SHIRE OF CARDINIA

INDIGENOUS VEGETATION SURVEY

PAKENHAM GROWTH CORRIDOR AND ADJOINING AREA

Ecology Australia

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INDIGENOUS VEGETATION SURVEY

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1.0 EXECUTIVE SUMMARY

- In May 2003 the Shire of Cardinia commissioned Ecology Australia to conduct an indigenous vegetation survey of the Shire's growth corridor and areas to the north of potential rural residential development.
- The aim of the survey is to document remnant terrestrial native flora and fauna, including significant communities, their condition and threats within the study area. This will be utilised by local government planners for consideration during the planning process and for environmental management purposes.

Biodiversity of the study area

Flora

- A total of 550 plant taxa - species, subspecies, hybrids, cultivars and unnamed (undescribed) taxa – have been recorded in the study area. Of these, 403 (73%) are indigenous taxa and 147 (27%) are naturalised exotic or introduced taxa.
- Seventeen Ecological Vegetation Classes (EVCs) have been recorded for the study area.
- All indigenous taxa are at least Locally significant given the massive regional depletion and degradation of vegetation. At higher conservation levels, 13 taxa are significant in a State and/or National context.
- It is calculated that about only 9% of former vegetation exists in the study area and that which remains is often severely degraded.
- All remnant vegetation is important for the maintenance of biodiversity and most of the remnants are important in their contribution to the integrity of the vegetation and fauna habitat of the broader study area. Therefore all vegetation in the study area has conservation significance irrespective of its current status at a broader bioregional scale.
- Remnant vegetation that is in good condition is extremely valuable and should be the initial focus of protection and management. These areas tend to be those in which most layers of vegetation are still present. Once the understorey species of a remnant have been lost it is very difficult and expensive to rebuild this habitat. It is therefore imperative to protect the best and largest remnant vegetation.
- One weed species is State Prohibited and 13 species listed as Regionally Controlled under the *Catchment and Land Protection Act 1994* were recorded in the area. In addition, five weed species of National significance have been recorded for the study area.

Fauna

- A total of 246 vertebrate fauna species have been recorded within the study area. This includes 31 mammal species (6 introduced, two threatened), 171 bird species (12 introduced, 20 threatened), 18 reptile species (one threatened), 11 frog species (two threatened) and 14 fish species (two threatened).
- Potential habitat occurs in numerous farm dams and creek systems (e.g. Cardinia, Deep, Kennedy and Toomuc Creeks) throughout the study area for the Nationally significant Southern Bell Frog (Growling Grass Frog (*Litoria raniformis*)).
- The fauna habitat throughout the study area is fragmented and of moderate quality. Impacts such as large scale clearing, cattle grazing and weed invasion have removed or degraded habitat attributes necessary to support many fauna species.
- The Cardinia riparian systems are important wildlife corridors and potentially link otherwise isolated habitat to larger, better quality habitat remnants to the north (e.g. Cardinia Reservoir, Bunyip State Forest and Beaconsfield Reservoir).

Strategic Directions for Biodiversity management

- Almost all vegetation and fauna habitats remaining are under direct or indirect threat at variable scales and intensity. The suite of processes which threaten flora and fauna in the study area have been listed. If these processes are not abated, biodiversity loss will be inexorable.

Relevant policy and legislation

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999)

One plant species (Maroon Leek-orchid (*Prasophyllum frenchii*)) listed under the EPBC Act occurs within the study area. No vegetation communities listed under the EPBC Act occur within the study area.

Seven species listed under the EPBC Act 1999 have previously been recorded in the Cardinia DRA. The Southern Bell Frog (Growling Grass Frog) *Litoria raniformis* is a Nationally significant species highly likely to occur in aquatic habitats throughout the study area. Potential impacts to this species from future proposed developments should be referred to the Commonwealth under the EPBC Act 1999.

Other species potentially requiring referral under the EPBC Act 1999 include the Dwarf Galaxias (*Galaxiella pusilla)* and Australian Grayling (*Prototroctes maraena).*
Nine Marine and/or Migratory species listed under the EPBC Act 1999 are also considered threatened and have been recorded in the DRA. Of these, the following are considered the most relevant to the study area:

- Blue-billed Duck *Oxyura australis*
- Hardhead *Aythya australis*
- Musk Duck *Biziura lobata*
- Latham's Snipe *Gallinago hardwickii*
- Great Egret *Ardea alba*
- Nankeen Night Heron *Nycticorax caledonicus*

Flora and Fauna Guarantee Act 1988 (FFG Act 1988)

Numerous threatening processes operating in the study area are listed under the FFG Act 1988. The most pertinent include:

- Degradation of native riparian vegetation along Victoria's rivers and streams.
- Predation of native wildlife by the cat *Felis cattus*.
- Predation of native wildlife by the fox *Vulpes vulpes.*

Two plant species (Purple Diuris (*Diuris punctata* var. *punctata*) and Maroon Leek-orchid (*Prasophyllum frenchii*)) listed under Schedule 2 of the *Flora and Fauna Guarantee Act 1988* (FFG Act) are present within the study area. No botanical communities listed under Schedule 2 of the *Flora and Fauna Guarantee Act 1988* (FFG Act) are present within the study area.

Ten avian species, one frog species, one mammal and two fish species that have previously been recorded in the Cardinia DRA are listed under the FFG Act 1988. The most relevant of these species are the Powerful Owl (*Ninox strenua*) and Great Egret (*Ardea alba*).

Guiding principles

Four guiding principles for native vegetation management in Victoria have been outlined by the *Victoria's Native Vegetation Management – A Framework for Action* and are applicable to this study.

1. Retention and management of remnant native vegetation
2. The conservation of native vegetation and habitat
3. The cost of vegetation management should be equitably shared
4. A landscape approach to planning native vegetation management is required

Each of these four guidelines can be applied to vegetation and fauna habitat protection and management issues within the study area.

2.0 INTRODUCTION

The Shire of Cardinia is located on the fringe of the Melbourne metropolitan area, with Pakenham being the main urban centre located 55 km south-east of Melbourne. Deep Creek to the east of Pakenham forms the eastern boundary of the urban growth boundary to the south-west along the Princes Highway (Department of Infrastructure 2002). Within the associated growth area (Pakenham Growth Corridor) growth rates are expected to exceed 8% per annum from 2001 (Cardinia Shire Council 2002). Such growth puts pressure on the environment, resulting in the need to adequately manage the biodiversity remaining. Consequently, in May 2003 the Shire of Cardinia commissioned Ecology Australia to conduct an Indigenous Vegetation Survey of the Shire's growth corridor and areas to the north of potential rural residential development (see Figure 1 for study area). The aim of the survey is to document remnant terrestrial native flora and fauna, including significant communities, their condition and threats within the study area. This will be utilised by local government planners for consideration during the planning process and for environmental management purposes.

This information will be incorporated into the Shire of Cardinia's Geographical Information System (GIS) and Planning Scheme through appropriate overlays and schedules. The Survey will predominantly identify remnant vegetation; hence individual or stands of non-indigenous trees in urban areas which may have cultural, landscape or heritage significance have not been included in this report.

The Report will provide a baseline of current condition for future audits, as well as provide a range of mechanisms to facilitate the preservation and management of the areas identified and provide guidance and assistance with the following:

- The assessment of planning permit applications, rezoning requests and submissions for subdivisions. In addition, strategic areas required for conservation and rehabilitation will be identified.
- The development of strategies to address vegetation conservation, landscape planning, wildlife protection, domestic and feral animal control, and environmental / noxious weed and invasive plant species control.

The major tasks to be undertaken for the project included:

- Collation of existing data on the biota of the study area.
- Consultation with the community to identify sites and provide data.
- Field work, surveys and assessments to document flora and fauna at a range of sites.
- Mapping identified sites for inclusion in the Shire of Cardinia Geographic Information System (GIS).
- Establishing an Access Database documenting sites and biological values.
- Production of a report detailing project findings, biodiversity policy framework and guiding principles for vegetation and fauna habitat protection and management.

The report is structured in the following way:

Section 1 summarises the findings of the study and the report.

Sections 2 and 3 provide an introduction to the report and give an overview of the study area.

Section 4 (given as an appendix) describes the methods used to collate existing data on flora and fauna, undertake the field survey, and collect additional data from a wide range of sites.

Section 5 presents the findings and the resulting inventory of biodiversity resources in the study area, *viz*. the indigenous and weed flora, Ecological Vegetation Classes (EVCs) and vertebrate fauna. This section also outlines and discusses the conservation status of flora, fauna and vegetation communities and includes threatening processes for flora and fauna in the study area as identified during the Study.

Section 6 outlines the need for retention of remnant vegetation and fauna habitat in the study area. This section also outlines the legislative content and discusses guiding principles for native vegetation protection and management in the study area.

Sections 7 and 8 provide acknowledgements and references cited in the report.

3.0 STUDY AREA

The study area (6,800 km^2) (Figure 1), located in the Shire of Cardinia, comprises two distinct areas; **1) Pakenham Growth Corridor** and **2) land immediately to the north of the corridor.** In this document these two areas collectively will be referred to as the 'study area'. The vegetation of the study area is partially continuous and forms stepping stones with vegetation in the north of the municipality and in doing so contributes to its overall integrity. For this reason the vegetation of the entire 'municipality' also needs to be considered to ensure a consolidated approach to the protection and management of vegetation and fauna habitat within the 'Shire of Cardinia' and to put the study area into a regional context.

The study area extends from the foothills of the Dandenong Ranges (maximum elevation 150 m ASL) in the north to the Gippsland Plains in the south (minimum elevation 20 m ASL) (Division of Surveying and Mapping 1977). The study area is located predominantly in the Highlands – Southern Fall Bioregion, but also includes the Gippsland Plain Bioregion (DNRE 2002a). The northern section of the study area forms part of the Highlands – Southern Fall Bioregion (DNRE 2002a). This bioregion extends from Bundoora in eastern Melbourne to Wulgumerang in eastern Victoria (Yugovic and Organ 2000). This hilly terrain forms part of the Great Dividing Range and is located predominantly on Silurian marine sediments grading into Quaternary alluvial sediments to the south, with some Tertiary basalt to the west. The area is largely private land including urban and agricultural areas with small areas of remnant native vegetation.

The lower, relatively flat to undulating areas in the south of the study area are part of the Gippsland Plain Bioregion. This bioregion extends from Port Phillip Bay to Bairnsdale, excluding the South Gippsland Uplands (Yugovic and Organ 2000). This part of the study area is underlain by Quaternary alluvial sediments.

The study area has a temperate climate, with a tendency for warm summers and maximum rain in winter (Department of Conservation and Natural Resources 1993). Rainfall data from Upper Beaconsfield indicate that the mean annual rainfall is fairly high (889-1016mm). Temperature data are unavailable but extremes would be uncommon (Carr 1992).

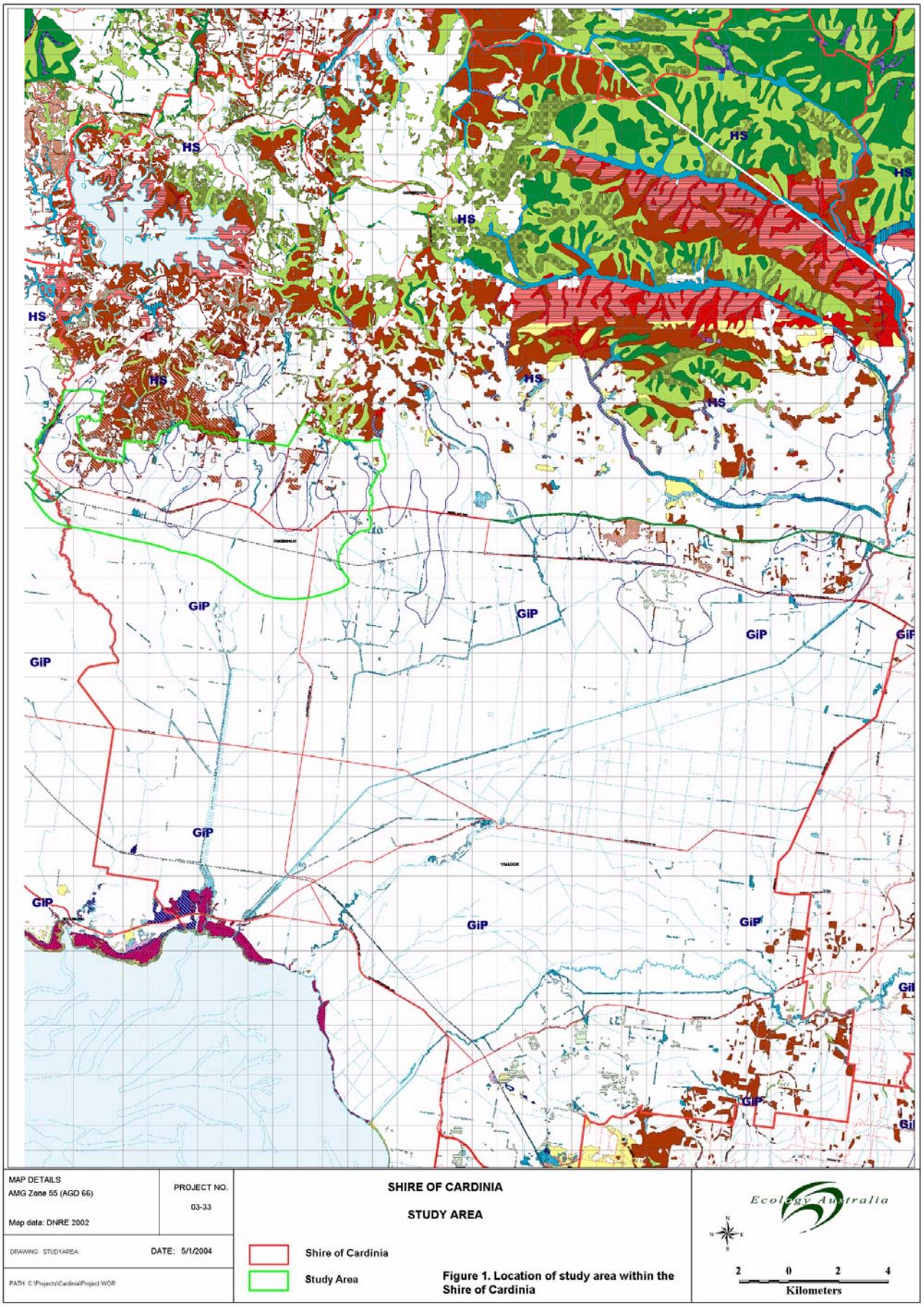

Figure 1 Location of the study area within the Shire of Cardinia

4.0 METHODS

The methodology for the Indigenous Vegetation Survey – Pakenham Growth Corridor and adjoining area is given in Appendix 1.

5.0 BIODIVERSITY IN THE STUDY AREA

5.1 Overview

Biodiversity is defined as:
The variety of all life forms – the different plants, animals and micro-organisms, the genes they contain, and the ecosystems of which they form a part (Commonwealth of Australia 1996).

The status of biodiversity in a given area can therefore be analysed at the levels of **genetic diversity**, **species diversity** and **ecosystem diversity**.

Except for a few species in Victoria, very little is known about genetic diversity, and nothing is known about genetic diversity of organisms in the context of the Shire of Cardinia. This however does not compromise the major findings of the study. The vast majority of biodiversity studies must, by necessity, focus on species and ecosystems.

Species diversity refers to the number of species and the density of species in an area. For the study area we have compiled information for vascular plants and vertebrate fauna. Information is lacking on all other groups of organisms (e.g. fungi, non-vascular plants and invertebrates) but the vascular flora and vertebrate fauna are reasonable surrogates for measures of biodiversity.

Ecosystem diversity is the complement of all flora and fauna species in an area together with the physical environment (e.g. soils). In practice, ecosystem diversity is considered at the level of the vegetation community (also embracing fauna habitats). For this study, vegetation is considered at a broad level, namely Ecological Vegetation Classes (EVCs) (see Section 5.2.2).

The region in which the study area is located is physically diverse with considerable variation in geology, physiography, soils and climate (Section 3.0). Land use impacts, predominantly from agriculture and, more recently, urbanisation, have reduced the pre-European biodiversity of the region to a fraction of that which formerly existed. **It is calculated that about only 9% of former vegetation exists in the study area and that which remains is often severely degraded**. A wide range of factors operate which continue to degrade biodiversity values (Section 5.4). Numerous plant and animal species are now extinct in the region; others are seriously threatened. The full extent of these losses cannot be quantified, but the salient point is that decline is on-going.

Against this background, all remnant indigenous vegetation and fauna in the study area is important, and without appropriate management, losses resulting from direct and indirect degradation processes, will inevitably mean **the loss of most biodiversity**. The time-scales at which this will occur vary according to the type and intensity of threats, the comparative resilience of some vegetation types, species or populations, and their present status.

The following section presents the inventory of flora and fauna. Summary sheets with vegetation quadrat data, species lists and point records with an outline of values for these sites are provided in a companion document entitled ***An inventory of sites of biodiversity significance in the Pakenham growth corridor and adjoining area.***

5.2 Flora

Summary data on the vegetation is given in the following Section. These have been compiled from previous studies and fieldwork carried out as part of this project (see also Appendix 2).

5.2.1 Plant species

A total of 550 plant taxa - species, subspecies, hybrids, cultivars and unnamed (undescribed) taxa – have been recorded in the study area (Flora Information System 2003). Of these 403 (73%) are indigenous taxa and 147 (27%) are naturalised exotic or introduced taxa. A breakdown of this total is summarised in Table 1.

Table 1. Statistics for the indigenous and exotic flora recorded in the study area

Taxa	Indigenous	Exotic
Mosses	0	1
Ferns and fern allies	12	0
Conifers	0	1
Monocotyledons	180	50
Dicotyledons	209	95
Total no. of taxa: 550	**Subtotal : 401 (73%)**	**Subtotal : 147 (27%)**

These figures reflect the composition of the remnant vegetation. The exotic component would be higher in the degraded and cleared areas. Indigenous and exotic plant species are listed in Appendix 2.
The study area has been based on two distinct areas: 1) Pakenham growth corridor and 2) land immediately to the north. The Pakenham growth corridor has already seen extensive loss of vegetation and fauna habitats as a result of land-use practices, principally agricultural pursuits (clearing, cropping, grazing) and urbanisation. **Currently less than 5% of the original indigenous vegetation remains in the Pakenham growth corridor.**

The remnant vegetation of the Shire of Cardinia is concentrated in the north, and coastal areas in the south of the municipality. The vegetation to the north of the municipality is contiguous with that of the Dandenong ranges**. The study area to the north of the growth corridor, which includes areas of potential rural residential development, currently has 20% of the former vegetation remaining.** This vegetation is partially continuous with vegetation in the north of the municipality and in doing so contributes to its overall integrity.

5.2.2 Ecological Vegetation Classes

In Victoria, the principal unit for vegetation circumscription and mapping for land use planning and management is the **Ecological Vegetation Class** (EVC). Ecological Vegetation Classes comprise one or more floristic vegetation communities which exist under a common regime of ecological processes and which are linked to broad landscape features (Woodgate et

al. 1994, Muir et al. 1995). Each vegetation type is identified on the basis of its floristic composition (plant species present), vegetation structure (e.g. woodland, forest, grassland), landform (e.g. gully, foothill, plain) and environmental characteristics (e.g. soil type, climate). Ecological Vegetation Classes generally relate to easily identifiable features on the ground, as distinct from more narrowly defined vegetation communities that rely on floristic composition for identification i.e. Floristic Vegetation Communities.

The study area is occurs within two bioregions: Highlands – Southern Fall to the north and Gippsland Plain to the south. A number of EVCs occur in both bioregions, while some are restricted to one. Thirty three EVCs have been recorded within the Shire of Cardinia (DNRE 2002b). Of these 17 (52%) occur within the study area. The following descriptions from Brown (2003) and Oates and Taranto (2001) provide a brief overview of each Ecological Vegetation Class recorded within the study area.

Wet Heathland

Within the study area Wet Heathland occurs on the lower slopes, north of Princes Highway, on soils subject to prolonged waterlogging. The structure is generally a treeless heathland although sometimes scattered eucalypts may be present. Generally the usual dominant shrubs are Scented Paperbark (*Melaleuca squarrosa*), sometimes Woolly tea-tree (*Leptospermum lanigerum*), Prickly Tea-tree (*Leptospermum continentale*) and Scrub Sheoak (*Allocasuarina paludosa*). Characteristic associated epacrids include Blunt-leaf Heath (*Epacris obtusifolia*), Ace of Spades (*Epacris gunnii*) and Pink Swamp-heath (*Sprengelia incarnata*).

The ground cover includes sedges and other sclerophyllous graminoids.

Within the Highlands - Southern Fall Bioregion Wet Heathland is listed as **depleted** (DNRE 2002b).

Lowland Forest

Some very large remnants of Lowland Forest persist in the north of the study area. The condition of the remnants varies from intact to partially intact, but the vegetation is generally continuous with that of adjacent EVCs, hence playing an important role in the continuity and integrity of the vegetation in the study area.

The overstorey is typically dominated by Messmate (*Eucalyptus obliqua*) and/or Narrow-leaf Peppermint (*E. radiata*). The composition of the understorey can be variable. Species include Prickly Moses (*Acacia verticillata*), Blackwood (*A. melanoxylon*), Burgan (*Kunzea ericoides*), Bushy Needlewood (*Hakea decurrens*), Furze (*H. ulicina*), Hop Goodenia (*Goodenia ovata*), Common Cassinia (*Cassinia aculeata*), Tree Everlasting (*Ozothamnus ferrugineus*), Prickly Tea-tree (*Leptospermum continentale*), Common Apple Berry (*Billardiera scandens*), Handsome Flat-pea (*Platylobium formosum*), Austral Bracken (*Pteridium esculentum*), Wire-grass (*Tetrarrhena juncea*), Weeping Grass (*Microlaena stipoides*), Variable Sword-sedge (*Lepidosperma laterale*) (Brown 2003, Oates and Taranto 2001).

Ground species include Ivy-leaf Violet (*Viola hederacea*), Yellow Rush-lily (*Tricoryne elatior*), Tall Sundew (*Drosera peltata* ssp. *auriculata*), Wallaby-grass (*Joycea pallida*), Grey Tussock-grass (*Poa sieberiana*). Thatch Saw-sedge (*Gahnia radula*) is also found and is

sometimes locally dominant. Kangaroo Grass (*Themeda triandra*) is occasionally present (Brown 2003, Oates and Taranto 2001).

Lowland Forest is listed as **least concern** in the Highlands – Southern Fall bioregion (DNRE 2002b). This EVC is seriously threatened by Sweet Pittosporum (**Pittosporum undulatum*) invasion and requires immediate attention (Plate 1).

Riparian Forest

Riparian forest is a tall forest which occurs along the banks and lower terraces of Deep Creek (Plate 2). It is dominated by Manna Gum (*Eucalyptus viminalis* ssp. *viminalis*) and Messmate (*E. obliqua*), with Silver Wattle (*Acacia dealbata*), Blackwood (*A. mearnsii*), Common Cassinia (*Cassinia aculeata*) and Prickly Coprosma (*Coprosma quadrifida*) (Brown 2003, Oates and Taranto 2001).

Generally a partially intact understorey persists with a wide variety of terrestrial species as well as a suite of semi-aquatic plants on the creek margins. Usually present are Fishbone Water-fern (*Blechnum nudum*), Tall Sedge (*Carex appressa*), Common Ground-fern (*Calochlaena dubia*), Sword Tussock-grass (*Poa ensiformis*), Slender Tussock-grass (*Poa tenera*), Small-leaf Bramble (*Rubus parviflorus*) and Rough Tree-fern (*Cyathea australis*) (Brown 2003, Oates and Taranto 2001).

Environmental weeds are a common component of Riparian Forest. This is due to a variety of factors including the natural pattern of disturbance through flooding, the amenable environment, and the history of human activity along rivers (Oates and Taranto 2001).

Riparian Forest formerly occurred along all major streams in southern lowland Victoria, but is now significantly depleted and is regarded as **endangered** across its range (DNRE 2002b).

Damp Forest

Damp Forest is more common at higher elevations, and occasionally at lower elevations such as in the northern section of the study area where it is confined to moist, sheltered areas along creeks and drainage lines (Plate 3). Damp Forest is dominated by a tall eucalypt layer which is typically Messmate (*Eucalyptus obliqua*) and Mountain Grey Gum (*E. cypellocarpa*). Broad-leaved shrub species typical of Wet Forest are present in the understorey, mixed with small-leaved and prickly-leaved shrubs from drier forest types. The broad-leaved species include Hazel Pomaderis (*Pomaderis aspera*), Snow Daisy (*Olearia lirata*), and Elderberry Panax (*Polyscias sambucifolia*). Drier Shrubby elements include Prickly Moses (*Acacia verticillata*), Narrow-leaf wattle (*A. mucronata*), and Rough Bush-pea (*Pultenaea scabra*). The lower stratum has a component of ferns. Other understorey species include Forest Wire-grass (*Tetrarrhena juncea*), Common Tussock-grass (*Poa Labillardierei*), Fireweed Groundsel (*Senecio linearifolius*), Tall Sword-sedge (*Lepidospema elatius*), Bidgee-widgee (*Acaena novae-zelandiae*) and Ivy-leaf Violet (*Viola hederacea* ssp. *hederacea*). The climbers Wonga Vine (*Pandorea pandorana*) and Mountain Clematis (*Clematis aristata*) are also common (Brown 2003, Oates and Taranto 2001).

