

Information Sheet on Ramsar Wetlands (RIS) – 2009-2012 version

Categories approved by Recommendation 4.7 (1990), as amended by Resolution VIII.13 of the 8th Conference of the Contracting Parties (2002) and Resolutions IX.1 Annex B, IX.6, IX.21 and IX. 22 of the 9th Conference of the Contracting Parties (2005).

1. Name and address of the compiler of this form:

Compiled by the Department of Conservation and Land Management (CALM) in 1990, updated by CALM in 1998 and 2003. Updated by Kellie Maher and Jenny Davis on behalf of the Department of Environment and Conservation (DEC) in 2009.

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DD			MM			YY			
Designation date			Site Reference Number						

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2. Date this sheet was completed/updated:

June 2009

3. Country:

Australia

4. Name of the Ramsar site:

Forrestdale and Thomsons Lakes

5. Designation of new Ramsar site or update of existing site:

This RIS is for (tick one box only):

- a) Designation of a new Ramsar site; or
- b) Updated information on an existing Ramsar site

6. For RIS updates only, changes to the site since its designation or earlier update:

a) Site boundary and area

The Ramsar site boundary and site area are unchanged:

Or if the site boundary has changed:

- i) the boundary has been delineated more accurately; or
- ii) the boundary has been extended; or
- iii) the boundary has been restricted**

And/or if the site area has changed:

- i) the area has been measured more accurately; or
- ii) the area has been extended; or
- iii) the area has been reduced**

** Important note: If the boundary and/or area of the designated site is being restricted/reduced, the Contracting Party should have followed the procedures established by the Conference of the Parties in the Annex to COP9 Resolution IX.6 and provided a report in line with paragraph 28 of that Annex, prior to the submission of an updated RIS.

b) Describe briefly any major changes to the ecological character of the Ramsar site, including in the application of the Criteria, since the previous RIS for the site:

Maximum water depths at both lakes are substantially lower, the period of inundation substantially less, and annual drying is occurring earlier than at any time in the past. Although drier conditions will potentially result in a major change to the ecology of the site the extent to which these conditions, which are largely the result of climate change, groundwater abstraction and urban development can be controlled or managed is not known. The introduced Bulrush *Typha orientalis* now covers expansive areas of the waters edge and is encroaching across the dry lake beds at both lakes. *Typha* is displacing and changing riparian vegetation, which appears to be altering waterbird habitat. The invasion of *Typha* is facilitated by drier conditions and some active control measures are underway.

Previous Ramsar Information Sheets have specified that the site met Criteria 5 and 6. Recent analysis of waterbird data indicates that the site does not support the current Ramsar definition of “regularly” (Ramsar Convention 2008) and therefore does not meet the current requirements for Criteria 5 and 6.

7. Map of site:

a) A map of the site, with clearly delineated boundaries, is included as:

- iv) a hard copy (required for inclusion of site in the Ramsar List);
- v) an electronic format (e.g. a JPEG or ArcView image);
- vi) a GIS file providing geo-referenced site boundary vectors and attribute tables.

b) Describe briefly the type of boundary delineation applied:

The boundary of the Ramsar site includes the Forrestdale Lake Nature Reserve 24781 and the Thomsons Lake Nature Reserve 15556, both of which are vested in the Conservation Commission of Western Australia and managed by the Department of Environment and Conservation.

Forrestdale Lake

Follows the boundary of the Forrestdale Lake Nature Reserve 24781

Thomsons Lake

The Thomsons Lakes Ramsar site includes Lot 301, 302 and 303 of plan of 52083 that is part of Thomsons Lake Nature Reserve 15556.

Excluded from the Ramsar site is Lot 300 of Plan 52083 of that is part of Thomsons Lake Nature Reserve 15556 and Lots 44 and 2725 of Plan 215761.

8. Geographical coordinates (latitude/longitude, in degrees and minutes):

Forrestdale Lake	Latitude: 32° 10' S	Longitude: 115° 56' E
Thomsons Lake	Latitude: 32° 09' S	Longitude: 115° 50' E

9. General location:

Forrestdale and Thomsons Lakes are located within the southern Perth metropolitan area, in southwestern Australia. Forrestdale Lake is located approximately 25 kilometres south east of Perth, in the City of Armadale. Thomsons Lake is located approximately 34 km southwest of Perth in the City of Cockburn. The wetlands are located approximately 8.5 kilometres apart, separated by freehold residential, rural and semi-rural (rural residential) land.

