

Site 43. Lakewood Nature Reserve, Knoxfield

Council reserve with bushland, a lake, a small dam, revegetation areas and open, grassed areas. Melway ref. 73 C2.

Site Significance Level: *State*

- One of the most important wildlife sites in Knox, because its artificial lake is frequented by many rare waterbirds;
- There are also many flora species that are threatened in Victoria, regionally or within Knox;
- The lake is fringed by the regionally endangered EVC, Aquatic Herbland, partly in good ecological condition;
- There are also forest remnants of the endangered Valley Heathy Forest and Swampy Woodland, partly in good ecological condition.



The site boundary is shown in red. Neighbouring sites are outlined and labelled in bright yellow. Areas of native vegetation are outlined in white, with dashed white lines demarcating different EVCs.

Boundaries

The site is the whole of the reserve, outlined in red on the aerial photograph above. It occupies 18.05 ha and nine lots, whose boundaries are drawn in pale orange on the aerial photograph.

Land use & tenure: Council park for the purposes of passive recreation, nature conservation, drainage and flood mitigation. The northern and southern ‘wings’ of the reserve and the area around the dam marked on the aerial photograph are zoned R1Z – Residential 1 Zone. A relatively small part of the site, southeast of the dam, is zoned PUZ6 – Public Use Zone Local Government. The remainder of the site – including all cleared areas and some of the natural forest, is zoned PUZ1 – Public Use Zone Service and Utility.

Site description

This site is at elevations of 70-81 m in a broad, very shallow valley facing westward, between the valleys of Blind Ck and Monbulk Ck.

The site has very shallow slopes ($\leq 5\%$), with two drainage lines that both flow into an artificial lake with an area of 3.3 ha and a depth of 2 m. The more substantial drainage line is called the Riddell Drain (marked on the aerial photograph). It flows westward into the lake’s eastern end, and has been excavated to install a pipe and a channel that flows intermittently with stormwater from the residential area to the east.

The other drainage line is very shallow and indistinct. It passes through the northern extremity of the reserve, labelled ‘Swampy Woodland’ on the aerial photograph. Surface water in this drainage line has appeared only briefly in recent years, but the presence of dense, tall Swamp Paperbarks (*Melaleuca ericifolia*) indicates that surface water would have been quite common prior to urbanisation and drainage of the area to the north.

The aerial photograph shows a small dam on the minor drainage line just northeast of the lake, filled partly by stormwater from the nearby residential area.

The natural topsoil along the more major drainage line is alluvium washed down from higher up the catchment. The minor drainage line has shallower alluvium. There are also swamp deposits beneath the lake. The rest of the site has shallow, poorly draining, light grey loam over clay subsoil, derived from decomposition of the underlying Lower Devonian siltstones of the Humevale formation.

The lake was constructed in 1985, according to Melbourne Water. It is one of the most biologically significant features of the whole municipality. The abundant waterbirds that visit the lake have introduced numerous native wetland plants, including some that are quite rare. These plants have developed into the regionally endangered EVC, Aquatic Herbland, around the lake perimeter. The lake’s water level rises and falls seasonally and from year to year, causing the width and composition of the fringing vegetation to vary. The aerial photograph above shows a time of low water, showing clear zonation into bands parallel with the water’s edge, dominated variously by rushes, sedges, Water Couch (*Paspalum distichum*) and short-lived species such as Waterwort (*Elatine gratioloides*) and the rare mud-mat, *Glossostigma cleistanthum*.

The last of these species is testament to the remarkable ability of wetland plants to spread across the landscape with the aid of waterbirds: the nearest record of the species prior to this study is near the Murray River, 200 km away, according to Walsh and Entwisle (1999) and *Australia’s Virtual Herbarium* on the internet. There are also other rare plants such as Pigweed (*Dysphania glomulifera*) and the wetland weed, *Bidens tripartita*, which is more than 100 km further west than any previously known occurrence in Australia.

The plants originally brought into the lake by waterbirds have, in turn, come to provide habitat for waterbirds and frogs. Threatened bird species, such as the resident Blue-billed Ducks and Hardheads, can be seen on and around the lake daily. The fact that dabbling species can be seen diving suggests that the lake bottom is probably at least partially vegetated and has some ecological function, but no vegetation could be found by wading in gumboots in the eastern (shallow) end of the lake.

A vegetated island can be seen on the aerial photograph, but it was not visited for this study. Its perimeter was observed being used for hunting by the uncommon Great Crested Grebe and threatened egrets, and beaches around it were seen being used by other uncommon birds such as Blue-billed Ducks and Black-fronted Dotterels.

The lake is an excellent example of how a wetland can be artificially created and acquire the species, diversity and ecological functions of a naturally created ecosystem. It well deserves a proper investigation of its aquatic and amphibious fauna. It is also an excellent resource for recreation, amenity and education (e.g. by the neighbouring Knox Park Primary School, Site 108).

The adjacent small dam provides similar habitat to the lake, but rare waterbirds are less likely to use it and it is periodically excavated to remove silt. In 1989, several of the plant species growing on its eastern bank were rare in the Melbourne area, e.g. *Mazus pumilio*. These had declined by 1999, apparently due mainly to machinery operating there to remove silt. The rare species are now no longer visible, being replaced by the bare ground that can be seen on the aerial photograph. There

is a slight chance that one or more of the rare species may reappear after the current drought, perhaps nearby, but mowing, heavy foot traffic and further de-silting works are likely to prevent or destroy any regeneration.