Damp Forest is listed as **least concern** in the Highlands – Southern fall bioregion (DNRE 2002b).

Heathy Woodland

Only one remnant of Heathy Woodland persists in the study area.
Heathy Woodland generally consists of Narrow-leaf Peppermint (*Eucalyptus radiata*) and Mealy Stringybark (*E. cephalocarpa*) over a shrub layer of Hakea (*Hakea* sp.), Prickly Tea-tree (*Leptospermum continentale*) and Common Heath (*Epacris impressa*). The ground layer would typically comprise Kangaroo Grass (*Themeda triandra*), Milkmaids (*Burchardia umbellata*), Thatch Saw-sedge (*Gahnia radula*), Common Raspwort (*Gonocarpus tetragynus*), Small Grass-tree (*Xanthorrhoea minor*) and Wattle Mat-rush (*Lomandra filiformis*).
Heathy Woodland is listed as **Least Concern** in the Highlands – Southern Fall Bioregion (DNRE 2002b).

Swamp Scrub

Swamp Scrub occurs along and adjacent to creeks, drainage lines, water bodies and on poorly drained sites in the study area.

Swamp Scrub characteristically lacks a eucalypt overstorey and is dominated by Swamp Paperbark (*Melaleuca ericifolia*) (or sometimes Prickly Tea-tree (*Leptospermum continentale*)) which often forms a dense thicket, outcompeting other species (Oates and Taranto 2001).

Swamp Scrub originally occupied large wetlands of Koo Wee Rup Swamp. Today it is much more restricted due to drainage of the swamps and clearing for agriculture (Oates and Taranto 2001). The remnants persisting in the study area tend to be linear, isolated patches of vegetation which have been heavily disturbed by grazing and weed invasion.

Within the Gippsland Plain bioregion, Swamp Scrub is listed as **endangered** (DNRE 2002b).

Plains Grassy Woodland

Plains Grassy Woodland persists in the southern section of the study area, particularly around Cardinia Creek. It forms an open, grassy eucalypt woodland occurring on fertile soils on flats and gently undulating plains at low elevations. The understorey consists of a few sparse shrubs over a diverse, grassy, herb-rich ground-layer. It was widespread and extensive in the past but has now been largely cleared for agriculture, and more recently for urban development (Oates and Taranto 2001).

Plains Grassy Woodland is listed as **endangered** in the Gippsland Plain bioregion. (DNRE 2002b).

Riparian Thicket

Only one remnant of Riparian Thicket occurs in the study area. It occurs along a tributary of Deep Creek in the north-west of the study area. The vegetation is dominated by Swamp Paperbark (*Melaleuca ericifolia*) with emergent Swamp Gum (*Eucalyptus ovata* var. *ovata*) and Messmate (*E. obliqua*) on the margins of the remnant. Black Wattle (*Acacia mearnsii*) and Blackwood (*A melanoxylon*) are also present. The site is heavily grazed and hence has an exotic understorey.

Riparian Thicket is listed as **vulnerable** in the Highlands – Southern Fall bioregion (DNRE 2002b).

Swampy Riparian Woodland

The overstorey of Swampy Riparian Woodland is dominated by Swamp Gum (*Eucalyptus ovata* var. *ovata*). The lower strata are variously locally dominated by Scented Paperbark (*Melaleuca squarrosa*), Prickly Tea-tree (*Leptospermum continentale*), Woolly Tea-tree (*Leptospermum lanigerum*) and Common Reed (*Phragmites australis*). A range of shrub species can occur including Hop Goodenia (*Goodenia ovata*), Prickly Currant-bush (*Coprosma quadrifida*), Hazel Pomaderis (*Pomaderis aspera*) and Wattles (*Acacia* spp.) in mixture with Red-fruit Saw-sedge (*Gahnia sieberiana*), Tasman Flax-lily (*Dianella tasmanica*) and Slender Tussock-grass (*Poa tenera*) (Brown 2003, Oates and Taranto 2001).

Once a common vegetation type along broad drainage lines with slight gradients and on levees near streams, Swamp Riparian Woodland has been largely altered, particularly by drainage for agriculture (Oates and Taranto 2001).

Swampy Riparian Woodland is listed as **endangered** in the Gippsland Plain bioregion and **depleted** in the Highlands – Southern fall bioregion.

Swampy Riparian Complex

Swampy Riparian Complex occurs on poorly drained areas located in topographically protected high rainfall country. The complex consists of emergent eucalypts over a shrub layer with a ground layer which is primarily ferny to sedgey in character, including mixtures of wet forest and species of poorly drained areas (Oates and Taranto 2001).

Swampy Riparian Complex is confined to the north-east of the study area where it is associated with drainage lines and farm dams. Swampy Riparian Complex is listed as **endangered** in the Highlands – Southern Fall bioregion (DNRE 2002b).

Grassy Forest

Grassy Forest is categorised by a dominance of Messmate (*Eucalyptus obliqua*) and Narrow-leaf peppermint (*E. radiata*), with associated species Long-leaf Box (*E. goniocalyx*) and Broad-leaf Peppermint (*E. dives*), over a ground layer containing "dry" species reflecting the infertility of the soils. The shrubs and small trees including Black Sheoak (Allocasuarina littoralis), Black wattle (Acaia mearnsii) and Blackwood (A. melanoxylon) can be conspicuous(Oates and Taranto 2001).

In some areas, Grassy Forest persists with a relatively intact understorey, including Grey Tussock-grass (*Poa sieberiana*), Veined Spear-grass (*Austrostipa rudis*), Variable Sword-sedge (*Lepidosperma laterale* var. *laterale*), Kangaroo Grass (*Themeda triandra*), Thatch Saw-sedge (*Gahnia radula*), Wattle Mat-rush (*Lomandra filiformis*), and Common Raspwort (*Gonocarpus tetragynus*) (Brown 2003, Oates and Taranto 2001).

Grassy Forest is listed as **endangered** in the Highlands – Southern Fall Bioregion (DNRE 2002b).

Plains Grassland

Plains Grassland was once common throughout Victoria but today very little remains, and of this even less is relatively undisturbed. Plains Grassland (South Gippsland) is typically dominated by Kangaroo Grass (*Themeda triandra*) or Smooth Wallaby-grass (*Austrodanthonia laevis*), with Common Bog-sedge (*Schoenus apogon*), Common Love-grass (*Eragrostis brownii*), Weeping Grass (*Microlaena stipoides* var. *stipoides*), Common Raspwort (*Gonocarpus tetragynus*), Pale Sundew (*Drosera peltat*a ssp. *peltata*), Small St John's Wort (*Hypericum gramineum*), Spotted Sun-orchid (*Thelymitra ixioides*) and Slender Sun-orchid (*Thelymitra pauciflora*). There may also be scattered shrubs of Prickly Tea-tree (*Leptospermum continentale*) and Heath Tea-tree (*Leptospermum myrsinoides*) (Oates and Taranto 2001).

Plains Grassland is listed as **endangered** in the Gippsland Plain bioregion (DNRE 2002b).

Grassy Woodland

Generally, Grassy Woodland forms an open eucalypt (or occasionally sheoak) woodland over a diverse layer of grasses and herbs. The shrub component is usually sparse.
The overstorey is variously dominated by Drooping Sheoak (*Allocasuarina verticillata*) and Black Sheoak (*Allocasuarina littoralis*) or eucalypt species e.g. Narrow-leaf Peppermint (*Eucalyptus radiata*), Coast Manna Gum (*E. viminalis* ssp. *pryoriana*), Swamp Gum (*E. ovata* var. *ovata*). Limited Grassy Woodland persists in the study area. The remnants consist of scattered trees over an exotic grassy understorey.

This EVC occurs in the Gippsland Plain Bioregion where it is listed as **endangered** (DNRE 2002b).

Damp Heathy Woodland

Damp Heathy Woodland develops on sites of intermittent waterlogging generally due to an underlying impeding soil layer, and is typically wet in winter and dry in summer (Oates and Taranto 2001).

The overstorey is variously dominated by Mealy Stringybark (*Eucalyptus cephalocarpa*), Narrow-leaf peppermint (*E. radiata*), Messmate (*E. obliqua*) and Swamp Gum (*E. ovata* var. *ovata*). Woody species of the understorey can include Prickly Tea-tree (*Leptospermum continentale*), Common heath (*Epacris impressa*), Common Flat-pea (*Platylobium obtusangulum*), Honey-pots (*Acrotriche serrulata*), Common Cassinia (*Cassinia aculeata*), Scrub Sheoak (*Allocasuarina paludosa*) and Common Hovea (*Hovea heterophyla*). Within the ground layer the monocotyledons Wiry Spear-grass (*Austrostipa muelleri*), Thatch Saw-sedge (*Gahnia radula*) and Small Grass-tree (*Xanthorrhoea minor* ssp. *lutea*) can be structurally significant. Other species present include Common Raspwort (*Gonocarpus tetragynus*), Trailing Ground-berry (*Acrotriche prostrata*), Common Apple-berry (*Billardieri scandens*), Milkmaids (*Burchardia umbellata*), Erect Guinea-flower (*Hibbertia riparia*), Variable Sword-sedge *(Lepidosperma laterale*), Wattle Mat-rush (*Lomandra filiformis*) and Kangaroo Grass (*Themeda triandra*) (Brown 2003, Oates and Taranto 2001).

Damp Heathy Woodland occurs in the northern section of the study area where it is listed as **depleted** in the Highlands – Southern Fall bioregion (DNRE 2002b).

Gully Woodland

Gully Woodland is a highly restricted woodland to open forest formation confined to narrow bands along low-gradient gullies of non-perennial streams (Oates and Taranto 2001). Only one remnant of this EVC occurs within the study area and this is included in Site 24. It occurs along the stream in the north-east of the remnant.

The overstorey is generally dominated by Manna Gum (*Eucalyptus viminalis* ssp. *viminalis*) and Swamp Gum (*E. ovata*). The understorey tends to be dominated by broad-leaved shrubs, with a component of ferns, sedges and herbs, including species affiliated with wetland or stream pond habitats (Oates and Taranto 2001).

Gully Woodland is listed as **vulnerable** in the Highlands – Southern Fall bioregion (DNRE 2002b).

Swampy Woodland

Swampy Woodland occurs in low gradient habitat on seasonally waterlogged soils. The overstorey is dominated by Swamp Gum (*Eucalyptus ovata* var. *ovata*) (with or without a relatively minor component of Messmate (*Eucalyptus obliqua*), Narrow-leaf Peppermint (*E. radiata*), Yellow Box (*E. melliodora*) or Green Scentbark (*E. fulgens*). However, it can include treeless areas (variously shrubland, reedbed or herbland) (Oates and Taranto 2001).

The understorey is generally open with small thickets of Swamp Paperbark (*Melaleuca ericifolia*) or Tea-tree (*Leptospermum* spp.) (Plate 5). The ground layer is generally dense with indigenous species, however, the modified nature of the Swampy Woodland in the study area generally results in an exotic ground layer.

Swampy Woodland occurs across the study area and is listed as **endangered** in the Gippsland Plain bioregion and **vulnerable** in the Highlands – Southern fall bioregion (DNRE 2002b).

Shrubby Gully Forest

Shrubby Gully Forest forms an open forest to woodland confined to narrow bands along low-gradient gullies on minor streams within forested hill country in the north-west of the study area. Swamp Gum (*Eucalyptus ovata* var. *ovata*) and Manna Gum (*E. viminalis* ssp. *viminalis*) dominate the overstorey. A variable understorey includes Blackwood (*Acacia melanoxylon*), Swamp Paperbark (*Melaleuca ericifolia*), Scented Paperbark (*M. squarrosa*), Prickly Tea-tree (*Leptospermum continentale*), and Hop Goodenia (*Goodenia ovata*). The ground layer is normally dense with sedges and ferns but lacks the diversity of herbs and grasses associated with drainage-lines on more fertile soils (Oates and Taranto 2001).

Shrubby Gully Forest is listed as **vulnerable** in the Highlands – Southern Fall bioregion (DNRE 2002b).

Derived EVC

During the fieldwork some sites were identified as having high habitat quality / potential, but did not qualify as a remnant site; most are artificial habitats. These sites tended to be farm dams which provided good foraging and nesting habitat for water fowl, and were generally accompanied by a fauna species list which included significant bird species. To

accommodate these sites, an additional EVC was devised (10000 - Wetland (derived) Complex). This EVC does not have a conservation status.

5.2.3 Conservation status of flora

The assessment of significance of the flora is usually evaluated at the Local, Regional, State and National scales. For this study we recognise that **all indigenous taxa are at least Locally significant given the massive regional depletion and degradation of vegetation**. At higher conservation levels, 13 taxa are significant in a State and/or National context. The information on State and Nationally significant taxa are listed in Table 2. The State/National significant taxa remaining in the Shire of Cardinia represents only c. 2% of the entire flora for the area.

Criteria for determining botanical significance are given in Appendix 3.

The significance of vegetation types is primarily a function of the following attributes:

- Rarity: distribution and abundance in the Region, the State and Nationally, and level of depletion;
- Landscape Context: patch size, degree of isolation/continuity, linkage role; and
- Vegetation Condition: the level of anthropogenic disturbance, e.g. physical modification and weed invasion.

Of the 17 EVCs (extant) recorded in the study area half (53%) are threatened at a bioregional scale. However, in the context of the study area **all remnant vegetation is important for the maintenance of biodiversity** and to the integrity of the vegetation and fauna habitat of the broader study area. Therefore **all vegetation in the study area has conservation significance irrespective of its current status at a broader bioregional scale** (Traill and Porter 2001) (see Table 3).

Table 2 State and Nationally significant vascular plant species recorded for the study area, December 2003

AROT - Australian Rare or Threatened Taxon (see Briggs and Leigh 1996)
VROT - Victorian Rare or Threatened Taxon (see Ross and Walsh 2003)
FFG Act - Listed under the Victorian *Flora and Fauna Guarantee Act* 1988
EPBC Act - Listed under the Commonwealth *Environmental Protection and Biodiversity Conservation Act* 1999
Conservation status (AROT, VROT) (Nationally – upper case; Victorian – lower case)

K k - poorly known (i.e. insufficient data to assess conservation status but likely to be rare, vulnerable or endangered)
R r - rare
V v - vulnerable
E e – endangered

Species	Common Name	AROT	VROT	FFG Act	EPBC Act
Arachnorchis oenochila	Wine-lipped Spider-orchid		v		
Burnettia cuneata	Lizard Orchid		r		
Carex alsophila	Forest Sedge		r		
Carex chlorantha	Green-top Sedge		k		
Desmodium varians	Slender Tick-trefoil		k		
Diuris punctata var. *punctata*	Purple Diuris		v	✓	
Eucalyptus fulgens	Green Scentbark		r		
Galium curvihirtum	Tight bedstraw		r		
Prasophyllum frenchii	Maroon Leek-orchid	E	e	✓	✓
Pterostylis grandiflora	Cobra Greenhood		r		
Pterostylis x *ingens*	Sharp grrenhood		r		
Tetratheca stenocarpa	Long Pinkbells		r		
Thelymitra x *irregularis*	Crested Sun-orchid		r		

Table 3 Extant Ecological Vegetation Classes (EVCs) recorded in the study area and unclassified equivalents (on public and private lands)

N/A not recorded in bioregion
Source of information: Department of Natural Resources and Environment (2002)

EVC Number	EVC Name	Gippsland Plain Bioregion	Highlands Southern Fall Bioregion
8	Wet Heathland	N/A	Depleted
16	Lowland Forest	Vulnerable	Least Concern
18	Riparian Forest	Vulnerable	Least Concern
29	Damp Forest	Endangered	Least Concern
48	Heathy Woodland	Least Concern	Least Concern
53	Swamp Scrub	Endangered	Endangered
55	Plains Grassy Woodland	Endangered	Endangered
59	Riparian Thicket	N/A	Vulnerable
83	Swampy Riparian Woodland	Endangered	Depleted
126	Swampy Riparian Complex	Endangered	Endangered
128	Grassy Forest	Endangered	Vulnerable
132	Plains Grassland	Endangered	Endangered
175	Grassy Woodland	Endangered	Depleted
793	Damp Heathy Woodland	Vulnerable	Depleted
902	Gully Woodland	N/A	Vulnerable
937	Swampy Woodland	Endangered	Vulnerable
938	Shrubby Gully Forest	Vulnerable	Vulnerable
10000	Wetland (derived) Complex	N/A	N/A

Plate 1 Lowland Forest adjacent to the Bunyip Main Race (Site 100). The invasion of Sweet Pittosporum (**Pittosporum undulatum*) threatens the understorey diversity and fauna habitat

Plate 2 Riparian Forest along Deep Creek is surrounded by cleared land (Site 94). Maintaining and enhancing buffers along waterways protects water quality and enhances fauna habitat

Plate 3 Damp Forest along Bunyip Main Race (Site 104). This large remnant is continuous with other EVCs in the area

Plate 4 Grassy Forest (Site 109) dominated by Sweet Pittosporum (**Pittosporum undulatum*) in the understorey

Plate 5 Swampy Woodland can be seen in the foreground (Site 98) where it occurs along a drainage line. Grassy Forest with a grazed understorey can been seen in the background (Site 99)

5.3 Fauna

A total of 246 species have been recorded by the Victorian Fauna Display (VFD) (DSE 2003b) for the Shire of Cardinia. This includes 31 mammal species (six introduced, two threatened), 171 bird species (12 introduced, 20 threatened), 18 reptile species, 11 frog species (two threatened), 14 fish species (two threatened) and one invertebrate species. A comprehensive fauna list for the study area, including conservation status, is shown in Appendix 4.

This is by no means an exhaustive inventory of the fauna of the region. Many sightings and observations may not have been submitted to the AVW database, and some areas have probably not been comprehensively surveyed for many years.

Ten mammal species, 78 bird species (two threatened) and five frog species were recorded during field surveys. Of these 93 records, two were additional records for the study area: Musk Lorikeet (*Glossopsitta concinna*) and Tree Martin (*Hirundo nigricans*). Additional records, including 32 bird species (one threatened) and one frog species were sourced from unpublished data collected from the study area by community conservation groups (e.g. Friends of Kennedy Creek, Cardinia Catchment Landcare Group)

5.3.1 Threatened Species

Brief comments of the status of those threatened species recorded in the study area are given below. Criteria for determining significance are listed in Appendix 5.

Nationally Significant Species

Southern Bell Frog (also known as Growling Grass Frog and Warty Bell Frog) *Litoria raniformis*

- Vulnerable, *EPBC Act* 1999
- Vulnerable, Action Plan for Australian Frogs (Tyler 1997)
- Listed on the *FFG Act* 1988
- Endangered in Victoria (DSE 2003c)

The former distribution of Southern Bell Frog was in southeast South Australia and the Murray Valley, most of Victoria and the ACT, southwestern NSW and northern and eastern Tasmania (Cogger 2000, Tyler 1997). It no longer occurs in the ACT and southern Tablelands of NSW, and it is now scarce in southeastern South Australia, and in parts of southern and central Victoria.

The Southern Bell Frog is a relatively large and highly mobile frog species that breeds in permanent or near-permanent water bodies, and spends the non-breeding season (approximately May to August) sheltering in terrestrial environments (e.g. rocks, fallen timber or dense ground vegetation) some distance from water. Aquatic habitats include farm dams, reservoirs, ponds, streams and swamps (Cogger 2000, Tyler 1997) and the species breeds in permanent wetlands and streams with emergent aquatic vegetation, including sedges and cumbungi.

One record occurs for the Southern Bell Frog in the DRA. Three individuals were recorded in 2002 from near Deep Creek, west of Ryan Road (DSE 2003b). Farm dams throughout the Shire of Cardinia (e.g. Sites 3, 9, 39, 41 & 82) provide potential habitat. Certain sections of Kennedy Creek (e.g. Site 102) also provide potential habitat and there have been unconfirmed records of the Southern Bell Frog from Pakenham, near Ryan Road, c. 1-2 km from Kennedy Creek (R. Berry, Resident, pers. comm.)

Grey-headed Flying-fox *Pteropus poliocephalus*

- Vulnerable, *EPBC Act* 1999
- Vulnerable, Action Plan for Australian Bats (Duncan et al. 1999)
- Listed on the *FFG Act* 1988
- Vulnerable in Victoria (DSE 2003c)

The Grey-headed Flying-fox occurs along the east coast of Australia from Rockhampton in Queensland to western Victoria. Preferred camp (roosting) sites include gullies close to water containing dense canopy cover (Churchill 1998). The two main camp sites in Victoria occur at Dowell Creek, Mallacoota (Menkhorst 1995), and Bell Bird Picnic Park along the Yarra River (newly established from the Royal Botanical Gardens camp). A captive colony occurs near Ivanhoe east in Melbourne. Grey-headed Flying-foxes can travel between 20-50 km from their roosting sites to feed and their movements and local distribution is often determined by climate and the flowering and fruiting of major food plants (Menkhorst 1996). Preferred forage resources include eucalyptus blossoms (as well as those from other Myrtaceae spp. and Proteaceae) and fruit, particularly native figs (*Ficus* spp.) and cultivated orchard fruits.

There are two records from 1981 and 1982 of Grey-headed Flying-fox in the DRA (DSE 2003b). The records are from north of Seymour Road close to the Dore Road junction approximately 2 km east of the study area. The species was described by Andrew et al. (1984) as an irregular visitor to the Westernport region. A camp site does not occur in the

Shire of Cardinia. However, Grey-headed Flying-foxes probably include the study area as part of their foraging range, as they search for prolific flowering eucalypt trees in forest remnants, or flowering and fruiting trees in gardens and parks.

Koala *Phascolarctos cinereus*

- Lower Risk – Near Threatened, Action Plan For Australian Marsupials and Monotremes (Maxwell et al. 1996).

The Koala is broadly distributed throughout eastern Australia, including north-eastern, central and south-eastern Queensland with populations in some western areas, eastern New South Wales, including the coastal strip and highlands of the Great Dividing Range, western plains and related riparian environments where suitable habitat occurs, and Victoria and South Australia (Maxwell et al. 1996). In Victoria, it is widespread throughout eucalypt woodlands and forests of lowland southern and north-eastern Victoria, though it is rare or absent from wet forests which do not provide suitable habitat (Menkhorst 1995). Populations are probably discontinuous due to habitat fragmentation. Highest, though unsustainable densities of 10 per ha, are reached in Manna Gum and Swamp Gum woodlands, and usually defoliation of food trees develops rapidly if densities are not lowered (e.g. on islands) (Menkhorst 1995). The diet of koalas is almost entirely composed of eucalypt leaves. In Victoria, the densest populations of koalas are usually associated with four eucalypt species: Manna Gum, Swamp Gum, Tasmanian Blue Gum and River Red Gum (Menkhorst 1995).

Threats include continuous habitat destruction, fragmentation and modification, bushfires and disease, as well as drought-induced mortality in habitat fragments (Menkhorst 1995; Maxwell et al. 1996). Predation, especially by domestic dogs, and mortality due to motor vehicles, are also problems in some areas.

There are 10 records of the Koala listed for the DRA (AVW). These are broadly distributed in the DRA, including: 2 km south of Beaconsfield Reservoir Spillway; Upper Beaconsfield, Bunyip State Park; Upper Pakenham. There is a high likelihood of occurrence of the Koala in forest and woodland remnants of the study area, especially those supporting Swamp Gum and Manna Gum.

Barking Owl *Ninox connivens connivens*

- Lower Risk – Near Threatened, Action Plan For Australian Birds (Garnett and Crowley 2000)
- Listed on the *FFG Act* 1988 (Action Statement No. 116)
- Endangered in Victoria (DSE 2003c)

The Barking Owl occurs in New Guinea and adjacent islands and mainland Australia, where an endemic race (*N. c. connivens*) occupies a disjunct distribution throughout much of the continent, though it is absent from arid treeless expanses of Western Australia, Northern Territory, Queensland and South Australia (Clemann and Loyn 2001). It has been recorded from scattered localities throughout Victoria, where it occupies open forest and woodlands, such Box-Ironbark and Riparian River Red Gum habitats and foothill habitats on granitic slopes (Clemann and Loyn 2001). It is more frequently recorded from edge habitats, such as the interface between woodlands and wooded farmlands, than in forest interiors. It is an obligate hollows nester which feeds on a variety of vertebrate and invertebrate prey with more mammals and birds being taken during the breeding season. European Rabbits, Sugar Gliders, Squirrel Gliders, Common Brushtail Possums, bats, rodents and a range of birds are taken (Clemann and Loyn 2001). Principal threats to this species include loss of hollow-

bearing trees for nesting and habitat clearance causing a decrease in prey availability (Garnett and Crowley 2000).

