Periodic assessment -
Lakes and wetlands of the Perth metropolitan area

Conservation and Parks Commission - Function

The Conservation and Parks Commission's (Commission) periodic assessments are undertaken primarily to fulfil the functions described in section 19 (g) of the *Conservation and Land Management Act 1984*. That is, to assess the performance of the Department of Parks and Wildlife and the Forest Products Commission in implementing management plans. The assessments also help to inform the Commission's policy development function and its responsibility to advise the Minister for Environment on conservation and management of biodiversity components throughout the state.

The periodic assessment was undertaken in accordance with the Commission's policy and guidelines for the periodic assessment of conservation reserve and forest management plans and biodiversity management in WA.

This document is available on the Commission's website www.conservation.wa.gov.au.

Approved at Conservation and Parks Commission meeting October 2017

Assessment number: CRMPPA–01/17

Conservation and Parks Commission
Block 11, 17 Dick Perry Avenue
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The recommended reference for this report is:

Conservation and Parks Commission 2017, *Periodic assessment – Lakes and wetlands of the Perth metropolitan area*.

The use of Department of Biodiversity, Conservation and Attractions and other key stakeholder data for the production of this report is acknowledged.

Executive Summary

This periodic assessment report provides an end-of-term review of the management plans for Beeliar Regional Park, Herdsman Lake Regional Park, Yellagonga Regional Park, Thomsons Lake Nature Reserve, and Forrestdale Lake Nature Reserve.

Lakes of the Perth metropolitan area provide important habitat for native fauna and migratory wading birds, with both Forrestdale and Thomson's Lake registered as Ramsar sites. They are also important places for nature based recreation in an urban setting. The evidence of stakeholder interest and effort as assessed in this report gives an indication of the value of these wetlands to the community.

The various planning areas include lands that are vested in bodies other than the Conservation and Parks Commission (the Commission) where there is a shared responsibility for implementing the relevant management plan. The Department of Biodiversity, Conservation and Attractions (the Department) has responsibilities for the overall implementation of the management plans for these lakes which involves coordination with stakeholders such as local government, State government agencies, private land holders, 'friends of' groups and wildlife organisations.

The management plans for these five areas were amongst the first Commission plans to include formal measures or Key Performance Indicators (KPIs) to track the implementation of the plans. A key part of this periodic assessment was a self-evaluation of the achievement of the KPI target outcomes which was provided by the Department. The overall intent of the Commission is to collate and analyse the data from the KPIs of management plans, and use this information to draft assessment reports as stipulated in the plans. These results have been summarised and included in Figure 1 of this report. Difficulties in resourcing the management of the metropolitan wetlands has resulted in many KPI's not being met and a lack of monitoring of the key values.

Where required, key findings have also been included. Key findings focus on the key values of the planning area where shortfalls in KPI target achievement have been identified but also highlight certain outcomes which have been effectively implemented. For each key finding a summary dashboard has been provided which details the relevant KPI and its management effectiveness rating (achievement or otherwise of target), summary statistics on related KPIs, a map, and a linked geolocated photo to aid in visualization of the issue. The dashboards are primarily designed for an interactive online user experience, but can be used as static 'snapshots' as presented in this report. The discussion section of the report, provides additional detail on the subject areas of the key findings.

Positive adaptive management outcomes have been observed with a water supplementation program at Thomsons Lake and there is future potential for this at Forrestdale Lake. The Department has also very effectively harnessed the engagement of volunteer groups with positive environmental outcomes observed particularly in the regional parks. Findings from this review indicate that the main threats or pressures on these lake systems are:

- a drying climate water extraction and altered hydrology;
- weeds (both aquatic and terrestrial);
- pollutants and high nutrient loads; and
- acid sulphate soils.

Weeds

Key finding 1

Aquarium plants that are grown in private ponds and aquariums have entered waterways and infestations have been found in metropolitan lakes. These weeds are not declared under the Biosecurity and Agricultural Management Act 2007; and are sold and freely traded.

Key finding 2

Lake edge vegetation including *Typha* have further encroached on Forrestdale Lake over the life of the management plan.

Fauna populations

Key finding 3

It is likely that Forrestdale Lake has exceeded limits of acceptable change based on the Ramsar criteria for which it was listed.

Key finding 4

It is likely that Thomsons Lake has exceeded limits of acceptable change based on the Ramsar criteria for which it was listed.

Water Quality

Key finding 5

An integrated catchment management plan has been created as required in the Herdsman Lake plan, however the outcomes of the implementation of catchment planning are not known.

Water Quality (supplementation)

Key finding 6

Water supplementation in Lake Mealup and Thomsons Lake has been successful and is planned for Forrestdale Lake.

Community (Volunteers)

Key finding 7

Friends groups have provided considerable additional resource to assist in operational management of the regional parks

Water quality

Key finding 8

There are no water quality reporting indicators in the management plans for Yellagonga and Herdsman Lake regional parks

Pest animals

Key finding 9

The Kangaroo population at Thomsons Lake has reached unsustainable levels and is impacting terrestrial vegetation.

Contents

KPI summary report

The KPIs for each management plan were evaluated by the Department and a self-evaluation was provided relating to whether the target for each KPI had been either met, partially met or whether no (or limited) progress had been made. This was based on a mix of qualitative judgement supported by available quantitative data. The results were then given a numerical score by the Commission for reporting purposes. The colour coding essentially follows the departmental self-assessment where: - 'KPI targets met' is green, 'KPI targets partially met' is yellow, and 'limited or no progress' is red. 'No data' indicates no KPIs for this grouping and management plan.

Figure 1 KPI summary with scoring shown according to the Departmental self-evaluation groupings are by KPI category and for each management plan area.

RATINGS FOR KPIs	**WATER QUALITY**	**WEEDS**	**ECOSYSTEM LEVEL BIODIVERSITY**	**SPECIES LEVEL BIODIVERSITY**	**LOCAL POPULATION LEVEL BIODIVERSIT**	**CATCHMENT MANAGEMENT AND WATER**	**RECREATION**	**COMMUNITY**	**PEST ANIMALS**	**OVERALL KPI AVERAGE**
Herdsman	No Data	3	No Data	No Data	2	5	4	6	4	4
Yellagonga	No Data	4	4	No Data	3	No Data	4	6	No Data	4
Thomsons	4	4	1	1	2	6	No Data	4	1	2
Forrestdale	4	1	3	3	3	3	No Data	6	No Data	3
Beeliar	No Data	3	No Data	3	2	6	4	6	5	4
Overall KPI group	4	3	3	2	3	5	4	5	3	3

Key findings and dashboards

Where the Commission has made a finding, extra detail in the form of a series of dashboards have been prepared. The dashboards include individual details of the relevant KPI as well as summary details of relevant KPI groupings and geo-located photographs and maps of on-ground inspections. As indicated for the KPI Summary report, the colour coding scores essentially follows the departmental self-assessment where: - 'KPI targets met' is green, 'KPI targets partially met' is yellow, and 'limited or no progress' is red. 'No data' indicates no KPIs for this grouping and management plan. The dashboards are primarily designed for an interactive online user experience, but can be used as static 'snapshots' as presented in this report.

Key Finding 1

Aquarium plants that are grown in private ponds and aquariums have entered waterways and infestations have been found in metropolitan lakes. These weeds are not declared under the *Biosecurity and Agricultural Management Act 2007;* and are sold and freely traded.

Department response- DBCA is aware of the risk of aquatic weed infestations particularly where lakes and wetlands are connected to the stormwater drainage network. Stormwater drainage from adjacent development was typically directed away from wetlands but in our current drying climate consideration needs to be given to accepting drainage water from new development where it is of acceptable quality. However, the benefit of higher water levels comes at the cost of an increased risk of weed infestation from urban gardens. DBCA will ensure that all field staff are adequately trained to identify aquatic weeds and that they remain vigilant and reactive to new plant species in areas that DBCA has management responsibility for. In addition, staff will be briefed on any new infestations that are reported within the Perth metropolitan region.

Commission recommendation- The Commission recognises the Department's previous and continuing on-ground management of weed infestations and the ongoing research into clean water supplementation and the potential benefits in terms of the control of *Typha* stands in other drying lakes of the Swan Coastal Plain. In relation to aquaticweeds, other state jurisdictions have placed more stringent controls on the sale and distribution of invasive water plants that have been found in Perth lakes. The Commission will support the Department in exploring greater biosecurity protection measures through consultation with the aquatic plant industry, and the Department of Primary Industries and Regional Development.

Location map

Photo

Departmental self-assessment

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Plan full name:	Beeliar Regional Park Management Plan
KPI measure:	1. Changes in populations of high priority weeds as identified in the Environmental Weeds Strategy for Western Australia.
KPI target:	1. No new populations of weed species rated high in the Environmental Weeds Strategy for Western Australia.
KPI group:	Weeds
Management Effectiveness score is:	4

4	6	3
Beeliar weeds KPI score	*Beeliar catchment management score*	*Overall weeds KPI score*

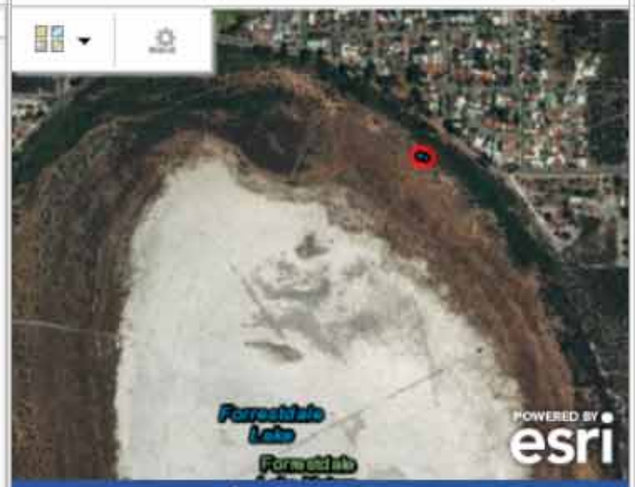
Key Finding 2

Lake edge vegetation including *Typha* have further encroached on Forrestdale Lake over the life of the management plan.

Departmental response - The invasive Typha spp has encroached on the lake due largely to increased drying and a reduction in water levels. Control through slashing and spraying has been undertaken on an annual basis to ensure fire access and to prevent further spread where possible. Increasing water levels is an effective method of controlling Typha. Alternatively, chemical control coupled with planting of native sedge species is effective but requires ongoing management which DBCA will continue to seek funding to undertake on a staged basis. DBCA is collaborating with other State and local government agencies that have responsibility for aspects of drainage and water resource management to address the need to increase water flows to Forrestdale Lake. (see Discussion for full response)

Commission Recommendation - The Commission recognises the Department's previous and continuing on-ground management of weed infestations and the ongoing research into clean water supplementation and the potential benefits in terms of the control of *Typha* stands in other drying lakes of the Swan Coastal Plain. In relation to aquatic weeds, other state jurisdictions have placed more stringent controls on the sale and distribution of invasive water plants that have been found in Perth lakes. The Commission will support the Department in exploring greater biosecurity protection measures through consultation with the aquatic plant industry, and the Department of Primary Industries and Regional Development.

