in turn further limit access to the central area.

Another threat for the birdlife at Herdsman Lake is human interaction which is presently concentrated around the fringe of the Lake. Human interaction usually ranges from casual bird observation to hand feeding of birds. It is recognised that the feeding of waterbirds is an activity that members of the public enjoy, especially children and visitors from other areas. Bird feeding has the positive advantage that it brings the public into close contact with populations of native birds in a natural setting and so builds up an appreciation of wildlife and the need for their conservation. There are nevertheless adverse effects including:

- selection in favour of more aggressive species, such as Silver Gulls which are not normally found in large numbers in such wetlands;
- unsightly food scraps in the water and on Lake surrounds; and
- the possibility that large amounts of organic material at feeding sites (from uneaten food and faecal material) may enhance conditions for the development of avian botulism.

For these reasons, the feeding of birds will be discouraged at Herdsman Lake.

Other activities such as model boats and canoeing have also been known to occur in the Park. Although it has been shown that the use of model boats does not significantly interfere with birds, it was found that the boat used to retrieve model boats scared birdlife and disturbed their behavioural patterns (Bamford, Davies and Van Delft, 1988).

TERRESTRIAL AND AQUATIC FAUNA

Mammals

No native mammal species are known to regularly occur in the Park. According to White (1984), the Western Grey Kangaroo (*Macropus fuliginosus*), Western Brush Wallaby (*Macropus irma*), Common Brushtailed Possum (*Trichosurus vulpecula*) and Quenda (*Isoodon obesulus fusciventer*) have not been sighted at Herdsman Lake since the late 1960s. The loss of these species from the Park can be attributed to the loss of habitat within and surrounding the Park. The Swan Coastal Plain has nine species of insectivorous bats some of which are likely to use the Park for occasional foraging, if not as a permanent home.

Reptiles and Amphibians

There are several reptile species at Herdsman Lake with the Mourning Skink (*Egernia luctuosa*) considered significant. Numbers of the Mourning Skink have declined dramatically with the draining and reduction of wetland habitats on the Swan Coastal Plain (DEP, 1998).

The Long Necked or Oblong Tortoise (*Chelodina oblonga*) is found in the open water bodies of the Park.

Western Tiger Snakes (*Notechis scutatus occidentalis*) are common within the Park and are important species in the Lake's ecosystem. Western Tiger Snakes are now considered uncommon in the metropolitan area and the isolated population at the Park is important in conservation and evolutionary terms. The presence of this species within the Park should be included in education programs and interpretive material to help develop an appreciation for wildlife. It is also acknowledged that the presence of the Western Tiger Snake (which are venomous) is a concern to some Park visitors and local residents. It is therefore proposed to provide contact details of wildlife carers within the Park for the removal of dangerous or injured fauna.

Eleven species of lizard have been recorded at Herdsman Lake including Gould's Sand Goanna (*Varanus gouldii*), the Marbled Gecko (*Phyllodactylus marmoratus*) and the Bobtail Skink (*Tiliqua rugosa*) (Maunsell & Partners, 1989).

Numerous amphibians also inhabit the area. Herdsman Lake has a full complement of amphibia expected of a lake on the Swan Coastal Plain (Esri, 1983). Six frog species have been recorded in the Park. These are the Moaning Frog (*Helioporous eyrei*), Sandplain Froglet (*Crinia insignifera*), Glauert's Froglet (*Crinia glauerti*), Western Bell Frog (*Litoria moorei*), Slender Tree Frog (*Litoria adelaidensis*) and the Pobblebonk Frog (*Limnodynastes dorsalis*). The replacement of natural habitat with surrounding urban development has markedly reduced the habitat of most amphibian species. Pollutants that also find their way into aquatic systems can cause marked population declines (DEP, 1998)

Fish

Of the three species of fish occurring at Herdsman Lake only one, the Swan River Goby (*Pseudogobius olorum*) is native. The Goldfish Carp (*Carassius auratus*) and the Mosquito Fish (*Gambusia holbrooki*) have been

introduced. The latter is an aggressive species introduced from Central America to control mosquitoes throughout Australia. It has probably contributed to the demise of native fish other than the Swan River Goby (Silberstein, undated) and to a reduction in diversity of aquatic invertebrates.

Davis, Halse and Ebell (1987) documented significant fish deaths associated with the spraying for Argentine ants, although the areas have recolonised rapidly. This has serious implications as fish are an important food source for other Lake fauna, especially waterbirds such as cormorants, grebes, herons and egrets.

Invertebrates

There are no data on terrestrial invertebrates in the Park, but numerous insect species common in the metropolitan region are undoubtedly present. The Argentine ant, an introduced species that has been reported to have a pronounced effect on other ant species and perhaps other invertebrate species, is present (Majer and Flugge, 1984). Past attempts to control this species by pesticides has had considerable, undesirable environmental impacts including a high mortality of other invertebrate species (see Section 19 – Pest Control).

The aquatic macro-invertebrate fauna of Herdsman Lake was studied as part of a monitoring program undertaken by Murdoch University in 1986/1987. The Herdsman Lake Water Quality Study (Davis, Murray and Clarke, 1989) details results from the monitoring program.

The variety of species of macro-invertebrate fauna at Herdsman Lake is intermediate when compared with other metropolitan wetlands on the Swan Coastal Plain. The Lake's fauna is lacking in the two largest groups of predatory invertebrates, *Odonata* (dragonflies and damsalflies), and *Coleoptera* (beetles). The number of species of predatory invertebrates recorded at a wetland can be used as an indication of the state of the aquatic food chain (Rolls, Davis, Balla and Bradley, 1990). Additionally, the presence of invertebrates is a useful indicator of wetland health.

It has been suggested that the lack of predatory invertebrates at Herdsman Lake is a result of high pesticide levels within the Lake waters and sediments. Of the 10 wetlands studied in the Perth metropolitan area by Rolls et al (1990), only Lake Monger, which has excessive nutrient enrichment, high pesticide levels and heavy metal pollution has fewer predatory macro-invertebrates.

Strategies

1. **Prepare and undertake a monitoring program of the avian community structure as well as species diversity and populations of selected avian fauna species in the Park. (CALM, CS, Educational Institutions, WA Museum, Birds Australia) [High]**

2. **Ensure recreation uses are consistent with the protection and management of fauna, for example prohibiting the use of recreational watercraft in the Park (Section 26). (CALM, CS) [Ongoing]**

3. **Provide interpretive and educational material which:**
   - **promotes an understanding and appreciation of the Park's fauna, particularly waterbirds and the Western Tiger Snake;**
   - **discourages the artificial feeding of birds;**
   - **educates local residents about the effects of the dumping of 'exotic' animals and fish in the wetland systems;**
   - **supports volunteer groups involved with the Park; and**
   - **informs the public about the adverse impacts of feral animals and domestic pets on native fauna in the Park. (Section 39) (CALM, CS) [High]**

4. **Identify seasonal mowing areas and areas not to be mown to preserve habitat and bird breeding sites. (CALM, CS) [Ongoing]**

5. **Provide the contact details of wildlife carers for the removal of injured fauna or dangerous fauna from places in the Park where they constitute a significant risk to people. (CALM) [Low]**

6. **Ensure the management of water levels in the Park provides for waterbird and other fauna habitats. (WC, CALM, CS) [Ongoing]**

7. **Consider the reintroduction of appropriate native wildlife into the Park. (CALM) [Low]**

17. Weeds

The objective is to minimise the impact of environmental weeds on biodiversity within the Park using methods compatible with the conservation of the natural environment.

Environmental weeds have been defined as plants that establish themselves in natural ecosystems (marine, aquatic and terrestrial) and proceed to modify natural processes, usually adversely, resulting in the decline of the communities they invade (Ecoscape, 1999).

The presence of weeds is a serious problem in the Park. Past land uses such as clearing and developing land for grazing have introduced many grass and weed species into the Park. Additionally, soil disturbance from vehicle access used in the construction of the drainage channels and moat has also allowed weeds to establish.

The invasion of weeds is a major threat to the conservation values of the Park and is vital that measures are introduced to limit or control the degradation processes. There are many reasons for the presence of weeds in the Park these include:

- past land uses such as clearing and market gardening;
- soil disturbance from vehicle access;
- construction of paths and other facilities or drainage channels which allow weeds to establish;
- frequent fires which promote the growth of weeds;
- drainage outlets that carry stormwater from adjoining areas and promote the spread of weeds in wetland areas
- the dumping of aquarium contents in the Lake can also lead to the spread of aquatic weeds;
- the dumping of garden refuse in the Park which introduces many plants that vigorously compete with local vegetation; and
- grasses planted for amenity purposes in parkland settings invading wetland areas.

Another source of weeds, which spread into the Park, is the large stockpile of sand on the north west boundary of the Park.

There are a number of weed species present within the wetland areas of the Park. Weed species in the wetland fringing areas of Herdsman Lake include Poplars (*Populus* spp), Castor Oil Bush (*Ricinus communis*), Flame tree (*Erythrina sykesii*), Cape Lilac (*Melia azedarach*) and Willows (*Salix* spp.). These are especially prevalent to the south-east of the Lake where much of the area has been greatly disturbed and consists mainly of open, weedy pasture and former market gardens. Other species include Common Vetch (*Vicia sativa*), Bushy starwort (*Aster subulatus*), Capeweed (*Arctotheca calendula*), Kikuyu grass (*Pennisetum clandestinum*), Pampas grass (*Cortaderia selloana*) and Cotton Bush (*Gomphocarpus fruticosus*). Cotton Bush is a declared noxious weed as listed by the Agriculture Protection Board.

Introduced grasses such as kikuyu, couch, pampas and veldt are well established in the Park, sometimes to the total exclusion of the local vegetation. Grasses used for amenity purposes in parkland settings need to be controlled to stop them invading local vegetation.

Bulrush

Bulrush (*Typha orientalis*) is an aggressive coloniser, especially following disturbance, and is present in most wetlands in the Swan Coastal Plain. The extent of bulrush establishment at Herdsman Lake is a direct result of past and continuing disturbances to, and modification of, the Lake's ecosystem.

The two methods of colonisation, seeding and rhizomal growth, can convert extensive open areas into closed bulrush stands in a matter of years. Seeding is faster with large beds growing where the ground has been cultivated or in areas which have been burned. Seedlings only become established where water levels are low and the substrate dries out. Bulrush spreads more slowly in permanently inundated areas via rhizomal growth. It does not invade undisturbed areas and it seems that Jointed-Twig Rush may be re-establishing in areas of Herdsman Lake where there has been no disturbance for some time (Maunsell & Partners, 1989).

Bulrush rapidly invades and can block newly constructed or cleared drains thus causing maintenance problems. Maintenance programs should take into account the rapid colonisation of bulrush in disturbed areas such as drainage outfalls and viewing platforms.

Although *Typha orientalis* is a non-local species, it does perform a number of valuable functions. It provides shelter, nesting sites and is a food source for some avifauna and other wildlife. Removal of Bulrush stands may result in increased nutrient levels within the waters of the Park with consequent implications for algal blooms and subsequent impacts on waterfowl. Efforts to keep its presence to a minimum, allowing the native species to return would provide benefits both ecologically and aesthetically. Bulrush's removal from the Park needs to be carefully considered.

Guidance for weed management in the Park is provided by CALM Policy Statement 14 – Weeds on CALM Land and The Environmental Weed Strategy for Western Australia. It is recognised however, that more detailed planning is required to develop an integrated and co-ordinated approach to weed management in the Park. As such CALM will prepare a weed management plan for the Park.

The Weed Management Plan will use the principles of weed control as outlined in the State Environmental Weed Strategy. Planning for weed control will consider the following priorities:

- recognise weed potential;
- maintain areas of the Park that have vegetation in good condition; and
- control weeds impacting on threatened species and communities.

The Plan will also outline the most effective methods for controlling priority weed species within the Park.

Weed control can greatly benefit from community involvement. The involvement of the community in volunteer works is critical to the successful implementation of this Plan. Managing agencies have limited resources and weed control can be very labour intensive. The managing agencies acknowledge the considerable efforts by the community in undertaking weed control works within the Park. Volunteer groups have completed weed control projects successfully within the Park for many years.

Although the overall co-ordination of weed control within the Park is the responsibility of the managing agencies, volunteer groups and the agencies should establish co-operative arrangements with agreed

processes and outcomes when undertaking specific weed control projects. Where volunteer groups initiate a project, discussion should occur with the relevant managing agency to ensure that activities are consistent with the Park's annual works program, implementation plans and monitoring processes.

Members of the community wanting to be involved in weed control programs in the Park can do so by:

- joining the community volunteer groups within the Park; and
- participating in activities in the Park organised or co-ordinated by the managing agencies.

