

SITES of BIOLOGICAL SIGNIFICANCE in MAROONDAH

Volume 1

A Report to

Maroondah City Council

by

Graeme S. Lorimer, Ph.D.

42 Gratten Rd, Montrose, Vic. 3765. Phone (03) 9728-5841

with

John C. Reid, B.App.Sci. (Envtl. Mgmt.)

Lynlee P. Smith, B.Sc. (Hons.)

Helen Moss, Dip.Hort.Sc.

February, 1997

Legal Notice

Where legal responsibility is to be taken for matters arising from authorship of this document, it is accepted by Dr. Graeme Lorimer.

This document should be cited as:

'Sites of Biological Significance in Maroondah' Vol.1
by G.S. Lorimer, J.C. Reid, L.P. Smith and H. Moss.
Published by Maroondah City Council, Ringwood, Victoria. (1997)

Foreword

This study reported here arose directly from the commitment of Maroondah City Council, in its 1995 Corporate Plan, to 'include sites of biological significance in the Maroondah Planning Scheme (local section) for public and private property, and assist with appropriate decision making on applications for development of sites in adjacent areas'. The project identifies the sites of biological significance, and also provides guidance on the additional 1995 Corporate Plan commitment to 'develop and maintain a program for protection and restoration of remnant vegetation on Council owned land, particularly along roadsides and open space corridors'. These commitments are carried on in Maroondah City Council's 1996-9 Corporate Plan.

This report also provides the necessary basic information for fulfilment of several goals of '*Maroondah 2020- A Shared Future: A Strategic Plan for the City of Maroondah*', which contains the objectives:

- 'to encourage the retention and enhancement of our natural environment including ... preservation of the current flora and fauna and the encouragement of indigenous species' (p.12);
- 'Flora and fauna will be preserved and enhanced' (p.13); and
- 'We will achieve an increase in the presence of indigenous species in the natural environment' (p.13).

The draft *Maroondah Environment Strategy* (1996) also contains the following goals supported by this report:

- 'Protect and enhance indigenous vegetation communities;
- 'Identify and enhance wildlife corridors; and
- 'Encourage the community to protect and enhance indigenous flora and fauna'.

The findings of this study show that Maroondah makes a significant contribution to Australia's biodiversity (i.e. flora, fauna, ecological communities and genetic material). The recently released National report, '*Australia: State of the Environment 1996*' (Alexander and Taylor, 1996), concluded (in part) that:

- 'The most significant impediment to the conservation and management of biodiversity is our lack of knowledge about it and the effects of the human population and activities on it'.

'*Sites of Biological Significance in Maroondah*' aims to greatly improve this situation within the municipality. It also aims to promote the objectives of '*The National Strategy for the Conservation of Australia's Biological Diversity*' (DEST, 1996).

This report was published as a draft and open to public comment in the later months of 1996 to seek community reaction and to elicit any additional information (e.g. bird sightings). It was also subject to independent scientific peer review by two referees. The resulting comments and additional information have been considered in consultation between Council and the authors, and appropriate modifications have been made to the final report. The final report also includes the results of some computer analysis of data which was not available in time for the published draft.

Updates

Persicaria lapathifolia is now regarded as indigenous. Appendices A&B updated, as well as the score of indigenous species.

Gavin Anderson (Warrien Reserve Committee of Management) reported an Eastern Grey Kangaroo in the reserve in 1996. Mammal list updated, as well as the tally figures in the text.

CONTENTS

Foreword	i
Executive Summary	1
1. Introduction	5
1.1 How to use this report	1
1.2 Background on Maroondah City Council	5
1.3 Outline of the issues	5
1.4 The study approach	7
2. The geography of Maroondah	7
2.1 Flood plains and valleys	7
2.2 The Wicklow Hills Ridge	7
2.3 The Loughnan-Warranwood Ridge	9
2.4 The foot of Mt Dandenong	9
2.5 Undulating country	9
3. Survey design and methods	9
3.1 Extent of coverage	9
3.2 Survey of literature and historical information	10
3.3 Finding potential sites	10
3.4 Field survey	11
3.4.1 Vegetation assessment	11
3.4.2 20-minute bird census	13
3.4.3 Spotlighting	13
3.4.4 Mammal hair survey	13
3.4.5 Frog call survey	13
3.4.6 Incidental records	15
3.5 Significance ratings	15
4. Survey results	16
4.1 Habitat types	16
4.2 Plant species	18
4.3 Bird species	20
4.4 Mammal Species	21
4.5 Frog species	21
4.6 Butterfly species	21
4.7 Reptile species	22
4.8 Sites	22