Location map



Photo

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Departmental self-assessment

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Plan full name:	Forrestdale Lake Nature Reserve Management Plan
KPI measure:	Change in the total area of T. orientalis within the reserve.
KPI target:	A decrease of at least 3% in the total area of T. orientalis from 2004 levels each report period (three years) over the next ten years.
KPI group:	Weeds
Management Effectiveness score	3

Forrestdale weed KPI score	Overall weed KPI score	Forrestdale ecosystem KPI score
3	3	3

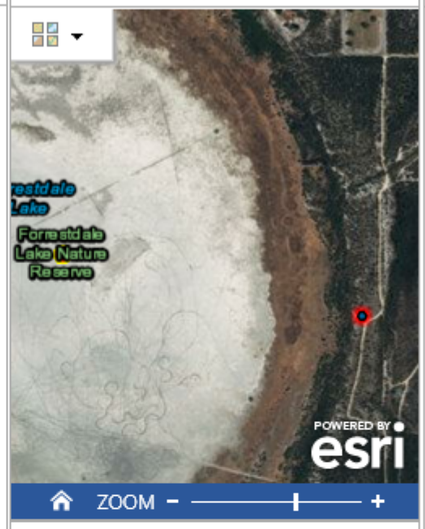
Key Finding 3

It is likely that Forrestdale Lake has exceeded the limits of acceptable change based on the Ramsar criteria for which it was listed.

Departmental response - The most significant cause of the exceedance of the limits of acceptable change for waterbirds at Forrestdale and Thomsons lakes is the alteration of hydrological conditions that support populations of greater than 5000 birds. Principally, this is a combination of lower maximum water levels, earlier drying out and reduced inundation periods. Associated causes are the spread of plants that prefer drier conditions and a resultant loss of wader habitat. Evidence from across Australia supports the hypothesis that if more favourable hydrological conditions can be maintained, waterbird populations are likely to respond. DBCA continues to participate in short-term adaptation actions to manage hydrological alteration including water supplementation for Thomsons Lake and control of terrestrial plant invasions. DBCA is also actively pursuing opportunities to increase water flow reaching Forrestdale Lake through proactive discussions with authorities with responsibility for local and regional drainage infrastructure and schemes, for instance management of James Drain to maximise flows reaching the lake. However, the achievable scale of these types of management actions is unlikely to prevent exceedance of the hydrological limits for Thomsons Lake in the medium to long-term as the impacts of climate change are the most significant driver of a continuing drying out of wetlands in the south-west of Western Australia. On this basis, there is a need to consider revision of the current limits of acceptable change for hydrology and waterbird populations taking into account the continuing influence of climate change, feasible adaptation strategies and regional wetland and biodiversity conservation objectives - (see full response in Discussion section of report)

Commission recommendation - The Commission recognises the challenges facing the Department in managing the Ramsar listed sites given a number of threatening processes are beyond the control of the land manager. The Commission supports further investigation into water supplementation given the success of previous programs. The Commission notes the Departments commitment to explore options for more consistent methods for monitoring birdlife and other values and condition within the lake systems.

Location map



Photo

Photo1.jpg

Departmental self-assessment

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Plan full name:	Forrestdale Lake Nature Reserve Management Plan
KPI measure:	Changes in species diversity of migratory wading birds.
KPI target:	Subject to natural variation_ maintain or increase the species diversity of migratory wading birds from 2004 levels.
KPI group:	Species level
Management Effectiveness score	3

3	3	2
Forrestdale species level KPI score	*Forrestdale local population level management score*	*Overall species level KPI score*

Key Finding 4

It is likely that Thomsons Lake has exceeded the limits of acceptable change based on the Ramsar criteria for which it was listed.

Departmental response - The most significant cause of the exceedance of the limits of acceptable change for waterbirds at Forrestdale and Thomsons lakes is the alteration of hydrological conditions that support populations of greater than 5000 birds. Principally, this is a combination of lower maximum water levels, earlier drying out and reduced inundation periods. Associated causes are the spread of plants that prefer drier conditions and a resultant loss of wader habitat. Evidence from across Australia supports the hypothesis that if more favourable hydrological conditions can be maintained, waterbird populations are likely to respond. DBCA continues to participate in short-term adaptation actions to manage hydrological alteration including water supplementation for Thomsons Lake and control of terrestrial plant invasions. DBCA is also actively pursuing opportunities to increase water flow reaching Forrestdale Lake through proactive discussions with authorities with responsibility for local and regional drainage infrastructure and schemes, for instance management of James Drain to maximise flows reaching the lake. However, the achievable scale of these types of management actions is unlikely to prevent exceedance of the hydrological limits for Thomsons Lake in the medium to long-term as the impacts of climate change are the most significant driver of a continuing drying out of wetlands in the south-west of Western Australia. On this basis, there is a need to consider revision of the current limits of acceptable change for hydrology and waterbird populations taking into account the continuing influence of climate change, feasible adaptation strategies and regional wetland and biodiversity conservation objectives - (see full response in Discussion section of report)

Commission recommendation - The Commission recognises the challenges facing the Department in managing the Ramsar listed sites given a number of threatening processes are beyond the control of the land manager. The Commission supports further investigation into water supplementation given the success of previous programs. The Commission notes the Departments commitment to explore options for more consistent methods for monitoring birdlife and other values and condition within the lake systems.

Location map

Photo

Photo1.jpg

Departmental self-assessment

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Plan full name:	Thomsons Lake Management Plan
KPI measure:	Changes in species diversity of migratory wading birds.
KPI target:	Subject to natural variation_ maintain or increase the species diversity of migratory wading birds from 2005 levels.
KPI group:	Species level
Management Effectiveness score is:	2

1	2	2
Thomsons species level KPI score	*Thomsons local population level management score*	*Overall species level KPI score*

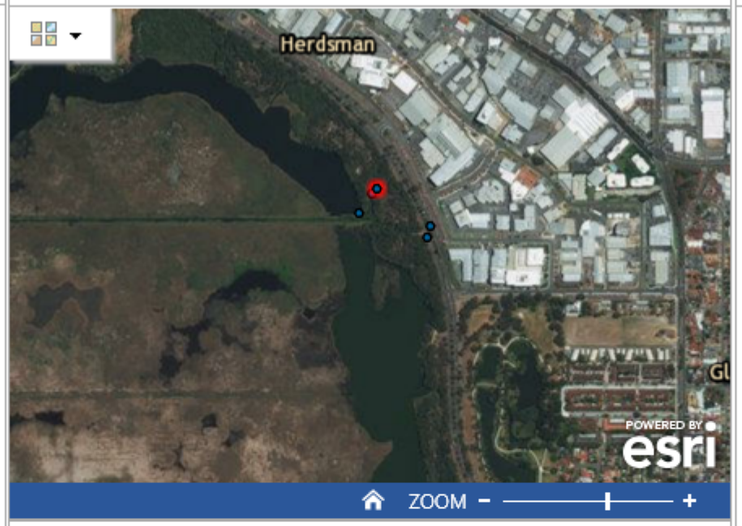
Key Finding 5

An integrated catchment management plan has been created as required in the Herdsman Lake plan, however the outcomes of the implementation of catchment planning are not known.

Departmental response - As stated by the Commission in the report, the City of Stirling is the driver for implementing the broader Herdsman Catchment Management Plan (2007) and although physical works and monitoring of inflows to the lake are being undertaken, data has not been collated to determine trends in water quality. DBCA will liaise with the Herdsman Lake Regional Park Community Advisory Committee and request that the City of Stirling undertakes a water quality analysis in response to drainage improvement works that have been undertaken in the catchment. It is also understood that the community advisory committee intends to continue advocating that the Water Corporation considers installation of deep sewerage in all parts of the catchment that are still on septic systems.

Commission recommendations - The Commission notes the Department's commitment as the coordinating agency for Regional Park management, to continue working with Advisory Committees, City Councils and the Water Corporation to increase water quality monitoring. The Commission will assess water quality monitoring results at the twelve-month review of this assessment.

Location map



Photo

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Plan full name:	Herdsman Lake Regional Park Management Plan
KPI measure:	2. Completion of an integrated catchment management plan for the Herdsman Lake catchment area.
KPI target:	2. Integrated catchment management plan finalised within 5 years of the completion of the regional park management plan.
KPI group:	Catchment management and water supply
Management Effectiveness score is:	5

5

Herdsman catchment KPI score

5

Overall catchment KPI score

Herdsman ecosystem KPI score

No Data

Key Finding 6

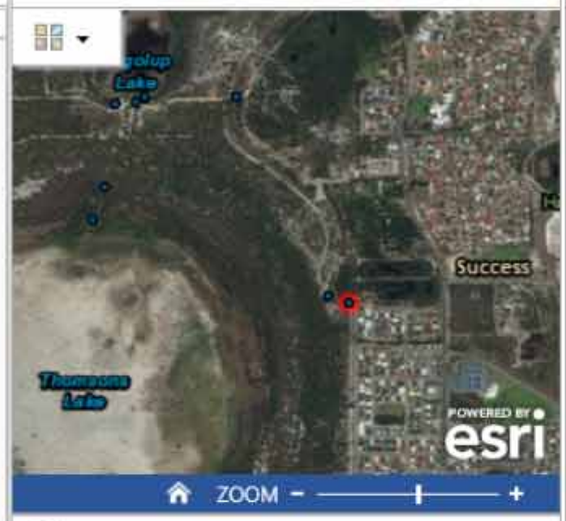
Water supplementation in Lake Mealup and Thomson's Lake has been successful and is planned for Forrestdale Lake.

Departmental response - The success of the Lake Mealup recovery program is duel argely to work of the technical advisory group, support from key stakeholders and the coordination that occurred as part of this group. The Lake Mealup project recognised that no one individual or group had the knowledge or capacity to manage these complicated wetland systems.

Currently DBCA only has the capacity to deal with issues as they arise at Forrestdale Lake. However, DBCA does recognise that an overall coordinated and collaborative approach looking at the system in its entirety and using adaptive management principles for implementing strategies with support from key stakeholders is the preferred method to increase water levels and improve the overall health of Forrestdale Lake. DBCA will continue to pursue this approach where possible.

Commission recommendations - The Commission commends the Department on the success of the Mealup Lake supplementation program and encourages the Department to document for the purposes of continuous improvement the process followed in the formation and function of the Technical Advisory Group.

Location map



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Departmental self-assessment

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Plan full name:	Thomsons Lake Management Plan
KPI measure:	Water supplementation regime.
KPI target:	N/A
KPI group:	Catchment management and water supply
Management Effectiveness score is:	6
Results and explanatory notes	Thomsons Lake Water Supplementation has been carried out yearly since 2004 and a review of the process is reported yearly. (2014 REPORT ATTACHED). RPU Planning Officer liaises with Water Corp each year for data on water levels (2014 ANNUAL REPORT ATTACHED) and timing to remove the weir boards. A Condition Statement for Thomsons Lake was produced in 2016 as part of the Green Growth Plan. (SEE PAGE 65 OF LINK - https://www.dpc.wa.gov.au/Consultation/StrategicAssessment/Documents/13-17-Commonwealth-IAR-Appendix-D.pdf)

6	6	5
Thomsons catchment KPI score	*Beeliar catchment KPI score*	*Overall catchment management score*

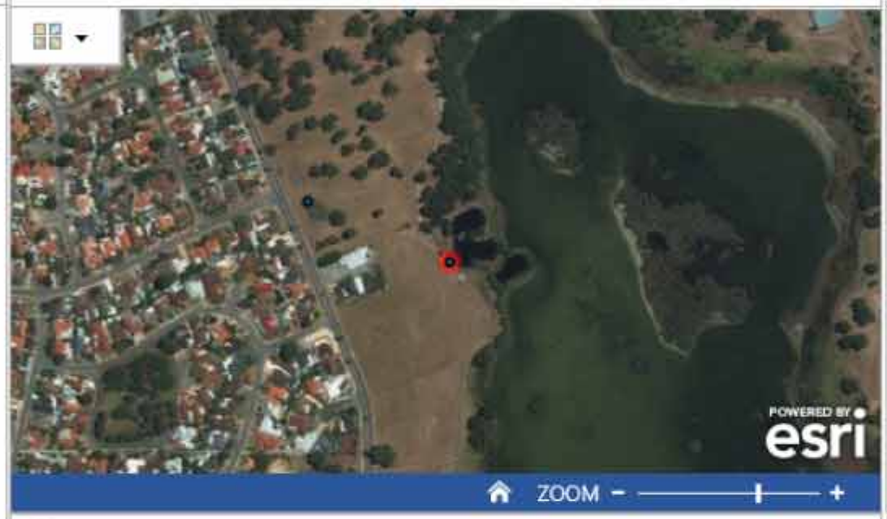
Key Finding 7

Friends groups have provided considerable additional resource to assist in operational management of the regional parks.