The Barking Owl has been recorded once in the DRA, in 1999, within the habitats of Beaconsfield Reservoir (VFD DSE 2003b). It is possible, but probably less frequently than the Powerful Owl, that the Barking Owl utilises Cardinia as part of a foraging territory, moving from the northern remnants into the remnant woodlands along creek corridors.

Helmeted Honeyeater *Manorina melanops cassidix*

- Nationally Endangered, *EPBC Act* 1999
- Critically Endangered, Action Plan For Australian Birds (Garnett and Crowley 2000)
- Listed on the *FFG Act* 1988 (Action Statement No. 8)
- Critically Endangered in Victoria (DSE 2003c)

There are four historic Helmeted Honeyeater records in the study area. The most recent record was collected in 1932 (DSE 2003c) from south-west of Beaconsfield Reservoir and the Cardinia Creek corridor near Hick's Hill. An unconfirmed observation of a Helmeted Honeyeater was recorded from the Gardenia Reserve in July 2002 (Friends of Kennedy Creek 2002). Cardinia Creek in the west of the study area historically supported a small population prior to the mid-1980's. However, this population was in decline even in the 1980's and disappeared following the Ash Wednesday Bushfires in 1983 (Land Conservation Council 1994, Department of Conservation Forests and Lands 1989).

Recent sightings of Helmeted Honeyeaters along Cardinia Creek, near the Stony Creek junction to the west of the study area, resulted from mis-identification of the nomadic Yellow-tufted Honeyeater (*Lichenostomus melanops*), which is similar in appearance and occasionally recorded outside of its normal range, especially during drought years (Bruce Quin, Helmeted Honeyeater Recovery Team, pers. comm.). A small number of captive-bred birds have successfully been released into Bunyip State Park. At least one female has attempted breeding in the past two years (Bruce Quin, pers. comm.).

Helmeted Honeyeaters prefer vegetated water courses with Manna Gum, Mountain Swamp Gum and Swamp Gums (*Eucalyptus viminalis*, *E. camphora* and *E. ovata*) and a shrubby understorey of tea trees, sedges, bracken and dense grass tussocks (Baker-Gabb 1992). Cardinia Creek Catchment, including the Beaconsfield Flora and Fauna Reserve, is recognised as providing potential habitat for the Helmeted Honeyeater (McNabb et al. 2001, Andrew et al. 1984). However, following recent field surveys and searches in the Cardinia Creek area, DSE and Helmeted Honeyeater Recovery Team consider that it is extinct in the area (B. Quin, pers. comm.).

Superb Parrot *Polytelis swainsonii*

- Vulnerable, *EPBC Act* 1999
- Vulnerable, Action Plan for Australian Birds (Garnett and Crowley 2000)
- Listed on the *FFG Act* 1988 (Action Statement No.33)
- Critically Endangered in Victoria (DSE 2003c)

One Superb Parrot record from 1997 occurs to the west of the DRA along Cardinia Creek north west of Beaconsfield (DSE 2003b). The Victorian distribution of Superb Parrots has contracted from south to north, where recent records are restricted to a narrow corridor of the Murray Valley between Echuca and Yarrawonga (Weber and Ahern 1992). Prior to European settlement, the range of the Superb Parrot was more extensive. However, clearing of

woodland feeding habitats (predominately box woodlands and associated grasslands) has been detrimental to the species in southern Victoria (Emison et al. 1987). Due to habitat depletion and modification, the Superb Parrot is no longer a resident species within the Shire of Cardinia.

Swift Parrot *Lathamus discolour*

- Endangered, *EPBC Act* 1999
- Endangered , Action Plan For Australian Birds (Garnett and Crowley 2000)
- Listed on the *FFG Act* 1988
- Endangered in Victoria (DSE 2003c)

The Swift Parrot is a winter migrant to Victoria from its summer breeding grounds in Tasmania, although a small number may remain on the mainland during summer (Emison et al. 1987). On the mainland, suitable habitat includes Eucalyptus forests and woodlands (usually box-ironbark communities), although they have been observed in a variety of urban habitats including parks, gardens, golf courses, street trees and native windbreaks, especially those supporting heavy-flowering eucalypts (e.g. Sugar Gum (*E. cladocalyx*)) (Higgins 1999). Three records were collected from the mid to late 1980's in the west of the DRA, along Cardinia Creek near Hicks Hill and south west of the Beaconsfield Reservoir (DSE 2003b).

It is possible that Swift Parrots utilise large woodland remnants within the Shire of Cardinia enroute to more favourable box-ironbark remnants further north.

Dwarf Galaxias *Galaxiella pusilla*

- Vulnerable, *EPBC Act* 1999
- Vulnerable, Action Plan for Australian Fishes (Wager and Jackson 1993)
- Listed on the *FFG Act* 1988
- Vulnerable in Victoria (DSE 2003c)

The current distribution of Dwarf Galaxias is limited to north east Tasmania, Flinders Island Victoria and South Australia. In Victoria, major populations are found in Dandenong, Diamond, Cardinia and Balcombe Creeks (Wager and Jackson 1993). The species prefers slow-flowing waters with aquatic and fringing vegetation, including swamps, drains and backwaters of creeks and streams (Wager and Jackson 1993). The Dwarf Galaxias is extremely vulnerable to habitat clearance and modification (e.g. swamp draining). There are nine records of the Dwarf Galaxias in the study area (DSE 2003b). The majority of these were collected during 1997 and 1999 from tributaries of Cardinia Creek which occur west of Beaconsfield Reservoir. An earlier record (1983) exists for Cardinia Creek, near Berwick (DSE 2003b).

During 1999, the species was collected from the Inglis Road Billabong in Beaconsfield Flora and Fauna Reserve, on the western boundary of the study area (Koster 2000). No Dwarf Galaxias were detected during recent aquatic surveys in Beaconsfield Flora and Fauna Reserve. However, this site is recognised as providing some of the best habitat along the Cardinia Creek system for this species (McNabb et al. 2001, Koster 2000).

Australian Grayling *Prototroctes maraena*

- Vulnerable, *EPBC Act* 1999
- Vulnerable, Action Plan for Australian Fishes (Wager and Jackson 1993)
- Listed on the *FFG Act* 1988
- Vulnerable in Victoria (DSE 2003c)

The Australian Grayling is now patchily distributed throughout its former range due to loss of riparian vegetation and increase in stream barriers (e.g. dams, weirs and culverts) (Wager and Jackson 1993). Populations are known from streams and rivers draining the eastern and southern flanks of the Great Dividing Range (McDowell 1996), including the Barwon, Tambo and Yarra Rivers in Victoria.

One record collected in 1985 exists for the DRA. This is situated in tributaries of Cardinia Creek, near Browns Road and south west of Beaconsfield Reservoir (DSE 2003b). Considering the extent of clearing of riparian vegetation and consequential habitat degradation along streams throughout the study area, as well as the lack of recent records, it is unlikely that the Australian Grayling persists in the Shire of Cardinia.

***EPBC Act* 1999 Listed Migratory and Marine Species**

A number of bird species are listed as migratory and/or marine under the *EPBC Act* 1999. This listing describes only one aspect of a species' ecology and does not necessarily imply that the species is Nationally threatened.

Listed migratory species include species listed in:

- appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals) for which Australia is a Range State under the Convention;
- the Agreement between the Governments of Australia and the Peoples Republic of China for the Protection of Migratory Birds and their Environment (CAMBA); and
- the Agreement between the Governments of Japan and Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA).

Listed marine species include any avian species that naturally occur in Commonwealth marine areas, including migratory birds (e.g. the nationally significant Swift Parrot *Lathamus discolour*) or those birds that use marine flyways (e.g. species that also colonise and inhabit off-shore islands).

A full list of 57 species recorded from the DRA and assigned migratory or marine status under the *EPBC Act* 1999 is given in Appendix 4. The majority have widespread distributions and/or are locally common. However, nine of these species are also considered threatened in Victoria:

- Blue-billed Duck *Oxyura australis*;
- Hardhead *Aythya australis;*
- Musk Duck *Biziura lobata*;
- Latham's Snipe *Gallinago hardwickii*;
- White-bellied Sea-eagle;
- Great Egret *Ardea alba*;
- Intermediate Egret *Ardea intermedia*;
- Nankeen Night Heron *Nycticorax caledonicus*; and
- Swift Parrot *Lathamus discolour*.

The study area does not constitute limiting or critical habitat for these species. However, a number of farm dams with associated soaks and inundated paddocks, as well as several streams and creeks in the study area provide potential habitat for the listed ducks, egrets, Latham's Snipe and Nankeen Night Heron. These species are discussed further in Table 4.

State Significant Species

Eighteen species of State significance have been recorded in the Cardinia DRA. This includes one mammal species, one frog species and 16 bird species (Table 4; Appendix 4). Due to the extensive loss of native vegetation and fauna habitat associated with clearing and development in the study area, the majority of these records arise from more extensive habitat to the north of the study area.

Water birds

The majority of the State significant fauna recorded in the DRA are water birds. Species such as the **Australasian Shoveler** (*Anas rhynchotis*), **Blue-billed Duck** (*Oxyura australis),* **Pied Cormorant** (*Phalacrocorax varius)* and **Royal Spoonbill** (*Platalea regia)* have only one or two records. These were collected mainly along Cardinia Creek at Beaconsfield to the west of the study area (DSE 2003b). The **Musk Duck** (*Biziura lobata),* **Hardhead** (*Aythya australis),* **Latham's Snipe** (*Gallinago hardwickii*) and **Great Egret** (*Ardea alba)* have also been recorded from Cardinia Creek near Beaconsfield. The riparian remnants along the Deep, Kennedy, Cardinia and Toomuc Creeks provide important habitat and corridors for these water bird species in an otherwise cleared and modified landscape.

Larger farm dams containing remnant indigenous aquatic and fringing vegetation (e.g. Sites 3, 9, 39, 44 & 54) are also important for State significant ducks and egrets. **Hardhead** were observed at one farm dam (Site 82).

The **Nankeen Night Heron** (*Nycticorax caledonicus)* has eight records from the DRA (DSE 2003b), including Beaconsfield Flora and Fauna Reserve, the Bunyip Main Race near Toomuc Creek and tributaries near the northern end of Army Road. Potential feeding and roosting habitat occurs for this nocturnal water bird throughout the vegetated sections of Toomuc, Kennedy, Deep and Cardinia Creeks.

The study area provides limited habitat for species such as the **Azure Kingfisher** (*Alcedo azurea*) and **White-bellied Sea-eagle (***Haliaeetus leucogaster*). Both have been recorded further north near Beaconsfield Reservoir (DSE 2003b). White-bellied Sea-eagles are also known to utilise larger reservoirs (e.g. Cardinia Reservoir) and may utilise riparian corridors through the municipality to move between inland and coastal habitats.

Owls

Powerful Owls have been observed in remnants on private property in Upper Beaconsfield (Eric Dodge, Upper Beaconsfield Conservation Group, pers. comm.) and there are seven records from the DRA (DSE 2003b). Powerful Owls have also been recorded along the Cardinia Creek in the Beaconsfield Flora and Fauna Reserve and have been observed breeding at the nearby Critchley Parker Junior Reserve (McNabb et al. 2001). Limited habitat occurs throughout the study area, mainly due to the extensive clearing of vegetation, including large hollow-bearing trees used for nesting. Smaller remnant habitats and a lack of hollows restrict the abundance of arboreal mammals which are the owl's main prey.

All seven VFD records occur to the north and east of the study area in more extensive habitat remnants in Pakenham Upper, and the O'Neil Road and Leppitt Road areas near Beaconsfield Reservoir (DSE 2003b). Powerful Owls occupy large territories and it is possible that some

individuals utilise the study area for supplementary foraging and hold breeding territories in more extensive and better quality habitats to the north (e.g. Beaconsfield and Cardinia Reservoirs and Bunyip State Forest).

The **Sooty Owl** has also been recorded in the DRA. There is only one record from 1992 from within the habitats of Beaconsfield Reservoir (VFD, DSE 2003b). It is possible, but less frequently than the Powerful Owl, that the Sooty utilises the study area as part of a foraging territory, moving from the northern remnants into the remnant woodlands along creek corridors.

Frogs

The **Southern Toadlet** (*Pseudophryne semimarmorata*) has numerous but dated records (from 1972 and 1982) from the Cardinia DRA. These mainly occur to the north of the study area around Beaconsfield Reservoir as well as Cardinia Creek to the west and south of Beaconsfield. Potential habitat exists along the Bunyip Main Race (e.g. Sites 101 and 103) and in the better quality riparian remnants along Deep (e.g. Sites 81, 89, 90 and 91), Toomuc (e.g. Sites 55 and 61) and Kennedy Creeks (Site 102). Some of the better quality farm dams and wetlands throughout the study area with adjoining vegetation also provide potential habitat.

Reptiles

One species that did not appear on the VFD search as occurring in the DRA was the Vulnerable (DSE 2003c) **Swamp Skink** (*Egernia coventryi*). Port Phillip and Western Port are two of seven major regions in Victoria known to support the Swamp Skink (Robertson 1998). Swamp Skinks prefer densely-vegetated freshwater swamps and associated watercourses, or adjacent wet heaths, sedgelands and saltmarshes. Swamp Skinks are difficult to observe in the wild and are very wary of disturbance. Consequently, they are difficult to detect and survey in dense habitat and are often overlooked. It is possible that those sites with remnant dense Swamp Paperbark (*Melaleuca ericifolia*) thickets may support Swamp Skinks (e.g. Site 70). Potential sites include the Officer Water Reserve (Site 45), riparian remnants along Deep Creek (e.g. Site 94) and the Bunyip Main Race (BMR), particularly near Liliput Lane (e.g. Sites 101 and 103).

Table 4 State significant fauna species recorded from the Cardinia DRA

Common Name & Conservation Status[1]	Scientific Name	Conservation Status[2]	Habitat[3]	Threats[3]
Critically Endangered				
Intermediate Egret[4]	*Ardea intermedia*	FFG Ma	Grassy wetlands, coastal wetlands, flooded pasture.	Habitat loss and alteration (e.g. wetland draining). Salinity.
Endangered				
Blue-billed Duck	*Oxyura australis*	FFG Mi	Deep, permanent wetlands with abundant aquatic flora	Ground water extraction, salinity, draining or modification of wetland habitats.
Vulnerable				
Australasian Shoveler	*Anas rhynchotis*	Mi	Open water wetlands or soft mud in fertile wetlands, occasionally sheltered estuaries and inland waters.	Habitat loss e.g. draining and modification of wetlands.
Great Egret	*Ardea alba*	FFG Ma, Mi	Various wetlands including farm dams, mangroves, swamps and rivers.	Habitat loss.
Hardhead	*Aythya australis*	Mi	Large, deep fresh waters with aquatic and emergent vegetation.	Habitat loss, wetland drainage/diversion for irrigation or flood-mitigation.
Musk Duck	*Biziura lobata*	Ma, Mi	Large, deep fresh waters with aquatic and emergent vegetation.	Wetland habitat loss/modification due to draining, grazing, clearing and increased salinity.
Powerful Owl	*Ninox strenua*	FFG (92)	Foothill and coastal woodland, occasionally in drier woodlands.	Habitat loss and modification, loss of hollow-bearing trees, disturbance while breeding.
Royal Spoonbill	*Platalea regia*		Various wetlands with water depth less than 0.4 m deep over soft substrate, wet grasslands, sheltered marine habitats.	Wetland habitat loss/modification due to draining, grazing, clearing and increased salinity. Disturbance to breeding habitat.
Sooty Owl	*Tyto tenebricosa*	FFG	Require large areas of continuous forest including rainforests, wet gullies and Mountain Ash Forests	Habitat loss and modification. Loss of hollow-bearing trees.
Southern Toadlet	*Pseudophryne semimarmorata*		Damp areas in sclerophyll forests under logs and leaf litter.	Habitat modification and clearance, pollution of waterways.
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	FFG Ma, Mi	Coastal habitats including islands and some inland rivers and lakes. (e.g.	Clearing of optimum breeding habitat such as coastal forests (loss of suitable nest

Common Name & Conservation Status[1]	Scientific Name	Conservation Status[2]	Habitat[3]	Threats[3]
			Cardinia and Beaconsfield Reservoir).	trees). Loss of hollow-bearing trees.
Low Risk – near threatened				
Azure Kingfisher	*Alcedo azurea*		Riparian habitats along rivers and streams.	Habitat loss and degradation of riparian environments, stream bank erosion.
Broad-toothed Rat[5]	*Mastacomys fuscus*		In lower altitudes, prefers wet forests communities with dense understorey and ground cover such as grasses, sedges and herbs.	Habitat loss, predation by introduced predators.
Brown Treecreeper[4]	*Climacteris picumnus*		Lowland dry woodlands dominated by River Red Gum or Yellow Gum. Wooded farmland.	Loss of hollow-bearing trees. Habitat loss. Predation by introduced predators.
Latham's Snipe	*Gallinago hardwickii*	Mi	Summer migrant. Wide range of aquatic habitats.	Wetland habitat loss/modification due to draining, grazing, clearing and increased salinity.
Nankeen Night Heron	*Nycticorax caledonicus*	Ma	Densely foliaged trees for roosting, a range of wetlands and watercourses.	Wetland habitat loss/modification due to draining, grazing, clearing and increased salinity.
Pied Cormorant	*Phalacrocorax varius*		Mainly marine but also terrestrial wetlands, lakes and rivers.	Loss of breeding habitat.
Spotted Quail-thrush[6]	*Cinclosoma punctatum*		Dry forests such as stringybark, peppermint and box-ironbark. Dry, grassy and rocky areas in woodlands with sparse shrub layer.	Destruction of ground nest sites, predation by introduced predators, habitat loss.

1 Conservation status taken from DSE (2003c).
2 FFG = listed on Schedule 2 of the *Flora and Fauna Guarantee Act* 1988, Ma = marine species under the *EPBC Act* 1999. Mi = migratory under the *EPBC Act* 1999.
3 Information sourced from Cogger (2000), Emison et al. (1987), Higgins and Davies (1996), Higgins et al. (2001), Marchant and Higgins (1990, 1993) and Menkhorst (1996).
4 Considered a vagrant species to the study area; Cardinia not in species' usual distribution.
5 One record of the Broad-toothed Rat exists from the DRA over ten years ago from Beaconsfield Reservoir. No suitable habitat remains within the study area.
6 One record of the Spotted Quail-thrush exists from the far north of the DRA, north of Beaconsfield Reservoir. Limited suitable habitat remains within the study area.

5.4 Threatening processes operating in the study area

Extensive loss of vegetation and fauna habitats has occurred in the study area, as a result of landuse practices, principally agricultural pursuits (clearing, cropping and grazing) and urbanisation**.** Currently less than 9% of the former indigenous vegetation remains in the study area and retains only a semblance of its former structure and floristic composition. **All of the vegetation types (EVCs) in the study area are now considered significant.** Modifications to the floristic composition generally include a moderate to severe reduction in the number of indigenous species, accompanied by weed invasion.

Almost all vegetation and fauna habitats remaining are under direct or indirect threat at variable scales and intensity. This will result in their loss or severe modification in the absence of effective management (over various time scales). A complex of threatening processes often exist at a given site, thus the threats act synergistically to hasten the rate or intensity of loss or degradation. Additionally, threats to vegetation floristic composition and structure usually degrade fauna habitat values. From a management viewpoint it is necessary to identify threatening processes and eliminate or ameliorate these where technically, logistically or economically feasible.

The suite of processes which threaten flora and fauna in the study area are given in Table 5. If these processes are not abated, biodiversity loss will be inexorable.

Table 5 Threatening processes acting within the study area

- *Clearing and vegetation removal:*
  - Urbanisation
  - Infrastructure development
- *Changes to physical environments:*
  - Deterioration in water-quality parameters
  - Increased salinity
  - Erosion
- *Plant-plant and plant-animal interactions:*
  - Weed invasions
  - Rural tree decline
  - Loss of key mutualistic organisms
- *Fauna populations and habitats:*
  - Habitat destruction and loss
  - Predation by introduced carnivores
  - Habitat fragmentation and isolation
  - Habitat degradation
  - Loss of hollow-bearing trees
  - Invasion of exotic marine organisms
  - Competition from exotic (e.g. Common Mynah) or invasive and aggressive native species (e.g. Bell Miner, Noisy Miner)
  - Drainage of, and altered flow regimes in, wetlands and watercourses

Some of these threatening processes or potentially threatening processes have been listed under Schedule 3 of the Victorian *Flora and Fauna Guarantee Act* 1988 (Appendix 6) which implies that such threats are widely acknowledged or understood, or operate at a State-wide scale. Listing under the FFG Act, however, should not be taken to indicate that this necessarily includes all or the most important threats to flora and fauna in the State or the region. Some are minor threats only in the local or wider context; numerous other threats could be listed under the FFG Act.

6.0 STRATEGIC DIRECTIONS FOR BIODIVERSITY MANAGEMENT

Broad scale clearing of vegetation for agriculture has largely ceased as all agriculturally useful land has already been cleared, mostly in the relatively distant past. The major cause of direct vegetation loss is now clearing for urban development. Given the rarity of remnant indigenous vegetation, further losses are unsustainable and should be avoided, irrespective of its absolute conservation significance (e.g. whether or not it contains listed species or communities) and (within reason) the quality of the remnant vegetation. Where possible all indigenous vegetation within the study area must be protected from destruction and clearing through regulation. The following section provides an overview of key State and Federal Government policies and statutes relevant to biodiversity management in the Shire of Cardinia.

6.1 Biodiversity Policy Framework

6.1.1 Flora and Fauna Guarantee Act 1988 (FFG Act)

The primary legislation for the protection of flora and fauna in Victoria is the *Flora and Fauna Guarantee Act 1988* (FFG Act). The Act builds on broader national and international policy in conservation of biodiversity. The objectives of the FFG Act are:

- to guarantee that all taxa of Victoria's flora and fauna other than the taxa listed in Schedule I (human disease organisms) can survive, flourish and retain their potential for evolutionary development in the wild;
- to conserve Victoria's communities of flora and fauna;
- to manage potentially threatening processes;
- to ensure that any use of flora or fauna by humans is sustainable;
- to ensure that the genetic diversity of flora and fauna is maintained;
- to provide programmes of community education in the conservation of flora and fauna;
- to encourage cooperative management of flora through, amongst other things, the entering into of land management cooperative agreements under the *Conservation, Forests and Lands Act* 1987*;*
- to assist and give incentives to people, including landholders, to enable flora and fauna to be conserved;
- to encourage the conserving of flora and fauna through cooperative community endeavours.

These objectives are fulfilled by a range of mechanisms including (Department of Conservation, Forests and Lands undated):

- measures for the identification and conservation of flora and fauna as species and ecological communities;
- management of serious threats to flora and fauna through the identification of potentially threatening processes;
- influencing planning processes at an early stage to ensure that conservation objectives are met;
- ensuring that human use of flora and fauna is sustainable - at a rate which allows for future use.

Taxa or communities of flora and fauna which are threatened in Victoria are listed in Schedule 2 of the Act. A range of mechanisms are in place to ensure that critical habitat of a listed species or community is protected. Potentially threatening processes are listed in

Schedule 3 of the Act.

Two plant species and no botanical communities listed under Schedule 2 or 3 of the *Flora and Fauna Guarantee Act 1988* (FFG Act) are present within the study area (Table 2).
Ten bird species, one mammal species, two fish species and one frog species listed under the *FFG Act 1988* have been recorded in the Cardinia DRA (see Section 5.3.1). Two species, the Powerful Owl (*Ninox strenua)* and the Great Egret (*Ardea alba)* have been recently recorded in the study area. Further investigation is required to ascertain the status of the FFG listed Swamp Skink (*Egernia coventryi*), as potential habitat occurs at several sites in the study area.

6.1.2 Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

This legislation establishes a Commonwealth process for assessment of proposed actions that are likely to have a significant impact on matters of national environmental or conservation significance or on Commonwealth land (this includes listed threatened species and ecological communities, and listed migratory species). The objectives of this Act are:

- to provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance; and
- to promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources; and
- to promote the conservation of biodiversity; and
- to promote a co-operative approach to the protection and management of the environment involving governments, the community, land-holders and indigenous peoples; and
- to assist in the co-operative implementation of Australia's international environmental responsibilities; and
- to recognise the role of indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity; and
- to promote the use of indigenous peoples' knowledge of biodiversity with the involvement of, and in co-operation with, the owners of the knowledge.

One plant species and no vegetation communities listed under the EPBC Act occur within the study area (Table 2).
There are seven EPBC listed fauna species previously recorded in the Cardinia DRA (Section 5.3.1): one mammal species, three bird species, one frog species and two fish species. Of these, the Southern Bell Frog/Growling Grass Frog (*Litoria raniformis*), Dwarf Galaxias (*Galaxiella pusilla*) and Australian Grayling (*Prototroctes maraena)* are the most likely to regularly occur in the study area.