5. Management of significant sites, flora and fauna	23
5.1 Objectives	23
5.1.1 Serving the community's expectations	23
5.1.2 Balancing conflicting interests	24
5.2 Issues	24
5.2.1 The role of private land	24
5.2.2 Habitat fragmentation	25
5.2.3 Vegetation clearing and damage	26
5.2.4 Roadsides	29
5.2.5 Fire hazard and fire management	30
5.2.6 Weeds	30
5.2.7 Pests	32
5.2.8 Tree dieback	33
5.2.9 Cats and dogs	35
5.2.10 Nutrient seepage	35
5.2.11 Drainage works and waterway degradation	36
5.2.12 Special protection for rare or threatened flora and fauna	36
5.2.13 Wildlife 'Rescue'	37
5.2.14 Harvesting of indigenous plants	37
5.2.15 Revegetation	37
5.3 Recommendations	38
Implementation	38
Strategic planning for conservation	39
Recognition of sites of biological significance in the Planning Scheme	39
Financial instruments to support biodiversity	41
Native vegetation removal regulations	41
Effective enforcement and penalties for illegal clearing	42
Dead trees	42
Local Law No.1	42
Fire hazard notices	42
Ecological burning	42
Weeds	42
Pests	43
Tree dieback	43
Cats and dogs	43
Roadsides	44
Drainage works	45
Special protection for rare or threatened flora and fauna	45
Revegetation	45
Harvesting of indigenous plants	46
Removal of wildlife	46
Supporting 'Friends' groups	46
Publicity and promotion	47
6. Future revision of significant sites	47
7. Bibliography	49
Appendix A - Indigenous plant species of Maroondah	52
Appendix B - Environmental weeds of Maroondah	62
Appendix C - Bird species of Maroondah	65
Appendix D - Mammal species of Maroondah	68
Appendix E - Frog species of Maroondah	69

Appendix F - Butterfly species of Maroondah	69
Appendix G - Sample <i>Phytophthora</i> Brochure	71
Glossary	65

Acknowledgment

We wish to warmly thank Kathryn Patterson for proofreading and editing drafts of this report, and assisting with processing of around ten thousand plant records.

We also wish to thank the two independent reviewers: David Cameron of the Department of Natural Resources and Environment, and another anonymous referee. Their comments helped improve the document substantially, and they invested a great deal of time and effort in their review.

Executive Summary

Purpose

This study reported here arose directly from the commitment of Maroondah City Council, in its 1995 Corporate Plan, to 'include sites of biological significance in the Maroondah Planning Scheme (local section) for public and private property, and assist with appropriate decision making on applications for development of sites in adjacent areas'. Council carries on this commitment through its current (1996-9) Corporate Plan.

The project brief sets the overall goal of determining the location of Maroondah's most environmentally significant sites and how best to protect and maintain them. It specifies the following specific objectives:

- to assess and map all Sites of Biological Significance on public and private property;
- to define the level and degree of significance of sites in terms of their value to Maroondah and in the wider context of the greater metropolitan area;
- to identify management issues to meet Council's needs as an advisory body for site owners; and
- to formulate appropriate protective land use controls which may be incorporated into Maroondah's Planning Scheme or Local Laws.

Methods

The study has three main parts:-

- scientific investigation;
- identification of issues affecting nature; and
- determination of practical ways to deal with those issues.

The first part comprised a scientific survey of the current state of nature in the municipality (flora, fauna, ecological communities, and the sites where these things occur). The survey actively sought plants, birds, mammals and frogs. Incidental observations of butterflies, reptiles and other fauna were also recorded. A small number of records were added from sources outside the study, where those records have irreproachable credentials and were not able to be confirmed during the study. The data has been analysed by computer, and will be further analysed during this draft report's exhibition period.