10. Elevation: (in metres: average and/or maximum & minimum)

Forrestdale Lake: 22.5 m Australian Height Datum (lake bed level or sediment surface)

Thomsons Lake: 11.8 m AHD (lake bed level or sediment surface)

11. Area: (in hectares)

Forrestdale Lake: 246 ha

Thomsons Lake: 538 ha

12. General overview of the site:

Forrestdale and Thomsons Lakes are the best remaining examples of brackish, seasonal lakes with extensive fringing sedgeland typical of the Swan Coastal Plain. They contain rich and diverse communities of aquatic invertebrates, and in a regional context, they constitute an important breeding, migration stop-over and drought refuge area for waterbirds. They contain WA listed threatened ecological communities, declared rare flora and other priority flora species.

13. Ramsar Criteria:

1 • 2 • 3 • 4 • 5 • 6 • 7 • 8 • 9

14. Justification for the application of each Criterion listed in 13 above:

Criterion 1: A wetland should be considered internationally important if it contains a representative, rare or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.

Forrestdale and Thomsons Lakes are the best remaining examples of large brackish, seasonal lakes with extensive fringing sedgeland typical of the Swan Coastal Plain, within the South-West Coast Drainage Division. While these types of wetland were formerly common, extensive development of the Swan Coastal Plain has resulted in the loss of many of these wetlands, and most of the remaining wetlands of this type have been degraded through drainage, eutrophication and the loss of fringing vegetation.

Criterion 3: A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.

Forrestdale and Thomsons Lakes provide important habitat for waterbirds on the Swan Coastal Plain with 85 species of waterbird occurring at the two lakes, including 29 migratory species listed under the EPBC Act. In addition, 27 waterbird species have been recorded breeding at the lakes. The Ramsar site contains rich and diverse communities of aquatic invertebrates that are representative of relatively undisturbed, large, shallow Swan Coastal Plain wetlands dominated by submerged macrophytes. Macroinvertebrates are an important component of wetland food webs, comprising much of the diet of many faunal species, including migratory waders and other waterbirds, and turtles. There are two WA listed Threatened Ecological Communities at Forrestdale Lake Nature Reserve, two 'Declared Rare Flora' species listed under WA legislation and nine Priority taxa. Thomsons Lake Nature Reserve contains one 'Declared Rare Flora' species listed under WA legislation and three Priority taxa.

15. Biogeography

a) biogeographic region:

South-West Coast Australian Drainage Division

b) biogeographic regionalisation scheme (include reference citation):

Australian Drainage Divisions, National Land & Water Resources Audit (Commonwealth of Australia 2000)

16. Physical features of the site:

Forrestdale and Thomsons Lakes are fresh/brackish, seasonal wetlands that dry out in summer or autumn. Both lakes are predominantly groundwater-fed and surface run-off probably had little effect on their depth when they were in an undisturbed condition. Both lakes contain large areas of open water and are fringed by rushes and sedges, behind which are belts of trees tolerant of seasonal waterlogging. The higher ground around the lakes supports open woodland.

Thomsons Lake occupies a depression between two sand dune systems – the Bassendean Dune System to the east, and the younger Spearwood System to the west (CALM 2005b). The two dune systems have occurred as a result of accumulation and subsequent distribution of beach sands and successive shorelines, and the major factors influencing their formation are thought to be a series of marine transgressions and prevailing westerly winds. Palaeobotany studies have revealed that the sediments of Thomsons Lake are between 30,000 and 40,000 years old, making them the oldest lake sediments discovered in Western Australia to date.

Forrestdale Lake is situated on the eastern edge of the gently undulating Bassendean Dune System, which are predominantly leached grey-white siliceous sands (CALM 2005a). The lake is a deflation basin rimmed by low sand ridges up to five metres high. On the north-eastern margin of the lake a rocky outcrop of lithified sandstone is present. The lake bed sediments are up to two metres thick and include silt, clay, peat, diatomite, marl and freshwater limestone (ERM Mitchell McCotter 2000).

17. Physical features of the catchment area:

Forrestdale and Thomsons Lakes are located within the southern Perth metropolitan area and are surrounded by medium density urban developments and some agricultural land. The lakes are situated in the Perth Basin, on the Swan Coastal Plain, on the eastern edge of the gently undulating Bassendean Dune System (Forrestdale Lake), and in the junction between the Bassendean Dune System and the Spearwood Dune System (Karrakatta unit – deep yellow sand over limestone – Thomsons Lake). The Swan Coastal Plain experiences a Mediterranean climate with a hot dry summer (December to February) and cool wet winter (June to August).