6.1.3 Victoria's Native Vegetation Management Framework (Net Gain) 2002

Victoria's Native Vegetation Management, A Framework for Action (DNRE 2002b) establishes the strategic direction for the protection and enhancement of native vegetation and revegetation across the State. It addresses native vegetation from a whole-catchment perspective but with a necessary focus on private land where the critical issues from clearing and fragmentation of native vegetation exist.

The framework identifies the following principles to guide native vegetation management in Victoria:

- retention and management of remnant native vegetation is the primary way to conserve the natural biodiversity across the landscape;
- the conservation of native vegetation and habitat in a landscape is dependent on the maintenance of catchment processes;

- the cost of vegetation management should be equitably shared according to benefits accrued by the landholder, community and region; and
- a landscape approach to planning native vegetation management is required. Goals for native vegetation management will be based on bioregions, or sub-units, within the Catchment Management Authority region. Priorities for vegetation management should be specific for each bioregion and catchment.

The primary goal for native vegetation management is 'A reversal, across the entire landscape, of the long-term decline in the extent and quality of native vegetation, leading to a Net Gain'.

Net Gain is the outcome for native vegetation and habitat where overall gains are greater than overall losses and where individual losses are avoided where possible. The system is based on "habitat hectares", a site-based measure of quality and quantity of native vegetation that is assessed in the context of the relevant vegetation. Whilst the priority is to avoid clearing, where clearing is permitted offset criteria have been established to ensure that the gains and losses are "commensurate".

The framework provides a strong focus on the protection and net improvement of higher conservation significant vegetation and a flexible but accountable approach for lower conservation significance vegetation to enable landholders to move towards more sustainable land-use options.

Resolution of the Net Gain requirements would need to be addressed if future developments were likely to impact on remnant vegetation and fauna habitat.

6.1.4 Planning and Environment (Planning Schemes) Act 1996

The *Planning and Environment (Planning Schemes) Act 1996*, which amended the *Planning and Environment Act 1987*, provided for the Minister to prepare a set of standard provisions for planning schemes called the Victoria Planning Provisions (VPP). The VPP is a comprehensive set of standard planning provisions and provides a standard format for all Victorian planning schemes. It provides the framework, standard provisions and State planning policy.

With reference to the removal of native vegetation the VPP states that:
- on land which together with all contiguous land in one ownership, has an area of greater than 0.4 ha, a permit is required, from the local government authority, to remove, destroy or lop native vegetation (except for certain exemptions).

The removal of any indigenous vegetation as a result of the proposed development will require a permit from Cardinia Shire Council.

6.1.5 Catchment and Land Protection Act 1994

The *Catchment and Land Protection Act 1994* (CALP Act) provides a legislative framework for the management of land including the control of declared noxious weeds and pest animals.

The Act sets out the responsibilities of private and public land managers, stating that they must take all reasonable steps to:

- Avoid causing or contributing to land degradation which causes or may cause damage to land of another land owner,
- Conserve soil,
- Protect water resources,
- Eradicate regionally prohibited weeds,
- Prevent the growth and spread of regionally controlled weeds, and
- Prevent the spread of, and as far as possible eradicate, established pest animals.

The Department of Sustainability and Environment (DSE) is responsible for administering the Act and it employs Catchment Management Officers through the Department of Primary Industries (DPI) to enforce the provisions of the Act. Catchment Management Officers are responsible for providing advice and assistance to land managers as well as:

- Undertaking inspections for noxious weeds and established pest animals (rabbits, foxes, wild dogs, feral pigs and goats) on land throughout Victoria.
- Undertaking investigations into the trade and possession of pest animals and noxious weeds.
- The power to enter and search land, which includes buildings, shops, nurseries and other commercial premises to ensure the provisions of the Act are being complied with.

One species listed as State Prohibited and 13 species listed as Regionally Controlled under the *Catchment and Land Protection Act 1994* were recorded in the study area (Table 6). In addition, five weed species of National significance have been recorded for the study area.

Table 6: Serious weed species which require management in the study area

Scientific Name	Common Name	Weed of National Significance	State Prohibited Weed	Regionally Prohibited Weed	Regionally Controlled Weed
Allium triquetrum	Three-corner Garlic				C
Asparagus asparagoides	Bridal Creeper	N			
Centaurea nigra	Black Knapweed		S		
Chrysanthemoides monilifera	Boneseed				C
Cirsium vulgare	Spear Thistle	N			C
Crataegus monogyna	Hawthorn				C
Echium plantagineum	Paterson's Curse				C
Foeniculum vulgare	Fennel				C
Genista linifolia	Flax-leaf Broom				C
Genista monspessulana	Montpelier Broom				C
Juncus acutus ssp. *scutus*	Spiny/Sharp Rush				C
Pittosporum undulatum	Sweet Pittosporum				
Rosa rubiginosa	Sweet Briar				C
Rubus fruticosus spp. agg.	Blackberry	N			C
Salix spp.	Willow	N			
Senecio jacobaea	Ragwort				C
Ulex europaeus	Gorse	N			C
Watsonia meriana var. *bulbillifera*	Bulbil Watsonia				C

6.2 Guiding Principles

In keeping with the policies and legislation outlined above, four guiding principles for native vegetation management in Victoria have been outlined by the *Framework* (DNRE 2002b).

1) **Retention and management of remnant native vegetation**
2) **The conservation of native vegetation and habitat**
3) **The cost of vegetation management should be equitably shared**
4) **A landscape approach to planning native vegetation management is required**

Each of these four guidelines can be applied to vegetation and fauna habitat issues and management within the study area.

1) **Retention and management of remnant native vegetation is the primary way to conserve the natural biodiversity across the landscape.**
   a) All native vegetation has value.
   b) Important habitats and populations of endangered species should be protected through voluntary or regulatory means.
   c) Biodiversity values are not restricted to threatened and depleted vegetation communities. An adequate proportion of each non-threatened vegetation community must also be managed principally for conservation.
   d) Large natural areas of remnant vegetation are of fundamental importance for nature conservation and are irreplaceable. All other things being equal, large remnants are inherently more valuable than small patches that total a comparable area.

- *In the context of the study area **all remnant vegetation is important for the maintenance of biodiversity** and most of the remnants are important in their contribution to the integrity of the vegetation and fauna habitat of the broader area.*
- *Remnant vegetation that is in good condition is extremely valuable and should be the initial focus of protection and management. These areas tend to be those in which most layers of vegetation are still present. Once the understorey species of a remnant have been lost it is very difficult and expensive to rebuild this habitat. It is therefore imperative to protect the best and largest remnant vegetation.*

In order to adequately protect and manage the vegetation remnants and fauna habitat of the study area, guidelines as to the expected planning response to an application, based on Regional Outcomes and Net Gain principles should be adopted.

In applying the Net Gain approach to protection and clearance decisions at the on-ground level, the steps (DNRE 2002b) are:

1. To avoid adverse impacts, particularly through vegetation clearance.
2. If impacts cannot be avoided, to minimise through appropriate consideration in planning processes and expert input to project design or management.
3. Identify appropriate offset options.

As a result of applying the above criteria to protection, investment and offset decisions the following net outcomes can be expected at the regional and state-wide levels.

Table 7 Local Responses and Regional Outcomes to achieve Net Gain

CONSERVATION SIGNIFICANCE	REGIONAL OUTCOMES			RESPONSES AT LOCAL LEVEL
	remnant retention	**gains in habitat score**	**net outcome**	
VERY HIGH	No losses	Substantial gains	Substantial net gain	• clearing not permitted unless exceptional circumstances apply (i.e. impacts are an unavoidable part of a development project of Statewide significance as determined at Ministerial level) • where clearing is permitted, offsets must achieve a **substantial Net Gain** (i.e. at least twice the identified loss) at the local level according to the offset criteria and such gains must be of an on-going and secure nature
HIGH	Minimise losses	Moderate gains	Net gain	• clearing generally not permitted • offsets must achieve a **Net Gain** (i.e. at least 1.5 times the identified loss) at the local level according to the **Net Gain** criteria and such gains must be of an on-going and secure nature • high priority for biodiversity conservation investment
MEDIUM	Minimise losses	Some gains	Equivalence between losses and gains	• clearing may be permitted but only as part of an appropriate sustainable use response as determined by the responsible planning authority • offset actions must achieve an **Equivalent Gain** at the local level according to offset criteria and such gains must be of an on-going and secure nature
LOW	Some losses	Longer term gains	Longer term equivalence between losses and gains	• clearing may be permitted but only as part of an appropriate sustainable use response as determined by the responsible planning authority • offset actions must aim for **equivalence** at the local level in the longer-term but will not achieve this in the short-term (i.e. less than ten years). For forest or woodland vegetation with less than 0.2 habitat score, tree replacement criteria rather than the full net gain offset criteria should be used (see vegetation replacement)
	TOTAL – Reversal in decline (change from loss to Net Gain)			

Source: Victoria's Native Vegetation Management – A Framework for Action

Application of Net Gain – Prioritising sites for Net Gain offsets

Implementation of Net Gain offsets on sites within the municipality provides an opportunity for the *protection* of vegetation, *management* of threatening processes and *supplementation* of biodiversity assets, of which funding and resources may not have been so readily available in the past. Astute prioritisation of Net Gain offset sites will ensure the best outcome for the protection and management of vegetation and fauna habitat in the municipality.

The *Framework* (DNRE 2002b) aims to ensure that Net Gain outcomes are strongly positive for higher significance vegetation, whilst also ensuring that less substantial achievements in lower significance vegetation do not undermine the achievement of the overall objective of Net Gain. For this reason various 'Like-for-Like' requirements have been set out in the *Framework* (DNRE 2002b). To ensure these requirements are fulfilled, proposed Net Gain offsets will have to be dealt with on a site-by-site basis, but the following should also be considered:

When prioritising sites for **Protection**:

- **Protect the best and largest remnants first.**
- When prioritising sites for **Management** consider that:
- **Environmental weed invasions constitute the single greatest threat to all terrestrial biodiversity in the study area.**
- When **Supplementing** biodiversity assets aim to:
- **Increase habitat size and increase connectivity between remnants.**
- **Include a number of layers of vegetation (priority should be given to canopy trees and understorey shrubs) to increase the habitat component of the site.**
- **Resources must first concentrate on protection and management of extant habitat.**

The values presented in this document represent minimum conservation significance for the identified sites of biodiversity significance. This acknowledges that additional values may be identified with more detailed surveys (e.g. unknown presence of *FFG* listed Swamp Skink and distribution of the *EPBC* listed Southern Bell Frog). The present site specific information in this report is inventory-based and does not represent an impact of proposal assessment. As sites have been identified as significant, loss or destruction of part or whole of a site must assume some loss of biodiversity, unless demonstrated otherwise.

Applications for proposals that could directly or indirectly impact on significant sites should be accompanied by detailed flora and fauna assessments, which would vary in scope according to the importance of the site and the nature of the proposed development. Generally assessments should include as a minimum requirement:

- Vegetation sampling in accordance with accepted and repeatable procedures – sufficient to describe the structure and indigenous composition of the vegetation;
- Compilation of site specific inventory of species/taxa and communities;
- Fauna habitat assessment, seasonally targeted and including the description of key habitat elements for significant fauna;
- The existing ecological function of the subject site in a landscape context – i.e. does the subject remnant form part of a larger consolidated block of native vegetation and/or habitat or does it facilitate the dispersal of fauna and plant propagules (e.g. via a wildlife corridor);
- Specific targeted species survey based on habitat modelling for significant taxa. Targeted taxa may include:
    - relevant species which are rare, threatened or depleted at the regional, State or National scale and which may be anticipated to occur on the subject site;
    - taxa which occur at the edge of their continental range;
    - disjunct populations of the otherwise secure taxa; and
    - unusual associations of biota (e.g. roosting colonies of bats and/or birds).

- The overall significance of the site, in terms of the scale (i.e. geographic context) and degree of represented biological features such as rare or threatened species and communities;
- Assessment of the potential direct and indirect impacts of the proposed development on identified values, including possible off-site repercussions and mechanisms for avoiding and/or mitigating impacts;
- Assessment of the legislative and policy implications of the proposal, particularly in the context of the *Flora and Fauna Guarantee Act 1988, Environment Protection and Biodiversity Act 1999* and Net Gain.

2) The conservation of native vegetation and habitat in a landscape is dependent on the maintenance of catchment processes.

a) Maintaining ecological processes provides productivity, salinity, water quality and other land management benefits.

b) Native vegetation management strategies must be integrated with land protection and resource use, including productive agriculture, for both long-term success and for ensuing that land and water protection outcomes are achieved.

The protection, management and re-establishment of vegetation can be used to ensure that important functional aspects of vegetation at the landscape scale (e.g. protection from erosion or salinisation; buffering of riparian or other significant areas; wildlife movement; large patch size) are maintained.

Secondary salinisation as a result of agricultural practices (clearing of deep-rooted indigenous vegetation) has probably resulted in loss of grassland and woodland habitat in the region.

Vegetation retention is a principle means of limiting further increase in salinity within the study area. Salinity can arise in low lying areas or at the break of slope (discharge areas) due to extensive clearing in the catchments. Excessive water enters the groundwater system causing the watertable to rise. Increasing vegetation cover in recharge areas will aid salinity control (Port Phillip and Westernport CALP Board 1999).
In some areas, streams and rivers form the most important and at times the only vegetation corridor and fauna habitat in an area. Where vegetation cover is lacking, watercourses are vulnerable to erosion and overland flows of sediments and nutrients. In such cases they have limited capacity to act as wildlife corridors or provide quality habitat for aquatic fauna (Port Phillip and Westernport CALP Board 1999).

Increased community and landholder activity in restoring and managing water frontages would be highly beneficial. To improve water quality and to restore habitat value, buffer strips of indigenous vegetation 10-30 m wide are desirable (Port Phillip and Westernport CALP Board 1999). In addition, reducing degrading processes particularly through weed control and fencing to exclude cattle is also recommended.

The main mechanisms to assist with improving riparian management are through schemes such as:
- Melbourne Water's Stream Frontage Program Scheme
- Cardinia Shire biodiversity incentive scheme (tree grant and weed control grant programs)
- Cardinia Shire rate rebates for Trust for Nature properties
- Activities associated with local Landcare groups
- Greening Australia's Remnant Fencing Assistance Scheme
- Natural Heritage Trust Bushcare and Rivercare Programs
- DSE's Land Protection Incentive Scheme and Second Generation Landcare Grants

3) **The cost of vegetation management should be equitably shared according to benefits accrued by the landholder, community and region.**
   a) Land managers have a responsibility to retain native vegetation.
   b) Public resources are to be directed to increasing the extent of native vegetation or to enhancing the quality of native vegetation through appropriate management.
   c) Public resources are to be used to facilitate voluntary actions by landholders and for shared investment in enhancing vegetation of conservation importance.

- ***All remnant indigenous vegetation and fauna in the study area is important****, and without appropriate management, losses resulting from direct and indirect degradation processes, will inevitably mean* ***the loss of most biodiversity.***

Within Victoria the current reserve system alone is insufficient to prevent further decline to vegetation and fauna habitat, therefore private landowners have been required to contribute by conserving their native vegetation through Native Vegetation Retention (NVR) controls. Clearly, retaining native vegetation on private land has costs and benefits for both the landowner and the public (Port Phillip and Westernport CALP Board 1999).

The majority of remnant vegetation within the study area is on privately owned property. Therefore the protection and management of this vegetation is paramount to the conservation of the region's biodiversity. Appropriate management of vegetation on private property requires knowledge, time, funds, equipment and commitment. All of these factors need to be considered and addressed in programs focused on private land (Port Phillip and Westernport CALP Board 1999).

In some respects, Victoria has led the field in catering for conservation on private land, particularly with the **Trust for Nature** and the **Land for Wildlife Program**. While these are the backbone of an industry supported by numerous grant schemes, philanthropic trusts and volunteer organisations, the ultimate success of a program is contingent on the owner being sympathetic and willing to commit resources. While these schemes are laudable, the outstanding challenge relates to the landowner who, for whatever reasons, remains distant from, or unsympathetic to, conservation objectives. Lack of action can result from attitudes that vary from minor disinterest to outright opposition on the part of landowners. Current US research (Vickerman 1999) indicate that the existing range of direct and indirect Government incentives to landholders in Victoria are poorly promoted and supported, and are generally inadequate in terms of expert advice and the capacity for landholders to recoup potential income loss and fund ongoing management actions (Carr et al. 2001).

Land owners are the key factor in arresting the decline in values on private land and the implications for the Shire of Cardinia include:

- Continue to promote and provide assistance through grant schemes, Land for Wildlife, Trust for Nature, "Friends of groups" etc. Ensure Cardinia staff are aware of these programs and are able to extend the relevant information to the general public (e.g. directly or indirectly such as meetings with Extension Officers and links on the Cardinia Shire web page).
- Continue to encourage conservation on private land through financial incentives. Within the municipality this includes tree and weed control grant programs, and rate rebates for Trust for Nature properties. The development of such incentives is invaluable to help in community education about the importance of biodiversity resources as well as demonstrating a new level of priority given to environmental responsibility.
- Investigate the provision of expert advice for the identification of biodiversity assets and management of nature conservation to interested landholders. This service should

specifically focus on key values and technical problems (i.e. weed management) and should not evolve into a role more suited to animal welfare officers.
- Utilise the Biodiversity Database to identify properties which contain remnant vegetation, and provide educational material to the owners to promote the benefits of retention and improved management. This could also include a list of potential resources for the land owner and may provide opportunities to build a rapport between the landowner and Council officers.

4) A landscape approach to planning native vegetation is required. Goals for native vegetation management will be based on bioregions, or sub-units, within the Catchment Management Authority region. Priorities for vegetation management should be specific for each bioregion and catchment.

a) Multiple patches of the same vegetation community should be retained or enhanced across their geographic range.
b) The position of remnants in the landscape influences their conservation value.

- *The study area to the north of the growth corridor, which includes areas of potential rural residential development,* ***currently has 20% of the former vegetation remaining.*** *This vegetation is partially continuous, and forms stepping stones with vegetation further north in the municipality. In doing so, it contributes to overall connectivity.*

The remnant vegetation within the Shire of Cardinia is concentrated to the north, and in coastal areas to the south of the municipality. The vegetation to the north is part of the broader Dandenong Ranges area. In order to conserve the biodiversity of the region, the integrity of vegetation and fauna habitat should be considered at a landscape scale.

Approaching biodiversity conservation at a landscape level helps to maintain dispersal routes allowing immigration and emigration between populations, potentially conserving gene-pools. In areas such as Cardinia, where large-scale clearing of fauna habitat has already occurred, the links between remnant vegetation become increasingly important to sustain even the most common species' assemblages. Roadsides and riparian corridors are key areas of fauna and flora habitat in Cardinia. The habitat potential of some smaller, lower quality remnants is often enhanced by their proximity to larger remnants, particularly for more mobile species such as bats, birds and larger mammals.

The primary goal for native vegetation management in Victoria is to achieve:
'A reversal, across the entire landscape, of the long-term decline in extent and quality of native vegetation, leading to a Net Gain' (DNRE 2002b).

This goal for native vegetation in Victoria can be best achieved by having a "whole of landscape" perspective, encompassing all land tenures, informed by catchment-wide understanding of native vegetation processes and values. For Cardinia it is recommended that strategies for vegetation protection and management are developed in the context of the whole municipality. Consideration of biodiversity from a municipal perspective will also allow for strategic prioritisation of actions, resources and funding.

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APPENDICES

Appendix 1. Methodology used in the preparation of the Indigenous Vegetation Survey Report

4.1 Site selection

Sites potentially supporting remnant vegetation, and thus warranting field inspection, were located by the following methods:

- aerial photograph interpretation (1:15,500 scale) provided by the Shire of Cardinia;
- literature (published and unpublished) that documents some sites of significance in the study area including ; and
- personal communications from landholders, local naturalists, and Shire of Cardinia staff (information from interested parties was solicited via a workshop held for this purpose).

The majority of sites were assessed by viewing the site from public land, through existing knowledge of the area, and aerial photograph interpretation. A field inspection was conducted on sites occurring on public land and on some sites on private land where the vegetation/habitat quality was high. Sites were not visited without the knowledge or permission of the landholder. The Shire of Cardinia contacted landholders through a mail-out.

4.2 Flora

The vegetation of the study area was assessed on the basis of existing information as well as a site survey.

4.2.1 Literature and desktop review

The desktop review included a search of the Victorian Flora Information System (DSE 2003b), a Statewide database maintained by the Department of Sustainability and Environment (DSE); this was conducted to access data previously collected from within the study area. Information from previous reports on the area have also been reviewed (e.g. Kern (2003), Beveridge Williams and Co (2002), Oates and Taranto (2001), Department of Conservation, Forests and Lands (1989), Opie et al. (1984a), Opie et al. (1984b), see also References – Section 7.0).

4.2.2 Field work

Vegetation sampling was undertaken from August – December 2003 with additional opportunistic data acquisition early in 2004. Data were collected from public and private land and involved the collection of quadrat data, species lists and incidental records of native and exotic plant species.

Quadrat data collection involved recording all vascular plant species in c. 700 m^2 (either 30 m diameter circles or areas of equivalent size along creek banks or roadsides) and assigning a visually-assessed cover/abundance value from the Braun-Blanquet scale (Gullan 1978).

+	cover <5%, few individuals;
1	cover <5%, any number of individuals;
2	cover 5-20%, any number of individuals;
3	cover 20-50%, any number of individuals;
4	cover 50-75%, any number of individuals; and
5	cover 75-100%, any number of individuals.

Species lists were recorded from a site of any size and these lists are not necessarily comprehensive and the abundance of the plant species was not noted. Incidental records were used to record a small number of species (usually between 1-5) found at site (e.g. a weed, rare indigenous species or a remnant species in a degraded landscape); abundance was not recorded. Notes were made on the vegetation structure and other features in the study area and in the vicinity of the survey site (e.g. soil type, slope, aspect and management issues). The quality of the vegetation was assessed using a rating system developed by Ecology Australia (Carr et al. 1997). The quality ratings, used to indicate the relative quality or degree of disturbance of the vegetation, are defined as follows:

APPENDICES

Vegetation Quality Ratings

1. Vegetation structurally and floristically **intact** or almost so; weed invasions **minimal** or weeds absent; disturbance **minimal** or absent.
2. Vegetation structurally and floristically **substantially intact**; low levels of weed invasion; low **levels** of disturbance.
3. Vegetation **partially intact** structurally and/or floristically; moderate levels of weed invasion**;** woody vegetation intact and herbaceous vegetation greater than 50% cover; moderate levels of disturbance.
4. Vegetation comprised of **less than 50% cover** of indigenous species and/or with **much reduced** species richness; in the case of woody vegetation the upper strata may provide moderate to high cover but field layer substantially exotic *or* only scattered overstorey remnants but moderately dense understorey and/or field layer; **high** levels of disturbance.
5. Vegetation **grossly modified** with scattered to rare dominants of upper strata only persisting; **very high cover** of weeds; current or former levels of disturbance **high or very high**.

NB. Quality ratings do not equate with significance ratings but do contribute to their determination (see Appendix D for significance criteria).

Planted exotic trees and shrubs (i.e. not naturalised) were not recorded. Sites, which upon field inspection, were found to have no remnant vegetation and little or no faunal habitat were not included in the inventory.

4.2.3 Habitat Quality Rating

The habitat Quality rating was determined using the criteria set out in the Arthur Rylah Institute (ARI) Vegetation Condition Field Assessment Sheets. Refer to Appendix 7.

4.2.4 Taxonomy

Plant names in this report and the accompanying documents follow *The Census of the Vascular Plants of Victoria* (Ross and Walsh 2003) except for taxa with informal names recognised by Ecology Australia (unpubl. data). These are undescribed or taxonomically unrecognised species or infraspecific taxa (subspecies, varieties) as well as newly recorded naturalised taxa – most recorded during this study – but not yet formally recognised by the National Herbarium of Victoria which maintains the *Census* of the Victorian flora. These taxa are listed in Appendix 2.

4.2.5 Mapping

Maps of vegetation remnants and otherwise significant sites for biodiversity across the study area were prepared using current EVC mapping (Oates and Taranto 2001), aerial photograph interpretation, field observations and information (including maps) from previous studies. The vegetation was categorised using Ecological Vegetation Classes (EVCs) which is now the standard typology for vegetation description and land use planning in Victoria. Where the vegetation was degraded, the former EVC (i.e. the pre-1750 EVC) was assigned. Polygons represented by the same EVC type can therefore have different vegetation qualities (e.g. an area of Grassy Woodland can contain intact, high quality vegetation, Quality rating 1 or 2, while another area of the same EVC can be of disturbed, low quality vegetation, Quality rating 4 or 5). The maps were produced in hard copy form and will also be utilised through Council's Geographic Information System (GIS). Digital data is to be stored and maintained by the Shire of Cardinia.