Strategies

1. **Prepare and implement a weed management plan in accordance with the Environmental Weed Strategy developed for CALM. The plan will:**
   - **map the extent and abundance of priority weeds, bushland condition and vegetation communities within the Park;**
   - **prioritise and control weed species according to invasiveness, distribution and environmental impacts;**
   - **specify appropriate control techniques and timing for removal including herbicide use;**
   - **be integrated with the rehabilitation strategy (Section 21) and not carried out in isolation. (CALM) [High]**

2. **Liaise with the Water Corporation and the City of Stirling to define weed infestations and control methods in drains that flow into the Park. (CALM, CS, WC) [Ongoing]**

3. **Research the impacts of bulrush on the wetland ecosystem on the Swan Coastal Plain. (CALM, Educational Institutions) [Low]**

4. **Set boundaries for grass areas used for recreation and control the spread of grasses outside these areas. (CALM, CS) [High]**

5. **Use interpretive and educational material to inform Park visitors and neighbours about:**
   - **the effects of dumping rubbish and garden refuse in the Park. Park neighbours will be informed that dumping aquarium contents in the local drainage system may lead to the proliferation of aquatic weed problems;**
   - **invasive plants that pose a threat to the biodiversity of the Park. (CALM, CS) [High]**

6. **Encourage volunteer community groups to become involved with weed control in the Park. (CALM, CS) [Ongoing]**

7. **Co-ordinate community involvement in weed control works within the Park. (CALM, CS) [Ongoing]**

8. **Monitor the extent of priority weed species distribution and abundance, bushland condition and changes to vegetation communities. Relate results to previous studies to monitor changes. (CALM) [Ongoing]**

18. Fire

The objective is to protect people, property and the conservation values of the Park, by minimising the impact of unplanned fire on the Park.

Wildfire is a significant threat within Herdsman Lake Regional Park. Increased visitor use of the Park is likely to increase the incidence of unplanned fire as is experienced in other bushland areas in the Perth metropolitan area. Of considerable concern are fires in areas of the Park with heavy infestations of bulrush (*Typha orientalis*). Fires in bulrush are difficult to control and can cause severe damage to fringing wetland vegetation.

In the past, unplanned fires have been a regular occurrence in the Park. The development of surrounding areas and the construction of the moat have lead to a reduction in the frequency of fires. This can probably be attributed to increased site surveillance by local residents.

Wild fires need to be avoided in the Park because they threaten human life, property and nature conservation values. From a biological viewpoint, fire at Herdsman Lake Regional Park is considered undesirable due to the poor adaptation of wetland vegetation (Halse, 1985). Frequent fires will prevent the establishment of paperbark vegetation and lead to an even greater dominance of bulrush.

Fire activity encourages the invasion of bulrush in wetland areas because it regenerates far quicker than other local rush species such as the Jointed Twig Rush. Bulrush is highly flammable in late summer and early autumn when most of the mature leaves have died. If a fire occurs during this period permanent damage to stands is minimal since the plants are dormant. Indeed bulrush will regenerate within 12 to 18 months to a level where it again carries high fuel loads. Poor access to the central area at Herdsman Lake makes fire suppression difficult.

Wildfires that occur in the Park need to be quickly controlled. Herdsman Lake Regional Park is within the Gazetted Fire District and the Lead Combat Authority for fire suppression is the Fire Emergency Service Authority (FESA). The Fire Incident Controller is responsible for initiating post fire recovery strategies. Pre-suppression works and post-suppression follow-up works are the land managers' responsibility. When managing fire, CALM is guided by the *Bushfires Act* and CALM Policy Statement No.19 - Fire Management.

An important consideration in pre-suppression works and post-suppression follow-up works should be the protection of environmentally sensitive areas. Measures should be initiated to help ensure the spread of plant diseases and weeds is minimised.

A Fire Response Plan has been developed by CALM in conjunction with FESA and the City of Stirling to help ensure effective response to unplanned fire by the responsible agencies and outlines practices such as:

- fire control actions and strategies that protect environmentally sensitive areas from unplanned fire;
- undertaking pre-suppression activities including reducing fuel loads by mowing or slashing large open grassed areas. Mown or slashed areas should be delineated so that mowing practices do not adversely affect natural regeneration and fauna habitat;
- maintaining a fire record system of all fires in the Park including date and cause;
- ensuring an effective network of firebreaks is maintained.

The Fire Response Plan is consistent with CALM's Fire Management Policy Statement No.19.

Strategies

1. **Implement and periodically update the Park's Fire Response Plan. (CALM, CS) [High]**

2. **Ensure that recreation planning takes into account fire prevention requirements. For example when constructing or upgrading paths in the Park consider building them to a standard that will carry fire control vehicles, so that access is improved for fire management (Section 29). (CALM, CS) [Ongoing]**

3. **Initiate measures in pre-suppression works and post-suppression follow-up works to minimise the spread plant diseases and weeds in the Park. (CALM, CS) [High]**

4. **Co-ordinate weed control and rehabilitation works with fire prevention requirements. Fire management will be an important consideration of the weed control and rehabilitation plans. (CALM, CS). [Ongoing]**

19. Pest Control

The objective is to minimise the negative effects of insect pest populations in a manner that has minimal environmental and social impacts.

ARGENTINE ANTS

Herdsman Lake supports a large population of Argentine ants (*Linepithema humile*) and acts as a source of infestation for surrounding land. Argentine ants have been a nuisance to local residents due to their high population density and their highly invasive nature. They have a deleterious effect on native ant and plant species (Majer and Flugge, 1984) and on wildlife in general. Agriculturally they effect a wide range of industries including citrus orchards, vineyards, apiculture (bees), dairy and our export markets. (Argentine Ant Control, Annual Report, 1987/88)

Argentine ants were first discovered in Perth in 1941. Their control was centralised under the Health Department from 1949 until 1954 when the State government initiated an eradication program using organochlorine insecticides.

The perimeter of Herdsman Lake was sprayed ever year between 1957 and 1983. In the past, a variety of sprays were used at the Lake including dichloro-diphenyl-trichoroethane (DDT), mirexbait, diasinon, endosulphur and chlorpyrifos. Heptachlor replaced dieldrin in 1972, and chlordane was used up until 1973 (Maunsell & Partners, 1989).

The use of heptachlor for Argentine ant control was stopped in 1986 due to the widespread public objection and mortality amongst all invertebrates (Davis, Halse and Ebell, 1987).

In 1988 the EPA reviewed the use of organochlorine insecticides for Argentine ant control and recommended that the broad-scale use of heptachlor for the control of Argentine ants was to cease. Due to these findings, the control/containment program was abandoned (Argentine Ant Control, Annual Report, 1987/88).

Since 1988, no control measures have been undertaken at Herdsman Lake with the control of Argentine ants being the responsibility of individual landholders. As a result Argentine ant populations have increased.

The Social Insect Research Section (SIRS) of Agriculture Western Australia has undertaken research into alternative methods of control, including the development of a bait suitable for use against Argentine ants. Any control works undertaken in the Park will need to be undertaken in consultation with CALM.

NON-BITING MIDGES

Herdsman Lake supports large numbers of non-biting midges (*Chironomid* spp.) (Halse, 1985) which at times in the past, have been a nuisance to local residents and visitors to the Park. Research undertaken by Pinder, Trayler and Davis (1991) indicates that midge densities vary in accordance with wetland nutrient levels and that midge problems are a symptom of a disturbed system and an effect of poor water quality. Given there are problems with nutrient enrichment with the three dredged water bodies at Herdsman Lake appearing to be intermediate in enrichment (Clarke, Davis and Murray, 1990) it can be expected that midges will continue to be a problem in the Park at times in the future. Poor water quality can be attributed to factors such as excessive fertiliser use occurring throughout the catchment of Herdsman Lake (see Section 14).

It is important that initiatives of Integrated Catchment Management (ICM) are established for the catchment area of Herdsman Lake (see Section 14).

MOSQUITOES

Mosquitoes are present at Herdsman Lake and the City of Stirling monitors numbers and species on a fortnightly basis from October to May each year. Wetlands on the Swan Coastal Plain often require a management response to mosquito populations. Mosquitoes may

cause a nuisance to nearby residents and are a public health risk as some species have the potential to transmit diseases such as Ross River Virus. The Health Department of WA administers a mosquito control program. This program subsidises mosquito control to Contiguous Local Authority Groups in areas that have been identified as having locally contracted mosquito-borne viruses. The City of Stirling would therefore have to demonstrate known cases of locally contracted mosquito borne disease before qualifying for this assistance. The management of mosquitoes on CALM managed estate is guided by Conservation Commission of Western Australia Policy A3 – Mosquito control.

Strategies

1. **Continue to monitor for mosquitoes at relevant times of the year and under take appropriate control practices in accordance to relevant standards. (CS) [Ongoing]**

2. **Ensure agencies controlling pests liaise with Park managers in relation to control techniques and practices. (CALM, CS, AgWA) [Medium]**

20. Pets and Introduced Animals

The objective is to minimise the environmental and social impacts of pets and introduced animals in the Park.

PETS

The ownership of pets in close proximity to the Park has ramifications for the Park's management. Pets such as dogs and cats are impacting upon the conservation values of the Park and their management needs to be strengthened.

Domestic cats hunt for birds, reptiles, and other animals within the Park. Cat owners should be encouraged to keep their cats at home, especially at night and have them de-sexed to help control feral populations. The City of Stirling has endorsed application for gazettal of the Cat Control Local Law. The Local Law will enable Council to declare a 200m cat exclusion zone around principal conservation reserves within its municipal boundaries. Herdsman Lake Regional Park is considered a principal conservation reserve under this Local Law. As part of implementing this law, the City of Stirling will ensure that all residents within the affected areas are suitably advised of their obligations with regard to restriction of cat numbers per household and restriction of cat movement.

Pet fish should not be disposed of in the Lake, wetland areas or drains flowing into the Park.

Dog walking is a common activity in the Park and a legitimate activity in certain areas. However appropriate restraint of dogs is necessary if they are not to have an adverse effect on wildlife and activities of other Park visitors.

Under the City of Stirling's Local Laws, all reserves in the City are open to dogs with the exception of the following:

- All coastal reserves (with the exception of small areas of Brighton Beach and Bennion Beach);
- Stirling Civic Centre Gardens;
- Albert James Park, Joondanna.

Additionally, the City of Stirling has classified all wetlands, lakes and their immediate surrounds within conservation reserves as Wildlife Protection Areas and requires dogs to be under control at all times.

Given Herdsman Lake Regional Park's high conservation values, the need to protect the Park's native fauna and the opportunity to exercise dogs off leads in nearly all City of Stirling reserves, it is appropriate that dogs are only permitted in the Park provided they are on a leash and under effective control at all times. Dogs will not be permitted in areas of the Park zoned for Conservation and Protection (see Figure 4 – Management Zones and Areas), areas surrounding the Wildlife Centre or areas such as the wetlands or water bodies of the Park.

The Perth Horse and Pony Club operates within an area in the north-east of the Park. Riding horses will only be permitted within this area as it may degrade Park values, and may conflict with other Park uses.

INTRODUCED ANIMALS

Introduced animals such as the mice, European red foxes, feral cats and black rats are present within the Park. All these animals have a detrimental effect on the Park's wildlife and their control and removal will help protect the integrity of the Park.

Introduced ducks should be monitored for any interbreeding with native ducks. If it is considered that the introduced ducks or hybrid offspring are affecting the wellbeing of native bird life then they will be removed. It is likely that hybridisation and competition between domestic and native ducks is adversely affecting the native species at Herdsman Lake.

Park visitors will be discouraged from feeding ducks and other birds through educational signs (see Section 16). Artificial feeding encourages greater numbers of birds than can be naturally supported. Uneaten food such as bread also increases nutrients (in already nutrient rich lakes) and decaying bread can also allow botulism to spread in bird populations.

Flocks of Chestnut-breasted Manikins (*Lonchura castaneothorax*), a northern Australian species, occur

around the Park. This species has most likely escaped from aviaries and may compete for habitat and resources with local birds in the Park.

With regard to the removal of introduced animals in the Park, the managing agencies will need to determine the extent and impacts of introduced animals and then, where appropriate, implement control options.

Strategies

1. **Use interpretative information to inform the community about the adverse effects of pets on native fauna and the implications of dumping pets in the Park (Section 39). (CALM, CS) [High]**

2. **Exclude dogs from areas of the Park zoned for Conservation and Protection, areas surrounding the Wildlife Centre as well as the wetlands or water bodies of the Park. For all other Park areas ensure dogs are on a leash and under effective control at all times. (CALM, CS) [High]**

3. **Provide dog excreta bins and dog excreta bags at appropriate sites within the Park. (CALM, CS) [High].**

4. **Implement the Cat Control Local Law for areas surrounding the Park. (CS) [Ongoing]**

5. **Develop and implement a strategy to control introduced animals (e.g. cats and foxes) within the Park. (CALM, CS) [High]**

6. **Remove hybrid and introduced ducks from the Park. (CALM, CS) [High].**

21. Rehabilitation

The objective is to restore degraded areas of the Park to a stable condition resembling the natural environment as closely as possible.

Past land uses have caused significant environmental degradation to Herdsman Lake Regional Park. Drainage systems, agriculture, fire, market gardening and surrounding urban development have resulted in severe modifications to vegetation communities and significant weed invasion.

A variety of techniques are available for landscape rehabilitation and the most appropriate is determined by the specific circumstances encountered.

Where possible, plant material or seed used in rehabilitation works should originate from within the Park or the nearest viable seed source, in order to conserve the genetic integrity of the vegetation communities. It is important that mulch and soil used in rehabilitation works does not contain unwanted weed seeds, pollutants or disease (Phytophthora dieback) (see Section 13).