Departmental response - The importance of the community's active involvement in implementing these management plans is acknowledged by the Commission, and it is highly valued by DBCA. It encourages a sense of ownership from the community and allows interested people to become involved in future planning and management. DBCA will continue to look for any interest from community members inthe establishment of new 'Friends of' groups, particularly for Thomsons Lake which could benefit from the formation of such a group. However, DBCA is aware that the vermin-proof fence and lack of recreational facilities at the site makes it harder for people to form a regular connection with the fauna reserve.

Commission Recommendations - The Commission supports renewed efforts to establish an active "Friends of" group or facilitation of other means of community involvement in the management of Thomsons Lake.

Location map



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Departmental self-assessment

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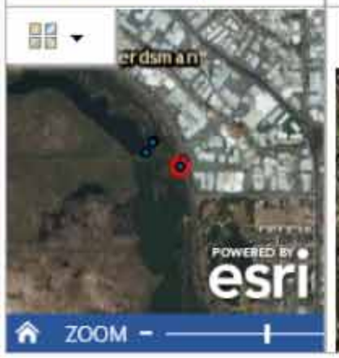
Plan full name:	Yellagonga Regional Park
KPI measure:	Involve the community in the planning and management of the Park.
KPI target:	39.1 Maintain active liaison with community groups involved in the Park.
KPI group:	Community
Management Effectiveness score	6

6	5	4
Yellagonga community KPI score	*Overall community KPI score*	*Thomsons community KPI score*

Key Finding 8

There are no water quality reporting indicators in the management plans for Yellagonga and Herdsman regional parks.
The relevant management plan KPI's that relate to water quality are indirectly based on the lakes macroinvertebrate communities and the development of an integrated catchment management plan. This does not directly specify information on the type and levels of pollutants in the lake system; which is key information in determining the outcomes of management.
Commission recommendation - The Commission recommends that direct measures of water quality (focusing on the physical and chemical levels of pollution) be incorporated into future management plans for Yellagonga and Herdsman regional parks.

Location map



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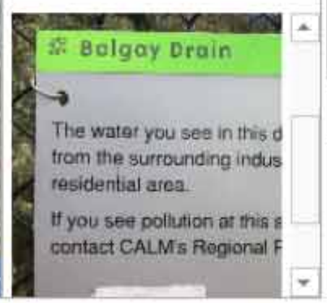

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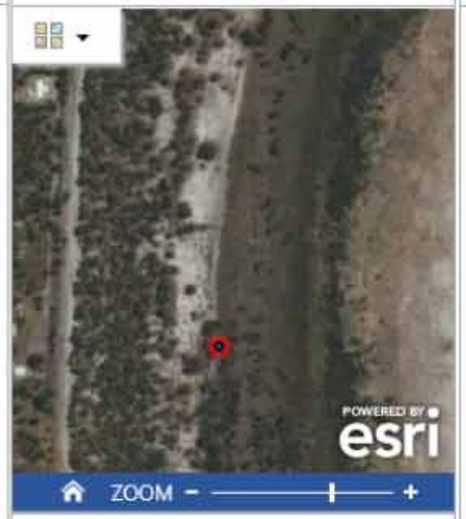
Plan full name:	Herdsman Lake Regional Park Management Plan
KPI measure:	1. Changes in abundance_ species diversity and structure of naturally occurring aquatic macro-invertebrate populations.
KPI target:	1. No decline in the abundance or diversity of naturally occurring aquatic macro-invertebrate populations based on 2005 levels.
KPI group:	Local population level
Management Effectiveness score is:	1
Results and explanatory notes	Macro-invertebrates have not been sampled or monitored at Herdsman Lake by DPaW. Water health is observed on DPaW staff patrols and any changes or concerns are investigated by appropriate staff from across the department, or sampled and analysed by Dept. of Water. Water Corp, CoS and DPaW all provide reports at Advisory Committee meetings and field officers maintain good contact to alert and discuss issues promptly. DPaW implements strategies beneficial to wetland health such as prioritising planting of wetland fringing vegetation, minimising run off, maintaining fauna protection signage and informing residents about the impacts of residential fertiliser runoff, especially around midge season when phone contact is high. CoS also provides the same advice over the phone in response to midge calls.The Gould League run macroinvertebrate sampling workshops with school students. This is an educational exercise and community awareness.

Yellagonga water quality KPI...	Herdsman water quality KPI...	
No Data	No Data	2 *Herdsman local population KPI score*

Key Finding 9

The kangaroo population at Thomsons Lake has reached unsustainable levels and is impacting terrestrial vegetation.
Departmental response - DBCA is aware of the importance of limiting the kangaroo population within the reserve and the need for a control plan to be developed. Planning is currently being undertaken to reduce the kangaroo population in the reserve and DBCA intends to progress any required works at the earliest opportunity.
Commission recommendation - The Commission supports the initial management plan intent to reduce the kangaroo population by culling and acknowledges that attempts have been made to recommence kangaroo population control. The Commission will assess implementation of the management options at the twelve-month review of this assessment.

Location map



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Departmental self-assessment

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Plan full name:	Thomsons Lake Management Plan
KPI measure:	Changes in the kangaroo population of the reserve.
KPI target:	To maintain the kangaroo population at a sustainable level.
KPI group:	Animal pests
Management Effectiveness score is:	1
Results and explanatory notes	The last kangaroo cull was carried out May 2006 when the population had reached the estimate of 1,143. 88% (1,109) of the population were culled. 2010 numbers estimated 165-210. Plans for a cull commenced, but it did not eventuate. 2014 numbers estimated 500-1000. Plans for a cull commenced, but did not eventuate. 2016 numbers estimated 700-800. A cull is currently being planned. A report shows the vegetation impact at 4 photo monitor sites from 2006 - 2016. (SEE REPORT ATTACHED). Fertility programs and translocation have been considered over the years but not favoured and a case study on sharpshooting at Thomsons Lake was published in 2016.

1	1	3
Thomsons ecosystem KPI score	*Thomsons pest KPI score*	*Overall pest KPI score*

Discussion

Weeds

Key finding 1

Aquarium plants that are grown in private ponds and aquariums have entered waterways and infestations have been found in metropolitan lakes. These weeds are not declared under the Biosecurity and Agricultural Management Act 2007; and are sold and freely traded.

Amazon frogbit, *Limnobium laevigatum* and Red ludwigia, *Ludwigia repens* have been identified at Yangebup Lake. Employees of the City of Cockburn physically removed the infestations, however, it is suspected that Red *Ludwigia* may have re-established. Plants can enter the lake via stormwater and then through the drainage channels that feed the lake. Both species are popular household water plants and can be purchased from retailers. An internet search provides numerous links to private sales. During the assessment, at least 6 species of the genus *Ludwigia* were found to be sold in WA.

Image 1. Top: images of internet advertisements for both Amazon frogbit, and Red Ludwigia.

Bottom: Amazon frogbit, present in a drainage channel, Perth metropolitan area.

The genus *Limnobium* has become a weed of environmental significance in the eastern states, particularly New South Wales where all species of *Limnobium* are deemed 'prohibited matter'. This means it is an offence to be a carrier or a dealer of the plant. The New South Wales Department of

Primary Industries have developed the Sydney-wide Regional *Ludwigia* Management Plan 2008-13 as a management tool to control the genus. It describes the potential threat *Ludwigia* poses to slow moving watercourses and waterways and subsequent impacts on bird habitat: -

> **Ludwigia is a vigorously opportunistic plant, clogging wetlands, slow moving watercourses and waterways, limiting their usefulness for recreational and navigational purposes as well as reducing biodiversity. Reducing the rate of flow in streams causes wide ecological damage through increased sedimentation and accumulation of additional organic material resulting in the deoxygenation of the water column. This leads to the death of aquatic fauna and a change in flora species composition. Dense stands of Ludwigia can intercept almost all incident light, dominate all other water plants and in some cases lead to the loss of native plants and animals. For example, in the Botany Wetlands, Ludwigia peruviana displaced all other wetland vegetation to the extent that bird populations were significantly reduced.*

The Commission is concerned that these aquatic weeds pose an existing and future threat to metropolitan wetlands. The source of the weeds is beyond the control of the Department and other land managers. Park management therefore becomes unavoidably reactive and relies on the vigilance of field staff in identifying any infestations. Further infestations could require significant additional resources to remove or contain in an already tight fiscal environment.

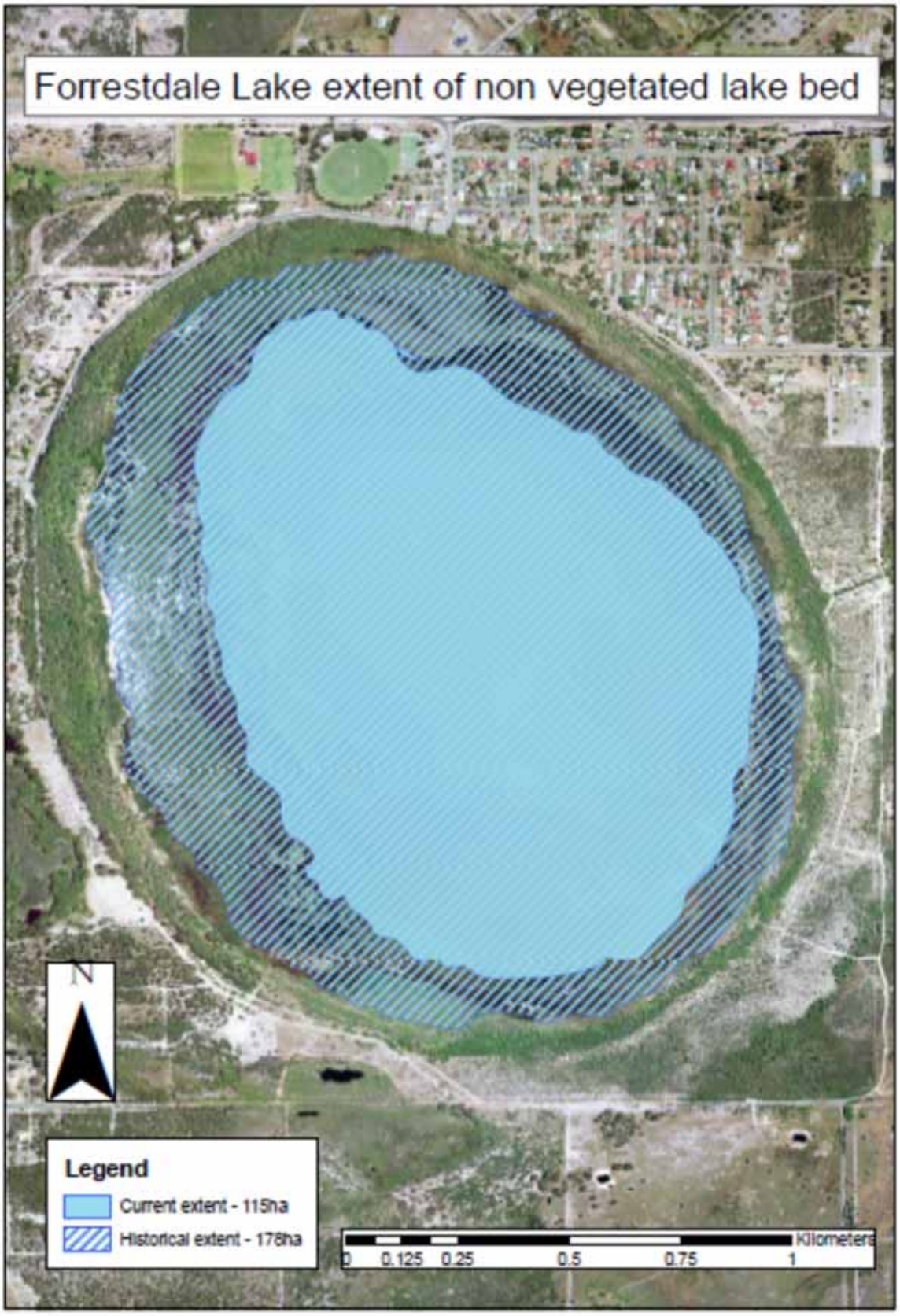
Key Finding 2

Lake edge vegetation including *Typha* have further encroached on Forrestdale Lake over the life of the management plan.