A roadside vegetation layer has been included in the GIS package accompanying this report. This data has been incorporated in an attempt to provide a holistic picture of the vegetation coverage within the study area. The data has been sourced from the Cardinia Shire Council roadside vegetation map (Road-5000-Shire) which was produced in 1999. The data collection and production of this map was separate from the current study. Ecology Australia assumes no responsibility for its accuracy.

APPENDICES

4.3 Fauna

A selection of sites within the Cardinia study area were visited. An assessment of the fauna values of the study area was conducted using the following methods:

Database and desktop review.
The Victorian Fauna Display (DSE 2003b), a CD-ROM version of the Atlas of Victorian Wildlife (AVW) database curated by the Department of Sustainability and Environment (DSE) was searched for fauna records from in and around the study area. An area encompassing the study area was searched for fauna records and is referred to as the Data Review Area (DRA).
Previous reports (e.g. Andrew et al. 1984, LCC 1991, 1993 & 1994) documenting biodiversity assets in the area were resourced. Unpublished data supplied by land owners and community conservation groups during the workshop were also reviewed and supplemented data collected from the field and database searches.

Active Searching. The majority of sites were searched for signs of wildlife including: scats, tracks, nests, dreys, burrows. Where appropriate, rock and log rolling was employed to try and locate reptiles. All opportunistic observations of wildlife were recorded, including indirect observations (e.g. bird calls).

Habitat Assessment. Sites were assessed according to their ability to support native fauna, particularly threatened species (if appropriate). As well as scoring the vegetation quality (see Section 4.2.1), the presence of other habitat attributes were noted including:
Stags and hollow-bearing trees.
Microhabitat including fallen timber, hollow logs, rocks and leaf litter.
Waterways, wetlands and/or dams.
Continuity with other remnants or areas of suitable habitat.

Any threatening processes affecting the site's potential to support wildlife and/or habitat quality were also noted.

4.4 Database

Data collected during the project is stored within a Microsoft Access Database. The database has been designed to allow both use on personal computers and also for incorporation into council's GIS. The data are stored in a series of tables in the database, which will allow for the incorporation of new information in the future. A number of standard queries have been established to allow routine searches to be performed on the data.

The database contains an inventory of the flora and fauna data collected during the project. This includes specific details with regard to the source of the data, the sites from where the data were collected, significance of the site, species and Ecological Vegetation Classes recorded and management prescriptions.

4.5 Limitations

Access to all private properties containing potential remnant flora was not possible. In such cases attempts were made to assess the vegetation using aerial photograph interpretation and viewing the vegetation from the public roads. Remote assessment of the conservation values of vegetation is particularly difficult and remnants of some vegetation types such as grasslands would undoubtedly have been overlooked. The inventory may be therefore lacking in detail for these particular areas.

The field inspection was performed from August – December 2003. Spring/Summer is the best time to record most seasonal botanical species, however, given the dry conditions encountered this year and the time taken to cover an area the size of the study area some indigenous and exotic species may not be evident at the time of survey.

APPENDICES

Appendix 2 Vascular plant species recorded for the study area

Data source includes fieldwork conducted during this survey (August – December 2003) and information from the Victorian Flora Information System (FIS) (DSE 2003a).

Taxonomy follows Ross and Walsh (2003)

* indicates that the has become naturalised in Victoria
\# indicates that a taxon is both native and naturalised in Victoria
E Endangered in Australia
e Endangered in Victoria
v Vulnerable in Victoria
r Rare in Victoria but not considered otherwise threatened
k Poorly know and suspected, but not definitely known, to be long to one of the categories e, v or r within Victoria

Mosses		
Brachytheciaceae		
*	*Pseudoscleropodium purum*	Neat Feather-moss
Ferns and Fern-like Plants		
Adiantaceae		
	Adiantum aethiopicum	Common Maidenhair
Blechnaceae		
	Blechnum cartilagineum	Gristle Fern
	Blechnum minus	Soft Water-fern
	Blechnum nudum	Fishbone Water-fern
	Blechnum wattsii	Hard Water-fern
Culcitaceae		
	Calochlaena dubia	Common Ground-fern
Cyatheaceae		
	Cyathea australis	Rough Tree-fern
Dennstaedtiaceae		
	Pteridium esculentum	Austral Bracken
Dicksoniaceae		
	Dicksonia antarctica	Soft Tree-fern
Dryopteridaceae		
	Polystichum proliferum	Mother Shield-fern
Lindsaeaceae		
	Lindsaea linearis	Screw Fern
Selaginellaceae		
	Selaginella gracillima	Tiny Selaginella
Conifers		
Pinaceae		
*	*Pinus radiata*	Radiata Pine
Monocotyledons		
Alliaceae		
*	*Agapanthus praecox* ssp. *orientalis*	Agapanthus
*	*Allium triquetrum*	Three-corner Garlic

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Amaryllidaceae		
*	*Leucojum aestivum*	Snowflake
Anthericaceae		
	Arthropodium fimbriatum	Nodding Chocolate-lily
	Arthropodium strictum s.l.	Chocolate Lily
	Arthropodium strictum s.s.	Chocolate Lily
	Chamaescilla corymbosa var. *corymbosa*	Blue Stars
	Thysanotus patersonii	Twining Fringe-lily
	Thysanotus tuberosus	Common Fringe-lily
Araceae		
*	*Zantedeschia aethiopica*	White Arum-lily
Asparagaceae		
*	*Asparagus asparagoides*	Bridal Creeper
*	*Asparagus scandens*	Asparagus Fern
Asphodelaceae		
	Bulbine bulbosa	Bulbine Lily
Centrolepidaceae		
	Centrolepis aristata	Pointed Centrolepis
Colchicaceae		
	Burchardia umbellata	Milkmaids
	Wurmbea dioica	Common Early Nancy
	Wurmbea spp.	Early Nancy
Cyperaceae		
r	*Carex alsophila*	Forest Sedge
	Carex appressa	Tall Sedge
	Carex breviculmis	Common Grass-sedge
k	*Carex chlorantha*	Green-top Sedge
	Carex fascicularis	Tassel Sedge
	Carex gaudichaudiana	Fen Sedge
	Carex spp.	Sedge
*	*Cyperus eragrostis*	Drain Flat-sedge
*	*Cyperus tenellus*	Tiny Flat-sedge
	Eleocharis acuta	Common Spike-sedge
	Eleocharis sphacelata	Tall Spike-sedge
	Gahnia radula	Thatch Saw-sedge
	Gahnia sieberiana	Red-fruit Saw-sedge
	Isolepis hookeriana	Grassy Club-sedge
	Isolepis inundata	Swamp Club-sedge
	Isolepis platycarpa	Broad-fruit Club-sedge
	Lepidosperma elatius	Tall Sword-sedge
	Lepidosperma filiforme	Common Rapier-sedge
	Lepidosperma gunnii	Slender Sword-sedge
	Lepidosperma laterale	Variable Sword-sedge
	Lepidosperma laterale var. *laterale*	Variable Sword-sedge
	Lepidosperma laterale var. *majus*	Variable Sword-sedge
	Lepidosperma semiteres	Wire Rapier-sedge

	Lepidosperma spp.	Sword Sedge
	Schoenus apogon	Common Bog-sedge
	Schoenus lepidosperma	Slender Bog-sedge
	Schoenus maschalinus	Leafy Bog-sedge
	Schoenus tesquorum	Soft Bog-sedge
Hypoxidaceae		
	Hypoxis spp.	Hypoxis
Iridaceae		
*	*Crocosmia* x *crocosmiiflora*	Montbretia
*	*Freesia alba*	White Freesia
*	*Gladiolus* spp.	Gladiolus
*	*Romulea rosea*	Onion Grass
*	*Sisyrinchium iridifolium*	Blue Pigroot
*	*Watsonia meriana* var. *bulbillifera*	Bulbil Watsonia
Juncaceae		
*	*Juncus acutus* ssp. *acutus*	Sharp Rush
	Juncus amabilis	Hollow Rush
*	*Juncus articulatus*	Jointed Rush
	Juncus australis	Austral Rush
	Juncus bufonius	Toad Rush
*	*Juncus bulbosus*	Bulbous Rush
	Juncus holoschoenus	Joint-leaf Rush
*	*Juncus microcephalus*	Tiny-headed Rush
	Juncus pallidus	Pale Rush
	Juncus planifolius	Broad-leaf Rush
	Juncus procerus	Tall Rush
	Juncus sarophorus	Broom Rush
	Juncus sp. (sect genuini)	No Common Name
	Juncus spp.	Rush
	Juncus subsecundus	Finger Rush
*	*Juncus tenuis*	Slender Rush
	Luzula campestris spp. agg.	Field Woodrush
	Luzula meridionalis	Common Woodrush
	Luzula spp.	Woodrush
Juncaginaceae		
	Triglochin procerum s.l.	Water Ribbons
	Triglochin striatum	Streaked Arrowgrass
Lemnaceae		
	Lemna spp.	Duckweed
Orchidaceae		
	Acianthus exsertus s.l.	Gnat Orchid
	Acianthus exsertus s.s.	Large Mosquito-orchid
	Acianthus pusillus	Small Mosquito-orchid
	Arachnorchis clavigera	Plain-lip Spider-orchid
	Arachnorchis dilatata s.l.	Green-comb Spider-orchid
v	*Arachnorchis oenochila*	Wine-lipped Spider-orchid

		Arachnorchis parva	Small Spider-orchid
		Arachnorchis tentaculata	Mantis Orchid
	r	*Burnettia cuneata*	Lizard Orchid
		Caladenia s.l. spp.	Caladenia s.l.
		Calochilus paludosus	Red Beard-orchid
		Calochilus robertsonii	Purple Beard-orchid
		Chiloglottis gunnii s.l.	Common Bird-orchid
		Chiloglottis spp.	Bird Orchid
		Chiloglottis trapeziformis	Dainty Bird-orchid
		Chiloglottis valida	Common Bird-orchid
		Corunastylis despectans	Sharp Midge-orchid
		Corunastylis morrisii	Bearded Midge-orchid
		Cryptostylis leptochila	Small Tongue-orchid
		Cryptostylis subulata	Large Tongue-orchid
		Dipodium punctatum s.l.	Hyacinth Orchid
		Diuris orientis	Wallflower Orchid
		Diuris pardina	Leopard Orchid
	v	*Diuris punctata* var. *punctata*	Purple Diuris
		Eriochilus cucullatus	Parson's Bands
		Gastrodia sesamoides s.l.	Cinnamon Bells
		Glossodia major	Wax-lip Orchid
		Leptoceras menziesii	Hare Orchid
		Lyperanthus suaveolens	Brown-beaks
		Microtis parviflora	Slender Onion-orchid
		Microtis spp.	Onion Orchid
		Microtis unifolia	Common Onion-orchid
		Nemacianthus caudatus	Mayfly Orchid
		Petalochilus carneus sensu Willis (1970)	Pink Fingers
		Petalochilus pusillus	Tiny Pink-fingers
		Pheladenia deformis	Bluebeard Orchid
		Prasophyllum brevilabre	Short-lip Leek-orchid
E	e	*Prasophyllum frenchii*	Maroon Leek-orchid
		Prasophyllum odoratum	Scented Leek-orchid
		Prasophyllum spp.	Leek Orchid
	r	*Pterostylis* x *ingens*	Sharp Greenhood
		Pterostylis alpina s.l.	Alpine Greenhood
	r	*Pterostylis grandiflora*	Cobra Greenhood
		Pterostylis longifolia s.l.	Tall Greenhood
		Pterostylis melagramma	Tall Greenhood
		Pterostylis parviflora s.l.	Tiny Greenhood
		Pterostylis pedunculata	Maroonhood
		Pterostylis plumosa s.l.	Bearded Greenhood
		Stegostyla congesta	Black-tongue Hood
		Stegostyla gracilis	Musk Hood
		Stegostyla praecox	Early Hood
	r	*Thelymitra* x *irregularis*	Crested Sun-orchid

	Thelymitra aristata	Great Sun-orchid
	Thelymitra flexuosa	Twisted Sun-orchid
	Thelymitra holmesii	Blue-star Sun-orchid
	Thelymitra ixioides s.l.	Spotted Sun-orchid
	Thelymitra ixioides s.s.	Spotted Sun-orchid
	Thelymitra media s.l.	Tall Sun-orchid
	Thelymitra nuda	Plain Sun-orchid
	Thelymitra pauciflora s.l.	Slender Sun-orchid
	Thelymitra rubra	Salmon Sun-orchid
	Thelymitra spp.	Sun Orchid
Phormiaceae		
	Caesia parviflora	Pale Grass-lily
	Dianella longifolia	Pale Flax-lily
	Dianella longifolia var. *longifolia*	Pale Flax-lily
	Dianella revoluta s.l.	Black-anther Flax-lily
	Dianella revoluta s.s.	Black-anther Flax-lily
	Dianella spp.	Flax Lily
	Dianella tasmanica	Tasman Flax-lily
	Tricoryne elatior	Yellow Rush-lily
Poaceae		
*	*Agrostis capillaris* s.l.	Brown-top Bent
	Agrostis s.l. spp.	Bent/Blown Grass
*	*Agrostis stolonifera*	Creeping Bent
*	*Aira caryophyllea*	Silvery Hair-grass
*	*Aira cupaniana*	Quicksilver Grass
*	*Aira elegantissima*	Delicate Hair-grass
*	*Aira* spp.	Hair Grass
	Amphibromus archeri	Pointed Swamp Wallaby-grass
*	*Anthoxanthum odoratum*	Sweet Vernal-grass
	Austrodanthonia bipartita s.l.	Leafy Wallaby-grass
	Austrodanthonia caespitosa	Common Wallaby-grass
	Austrodanthonia geniculata	Kneed Wallaby-grass
	Austrodanthonia laevis	Smooth Wallaby-grass
	Austrodanthonia penicillata	Slender Wallaby-grass
	Austrodanthonia pilosa	Velvet Wallaby-grass
	Austrodanthonia racemosa var. *racemosa*	Stiped Wallaby-grass
	Austrodanthonia setacea	Bristly Wallaby-grass
	Austrodanthonia tenuior	Purplish Wallaby-grass
	Austrostipa mollis	Supple Spear-grass
	Austrostipa nodosa	Knotty Spear-grass
	Austrostipa pubinodis	Tall Spear-grass
	Austrostipa rudis	Veined Spear-grass
	Austrostipa rudis ssp. *nervosa*	Veined Spear-grass
	Austrostipa spp.	Spear Grass
*	*Avena fatua*	Wild Oat
*	*Avena sativa*	Oat

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*	*Briza maxima*	Large Quaking-grass
*	*Briza minor*	Lesser Quaking-grass
*	*Bromus catharticus*	Prairie Grass
*	*Bromus catharticus* var. *catharticus*	Prairie Grass
*	*Bromus diandrus*	Great Brome
*	*Bromus hordeaceus* ssp. *hordeaceus*	Soft Brome
*	*Cortaderia selloana*	Pampas Grass
*	*Critesion marinum*	Sea Barley-grass
	Cynodon dactylon	Couch
*	*Cynosurus cristatus*	Crested Dog's-tail
*	*Cynosurus echinatus*	Rough Dog's-tail
*	*Dactylis glomerata*	Cocksfoot
	Danthonia s.l. spp.	Wallaby Grass
	Deyeuxia quadriseta	Reed Bent-grass
	Deyeuxia spp.	Bent-grass
	Dichelachne crinita	Long-hair Plume-grass
	Dichelachne sciurea spp. agg.	Short-hair Plume-grass
	Dichelachne spp.	Plume Grass
	Distichlis distichophylla	Australian Salt-grass
	Echinopogon ovatus	Common Hedgehog-grass
*	*Ehrharta erecta* var. *erecta*	Panic Veldt-grass
	Elymus scaber var. *scaber*	Common Wheat-grass
	Eragrostis brownii	Common Love-grass
	Glyceria spp.	Sweet Grass
	Hemarthria uncinata var. *uncinata*	Mat Grass
*	*Holcus lanatus*	Yorkshire Fog
	Imperata cylindrica	Blady Grass
	Joycea pallida	Silvertop Wallaby-grass
	Lachnagrostis aemula s.l.	Leafy Blown-grass
	Lachnagrostis filiformis	Common Blown-grass
*	*Lolium perenne*	Perennial Rye-grass
	Microlaena stipoides var. *stipoides*	Weeping Grass
	Notodanthonia semiannularis	Wetland Wallaby-grass
*	*Paspalum dilatatum*	Paspalum
*	*Paspalum distichum*	Water Couch
*	*Phalaris aquatica*	Toowoomba Canary-grass
*	*Phalaris minor*	Lesser Canary-grass
	Phragmites australis	Common Reed
*	*Poa annua*	Annual Meadow-grass
	Poa australis spp. agg.	Tussock Grass
	Poa clelandii	Noah's Ark
	Poa ensiformis	Sword Tussock-grass
	Poa labillardierei	Common Tussock-grass
	Poa morrisii	Soft Tussock-grass
	Poa rodwayi	Velvet Tussock-grass
	Poa sieberiana	Grey Tussock-grass

	Poa spp.	Tussock Grass
	Poa tenera	Slender Tussock-grass
*	*Setaria viridis*	Green Pigeon-grass
	Tetrarrhena juncea	Forest Wire-grass
	Themeda triandra	Kangaroo Grass
*	*Vulpia bromoides*	Squirrel-tail Fescue
*	*Vulpia* spp.	Fescue
Typhaceae		
	Typha domingensis	Narrow-leaf Cumbungi
Xanthorrhoeaceae		
	Lomandra filiformis	Wattle Mat-rush
	Lomandra filiformis ssp. *coriacea*	Wattle Mat-rush
	Lomandra filiformis ssp. *filiformis*	Wattle Mat-rush
	Lomandra longifolia	Spiny-headed Mat-rush
	Lomandra longifolia ssp. *longifolia*	Spiny-headed Mat-rush
	Lomandra multiflora ssp. *multiflora*	Many-flowered Mat-rush
	Lomandra nana	Dwarf Mat-rush
	Xanthorrhoea minor ssp. *lutea*	Small Grass-tree
Dicotyledons		
Amaranthaceae		
	Alternanthera denticulata s.l.	Lesser Joyweed
Apiaceae		
	Centella cordifolia	Centella
*	*Daucus carota*	Carrot
*	*Foeniculum vulgare*	Fennel
	Hydrocotyle foveolata	Yellow Pennywort
	Hydrocotyle hirta	Hairy Pennywort
	Hydrocotyle laxiflora	Stinking Pennywort
	Hydrocotyle spp.	Pennywort
	Hydrocotyle verticillata	Shield Pennywort
	Xanthosia dissecta s.l.	Cut-leaf Xanthosia
Apocynaceae		
*	*Vinca major*	Blue Periwinkle
Araliaceae		
	Polyscias sambucifolia	Elderberry Panax
Asteraceae		
	Angianthus preissianus	Salt Angianthus
*	*Arctotheca calendula*	Cape Weed
*	*Aster subulatus*	Aster-weed
	Brachyscome cardiocarpa	Swamp Daisy
	Cassinia aculeata	Common Cassinia
	Cassinia spp.	Cassinia
*	*Centaurea nigra*	Black Knapweed
	Centipeda cunninghamii	Common Sneezeweed
*	*Chrysanthemoides monilifera*	Boneseed
	Chrysocephalum semipapposum	Clustered Everlasting

*	*Cirsium vulgare*	Spear Thistle
*	*Conyza bonariensis*	Flaxleaf Fleabane
*	*Conyza* spp.	Fleabane
*	*Cotula coronopifolia*	Water Buttons
	Craspedia spp.	Billy Buttons
*	*Crepis capillaris*	Smooth Hawksbeard
	Cymbonotus preissianus	Austral Bear's-ear
	Euchiton collinus s.s.	Creeping Cudweed
	Euchiton involucratus s.l.	Common Cudweed
	Euchiton involucratus s.s.	Star Cudweed
	Euchiton sphaericus	Annual Cudweed
*	*Gamochaeta purpurea* s.l.	Purple Cudweed
	Helichrysum scorpioides	Button Everlasting
*	*Hypochoeris glabra*	Smooth Cat's-ear
*	*Hypochoeris radicata*	Cat's Ear
	Lagenophora gracilis	Slender Bottle-daisy
	Lagenophora stipitata	Common Bottle-daisy
*	*Leontodon taraxacoides* ssp. *taraxacoides*	Hairy Hawkbit
	Leptorhynchos tenuifolius	Wiry Buttons
	Microseris spp.	Yam Daisy
	Olearia argophylla	Musk Daisy-bush
	Olearia lirata	Snowy Daisy-bush
	Olearia ramulosa	Twiggy Daisy-bush
	Ozothamnus ferrugineus	Tree Everlasting
	Ozothamnus obcordatus	Grey Everlasting
	Pseudognaphalium luteoalbum	Jersey Cudweed
	Senecio glomeratus	Annual Fireweed
	Senecio hispidulus	Rough Fireweed
	Senecio minimus	Shrubby Fireweed
	Senecio quadridentatus	Cotton Fireweed
	Senecio spp.	Groundsel
	Senecio tenuiflorus	Slender Fireweed
	Sigesbeckia orientalis ssp. *orientalis*	Indian Weed
*	*Sonchus asper* s.l.	Rough Sow-thistle
*	*Sonchus oleraceus*	Common Sow-thistle
	Sonchus spp.	Sow Thistle
*	*Taraxacum officinale* spp. agg.	Garden Dandelion
	Taraxacum spp.	Dandelion
Bignoniaceae		
	Pandorea pandorana	Wonga Vine
Boraginaceae		
	Cynoglossum suaveolens	Sweet Hound's-tongue
*	*Echium plantagineum*	Paterson's Curse
*	*Myosotis sylvatica*	Wood Forget-me-not
Brassicaceae		
*	*Raphanus raphanistrum*	Wild Radish

*	*Rapistrum rugosum*	Giant Mustard
*	*Rorippa palustris*	Marsh Yellow-cress
Brunoniaceae		
	Brunonia australis	Blue Pincushion
Callitrichaceae		
*	*Callitriche stagnalis*	Common Starwort
Campanulaceae		
	Lobelia anceps	Angled Lobelia
	Wahlenbergia communis s.l.	Tufted Bluebell
	Wahlenbergia gracilenta s.l.	Annual Bluebell
	Wahlenbergia gracilis s.l.	Sprawling Bluebell
	Wahlenbergia multicaulis	Branching Bluebell
	Wahlenbergia spp.	Bluebell
	Wahlenbergia stricta	Tall Bluebell
Caprifoliaceae		
*	*Lonicera japonica*	Japanese Honeysuckle
Caryophyllaceae		
*	*Cerastium glomeratum* s.l.	Common Mouse-ear Chickweed
*	*Silene gallica* var. *gallica*	French Catchfly
*	*Silene gallica* var. *quinquevulnera*	Spotted Catchfly
*	*Silene* spp.	Catchfly
	Stellaria flaccida	Forest Starwort
*	*Stellaria media*	Chickweed
	Stellaria spp.	Starwort
Casuarinaceae		
	Allocasuarina littoralis	Black Sheoak
	Allocasuarina spp.	Sheoak
Clusiaceae		
	Hypericum gramineum	Small St John's Wort
Convolvulaceae		
	Dichondra repens	Kidney-weed
Cunoniaceae		
	Bauera rubioides	Wiry Bauera
Dilleniaceae		
	Hibbertia riparia	Erect Guinea-flower
	Hibbertia spp.	Guinea Flower
Droseraceae		
	Drosera peltata	Pale Sundew
	Drosera peltata ssp. *auriculata*	Tall Sundew
	Drosera peltata ssp. *peltata*	Pale Sundew
	Drosera spp.	Sundew
	Drosera whittakeri ssp. *aberrans*	Scented Sundew
Epacridaceae		
	Acrotriche prostrata	Trailing Ground-berry
	Acrotriche serrulata	Honey-pots
	Epacris impressa	Common Heath