There is a large old Silver-leaved Stringybark (*Eucalyptus cephalocarpa*) north of the lake and a small area of remnant understorey around it. The tree is significant for its size and the likely habitat value of its hollows. It is circled in white on the aerial photograph. Its ecological function is being increasingly augmented by adjacent revegetation areas. There are many more revegetation plots on the southern side of the lake.

Open, grassed areas around the lake are fairly heavily grazed by waterbirds, mainly Purple Swamphens and Australian Wood Ducks. Masked Lapwings also frequently use the grassed areas.

During the fieldwork for this study, insectivorous bats were seen above the lake at dusk. They may be just as numerous above the forest, but less easily seen. They would be roosting during the daytime in hollows and fissures within the forest's trees.

The reserve's 5½ ha of forest are of comparable biological significance to the lake. The two EVCs that are present, Valley Heathy Forest and Swampy Woodland, are both regionally endangered, and they tend to intergrade into one another. The forest's ecological condition is quite variable, but there is some of each EVC in good ecological condition. The main causes for deterioration of the native vegetation have been the effects of clearing and drainage works, and consequential invasion by environmental weeds.

Eucalypt dieback is widespread, and has been severe in parts but is apparently not worsening. The canopy of tall Swamp Paperbarks (*Melaleuca ericifolia*) in the northwestern corner was reported by Jaremovic *et al.* (1989) to be dense in 1989, but has been observed steadily thinning as the trees senesce. Regeneration of paperbarks has probably been inhibited by the drier soil conditions that have resulted from drainage schemes in the residential area immediately uphill, but some regeneration occurred in 2003.

Weed infestations that were severe in many parts of the forest until recent years have been eradicated and there is extensive natural regeneration of indigenous flora, including species that are rare or threatened in the Melbourne area.

Ecological burning has been conducted in the reserve in recent years. This has regenerated some indigenous plant species as well as the serious weed, Gorse (*Ulex europaeus*). Knox City Council is keeping serious weeds such as Gorse under control.

A feature of particular interest is the unusually high abundance of Black Sheoak (*Allocasuarina littoralis*) in the forest, in both the Valley Heathy Forest and the Swampy Woodland. Such a large, secure, breeding population is unusual in the Melbourne area.

The reserve is fairly popular for passive recreation. It has a 'Friends' group and is used as an educational resource by the adjacent Knox Park Primary School. It has a path system with paving, boardwalks, a pier and signs about natural history, as well as informal paths that cause some damage to the vegetation. There are no buildings.

The reserve was part of the Scoresby Horticultural Research Station until the 1980s.

Relationship to other land

The site's canopy of Valley Heathy Forest continues into the adjoining Knox Park Primary School (Site 108), which has very scarce and patchy native understorey. There is a gap of less than 200 m from there to R.D. Egan-Lee Reserve (Site 41). Some birds and insects no doubt commute between these sites, but the incidental observations during the fieldwork for this study did not reveal such movements other than by common urban birds and Musk Lorikeets.

There is almost no other native understorey for a radius of 900 m from these three sites, and the nearest 'core' areas of native vegetation are more than 3 km away, along Dandenong Ck and in the Dandenong Ranges. These distances represent substantial disconnection of the reserves from other forest habitat, other than for mobile fauna such as waterbirds.

Many of the abundant waterbirds at the lake apparently move between there and the various other lakes on the floodplain of the Dandenong Creek system, including the Dept of Primary Industries' dam 1.2 km to the north-northeast, Caribbean Lake, Koolamarra Waters, the Waterford Valley lakes and Jells Park's lake. Some species of waterbirds move among these on a daily basis and others move seasonally.

Bioregion: Gippsland Plain

Habitat types

Open Water in the lake and small dam, with no vegetation detectable by wading in gumboots. The size of the area varies above and below 3.3 ha as the water level rises and falls from month to month and year to year. This habitat is critical for the many significant waterbirds that live in the reserve or visit it.

Aquatic Herbland (EVC 653, regionally Endangered) fringing the lake and small dam. Although the water bodies are artificially created, the fringing vegetation has colonised naturally. The area is typically 1.5 ha but varies as the water level rises and falls. The ecological condition also varies but can be reasonably characterised as roughly equally divided between all four ratings A to D (i.e. between excellent and poor). 47 indigenous plant species recorded.

Trees and vines: None.

Shrubs: There are a few *Goodenia ovata* and *Melaleuca ericifolia* on the southern fringe, and several seedlings of *Viminaria juncea* have been planted at the eastern end of the lake.

Ferns: Four patches of *Hypolepis rugosula* on the southern fringe.

Ground flora: Dominated by indigenous rushes, particularly *Juncus sarophorus* and *Juncus procerus*, with patches of various *Persicaria* species (particularly *P. decipiens*), *Carex appressa*, *Carex gaudichaudiana*, *Typha* species, *Triglochin striatum*, *Eleocharis acuta* and seasonally, many small, amphibious herbs such as *Elatine gratioloides*, *Glossostigma cleistanthum*, *Dysphania glomulifera*, *Isolepis* species and *Alternanthera denticulata*. There are also bands of the serious weed, *Paspalum distichum*. *Alisma plantago-aquatica* is abundant, as are *Helichrysum luteoalbum* and *Senecio campylocarpus*, in season.