The second part of the study aimed to identify issues which are positively or adversely affecting the natural flora and fauna in Maroondah, by beginning with the survey results and working back to the root causes.

The third area of investigation aimed to devise and identify means for improving the positive influences on the natural environment, and reducing the adverse effects. This area of investigation was aided by literature searches and consultation with the Maroondah City Council and the public.

Principal Findings

The study has made some exciting discoveries for Maroondah. The survey work uncovered more biologically significant sites, and more species of plants and animals, than anyone expected. The highlights were discoveries of sites of state-wide biological significance that were not previously known to be significant at all. There have also been discoveries of many plant and bird species not previously recorded for the municipality.

Eighty-two sites, on both public and private land, have been identified to be worthy of, and suited to, protection in the Maroondah Planning Scheme under the Vegetation Protection Overlay of the new Victoria Planning Provisions. The biological significance of the sites has been assessed using scientific criteria, and the most significant sites rank at the State level on both public and private land. Each site is described in detail in Volume 2.

An additional fifty sites have been identified which are biologically significant at the Local level (the lowest level) but not suited to the same level of protection under the Maroondah Planning Scheme, mostly because the

boundaries are too ill-defined and the significant attributes are too patchy to allow fair and reasonable application of the protective measures recommended in this report.

It has been found that remnant indigenous vegetation or areas with indigenous tree cover occupy 5% of the municipality. This figure drops to 3% if one excludes sites with only a handful of hardy native plant species and little chance of natural regeneration.

The amount of significant habitat on private land is higher than was expected. Many indigenous plant species are not present in reserves, and nearly all of Maroondah's wildlife relies on private land to provide part of its habitat requirements. In addition, fragmentation of natural habitat is found to be a major threat to the municipality's flora and fauna, and it is very important to consider the bushland remnants not in isolation but as components of the broader environment, with the well-being of each component being reliant on appropriate management of the spaces between them. Maroondah City Council should therefore treat private land as an important part of its conservation measures, and a few of the recommendations in this report (relating to cats and removal of native vegetation) apply not just within the recognised sites but throughout the municipality.

One of the most important findings of the study is that most of the eighty-two sites recommended for listing in the Planning Scheme contain plant and/or animal species that are rare or threatened in Maroondah. In the case of about three-quarters of these eighty-two sites, the loss of the site would either render a species extinct from Maroondah (or more widely), or leave it at great risk of becoming so.

Maroondah is therefore at the stage where many indigenous species of flora and fauna are poorly conserved and threatened with local extinction. The present rate of removal of native vegetation, if it is not curtailed, is seen as extremely likely to lead to an unprecedented high rate of local extinctions in the next decade. (Native vegetation in this context means naturally occurring plants such as trees, shrubs, wildflowers and grasses, but not if planted and not weeds).

Positive and Negative Trends

There are encouraging signs of change by the public, Council and other agencies; for example:

- widespread planting of indigenous species to encourage wildlife and enhance the local landscape;
- enthusiastic community participation in management of bushland reserves; and
- Council's commitments to conservation such as the draft Maroondah Environment Strategy, the Roadside Conservation and Street Trees Strategy, and this report.

Council is well positioned to encourage these trends; for example, by providing practical support to the many 'Friends' groups that have working bees in Council reserves.

This report also establishes the need to take action immediately, because despite the positive signs on the human side, the natural environment is in general decline.

It is not surprising that there have been local extinctions of plants and animals during Maroondah's development, but a massive increase in the rate of local extinctions appears imminent. Many species of plants and animals are threatened with extinction from Maroondah within ten years or so, including the Koala, Eastern Grey Kangaroo, Swamp Wallaby, Echidna and a beautiful Spider-orchid which is known from one private allotment and nowhere else in the world.

Nevertheless, the threats to these plants and animals are known and they can be overcome. It is still realistic to aim to retain all presently existing native fauna and flora species for the indefinite future, and this is recommended as a cornerstone goal for Council.