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Ericaceae			
	*	*Erica lusitanica*	Spanish Heath
Euphorbiaceae			
		Amperea xiphoclada var. *xiphoclada*	Broom Spurge
		Poranthera microphylla	Small Poranthera
Fabaceae			
		Bossiaea prostrata	Creeping Bossiaea
		Daviesia latifolia	Hop Bitter-pea
		Daviesia leptophylla	Narrow-leaf Bitter-pea
		Desmodium gunnii	Southern Tick-trefoil
	k	*Desmodium varians*	Slender Tick-trefoil
		Dillwynia cinerascens s.l.	Grey Parrot-pea
		Dillwynia glaberrima	Smooth Parrot-pea
		Dillwynia spp.	Parrot Pea
	*	*Genista linifolia*	Flax-leaf Broom
	*	*Genista monspessulana*	Montpellier Broom
		Glycine clandestina	Twining Glycine
		Glycine microphylla	Small-leaf Glycine
		Gompholobium huegelii	Common Wedge-pea
		Hardenbergia violacea	Purple Coral-pea
		Hovea heterophylla	Common Hovea
		Indigofera australis	Austral Indigo
		Kennedia prostrata	Running Postman
		Kennedia spp.	Coral Pea
	*	*Lotus corniculatus*	Bird's-foot Trefoil
	*	*Lotus suaveolens*	Hairy Bird's-foot Trefoil
	*	*Lotus uliginosus*	Greater Bird's-foot Trefoil
	*	*Medicago polymorpha*	Burr Medic
		Platylobium formosum	Handsome Flat-pea
		Platylobium obtusangulum	Common Flat-pea
		Pultenaea gunnii	Golden Bush-pea
		Pultenaea gunnii ssp. *gunnii*	Golden Bush-pea
		Pultenaea sericea	Chaffy Bush-pea
	*	*Trifolium dubium*	Suckling Clover
	*	*Trifolium repens* var. *repens*	White Clover
	*	*Trifolium* spp.	Clover
	*	*Trifolium subterraneum*	Subterranean Clover
	*	*Ulex europaeus*	Gorse
	*	*Vicia hirsuta*	Tiny Vetch
	*	*Vicia sativa*	Common Vetch
	*	*Vicia sativa* ssp. *nigra*	Narrow-leaf Vetch
	*	*Vicia tetrasperma*	Slender Vetch
		Viminaria juncea	Golden Spray
Fumariaceae			
	*	*Fumaria muralis* ssp. *muralis*	Wall Fumitory
Gentianaceae			

*	*Centaurium erythraea*	Common Centaury
*	*Centaurium tenuiflorum*	Slender Centaury
	Sebaea ovata	Yellow Sebaea
Geraniaceae		
*	*Geranium dissectum*	Cut-leaf Cranesbill
*	*Geranium molle* var. *molle*	Dovesfoot
	Geranium potentilloides	Cinquefoil Cranesbill
	Geranium solanderi s.l.	Austral Cranesbill
	Geranium spp.	Crane's Bill
Goodeniaceae		
	Goodenia humilis	Swamp Goodenia
	Goodenia lanata	Trailing Goodenia
	Goodenia ovata	Hop Goodenia
Haloragaceae		
	Gonocarpus humilis	Shade Raspwort
	Gonocarpus spp.	Raspwort
	Gonocarpus tetragynus	Common Raspwort
Lamiaceae		
	Prostanthera lasianthos	Victorian Christmas-bush
	Prostanthera lasianthos var. *lasianthos*	Victorian Christmas-bush
*	*Prunella vulgaris*	Self-heal
Lauraceae		
	Cassytha pubescens s.s.	Downy Dodder-laurel
Linaceae		
*	*Linum trigynum*	French Flax
Loranthaceae		
	Amyema miquelii	Box Mistletoe
	Amyema pendula	Drooping Mistletoe
	Muellerina eucalyptoides	Creeping Mistletoe
Lythraceae		
	Lythrum hyssopifolia	Small Loosestrife
Malvaceae		
*	*Malva parviflora*	Small-flower Mallow
*	*Modiola caroliniana*	Red-flower Mallow
Menyanthaceae		
	Villarsia reniformis	Running Marsh-flower
Mimosaceae		
*	*Acacia baileyana*	Cootamundra Wattle
	Acacia dealbata	Silver Wattle
	Acacia genistifolia	Spreading Wattle
	Acacia leprosa	Cinnamon Wattle
#	*Acacia longifolia* s.l.	Coast/Sallow Wattle
#	*Acacia longifolia* ssp. *longifolia*	Sallow Wattle
#	*Acacia longifolia* ssp. *sophorae*	Coast Wattle
	Acacia mearnsii	Black Wattle
	Acacia melanoxylon	Blackwood

	Acacia mucronata ssp. *longifolia*	Narrow-leaf Wattle
	Acacia myrtifolia	Myrtle Wattle
	Acacia paradoxa	Hedge Wattle
	Acacia pycnantha	Golden Wattle
	Acacia spp.	Wattle
	Acacia stricta	Hop Wattle
	Acacia ulicifolia	Juniper Wattle
	Acacia verniciflua	Varnish Wattle
	Acacia verticillata	Prickly Moses
Myrsinaceae		
	Rapanea howittiana	Mutton-wood
Myrtaceae		
	Eucalyptus baxteri s.l.	Brown Stringybark
	Eucalyptus cephalocarpa s.l.	Silver-leaf Stringybark
	Eucalyptus cephalocarpa s.s.	Mealy Stringybark
	Eucalyptus cypellocarpa	Mountain Grey-gum
	Eucalyptus dives	Broad-leaved Peppermint
r	*Eucalyptus fulgens*	Green Scentbark
	Eucalyptus goniocalyx s.l.	Bundy
	Eucalyptus goniocalyx s.s.	Bundy
	Eucalyptus obliqua	Messmate Stringybark
	Eucalyptus ovata	Swamp Gum
	Eucalyptus radiata s.l.	Narrow-leaf Peppermint
	Eucalyptus radiata ssp. *radiata*	Narrow-leaf Peppermint
	Eucalyptus rubida	Candlebark
	Eucalyptus sieberi	Silvertop Ash
	Eucalyptus spp.	Eucalypt
	Eucalyptus viminalis	Manna Gum
	Kunzea ericoides	Burgan
	Leptospermum continentale	Prickly Tea-tree
	Leptospermum scoparium	Manuka
	Leptospermum spp.	Tea Tree
	Melaleuca ericifolia	Swamp Paperbark
	Melaleuca spp.	Honey-myrtle
Oleaceae		
*	*Fraxinus angustifolia*	Desert Ash
*	*Ligustrum* spp.	Privet
Onagraceae		
	Epilobium billardierianum	Variable Willow-herb
	Epilobium billardierianum ssp. *cinereum*	Grey Willow-herb
*	*Epilobium ciliatum*	Glandular Willow-herb
	Epilobium hirtigerum	Hairy Willow-herb
Oxalidaceae		
	Oxalis corniculata s.l.	Yellow Wood-sorrel
	Oxalis exilis	Shady Wood-sorrel
	Oxalis perennans	Grassland Wood-sorrel

*	*Oxalis pes-caprae*	Soursob
Pittosporaceae		
	Billardiera scandens	Common Apple-berry
	Billardiera scandens var. *scandens*	Common Apple-berry
	Bursaria spinosa ssp. *spinosa*	Sweet Bursaria
#	*Pittosporum undulatum*	Sweet Pittosporum
Plantaginaceae		
*	*Plantago lanceolata*	Ribwort
*	*Plantago major*	Greater Plantain
	Plantago varia	Variable Plantain
Polygalaceae		
	Comesperma volubile	Love Creeper
Polygonaceae		
*	*Acetosella vulgaris*	Sheep Sorrel
*	*Fallopia convolvulus*	Black Bindweed
	Persicaria decipiens	Slender Knotweed
*	*Persicaria maculosa*	Redshank
	Persicaria praetermissa	Spotted Knotweed
	Persicaria prostrata	Creeping Knotweed
	Rumex brownii	Slender Dock
*	*Rumex conglomeratus*	Clustered Dock
*	*Rumex crispus*	Curled Dock
*	*Rumex obtusifolius* ssp. *obtusifolius*	Broad-leaf Dock
Primulaceae		
*	*Anagallis arvensis*	Pimpernel
Proteaceae		
	Banksia marginata	Silver Banksia
	Hakea sericea s.l.	Bushy Needlewood
	Hakea ulicina	Furze Hakea
	Lomatia ilicifolia	Holly Lomatia
Ranunculaceae		
	Clematis aristata	Mountain Clematis
	Ranunculus glabrifolius	Shining Buttercup
	Ranunculus lappaceus	Australian Buttercup
	Ranunculus plebeius s.l.	Forest/Hairy Buttercup
*	*Ranunculus repens*	Creeping Buttercup
	Ranunculus spp.	Buttercup
Rhamnaceae		
	Pomaderris aspera	Hazel Pomaderris
	Pomaderris racemosa	Cluster Pomaderris
	Spyridium parvifolium	Dusty Miller
Rosaceae		
	Acaena agnipila	Hairy Sheep's Burr
	Acaena novae-zelandiae	Bidgee-widgee
	Acaena spp.	Sheep's Burr
*	*Cotoneaster franchetii*	Grey Cotoneaster

*	*Cotoneaster pannosus*	Velvet Cotoneaster
*	*Crataegus monogyna*	Hawthorn
*	*Malus pumila*	Apple
*	*Prunus cerasifera*	Cherry Plum
*	*Prunus* spp.	Prunus
*	*Pyracantha crenulata*	Nepal Firethorn
*	*Rosa rubiginosa*	Sweet Briar
*	*Rubus fruticosus* spp. agg.	Blackberry
*	*Rubus laciniatus*	Cut-leaf Bramble
	Rubus parvifolius	Small-leaf Bramble
*	*Rubus* sp. aff. *armeniacus*	Blackberry
	Rubus spp.	Bramble
*	*Rubus ulmifolius*	Blackberry
Rubiaceae		
	Asperula conferta	Common Woodruff
	Asperula scoparia	Prickly Woodruff
	Asperula spp.	Woodruff
	Coprosma hirtella	Rough Coprosma
	Coprosma quadrifida	Prickly Currant-bush
*	*Coprosma repens*	Mirror Bush
*	*Galium aparine*	Cleavers
	Galium binifolium	Reflexed Bedstraw
r	*Galium curvihirtum*	Tight Bedstraw
	Galium gaudichaudii	Rough Bedstraw
	Galium migrans	Wandering Bedstraw
	Galium propinquum	Maori Bedstraw
	Galium spp.	Bedstraw
	Opercularia varia	Variable Stinkweed
Rutaceae		
	Correa reflexa	Common Correa
Salicaceae		
*	*Populus* spp.	Poplar
*	*Salix* spp.	Willow
Santalaceae		
	Exocarpos cupressiformis	Cherry Ballart
	Exocarpos strictus	Pale-fruit Ballart
Scrophulariaceae		
	Gratiola peruviana	Austral Brooklime
	Gratiola pubescens	Glandular Brooklime
*	*Parentucellia viscosa*	Yellow Bartsia
	Veronica calycina	Hairy Speedwell
	Veronica plebeia	Trailing Speedwell
Solanaceae		
*	*Solanum nigrum* sensu Willis (1972)	Black Nightshade
*	*Solanum pseudocapsicum*	Madeira Winter-cherry
	Solanum spp.	Nightshade

APPENDICES

Stackhousiaceae		
	Stackhousia monogyna	Creamy Stackhousia
Stylidiaceae		
	Stylidium graminifolium s.l.	Grass Trigger-plant
	Stylidium spp.	Trigger Plant
Thymelaeaceae		
	Pimelea humilis	Common Rice-flower
	Pimelea linifolia	Slender Rice-flower
Tremandraceae		
	Tetratheca ciliata	Pink-bells
r	*Tetratheca stenocarpa*	Long Pink-bells
Urticaceae		
*	*Urtica urens*	Small Nettle
Violaceae		
	Viola cleistogamoides	Hidden Violet
	Viola hederacea sensu Entwisle (1996)	Ivy-leaf Violet
	Viola hederacea sensu Willis (1972)	Ivy-leaf Violet

APPENDICES

Appendix 3 Criteria for determining botanical significance

Definition of significance

Significance in the biological context has a similar meaning as in general use, *significant* being defined as noteworthy or of considerable importance (Oxford Dictionary). Sites of botanical significance are areas where features of the vegetation meet defined botanical criteria. These assessments are independent of land-use classifications (e.g. biological reserves) or land ownership (e.g. public or private), instead being an assessment of the qualities of the remnant indigenous vegetation in the context of its current distribution, conservation status and integrity.

Significance has two components - scale and degree. The assessment of *degree* of significance (e.g. high or moderate) is based on the values of the site in relation to the overall distribution, condition or importance of sites possessing these values - within the range delineated by the *scale* of reference, i.e. national, state, regional or local. In general usage, scale and degree are combined into levels of significance denoted by scale alone. In the context of the present study the following areas apply to the scale of significance:

Local Shire of Cardinia
Regional: Gippsland Plain bioregion
State: Victoria
National: Australia

It should be noted that all remnant indigenous vegetation and populations of indigenous plant species in the study area have at least local conservation significance given the massive depletion and poor conservation status of vegetation in the region.

Indigenous plant species

The assessment of significance of plant species recorded from the site during this study is based on the application of one or more of the following criteria:

- Naturally uncommon or rare in Australia, Victoria, the region or the municipality;
- Formerly widespread in Australia, Victoria, the region or the municipality but now depleted through habitat destruction or degradation;
- Remnant population(s) with important information content on floristics of the regional or local vegetation;
- Species which are taxonomically or biogeographically interesting, e.g. geographic forms of more widespread species, disjunct populations;
- Species which may play a keystone role in particular environments or display unusual characteristics.

Species are of National Significance if they are either rare, threatened or endangered on an Australia-wide basis. Many of these taxa are listed as Rare or Threatened Australian Plant Species (ROTAPS) by Briggs and Leigh (1995), ANZECC (1999), DNRE (2000), or listed under the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*); these listings are periodically updated on the basis of new data.

Species which are rare, threatened or endangered in Victoria are listed on the *Flora and Fauna Guarantee Act* 1988 and/or DNRE (2000), although additional species may be similarly categorised as further information comes to hand. All such species are considered to be of at least State significance.
Species are considered to be Regionally significant if they occur in 5 percent or fewer of the quadrats (vegetation sampling units) currently sampled in the region (Gippsland Plain bioregion).

APPENDICES

Appendix 4 Fauna species list for the study area

Key:
ce Listed as Critically Endangered in Victoria in *Advisory List of Threatened Vertebrate Fauna in Victoria -2003* (DSE 2003c).
DSE *Advisory List of Threatened Vertebrate Fauna in Victoria -2003* (DSE 2003c).
EPBC Federal *Environment Protection and Biodiversity Conservation* (*EPBC*) *Act* 1999.
E Listed as Nationally Endangered in Australia on the *EPBCAct* 1999.
e Listed as Endangered in Victoria on DSE (2003c).
FFG State *Flora and Fauna Guarantee Act* 1988
FOK Data from Friends of Kennedy Creek (2002).
J&PS Data from J. and P. Szalman, Cardinia Catchment Landcare Group.
L Listed on Victoria's *Flora and Fauna Guarantee* (*FFG*) *Act* 1988.
pc Record obtained via personal communication with landholders.
nt Listed as Near Threatened in Victoria on DSE (2003c).
Ma Listed as a marine species under the *EPBC* Act 1999.
Mi Listed as a migratory species under the *EPBC* Act 1999 due inclusion on the Japan Australia Migratory Bird Agreement (JAMBA) and/or the China Australia Migratory Bird Agreement (CAMBA).
N Nominated for listing on the *FFG Act* 1988.
n New record.
X Observed during this study (Obs).
CCS New record occurring at the Cardinia Creek Flora and Fauna Sanctuary (unpublished data.).
sp. Species.
V Listed as Vulnerable in Australia on the *EPBC Act* 1999.
v Listed as Vulnerable in Victoria on DSE (2003c).

Classification	Common Name	Scientific Name	EPBC	FFG	DSE	Obs
Mammals						
Acrobatidae - Feathertail Gliders						
	Feathertail Glider	*Acrobates pygmaeus*				
Burramyidae - Pygmy Possums						
	Eastern Pygmy-possum	*Cercartetus nanus*				
Canidae - Dogs/Foxes						
	Dingo/Dog (feral)	*Canis familiaris*				
	Red Fox*	*Canis vulpes*				X
Dasyuridae - Dasyurids						
	Agile Antechinus	*Antechinus agilis*				
	Dusky Antechinus	*Antechinus swainsonii*				
Felidae - Cats						
	Cat (feral)*	*Felis catus*				
Leporidae - Rabbits/Hares						
	Brown Hare*	*Lepus capensis*				

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Classification	Common Name	Scientific Name	EPBC	FFG	DSE	Obs
	European Rabbit*	*Oryctolagus cuniculus*				X
Macropodidae - Kangaroos/Wallabies						
	Black Wallaby	*Wallabia bicolor*				X
	Eastern Grey Kangaroo	*Macropus giganteus*				X
Molossidae - Freetail-bats						
	White-striped Freetail Bat	*Tadarida australis*				
Muridae - Rats/Mice						
	Black Rat*	*Rattus rattus*				
	Broad-toothed Rat	*Mastacomys fuscus*			nt	
	Bush Rat	*Rattus fuscipes*				
	House Mouse*	*Mus musculus*				
	Swamp Rat	*Rattus lutreolus*				
Petauridae - Possums/Gliders						
	Sugar Glider	*Petaurus breviceps*				pc, X
Phalangeridae - Brushtail Possums						
	Common Brushtail Possum	*Trichosurus vulpecula*				
Phascolarctidae - Koala						
	Koala	*Phascolarctos cinereus*				X
Pseudocheiridae - Ringtail Possums						
	Common Ringtail Possum	*Pseudocheirus peregrinus*				X
	Greater Glider	*Petauroides volans*				pc, X
Pteropodidae - Flying Foxes						
	Grey-headed Flying-fox	*Pteropus poliocephalus*	V	L	v	
Tachyglossidae - Echidnas						
	Short-beaked Echidna	*Tachyglossus aculeatus*				X
Vespertilionidae - Small Bats						
	Chocolate Wattled Bat	*Chalinolobus morio*				
	Gould's Wattled Bat	*Chalinolobus gouldii*				
	Large Forest Bat	*Vespadelus darlingtoni*				

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Classification	Common Name	Scientific Name	EPBC	FFG	DSE	Obs
	Lesser Long-eared Bat	*Nyctophilus geoffroyi*				
	Little Forest Bat	*Vespadelus vulturnus*				
	Southern Forest Bat	*Vespadelus regulus*				
Vombatidae - Wombats						
	Common Wombat	*Vombatus ursinus*				X
Birds						
Accipitridae - Eagles/Hawks/Kites						
	Black-shouldered Kite	*Elanus axillaris*	Mi			X
	Brown Goshawk	*Accipiter fasciatus*	Ma, Mi			CCS, X
	Collared Sparrowhawk	*Accipiter cirrhocephalus*	Mi			
	Swamp Harrier	*Circus approximans*	Ma, Mi			
	Wedge-tailed Eagle	*Aquila audax*	Mi			J&PS, X
	Whistling Kite	*Haliastur sphenurus*	Ma, Mi			
	White-bellied Sea-Eagle	*Haliaeetus leucogaster*	Ma, Mi	L	v	
Aegothelidae - Owlet-nightjars						
	Australian Owlet-nightjar	*Aegotheles cristatus*				
Alaudidae - Larks						
	Skylark*	*Alauda arvensis*				
Alcedinidae - Kingfishers						
	Azure Kingfisher	*Alcedo azurea*			nt	
Anatidae - Ducks/Swans						
	Australasian Shoveler	*Anas rhynchotis*	Mi		v	
	Australian Shelduck	*Tadorna tadornoides*	Mi			CCS, X
	Australian Wood Duck	*Chenonetta jubata*	Mi			X
	Black Swan	*Cygnus atratus*	Mi			
	Blue-billed Duck	*Oxyura australis*	Mi	L	e	
	Chestnut Teal	*Anas castanea*	Mi			X
	Grey Teal	*Anas gracilis*	Mi			CCS, X
	Hardhead	*Aythya australis*	Mi		v	X
	Mallard*	*Anas platyrhynchos*	Mi			
	Musk Duck	*Biziura lobata*	Ma, Mi		v	

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Classification	Common Name	Scientific Name	EPBC	FFG	DSE	Obs
	Pacific Black Duck	*Anas superciliosa*	Mi			X
	Pink-eared Duck	*Malacorhynchus membranaceus*	Mi			
Anhingidae - Darters						
	Darter	*Anhinga melanogaster*				
Apodidae - Swifts						
	White-throated Needletail	*Hirundapus caudacutus*	Ma, Mi			
Ardeidae - Herons/Egrets/Bitterns						
	Cattle Egret	*Ardea ibis*	Ma, Mi			X
	Great Egret	*Ardea alba*	Ma, Mi	L	v	
	Intermediate Egret	*Ardea intermedia*	Ma	L	ce	
	Nankeen Night Heron	*Nycticorax caledonicus*	Ma		nt	X
	White-faced Heron	*Egretta novaehollandiae*				X
	White-necked Heron	*Ardea pacifica*				
Artamidae - Woodswallows/Magpies						
	Australian Magpie	*Gymnorhina tibicen*				X
	Dusky Woodswallow	*Artamus cyanopterus*				CCS, X
	Grey Butcherbird	*Cracticus torquatus*				X
	Grey Currawong	*Strepera versicolor*				J&PS, X
	Pied Currawong	*Strepera graculina*				X
	White-browed Woodswallow	*Artamus superciliosus*				
Cacatuidae - Cockatoos						
	Galah	*Cacatua roseicapilla*				X
	Gang-gang Cockatoo	*Callocephalon fimbriatum*				X
	Little Corella	*Cacatua sanguinea*				X
	Long-billed Corella	*Cacatua tenuirostris*				X
	Sulphur-crested Cockatoo	*Cacatua galerita*				X
	Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*				CCS, X
Campephagidae -						

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Classification	Common Name	Scientific Name	EPBC	FFG	DSE	Obs
Cuckoo-shrikes						
	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	Ma			X
Charadriidae - Plovers/Dottere						
	Black-fronted Dotterel	*Elseyornis melanops*				
	Masked Lapwing	*Vanellus miles*				X
Cinclosomatidae - Whipbirds/Quails						
	Eastern Whipbird	*Psophodes olivaceus*				X
	Spotted Quail-thrush	*Cinclosoma punctatum*			nt	
Climacteridae - Tree-creepers						
	Brown Treecreeper	*Climacteris picumnus*			nt	
	Red-browed Treecreeper	*Climacteris erythrops*				
	White-throated Treecreeper	*Cormobates leucophaeus*				X
Columbidae - Pigeons/Doves						
	Brush Bronzewing	*Phaps elegans*				CCS, X
	Common Bronzewing	*Phaps chalcoptera*				X
	Rock Dove*	*Columba livia*				
	Spotted Turtle-Dove*	*Streptopelia chinensis*				X
Corvidae - Ravens/Crows						
	Australian Raven	*Corvus coronoides*				X
	Corvid	*Corvus sp.*				X
	Little Raven	*Corvus mellori*	Ma			X
Cuculidae - Cuckoos						
	Brush Cuckoo	*Cacomantis variolosus*				FOK, X
	Fan-tailed Cuckoo	*Cacomantis flabelliformis*	Ma			X
	Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*	Ma			CCS, X
	Pallid Cuckoo	*Cuculus pallidus*	Ma			X
	Shining Bronze-Cuckoo	*Chrysococcyx lucidus*	Ma			CCS, X
Dicaeidae - Flowerpeckers						
	Mistletoebird	*Dicaeum hirundinaceum*				CCS, X

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Classification	Common Name	Scientific Name	EPBC	FFG	DSE	Obs
Dicruridae - Flycatchers/Fantails						
	Grey Fantail	*Rhipidura fuliginosa*				X
	Leaden Flycatcher	*Myiagra rubecula*				
	Magpie-lark	*Grallina cyanoleuca*	Ma			X
	Restless Flycatcher	*Myiagra inquieta*				
	Rufous Fantail	*Rhipidura rufifrons*	Ma			CCS, X
	Satin Flycatcher	*Myiagra cyanoleuca*	Ma			CCS, X
	Willie Wagtail	*Rhipidura leucophrys*				X
Falconidae - Falcons						
	Australian Hobby	*Falco longipennis*	Mi			
	Brown Falcon	*Falco berigora*	Mi			X
	Nankeen Kestrel	*Falco cenchroides*	Ma, Mi			
	Peregrine Falcon	*Falco peregrinus*	Mi			
Fringillidae - Finches						
	European Goldfinch*	*Carduelis carduelis*				X
	European Greenfinch*	*Carduelis chloris*				CCS, X
Halcyonidae - Inland Kingfishers						
	Laughing Kookaburra	*Dacelo novaeguineae*				X
	Sacred Kingfisher	*Todiramphus sanctus*	Ma			CCS, X
Hirundinidae - Swallows/Martin						
	Welcome Swallow	*Hirundo neoxena*	Ma			
	Tree Martin	*Hirundo nigricans*	Ma			n, X
Laridae - Gulls/Terns						
	Silver Gull	*Larus novaehollandiae*	Ma			CCS, X
Maluridae - Fairy-wrens						
	Southern Emu-wren	*Stipiturus malachurus*				
	Superb Fairy-wren	*Malurus cyaneus*				X
Meliphagidae - Honeyeaters/Chats						
	Bell Miner	*Manorina*				X