18. Hydrological values:

Forrestdale and Thomsons Lakes are examples of interdunal groundwater wetlands. Both lakes are situated on the Jandakot Groundwater Mound, which is a region of elevated groundwater table beneath the Swan Coastal Plain. Groundwater discharges from the mound into low lying depressions that support groundwater dependant vegetation and extensive wetland systems, the most notable of which are Forrestdale and Thomsons Lakes (CALM 2005a, b). The water levels in both lakes respond to events which cause variations in local groundwater supply, including natural processes such as seasonal rainfall, and as a result of modified land-uses within the catchment, particularly groundwater abstraction, drainage and urban development (CALM 2005a, b). Forrestdale Lake also receives a small amount of drainage from adjacent residential areas. A drainage scheme diverts water from residential subdivisions to the east of Thomsons Lake away from the lake. Strict criteria have been imposed for water level management in both lakes (DoE 2004).

19. Wetland Types

a) presence:

Marine/coastal: A • B • C • D • E • F • G • H • I • J • K • Zk(a)

Inland: L • M • N • O • P • Q • R • Sp • Ss • Tp • Ts • U • Va • Vt • W • Xf • Xp • Y • Zg • Zk(b)

Human-made: 1 • 2 • 3 • 4 • 5 • 6 • 7 • 8 • 9 • Zk(c)

b) dominance:

P

20. General ecological features:

Forrestdale and Thomsons Lakes provide important habitat for waterbirds on the Swan Coastal Plain with 85 species of waterbird occurring at the two lakes and 27 species recorded breeding. Twenty nine of the recorded species are protected by the Japan-Australia Migratory Bird Agreement (JAMBA), the China-Australia Migratory Bird Agreement (CAMBA), Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA) and the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention). Seventy-three waterbird species have been recorded at Thomsons Lake, including 20 species that are protected by JAMBA, CAMBA, ROKAMBA and Bonn Convention. Seventy-six waterbird species have been recorded at Forrestdale Lake, with 23 of these protected by JAMBA, CAMBA, ROKAMBA and Bonn Convention. All species listed under JAMBA, CAMBA, ROKAMBA and Bonn Convention are identified as migratory under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

The highest number of waterbirds counted at Thomsons Lake was 21,083 in February 1987, and more than 10,000 waterbirds have been recorded in several years. Species occurring in significant numbers at Thomsons Lake are:

Australasian Shoveler (2,000 Mar 1982), Australian Shelduck (1,600 Nov 1982), Black-winged Stilt (3,000 Feb 1986), Curlew Sandpiper (2,500 Mar 1983), Eurasian Coot (7,000 Feb 1987), Grey Teal (6,000 Feb 1986), Hoary-headed Grebe (1,500 Nov 1982), Pacific Black Duck (4,500 Dec 1985), Red-capped Plover (1,000 Feb 1986), Red-necked Avocet (2,000 Mar 1983), Red-necked Stint (2,500 Mar 1983), Sharp-tailed Sandpiper (1,000 Jan 1986).

The highest number of waterbirds counted at Forrestdale Lake was 22,196 in January 1986 and at least 10,000 have been recorded in several years. Species occurring in significant numbers at Forrestdale Lake are: Australasian Shoveler (2,000 Jan 1984), Australian Shelduck (1,650 Jan 1985), Black Swan (1,416 Feb 1987), Black-winged Stilt (3,840 Dec 1985), Curlew Sandpiper (2,000 Jan 1983), Eurasian Coot (7,670 Jan 1987), Grey Teal (9,000 Mar 1987), Hardhead (1,053 Oct 1982), Hoary-headed Grebe (1,890 Jan 1987), Pacific Black Duck (5,500 Mar 1987), Red-capped Plover (1,300 Mar 1987), Red-necked Stint (3,000 Mar 1982).

All waterbird count data are from Crook and Evans (1981), Bartle *et al.* (1987), Jaensch *et al.* (1988), Storey *et al.* (1993), Halse *et al.* (1990, 1992, 1994, 1995), Bamford and Bamford (1998, 1999, 2000, 2001, 2003, 2004), Bamford and Wilcox (2005), Bamford and Bancroft (2006, 2007), Barrett *et al.* (2003), which include surveys conducted between 1981 and 2007.