Valley Heathy Forest (EVC 127, regionally Endangered): 2.8 ha in total, comprising approximately 0.8 ha in good ecological condition (rating B), 1.9 ha in fair ecological condition (rating C) and 0.1 ha in poor ecological condition (rating D). 65 indigenous plant species recorded.

Dominant canopy trees: *Eucalyptus cephalocarpa* with smaller numbers of *Eucalyptus radiata* and *Eucalyptus ovata*.

Dominant lower trees: *Acacia melanoxylon*, *Acacia mearnsii*, *Exocarpos cupressiformis* and *Allocasuarina littoralis* are fairly dense.

Shrubs: There is a shrub layer that is approximately 3 m tall, mostly dense and prickly at maturity but with open patches. It is dominated by *Bursaria spinosa*, accompanied variously by *Coprosma quadrifida*, *Leptospermum continentale*, *Leptospermum scoparium* or *Kunzea ericoides*. *Acacia paradoxa* and *Cassinia arcuata* are also locally abundant following fire or mild soil disturbance. There are also plenty of smaller shrubs, of which *Epacris impressa* is the main species emerging above the ground layer.

Vines: *Billardiera mutabilis* is fairly abundant but with small total cover. There is one dense patch of *Clematis aristata*.

Ferns: *Pteridium esculentum* is dense in patches.

Ground flora: Grassy but with scattered sub-shrubs including the characteristic species, *Hibbertia riparia*. There are patches dominated variously by *Microlaena stipoides*, *Gahnia radula*, *Poa morrisii*, *Austrostipa rudis* and several *Rytidosperma* species. Other abundant species are *Arthropodium strictum*, *Burchardia umbellata*, *Caesia parviflora*, *Dianella longifolia*, *Dillwynia cinerascens*, *Gonocarpus tetragynus*, *Goodenia lanata*, *Rytidosperma pallidum*, *Lepidosperma gunnii*, *Lomandra filiformis*, *Themeda triandra* and *Xanthorrhoea minor*. The characteristic species *Acrotriche serrulata*, *Bossiaea prostrata*, *Caesia parviflora*, *Dianella admixta*, *Pimelea humilis*, *Platylobium obtusangulum* and *Veronica gracilis* are present.

Swampy Woodland (EVC 937, regionally Endangered): 2.5 ha in total, estimated to comprise 0.15 ha in good ecological condition (rating B), 1.55 ha in fair ecological condition (rating C) and 0.8 ha in poor ecological condition (rating D). 68 indigenous plant species recorded.

Dominant canopy trees: *Eucalyptus ovata* to approx 20 m tall, with considerably fewer *Eucalyptus cephalocarpa* and occasional *Eucalyptus radiata*.

Dominant lower trees: Rather dense, comprising *Acacia melanoxylon*, *Acacia mearnsii*, *Exocarpos cupressiformis*, *Allocasuarina littoralis* and a tall patch of *Melaleuca ericifolia*.

Shrubs: There is a layer approximately 4 m tall, dominated by *Coprosma quadrifida* with smaller numbers of *Ozothamnus ferrugineus*, *Bursaria spinosa*, *Kunzea ericoides* and *Leptospermum scoparium*. There are also scattered lower shrubs, comprising *Acacia verticillata*, *Leptospermum continentale* and *Goodenia ovata*.

Vines: *Billardiera mutabilis* is fairly abundant.

Ferns: *Pteridium esculentum* is scattered and there is a dense, ferny patch that includes approximately 13 *Cyathea australis* and one plant each of *Polystichum proliferum* and *Adiantum aethiopicum*.

Ground flora: Dominated variously by *Lomandra longifolia*, *Gahnia radula*, *Gahnia sieberiana*, *Microlaena stipoides* and patches of *Pteridium esculentum*. Species that are abundant but not dominant include *Acaena novae-zelandiae*, *Burchardia umbellata*, *Dianella longifolia*, *Gonocarpus tetragynus*, *Poa morrisii* and *Austrostipa rudis*. The characteristic species, *Goodenia elongata*, *Hemarthria uncinata*, *Dianella tasmanica*, *Lobelia anceps* and *Poa tenera* are all present.

Plant species

The following plant species were observed in the years indicated. The column headed 'Risk' indicates the indigenous species' risk of extinction in Knox as follows: 'C'=Critically Endangered; 'E'=Endangered; and 'V'=Vulnerable. In addition, *Glossostigma cleistanthum*, *Senecio campylocarpus* and *Acacia leprosa* (Dandenong Range variant) are rare

nationally, *Lepidium pseudohyssopifolium* is listed as 'data deficient' in Victoria and species with names in bold are rare throughout the Melbourne region.