Reduced rainfall, ground water extraction and changed hydrology has seen reduced water levels in the lake and reduced periods of inundation. Map 1 was derived from a collection of historical images dating back to the year 2000, and more recent aerial photography. The historical extent of where the lake used to fill can be seen at the margin of the native terrestrial vegetation line and the perimeter of the blue hatched polygon in Map 1.

Progressive drying has seen the creep of bulrushes and other terrestrial vegetation towards the centre of the lake, reducing the area of clear lake bed suitable for wading birds. The reduction in wading habitat from historical peaks is approximately 63 hectares from 178 hectares down to 115 hectares.

Native plants as well as weeds have replaced what once would have been shallow mudflats during the late winter and spring. Weeds identified at the lake include Japanese Pepper, Arum Lily, Bridal Creeper, Cotton Bush, Fleabane and Pampas Grass. The Department undertakes weed control at the lake using spraying and physical removal methods.



Map 1: - Historical extent of Forrestdale Lake peak inundation compared with the current extent.

Image 2: - Lake edge 2002 – southern boundary

Image 3: - Lake edge 2017, note establishment of terrestrial plants further into the lake

Invasive *Typha orientalis* is slashed to keep sections of the lake open for access. There is no mapping information available to determine whether the KPI target (a 3% decrease from 2004 levels) has been achieved. The last weed occurrence map identified during this assessment was in the 2009 Strategic Assessment for the Perth and Peel Regions.

Departmental response - Weeds

Key finding 1: ***Aquarium plants that are grown in private ponds and aquariums have entered waterways and infestations have been found in metropolitan lakes. These weeds are not declared under the Biosecurity and Agriculture Management Act 2007, and are freely traded*****.**

DBCA is aware of the risk of aquatic weed infestations particularly where lakes and wetlands are connected to the stormwater drainage network. Stormwater drainage from adjacent development was typically directed away from wetlands but in our current drying climate consideration needs to be given to accepting drainage water from new development where it is of acceptable quality. However, the benefit of higher water levels comes at the cost of an increased risk of weed infestation from urban gardens.

DBCA will ensure that all field staff are adequately trained to identify aquatic weeds and that they remain vigilant and reactive to new plant species in areas that DBCA has management responsibility for. In addition, staff will be briefed on any new infestations that are reported within the Perth metropolitan region.

Key finding 2: ***Lake edge vegetation including Typha* spp*. have further encroached on Forrestdale Lake over the life of the management plan*****.**

The invasive *Typha spp* has encroached on the lake due largely to increased drying and a reduction in water levels. Control through slashing and spraying has been undertaken on an annual basis to ensure fire access is maintained and to prevent further spread where possible. Increasing water levels is an effective method of controlling *Typha*. Alternatively, chemical control coupled with planting of native sedge species is effective but requires ongoing management which DBCA will continue to seek funding to undertake on a staged basis.

DBCA is collaborating with other State and local government agencies that have responsibility for aspects of drainage and water resource management to address the need to increase water flows to Forrestdale Lake. The strategy of employing flooding of *Typha* stands following slashing has been effective at other wetlands, such as Lake Mealup in managing the spread of invasive *Typha* stands. Several opportunities for increasing water flow are currently being assessed, including modification of the James Drain infrastructure (involving the City of Armadale and the Department of Water and Environmental Regulation) which if approved by planning authorities, should provide improved water availability in Forrestdale Lake and better control options for *Typha*.

Commission Recommendation

The Commission recognises the Department's previous and continuing on-ground management of weed infestations and the ongoing research into clean water supplementation and the potential benefits in terms of the control of *Typha* stands in other drying lakes of the Swan Coastal Plain. In relation to aquatic weeds, other state jurisdictions have placed more stringent controls on the sale and distribution of invasive water plants that have been found in Perth lakes. The Commission will support the Department in exploring greater biosecurity protection measures through consultation with the aquatic plant industry, and the Department of Primary Industries and Regional Development.

Fauna populations

Key finding 3

It is likely that Forrestdale Lake has exceeded limits of acceptable change based on the Ramsar criteria for which it was listed.

The Forrestdale and Thomsons Lakes Ramsar site where originally listed as Ramsar sites based on four of the nine criteria as follows: -

> *Criterion 1: Forrestdale and Thomsons Lakes are the best remaining examples of wetlands of their type on the Swan Coastal Plain. Although formerly common, extensive development has resulted in the loss of many wetlands of this type, and most remaining examples have been degraded through drainage, excessive nutrients, and the loss of fringing vegetation.*
>
> *Criterion 3: Thomsons Lake is one of the last remaining refuges within the Swan Coastal Plain for the Western Australian-listed threatened Australasian Bittern. It is also one of few known breeding localities for Baillon's Crake, and is the only remaining wetland within the Perth metropolitan area where the Swamp Harrier still breeds.*
>
> *Criterion 5: More than 20,000 waterbirds have been recorded on both Thomsons and Forrestdale Lake. Research indicates that conditions at both lakes are suitable for use by more than 20,000 waterbirds at least several times within a 25-year period.*
>
> *Criterion 6: Thomsons Lake regularly supports more than 1% of the national population of four shorebirds: Red-capped Plover, Black-winged Stilt, Red-necked Avocet and Curlew Sandpiper. Forrestdale Lake regularly supports more than 1% of the national population of five shorebirds: Red-capped Plover, Black-winged Stilt, Red-necked Avocet, Long-toed Stint and Curlew Sandpiper.*

The diversity of avian fauna at Forrestdale Lake appears to be decreasing based on available data and anecdotal evidence. Bamford and Bancroft (2007) attributed the 'virtual disappearance' of migratory waders to loss of habitat due to the encroachment of riparian vegetation across the lake floor, which has covered the open muddy shallows utilised by migratory shorebirds.

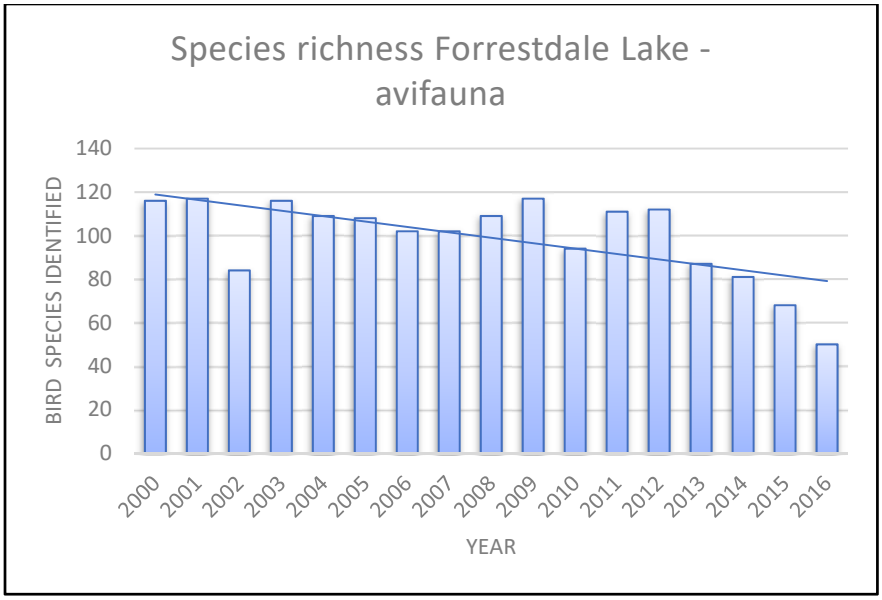


Figure 2

Data included in Figure 2 and Figure 3 are drawn from a range of contributing sources that includes Birdlife WA, universities, private consultancies, government agencies and individuals. There is no measure of survey effort from year to year. Birdlife WA verifies the records prior to including them in the database. Levels of confidence in the dataset is unknown.

Key finding 4

It is likely that Thomsons Lake has exceeded limits of acceptable change based on the Ramsar criteria for which it was listed.

There has been no systematic waterbird monitoring for Thomsons Lake since 2010 so the presence and number of migratory waders using the lake is unknown. There is an overall decreasing trend in species diversity for avian fauna at Thomsons Lake, based on the information presented in Figure 3. The decreasing trend in species diversity at Thomsons Lake does not appear as marked as Forrestdale Lake which may be correlated to the relative success of water replenishment at the lake across the survey period.

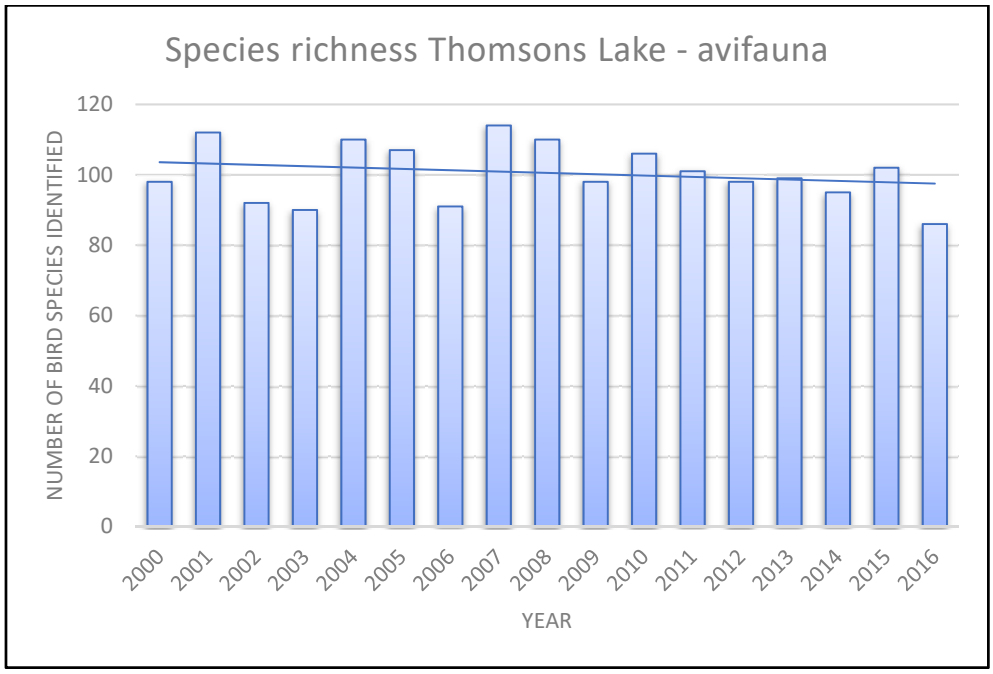


Figure 3

Thomsons Lake Ramsar listing includes internationally significant waterbird habitat which regularly supports more than 1% of the individuals of the known Australian population of the long-toed stint. From the data provided since 2000 it does not appear that the long-toed stint is present in significant numbers. Similarly, the Curlew sandpiper has not been recorded at the lake since 2010 and has only been recorded sporadically before 2010, and only in small numbers.