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Classification	Common Name	Scientific Name	EPBC	FFG	DSE	Obs
		melanophrys				
	Brown-headed Honeyeater	*Melithreptus brevirostris*				X
	Crescent Honeyeater	*Phylidonyris pyrrhoptera*				X
	Eastern Spinebill	*Acanthorhynchus tenuirostris*				X
	Helmeted Honeyeater	*Lichenostomus melanops cassidix*	E	L	ce	
	Lewin's Honeyeater	*Meliphaga lewinii*				
	Little Wattlebird	*Anthochaera chrysoptera*				X
	New Holland Honeyeater	*Phylidonyris novaehollandiae*				X
	Noisy Miner	*Manorina melanocephala*				X
	Red Wattlebird	*Anthochaera carunculata*				X
	White-eared Honeyeater	*Lichenostomus leucotis*				X
	White-fronted Chat	*Epthianura albifrons*				
	White-naped Honeyeater	*Melithreptus lunatus*				X
	White-plumed Honeyeater	*Lichenostomus penicillatus*				CCS, X
	Yellow-faced Honeyeater	*Lichenostomus chrysops*				X
	Yellow-tufted Honeyeater	*Lichenostomus melanops*				
Motacillidae - Wagtails/Pipits						
	Richard's Pipit	*Anthus novaeseelandiae*	Ma			
Muscicapidae - Thrushes						
	Bassian Thrush	*Zoothera lunulata*				
	Common Blackbird*	*Turdus merula*				X
	Song Thrush*	*Turdus philomelos*				X
Neosittidae - Sittellas						
	Varied Sittella	*Daphoenositta chrysoptera*				X
Oriolidae - Orioles						
	Olive-backed Oriole	*Oriolus sagittatus*				CCS, X
Pachycephalidae - Whistlers						
	Crested Shrike-tit	*Falcunculus frontatus*				CCS, X

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Classification	Common Name	Scientific Name	EPBC	FFG	DSE	Obs
	Golden Whistler	*Pachycephala pectoralis*				X
	Grey Shrike-thrush	*Colluricincla harmonica*				X
	Olive Whistler	*Pachycephala olivacea*				CCS, X
	Rufous Whistler	*Pachycephala rufiventris*				X
Pardalotidae - Pardalotes/Thornbills						
	Brown Thornbill	*Acanthiza pusilla*				X
	Buff-rumped Thornbill	*Acanthiza reguloides*				X
	Large-billed Scrubwren	*Sericornis magnirostris*				
	Spotted Pardalote	*Pardalotus punctatus*				X
	Striated Pardalote	*Pardalotus striatus*				X
	Striated Thornbill	*Acanthiza lineata*				X
	Weebill	*Smicrornis brevirostris*				
	White-browed Scrubwren	*Sericornis frontalis*				X
	Yellow Thornbill	*Acanthiza nana*				CCS, X
	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*				CCS, X
Passeridae - Sparrows/Grass-finches						
	Eurasian Tree Sparrow*	*Passer montanus*				
	House Sparrow*	*Passer domesticus*				X
	Red-browed Finch	*Neochmia temporalis*				X
	Zebra Finch	*Taeniopygia guttata*				
Pelecanidae - Pelicans						
	Australian Pelican	*Pelecanus conspicillatus*	Ma			
Petroicidae - Robins						
	Eastern Yellow Robin	*Eopsaltria australis*				X
	Flame Robin	*Petroica phoenicea*	Ma			
	Jacky Winter	*Microeca fascinans*				FOK, X
	Red-capped Robin	*Petroica goodenovii*				
	Rose Robin	*Petroica rosea*				CCS, X

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Classification	Common Name	Scientific Name	EPBC	FFG	DSE	Obs
	Scarlet Robin	*Petroica multicolor*				CCS, X
Phalacrocoracidae - Cormorants						
	Great Cormorant	*Phalacrocorax carbo*				
	Little Black Cormorant	*Phalacrocorax sulcirostris*				
	Little Pied Cormorant	*Phalacrocorax melanoleucos*				X
	Pied Cormorant	*Phalacrocorax varius*			nt	
Phasianidae - Pheasants/Quails						
	Stubble Quail	*Coturnix pectoralis*	Ma			
Podargidae - Frogmouths						
	Tawny Frogmouth	*Podargus strigoides*				X
Podicipedidae - Grebes						
	Australasian Grebe	*Tachybaptus novaehollandiae*				X
	Hoary-headed Grebe	*Poliocephalus poliocephalus*				CCS, X
Psittacidae - Parrots/Lorikeets						
	Australian King-Parrot	*Alisterus scapularis*				CCS, X
	Crimson Rosella	*Platycercus elegans*				X
	Eastern Rosella	*Platycercus eximius*				X
	Little Lorikeet	*Glossopsitta pusilla*				CCS, X
	Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*				
	Rainbow Lorikeet	*Trichoglossus haematodus*				X
	Scaly-breasted Lorikeet	*Trichoglossus chlorolepidotus*				
	Musk lorikeet	*Glossopsitta concinna*				n, X
	Superb Parrot	*Polytelis swainsonii*	V	L	e	
	Swift Parrot	*Lathamus discolor*	E, Ma	L	e	
Ptilonorhynchidae - Bower Bird						
	Satin Bowerbird	*Ptilonorhynchus violaceus*				
Rallidae - Rails/Crakes/Swamphens						
	Buff-banded Rail	*Gallirallus philippensis*	Ma			
	Dusky Moorhen	*Gallinula tenebrosa*				X

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Classification	Common Name	Scientific Name	EPBC	FFG	DSE	Obs
	Eurasian Coot	*Fulica atra*				X
	Purple Swamphen	*Porphyrio porphyrio*	Ma			X
	Spotless Crake	*Porzana tabuensis*	Ma			
Scolopacidae - Curlews/Sandpipers						
	Latham's Snipe	*Gallinago hardwickii*	Ma, Mi		nt	
Strigidae - Hawk Owls						
	Barking Owl	*Ninox connivens*		L	e	
	Powerful Owl	*Ninox strenua*		L	v	
	Southern Boobook	*Ninox novaeseelandiae*	Ma			
Sturnidae - Starlings/Mynas						
	Common Myna*	*Acridotheres tristis*				X
	Common Starling*	*Sturnus vulgaris*				X
Sylviidae - Warblers						
	Brown Songlark	*Cincloramphus cruralis*	Mi			
	Clamorous Reed Warbler	*Acrocephalus stentoreus*	Ma, Mi			CCS, X
	Golden-headed Cisticola	*Cisticola exilis*	Mi			
	Little Grassbird	*Megalurus gramineus*	Mi			
Threskiornithidae - Ibis/Spoonbills						
	Australian White Ibis	*Threskiornis molucca*	Ma			X
	Royal Spoonbill	*Platalea regia*			v	CCS, X
	Straw-necked Ibis	*Threskiornis spinicollis*	Ma			X
	Yellow-billed Spoonbill	*Platalea flavipes*				CCS, X
Turnicidae - Button Quails						
	Painted Button-quail	*Turnix varia*				CCS, X
Tytonidae - Barn Owls						
	Barn Owl	*Tyto alba*				
	Sooty Owl	*Tyto tenebricosa*		L	v	
Zosteropidae - Silvereyes						
	Silvereye	*Zosterops lateralis*	Ma			X
Reptiles						
Agamidae - Dragons						
	Tree Dragon	*Amphibolurus muricatus*				

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Classification	Common Name	Scientific Name	EPBC	FFG	DSE	Obs
Elapidae - Elapid Snakes						
	Eastern Small-eyed Snake	*Rhinoplocephalus nigrescens*				
	Lowland Copperhead	*Austrelaps superbus*				
	Tiger Snake	*Notechis scutatus*				
	White-lipped Snake	*Drysdalia coronoides*				
	unidentified copperhead	*Austrelaps sp.*				
Scincidae - Skinks						
	Black Rock Skink	*Egernia saxatilis intermedia*				
	Blotched Blue-tongued Lizard	*Tiliqua nigrolutea*				
	Delicate Skink	*Lampropholis delicata*				
	Eastern Three-lined Skink	*Bassiana duperreyi*				
	Garden Skink	*Lampropholis guichenoti*				
	McCoy's Skink	*Nannoscincus maccoyi*				
	Metallic Skink	*Niveoscincus metallicus*				
	Southern Water Skink	*Eulamprus tympanum tympanum*				
	Weasel Skink	*Saproscincus mustelinus*				
	unidentified grass skink	*Pseudemoia sp.*				
	unidentified scincid	*Scincidae sp.*				
	unidentified water skink	*Eulamprus sp.*				
Frogs						
Hylidae - Tree Frogs						
	Growling Grass Frog	*Litoria raniformis*	V	L	e	
	Southern Brown Tree Frog	*Litoria ewingii*				X
	Southern Brown Tree Frog SOUTHERN	*Litoria ewingii SOUTHERN*				
	Verreaux's Tree Frog	*Litoria verreauxii*				
	Whistling Tree Frog	*Litoria verreauxii verreauxii*				
Myobatrachidae -						

APPENDICES

Classification	Common Name	Scientific Name	EPBC	FFG	DSE	Obs
Southern Frogs						
	Common Froglet	*Crinia signifera*				X
	Southern Bullfrog	*Limnodynastes dumerilii*				X
	Southern Toadlet	*Pseudophryne semimarmorata*			v	
	Spotted Marsh Frog	*Limnodynastes tasmaniensis*				X
	Striped Marsh Frog	*Limnodynastes peronii*				X
	Victorian Smooth Froglet	*Geocrinia victoriana*				CCS, X
Fish						
Bovichthyidae - Tupong/Congoll						
	Tupong	*Pseudaphritis urvillii*				
Cyprinidae - Carp/Tench/Roach						
	Goldfish*	*Carassius auratus*				
Gadopsidae - River Blackfish						
	River Blackfish	*Gadopsis marmoratus*			i	
Galaxiidae - Galaxiids						
	Broadfin Galaxias	*Galaxias brevipinnis*				
	Common Galaxias	*Galaxias maculatus*				
	Dwarf Galaxias	*Galaxiella pusilla*	V	L	v	
	Spotted Galaxias	*Galaxias truttaceus*				
Kuhliidae - Pygmy Perches						
	Southern Pigmy Perch	*Nannoperca australis*				
Petromyzontidae - Lampreys						
	Short-headed Lamprey	*Mordacia mordax*				
Poecilidae - Live-bearers						
	Mosquitofish*	*Gambusia holbrooki*				
Prototroctidae - Grayling						
	Australian Grayling	*Prototroctes maraena*	V	L	v	
Salmonidae - Salmon/Trout						
	Brown Trout*	*Salmo trutta*				
	Rainbow Trout*	*Oncorhynchus mykiss*				
Undetermined						

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Classification	Common Name	Scientific Name	EPBC	FFG	DSE	Obs
	Shortfin Eel	*Anguilla australis*				
Invertebrates						
Undetermined Invertebrate						
	Common Freshwater Shrimp	*Paratya australiensis*				

APPENDIX

Appendix 5 Criteria for determining zoological significance.

Criteria for assessing zoological significance of taxa:

Local	All indigenous fauna is considered significant at a Local level, because of the overall decline in the fauna since European settlement, and the continued incremental loss of habitat and reduction in abundance due to development.
Regional	A taxon is considered significant at a Regional level if: • it has a disjunct distribution in the bioregion; or • it is represented in high concentrations in terms of colonial nesting, roosting or feeding sites; or • it is substantially depleted or restricted in the bioregion; or • it has an unusual ecological or biogeographical occurrence, • if the study area is within the Melbourne metropolitan area, the above four points pertain to the region of 'Greater Melbourne' as described by Beardsell (1997).
State	A taxon is considered significant at a State level if it is: • listed under Schedule 2 of the Victorian *Flora and Fauna Guarantee Act 1988*; or • listed under the *Advisory List of Threatened Vertebrate Fauna in Victoria – 2003* (DSE 2003); or • Listed as Data Deficient or Insufficiently Known under the following Australian Action Plans: Bannister *et al*. (1996), Cogger *et al.* (1993), Duncan *et al.* (1999), Garnett and Crowley (2000), Lee (1995), Maxwell *et al.* (1996), Pogonoski *et al.* (2002), Tyler (1997), Wager and Jackson (1993), or Sands and New (2003).
National	A taxon is considered significant at a National level if it is: • listed as Critically Endangered, Endangered, Vulnerable, Conservation Dependant or Presumed Extinct on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*; or • listed as Extinct, Extinct in the Wild, Critically Endangered, Endangered, Vulnerable Rare or Lower Risk (near threatened or conservation dependent) under the following Australian Action Plans: Bannister *et al*. (1996), Cogger *et al.* (1993), Duncan *et al.* (1999), Garnett and Crowley (2000), Lee (1995), Maxwell *et al.* (1996), Pogonoski *et al.* (2002), Tyler (1997), Wager and Jackson (1993), or Sands and New (2003).

APPENDIX

Guidelines for determining significant sites for fauna:

Local	All sites are generally considered at least Locally significant if they contain indigenous and/or exotic vegetation which supports indigenous fauna. A site is also designated as being of Local significance if: • *it has moderate to high potential for serving as a habitat link between two sites of Regional significance or as a link to suburban areas to enable native taxa to disperse into such areas; or* • *it has moderate to high potential for rehabilitation and management for the public appreciation of fauna values.*
Regional	A site is designated as being of Regional significance if: • it regularly supports taxa that are classified as Regionally significant; or • it regularly supports individuals of a disjunct population, unusual ecological or biogeographical occurrence or extraordinary concentration in a regional context of a naturally restricted (eg. colonial nesting, roosting or feeding) or substantially depleted or restricted taxon in the region; or • it supports a high level of species richness for the bioregion[1]; or • it contains a partial habitat link between two sites of state fauna significance, or a Regional and State site, or a primary habitat link between two sites of regional significance, or between a site of State significance and large urban areas.
State	A site is designated as being of State significance if: • it, at least occasionally, supports individuals of a taxon listed under the *Flora and Fauna Guarantee Act 1988* or listed as Critically Endangered or Endangered in Victoria (DSE 2003); or • it regularly supports taxa listed as Vulnerable in Victoria (DSE 2003). For birds this only includes records of breeding, a single sighting of a large population or repeated sightings of individuals; or • it regularly supports individuals of a taxon listed as Low Risk – near threatened or Data Deficient in Victoria (DSE 2003), or listed as Data Deficient or Insufficiently Known under the following Australian Action Plans: Bannister *et al*. (1996), Cogger *et al.* (1993), Duncan *et al.* (1999), Garnett and Crowley (2000), Lee (1995), Maxwell *et al.* (1996), Pogonoski *et al.* (2002), Tyler (1997), Wager and Jackson (1993), or Sands and New (2003), or supports a roosting colony of cave-dwelling bats; or • it supports very high species richness in the bioregion[2]; or • it regularly supports 5% or more of the Victorian population, or an extraordinary concentration in a State context of any taxa; or • it represents an intact primary habitat link containing comparable habitat attributes to two connecting sites or series of sites of State or higher zoological significance; or • *it has high scientific significance, eg. it forms a long-term study or monitoring site.*
National	A site is designated as being of National significance if: • it supports individuals of a taxon listed as Critically Endangered or Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, or the following Australian Action Plans: Bannister *et al*. (1996), Cogger *et al.* (1993), Duncan *et al.* (1999), Garnett and Crowley (2000), Lee (1995), Maxwell *et al.* (1996), Pogonoski *et al.* (2002), Tyler (1997), Wager and Jackson (1993), or Sands and New (2003); or • it regularly supports taxa listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, or the following Australian Action Plans: Cogger *et al.* (1993), Duncan *et al.* (1999), Garnett and Crowley (2000), Lee (1995), Maxwell *et al.* (1996), Tyler (1997), Wager and Jackson (1993), or Sands and New (2003); or

APPENDIX

	• *it regularly supports a large population (exceeding 5% of the total known population) of a taxon listed as Conservation Dependant under the Commonwealth* Environment Protection and Biodiversity Conservation Act 1999*, or listed as Rare or Lower Risk (near threatened, conservation dependent or least concern) in the following Australian Action Plans: Bannister* et al. *(1996), Cogger* et al*. (1993), Duncan* et al*. (1999), Garnett and Crowley (2000), Lee (1995), Maxwell* et al*. (1996), Pogonoski* et al. *(2002), Tyler (1997), Wager and Jackson (1993), or Sands and New (2003)* • *it contains areas declared as 'Critical Habitat' under the Commonwealth* Environment Protection and Biodiversity Conservation Act 1999*.*

[1]The number of taxa required to fulfil this criterion will vary depending on the size, scope and season of the survey. For the Greater Melbourne region Schulz *et al.* (1991) used 2' latitude by 2' longitude blocks with a six year survey period. Their species richness criteria required 7 to 21 native mammal taxa, 50 to 100 native bird taxa, or 8 to 24 taxa of native frogs and reptiles.

[2] For the Greater Melbourne region, Schulz *et al.* (1991) specified 22 or more native mammal species, 110 to 150 native bird species, or 25 or more species of native frogs and reptiles for 2' latitude by 2' longitude blocks surveyed over six years. The number of species required to fulfil this criterion will vary depending on the size, scope and season of the survey, and a knowledge of the fauna of the region.

Watkins (1993) Criteria for determining National and International significant sites for shorebirds[1]

National	A site is designated as being of National significance for shorebirds if: • it supports 10,000 or more shorebirds; or • it supports 1% or more of the individuals of the Australian population of a taxon or sub-taxon of shorebird.
International	A site is designated as being of International significance for shorebirds if: • it supports 20,000 or more shorebirds; or • it supports 1% or more of the individuals in a population[2] of a taxon or sub-taxon of shorebird.

[1]These criteria are modelled on the RAMSAR Convention criteria for identifying sites of significance for waterbirds.

[2]For taxon and sub-taxon that also occur outside Australia, the population is defined as all of the birds of that taxa or sub-taxa occurring in the East Asian-Australasian Flyway.

APPENDIX

ASSOCIATED REFERENCES

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Wager, R. and Jackson, P. (1993). The Action Plan for Australian Freshwater Fishes. Australian Nature Conservation Agency, Canberra, ACT.

Watkins, D. (1993). A National Plan for Shorebird Conservation in Australia. Australasian Wader Studies Group, Royal Australasian Ornithologists Union and World Wide Fund for Nature

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APPENDIX

Appendix 6 Potentially threatening processes for flora and fauna listed under Schedule 3 of the Victorian *Flora and Fauna Guarantee Act* 1988

- Alteration to the natural flow regimes of rivers and streams.
- Alteration to the natural temperature regimes of rivers and streams.
- Collection of native orchids.
- Degradation of native riparian vegetation along Victorian rivers and streams.
- Habitat fragmentation as a threatening process for fauna in Victoria.
- Increase in sediment input into Victorian rivers and streams due to human activities.
- Input of organotoxins to Victorian marine and estuarine waters.
- Input of petroleum and related products into Victorian marine and estuarine environments.
- Input of toxic substances into Victorian rivers and streams.
- Introduction and spread of *Spartina* (Cord-grass) to Victorian estuarine environments.
- Introduction of live fish into waters outside their natural range within a Victorian river catchment after 1770.
- Loss of hollow-bearing trees in Victorian native forests.
- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases.
- Predation of native wildlife by the Cat *Felis catus*.
- Predation of native wildlife by the introduced Red Fox *Vulpes vulpes*.
- Prevention of passage of aquatic biota as a result of the presence of instream structures.
- Removal of wood debris from Victorian streams.
- Spread of *Pittosporum undulatum* in areas outside its natural range.
- The introduction and spread of the Large Earth Bumblebee *Bombus terrestris* into Victorian terrestrial environments.
- The introduction of exotic organisms into Victorian marine waters.
- The invasion of native vegetation by environmental weeds.
- The spread of *Phytophthora cinnamomi* from infected sites into parks and reserves, including roadsides, under the control of a state or local government authority.
- Threats to native flora and fauna arising from the use by the feral honeybee *Apis mellifera* of nesting hollows and flora resources.
- Use of lead shot in cartridges for the hunting of waterfowl.
- Use of *Phytophthora*-infected gravel in construction of roads, bridges and reservoirs.

APPENDIX

Appendix 7 Vegetation Condition Field Assessment Datasheet - Arthur Rylah Institute (ARI) Flora Research

Vegetation Condition Field Assessment - ARI Flora Research

Cover* of Weeds *Score* ☐

Category & Description	*Value* (*% of 'very serious' weeds)		
	None	<50%	>50%
> 50% cover of weeds	4	2	0
25 - 50% cover of weeds	7	5.5	4
5 - 25% cover of weeds	11	9	7
< 5% cover of weeds	15	13	11

(* Proportion of Indigenous Native Spp *to* Weed Spp)

Organic Litter *Score* ☐

Category & Description	*Value*
< 10% of benchmark cover	0
< 50% or > 150% of expected cover	3
> 50% or < 150% of expected cover	5

Logs *Score* ☐

Category & Description	*Value*
< 10% of benchmark length	0
< 50% or > 150% of expected length	3
> 50% or < 150% of expected length	5

'Landscape Context Score' * #

** 'Landscape Context' Scores will eventually be calculated using a 'GIS' tool that is currently being developed. In the interim these components should be assessed on-site.*

 # assessments relate to the block within the landscape unit

Neighbourhood # *Score* ☐

Radius from site	% native vegetation &	Weighting	Values
100 m		*0.03*	
1 km		*0.04*	
5 km		*0.03*	
		Add Values	

Multiply % x Weighting for each radius from the site; then add values to obtain final Neighbourhood Value.