Seed collection from within the Park will generally only be permitted for rehabilitation projects within, or directly impacting upon the Park.

Given Herdsman Lake's urban surroundings, an important consideration in Park rehabilitation will be the maintenance of views. Where possible, views will be maintained, however, the principles of conservation should not be compromised. Lower vegetation types will be used to maintain views over the Lake. Local residents will be informed of significant revegetation works proposed for the Park.

Local residents, community groups and education institutions should be encouraged to be actively involved in rehabilitation works. These activities are to be co-ordinated by the joint managers of the Park through the preparation of a rehabilitation plan for the Park.

The rehabilitation plan will provide a guide for the long-term restoration of degraded areas within the Park. The plan will identify major disturbance sites within the Park and priorities for their restoration to a condition resembling the natural environment.

Rehabilitation of areas fringing the lakes and wetlands will be given a high priority. Local fringing vegetation helps create a more natural habitat and nutrient inputs are reduced through filtration and storage (see Section 14).

The managing agencies acknowledge the enormous effort by volunteer groups in completing rehabilitation works within the Park. In undertaking rehabilitation projects volunteer groups should establish agreed processes and outcomes with the managing agencies. All activities should be consistent with the planning and operations for the Park. When undertaking rehabilitation works within the Park, CALM is guided by Policy Statement No. 10 – Rehabilitation of disturbed land.

Strategies

1. **Prepare and implement a rehabilitation plan for the Park prioritising proposed works. A priority will be the rehabilitation of wetland fringing vegetation. (CALM, CS) [High]**

2. **Co-ordinate rehabilitation works between the land managers and relevant community groups. (CALM, CS) [Ongoing]**

3. **Co-ordinate rehabilitation with weed control, fire protection and recreational developments at the planning, design and**

implementation stages. **(CALM,CS) [Ongoing]**

4. **Inform local residents neighbouring the Park when proposing to undertake significant rehabilitation works within the Park. (CALM, CS) [Ongoing]**

5. **Use locally collected seed (where possible) for propagating plants or for direct seeding. (CALM, CS) [Ongoing]**

6. **Encourage members of the local community and schools to participate to undertake rehabilitation works and seek external funding to achieve these works where possible. (CALM, CS) [Ongoing]**

7. **Ensure mulch and soil used in rehabilitation works does not contain unwanted seeds or disease. (CALM, CS) [Ongoing]**

8. **Where appropriate, allow licensed seed collection from within the Park for rehabilitation projects within, or directly impacting upon the Park. (CALM, CS) [Ongoing]**

22. Cultural Heritage

The objective is to identify, protect and appropriately manage sites with Aboriginal and non-Aboriginal cultural heritage value within the Park.

ABORIGINAL USE AND ASSOCIATION

Little is known of Aboriginal use and association with the lands that comprise Herdsman Lake Regional Park. An investigation into Aboriginal significance of wetlands and rivers on the Swan Coastal Plain (O'Connor, Quartermaine and Bodney, 1989) makes no reference to Herdsman Lake as having any special Aboriginal significance. The report, however, mentions a letter by Daisy Bates, a pioneer anthropologist, who makes reference to an Aboriginal burial at Herdsman Lake. The location of this burial place is unknown, and it has been suggested that it could be "anywhere within a few kilometres of the lake edge" (O'Connor, *et al*, 1989).

Aboriginal Heritage Act (1972)

Under the *Aboriginal Heritage Act (1972)*, it is an offence to damage, alter or destroy any Aboriginal sites unless written consent has been obtained from the Minister for Aboriginal Affairs. This includes sites not yet registered with the Aboriginal Affairs Department.

Declared Aboriginal sites within or near Herdsman Lake Regional Park are as follows:

- S02411 - Herdsman Lake;
- S00681 - Herdsman Lake North; and
- S00682 - Herdsman Lake North East.

Native Title Amendment Act (1998)

The land comprising Herdsman Lake Regional Park is subject to two native title claims. In accordance with the *Native Title Amendment Act (1998)* (NTAA), public works constructed on all reserved lands and waters managed by CALM will need to be notified in writing. Parties that require notification are:

- any representative Aboriginal bodies; and
- registered native title bodies (corporate) and registered native title claimants for the CALM land/waters on which the operations are to be carried out.

These parties need to be given the opportunity to comment on the proposed public works. "public work" is defined in the NTAA to include buildings, structures which are fixtures, roads, bridges, wells, bores and major earthworks constructed or established on behalf of the Crown. Additionally, a management plan for any National or State Park intended to preserve the natural environment of an area must be notified in the same manner as for public works. The NTAA's intention to preserve the natural environment will probably cause sections of regional parks to be included in this requirement.

NON - ABORIGINAL USE AND ASSOCIATION

In 1854 a large area of land in the vicinity of the Lake was granted to a group of Benedictine monks and by the 1900s the majority of Herdsman Lake area was owned by the Roman Catholic Church (Blyth and Halse, 1986). At this time, land use consisted mainly of stock for grazing.

In 1912, the Osborne Park area was made suitable for market gardening by drainage into Herdsman Lake (Blyth and Halse, 1986). In 1916 the soils of Herdsman Lake were tested for agricultural potential and found to be inferior to those in Osborne Park (MRPA, 1976). Despite this a solider settlement scheme began in 1920 through purchase of land from the Roman Catholic Church (Blyth and Halse, 1986) which was followed by an ambitious planning scheme to reclaim land from the Lake.

With the introduction of the drainage system for the soldier's settlement scheme, Herdsman Lake became a compensating basin for drainage waters from surrounding areas (Clarke, Davis, Murray, 1990). Drainage work commenced in 1921. An open drain was constructed from Osborne Park to pass through the north western corner of Herdsman Lake and flow, via a three kilometre long tunnel, to the Indian Ocean near Floreat Beach. A system of subsidiary drains, connected

to the Osborne Park Main Drain was developed to drain Herdsman Lake itself. Irrigation of the reclaimed Lake was affected by a system of locks on the drains. Drains could be made to overflow into the surrounding lands when irrigation was required (Teakle and Southern, 1937).

The drainage scheme was completed in 1925. The sale of long narrow blocks of land radiating out from the edge of the Lake began in 1928 but the project was never successful (Blyth and Halse, 1986). Unlike adjacent areas, the highly acidic Lake bed peat of Herdsman Lake proved unsuitable for intensive agriculture and the area still flooded in winter. This led to a detailed soil survey by Teakle and Southern in 1934 to fully assess the agricultural potential of Herdsman Lake (MRPA, 1976).

Since the 1930s, past uses have included cattle grazing and extensive market gardening. While both of these land uses have been removed from the Park, the pressures of urban development have gradually led to the encroachment of residential and industrial developments upon the Park.

The Stephenson - Hepburn report of 1955 recommended reservation of the Lake area for Parks and Recreation. This was subsequently implemented in the 1963 Metropolitan Region Scheme (MRPA, 1976).

Following the implementation of the 1976 Concept Plan for Herdsman Lake, several regional roads were developed near the Lake as well as an industrial zone to the north-east and residential developments on the north-west and south-west shores of the Lake. The Concept Plan recognised the value of the natural environment by restricting access to the central wetland area. The concept of creating deep channels with open waters to form a moat around the Lake was initiated to increase the diversity of habitats available to wildlife. Subsequently three deep lakes were formed, known as Floreat Waters, Industrial Lake and Powis Lake, each with shallow extensions to form part of the moat proposed for the whole Lake. To date the moat is still to be completed. Approval was granted by the former State Planning Commission in 1988 for dredging operations to complete the moat surrounding Herdsman Lake (see Section 13).

The ICOMOS Burra Charter

The ICOMOS Burra Charter, adopted by the Australian International Council on Monuments and Sites as revised in 1999, provides the basis for management of places of cultural significance. It defines conservation principles, processes and practises for application to places of cultural significance.

The main feature of European cultural heritage value in the Park is the Herdsman Lake Settlers Cottage. The cottage which provides an example of an early settlers' cottage and has been acquired and renovated by the National Trust of WA in association with the Western Australian Planning Commission. The cottage and the surrounding area (which contains a small vegetable garden and interpretive display) will be vested in the National Trust in accordance with Section 9 – Park Management Zones.

Strategies

1. **Ensure management obligations are fulfilled according to the *Aboriginal Heritage Act (1972)* and the *Native Title Amendment Act (1998)* before any planning or public works take place. (CALM, CS) [Ongoing]**

2. **Incorporate information on Aboriginal and non-Aboriginal history of the Park into interpretive material where appropriate (Section 39). (CALM, CS) [High]**

3. **Liaise with Aboriginal and historic groups to determine their interests and possible involvement in the Park. (CALM, CS, NT) [Ongoing]**

4. **Manage historic sites in accordance with the ICOMOS Burra Charter and in consultation with other appropriate conservation bodies. (National Trust of Australia) [Ongoing]**

23. Park Aesthetics and Landscape Amenity

The objective is to maintain and enhance the natural and cultural landscape qualities of the Park.

LANDSCAPE DESCRIPTION

The Park lies within the Swan Coastal Plain landscape character type (CALM 1994). The Coastal Plain slopes gently westwards from the Darling Scarp to the Indian Ocean. The Park is located approximately five kilometres from the coast and is part of a chain of wetlands that extends north-south parallel to the coast.

As a series of wetlands, Herdsman Lake, Lake Monger and Jackadder Lake provide strong visual connections to and within surrounding residential suburbs. Herdsman Lake, the predominant landscape feature of the Park, helps define the character of an area formerly known as "The Great Lakes Area" shortly after European settlement (Blyth and Halse 1986).

The Park includes a variety of different landscapes, ranging from "natural" areas to highly modified, developed parkland areas. This variety of landscapes is in contrast to the surrounding urban development and increases the Park's aesthetic value.

Human intervention has had significant impacts upon Herdsman Lake Regional Park and its surrounds. Firstly, the Park is surrounded by urban development which has isolated Herdsman Lake from nearby wetland areas. Secondly, the Park's natural landscapes have been modified by the dredging of open water bodies (Powis Lake, Industrial Lake and Floreat Waters), the construction of reticulated open parkland, the removal of Lake fringing vegetation and the introduction of bulrush. Other infrastructure and facility developments include car parks, recreation facilities, board walks, built structures, signs, and drainage infrastructure.

LANDSCAPE QUALITY

The Park landscape encompasses areas which can be described as high, medium or low visual quality. These categories can be mapped using CALM's Visual Management System, 1989. Once mapped, any modifications within and adjacent to the Park can be assessed according to the visual quality rating and the ability of the landscape to incorporate the proposed change.

There are many areas of high scenic quality, most of which occur around the wetlands and open water bodies of Herdsman Lake.

A modified landscape is not always considered to be of low scenic quality. Areas of high scenic quality can include well maintained parkland, areas fronting on to water elements, and areas which have extensive views that are enjoyed and appreciated by visitors. Having a natural or parkland foreground with a backdrop of Perth's central business district skyline can also contribute to high visual quality. The Park contains all these features.

Areas of low visual quality include large cleared areas, highly disturbed areas (with dumped rubbish or weed infestation), built structures such as drainage outlets, views into adjoining houses, power lines and other utilities. These structures detract from the enjoyment of the lakeside environment and require upgrading, replacement, removal or screening to contribute positively to Park amenity. Provision of adequate shade is also an issue that has a major impact on the quality of visitor experience and landscape amenity.

LANDSCAPE CHARACTER

Maintaining or enhancing the natural and cultural landscapes of the Park are integral components of the effective management of the Park. While this means protecting natural areas, in other areas it may involve upgrading modified landscapes. Vegetation used in rehabilitation works should use local plant species grown from locally collected seed or from the nearest viable seed source. The re-created landscape should resemble the character of the original landscape. It is important that the ambience of the wetland is retained even if the area is going to be used intensively. View corridors incorporating the use of low vegetation should be considered in rehabilitation planning (Section 21). In grassed areas, a substantial part of the shoreline should be planted with rushes. Rushes would not impede the view of the water and would add to the "natural" appearance of the area, as well as providing habitat for birds and trapping nutrients.

The strategy of planting only local plants within the park will not apply to areas surrounding the Herdsman Lake Settlers Cottage. Non-local species that reinforce the historical character of the cottage will be allowed, provided they are not invasive.

Strategies

1. **Classify landscape features in the Park according to CALM's Visual Management System in order to assess the form and location of all facilities and services within the Park. (CALM, CS) [Low]**

2. **Identify and protect important landscapes within the Park. (CALM, CS) [Low]**

3. **Ensure recreation facilities and park furniture are of a high standard and suited to the surrounding landscape. Facility provision should be planned and agreed to by the joint managers of the Park. (CALM, CS) [Ongoing]**

4. **Ensure that new infrastructure and developments within or adjacent to the Park are designed to minimise impacts on visual quality and include a landscape plan demonstrating integration with the surrounding area. Liaise with Western Power, Water Corporation, City of Stirling and other infrastructure providers before works are carried out in the Park. (CALM, CS) [Ongoing]**

5. **Identify sites of low visual quality (e.g drainage outlets, degraded and weed infested areas) and undertake appropriate remedial action. (CALM, CS) [Low]**

6. **Consider view corridors when undertaking rehabilitation works within the Park. (CALM, CS) [Ongoing]**

24. Greenway Corridors and Links

The objectives are to manage Herdsman Lake Regional Park consistently with Greenway principles and to encourage appropriate management of corridors and links between the Park and other conservation or recreation areas.