The Australasian bittern was not recorded during the period 2000-2016 noting the species is often secretive in behaviour where intensive listening survey and intensive transect survey methods are required to locate birds. The Swamp harrier has not been recorded since 2007.

Table 1: - Bird survey data available for Thomsons Lake 2000-2016; Birdlife WA.

	Australasian Bittern	Swamp Harrier	Baillon's Crake	Red-capped plover	Black winged stilt	Curlew sandpiper	Red necked avocet	Long toed stint
2000						6	1	
2001			7	12	12		4	1
2002			5	5	18		4	2
2003		6			6		1	
2004		4	2	5	9	2	2	
2005		4		9	19	4	12	
2006		6	5	1	11		3	
2007		18	5	27	51	1	4	5
2008			2	9	18		3	
2009				5	5			3
2010			1	10	22	2	10	2
2011			5	4	19			
2012			2	5	14		3	
2013			1	7	23			
2014			1	8	17			2
2015			3	7	10		7	3
2016			1	8	7		1	2

Department response - Fauna populations

Key finding 3: ***It is likely that Forrestdale Lake has exceeded limits of acceptable change based on the Ramsar criteria for which it was listed.***

Refer to response below that discusses both Forrestdale and Thomsons lakes.

Key finding 4: ***It is likely that Thomsons Lake has exceeded limits of acceptable change based on the Ramsar criteria for which it was listed.***

The most significant cause of the exceedance of the limits of acceptable change for waterbirds at Forrestdale and Thomsons lakes is the alteration of hydrological conditions that support populations of greater than 5000 birds. Principally, this is a combination of lower maximum water levels, earlier drying out and reduced inundation periods. Associated causes are the spread of plants that prefer drier conditions and a resultant loss of wader habitat. Evidence from across Australia supports the hypothesis that if more favourable hydrological conditions can be maintained, waterbird populations are likely to respond.

DBCA continues to participate in short-term adaptation actions to manage hydrological alteration including water supplementation for Thomsons Lake and control of terrestrial plant invasions. DBCA is also actively pursuing opportunities to increase water flow reaching Forrestdale Lake through proactive discussions with authorities with responsibility for local and regional drainage infrastructure and schemes, for instance management of James Drain to maximise flows reaching the lake.

However, the achievable scale of these types of management actions is unlikely to prevent exceedance of the hydrological limits for Thomsons Lake in the medium to long-term as the impacts

of climate change are the most significant driver of a continuing drying out of wetlands in the south-west of Western Australia. On this basis, there is a need to consider revision of the current limits of acceptable change for hydrology and waterbird populations taking into account the continuing influence of climate change, feasible adaptation strategies and regional wetland and biodiversity conservation objectives. The premise for revision of limits of acceptable change remains that these wetlands should continue to maintain, as far as possible, the suite of values for which they have been identified as being of conservation importance for. Other jurisdictions are facing similar challenges, although Western Australia appears to be at the forefront of climate change impacts on hydrological drivers.

The Commission has reiterated the importance of maintaining Ramsar listing and international significance for Thomsons Lake and identified concern that monitoring programs for waterbirds have been discontinued, leaving gaps in the monitoring for these key species. DBCA is aware of this gap as well as a lack of monitoring of littoral vegetation condition and extent and continues to look for opportunities to resource the continuation of this monitoring. A review of monitoring priorities and potential additional and alternative resources for all Ramsar sites in WA is being conducted by DBCA and this will assist in identifying strategic directions and resourcing options to support further activity in this area.

DBCA is also participating in the development of the draft Strategic Assessment of the Perth and Peel Region and the need for monitoring of Ramsar sites has been recognised in the current Draft Action Plan H: Conservation Program. Page 15 of Draft Action Plan H states that several measures will be implemented to improve the protection of wetlands throughout the Perth and Peel regions. Such measures include a commitment to establish an ongoing monitoring program that includes the limits of acceptable change, to improve and maintain the health of internationally listed wetlands including the Forrestdale-Thomsons Ramsar site. Work is continuing on the Strategic Assessment of the Perth and Peel Region, which was released in December 2015 as the draft Green Growth Plan. Release of a revised draft for public consultation is planned for the first half of 2018, subject to Government decision-making in late 2017.

Commission recommendation

The Commission recognises the challenges facing the Department in managing the Ramsar listed sites given a number of threatening processes are beyond the control of the land manager. The Commission supports further investigation into water supplementation given the success of previous programs. The Commission notes the Departments commitment to explore options for more consistent methods for monitoring birdlife and other fauna populations within the lake systems.

Other fauna management

Cygnets and Turtles

Regional parks staff successfully relocate Black swan cygnets at Thomsons lake during early summer months as the lake begins to dry out. As the cygnets are not capable of flight they require assistance in crossing the fence between Lake Kogolup to the north. Similarly, turtles need to traverse the 500m sand dune between the lakes. The Department has successfully designed and installed turtle crossings in the fence to allow the turtles to move between lakes. The Commission commends the Department on this and other examples of adaptive management.

Image 4. Turtle crossing in the fence separating Thomsons Lake and Lake Kogolup

Water quality

Key finding 5

An integrated catchment management plan has been created as required in the Herdsman Lake plan, however the outcomes of the implementation of catchment planning are not known.

Herdsman Lake

In 2007-2008 the Department of Water undertook a 'snapshot' study of water quality in Perth wetlands with catchments that included industrial and commercial land uses. Two drains feeding the northern section of Herdsman Lake were sampled for nutrient levels, synthetic hormones, heavy metals, and hydro carbons. Samples recorded showed levels that exceeded the Australia and New Zealand Environment and Conservation Council trigger values (ANZECC & ARMCANZ 2000). https://www.water.wa.gov.au/__data/assets/pdf_file/0017/5273/84622.pdf
Parts of the industrial area do not have deep sewerage and in this instance effluent is generally treated by septic tank systems.

For nutrient loads, the report stated; -

"Total nitrogen and total phosphorus levels were both detected in the Balgay Drain at levels that exceed trigger values. The most likely source of nutrients is from fertiliser use and septic tanks in the catchment, but other sources may contribute."

For hydrocarbons, the report stated: -

"Elevated concentrations suggest that petroleum hydrocarbons are being discharged in the catchment. Petrol stations are a common source of petroleum hydrocarbons, but road runoff and a wide variety of industries are also potential sources."

For heavy metals, the report stated: -

"Of the metals sampled in Hasler Road Drain, zinc exceeded trigger values in water; and copper and lead were above trigger values in the sediment."

Image 5. Balgay drain and signage

For sewerage, the report stated: -

"Ethinylestradiol was detected in surface water at a concentration of 0.013 mg/L. Detection of this synthetic hormone, which is found in the birth control pill, suggests that there may be human sewage inputs into the drain."

The regional parks model requires a multi stakeholder approach to catchment management as inputs to the wetland system originate outside of the reserves. The performance measure for water quality in the lake focuses on any changes in the abundance and diversity of macro invertebrate communities. Water monitoring of nutrients, hydrocarbons and heavy metals is not a performance measure (KPI) of the regional park management plan, but is instead written into the integrated catchment management plan for the Herdsman catchment.

The City of Stirling is the driver for implementing the broader Herdsman Catchment Management Plan (2007) including engineering associated with drain management and monitoring of water quality. Information provided by the City of Stirling suggest that physical works and monitoring of inflows to the lake is being undertaken, however any data collected thus far has not yet been collated to determine trends in water quality.

Yellagonga

The Yellagonga Regional Park Management Plan does not include a KPI on water quality. One of the strategies of the plan was to develop an integrated catchment management plan and this has been achieved.

The Yellagonga Integrated Catchment Management Plan (YICMP) is an example of collaborative planning involving, two cities, two government departments, an advisory committee, a working group and a 'friends of group'. The initial plan (2009-2014) was reviewed in 2015 based on the results of annual reviews undertaken in the preceding years. The plan has subsequently been revised and is current as the YICMP 2015-2019. This included full public consultation and endorsement from the Joondalup City council in March 2015.

The minutes of the City of Joondalup March 2015 council meeting details the following stakeholders as contributors to the YICMP: -

'The YICM Plan 2015-2019 is a joint initiative of the Cities of Joondalup and Wanneroo with projects to be delivered both jointly and individually to protect the wetlands of the Yellagonga Regional Park.

Liaison will continue with the third park co-manager, the Department of Parks and Wildlife, and key stakeholders including the Yellagonga Regional Park Community Advisory Committee, Friends of Yellagonga Regional Park, Edith Cowan University and the Department of Water.'

Annual reviews of ground water monitoring and surface water monitoring have been completed as per the YICMP. This reporting was achieved in collaboration with Edith Cowan University. The Commission notes this achievement of the regional park model, where multiple stakeholders have combined to reach the desired end result; current data on the quality of surface and ground water.