The margins of both lakes support a large number of terrestrial birds, and other vertebrate species including the uncommon skink *Lerista lineata*. Both lakes support 6 wetland frog species, and freshwater turtles *Chelodina oblonga* are also present in both lakes. A large diversity of macroinvertebrates exists at these lakes. Macroinvertebrates from a total of 59 families and 3 taxa identified only to order have been collected from Thomsons Lake from 1985–2007, including 2 annelids, 4 molluscs, 15 crustaceans, 8 arachnids, and 33 insects. Macroinvertebrates from a total of 40 families and 3 taxa identified only to order have been collected from Forrestdale Lake from 1986–2007, including 2 molluscs, 12 crustaceans, 7 arachnids, and 22 insects.

Extensive stands of the submerged macrophyte *Myriophyllum salusigenium* have been recorded in open water at Thomsons Lake (Halse *et al.* 1993) and the floating macrophyte *Lemna* has also been recorded (Balla 1992). *Baumea articulata* and the introduced *Typha orientalis* grow around the edge of the lake. Behind the fringing zone is a belt of *B. juncea* and *B. articulata* with emergent *Viminaria juncea* and *Acacia saligna* shrubs, which gives way to a belt of trees, *Eucalyptus rudis* and *Melaleuca preissiana*, and the shrub *Jacksonia furcellata*. As the ground rises, these are replaced by open woodland dominated by *E. marginata*, *Banksia menziesii* and *B. attenuata*. Keighery (2002a) surveyed the vascular flora of Thomsons Lake and identified 491 taxa, including 360 native and 131 introduced species.

The submerged macrophytes *Ruppia polycarpa* and *Potamogeton pectinatus* sometimes form dense stands in the water at Forrestdale Lake and 26 species of algae, notably *Chara*, have also been recorded (Bartle *et al.* 1987). Around the waters edge at Forrestdale Lake there is an almost continuous belt of *Typha orientalis*, behind which *Baumea articulata*, *B. juncea*, *Juncus pallidus*, *Bolboschoenus caldwellii* and *Gahnia trifida* sometimes grow. Beyond these is a belt of trees, principally *Melaleuca raphiophylla*, with some *M. preissiana*, *M. incana*, *M. cuticularis*, *M. lateritia* and *Banksia littoralis* also present. *Acacia saligna* and *Eucalyptus rudis* occur on the landward side of this zone. The higher sandy ground on the eastern side of Forrestdale Lake supports open woodland dominated by *Banksia attenuata*. Keighery (2002b) surveyed the vascular flora of Forrestdale Lake Nature Reserve and identified 351 taxa; including 252 native and 99 introduced species.

21. Noteworthy flora:

Thomsons Lake Nature Reserve contains one WA listed 'Declared Rare Flora' species: *Caladenia huegeli* (Keighery 2002a); and three Priority taxa: *Dodonaea hackettiana* (State of Western Australia 2000), *Cardamine paucijuga* (Keighery 2002a) and *Eryngium pinnatifidum* subsp. *palustre* ms (Keighery 2002a). Forrestdale Lake Nature Reserve contains two WA listed Threatened Ecological Communities: 'shrublands on dry clay flats' and 'herb-rich shrublands in clay pans'; two WA listed 'Declared Rare Flora' species: *Diuris purdiei* (State of Western Australia 2000) and *Drakaea elastica* (State of Western Australia 2000); and nine Priority taxa: *Acacia lasiocarpa* var. *bracteolata* (State of Western Australia 2000), *Eryngium pinnatifidum* subsp. *palustre* ms (State of Western Australia 2000), *Stylidium mimeticum* (State of Western Australia 2000), *Villarsia submersa* (State of Western Australia 2000), *Drosera occidentalis* (State of Western Australia 2000), *Verticordia lindleyi* subsp. *lindleyi* (State of Western Australia 2000), *Anthotium junciforme* (State of Western Australia 2000), *Schoenus benthamii* (Keighery 2002b) and *Jacksonia sericea* (*Jacksonia gracilis*) (Keighery 2002b).

22. Noteworthy fauna:

One to two Australasian Bittern were recorded at Thomsons Lake in six consecutive years 1981–1987 (one in four years and two in three years) inhabiting tall sedgeland with enclosed areas of shallow open water or low sedges. The Australasian Bittern population is listed as a vulnerable species in the 2003 IUCN Red List of Threatened Species, however, this species has not been recorded at Thomsons Lake since 1991. Thomsons Lake was one of few known breeding localities for Baillon's Crake *Porzana pusilla*, and the only remaining wetland within the Perth metropolitan area where Swamp Harrier *Circus approximans* was known to breed. These species have not been recorded breeding at this lake since the mid-1980s.