Greenways is a generic term that has been applied to a wide range of landscape planning strategies, concepts and plans (Tingay and Associates, 1998). It has been defined as "networks of land containing linear elements that are planned, designed and managed for multiple purposes including ecological, recreational, cultural, aesthetic, or other purposes compatible with the concept of sustainable use" (Ahern, 1995).

Herdsman Lake Regional Park is surrounded by urban and industrial development, which isolates it from other major "green" areas. Due to the intensity and close proximity of development, the Park is vulnerable to the pressures of adjacent land uses. It is therefore important that greenway links between the Park to

adjoining parkland areas of open space are maintained and further enhanced where necessary.

Major roads limit linkages within the Park and between other wetland areas. For example, Jon Sanders Drive divides Glendalough Open Space and the remainder of the Park.

On a regional scale, there are a number of "green" areas within close proximity to the Park. To the east is Lake Monger, to the north is Lake Gwelup, and to the south-west are the Churchlands campus of Edith Cowan University, Wembley Golf Complex and Bold Park. Kings Parks is located approximately four kilometres to the south.

A study of Perth's Greenways has identified a number of proposed corridors including and surrounding Herdsman Lake Regional Park. These are illustrated in Figure 8 and are as follows:

Link Number	Link Name
23	Herdsman Lake to Lake Gwelup
9	Mitchell Freeway / Railway
30	Herdsman Lake – Lake Monger – Freeway –Wanneroo Road
18	Herdsman Lake – Bold Park

(Tingay and Associates, 1998)

In addition to the corridors outlined above, it may be possible to extend the Herdsman Lake – Bold Park greenway to include Lake Claremont, Cottesloe Golf Course and Allen Park.

The use of local plants in landscaping road reserves together with purpose-designed animal underpasses and overpasses as well as fauna warning signs can assist to minimise the impact of major roads on the movement of fauna.

The type of interface between the Park and adjoining land uses plays a major role in insulating or exposing (as the case may be) the Park to undesirable impacts. The spread of invasive weed species into the Park can be reduced by providing educational information to local residents about the proliferation of weeds from adjoining properties and by the planting of local species in existing areas. Park managers should liaise with the landowners of proposed Greenways near the Park to develop a co-ordinated approach to their management.

Strategies

1. **Liaise with the landowners involved with proposed Greenways near Herdsman Lake regional Park to develop a co-ordinated approach to the management. (CALM, CS, MfP) [Medium]**

2. **Through a communication plan, develop and foster community awareness about the importance of Greenway corridors. (CALM, CS) [Low]**

3. **Develop a list of Park compatible plants to be provided to Park neighbours and the City of Stirling. Local plant species should be used in landscaping road reserves near the Park. (CALM, CS) [Medium]**

4. **Encourage providers of transport and power services to adopt "wildlife friendly" designs, management and maintenance practices. (CALM, CS) [Medium]**

Figure 8 - Greenway Corridors and Links

Source: Tingay and Associates, 1998

D. RECREATION

25. Recreation Goal and Guiding Principles

RECREATION GOAL

Manage for recreation and leisure by providing high quality recreation opportunities which are compatible with the protection and enhancement of Park values.

RECREATION GUIDING PRINCIPLES

1. Preservation of the Values of the Land Itself
Natural systems (including landscapes, particular sites, biota) should be able to sustain the recreation which is occurring or proposed. Recreation should be focused in public use areas of the Park, zoned for recreation. The intensity of recreational activities may need to be controlled to ensure it does not destroy the value and nature of the activity.

2. Consistency of Recreation with Reserve Purpose
Recreational activities should be compatible with the assigned purpose and management zoning of reserves within the Park. Reserves within the Park will be assigned an appropriate purpose for the protection and enhancement of Park values under the *Land Administration Act (1997).*

3. Equity
A range of activities consistent with a reserve's purpose should be allowed in the Park. However, uses that impair other forms of acceptable use or jeopardise the safety of other visitors should be specifically managed, directed to more appropriate places or not permitted. Priority will be given to low impact activities and those that increase awareness, appreciation and understanding of the natural environment.

4. Management
Activities and facilities must comply with the managing agencies' requirements. If effective management of recreational activities or facilities cannot be provided they should be restricted, relocated or removed from the Park.

5. Recreation Opportunities
A range of recreation opportunities should be provided for in a local and regional context thereby providing Park visitors with a choice of recreation activities and experiences which enhance the values of the Park. The Recreation Opportunity Spectrum (ROS) is a planning tool that enables managers to provide for the greatest possible range of opportunities in a given area, while limiting unintended incremental development (Stankey and Wood, 1982). Principles of the ROS have been utilised in developing the Recreation Masterplan.

26. Visitor Use

The objective is to ensure that the level and type of visitor use are sustainable and minimise conflict with other Park visitors and values.

A diverse range of recreational uses and activities occur within Herdsman Lake Regional Park. A recreation survey to identify the reasons and numbers of people visiting the Park was undertaken by Barnes (1998). The survey identified that most visitors to the Park are local residents who use it for recreational purposes such as walking, exercising the dog, enjoying the scenery, cycling, picnic and playground use. At Maurice Hamer Park, for example more than 75% of the people surveyed walked to the Park and over 35% visited the Park daily (Barnes, 1998).

The Herdsman Lake Wildlife Visitor Centre is a popular facility within the Park. The Gould League in conjunction with the Education Department organises environmental and educational programs at the Centre which attract large numbers of school groups throughout the year. In 1998, approximately 267 schools and 7,422 students visited the Centre (Report to the Gould League Council, 1999).

Observation and community input also suggest that the natural features, serenity and abundant wildlife attract visitors to the Park. Workers from the nearby Herdsman Industrial Area also frequent the Park at lunchtime.

An important consideration for the integrated management of the Park is that the managing agencies have the necessary authority to regulate visitor use (see Section 10). Interagency agreements will be required to allow Park managers to co-ordinate and maintain consistency in the application and enforcement of regulations, for example, the regulation of dogs within the Park.

Strategies

1. **Develop and implement a visitor survey program to gain an understanding of visitor use, numbers and satisfaction within the Park. Use CALM's VISTAT as a basis for the program. Following the survey take appropriate action where necessary. (CALM, CS) [High]**

2. **Ensure Park management has the authority required to control visitor use when necessary. (CALM, CS) [High]**

3. **Prepare a communication plan incorporating a sign system and sign plan as well as interpretive strategies and techniques. Interpretive material should be aimed at:**
   - **promoting visitor use and activities which are consistent with the protection and promotion of Park values and minimise conflicts between Park visitors;**
   - **providing information about the recreation and interpretation opportunities available in the Park. (CALM) [Medium].**

27. Recreation Masterplan

A Recreation Masterplan will help ensure that a variety of recreation opportunities are offered in the Park and that they will complement those offered in surrounding areas such as Jackadder Lake and Lake Monger.

A Recreation and Interpretation Plan for Herdsman Lake Regional Park was developed by Tooby and Associates in 1984. Considering the changes that have occurred to the Park, the increase in surrounding residential development and different management requirements, this plan has been revised.

The revised Masterplan will co-ordinate recreation developments within the Park and will allocate appropriate facilities and services to those areas of the Park best able to accommodate them in a sustainable manner.

The Masterplan reflects the management zones and land uses described in Section 9 of this Plan. The three management zones (Conservation, Natural Environment Use, Recreation) provide a guide to acceptable facilities and uses at a given site. The Recreation Masterplan considers access, internal circulation and the type of facilities to be provided within the Park.

The wetlands areas of Herdsman Lake Regional Park, managed for Conservation and Protection will have access limited to boardwalks with the emphasis being on the enjoyment of nature. The Natural Environment Use areas will have greater access with the emphasis on passive uses, education and interpretation. Provision of some facilities within these areas is anticipated. The designated Recreation areas will be the most intensively used and modified sections of the Park. The emphasis will be on providing well-designed recreation areas without detracting from the natural and cultural values of the Park.

Strategies

1. **Implement the Recreation Masterplan that allocates appropriate facilities and services to those areas of the Park best able to accommodate them in a sustainable manner. Priority will be placed on developing appropriate access in the Park (CALM, CS) [High].**

28. Recreation Sites and Facilities

The objective is to provide and manage a range of quality recreation sites and facilities that allow for a diversity of recreation opportunities without conflicting with other Park values. Recreation facilities should complement the surrounding areas of the Park focusing on nature based opportunities.

Although the Herdsman Lake Regional Park provides for a range of recreation opportunities, of particular significance is the opportunity to recreate in a natural environment within an urban area. Maintaining this experience will be a key consideration in providing for recreation sites and facilities within the Park as it is this experience that attracts many people to the Park.

In the past there has been limited direction for the co-ordinated development of recreation sites within the Park. This has lead to a proliferation of facilities in the Park some of which are poorly located, while others could be considered inappropriate or surplus to demand. Conversely, there are areas in the Park which could sustain greater public use provided appropriate facilities are developed. These include North Lake Parkland and Glendalough Open Space (refer to the Recreation Masterplan, Figure 9).

Facilities that are considered to be poorly located include the car parking areas in the northern section of Maurice Hamer Park and at Moondine Drive Parkland. Facilities such as the tennis courts may be considered inappropriate considering the intention to focus on nature based recreation within the Park. However, due to the historical use of these facilities, this plan will allow for their continued operation within the Park.

Site Plans

Three site plans will be prepared for North Lake Parkland, Glendalough Open Space and the area surrounding the Wildlife Centre providing more detailed direction for the development of each site. The site plans are discussed below:

North Lake Parkland

The site plan for North Lake Parkland will focus on improving access and providing additional facilities. The current road into the site lacks prominence and is difficult to exit with limited visibility. There may be the potential for the provision of new facilities such as a restaurant, café or kiosk, upgraded playground and a walk circuit around Industrial Lake. Controlled after hours access will be considered as part of the planning for the site. Further investigation of social and environmental issues will be required by the managing agencies.

Glendalough Open Space

The Glendalough Open Space site plan will investigate providing active recreation facilities in the north of the site. This may include facilities such as a sports ground, playground and basketball area. The development of this site for active recreation is intended to provide an alternative location for activities considered inappropriate at Herdsman Lake.

Wildlife Centre

The site plan for the area surrounding the Wildlife Centre will concentrate on improving access, car parking and the prominence of the Wildlife Centre in relation to the surrounding area. Currently the site is difficult to access with the configuration of the intersection at Selby Street and Pearson Street and car parking is sub-standard. Improved pedestrian access is also an important consideration for the site.

Perth Horse and Pony Club

The preparation of a site development plan for the Perth Horse and Pony Club site will be considered subject to lease negotiations and discussions between the City of Stirling and CALM. There is potential to enhance the area allowing for additional visitor services and multiple use of the site.

Strategies

1. **Prepare site development plans for significant works within the Park. (CALM, CS) [Ongoing]**

2. **Provide suitable and safe facilities guided by Australian standards. (CALM, CS) [Ongoing]**

3. **Develop facilities and structures in a manner that is sympathetic to the surrounding landscape. (CALM, CS) [Ongoing]**