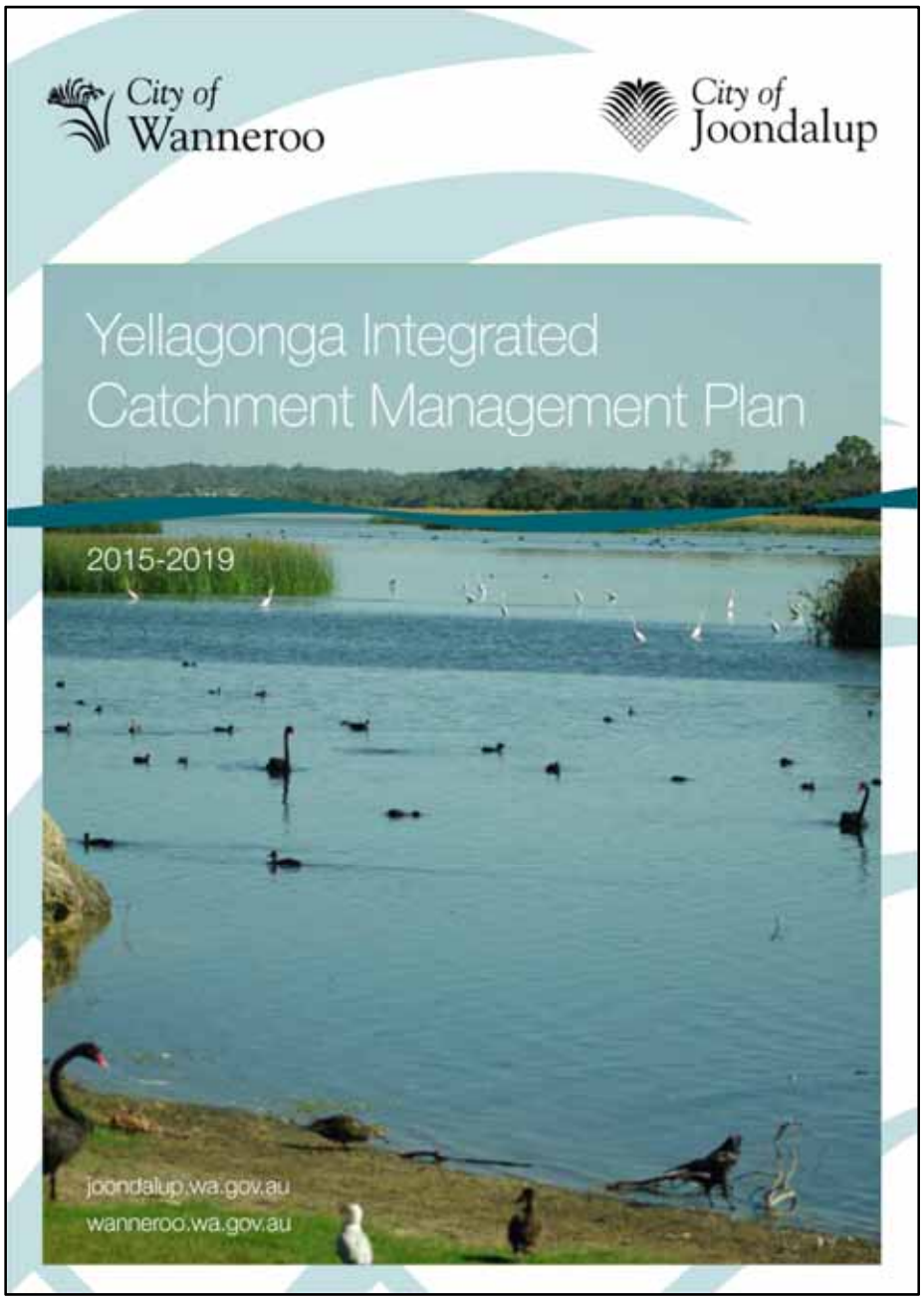


Image 6. Yellagonga Integrated Catchment Management Plan 2015-2019

Department response - Water quality

Key finding 5: ***An integrated catchment management plan has been created as required in the Herdsman Lake plan, however the outcomes of the implementation of the catchment planning are not known*****.**

As stated by the Commission in the report, the City of Stirling is the driver for implementing the broader Herdsman Catchment Management Plan (2007) and although physical works and monitoring of inflows to the lake are being undertaken, data has not been collated to determine trends in water quality. DBCA will liaise with the Herdsman Lake Regional Park Community Advisory Committee and request that the City of Stirling undertakes a water quality analysis in response to drainage improvement works that have been undertaken in the catchment. It is also understood that the community advisory committee intends to continue advocating that the Water Corporation considers installation of deep sewerage in all parts of the catchment that are still on septic systems.

Commission recommendations

The Commission notes the Department's commitment as the coordinating agency for regional park management, to continue working with Advisory Committees, City Councils and the Water Corporation to increase water quality monitoring. The Commission will assess water quality monitoring results at the twelve-month review of this assessment.

Catchment management and water supply (supplementation)

Finding

A case study on Lake Mealup demonstrated the positive benefits of reintroducing water to drying lake systems which has relevance to Forrestdale lake where there is potential for supplementation in the future.

Lake Mealup

During the periodic assessment, the audit team undertook a field visit to Lake Mealup with assistance of the Departments project coordinators. The Lake Mealup project is an excellent example of adaptive management where water replenishment has seen the recovery of a failing wetland system.

Image 7. Lake Mealup 3/3/2006 prior to water replenishment

Image 8. Lake Mealup 3/3/2015 post water replenishment

Prior to additional water being channelled into the system Lake Mealup was often dry, with the lake bed becoming increasingly acidic and overgrown with *Typha;* as can be seen in the March-2006 image. The Lake is now a permanent water body with the almost total eradication of *Typha* as seen in the March 2015 image. The smaller lake, adjacent to the left has also transformed from almost completely covered in *Typha* to free of *Typha* and permanently inundated.

The audit team noted during the assessment the expertise and commitment of Departmental staff driving the project from it's infancy through to completion and ongoing management. The project was organised around a Technical Advisory Group (TAG) bringing together expert advice from, land managers, environmental scientists, engineers, and hydrologists. Much of the success of the project was attributed to the effective functioning of this TAG.

Thomsons Lake and Forrestdale Lake (Water quality – supplementation)

A report undertaken by the Department of Water in 2009 identified lakes on the Jandakot mound including both Forrestdale Lake and Thomsons Lake as at 'severe risk of drawdown'. Since 2009 both lakes have experienced a drying trend.

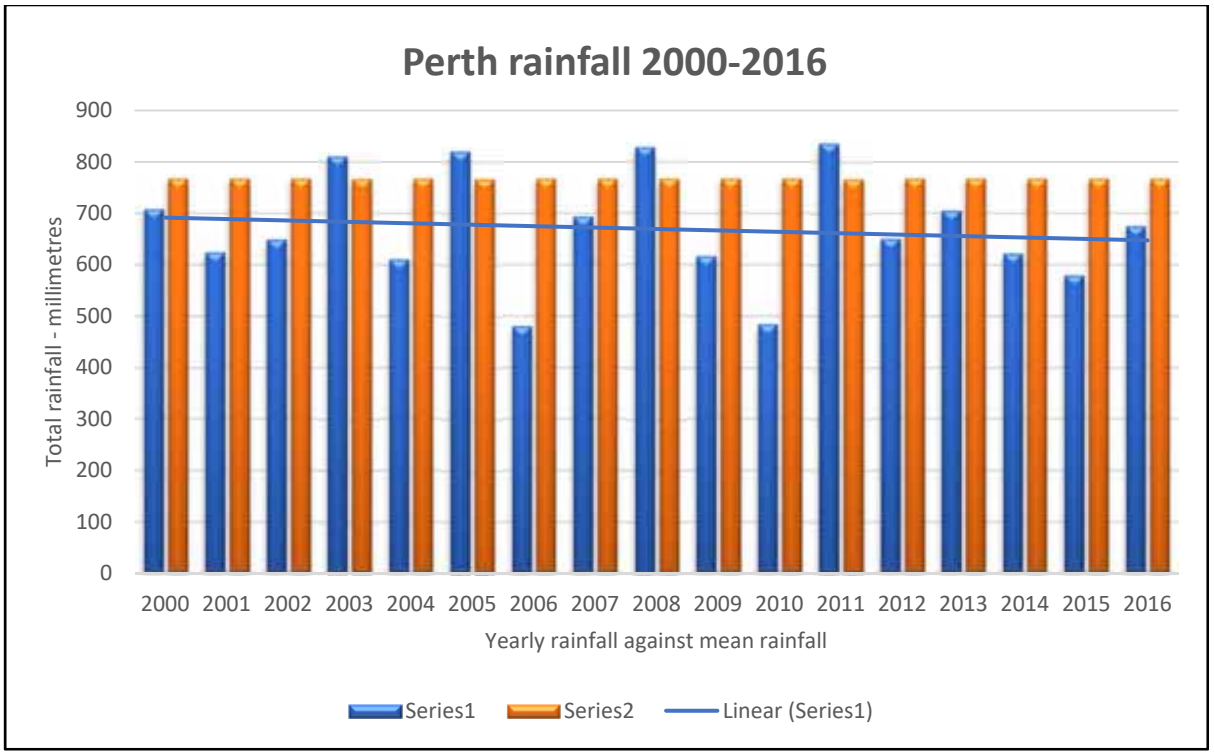


Figure 4. Perth yearly rainfall 2000-2016 plotted against Perth average with trend line

A water supplementation program was trialled at Thomsons Lake in 2004 and this has continued every year since. The Department provides a yearly review of the success of the programme together with recommendations for the future. This has been done annually and water supplementation was considered beneficial despite the Russell Road Buffer Lake having higher levels of nutrients and pollutants.

The audit team was able to participate in a workshop investigating the feasibility of redirecting storm water into Forrestdale Lake. Friends of Forrestdale, the Department, The Department of Water, URBaqua environmental consultants, Armadale City Council and the Department of Sport and Recreation were involved. The Commission looks forward to seeing the ongoing development of this project.

Department response - Catchment management and water supply (supplementation)

Key finding 6: ***A case study on Lake Mealup demonstrated the positive benefits of reintroducing water to drying lake systems which has relevance to Forrestdale Lake where there is potential for supplementation in the future.***

The success of the Lake Mealup recovery program is due largely to work of the technical advisory group, support from key stakeholders and the coordination that occurred as part of this group. The Lake Mealup project recognised that no one individual or group had the knowledge or capacity to manage these complicated wetland systems.

Currently DBCA only has the capacity to deal with issues as they arise at Forrestdale Lake. However, DBCA does recognise that an overall coordinated and collaborative approach looking at the system in its entirety and using adaptive management principles for implementing strategies with support from key stakeholders is the preferred method to increase water levels and improve the overall health of Forrestdale Lake. DBCA will continue to pursue this approach where possible.

Commission recommendations - Catchment management and water supply (supplementation)

The Commission commends the Department on the success of the Mealup Lake supplementation program and encourages the Department to document for the purposes of continuous improvement the process followed in the formation and function of the Technical Advisory Group.

Community (volunteers)

Key Finding 7

Friends groups have provided considerable additional resource to assist in operational management of the regional parks

The assessment revealed four of the lakes had active community (friends of) groups. These community groups are comprised of an administrative committee and several members. The friends of groups work in collaboration with the Department as well as city councils and university bodies to manage the lakes. Volunteer work evidenced during site visits included weed control, native revegetation, mulching, rubbish control and other on-ground maintenance of park facilities.

Members of these friends of groups that were met during the assessment demonstrated excellent historical knowledge of the lakes, the general condition of the lakes and how they have changed over time. They also demonstrated detailed scientific knowledge of the lakes' biota.

Communication between community groups and other stakeholders is coordinated through advisory committees of which the Department has a significant role in coordinating. The Commission would like to acknowledge the success of the Departments work in this regard. The benefits of community involvement were demonstrated in the following areas:

- historical and current knowledge of the condition of the lake;
- contribution of volunteer work;
- input into planning;
- input into monitoring (e.g. bird surveys, water levels);
- generation of extra funding for management of the lakes, and
- promotion of the values of the lakes through well designed and informed web sites

Thomsons Lake is fenced and does not provide the recreational facilities that other lakes in this assessment provide such as; pathways, walkways, and lookouts etc. The audit team could not find evidence of an active friends group for Thomsons Lake.

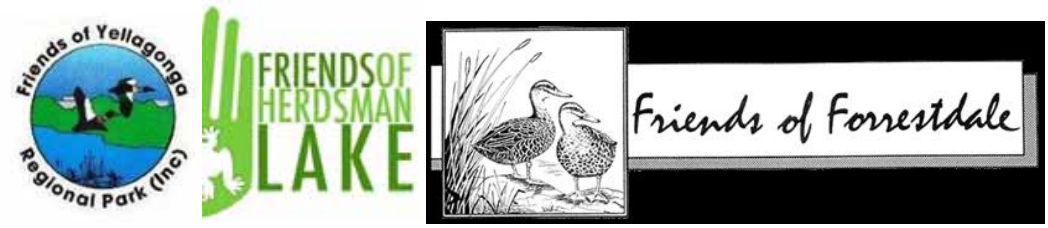


Image 9. Logos of some of the friends of groups

The audit team noted during the assessment that one of the benefits of the regional Parks model is community input through the various Regional Park Advisory Committees. The Community can take ownership of not only the values of the park but also the issues facing the park. This was demonstrated in the number of community inspired revegetation projects across the various wetlands surrounds. The Department plays a key role in coordinating the Regional Park Advisory Committees

Department response - Community (volunteers)

Key finding 7: ***Friends groups have provided considerable additional resource to assist in operational management of the regional parks.***

The importance of the community's active involvement in implementing these management plans is acknowledged by the Commission, and it is highly valued by DBCA. It encourages a sense of ownership from the community and allows interested people to become involved in future planning and management. DBCA will continue to look for any interest from community members in the establishment of new 'Friends of' groups, particularly for Thomsons Lake which could benefit from the formation of such a group. However, DBCA is aware that the vermin-proof fence and lack of recreational facilities at the site makes it harder for people to form a regular connection with the fauna reserve.