Risk	Indigenous Species		Risk	Indigenous Species	
V	<i>Acacia leprosa</i> (Dandenong Range variant)	2009	V	<i>Epacris impressa</i>	2007
	<i>Acacia leprosa</i> × <i>paradoxa</i>	1989	V	<i>Epilobium billardierianum</i> ssp. <i>cinereum</i>	2007
V	<i>Acacia mearnsii</i>	2007		<i>Epilobium hirtigerum</i>	2007
V	<i>Acacia melanoxylon</i>	2007		<i>Epilobium ?pallidiflorum</i>	2009
E	<i>Acacia myrtifolia</i> (planted)	2007		<i>Eragrostis brownii</i>	2004
	<i>Acacia paradoxa</i> (wild and planted)	2007	V	<i>Eucalyptus cephalocarpa</i>	2007
V	<i>Acacia verticillata</i>	2007	V	<i>Eucalyptus cypellocarpa</i>	1989
	<i>Acaena novae-zelandiae</i>	2007	V	<i>Eucalyptus melliodora</i> (perhaps planted)	2009
	<i>Acrotriche serrulata</i>	2007	V	<i>Eucalyptus obliqua</i>	2007
V	<i>Adiantum aethiopicum</i>	2009	V	<i>Eucalyptus ovata</i>	2007
	<i>Alisma plantago-aquatica</i>	2007	E	<i>Eucalyptus radiata</i>	2007
V	<i>Allocasuarina littoralis</i>	2007	E	<i>Euchiton involucratus</i>	2007
V	<i>Alternanthera denticulata</i>	2007	E	<i>Euchiton sphaericus</i>	2009
	<i>Arthropodium strictum</i>	2007	V	<i>Exocarpos cupressiformis</i>	2009
	<i>Austrostipa pubinodis</i>	2007		<i>Gahnia radula</i>	2007
	<i>Austrostipa rudis</i> subsp. <i>rudis</i>	2007	E	<i>Gahnia sieberiana</i>	2009
C	<i>Baumea rubiginosa</i>	2007	E	<i>Glossostigma cleistanthum</i>	2009
	<i>Billardiera mutabilis</i>	2007		<i>Gonocarpus tetragynus</i>	2007
	<i>Bossiaea prostrata</i>	2004	C	<i>Goodenia elongata</i>	2007
	<i>Burchardia umbellata</i>	2007	E	<i>Goodenia humilis</i>	1999
	<i>Bursaria spinosa</i>	2009		<i>Goodenia lanata</i>	2007
V	<i>Caesia parviflora</i>	2007		<i>Goodenia ovata</i> (wild and planted)	2007
	<i>Campylopus clavatus</i>	2009	C	<i>Hakea nodosa</i> (planted)	2007
	<i>Campylopus introflexus</i>	2007	V	<i>Hardenbergia violacea</i>	2009
	<i>Carex appressa</i>	2007	V	<i>Helichrysum luteoalbum</i>	2007
	<i>Carex breviculmis</i>	2007	V	<i>Helichrysum scorpioides</i>	2007
E	<i>Carex gaudichaudiana</i> (wild & planted)	2007	V	<i>Hemarthria uncinata</i>	2007
	<i>Carex tereticaulis</i> (planted)	2007	E	<i>Hibbertia riparia</i>	2007
	<i>Carex inversa</i> (perhaps not indigenous)	1989	V	<i>Hovea heterophylla</i>	2004
	<i>Cassinia aculeata</i>	1999	V	<i>Hydrocotyle hirta</i>	2007
	<i>Cassinia arcuata</i>	2007	E	<i>Hydrocotyle laxiflora</i>	1999
V	<i>Cassinia longifolia</i>	2009	E	<i>Hypericum gramineum</i>	2004
V	<i>Cassinia longifolia</i>	2009		<i>Hypnum cupressiforme</i>	2009
E	<i>Centella cordifolia</i>	2007	C	<i>Hypolepis rugosula</i>	2007
	<i>Chiloscyphus ?semiteres</i>	2009	E	<i>Imperata cylindrica</i>	2007
V	<i>Clematis aristata</i>	2009	E	<i>Isolepis cernua</i> var. <i>platycarpa</i>	2002
	<i>Clematis decipiens</i>	2009	V	<i>Isolepis inundata</i>	2007
V	<i>Comesperma volubile</i>	2007		<i>Juncus amabilis</i>	2009
C	<i>Coprosma hirtella</i>	1989		<i>Juncus bufonius</i>	2007
V	<i>Coprosma quadrifida</i>	2009		<i>Juncus gregiflorus</i>	2007
V	<i>Cotula australis</i>	2009	C	<i>Juncus holoschoenus</i>	2004
V	<i>Crassula decumbens</i>	2009		<i>Juncus pallidus</i>	2007
E	<i>Crassula helmsii</i> (wild & planted)	2009	E	<i>Juncus planifolius</i>	1999
E	<i>Cyathea australis</i>	2009	E	<i>Juncus procerus</i>	2007
E	<i>Daviesia latifolia</i>	2009		<i>Juncus sarophorus</i>	2007
	<i>Deyeuxia quadrisetata</i>	2004	E	<i>Juncus subsecundus</i> (planted)	2002
	<i>Dianella admixta</i>	2007	C	<i>Kennedia prostrata</i>	2002
V	<i>Dianella longifolia</i> s.l.	2007		<i>Kunzea ericoides</i> spp. agg.	2007
V	<i>Dianella tasmanica</i>	1989		<i>Lachnagrostis filiformis</i>	2007
	<i>Dichelachne rara</i>	2007	V	<i>Lagenophora gracilis</i>	2009
V	<i>Dillwynia cinerascens</i>	2007	E	<i>Lemna disperma</i>	1989
V	<i>Drosera whittakeri</i>	2009	C	<i>Lepidium pseudohyssopifolium</i>	2009
E	<i>Dysphania glomulifera</i>	2007		<i>Lepidosperma gunnii</i>	2007
E	<i>Elatine gratioloides</i>	2009	V	<i>Lepidosperma laterale</i>	2009
V	<i>Eleocharis acuta</i>	2009	V	<i>Leptorhynchus tenuifolius</i>	1999
	<i>Eleocharis sphacelata</i>	1989		<i>Leptospermum continentale</i>	2007
			E	<i>Leptospermum scoparium</i>	2007