The threats to nature in Maroondah are discussed in detail in Section 5.2, along with the positive things that can be done to address them.

The greatest threat to nature in Maroondah is clearing of native vegetation on private land and roadsides. Construction of arterial roads is expected to be the greatest cause of loss of native vegetation in the next few years. The next greatest threat is the spread of weeds.

An Outline of the Recommendations

Section 5.3 of this volume lists 97 specific, prioritised recommendations to Council, written in such a way as to make it easy to monitor implementation. In addition, recommendations which apply to individual sites are given in the descriptions of those sites in Volume 2. It is not possible to summarise all of the detailed recommendations, so the following should be taken as just a broad overview.

To prevent the likely clearing of some of Maroondah's most significant habitat, Council's highest priority should be to investigate the purchase and reservation of several private allotments. The most important of these are in Kilsyth South (State significance), northern Ringwood (Regional significance) and Heathmont (Municipal significance), in each case adjacent to existing nature reserves. Because the significance of these sites exceeds the local scale, support should be garnered from State and Federal sources.

The eighty-two main sites of biological significance are recommended to come under the Vegetation Protection Overlay of the Victoria Planning Provisions. The remaining fifty sites are recommended to be covered by the Significant Landscape Overlay, in conjunction with the existing Environmental Living Zones and Landscape Protection Area. In both cases, a permit would be required for removal or destruction of native vegetation in these sites, which addresses the greatest single threat to natural habitat in Maroondah.

Next to clearing, the second-greatest threat to nature in Maroondah is from environmental weeds; that is, plants which adversely affect native flora or fauna. Ten of the most serious environmental weed species have been identified for special attention by Council (see Table 4, p.31). It is recommended that planting of these species be prohibited, and that Council and the Department of Natural Resources and Environment mount a campaign for the removal of existing plants.

It is also recommended that Council prohibit owners of cats from allowing their animals to roam at large in recognised Sites of Biological Significance; that is, that cats be treated the same as dogs in Maroondah's most biologically significance sites. In other parts of the municipality, it is recommended that cats be prohibited from roaming at large either at night, or at all hours, depending on analysis of a recent community survey.

As stated earlier, a primary motivation for this study was Council's 1995 Corporate Plan commitment to recognise sites of biological significance in the Maroondah Planning Scheme. Section 5.3 gives guidance on the level and types of protection which should apply to the significant sites. The Municipal Strategic Statement, local planning policies and the two aforementioned overlays provide the planning mechanisms for recognising and protecting the sites. A planning amendment will be prepared to incorporate the sites and protective measures in the Planning Scheme, and this will be exhibited for further public comment prior to final consideration by Council.

It is recommended that implementation of the adopted recommendations should be overseen by a committee with representation from Council, the Department of Natural Resources & Environment, and the community.

Attention is drawn to the commitment of the Federal Department of the Environment, Sport and Territories that 'Local governments will be encouraged to cooperate with each other to develop bioregional biological diversity management plans, with assistance from State and Territory governments' (DEST, 1996). It is recommended that this report be used by Maroondah City Council and neighbouring councils as a starting point for developing a biological diversity management plan for the eastern and north-eastern Melbourne fringe.

Council cannot protect Maroondah's flora and fauna without cooperation of the public. There is therefore a group of recommendations for publicity and promotional activities.

Quality Assurance

The utmost care has been taken to ensure that the findings and recommendations of this study stand up to scientific and legal scrutiny.

The most basic safeguard against faulty or misleading results is that extensive survey work was carried out to avoid reliance on historical records, whose reliability and currency are often dubious. The vast majority of species of plants, birds, mammals and frogs in Maroondah have been observed by us personally. We sought to authenticate all plant, bird and animal observations reported to us, and rejected all those that are neither validated

by preserved specimens nor certified by people of impeccable standing. A specimen was taken of almost all significant plant species found during the study, to be lodged at the National Herbarium of Victoria for authentication.