Commission Recommendations - Community (volunteers)

The Commission supports renewed efforts to establish as active "Friends of" group or facilitation of other means of community involvement in the management of Thomsons Lake.

Water quality KPI's

Key finding 8

There are no water quality reporting indicators in the management plans for Yellagonga and Herdsman Lake regional parks

The relevant management plan KPI's that relate to water quality are indirectly based on the lakes macroinvertebrate communities and the development of an integrated catchment management plan. This does not directly specify information on the type and levels of pollutants in the lake system; which is key information in determining the outcomes of management.

Commission recommendation - Water quality KPI's

The Commission recommends that direct measures of water quality (focusing on the physical and chemical levels of pollution) be incorporated into future management plans for Yellagonga and Herdsman regional parks.

Pest animals

Key finding 9

The Kangaroo population at Thomsons Lake has reached unsustainable levels and is impacting terrestrial vegetation.

At the time the management plan was written the number of western grey kangaroos (*Macropus fuliginosus*) was well in excess of the original number of kangaroos that lived in that area prior to the construction of the fence (20-30 individuals). In 2006 a cull was undertaken that removed approximately 1000 Kangaroos. This was a significantly involved process for the Department that required the development of a public communication strategy and full public consultation, given the Lake's proximity to residential areas. No follow up cull has occurred since 2006 as required by the management plan (every 2-3 years). The population of kangaroos in Thomsons Lake is now reportedly approaching 2006 numbers. The original wording of the management plan identifies the importance of protecting vegetation in the reserve from overgrazing: -

> *This is far in excess of the kangaroo population at the reserve prior to construction of the fence. Consequently, the biodiversity values of the reserve are being significantly affected. Vegetation within the reserve is being overgrazed, habitat is being destroyed, flora values are being diminished and naturally occurring rehabilitation and plant succession is being inhibited. To prevent, and where possible, negate the impacts of problem animals on the reserve's values.*

To enable the vegetation to recover from its current degraded state, the Commission supports the strategies for kangaroo population management identified in the Thomsons Lake Nature Reserve Management Plan 2005. This includes the initial management intent to reduce the population to sustainable levels by culling or other options such as the removal of the entire kangaroo population and replacement with alternative macropod species of higher conservation significance that once inhabited the area.

Image 10. Kangaroo on the move at Thomsons lake

Department response - Pest animals

Key finding 9: ***The kangaroo population at Thomsons Lake has reached unsustainable levels and is impacting terrestrial vegetation.***

DBCA is aware of the importance of limiting the kangaroo population within the reserve and the need for a control plan to be developed. Planning is currently being undertaken to reduce the kangaroo population in the reserve and DBCA intends to progress any required works at the earliest opportunity.

Commission recommendations – Pest Animals

The Commission supports the initial management plan intent to reduce the kangaroo population by culling and acknowledges that attempts have been made to recommence kangaroo population control. The Commission will assess implementation of the management options at the twelve-month review of this assessment.

Conclusion

Information on the status of the key values of the lakes and wetlands in this report is largely unknown due to either a lack of monitoring or third-party monitoring outside the Department. The assessment revealed a few monitoring programs that were discontinued and not replaced resulting in large gaps in the monitoring of those key values. For example, as with the monitoring of migratory waders and bird species identified in the Ramsar listing for Thomsons Lake and Forrestdale Lake. The Commission would like to see the Ramsar listed wetlands maintain their listing and associated international significance.

The wetlands are the receiving environment for what are mostly non-point source origins of pollutants and weeds. It is also recognised that threatening processes identified in this report such as drying climate, changed hydrology, pollutants, nutrient enrichment, and aquatic weeds are to an extent beyond the control of the Department.

Managing the number of kangaroos within Thomsons Lake Nature Reserve is within the control of the Department and has been addressed successfully in the past. However, the Commission notes that the current situation is not sustainable and that degradation of the reserve will continue as the population continues to increase.

An integrated catchment management plan has been created and implemented for Yellagonga with comprehensive annual monitoring reports completed. However, the extent as to which the same has been undertaken for Herdsman Lake remains unknown. There is also no formal measure of water quality for Herdsman Lake in the form of a management plan KPI. The role of the Department in achieving water quality monitoring objectives through the integrated catchment management model at Herdsman Lake remains unclear at this stage.

Despite the drying trend, the Department has successfully applied water supplementation programs to Thomsons Lake and Lake Mealup with generally positive results. The Commission supports the Department in pursuing further water replenishment projects where it is considered suitable, noting that supplementation planning for Forrestdale Lake has commenced.

The Commission encourages the Department to continue its coordinating role on the Regional Parks Advisory Committees and acknowledges the excellent support the community has provided to park managers. The Commission also commends the commitment of Regional parks staff and Swan Region staff for the ongoing management of the regional parks with restricted resources.

References

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BirdLife Australia's Bittern Survey Guide: Guidelines for surveying Australasian and Australian Little Bitterns, Birldlife Australia

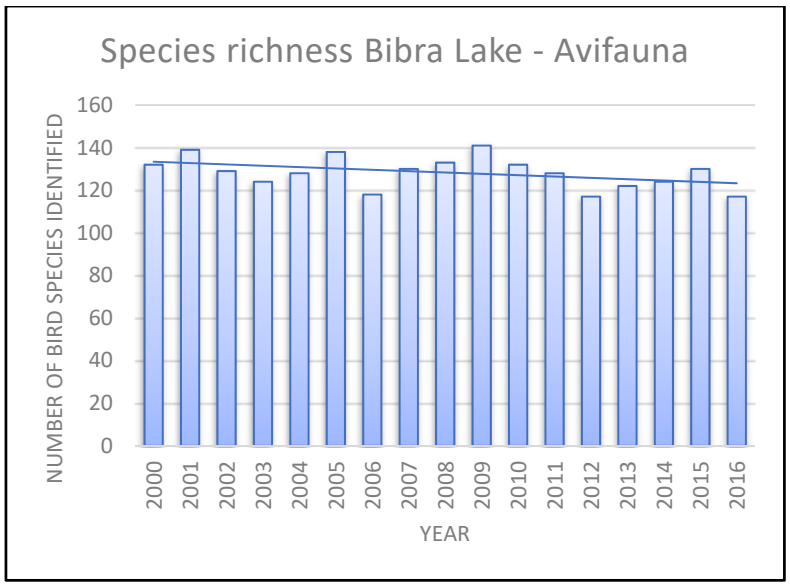
Yellagonga Integrated Catchment Management Plan 2015-2019 joondalup.wa.gov.au, wanneroo.wa.gov.au

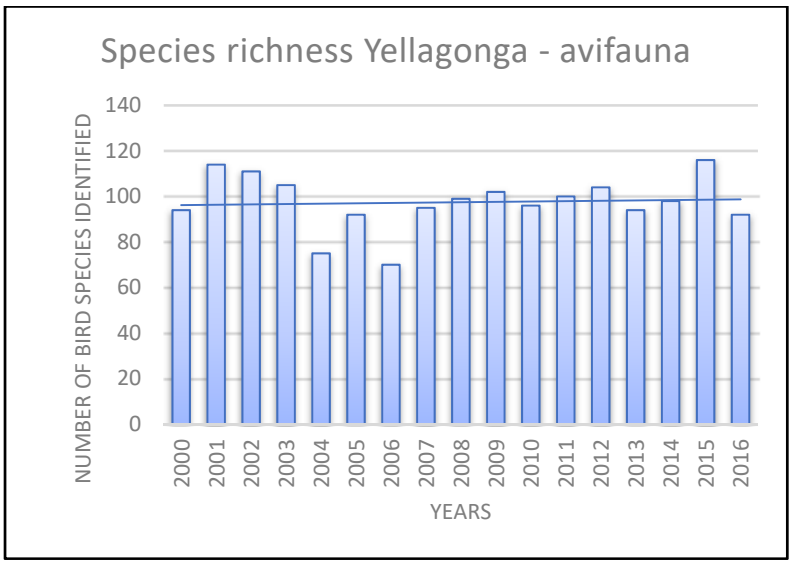
Appendices

Bird data for Herdsman Lake, Bibra Lake and Lake Yellagonga

Summary of Herdsman Lake bird banding project results

All species	2002-2016	2016	2015	2014	2013	2012
New birds	15,254	1,155	1,001	1,321	897	1,422
Recoveries	423	333	476	520	520	509
All birds	19,097	1,578	1,334	1,797	1,417	1,931
Recovery rate	20.1%	26.8%	24.9%	26.5%	36.7%	26.3%
Species	87	43	45	44	47	47





Data included in the graphs above are drawn from a range of contributing sources that includes Birdlife WA; universities, private consultancies, government agencies and individuals. There is no measure of survey effort from year to year. Birdlife WA verifies the records prior to including them in the database. Levels of confidence in the dataset is unknown.

GOVERNMENT OF WESTERN AUSTRALIA

Department of **Biodiversity, Conservation and Attractions**
Office of the Director General

Your ref:
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3 APR 2018

CONSERVATION AND PARKS COMMISSION

Director
Conservation and Parks Commission
17 Dick Perry Avenue
KENSINGTON WA 6151

FURTHER DETAILS - PERIODIC ASSESSMENT REPORT: LAKES AND WETLANDS OF THE PERTH METROPOLITAN AREA

Further to my letter of 28 September 2017, I provide additional advice from the Department of Biodiversity, Conservation and Attractions in response to the Conservation and Parks Commission's Draft Periodic Assessment Report for the Lakes and Wetlands of the Perth Metropolitan Area. This draft report assesses the implementation of five management plans that apply to lands vested in the Commission, as well as other land managers.

The department's Parks and Wildlife Service is responsible for the on-ground implementation of the management plans and does so in conjunction with departmental scientists, other land managers and the community. The lakes of the Perth metropolitan area support unique fauna assemblages, particularly migratory wading bird populations and are valued by the community as places for nature-based recreation.

Notwithstanding the conservation and community values associated with the wetlands, the department acknowledges the many challenges in managing these conservation assets within an urban environment. Of note are those challenges that are outside of the direct control of the department including a drying climate, altered hydrology and historic land uses, both within and surrounding the wetlands.

The report recognises the significant role Perth's drying climate is having on the conservation values of the wetlands. The spread and encroachment of the weed species *Typha* and other terrestrial plant species as a direct result of reduced water levels has decreased lake bed areas suitable for wading birds. This in turn, has resulted in a general decrease in avifauna species diversity. The department's water replenishment project at Lake Mealup serves as an excellent example of how wetland ecology can be improved through the provision of increased surface water flows.

The City of Joondalup has recently coordinated the development of a Federally funded Smart Cities Grant in partnership with the City of Wanneroo, Edith Cowan University, the Department of Water and Environmental Regulation (DWER) and the department's Regional Parks Unit.