Risk	Indigenous Species		Risk	Indigenous Species	
V	<i>Lindsaea linearis</i>	2009		<i>Ptychomnion aciculare</i>	2007
E	<i>Lobelia anceps</i>	2002		<i>Riccia crystallina</i>	2009
	<i>Lomandra filiformis</i>	1989		<i>Rosulabryum billarderi</i>	2009
	<i>Lomandra filiformis</i> subsp. <i>coriacea</i>	2007		<i>Rytidosperma ?linkii</i> var. <i>fulvum</i>	2007
	<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	2009		<i>Rytidosperma pallidum</i>	2007
	<i>Lomandra longifolia</i>	2007		<i>Rytidosperma penicillatum</i>	2002
	<i>Lunularia cruciata</i>	2009	E	<i>Rytidosperma semiannulare</i>	2002
V	<i>Lythrum hyssopifolia</i>	2007		<i>Rytidosperma setaceum</i>	1999
C	<i>Mazus pumilio</i> (destroyed in the 1990s)	1989		<i>Rytidosperma tenuius</i>	2007
E	<i>Melaleuca ericifolia</i>	2007		<i>Schoenus apogon</i>	2007
	<i>Microlaena stipoides</i>	2007	C	<i>Schoenus tesquorum</i>	1989
	<i>Microtis parviflora</i>	2009	E	<i>Senecio campylocarpus</i>	2009
V	<i>Opercularia ovata</i>	1989		<i>Senecio glomeratus</i>	2009
V	<i>Opercularia varia</i>	2007		<i>Senecio hispidulus</i>	2007
	<i>Oxalis exilis/perennans</i>	2007	E	<i>Senecio minimus</i>	2004
E	<i>Ozothamnus ferrugineus</i>	2007	E	<i>Senecio prenanthoides</i>	2007
	<i>Pandorea pandorana</i>	2009		<i>Senecio quadridentatus</i>	2004
	<i>Persicaria decipiens</i>	2007	C	<i>Solanum aviculare</i>	2007
E	<i>Persicaria hydropiper</i>	2007	V	<i>Solanum laciniatum</i>	2009
E	<i>Persicaria lapathifolia</i>	2004	V	<i>Thelymitra peniculata</i>	1989
E	<i>Persicaria praetermissa</i>	1989		<i>Themeda triandra</i>	2007
V	<i>Pimelea humilis</i>	2007		<i>Thuidiopsis furfurosa</i>	2009
V	<i>Platylobium obtusangulum</i>	2007		<i>Tricoryne elatior</i>	2007
	<i>Poa ensiformis</i>	2007	E	<i>Triglochin striata</i> (flat leaf variant)	2009
	<i>Poa morrisii</i>	2007	E	<i>Typha domingensis</i>	2007
E	<i>Poa tenera</i>	2004	E	<i>Typha orientalis</i>	2004
E	<i>Polyscias sambucifolia</i>	2009	V	<i>Veronica gracilis</i>	2009
E	<i>Polystichum proliferum</i>	2009	C	<i>Viminaria juncea</i> (planted)	2007
E	<i>Pomaderris aspera</i> (planted)	2007	E	<i>Viola hederacea</i>	2007
	<i>Poranthera microphylla</i>	2009	E	<i>Wahlenbergia gracilis</i>	2009
V	<i>Potamogeton ochreateus</i>	2007	V	<i>Xanthorrhoea minor</i>	2007
	<i>Pteridium esculentum</i>	2009	E	<i>Xanthosia dissecta</i>	2004