* if part of neighbourhood is disturbed, subtract 2

example calculation

Radius	% native vegetation	Weighting	Score
100m	80	0.03	2.4
1 km	40	0.04	1.6
5 km	40	0.03	1.2
		Sub-Total	5.2
	* 'significantly disturbed'		-2.0*
		Total	3.2

Patch Size # *Score* ☐

Category & Description	*Value*
< 2 ha	1
Between 2 and 5 ha	2
Between 5 and 10 ha	4
Between 10 and 20 ha	6
> 20 ha, but 'significantly disturbed'*	8
> 20 ha, but not 'significantly disturbed'*	10

* as per RFA 'Old Growth' analyses eg. roading, coupes, etc. - effectively all private land remnants in the rural landscape are classified as 'significantly disturbed'

Distance to Core Area # *Score* ☐

Distance	Value
> 5 km	0
1-5 km	2*
< 1 km	4*
contiguous	5*

* if core area is 'disturbed' then subtract 1

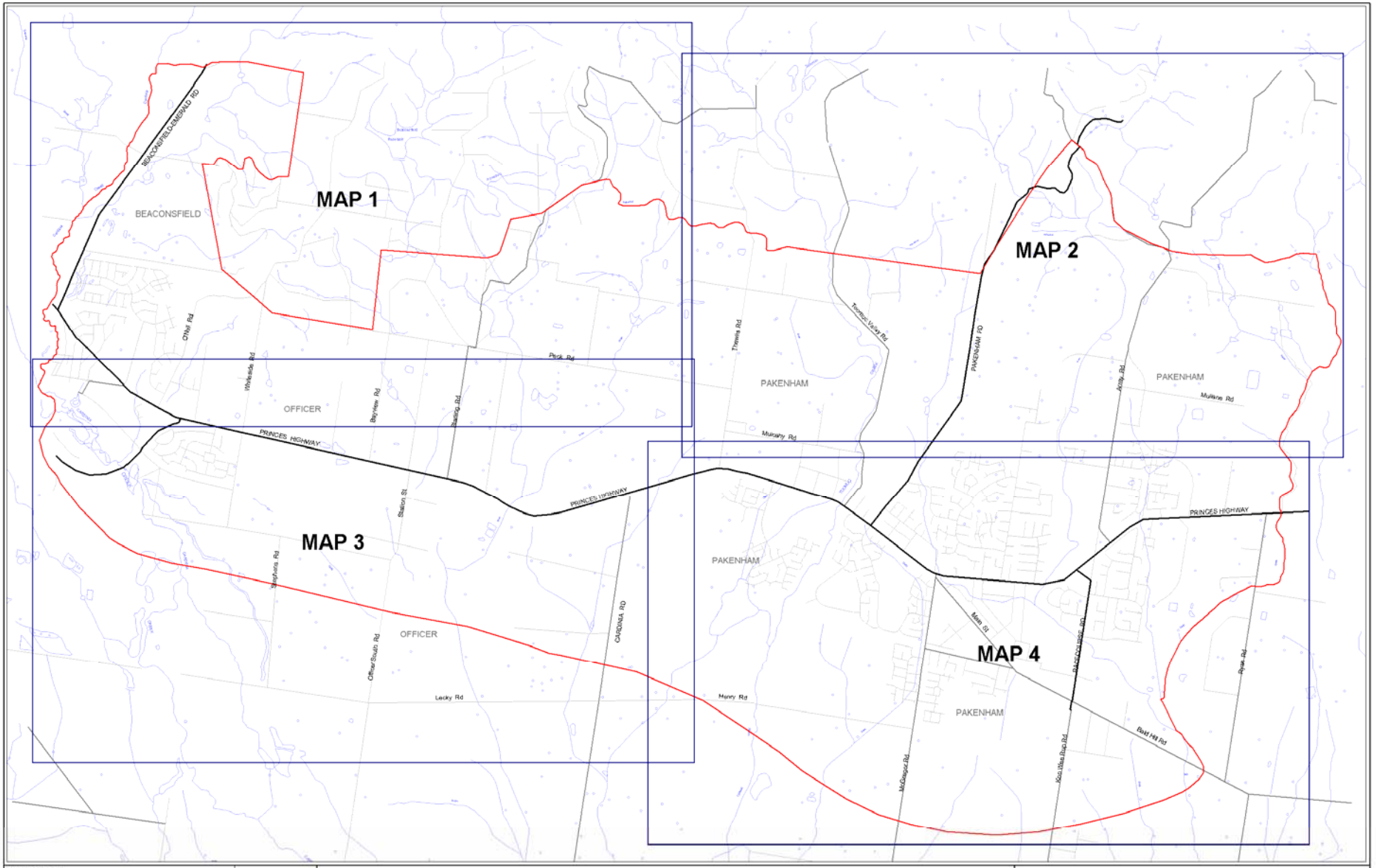
Final Site Assessment Score

'Vegetation Condition' Score = (Condition Score Components) + (Landscape Context Components)

Component	**'Condition Score'**							**'Landscape Context Score'**			
	Large Trees	Tree Canopy Cover	Understorey	Cover of Weeds	Recruitment	Litter	Logs	Neighbourhood	Patch Size	Distance Core Area	**TOTAL**
Max Score	***10***	***5***	***25***	***15***	***10***	***5***	***5***	***10***	***10***	***5***	***100***
Score											

APPENDIX

Appendix 8 Maps of City of Casey Study area showing locations of sites of Biodiversity significance



MAP DETAILS
AMG Zone 55 (AGD 66)

Road, Hydro data: Cardinia Shire

PROJECT NO. 03-33

DRAWING: CARD03-33_RefMap

DATE: 21/1/2004

PATH: C:\Projects\Cardinia\A3_4page.WOR

SHIRE OF CARDINIA

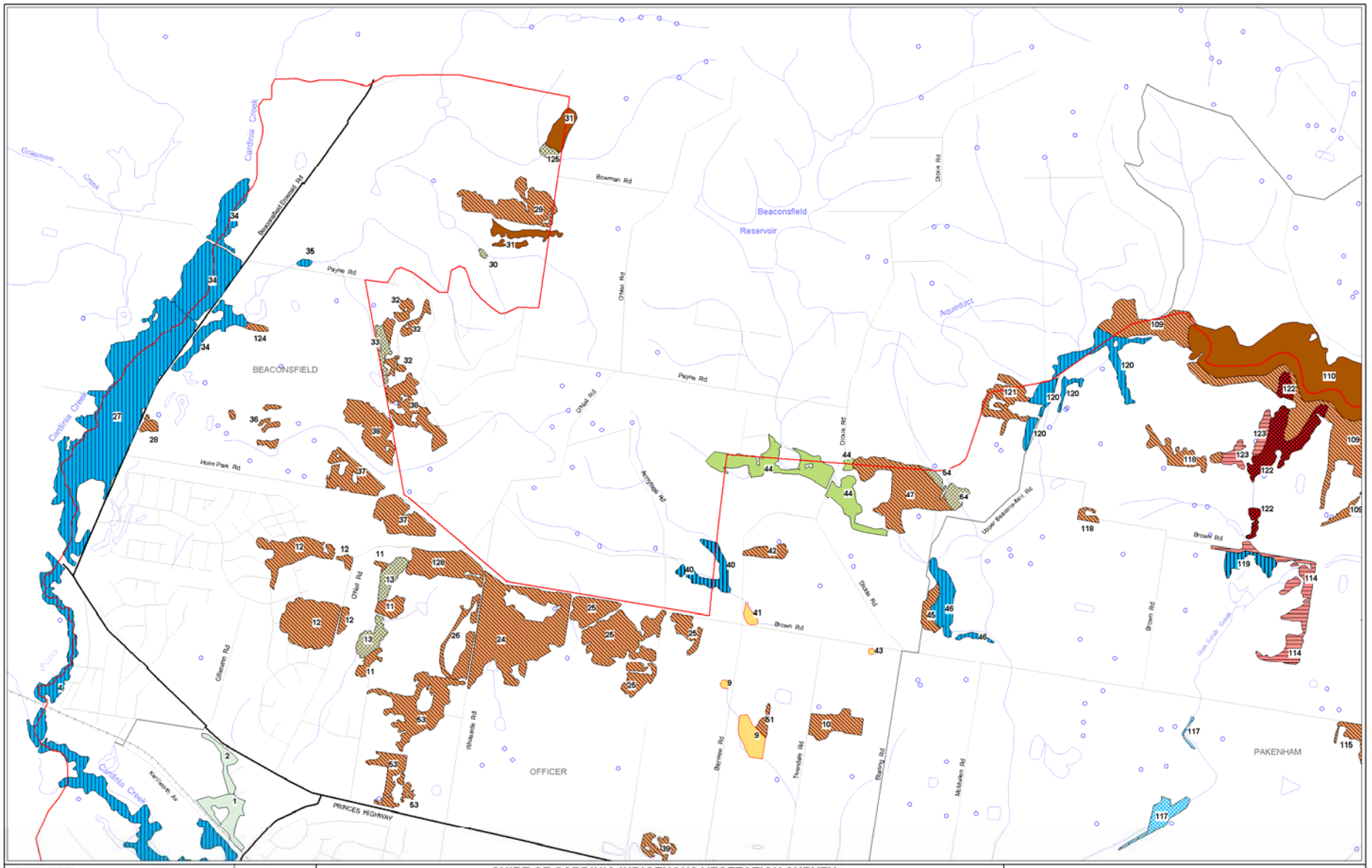
INDIGENOUS VEGETATION SURVEY

Study Area

Ecology Australia

1 0 1 2

Kilometers



MAP DETAILS
AMG Zone 55 (AGD 66)

Road, Hydro data: Cardinia Shire

PROJECT NO. 03-33

DRAWING: CARD03-33_MAP1 DATE: 21/1/2004

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SHIRE OF CARDINIA INDIGENOUS VEGETATION SURVEY

ECOLOGICAL VEGETATION CLASS

- Wet Heathland
- Lowland Forest
- Riparian Forest
- Damp Forest
- Heathy Woodland
- Swamp Scrub
- Plains Grassy Woodland
- Swampy Riparian Woodland
- Swampy Riparian Complex
- Grassy Forest
- Grassy Woodland
- Damp Heathy Woodland
- Gully Woodland
- Swampy Woodland
- Shrubby Gully Forest
- 53 Site
- Study Area
- Fauna Record
- Plains Grassland
- Riparian Thicket

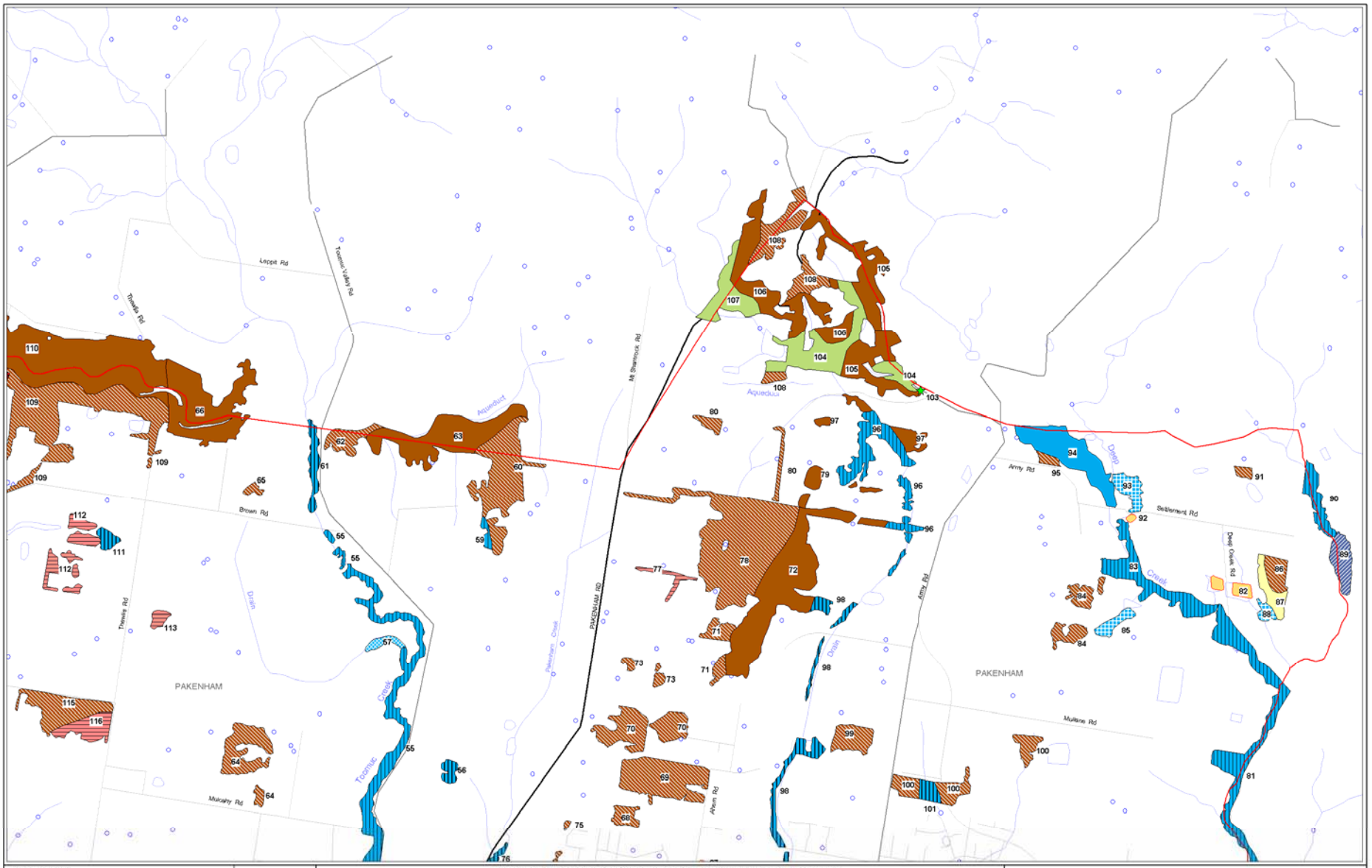
N W E S

Ecology Australia

MAP 1

500 0 500 1000

Meters



MAP DETAILS
AMG Zone 55 (AGD 66)

Road, Hydro data: Cardinia Shire

PROJECT NO.
03-33

DRAWING: CARD03-33_MAP2

DATE: 21/1/2004

PATH: C:\Projects\Cardinia\A3_4page.WOR

SHIRE OF CARDINIA INDIGENOUS VEGETATION SURVEY

ECOLOGICAL VEGETATION CLASS

- Wet Heathland
- Lowland Forest
- Riparian Forest
- Damp Forest
- Heathy Woodland
- Swamp Scrub
- Plains Grassy Woodland
- Swampy Riparian Woodland
- Swampy Riparian Complex
- Grassy Forest
- Grassy Woodland
- Damp Heathy Woodland
- Gully Woodland
- Swampy Woodland
- Shrubby Gully Forest

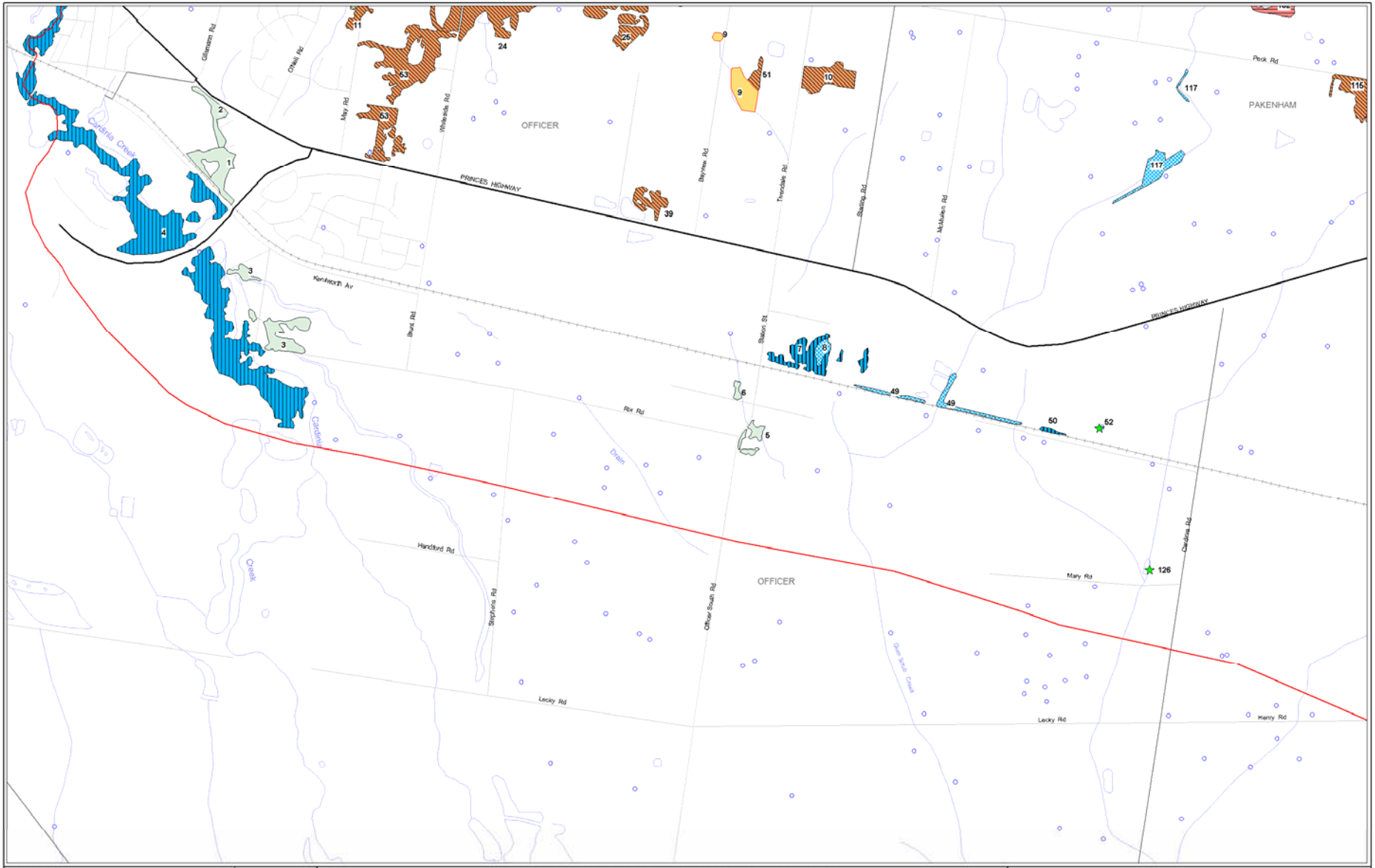
53 Site
Study Area
Fauna Record
Plains Grassland
Riparian Thicket

N
W
E
S

Ecology Australia

MAP 2

500 0 500 1000
Meters



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DRAWING: CARD03-33_MAP3	DATE: 21/1/2004
PATH: C:\Projects\Cardinia\A3_4page WOR	

SHIRE OF CARDINIA INDIGENOUS VEGETATION SURVEY

ECOLOGICAL VEGETATION CLASS

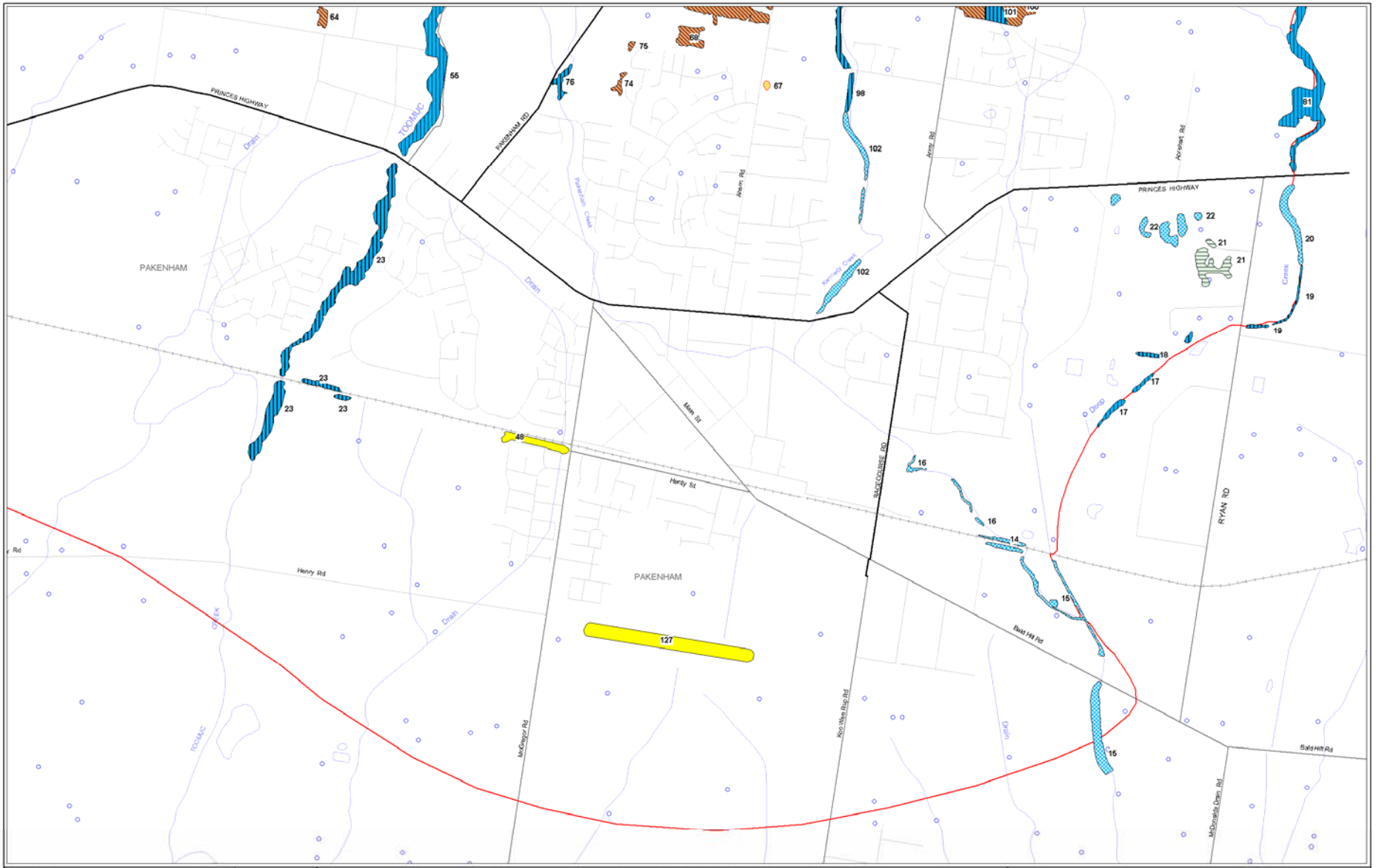
- Wet Heathland
- Lowland Forest
- Riparian Forest
- Damp Forest
- Heathy Woodland
- Swamp Scrub
- Plains Grassy Woodland
- Swampy Riparian Woodland
- Swampy Riparian Complex
- Grassy Forest
- Grassy Woodland
- Damp Heathy Woodland
- Gully Woodland
- Swampy Woodland
- Shrubby Gully Forest
- 53 Site
- Study Area
- Fauna Record
- Plains Grassland
- Riparian Thicket

MAP 3

Ecology Australia

500 0 500 1000

Meters



MAP DETAILS
AMG Zone 55 (AGD 66)

Road, Hydro data: Cardinia Shire

PROJECT NO.
03-33

DRAWING: CARD03-33_MAP4

DATE: 21/1/2004

PATH: C:\Projects\Cardinia\A3_4page.WOR

SHIRE OF CARDINIA INDIGENOUS VEGETATION SURVEY

ECOLOGICAL VEGETATION CLASS

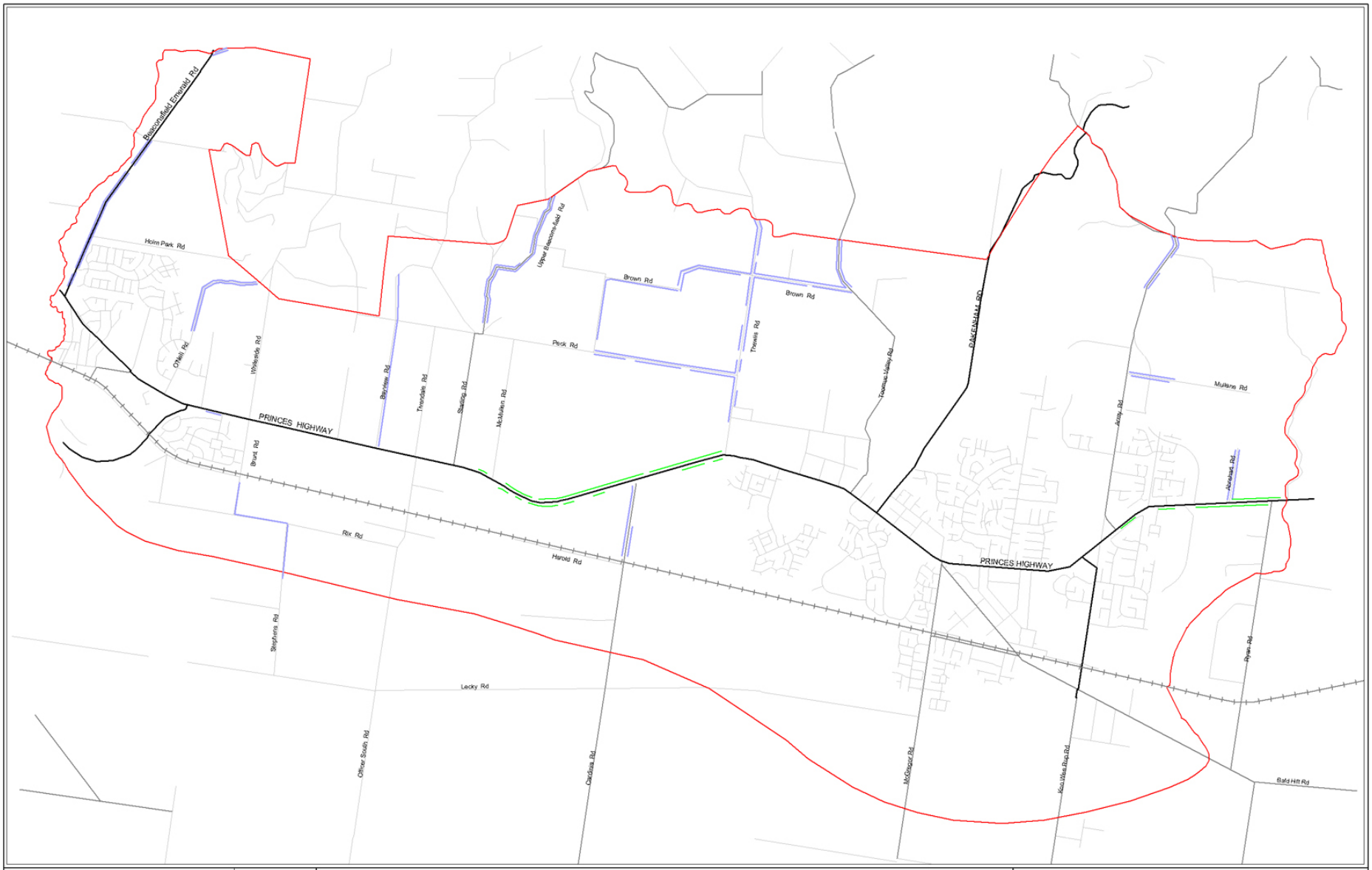
- Wet Heathland
- Lowland Forest
- Riparian Forest
- Damp Forest
- Heathy Woodland
- Swamp Scrub
- Plains Grassy Woodland
- Swampy Riparian Woodland
- Swampy Riparian Complex
- Grassy Forest
- Grassy Woodland
- Damp Heathy Woodland
- Gully Woodland
- Swampy Woodland
- Shrubby Gully Forest
- 53 Site
- Study Area
- Fauna Record
- Plains Grassland
- Riparian Thicket

Ecology Australia

MAP 4

500 0 500 1000

Meters



MAP DETAILS
AMG Zone 55 (AGD 66)

Roadside vegetation: Cardinia Shire
Road, Hydro data: Cardinia Shire

PROJECT NO.
03-33

DRAWING: CARD03-33_RdVeg

DATE: 28/1/2004

PATH ...\Projects\Cardinia\Roadside.WOR

Conservation Value

- Medium
- High

Study Area

SHIRE OF CARDINIA

ROADSIDE VEGETATION

N W E S

Ecology Australia

1 0 1 2
Kilometers