A safeguard against unjustified assessments of biological significance is the detailed descriptions which are given of the sites, their significant flora and fauna, and the reasons for deciding on the level of significance assigned, based on published criteria of the Victorian Department of Natural Resources and Environment. (Normally, reports such as this give little or no written justification). Computer analysis of the field data (many tens of thousands of records of plants and animals) have been done to provide statistics of the distribution of rare and uncommon species, so that there is no chance that the report claims a species to be significant when it is not warranted by the data. There are many examples of species purported by others to be significant which we have found to be actually widespread and secure.

As an additional quality assurance measure, Council has had this report independently peer-reviewed by experts.

An outcome of the high standards of proof adopted in this study is the strong likelihood that the existence of some additional rare native species of flora and fauna will be proved in future, and the richness of flora and fauna at some sites might be shown to be higher than accepted here.

Periodic Review

Sites of biological significance can either lose or gain significance through changes at the site. Widespread depletion of habitat can also make the remaining habitat more significant. It is also possible that some sites may have been missed in this study (although it is very unlikely that anything very significant was missed).

It is therefore important to anticipate the need to review the Planning Scheme's proposed list of sites. This would normally occur in response to a case put to Council by someone concerning a specific site.

Changing the list in the Planning Scheme would have to be done as a Planning Amendment, which imposes various requirements on the process. After being approached to make an amendment, Council is free to either reject the approach or go ahead and exhibit an amendment. It is recommended that Council should not exhibit an amendment without a recommendation from a biologist.

1. Introduction

1.1 How to use this report

The sites of biological significance identified in this study are listed, mapped and described in Volume 2. For readers who simply want to see whether a particular site or area has biological significance, or to read an assessment of a site, it may be adequate to go directly to the key map or site inventory at the start of Volume 2, determine the site number(s), and turn to the corresponding section in the text. Note that there are 82 fully described sites and 50 brief summaries of generally lesser sites not recommended for special recognition in the Planning Scheme; however only the group of fully described sites appears on the key map.

Readers who want to check on the rarity or other significant features of an indigenous animal or plant, or the severity of an environmental weed, will find an overview in Section 4 and tabulated summary data in the appendices of Volume 1.

To fully appreciate the basis for the assessments which have been made of the sites and the individual species, read Chapters 3 and 4 which describe the survey, its methods and main findings.

An overview of issues related to nature conservation at the municipal scale and above is given in Section 1.3 and a detailed discussion appears in Chapter 5. There is a list of recommended actions in Section 5.3.

1.2 Background on Maroondah City Council

The municipality of Maroondah City Council (abbreviated to 'Maroondah' below) has a population of 94,500 and lies on the eastern fringe of the suburbs of Melbourne, a city of around three million people in the cool-temperate south-east of mainland Australia. Maroondah includes the main suburbs of Bayswater North, Croydon, Croydon Hills, Croydon North, Croydon South, Heathmont, part of Kilsyth and Kilsyth South, Ringwood, Ringwood East, part of Ringwood North, and Waranwood. A map of Maroondah is shown in Figure 1.

Maroondah's 61 square kilometres have varied land use, comprising significant areas of commerce, industry, reserves of various kinds (including nature reserves) and residential areas of low to high density (sometimes incorporating native vegetation). Being on the fringe of Melbourne, substantial areas of rural land that existed a decade or so ago have since been converted almost wholly to industrial and (more commonly) residential development. This study found that remnant native vegetation or areas with natural tree cover occupy 5% of the municipality. This figure drops to 3% if one excludes sites with only a handful of hardy native plant species and little chance of natural regeneration.

1.3 Outline of the issues

Conservation of native flora and fauna in Maroondah is at a critical stage. It is still realistic to aim to maintain the existence of every indigenous plant and animal species presently in Maroondah, but at least half of these species could be lost within two or three decades if no preventative action is taken. This report aims to identify:

- sites, species and ecological communities that are at risk;
- the most serious problems causing loss of biodiversity (i.e. flora, fauna, ecological communities and genetic material); and
- how these problems should be dealt with.