Pectoral Sandpiper *Calidris melanotos* (up to four) and Ruff *Philomachus pugnax* (one) occur at Thomsons Lake in some years. Forrestdale Lake is one of the few sites in Western Australia where Little Ringed Plover *Charadrius dubius* and Little Stint *Calidris minuta* have been recorded more than once, and it is the only location in Western Australia where White-rumped Sandpiper *C. fuscicollis* have been recorded. None of these species have been recorded since the 1980s. However, the species recorded at Forrestdale Lake in particular are vagrants and it is remarkable they were ever recorded. Very few Ruff and Pectoral Sandpipers have been recorded in southwestern Australia and although are not considered to be as vagrant as the Little Stint, they are rare migrants and also unpredictable. It is therefore unsurprising that these species have not been recorded since the 1980s.

The margins of both lakes support diverse and abundant terrestrial bird life including Carnaby's Black-cockatoo (*Calyptorhynchus latirostris*), which is listed as endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, as rare or is likely to become extinct under the *Wildlife Conservation Act 1950* (Wildlife Conservation (Specially Protected Fauna) Notice 2008) and as endangered on the IUCN Red List of Threatened Species. Three reptile species found at Forrestdale Lake Reserve are significant because they are scarce or rare in the area and have relatively localised distributions: the Swamp Skink (*Acrisoscinus trilineatum*), Lined Skink (*Lerista lineata*) and Crowned Snake (*Notechis coronatus*) (State of Western Australia 2000).

23. Social and cultural values:

- a) Describe if the site has any general social and/or cultural values e.g., fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values:

Forrestdale and Thomsons Lakes provide an attractive natural environment within a metropolitan region that people can view, enjoy, or otherwise appreciate. Although the lakes are primarily reserved for nature conservation purposes, passive recreation that does not impact on natural values or ecosystems of the reserve is permitted. The main visitor activities at the lakes include birdwatching and bushwalking, horse riding and general recreation. Research is included in the purpose for Thomsons Lake Nature Reserve and Murdoch University has undertaken research at the lakes since the 1980s. Thomsons and Forrestdale Lakes are of cultural significance to the indigenous Noongar, as detailed below.

Forrestdale and Thomsons Lakes were important camping and hunting (particularly for turtles) sites for Aboriginal people (Polglaze 1986; O'Conner *et al.* 1989; Gray 1994). The lakes are associated with a powerful Waugal (an important Aboriginal mythological being). The Waugal is spiritually and mythologically important to Aboriginal people who believe that it created rivers and lakes, and maintains the flow of waters that feed its resting places. There are five registered sites of aboriginal significance at Thomsons Lake and two at Forrestdale Lake. These sites include ceremonial, mythological and historical sites, hunting sites, and sites with archaeological artefacts.

- b) Is the site considered of international importance for holding, in addition to relevant ecological values, examples of significant cultural values, whether material or non-material, linked to its origin, conservation and/or ecological functioning?

If Yes, tick the box and describe this importance under one or more of the following categories:

- i) sites which provide a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland:
- ii) sites which have exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland:
- iii) sites where the ecological character of the wetland depends on the interaction with local communities or indigenous peoples:
- iv) sites where relevant non-material values such as sacred sites are present and their existence is strongly linked with the maintenance of the ecological character of the wetland:

24. Land tenure/ownership:

a) within the Ramsar site:

The wetland area at Forrestdale Lake is within Nature Reserve 24781, vested in the Conservation Commission of Western Australia and managed by the Department of Environment and Conservation. The wetland area at Thomsons Lake is within Nature Reserve 15556 and has the same vesting and management.

b) in the surrounding area:

Both lakes are surrounded by freehold residential, rural and semi-rural (rural residential) land. Adjoining the eastern side of Forrestdale Lake Nature Reserve is reserve (27165) vested in the City of Armadale for the purpose of recreation, part of which is leased for use as a golf course. Adjoining the south-western side of Forrestdale Lake Nature Reserve is a parcel of bushland owned by the Western Australian Planning Commission. Both of these areas have been proposed for future addition to the Nature Reserve (see item 28).