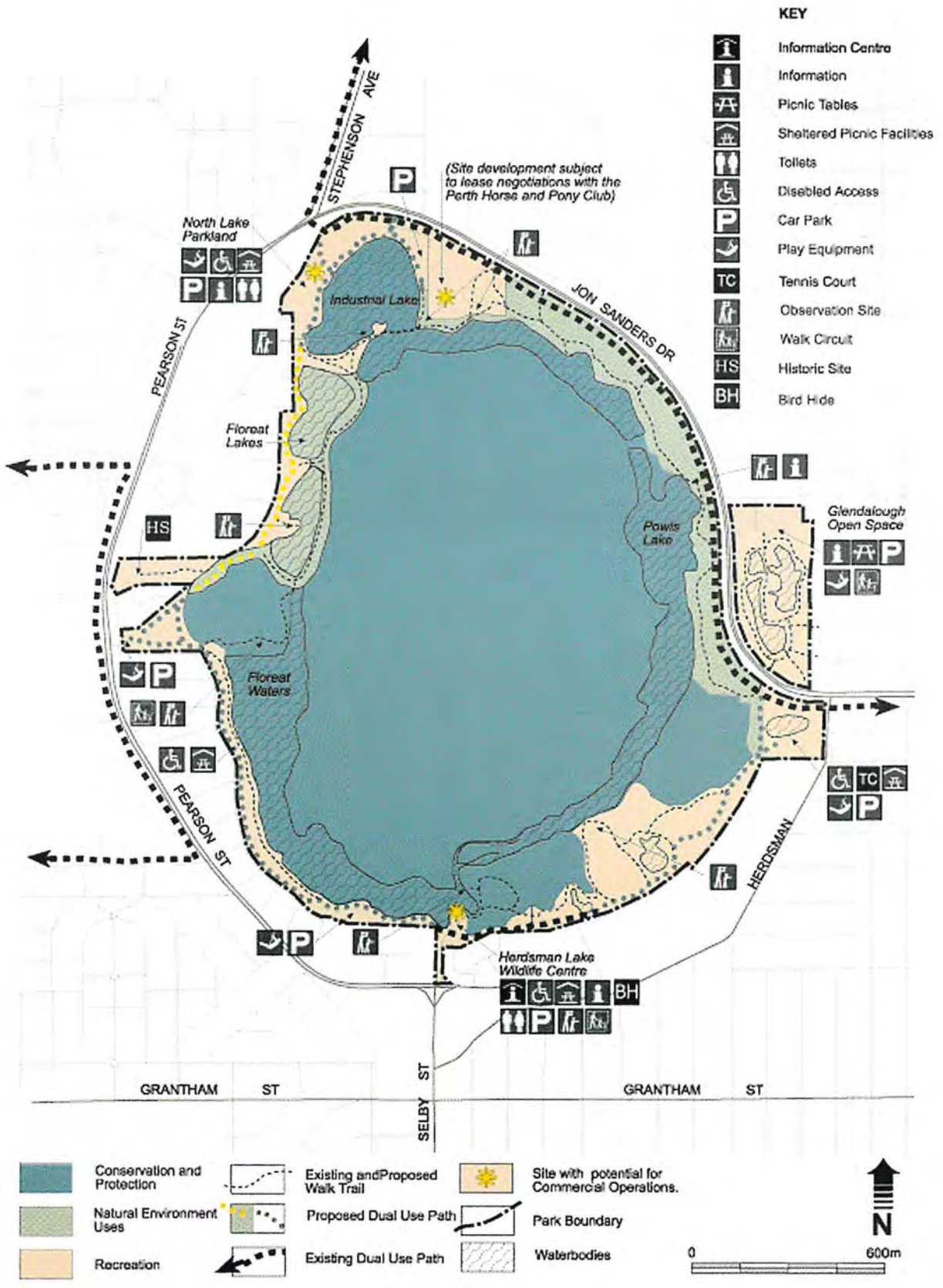

Figure 9 - Recreation Masterplan

29. Park Access and Circulation

The objective is to provide safe, convenient and structured access to and within the Park that is consistent with Park values.

Having a large park surrounded by urban development means that access is a major issue. While access for recreation and education is a legitimate use within the Park, uncontrolled vehicle and pedestrian access has degraded some areas and is a major issue for the managing agencies. Uncontrolled access also enables the dumping of rubbish and garden refuse which is presently a problem.

Park access and circulation are key components of the Recreation Masterplan (see Figure 9).

Road Access

The Park is serviced by a comprehensive road network system with a number of major roads passing within close proximity to the Park, including the Mitchell Freeway to the east.

Direct access to the Park is via a number of suburban streets including Jon Sanders Drive, Herdsman Parade, Flynn Street and Pearson Street. Jon Sanders Drive divides the Park in the east separating Glendalough Open Space from Herdsman Lake.

TransPerth operates a number of bus services to areas surrounding the Park. Buses stopping along Pearson Street provide access to the Park.

Car Parking

The provision of adequate car parking will help prevent the undesirable effects of uncontrolled parking and access. Existing car parking is available at the following nine locations: the Wildlife Centre, Moondine Drive Parkland, Herdsman Lake Tennis Courts, Perth Horse and Pony Club lease area, North Lake Park, The Lane, Maurice Hamer Park (north), Maurice Hamer Park (south), and Glendalough Open Space.

A key issue for the managing agencies to address is the appropriateness of car parking in the Park. While it is anticipated that no further car parks will be required in the Park, it should be recognised that a number of car parks may need to be redesigned or access controlled after hours. For example the car parks at the Wildlife Centre and The Lane may be redesigned to meet Australian design standards or to increase their capacity. Additionally, due to the small size of a number of existing car parks, several may need to be redesigned or removed as they do not conform to standards. It is proposed to remove the car parks at Maurice Hamer Park (north) and Moondine Drive Parkland as the majority of visitors to these areas are local residents and on-street parking is considered sufficient. In accordance with the Recreation Masterplan, car parking will be re-assessed during the term of this Plan to ensure it is adequately servicing demand.

Cycle and Pedestrian Access

Local residents access the Park by cycling and walking. Quiet suburban streets surrounding the Park provide good walking and cycling environments. A dual use pathway (DUP) borders the Park to the north and east along Jon Sanders Drive.

Paths provide access throughout the Park with the exception in the north-west where the path system is incomplete as the area is still under private ownership. Paths are generally constructed of crushed limestone with many being less than two metres in width. Although pedestrian access around the Park is adequate during most times of the year, during winter sections of the path system become inundated after heavy rain.

It is planned to upgrade the path system in the Park to improve access for both pedestrians and cyclist. This will be achieved by developing a DUP around the Park. Where possible, separate pathways for pedestrian and cyclists will be provided in order to avoid the dangers of combined use on the DUP (see Figure 9 – Recreation Masterplan).

Access to the wetlands and waterbodies of the Park will be restricted to the boardwalks as outlined in the Recreation Masterplan. All other access to the wetlands and waterbodies will be prohibited unless it is for monitoring, research, education or managerial purposes.

Access for All

The condition of path surfaces within the Park is poor in sections and inhibits access for people with disabilities. Where required, path surfaces will be upgraded to allow for improved disabled access. Appropriate pathways and ramps will need to be provided to allow those with disabilities to experience the diverse settings within the Park. All paths within the Park will be designed in accordance with Australian standards.

Private Vehicle and Motorbike Access

The illegal driving of vehicles on pathways, grass areas and other recreation areas is a management issue. Private vehicle access will be restricted to designated parking areas and access roads. Access outside these areas may endanger other Park visitors, cause damage to the landscape and adversely affect wildlife.

Model Boat, Boat and Canoe Access

Uncontrolled recreational use of watercraft such as rowing boats or canoes could have adverse impacts on Park fauna and lakeside vegetation. The use of watercraft will only be permitted for education, research and managerial purposes for approved users. The use of motor craft for recreational purposes is not considered appropriate in the Park.

A study on model boat activity on Herdsman Lake was undertaken by Birds Australia to determine the impact of this activity on birdlife. The study found that the activity of the WA Model Boat Club was not detrimental to waterbirds (Bamford *et al*, 1988). However, the retrieval of boats had the potential to disturb bird-breeding sites. The use of model boats is therefore prohibited.

Access for Maintenance Vehicles

Boundary access for maintenance vehicles is provided at many points throughout the Park. Vehicle use within the Park must be justified and appropriately controlled. Where possible, maintenance vehicles should use existing pathways.

Horses and other Animals

Riding horses and other animals in the Park could create conflict with the Park's values and its users. Riding of horses will only be considered at the Perth Horse and Pony Club located in the north-east of the Park.

Strategies

1. **Implement the Recreation Masterplan. The Masterplan will:**
   - **co-ordinate access and circulation allowing visitors to move safely and conveniently throughout the Park. Park access should be integrated with surrounding community and regional path networks;**
   - **provide appropriate recreation facilities and services;**
   - **provide adequate parking facilities at major recreation nodes;**
   - **provide sensitively located and designed shoreline access to the Lake (e.g. boardwalks and viewing platforms);**
   - **restrict private vehicles to designated car parks and access roads. (CALM, CS) [High]**

2. **Prohibit the use of recreational watercraft (including model boats) in the wetland and waterbodies of the Park. The use of watercraft will only be permitted for education, research and managerial purposes for approved users. (CALM) [High]**

3. **Where appropriate, ensure pathways are developed in accordance with Australian standards for people with disabilities. (CALM, CS) [Ongoing]**

4. **Allow for emergency response within the Park and ensure new paths enable emergency vehicle access (Section 29). (CALM, CS) [Medium]**

5. **Re-assess car parking facilities within the term of this Plan to ensure they are adequately servicing demand. (CALM, CS) [Ongoing]**

6. **Restrict private vehicles to designated car parks and access roads. Design facilities that restrict vehicles to designated areas. (CALM, CS) [Ongoing]**

30. Signs

The objective is to provide a system of signs that communicates the location of the Park features, provides orientation assistance, identifies hazards, leads to appropriate use of the recreation areas and helps communicate information about the Park.

Signs play an important role, both notifying Park visitors about the way in which the Park can be accessed and used, as well as communicating information about the Park's identity and values. Signs need to be designed and located to provide messages about the Park in a consistent way and without compromising the quality of the area in which they are sited.

To help ensure signs are designed and located appropriately, CALM will prepare a sign system and a sign plan for the Park.

Sign System

The sign system will be form a part of the overall CALM Sign Manual and will outline the design specifications of all signs provided in the Park. It is important that the signs be of a high standard, robust and have a consistent style. Existing sign styles vary between those located in areas under the management of the City of Stirling and those managed by CALM. The sign system will provide a consistent system of signs which are clearly identifiable with the Park.

Sign Plan

The sign plan will direct the placement of signs within the Park. Informational, directional and interpretive signs will be placed at prescribed locations within the Park.

Recognition of the Park will also be enhanced by the use of a park logo on all signs installed by the management agencies.

Strategies

1. **Develop and implement a sign system and sign plan for the Park. The sign system will outline the design of all signs provided in the Park and will form part of CALM's Sign Manual. The sign plan will direct the placement of Informational, directional and**

interpretive signs within the Park. (CALM, CS) [High]

2. **Develop a Park logo for use on feature and information signs. (CALM, Community Advisory Committee) [High]**

3. **Liaise with other authorities which have jurisdiction within the Park to ensure consistency of signs within the Park. (CALM, CS) [Ongoing]**

31. Visitor Safety

The objective is to take all reasonable and practical steps to ensure the safety of visitors in the Park.

There is always an element of risk in outdoor recreation activities. Nevertheless, all reasonable and practical efforts will be taken to minimise risks to visitors.

Visitor safety will be promoted through information and education about potential problems and dangers. Visitor safety will also be considered in design of access systems and recreation sites. Recreation facilities will be managed in accordance with relevant Australian design standards. Management actions to reduce safety hazards should, if possible, be consistent with the values of the Park and should not intrude unduly on the experience of visitors. Visitor safety will be an integral component in undertaking maintenance and capital developments within the Park.

When managing risk, the Department of Conservation and Land Management is guided by Policy Statement No.53 - Visitor Risk Management.

Strategies

1. **Prepare and implement a safety audit program to ensure procedures are developed to manage and monitor all known risks. (CALM, CS) [High]**

2. **Ensure visitor safety and risk management is an integral component in undertaking works programs and capital developments within the Park. (CALM, CS) [Ongoing]**

3. **Provide information to visitors that highlights potentially hazardous areas, activities and appropriate preventative actions and emergency procedures. (Section 39). (CALM, CS) [Medium]**

32. Utilities and Park Services

The objective is to provide cost efficient, effective and safe services and utilities within the Park in a manner that minimises environmental impact.

SERVICES

Services such as electricity, water, sewer, gas and telephone are available at locations within the Park. Future recreational, commercial, educational or managerial facilities within the Park may require services at additional locations within the Park.

STORM WATER OUTLETS AND DRAINAGE FACILITIES

The Water Corporation manages the main drains and branch drains leading into and located within Herdsman Lake. The City of Stirling manages the local drainage system entering the Lake.

There are numerous stormwater outlets and drainage facilities within the Park (see Figure 10). The two main issues associated with drainage facilities are:

- Ecological impacts (Section 14 The Lake and Wetlands, Section 15 Vegetation and Section 17 Weeds).
- Aesthetic and visual impacts (Section 23 Landscape Amenity).

The ecological impacts associated with stormwater drainage can be reduced and requires co-operation and consultation between the managing agencies. The management of stormwater entering the Park's wetlands is a catchment wide issue, and controls need to be implemented at that level. No additional outfalls or connection of any newly constructed drain networks to existing outfalls are considered appropriate. Existing stormwater outfalls will be reviewed to assess the viability of improving water quality entering the Park.

Many outlets are unattractive and more attention to detail is necessary so that they blend with their natural surroundings. Consideration should be given to their appearance and function by battering back walls and planting the sides with local vegetation. This would have the effect of improving existing outlets and may assist in stripping nutrients from storm water before it reaches the lake. Together with modifications to their alignment

these treatments should lead to utilities that remain functional and yet merge into their surroundings.

It should be noted, that although the vegetated and unlined drains located throughout the Lake help improve the water quality by stripping nutrients and allowing settlement of silt, the precipitation of inorganic contaminants and degradation of organic contaminants from the runoff water can impede water flow and become stagnant and malodorous. It is therefore important that the Water Corporation and the City of Stirling review and monitor the drains within the Park for improving (or at least not further degrading) the quality of water in the Park.

The impact of the storm water and drainage facilities can be reduced and requires co-operation and consultation between the managing agencies and the Water Corporation.

South-East Sector Development Proposal

In 1997, a site development plan was prepared for the wetland areas of Herdsman Lake near the corner of Jon Sanders Drive and Herdsman Parade by the Western Australian Planning Commission. The Commission proposed to create a new lake adjacent to the existing small lake near the tennis courts which would act as a nutrient stripping basin for drainage waters from nearby roads and developments which currently drain straight into Herdsman Lake.