Does it really matter if species are lost from Maroondah? It is commonly believed that there is a system of conservation reserves to conserve nearly all Australian native flora and fauna, so that the loss of species from urban areas such as Maroondah is not biologically important on a state-wide or national scale. This belief is false, as the following examples show. Maroondah contains a threatened spider-orchid (*Caladenia* aff. *venusta*) known from no other place on earth, as well as 6-7 hectares of an endangered ecological community (see Section 4.1) present on only about 70 hectares outside Maroondah. There are also several species of flora and fauna in Maroondah that are officially regarded as rare or threatened nationally, and Maroondah makes a significant contribution to the distribution of some plant species (e.g. most of the White Stringybarks west of West Gippsland occur in Maroondah).

Figure 1. Map of Maroondah

Therefore, biological resources cannot be sacrificed in Maroondah in the expectation that they are adequately conserved elsewhere. We contend that Maroondah plays an important role in conserving Australia's biodiversity.

The importance of this contention becomes clear upon reading the main conclusions about the Australian environment appearing in the newly released Executive Summary of *'Australia: State of the Environment 1996'* (Alexander and Taylor, 1996), which states:

- 'The loss of biological diversity is perhaps our most serious environmental problem'.
- 'Habitat modification, particularly removal of native vegetation for agriculture, urban development and forestry has been, and still is, the most significant cause of loss of biodiversity'.
- 'Introduced plants are an acute and insufficiently appreciated ecological problem'.
- 'The most significant impediment to the conservation and management of biodiversity is our lack of knowledge about it and the effects of the human population and activities on it'.

The following chapters show that, in these respects, Maroondah is representative of Australia as a whole, except that this study has made considerable progress on the last of the four points above at the municipal scale, and the issues of agriculture and forestry do not currently apply in Maroondah.

We have therefore put Maroondah's biodiversity issues in the national context, and drawn attention to the many recommendations of *'The National Strategy for the Conservation of Australia's Biological Diversity'* (DEST, 1996) that apply to Maroondah.

1.4 The study approach

This study has three main parts:-

- scientific investigation;
- identification of issues affecting nature; and
- determination of practical ways to deal with those issues.

The first part comprised a scientific survey of the current state of nature in the municipality (flora, fauna, ecological communities, and the sites that these things occupy), based on field work and a survey of literature and historical information. As discussed in Section 3, this included a very detailed study of the vegetation (particularly native vegetation), less detailed study of birds, mammals and frogs, and incidental observation of reptiles and butterflies. The methods for these surveys are described in Section 3.

Flora and fauna data were transferred to a computer and analysed to determine the abundance and distribution of species and ecological communities. The results of the survey work are summarised in Chapter 4.

The second part of the study aims to identify those issues which are positively or adversely affecting the natural flora and fauna in Maroondah, by beginning with the survey results and working back to the root causes.

The third area of investigation aims to devise and identify means for improving the positive influences on the natural environment, and reducing the adverse effects. This area of investigation was aided by literature searches and consultation with the Maroondah City Council and the public.

The principal author of this report (Dr. Lorimer) has weighed up the likely costs and benefits of the options compared with those of inaction to come up with recommendations. The recommendations are his responsibility.

2. The geography of Maroondah

An outcome of the study is the recognition that Maroondah's geography and biogeography can be divided into five zones (Figure 2) which are discussed below in sections 2.1 to 2.5. Each zone is characterised by its soil type and topography, and there are clear differences between the zones' natural flora and fauna. All zones share a cool-temperate, Mediterranean climate.

Within each zone, the pre-European flora and fauna at any particular location were primarily determined by topographic factors: whether the site is a hilltop, a valley floor, a 'dry' hillside (facing generally northerly or westerly), or a sheltered hillside (facing generally southerly or easterly). In nature, the flora and fauna on a site vary with time due to the cycles of fires, floods, storms and droughts.