Introduced Species

<i>Acacia baileyana</i>	<i>Cordyline australis</i>	<i>Helminthotheca echioides</i>	<i>Plantago coronopus</i>
<i>Acacia longifolia</i> subsp. <i>longifolia</i>	<i>Cortaderia selleana</i>	<i>Holcus lanatus</i>	<i>Plantago lanceolata</i>
<i>Acetosella vulgaris</i>	<i>Cotoneaster glaucophyllus</i>	<i>Hypericum tetrapterum</i>	<i>Plantago major</i>
<i>Agrostis capillaris</i>	<i>Cotoneaster pannosus</i>	<i>Hypochoeris glabra</i>	<i>Poa annua</i>
<i>Allium triquetrum</i>	<i>Cotoneaster simonsii</i>	<i>Hypochoeris radicata</i>	<i>Polygonum aviculare</i> s.l.
<i>Anagallis arvensis</i>	<i>Cotula coronopifolia</i>	<i>Juncus articulatus</i>	<i>Prunella vulgaris</i>
<i>Anthoxanthum odoratum</i>	<i>Crassula multicava</i>	<i>Juncus bulbosus</i>	<i>Prunus cerasifera</i>
Apiaceae sp.	<i>Crataegus monogyna</i>	<i>Leontodon taraxacoides</i>	<i>Pyrus communis</i>
<i>Arbutus unedo</i>	<i>Crepis capillaris</i>	<i>Lepidium didymum</i>	<i>Ranunculus muricatus</i>
<i>Arctotheca calendula</i>	<i>Cynodon dactylon</i>	<i>Ligustrum lucidum</i>	<i>Ranunculus repens</i>
<i>Aster subulatus</i>	<i>Cyperus eragrostis</i>	<i>Ligustrum vulgare</i>	<i>Ranunculus sceleratus</i>
<i>Atriplex prostrata</i>	<i>Dactylis glomerata</i>	<i>Lolium perenne</i>	<i>Raphanus raphanistrum</i>
<i>Bidens tripartita</i>	<i>Danthonia procumbens</i>	<i>Lonicera japonica</i>	<i>Romulea rosea</i>
<i>Briza maxima</i>	<i>Daucus carota</i>	<i>Lotus corniculatus</i>	<i>Rubus anglocandicans</i>
<i>Bromus catharticus</i>	<i>Echinochloa crus-galli</i>	<i>Lotus subbiflorus</i>	<i>Rubus ulmifolius</i>
<i>Callitriche stagnalis</i>	<i>Ehrharta erecta</i>	<i>Lythrum junceum</i>	<i>Rumex conglomeratus</i>
<i>Cardamine ?hirsuta</i> s.l.	<i>Ehrharta longiflora</i>	<i>Malus pumila</i>	<i>Rumex crispus</i>
<i>Centaurium erythraea</i>	<i>Epilobium ciliatum</i>	<i>Medicago polymorpha</i>	<i>Salix cinerea</i>
<i>Cerastium glomeratum</i> s.l.	<i>Euphorbia peplus</i>	<i>Myoporum insulare</i>	<i>Senecio vulgaris</i>
<i>Chenopodium album</i>	<i>Festuca arundinacea</i>	<i>Oxalis pes-caprae</i>	<i>Setaria parviflora</i>
<i>Chrysanthemoides monilifera</i> subsp. <i>monilifera</i>	<i>Fraxinus angustifolia</i>	<i>Paspalum dilatatum</i>	<i>Sisyrinchium iridifolium</i>
<i>Cirsium vulgare</i>	<i>Fumaria bastardii</i>	<i>Paspalum distichum</i>	<i>Solanum americanum</i>
<i>Conyza sumatrensis</i>	<i>Galium aparine</i>	<i>Phalaris arundinacea</i>	<i>Solanum mauritanium</i>
<i>Coprosma repens</i>	<i>Genista monspessulana</i>	<i>Pinus radiata</i>	<i>Solanum nigrum</i>
	<i>Grevillea rosmarinifolia</i>	<i>Pittosporum undulatum</i>	<i>Sonchus asper</i>
	<i>Hedera helix</i>	<i>Plantago australis</i>	<i>Sonchus oleraceus</i>

<i>Spergularia rubra</i> s.l.	<i>Trifolium dubium</i>	<i>Typha latifolia</i>	<i>Vicia sativa</i>
<i>Stachys arvensis</i>	<i>Trifolium pratense</i>	<i>Ulex europaeus</i>	<i>Viola odorata</i>
<i>Stellaria media</i>	<i>Trifolium repens</i>	<i>Veronica ?persica</i>	<i>Vulpia bromoides</i>
<i>Taraxacum officinale</i>	<i>Trifolium subterraneum</i>	<i>Vicia ?hirsuta</i>	

Notes concerning some of the locally threatened plant species

Acacia leprosa (Cinnamon Wattle), Dandenong Range variant. One wild plant used to grow near where the Riddell Drain enters the reserve. It died out in c. 2005 but many plants have since regenerated and others have been planted nearby. Although listed as 'rare' in Victoria because of its limited geographic range, this taxon is fairly abundant in Knox, Maroondah and the Shire of Yarra Ranges.

Acacia leprosa × *paradoxa* (Cinnamon Wattle × Hedge Wattle hybrid). Last recorded in 1989.

Carex gaudichaudiana (Fen Sedge). Over 20 m² occurs in patches near the inlet to the lake; secure.

Dysphania glomulifera (Pigweed), growing as a diminutive form. Discovered in 2004 growing densely in a number of patches at the lake's edge, and seen in smaller numbers on each inspection since.

Elatine gratioloides (Waterwort). Seasonally abundant in the Aquatic Herbland.

Epilobium ?pallidiflorum (Showy Willow-herb). Hundreds of plants are scattered around the lake's edge.

Euchiton sphaericus (Annual Cudweed). Many plants germinated next to the small dam following de-silting in 2001, and others were seen by the lake in subsequent years.

Gahnia sieberiana (Red-fruit Saw-sedge). A secure and growing population of over 20 plants.

Glossostigma cleistanthum (a mud-mat). Seasonally abundant in mud at the lake's edge, mainly in the southeast. The nearest record of this species prior to this discovery in 2004 was on the Murray River, roughly 200 km away.

Goodenia elongata (Lanky Goodenia). One patch measuring 20 m² and growing; not otherwise threatened.

Goodenia humilis (Swamp Goodenia). A population beside the small dam was destroyed by de-silting work in 2001.

Helichrysum luteoalbum (Jersey Cudweed). Fairly abundant around the lake, at least in some years.

Hydrocotyle laxiflora (Stinking Pennywort). Recorded in 1989 and 1999. Current status not known.

Hypolepis rugosula (Ruddy Ground-fern). Approx. 4 m² in five patches on the lake's southern shore.

Imperata cylindrica (Blady Grass). Restricted to one large patch, not facing any known threat.

Isolepis platycarpa (a Club-rush). Grows around the small dam and probably the lake, at least in some years.

Juncus holoschoenus (Joint-leaf Rush). Several were scattered south of the inlet to the lake in 2004 but have not been seen since. They may well reappear but are threatened by drought.

Kennedia prostrata (Running Postman). A single plant germinated following fire in the southern forest area.