The excavated material from the new lake was to be used to create a public access track to the main open water moat, a firebreak and to undertake minor top dressing and filling of adjacent open space. A boardwalk, observation deck and an extensive planting program of local species on the new lake fringe was also proposed.

Additionally, a bund was planned which would limit the potential for fire to damage the woodland area adjacent to Jon Sanders Drive. The bund would allow management and public access to the moat within Herdsman Lake.

Although the project has conservation, recreation and management merit, CALM prefers to investigate all possible options for the treatment of stormwater entering the Park prior to the implementing the plan. The implementation of the plan is therefore not a high priority for CALM which will consider its position with regard to the proposal in light of community submissions on this draft Management Plan, overall water management requirements and funding availability.

PARK MAINTENANCE

Regular maintenance is required to provide a safe and pleasant environment for visitors to the Park. Additionally, maintenance activities need to be undertaken in a manner that does not impact upon the conservation values of the Park. Issues such as mowing and fertilising programs need to be strictly implemented to ensure mowing does not encroach into conservation areas and that fertilsiers are not contributing to nutrient runoff. In addition, management access points within the Park need to be controlled in order to prevent inappropriate vehicle access.

Proposed toilets within the Park are to be connected to sewer outlets or other environmentally acceptable disposal systems. The use of septic tanks is to be avoided except in conjunction with alternative treatment units.

TOILETS

The provision of toilet facilities within the Park is addressed in the Recreation Masterplan (Figure 9). At this stage it is not planned to develop any stand-alone toilet blocks within the Park. The toilet facilities indicated at North Lake Parkland would only be constructed as part of a commercial development for the site. Public access to the toilet facilities in the Wildlife Centre will also be investigated. This will include discussions with the Gould League of WA and the WWF.

RUBBISH COLLECTION

The provision of rubbish bins should be minimised and visitors encouraged to take their rubbish home. Managing agencies will determine the location of bins and collection arrangements.

ROADS

Roads will only be constructed in the Park if they are for management purposes or as part of recreation, educational or commercial development. Where possible, facilities should be located close to existing car parks or near the Park boundary to reduce the need to place roads within the Park. Management vehicles should, where possible, use paths to limit the need for additional roads and to minimise the impact on the natural environment.

Future road plans for the area around Herdsman Lake indicate that Stephenson Avenue will be aligned along the north-west boundary of the Park parallel to Pearson Street. This is a part of the State government's plan for a major arterial roads network in the Perth metropolitan area.

POWER LINES

To minimise the visual impact of power supply within the Park it is advocated that all power lines be placed underground. Mains power lines should be placed so that there is minimal visual impact. Where feasible, power supplies should be from alternative energy sources, for example solar power.

Strategies

1. **Where appropriate, ensure a detailed rehabilitation program accompanies service works which may impact on Park values (Section 21). (CALM, CS) [Ongoing]**

2. **Review existing drainage facilities to improve water quality in the Park and to improve the aesthetics of the outlets (Sections 14 and 23). (CALM, WC, CS) [High]**

3. **Consider the development proposal for the South East Sector in light of community**

submissions on this draft Management Plan, overall water management requirements and funding availability. (CALM, WAPC) [High]

4. **Incorporate deep sewer or biological sewage systems with new recreation or commercial facilities. Do not use septic tanks except in conjunction with alternative treatment units. (CALM, CS) [High]**

5. **Promote "take it home" rubbish education. (CALM,CS) [Medium]**

6. **Construct roads within the Park for approved recreation or management purposes only. (CALM, CS) [Ongoing]**

7. **Place power lines to facilities and amenity lighting underground to improve aesthetics of the Park. (CALM, CS) [Low].**

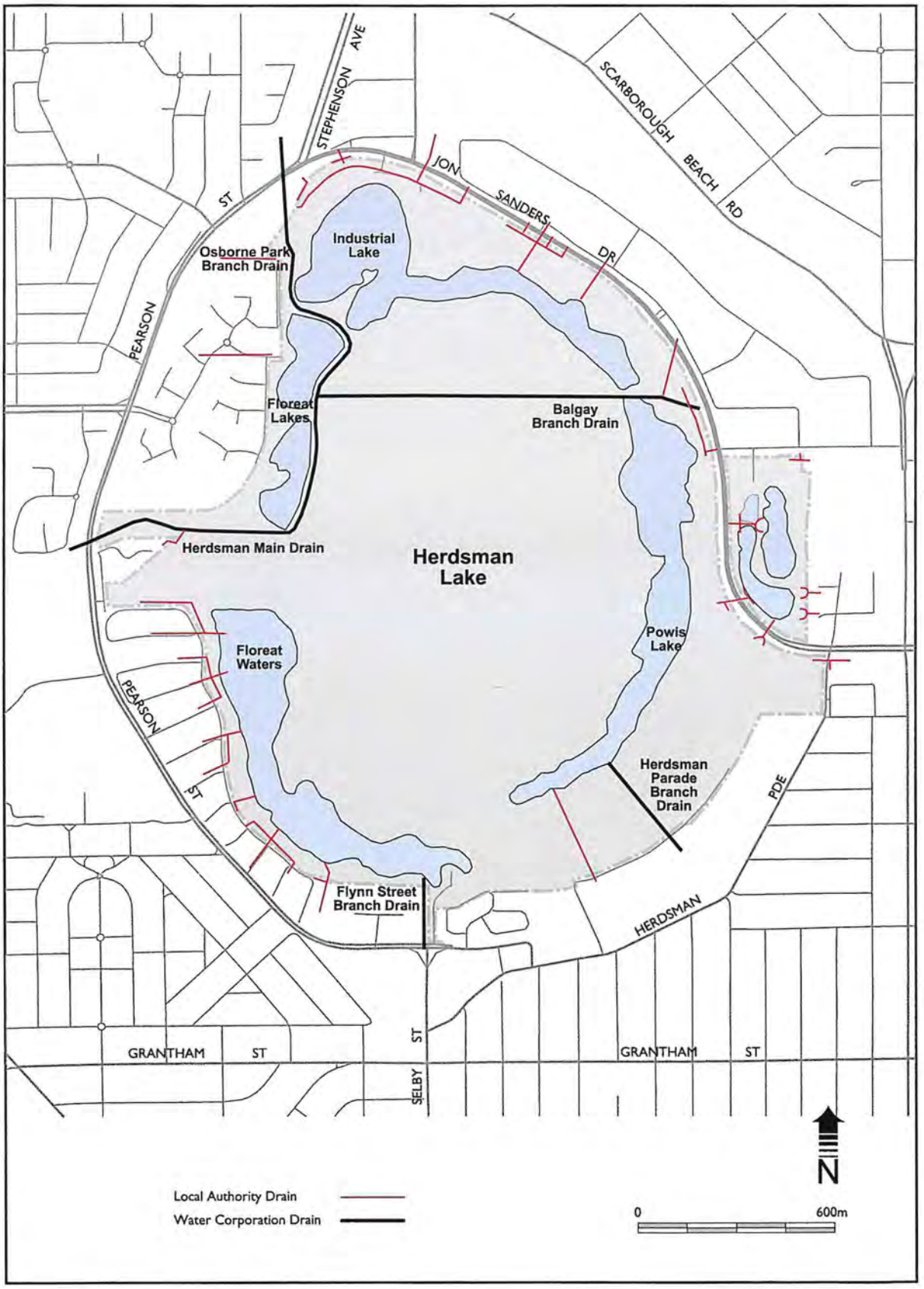

Figure 10 - Existing Drainage Infrastructure
(Source: Clarke *et al* 1990).

E. COMMERCIAL CONCESSIONS

33. Commercial Goal and Guiding Principles

COMMERCIAL GOAL

Allow for appropriate commercial uses within the Park and manage them in a manner that minimises impact on other values and contributes to park management costs.

COMMERCIAL GUIDING PRINCIPLES

1. Consistency of Commercial Use with Reserve Purpose

Commercial activities should be compatible with the assigned purpose of reserves within the Park. Reserves within the Park will be afforded an appropriate purpose for the protection and enhancement of Park values under the *Land Administration Act (1997)*. Developments within the Park should service visitor demand. Facilities or services which exist or can be developed elsewhere, in a way which adequately meet the needs of visitors, would not normally be provided within the Park.

2. Preservation of the Values of the Land Itself

Commercial use should not compromise the natural and cultural values of the Park. Commercial activities should not be located in areas of the Park zoned for Conservation and Protection. Future developments should be of a character and arrangement that do not detract from the natural settings, landscape amenity and conservation values of the Park. Through the tendering process proponents of significant developments within the Park will be required to assess the environmental impacts of the proposed commercial use.

3. Equity

Commercial use within the Park should be of a nature that promotes multiple use by Park visitors. Commercial uses which impair other forms of acceptable use or jeopardise safety of other visitors should be specifically managed, directed to more appropriate places or not permitted. Priority will be given to commercial uses that incorporate features aimed at increasing the awareness, appreciation and understanding of the natural environment. All development applications will be assessed in terms of the overall commercial requirements for the Park.

4. Leased or Owned by the Managing Agencies

Commercial use of areas within the Park should be either through a lease or license arrangement, or where the managing agency owns and operates the facility or development.

5. Financially Viable

Through the tendering process proponents of significant developments within the park will be required to document the financial viability of the proposed commercial use. Revenue generated by all commercial use within the Park will be used to help meet the overall cost of managing the Park.

6. Management

Activities and facilities must comply with the managing authorities' requirements. If effective management of commercial facilities or activities cannot be provided they should be restricted to appropriate levels, relocated or removed from the Park.

34. Leases and Licences

The objectives are to ensure that leases and licenses are consistent with the values of the Park, enhance visitor satisfaction and help offset Park management costs.

Given its urban location and potential to accommodate commercial activities, the Park will continue to be subject to a variety of commercial proposals.

Leases and licenses may be granted on lands or waters managed by CALM to provide appropriate facilities and services for visitors. A lease allows the lessee to occupy a particular area of land or waters, whereas a license allows the licensee to enter and use the land.

Proposals for leases and licenses are assessed by CALM (in consultation with the Conservation Commission of Western Australia) and require the approval of the Minister for the Environment. If the land in question is within a management area of the Water and Rivers Commission, the Commission must be also be consulted. If the land is subject to a Section 16 agreement under the *CALM Act (1984)*, the approval of the owner and consent of the occupier is required before a lease can be granted. Concessions must be consistent with the purpose of the reserve and the protection of its values.

Leases and licenses provide a mechanism to bring private capital and management expertise into visitor services in natural areas. They need to be carefully designed and managed, or they may detract from the conservation and landscape values of the Park. Appropriate concessions can generate income to help offset Park management costs and can significantly enhance public access and enjoyment of the Park.

CALM and the City of Stirling, as managers of the Park, should assess leasing and commercial operations according to the goals and objectives set out in this Plan.

All development proposals on land reserved as Parks and Recreation in Perth's Metropolitan Region Scheme require approval from the Western Australian Planning Commission (WAPC). The WAPC in association with CALM will use this Plan as a mechanism for guiding development proposals within the Park or areas which impact upon the Park.

All commercial concessions within the Park will be established and managed in accordance with CALM's Policy Statement No 18 - Recreation Tourism and Visitor Services. The tendering process for proponents involved in the Park will be consistent with the State and local government tendering processes.

Advertising within the Park requires the approval of the relevant managing agency.

The locations of existing and potential sites for commercial visitor services are illustrated in Figure 9 - Recreation Masterplan.

EXISTING CONCESSIONS FOR VISITOR SERVICES

Existing concessions for visitor services (including community environmental organisations and recreation clubs) within the Park are as follows:

- The Herdsman Lake Wildlife Centre (Gould League of WA).
- The World Wide Fund for Nature (WWF).
- The Perth Horse and Pony Club.
- Tennis courts at the corner of Jon Sanders Drive and Herdsman Parade are available for hire. The City of Stirling's Parks and Reserves section is responsible for their operation.

Wildlife Centre - Gould League of WA

The Gould League of WA provides environmental education programs at the Herdsman Lake Wildlife Centre on behalf of the Education Department. Lease arrangements for the Centre (at lot 421 Selby Street, Herdsman) are currently being negotiated with CALM.

The potential exists to further develop the site into a visitor interpretive centre. Scope exists to promote awareness of the Park through the centre for local, regional and international visitors. In conjunction with these services opportunity exists for the centre to be developed as an education and research centre attracting university and school students as well as the broader community. Research and education studies could be used in monitoring Park requirements. Information on the values of the Park combined with activities and programs to further develop and appreciate these values could also be provided.

As outlined in Section 28 – Recreation Sites and Facilities, a site development plan will be prepared by CALM to upgrade access and parking at the Wildlife Centre. Public access and enhancements to the Centre will also be investigated. This will include discussions with the Gould League of WA and the World Wide Fund for Nature.

World Wide Fund for Nature (WWF)

The WWF played an important role in establishing the Wildlife Centre at Herdsman Lake in the early 1980s. Currently the WWF is utilising a small cottage next to the Wildlife Centre and is negotiating lease arrangements and access requirements to the Centre with CALM and the Gould League of WA.