2.1 Flood plains and valleys

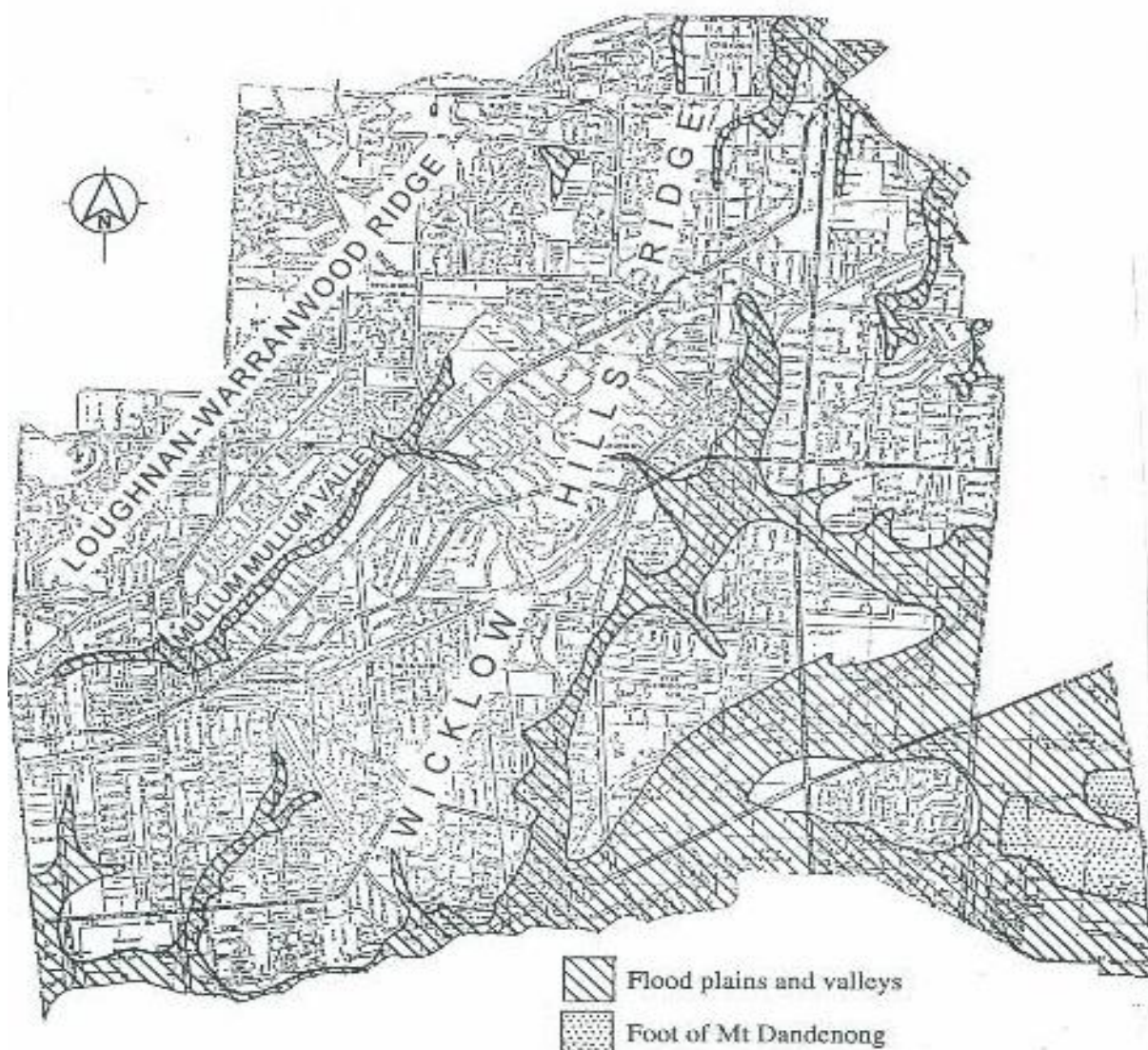
The flood plains are covered with moderately fertile, alluvial soil washed down from the hills. The combination of this soil type and poor drainage gives rise to large areas dominated by Swamp Gums, Silver-leafed Stringybarks and Swamp Paperbarks prior to European settlement (and still visible on many roadsides today). The ground remains moist for most of the year, so the small variation of rainfall across the municipality (850-1,000 mm annual average) has negligible effect.