Lemna disperma (Common Duckweed). Last recorded in 1989 but likely to reappear from time to time.

Mazus pumilio (Swamp Mazus). Last recorded in 1989 around the small dam, since destroyed by de-silting work.

Persicaria lapathifolia (Pale Knotweed). Small numbers grow in the Aquatic Herbland.

Polystichum proliferum (Mother Shield-fern). One plant in the northern area of Swampy Woodland.

Senecio campylocarpus (Floodplain Groundsel). Abundant in mud at the lake's edge.

Solanum aviculare (Kangaroo Apple). Scattered in the northern forest area. The author could not confirm the identity of these *Solanums*, but *S. aviculare* was recorded by Jaremovic *et al.* (1989).

Triglochin striatum (Streaked Arrow-grass) - flat leafed variant. Abundant around the lake's southern and eastern shores.

Fauna of special significance

Blue-billed Duck. Resident birds, breeding at the lake. This species is Endangered in Victoria and listed under the *Flora & Fauna Guarantee Act*.

Hardhead. Apparently resident, but breeding not recorded. Vulnerable in Victoria.

Musk Duck (visitor). Vulnerable in Victoria. A 1999 record appears in the Atlas of Victorian Wildlife.

Magpie Goose (vagrant). Vulnerable in Victoria. A 1994 record appears in the Atlas of Victorian Wildlife.

Great Crested Grebe. An occasional visitor.

Pied Cormorant. Vagrant only.

Great Egret. A fairly regular visitor. Vulnerable in Victoria and listed under the *Flora & Fauna Guarantee Act*.

Cattle Egret

Spotless Crake

Latham's Snipe

Black-fronted Dotterel

Red-kneed Dotterel. A year-round resident.

Australian Reed Warbler

Little Grassbird

Fauna habitat features

As explained in the site description, the lake is one of the most biologically significant fauna habitats in Knox, and is augmented by the small dam.

The good cover of remnant trees within the forest provides good habitat for forest and woodland birds, but the area of tree canopy and the paucity of similar habitat in the neighbourhood must be limiting the fauna that can take advantage of the habitat. There are some large Swamp Gums and Mealy Stringybarks with hollows suitable for habitation by certain birds, bats or insects.

Some nest boxes have been installed but their usage is not known.

Significance ratings

The following is an assessment of the site's significance against the Department of Sustainability & Environment's standard criteria (Amos 2004).

Ecological Integrity and Viability

The site is a 'stepping stone' for movements of nomadic and migratory waterbirds, as evidenced by abundance of such species at the lake. It is not clear whether the site attracts birds moving along the Blind Creek corridor, the Corhanwarrabul/Monbulk Creek corridor, or both. Either way, the movement of so many significant species gives the site **Regional** significance under criterion 1.2.6 of Amos (2004).

Richness and Diversity

The tally of 137 indigenous plant species is high for Knox, but this type of attribute is not formally recognised in the standard criteria. Despite the absence of a fauna survey, the abundance of bird life also stands out in Knox.

Regionally Threatened Ecological Vegetation Class

All the EVCs present at Lakewood Nature Reserve are listed as regionally Endangered. It follows from Appendix 3 of *Victoria's Native Vegetation Management - a Framework for Action* (NRE 2002a) that Lakewood Nature Reserve's native vegetation is of at least High conservation significance. This, in turn, gives the site **State** significance under criterion 3.2.3.

Rare or Threatened Flora

The site has a large, viable population of the mud-mat, *Glossostigma cleistanthum*, which is listed as 'rare' in the Department of Sustainability & Environment's *Advisory List of Rare or Threatened Flora 2005*. This is of **State** significance under criterion 3.1.2 of the standard criteria. Prior to this study, the species had evidently never been recorded within 200 km, and never south of the Great Divide.

The substantial population of the regionally rare Pigweed (*Dysphania glomulifera*) is of **Regional** significance according to criterion 3.1.4.

Many of the locally threatened plant species listed above have viable populations, thereby meeting criterion 3.1.5 for a site of **Local** significance.

Rare or Threatened Fauna

The site has stable, breeding, resident populations of the statewide-vulnerable species, Hardhead, and the statewide-endangered Blue-billed Duck. It is also known to be visited by the statewide-vulnerable Great Egret. The last two of these species are listed under the *Flora and Fauna Guarantee Act 1988*. The evidently resident and viable populations of Blue-billed Duck and Hardhead fit criterion 3.1.2 for a site of **State** significance.

Of the remaining species listed above under the heading, 'Fauna of special significance', the less common ones are sufficiently rare and threatened locally that their presence confers at least **Local** significance upon the site under criterion 3.1.5. Criterion 3.1.4 may also confer Regional significance on some of the species.