Perth Horse and Pony Club

The Perth Horse and Pony Club is located in the north-east of the Park adjacent to Jon Sanders Drive (at lot 468 Jon Sanders Drive, Herdsman). The Club operates under an arrangement with the City of Stirling allowing for horse riding activities within the Club's designated area. Due to the historical nature of the use, this Plan will allow for the continued horse riding activities of the Club.

There is however, potential to utilise the Club's area for additional visitors services. Subject to lease negotiations and discussions between the City of Stirling and CALM, consideration should be given to multiple use of the site.

OPPORTUNITIES FOR COMMERCIAL VISITOR SERVICES

Ice Cream Vans, Fast Food Outlets and Bicycle Hire

These businesses might operate in the Park, subject to the issuing of an appropriate licence by the managing authorities. Such activities must comply with the managing authorities' requirements including not conflicting with other Park visitors or degrading Park values.

Café, Kiosk or Restaurant

An opportunity may exist to develop a restaurant, café or kiosk within Herdsman Lake Regional Park. The Park is centrally located, easily accessible and has expansive views to the central business district of Perth. The sensitive siting and design of the building would enable Park visitors to interact with the environment, without significant impacts upon the conservation values of the Park. Revenue generated from lease arrangements will be used to assist in the management of the Park.

A restaurant, café or kiosk would be best located in an already disturbed or developed area. Many of the developed sites around Herdsman Lake have existing car parks. Sites which require further investigation regarding such a development include the North Lake parkland or the Perth Horse and Pony Club (subject to lease negotiations and discussions between the City of Stirling and CALM).

For the development of a café or restaurant to proceed, expressions of interest would be sought through the State government tendering process. A comprehensive environmental assessment, social survey, feasibility study and business plan would be required before the development could proceed.

One-off Special Events

One-off special events will be assessed by the relevant management agency. Depending on the type of activity a concession arrangement may be required between the event organiser and the managing agency. Management agencies should use the guiding principles established for commercial uses (Section 33) as a means of determining the appropriateness of proposed activities. As the agency co-ordinating the management of regional parks, CALM should be consulted in the assessment of one-off community events.

CONCESSIONS FOR PURPOSES OTHER THAN VISITOR SERVICES

Commercial concessions for purposes other than visitor services are generally not considered appropriate within the Park, unless there is a considerable benefit to the Park. Two such concessions currently exist within the Park:

- a lease with the Chrysalis Montessori School; and
- a lease with Telstra for a mobile phone telecommunications tower.

Chrysalis Montessori School

Chrysalis Montessori School, located on Parkland Road, currently holds a lease over a small portion of Park (Part lot 1 Parkland Road, Glendalough) adjacent to its school buildings. The lessor is the Western Australian Planning Commission (WAPC). The leased area adjoining the school buildings is fenced and used solely as a playground for the school. The current lease is valid until 2001. Negotiations are currently taking place between the WAPC, CALM and the school to excise the lease area from the Park.

Telstra mobile phone telecommunications tower

Lot 277 Selby Street, Herdsman which contains the mobile phone tower was transferred to the Conservation Commission of Western Australia as public open space to be managed by CALM under a lease to Telstra. Managing the reserve for telecommunication is consistent with the reserves assigned purpose. When managing reserves containing telecommunication facilities, CALM is directed by Policy Statement 49 - Radio Communications Facilities Policy.

Strategies

1. **Establish and manage any commercial operations in accordance with CALM Policy Statement No 18, Recreation Tourism and Visitor Services. Concessions in the Park may be permitted if they are consistent with the purpose of the Park and approved by the Minister for the Environment. Proceeds from commercial operations are to be used for Park management and infrastructure. (CALM, CS) [Ongoing]**

2. **Ensure any commercial activities are consistent with the commercial guiding principles. Conditions are fulfilled by concession holders and an appropriate fee is paid that contributes an income to Park management. (CALM, CS) [Ongoing]**

3. **Proponents of major commercial activities must complete an appropriate expression of interest. (CALM, CS) [Ongoing]**

4. **All development proposals to be assessed in terms of the overall commercial requirements for the Park. (CALM, CS) [Ongoing]**

5. **Assess one-off special events in relation to the guiding principles for commercial use of the Park. (CALM, CS) [Ongoing]**

6. **Explore sponsorship opportunities with local businesses. (CALM, CS) [High]**

7. **Where appropriate, allow provisions for community organisations and clubs that are consistent with the reserve purpose. (CALM, CS) [Ongoing]**

8. **Develop management guidelines for advertising within the Park. CM, CC, TK, CALM) [Medium]**

9. **Prepare and implement a site development plan to upgrade access and parking at the Wildlife Centre. Investigate the potential to further develop the site into a visitor interpretive centre. (CALM) [High]**

10. **Investigate the feasibility of locating a café, kiosk or restaurant at the North Lake parkland or the Perth Horse and Pony Club (subject to lease negotiations and discussions between the City of Stirling and CALM). (CALM, CS) [Low]**

11. **Excise the Chrysalis Montessori School lease area from the Park. (MfP, CALM, Chrysalis Montessori School) [Medium].**

35. Mining and the Extraction of Basic Raw Materials

The objective is to protect the Park's values from exploration, mining and the extraction of basic raw materials.

There is a strong presumption against mining and the extraction of basic raw materials (BRM) in Herdsman Lake Regional Park.

EXTRACTION OF BASIC RAW MATERIALS (BRM)

Depending on the land tenure involved there are different legislative requirements for extraction or mining of basic raw materials.

On freehold land basic raw materials including sand, limestone, limesand, clay, gravel and hard rock) are not defined as "minerals" under the *Mining Act (1978)* and commercial extraction is subject to Extractive Industry Licences under the *Local Government Act (1995)*. Any freehold property in the Park that is subject to an extractive industry licence will be processed under the *Local Government Act (1995)*.

Basic raw materials targeted on CALM managed land or crown land will be processed under the *Mining Act (1978)*. Any proposals to access basic raw materials on CALM land for "public works purposes" will be considered by CALM in accord with the Conservation Commission of Western Australia's Basic Raw Basic Raw Materials Policy Statement No. 5.

Mining of basic raw materials from within the Park is unlikely to be environmentally acceptable and such proposals will be referred to the EPA.

MINING

Applications for mining within the Park will be processed in accordance with:

1. The Mineral Exploration and Development Memorandum of Understanding (MOU) between the Environmental Protection Authority and the Department of Minerals and Energy (DME) (1995) for applications occurring in any conservation reserves in the Park (refer DME Information Series No 11); and

2. The Regional Park Mining Protocol currently being developed by CALM and DME for all other land tenure in the Park including freehold property, unallocated Crown land, local government reserves and other crown reserves vested in other authorities other than CALM.

Mineral exploration in 'A' Class nature reserves, national parks and conservation parks (South West of Western Australia) is subject to the concurrence of the Minister for the Environment and the Minister for Mines. The Conservation Commission of Western Australia may refer proposals causing significant environmental disturbance to the EPA. Approval for mining will require the consent of both Houses of Parliament and EPA assessment.

Strategies

1. **Finalise the Regional Park Mining Protocol. (CALM, DME) [High]**

2. **Assess all requests to access basic raw materials within the Park are in accord with CALM and NPNCA policies, the Regional Park Protocol and the DME and EPA MOU (CALM, CS) [Ongoing].**

F. RESEARCH AND MONITORING

36. Research and Monitoring Goal

RESEARCH AND MONITORING GOAL

Seek a better understanding of the natural, cultural and social environments, and the impacts of visitor use and Park management.

37. Research and Monitoring

The objective is to further develop and maintain knowledge regarding visitor use, natural processes and the influence of people and other external influences on the Park.

RESEARCH

There are many opportunities for research within the Park. Visitor use, management regimes, rehabilitation and weed control, and external influences all need to be evaluated for their impact on the Park.

As discussed in Section 26 – Visitor Use, Barnes (1998) conducted a visitor survey of Herdsman Lake Regional Park outlining the current use patterns and visitor profiles. Information on visitor demographics, satisfaction and preference is vital for the future planning of the Park. It will therefore be necessary to repeat a similar visitor survey in the future as part of an integrated monitoring program. Social monitoring of visitor satisfaction and impacts is receiving increasing attention from park management agencies throughout Australia.

Between September 1982 and May 1983, Esri Australia Pty Ltd undertook a water quality study of Herdsman Lake for Herdsman Industrial Estate Pty Ltd. This study was undertaken concurrently with the sampling of Floreat Waters by the State Planning Commission.

A study of the environmental effects of the 1986 Argentine ant treatment program at Herdsman Lake was carried out by the Wetland Ecology Group at Murdoch University in conjunction with Dr Geoff Ebell of the Chemistry Centre and Dr Stuart Halse of CALM. Funding from the State Planning Commission and Agriculture Western Australia supported the study. The study provided information on the nature of stratification and inputs into the moat, the impact of dredging and possible designs for future monitoring programs (Davis and Garland, 1986).

The Marine and Freshwater Research Laboratory at Murdoch University also undertook a study of water quality and invertebrate community structure at Herdsman Lake as part of a chemical and biological monitoring program for ten lakes on the Swan Coastal Plain in 1986/87. This allowed a comparison of Herdsman Lake to be made with nine other local wetlands (Rolls *et al*, 1990).

It is desirable that research programs involve as wide a range of people as possible. The involvement of volunteers, labour market programs, educational institutions and individual researchers can reduce research and monitoring costs and assist in providing information to management agencies and the broader community. The Park is situated close to a number of tertiary, secondary and primary education institutions and further opportunities exist for these institutions to play an important role in research and monitoring within the Park.

MONITORING

The priorities for monitoring in the Park have been defined by the key performance indicators (Section 11). Key performance indicators for Herdsman Lake Regional Park are:

- Wetland health;
- Bushland condition;
- Fauna populations and species diversity;
- Visitor satisfaction;
- Visitor risk; and
- Integrated management.

Individual sections of this Plan provide strategies concerning research and monitoring that is required.

In the past, Murdoch University and community groups such as Habitat Herdsman have previously undertaken monitoring projects in the Park. Community groups can play a valuable role in research and monitoring and should be encouraged and trained in environmental practices.

All research and monitoring undertaken in the Park is to be co-ordinated by CALM. A process for authorising access to the Park is to be established by the managing agencies in an effort to ensure an integrated approach to research and monitoring.

Strategies

1. **Develop an integrated program of survey, research and monitoring based on the Key Performance Indicators (Section 11). (CALM, CS) [High]**

2. **Support and where possible seek grant applications to encourage scientific research and monitoring within the Park. (CALM, CS) [Ongoing]**

3. **Encourage the participation of volunteers, educational institutions and other organisations in research projects within the Park and promote research programs that address the Key Performance Indicators. (CALM, CS) [High]**

G. COMMUNITY RELATIONS

38. Community Relations Goal

COMMUNITY RELATIONS GOAL

Promote informed appreciation of the Park's natural environment, cultural values and recreation opportunities and facilitate liaison with the community about their management.

39. Information, Interpretation and Education

The objectives are to increase the community's awareness, appreciation and understanding of the Park's values, to gain support for management practices and to involve a wide range of public participation in implementing this Management Plan.

An effective communication program is essential to achieve the goals and objectives of the management of the Park. It informs the public of attractions, facilities and recreation opportunities available within the Park and provides an avenue to promote an appreciation and greater understanding of the natural environment. Additionally, it fosters appropriate behaviour so that adverse impacts on the environment are minimised.

The Herdsman Lake Regional Park communication program will have three parts:

- Information – providing an overview of opportunities and details of facilities, activities and regulations;
- Interpretation – explaining natural and cultural values; and
- Education – providing detailed materials and programs designed to facilitate learning, focussing on target groups (e.g. school groups, community groups).

An integrated information, interpretation and education program will be developed for Herdsman Lake Regional Park. Mechanisms for facilitating the program include signs, displays, publications (such as brochures and Park notes) and guided activities.

Involvement of the community in Park operations, ongoing liaison with community groups and the provision of interpretative and educational materials will be important for maintaining the values of the Park and to maximise its use as an educational resource.

The Gould League has been an extremely important and active group, leading regular interpretative activities for the public, providing considered and invaluable advice and comments about management issues and generating excellent press coverage for issues and activities in the Park. Their efforts have assisted in raising the awareness and understanding in the local community of the Park's identity and values.

There is potential to upgrade the Wildlife Centre into a multi-purpose conservation education facility. The Centre could serve as a focus for educational and research programs and could offer accessible, timely information about the values of the Park together with activities and programs to interpret those values. The viability of the Centre may be strengthened by an association with other community facilities or combined with a commercial activity (see Section 34).

School groups will continue to be the source of heavy demand for educational activities and talks at the Park. A number of local schools have been involved with activities such as planting and rehabilitating degraded areas. There is the opportunity to integrate these school activities with CALM's existing schools education program, including the CALM Bush Rangers Program.

The Herdsman Lake Settler's Cottage is also an important interpretation node in the Park presenting the social history of Herdsman Lake and relevant aspects of the natural environment.