25. Current land (including water) use:

a) within the Ramsar site:

Thomsons Lake Nature Reserve is fenced to exclude feral predators. Both lakes are used principally for birdwatching, nature walks, horse riding, and general recreation by surrounding residents.

b) in the surroundings/catchment:

The area to the northeast of Forrestdale Lake is urban, and houses occur within 50 m of the lake. Land to the west of the lake has been developed for agricultural or housing purposes to within about 100 m of the lake edge. There is a substantial area of natural open woodland on the eastern side of the lake, which is used for horse riding. There is a much larger area of bush around Thomsons Lake than remains around Forrestdale Lake, however, both lakes are islands of natural vegetation in a sea of agricultural and urban land.

26. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land (including water) use and development projects:

a) within the Ramsar site:

Nutrient enrichment (eutrophication) is an issue of ongoing concern at both lakes and their biological value may decline if high levels of nutrient loading continue. The need to use pesticides to control chironomids (non-biting midges) in Forrestdale Lake (emerging adults can be a severe nuisance to nearby residents) is a potential threat to aquatic invertebrate and bird life. In 1984, approximately 220 waders were killed at Forrestdale Lake as a result of pesticide spraying to control midges (Keeling and McNee 1984). Large swarms of midges have not been evident at Forrestdale Lake in recent years because the lake has been dry over the summer period. However, if the climate becomes wetter again, this could lead to a sharp increase in nutrient enrichment and issues with odours, toxic algae and midges.

Introduced plant species, particularly *Typha orientalis*, compete with native flora, alter the floristics of fringing vegetation, and reduce the amount of open water and thus waterbird habitat. Predation by cats and foxes reduces the survival of waterbirds, particularly hatchlings, at Forrestdale Lake, which is not protected by a predator-proof fence. Kangaroos enclosed within the predator-proof fence at Thomsons Lake have overgrazed native vegetation as numbers have increased. However, a recent culling program has ameliorated this problem. Spread of the disease known as 'dieback', caused by the pathogen *Phytophthora cinnamomi*, could lead to permanent changes to some littoral native plant communities and their dependent fauna.

b) in the surroundings/catchment:

Increased groundwater abstraction and an increasingly drier climate have adversely affected the water levels and period of inundation at both lakes. Impacts include: a reduced amount of time for flora and fauna dependent on water e.g. aquatic plants, macroinvertebrates and waterbirds, to complete their lifecycle; reduced habitat availability for waterbirds and invertebrates; decline of fringing vegetation condition; and encroachment of vegetation (predominantly *Typha orientalis*) onto the lake bed. Over the past 20 years the area of *Typha* in the fringing vegetation of both lakes has increased substantially and poses a threat by changing floristics and reducing the amount of open water.

Increasing urbanisation of the catchment of both lakes may result in changes to the water balance or nutrient status of the lake, and may lead to an increased number of unplanned fires. Excessive disturbance of waterbirds by humans and dogs may occur at Forrestdale Lake (which lacks a predator-proof fence), especially in late summer/autumn when the lake is drying out.

27. Conservation measures taken:

a) List national and/or international category and legal status of protected areas, including boundary relationships with the Ramsar site:

Both lakes are Class A Nature Reserves, gazetted for the Conservation of Flora and Fauna, are included on the Register of the National Estate, and are listed under the Western Australian Environmental Protection Authority's *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992*.

b) If appropriate, list the IUCN (1994) protected areas category/ies which apply to the site (tick the box or boxes as appropriate):

Ia ; Ib ; II ; III ; IV ; V ; VI

c) Does an officially approved management plan exist; and is it being implemented?:

Management plans for Thomsons Lake and Forrestdale Lake were published in 1981 and 1987, respectively. Revised plans for both lakes were released in 2005 and are being implemented (CALM 2005a, b).

d) Describe any other current management practices:

In 1992, Environmental Water Provisions (EWPs) were set for a number of wetlands including Thomsons and Forrestdale Lakes, and these were updated in 2004. The EWPs include a preferred minimum water level and an absolute minimum level, and were set to ensure the maintenance of the lakes' habitat value for migratory birds and rare, threatened and priority flora and fauna. The preferred minimum water level of Thomsons Lake is 11.3–11.8 m AHD, with an absolute minimum of 10.8 m AHD (DoE 2004). The lake bed level used by the Department of Environment in setting EWPs is 11.8 m AHD. This equates to a preferred minimum water level that is at the lake bed surface to 0.5 m below the lake bed, and an absolute minimum water level of 1.0 m below the lake bed surface. Thomsons Lake is supplemented with water to ensure these limits are not exceeded. The maximum permitted water level at Thomsons Lake is 12.8 m AHD, at which time water is pumped out to a level of 12.6 m AHD. The maximum levels were developed with the Environment Protection Authority's (EPA) approval, as an environmental condition on the rezoning of land to the east of Thomsons Lake from rural to urban (CALM 2005b). At Forrestdale Lake, the preferred summer minimum is 21.2–21.6 m AHD (reading from the staff gauge) and an absolute summer minimum of 20.2 m AHD (reading from monitoring well) (DoE 2004). The lake bed level used by the Department of Environment in setting EWPs is 21.6 m AHD. This equates to a preferred minimum water level that is at the lake bed surface to 0.4 m below the lake bed, and an absolute minimum water level of 1.4 m below the lake bed surface.

The current criteria for the Jandakot Mound limit the allowances for water levels to fall between the preferred and absolute minimum values for no more than two in six years. The 'two in six year' approach was adopted as a simplistic means of accounting for and mimicking the occurrence of drier years, during which water levels would be expected to be lower as a direct consequence of less rainfall. The criterion effectively requires that, on average, water levels should not be below the preferred minima for more than one third of years, and for no longer than two consecutive years in any six-year period (DoE 2004).

28. Conservation measures proposed but not yet implemented:

Adjoining the eastern side of Forrestdale Lake Nature Reserve is reserve (27165) vested in the City of Armadale for the purpose of recreation. Adjoining the southwestern side of Forrestdale Lake Nature Reserve is a parcel of bushland owned by the Western Australian Planning Commission. Both of these areas have been proposed for future addition to the Nature Reserve. The current management plans include the existing nature reserves and proposed additions.

29. Current scientific research and facilities:

Murdoch University has undertaken extensive studies of the water chemistry and aquatic invertebrate fauna of both wetlands (Davis and Rolls 1987; Rolls 1989; Pinder *et al.* 1991; Balla and Davis 1993, 1995; Davis *et al.* 1993; McGuire and Davis 1999; Wild *et al.* 2003; Wild and Davis 2004; Davis *et al.* 2008). DEC has undertaken studies to determine the factors influencing waterbird usage of both lakes, including water chemistry, extent of vegetation and water levels. DEC, with assistance from the Friends of Forrestdale community group, undertakes regular monitoring of water levels, nutrients and chemistry in both lakes. Department of Water (DoW) monitors environmental parameters including wetland vegetation, water quality, wetland birds and macroinvertebrates to provide an indication of whether changes in groundwater and wetland levels (primarily related to public and private

groundwater abstraction, and climate) are having an impact on the identified ecological values of wetlands.

30. Current communications, education and public awareness (CEPA) activities related to or benefiting the site:

Existing interpretation facilities within Forrestdale and Thomsons Lakes are limited. There is a well established network of firebreaks and management access tracks within Thomsons Lake Nature Reserve that is used by bushwalkers. A boardwalk was installed at Forrestdale Lake in 1994; however a fire destroyed it in early 2003. The Department of Conservation and Land Management prepared a brochure on Forrestdale Lake; however, it is now out of print (CALM 2005a). There is a trail located around the perimeter of Forrestdale Lake Reserve ('the Forrestdale Trail'), and an ad hoc network of trails throughout the reserve. The Cockburn Wetlands Education Centre plays an important role in environmental education within the Beeliar Regional Park, which includes Thomsons Lake (CALM 2005b).

31. Current recreation and tourism:

Both lakes are used for passive recreation including bushwalking and birdwatching. Horse riding and mountain bike riding occur regularly along a multi-purpose limestone path ('the Forrestdale Trail') located around the perimeter of Forrestdale Lake Nature Reserve (CALM 2005a). There is a well-established network of fire-breaks and management access tracks within Thomsons Lake Nature Reserve which is regularly used as bushwalking trails while horse riding is only permitted along a narrow trail on the outside perimeter of the vermin-proof fence (CALM 2005b).

32. Jurisdiction:

Territorial: Government of Western Australia

Functional: Conservation Commission of Western Australia (vesting) and the Western Australian Department of Environment and Conservation (management on behalf of the Conservation Commission).

33. Management authority:

Western Australian Department of Environment and Conservation, Perth.

34. Bibliographical references:

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