This project is aimed at developing an automated monitoring system for the Yellagonga wetlands. Although in its early stages, this project has the potential to deliver a world class wetland monitoring system that provides real-time data on a range of physio-chemical properties, drainage and groundwater inputs into the wetland system.

I am pleased the report acknowledges the success of the department's regional parks delivery model in the management of these reserves. The bringing together of Government agencies, local governments, private landholders, technical specialists, and community volunteers is essential to the successful implementation of the management plans. The strong partnerships developed by the department through the Regional Park Community Advisory Committees provides avenues for the department to positively influence surrounding land uses, develop and obtain funding for unique projects and access volunteers to undertake on-ground works.

The department provides the following specific comments in response to the nine key findings in the report.

Weeds

Key finding 1: *Aquarium plants that are grown in private ponds and aquariums have entered waterways and infestations have been found in metropolitan lakes. These weeds are not declared under the Biosecurity and Agriculture Management Act 2007 and are freely traded.*

The department is aware of the risk of aquatic weed infestations particularly where lakes and wetlands are connected to the stormwater drainage network. Stormwater drainage from adjacent development is typically directed away from wetlands but in our current drying climate consideration has been given to accepting drainage water where it is of acceptable quality. However, the benefit of higher water levels comes at the cost of an increased risk of weed infestation from urban and industrial landscapes, vacant land and aquariums.

The department does not have responsibility for regulation of stormwater drainage and can only provide advice and information to the Water Corporation and DWER regarding suitability of stormwater quality and the locations of new invasive aquatic species, in conjunction with the Department of Primary Industries and Regional Development (DPIRD).

In strengthening this role, the department will ensure that all field staff are adequately trained to identify aquatic weeds and that they remain vigilant and reactive to new plant species in areas that the department has management responsibility for. Formal mechanisms, such as cross-agency committees will be sought to improve exchange of information on weed outbreaks, suitable control mechanisms and broader public education. One such committee that may be suitable for this role is the Freshwater Ecosystem Working Group, which currently has membership from this department, DWER and DPIRD. This committee could investigate the need to recommend inclusion of weed species that are shown to have potential to invade wetlands on the Swan Coastal Plain on the declared species list. In addition, staff will be briefed on any new infestations that are reported within the Perth Metropolitan Region.

Key finding 2: *Lake edge vegetation including Typha spp. have further encroached on Forrestdale Lake over the life of the management plan.*

The invasive *Typha spp.* have encroached on the lake due largely to increased drying and a reduction in water levels. These conditions are multi-factorial in causation, but while the drying climate is the principal driver, alteration of the regional surface drainage regime combined with groundwater abstraction are also influencing the transition from a near permanently wet system to a lake that dries every year and sometimes for up to 6-8 months. *Typha* is well adapted to respond to these conditions and while the department is mindful of the need for short-term control of *Typha* by slashing and the use of herbicides, long-term solutions are required to increase surface water flows into the system.

Typha slashing and spraying is undertaken on an annual basis to ensure fire access is maintained and to prevent further spread in some areas. Increasing water levels is recognised as an effective method of reducing *Typha* spread. Alternatively, chemical control coupled with planting of native sedge species can be effective but requires ongoing management which the department will continue to seek funding to undertake on a staged basis.

The department is collaborating with other State and local government agencies that have responsibility for aspects of drainage and water resource management to address the need to increase water flows to Forrestdale Lake. This strategy has been effective at other wetlands, such as Lake Mealup in managing the spread of invasive *Typha* stands, by employing flooding of *Typha* stands following slashing. Several opportunities for increasing water flow are currently being assessed, including modification of the James Drain infrastructure (involving the City of Armadale and DWER) which if approved by planning authorities, should provide improved water availability in Forrestdale Lake and provide better control options for *Typha.*

Fauna populations

Key finding 3: *It is likely that Forrestdale Lake has exceeded limits of acceptable change based on the Ramsar criteria for which it was listed.*

Key finding 4: It is likely that Thomsons Lake has exceeded limits of acceptable change based on the Ramsar criteria for which it was listed.

The most significant cause of the exceedance of the Limits of Acceptable Change for waterbirds at Forrestdale and Thomsons lakes is the alteration of hydrological conditions that support populations of greater than 5000 birds. Principally, this is a combination of lower maximum water levels, earlier drying out and reduced inundation periods. As discussed for key finding 2, these conditions are multi-factorial in causation, but while the drying climate is the principal driver, alteration of the regional surface drainage regime combined with groundwater abstraction are also influencing the transition from near permanently wet systems to lakes that dry every year and sometimes for up to 6-8 months. As a result of drying conditions, some plant species that are disturbance opportunists such as *Typha* are responding to the drier conditions with a resultant loss of wader habitat. Evidence from across Australia supports the hypothesis that if more favourable hydrological conditions can be restored, waterbird populations are likely to respond favorably.

Responsibilities for stormwater drainage and water resources are shared by two agencies outside this department and water flows to Thomsons Lake are in part influenced by abstraction of groundwater for domestic purposes and for the drinking water supply of Perth. The department continues to participate in cross-agency short-term adaptation actions to manage hydrological alteration, including water supplementation for Thomsons Lake and control of terrestrial plant invasions. Under Ministerial conditions established for the South Jandakot Drainage Scheme and for drinking water supply, the Thomsons Lake Water Supplementation Plan was trialed in 2004 and has been in operation every year since. The department is also actively pursuing opportunities to increase water flow reaching Forrestdale Lake through proactive discussions with authorities with responsibility for local and regional drainage infrastructure and schemes, for instance, management of James Drain to maximise flows reaching the lake.

The achievable scale of these types of management actions is unlikely to prevent exceedance of the hydrological limits for Thomsons Lake in the medium to long-term as the impacts of climate change are the most significant driver of continuing drying of wetlands in the south-west of Western Australia. On this basis, there is a need to consider revision of the current Limits of Acceptable Change for hydrology and waterbird populations, taking into account the continuing influence of climate change, feasible adaptation strategies and regional wetland and biodiversity conservation objectives. The premise for revision of Limits of Acceptable Change remains that these Ramsar wetlands should continue to maintain, as far as possible, the suite of conservation values for which

they were originally identified, but with limits that reflect current conditions. Other jurisdictions are facing similar challenges, although Western Australia appears to be at the forefront of climate change impacts on hydrological drivers.

The Commission has reiterated the importance of maintaining Ramsar listing and international significance for Thomsons Lake and identified concern that monitoring programs for waterbirds have been discontinued, leaving gaps in the monitoring for these key species. The department is aware of this gap as well as a lack of monitoring of littoral vegetation condition and extent and continues to look for opportunities to resource the continuation of this monitoring. A review of monitoring priorities and potential additional and alternative resources for all Ramsar sites in WA is being conducted by the department and this will assist in identifying strategic directions and resourcing options to support further activity in this area.

The department is also providing input to the Strategic Assessment of the Perth and Peel Region, which seeks approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* for development to support the growth of the Perth and Peel regions to 3.5 million people. The Strategic Assessment, which is being led by the Department of the Premier and Cabinet, comprises a suite of documents including an impact assessment report and strategic conservation plan for the protection of matters of national environmental significance, including Ramsar sites. The Strategic Assessment also includes an assessment of impacts on State environmental values, including wetlands, and related conservation commitments in response to interim strategic advice prepared by the Environmental Protection Authority under s16(e) of the *Environmental Protection Act 1986*.

The draft Strategic Assessment documents were released for public comment between December 2015 and May 2016 and identified several proposed measures to improve the protection of wetlands throughout the Perth and Peel regions, including monitoring Limits of Acceptable Change and other measures to improve and maintain the health of three Ramsar sites. In addition, the draft Strategic Assessment also identified water quality improvement measures for the Peel-Harvey and Swan estuaries, and a conservation program for the protection of threatened species and communities. Following the conclusion of the public comment period, further work has been undertaken to refine the commitments, including for wetlands on the Swan Coastal Plain.

In July 2017, the Government supported continuation of the Strategic Assessment and requested that data and outcomes for wetlands be improved and further opportunities for avoidance of environmental impacts be identified. In response, a desktop review of wetlands in the Perth and Peel regions by DWER and DBCA has been completed and significant work has been undertaken to further reduce the impacts of future infrastructure (through identification of new alignments for Government consideration) and urban and industrial development on wetlands (through development of a retention layer). Subject to consideration by the WA Government, revised draft Strategic Assessment documents could be released for public consultation in mid-2018.

Water quality

Key finding 5: *An integrated catchment management plan has been created as required in the Herdsman Lake plan, however the outcomes of the implementation of the catchment planning are not known.*

As stated by the Commission in the report, the City of Stirling is the driver for implementing the broader Herdsman Catchment Management Plan (2007) and although physical works and monitoring of inflows to the lake are being undertaken, data have not been collated to determine trends in water quality. The department will liaise with the Herdsman Lake Regional Park Community Advisory Committee and request that the City of Stirling undertakes a water quality analysis in response to drainage improvement works that have been undertaken in the catchment.

The community advisory committee intends to continue advocating that the Water Corporation consider installation of deep sewerage in all parts of the catchment that are still on septic systems.

Catchment management and water supply (supplementation)

Key finding 6: *A case study on Lake Mealup demonstrated the positive benefits of reintroducing water to drying lake systems which has relevance to Forrestdale Lake where there is potential for supplementation in the future.*

The success of the Lake Mealup recovery program is due largely to work of the technical advisory group, the support from key stakeholders and the coordination that occurred as part of this group. The Lake Mealup project recognised that no one individual or group had the knowledge or capacity to manage these complicated wetland systems.

Currently, the department only has the capacity to deal with issues as they arise at Forrestdale Lake. However, the department does recognise that an overall coordinated and collaborative approach looking at the system in its entirety and using adaptive management principles for implementing strategies with support from key stakeholders is the preferred method to increase water levels and improve the overall health of Forrestdale Lake. The department will continue to pursue this approach where possible.

Community (volunteers)

Key finding 7: *Friends groups have provided considerable additional resources to assist in operational management of the regional parks.*

The importance of the community's active involvement in implementing these management plans is acknowledged by the Commission, and it is highly valued by the department. It encourages a sense of ownership from the community and allows interested people to become involved in future planning and management. The department will continue to look for interest from community members in the establishment of new 'Friends Of' groups, particularly for Thomsons Lake which could benefit from the formation of such a group. However, the department is aware that the vermin-proof fence and lack of recreational facilities at the site makes it harder for people to form a regular connection with the fauna reserve.

Water quality

Key finding 8: *There are no water quality reporting indicators in the management plans for Yellagonga and Herdsman Lake regional parks.*

Although not specified as a performance indicator in the management plan, surface and ground water quality monitoring is currently undertaken at Yellagonga Regional Park by the Cities of Joondalup and Wanneroo through the Yellagonga Integrated Catchment Management Plan. Development of an automated water quality monitoring system is also currently underway that will provide real-time data on a range of physio-chemical parameters in the Yellagonga wetlands.

It is noted that this issue is not addressed in the *Discussion* section of the Commission's report. Should more information be presented, the department will be happy to respond.

Pest animals

Key finding 9: *The kangaroo population at Thomsons Lake has reached unsustainable levels and is impacting terrestrial vegetation.*

The department is aware of the importance of managing the kangaroo population within the reserve. The department has previously undertaken operations to reduce kangaroo numbers. Planning is currently being undertaken to commence further operations of this nature.

Should you have any queries regarding this response, please contact DBCA's Regional Parks Planning Officer

Yours sincerely

Mark Webb
DIRECTOR GENERAL

29 March 2018