Materials for interpretation and education have also been developed for the Park. Visitors to Herdsman Lake Regional Park will require additional information to help plan their visit, enjoy and appreciate the Park and help them to recall their experience when they depart. The Park offers many opportunities for developing an enriching body of interpretative material. Key areas for interpretation and education within the Park include:

- Herdsman Lake and other wetland areas in the Park;
- recreational opportunities;
- flora and fauna;
- cultural influences (both Aboriginal and non-Aboriginal);
- the regional park entity, its management and evolution;
- responsible use of the Park including the feeding of ducks and other wildlife; and
- relationships with other wetlands on the Swan Coastal Plain.

The development of interpretative material should be undertaken in a co-ordinated way to ensure the most effective use of available resources and to ensure that information is presented in a well integrated and consistent manner throughout the Park.

Strategies

1. **Develop and implement a Regional Park Communication Plan for interpreting Park values and understanding and supporting management programs. (CALM) [Medium]**

2. **Investigate upgrading the Wildlife Centre into a multi-purpose conservation and education facility. (CALM) [High]**

H. PLAN IMPLEMENTATION

40. Priorities, Funding and Staff

The objective is to manage the Park according to the priorities developed for implementation.

PRIORITIES AND TIMELINES

The priorities for managing the Park have been established by the joint managers of the Park and appear in brackets behind each strategy in the Plan. They represent the priorities at the start of the planning process and will be reviewed in reference to changing circumstances during the term of the Plan. There are many strategies outlined in this Plan, while some are guidelines others are prescriptions for specific actions. The City of Stirling and CALM will implement this Plan within the framework of available resources.

The Key Management Strategies listed in Section 43 represent those strategies with the greatest priority in the Plan. A timeline for completing these Key Management Strategies is provided in Table 3.

Subsidiary plans and implementation programs
In implementing the priorities of the Plan, more detailed subsidiary plans will be required prior to operations taking place within the Park (see Section 2). Additionally, a five-year implementation program and annual works program will be prepared to guide the implementation of this Plan.

The City of Stirling and other agencies involved in the management of the Park will be consulted by CALM in the preparation of the Park's annual works program and five-year implementation program.

STAFFING

The City of Stirling currently manages Council reserves within the Park using staff from their Parks and Reserves Department and contractors as required. CALM services its management obligations with staff from the Regional Parks Unit and contractors.

FUNDING ARRANGEMENTS

The City of Stirling and CALM will finance and manage their respective land areas (Figure 4). CALM has been allocated a recurrent budget for the maintenance of regional parks from State Treasury. Additionally, a capital budget has been provided by the Western Australian Planning Commission (WAPC) for the future planning and development of facilities within regional parks. Funding for local governments involved in regional parks is available through Area Assistance Grants Schemes administered by the WAPC.

Responsibility for acquisition of private lots proposed for inclusion in the Park remains with the WAPC.

Strategies

1. **Prepare and implement a five-year implementation program and annual works program, taking into account the priorities identified in this plan. Consult with the appropriate management agencies involved in the Park when preparing these programs. (CALM, CS, WC) [High]**
2. **Prepare a grant application through the Area Assistance Grants Scheme (AAGS) for the City of Stirling to undertake infrastructure improvements in Management Zones 3 and 11. (CALM, CS) [High]**
3. **Seek corporate sponsorship and other funding arrangements for the Park. (CALM, CS) [Ongoing]**

41. Community Involvement

The objective is to actively encourage as much community involvement as possible in implementing this Plan.

Preparation of the Management Plan
The community was made aware of the preparation of this draft Plan through face-to face consultation, newspaper advertising, articles and CALM publications.

The public was formally involved in the preparation of this draft Management Plan through the Herdsman Lake Regional Park Community Advisory Committee. The Committee provided advice and commented on a preliminary version of the draft Plan. Additionally, a community workshop was held in July 1998 as part of the management planning process. The workshop was attended by people representing broad community interests as well as representatives from the City of Stirling and CALM.

Community involvement in the implementation of this Management Plan
Community involvement in the implementation of this Plan occurs primarily through the Herdsman Lake Regional Park Community Advisory Committee. The committee consists of community members, State government agency representatives and representatives of the management agencies. The committee's role is to assist in the development of the management plan and to provide advice in regard to the ongoing management of the Park.

The existing Community Advisory Committee's role, composition and structure will be reviewed periodically.

It is important that the community is actively involved in implementing this Plan. This encourages a sense of ownership of the Park by the community and encourages interested people to become involved in the Park's future planning and management. With limited

resources available to undertake works in the Park, volunteer labour needs to be used wherever possible.

It is important to seek the cooperation and involvement of adjacent landowners to protect the values of the Park. This can be done through educational programs which promote responsible use of the Park and inform the community of management roles and responsibilities. Programs should outline the effects of inappropriate activities such as dumping rubbish and garden waste in the Park, and disposing fish and pool water into local drains which flow into the Park's wetlands and waterbodies (Section 39).

Edith Cowan University – Churchlands Campus, Churchlands TAFE College and a number of primary and secondary schools provide a strong educational presence in close proximity to the Park. All educational institutions, particularly Edith Cowan University should be encouraged to use the Park for educational research purposes.

There are a number of different ways members of the community can be involved in assisting with the implementation of this Plan including:

- joining volunteer organisations such as the Gould League and Habitat Herdsman;
- joining CALM's Bush Rangers Program;
- contacting members of the Herdsman Lake Regional Park Community Advisory Committee; and
- being involved in clean up days (e.g. Clean up Australia Day); and
- reporting of problems to the managing agencies.

It is important that all works carried out are carefully planned and co-ordinated by the managing agencies. Activities need to be consistent with the planning and operations of the managing agencies. Volunteer groups should develop their projects in consultation with the managing agencies to be consistent with the Park's annual works program and five-year implementation program.

Strategies

1. **Maintain active liaison with community groups involved in the Park. (CALM, CS) [Ongoing]**

2. **Promote responsible use of the Park, keep the public informed of management actions, activities and developments in the Park. (CALM, CS) [Medium]**

3. **Continue to encourage, promote and support the activities of community groups, schools and associations within the Park. (CALM, CS) [Ongoing]**

4. **Encourage the use of the Park by educational institutions. (CALM, CS) [Ongoing]**

5. **Co-ordinate all activities of volunteers in the Park. (CALM, CS) [Ongoing]**

42. Term of the Plan

This Plan will help progress the Park towards its long-term vision (Section 5). In doing so it will be subject to conditions and reviews to ensure its appropriateness and effectiveness.

The term of this plan will be 10 years. If the Plan does not require revision after 10 years, it will continue to provide management direction. Section 61 of the CALM Act provides for the Plan to be amended as required. If major changes to the Plan are proposed, the revised Plan will be released for public comment.

43. Performance Assessment

The Conservation Commission of Western Australia has overall responsibility for monitoring the implementation of the Plan. The effectiveness of the Plan will be reviewed through a formal auditing and review process.

The Plan will be subject to:

- a mid-term (five year) and end-of-term audit (10 year); and
- an annual review.

The difference between the two processes is described below:

Mid-term and end-of-term audit

The Plan will be audited mid-term and towards the end of its 10 year term by the Conservation Commission of Western Australia. Auditing of the Plan will focus upon the Key Performance Indicators listed in Table 3. The Audit will include a re-assessment of the overall direction of the Plan (including the need for a replacement management plan) in light of what has been achieved, changes in surrounding land uses, community aspirations, funding and relative priorities.

Overall management performance will be audited assessing the key performance indicators and key management strategies (see Table 3).

Annual review

The purpose of the annual review is to assess the implementation progress of the Plan prior to preparing the operations program for the following year. The annual review will be undertaken by Park management and should identify which strategies have been achieved since the last review and facilitate target setting for the next year. Major milestones and achievements should be noted for updating the Plan and informing the Conservation Commission of Western Australia.

Strategies

1. **Review the implementation of the management plan annually to identify strategies that have been achieved and to what degree any new information may affect management. (CALM, CS) [Ongoing]**

2. **Audit the management plan mid-term and towards the end of its 10 year term. (CALM, Conservation Commission of Western Australia) [Ongoing]**

Table 3 - Performance Audit Table

Key Performance Indicators	Key Management Targets	Key Management Strategies	Timeline
Wetland health - • nutrients and chlorophyll-a concentrations; • the presence of blue-green algae cells; and • diversity of macro-invertebrates and the avian community structure.	To be determined following the gathering of baseline information.	14.1 Prepare an overall water management plan for Herdsman Lake. The plan will: • propose pollution containment devices and strategies; • develop emergency pollution response procedures; • investigate the management of water levels in the Park for the protection of wildlife habitat and other conservation values; • investigate nutrient stripping basins and other pollution containment devises within the Park; and • investigate methods to ensure the low water level for the Lake is not raised above 7:00m AHD (this being the current average winter water level for the Lake). 14.7 Prepare and undertake a monitoring program to gather baseline information on the Key Performance Indicators of Wetland Health and relevant heavy metals and pollutants at selected sites in the Park.	To be completed prior to completion of Floreat Lakes Development. To be completed prior to mid-term audit.
Avian fauna populations, community structure and species diversity.	No decline in the current populations, community structure and diversity of selected avian fauna species in the Park.	16.1 Prepare and undertake a monitoring program of the avian community structure as well as species diversity and populations of selected avian fauna species in the Park.	To be completed prior to mid-term audit.
Bushland condition – • assessment of bushland condition; • priority weed species; and • changes to vegetation communities.	Increase the areas of bushland condition assessed as good – excellent within the Park; and reduce the area of priority weeds in the Park, as identified in the weed management plan.	17.1 Prepare and implement a weed management plan in accordance with the Environmental Weed Strategy developed for CALM. The plan will: • map the extent and abundance of priority weeds, bushland condition and vegetation communities within the Park; • prioritise and control weed species according to invasiveness, distribution and environmental impacts; • specify appropriate control techniques and timing for removal including herbicide use; and • be integrated with the rehabilitation strategy (Section 21) and not carried out in isolation. 21.1 Prepare and implement a rehabilitation plan for the Park prioritising proposed works. A priority will be the rehabilitation of wetland fringing vegetation.	To be completed within 2 years of the release of the Final Management Plan. To be completed within 2 years of the release of the Final Management Plan.

Visitor satisfaction and visitor numbers.	Maintain an overall trend of positive visitor satisfaction.	26.1 Develop and implement a visitor survey program to gain an understanding of visitor use, numbers and satisfaction within the Park. Use CALM's VISTAT as a basis for the program. 26.3 Prepare a communication plan incorporating a sign system and sign plan as well as interpretive strategies and techniques. Interpretive material should be aimed at: • promoting visitor use and activities which are consistent with the protection and promotion of Park values and minimise conflicts between Park visitors; and • providing information about the recreation and interpretation opportunities available in the Park. 29.1 Implement the Recreation Masterplan. The Masterplan will: • co-ordinate access and circulation allowing visitors to move safely and conveniently throughout the Park. Park access should be integrated with surrounding community and regional path networks; • provide appropriate recreation facilities and services; • provide adequate parking facilities at major recreation nodes; • provide sensitively located and designed shoreline access to the Lake (e.g. boardwalks and viewing platforms); and • restrict private vehicles to designated car parks and access roads.	To be completed prior to mid-term audit. To be completed prior to mid-term audit. Access and circulation aspects of the Masterplan to be completed prior to the end of term audit.
Visitor risk.	Remove or mitigate all identified high risk sites or facilities in the Park.	31.1 Prepare and implement a safety audit program to ensure procedures are developed to manage and monitor all known risks.	To be completed prior to mid-term audit.
Integrated Management.	Not applicable	7.1 Create reserves to be placed in the care, control and management of the relevant managing agency using Table 1 and Figure 4 as a guide. 10.3 Prepare interagency agreements that provide Park management with the authority to regulate in all areas of the Park (e.g. City of Stirling rangers controlling dogs on CALM managed estate).	To be completed prior to mid-term audit. To be completed prior to mid-term audit.

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APPENDICES

Appendix A - Abbreviations used in this Plan

AgWA	Agriculture Western Australia
AHD	Australian Height Datum
ANCA	Australian Nature Conservation Agency
BRM	Basic Raw Materials
CALM	Department of Conservation and Land Management
CAMBA	China Australia Migratory Bird Agreement
CBD	Central Business District
CS	City of Stirling
DCE	Department of Conservation and Environment
DEP	Department of Environmental Protection
DME	Department of Minerals and Energy
DOLA	Department of Land Administration
DOT	Department of Transport
DPUD	Department of Planning and Urban Development
DUP	Dual Use Pathway
EGS	Environmental Geology Services
EPA	Environmental Protection Authority
FESA	Fire Emergency Service Authority
ICOMOS	The International Charter for the Conservation of Monuments and Sites. The Burra Charter was adopted by the Australian ICOMOS in 1981.
HDWA	Health Department of Western Australia
JAMBA	Japan Australia Migratory Bird Agreement
LAA	*Land Administration Act (1997)*
MfP	Ministry for Planning
MRPA	Metropolitan Regional Planning Authority
MRS	Metropolitan Region Scheme
MRWA	Main Roads Western Australia
NT	National Trust of Australia
NTAA	*Native Title Amendment Act (1998)*
RAOU	Royal Australasian Ornithologists Union
SPC	State Planning Commission
WAPC	Western Australian Planning Commission
WC	Water Corporation
WRC	Water and Rivers Commission
WWF	World Wide Fund for Nature

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