Threats

- Invasion by environmental weeds:
 - Serious: Sweet Vernal-grass (*Anthoxanthum odoratum*), Panic Veldt-grass (*Ehrharta erecta*) around *Exocarpos* and *Allocasuarina* trees, Cleavers (*Galium aparine*), Water Couch (*Paspalum distichum*) around the edge of the lake;
 - Moderate: Brown-top Bent (*Agrostis capillaris*), Trifid Burr-marigold (*Bidens tripartita*) around the lake edge, Large Quaking-grass (*Briza maxima*), Water Starwort (*Callitriche stagnalis*), a cotoneaster (*Cotoneaster glaucophyllus*), Shade Crassula (*Crassula multicava* ssp. *multicava*), Drain Flat-sedge (*Cyperus eragrostis*), Cocksfoot (*Dactylis glomerata*), Desert Ash (*Fraxinus angustifolia*), Yorkshire Fog (*Holcus lanatus*), Cat's Ear (*Hypochoeris radicata*), Jointed Rush (*Juncus articulatus*), Hairy Hawkbit (*Leontodon taraxacoides*), Japanese Honeysuckle (*Lonicera japonica*), Sweet Pittosporum (*Pittosporum undulatum*), Ribwort (*Plantago lanceolata*), Creeping Buttercup (*Ranunculus repens*), Common Onion-grass (*Romulea rosea*), Blackberry (*Rubus discolor*), Glossy Nightshade (*Solanum americanum*), Tobacco-bush (*Solanum mauritianum*) on the island, Black Nightshade (*Solanum nigrum*), Gorse (*Ulex europaeus*).
- Tree dieback disease;
- Proliferation of informal paths in the northern forest area;

- Construction of cubby houses by children in the forest;
- Tree cutting by children;
- Loss or decline of plant species such as *Polystichum proliferum* and *Kenmedia prostrata* whose populations are so small that they are vulnerable to inbreeding, poor reproductive success or elimination by incidents such as being run over by a bike;
- Silt build-up in the lake, if it were to significantly reduce the water depth in the deepest parts;
- De-silting of the lake or small dam, if it were to be done without due care for the rare and threatened flora and fauna in and around the lake.

Management issues

- The forest area of this site is being very actively and competently managed, including the judicious use of fire;
- Council could consider preparing a vegetation management plan to provide the most efficient works program, although the absence of one has not prevented successful management so far;
- De-silting of the lake and small dam should be done with care to cause minimum damage to native vegetation and fauna habitat;
- It would be desirable to monitor the populations of the plant species listed above as rare or threatened in the Melbourne area or more widely;
- An effort has been commenced since the fieldwork for this study to eradicate the highly isolated outbreak of Trifid Burr-marigold (*Bidens tripartita*) around the lake. This will need monitoring and probably follow-up weed control each March, April and May until all signs of the weed have gone. The same approach seems to have succeeded in this reserve with Square-stemmed St John's Wort (*Hypericum tetrapterum*), also known as St Peter's Wort;
- The localised infestation of Tobacco-bush on the island should be eradicated fairly urgently.

Administration matters

- This site is suited to inclusion under the proposed ESO2 overlay because of its state significance and the presence of riparian and lake habitat that could be harmed by works in areas with no native vegetation;
- The existing Vegetation Protection Overlay VPO1 covers the forested parts of this site, and one isolated, large Mealy Stringybark (*Eucalyptus cephalocarpa*) north of the lake (although the location of the tree is wrongly mapped). This is partly on the basis of the study by Water Ecoscience (1998), in which the forest is Site 5 and the tree is Site 104. The Mealy Stringybark tree was wrongly identified as a Scentbark (*Eucalyptus ignorabilis*), which would be a remarkable occurrence. Site 5 extends into the adjacent Knox Park Primary School, which is treated separately in this report as 0;
- The lake and its surroundings deserve a serious investigation of the aquatic and amphibious fauna, if this is within the priorities of Council, the Department of Sustainability & Environment or naturalists. No works should be allowed to put the ecological function of these areas at risk without such an investigation;
- Melbourne Water should be made aware of the sensitivity and significance of the lake and its fringing vegetation, particularly in regard to any de-silting work that may be conducted in future.

Information sources used in this assessment

- Jaremovic R., McMahon A.R.G, Carr G.W. and McWha M. (1989). '*Lakewood Estate Nature Reserve – Concept Development Plan Final Report*'. A copy is held by Knox City Council. This includes a set of photographs, vegetation community descriptions, lists of flora and fauna species and data from sixteen quadrats;
- Vegetation monitoring data, as described in the reports, '*Monitoring of Bushland Reserves in Knox*' (Lorimer 1999), '*Monitoring of Bushland Reserves in Knox – 2002 Review*' (Lorimer 2002) and '*Monitoring of Bushland Reserves in Knox – 2007 Review*' (Lorimer 2007a) for Knox City Council, comprising:
 - Updated data for three of the quadrats of Jaremovic *et al.*, compiled during February 1999 and again in March 2002, as well as data collected for two additional quadrats in both those months;
 - Lists of plant species (indigenous and introduced) observed in the reserve by Dr Lorimer in February 1999 and March 2002;
 - Maps and assessments of the population sizes and distributions of 21 scarce plant species in each of those years;
 - A list of fauna observed during the above botanical surveys; and
 - A series of nine photographs highlighting aspects of the reserve's vegetation, taken in 1999 and repeated in 2002;
- Site inspections totalling approximately seven hours by Dr Lorimer between 30/4/04 and 19/5/04 to fill any gaps in the pre-existing information compared with the standard survey data described in Section 2.4 of Volume 1;
- A thorough ecological investigation with approximately twenty hours of fieldwork by Dr Lorimer for '*2009 Bushland Management Plan for Lakewood Nature Reserve, Knoxfield*' for Knox City Council;
- Bird lists from U3A Knox Birdwatching Group, who visit the site from time to time;
- The Atlas of Victorian Wildlife;

- Aerial photography from February 2001 and April 2003;
- Satellite imagery of the district;
- The Department of Sustainability & Environment's BioMaps of the area;
- Maps of geology and topography produced by agencies of the Victorian government.