2.2 The Wicklow Hills Ridge

There is a clearly defined ridge from southern Heathmont to Exeter (or Hochkins) ridge in Croydon North. It is formed by a band of rock just over 1 km wide that is less easily eroded than adjacent areas, oriented at a bearing of 20-25° east of north. The Maroondah Highway cutting east of Yarra Road provides an excellent view of the geology.

The ridge is sometimes called the Wicklow Hills Ridge, and the band of rock is called the Dargile Formation. The soils are infertile, thin duplex soils, stony along the ridge top. The flanks of the ridge have slopes sometimes as steep as 1:5.

Figure 2. Biogeographical zones of Maroondah (flood plains taken from O'Neill, 1995)



The Upper Silurian sandstone differentiates the ridge from the rest of Maroondah, which is evident from the flora growing there. For example, there are many White Stringybarks (*Eucalyptus globoidea*) along the ridge, and only a handful of them elsewhere west of West Gippsland.

The annual average rainfall varies slightly from about 870 mm in the north of Wicklow Hills Ridge to about 900 mm in the south. The hills are also more weathered in the south, reflecting a geological gradient. These factors combine to produce a subtle change in vegetation from one end to the other. The proximity of the northern parts to the Yarra Valley also brings fauna which use the valley for migration or as part of their habitat requirements.

2.3 The Loughnan-Warranwood Ridge

The other hilly areas of Maroondah are Warranwood and the Loughnans Hill - Oban Road area in Ringwood. These areas are linked by what O'Neill (1995) calls the 'Loughnan-Warranwood Ridge', which is not nearly as distinct as the Wicklow Hills Ridge. The area has its own characteristic flora and fauna; for example, Red Box trees are abundant there, but rare elsewhere in Maroondah.

The soils are structurally similar to the Wicklow Hills Ridge zone, but the difference in vegetation suggests higher fertility on the Loughnan-Warranwood Ridge. The average annual rainfall is about 850-870 mm throughout this zone.

2.4 The foot of Mt Dandenong

Mount Dandenong was formed from three main layers of Devonian volcanic rock, the lowest of which ('the Coldstream Rhyolite') extends just into the south-east corner of the municipality, in Kilsyth South. The rock has eroded to a clay loam. The combination of soil type and the highest rainfall in Maroondah (1,000 mm annual average) provides conditions for flora and fauna associated more with the Dandenong Ranges than the rest of Maroondah, e.g. abundant Variable Sallow Wattles.

2.5 Undulating country

The rest of Maroondah comprises gently undulating terrain with shallow slopes and moderate drainage. The soils are thin duplex soils, derived from Middle Silurian sediments west of the Wicklow Hills Ridge, and from the similar Lower Devonian sediments to the east. The annual average rainfall grades from about 860 mm on Oban Rd in the north-west to about 980 mm on Colchester Rd in the south-east.

The original vegetation of this zone was largely dominated by Messmate Stringybark and Silver-leafed Stringybark, as can be seen along most of Mt Dandenong Rd.

3. Survey design and methods

3.1 Extent of coverage

No biological study ever aims to survey every organism from the largest tree down to the smallest bacterium. A decision has to be made about what can be surveyed within the available budget and time to provide the best indication of overall biodiversity and ecological well-being. This study adopted the usual approach of starting with a detailed survey of the vegetation (excluding mosses, algae, fungi and other lower life-forms), and of the habitat which the vegetation provides for native fauna. We have also conducted methodical surveys of birds, mammals and frogs, but with less thoroughness than the vegetation survey. Incidental observations of reptiles and butterflies were also recorded.

The surveys of fauna are less thorough than the vegetation survey because:

- the state of vegetation largely determines the richness and well-being of fauna; and
- only a fraction of the total fauna can be observed in any short-term study like this.

Our aim has been to investigate every area of natural or semi-natural habitat larger than the size of a typical house allotment. We also tried to find any smaller areas which are providing habitat for biologically significant plants or animals (e.g. we found rare plants in a small dam in a pine plantation).

Individual trees of very high biological significance are included in the companion report, *'Notable Trees of Maroondah'* (Moss and Lorimer, 1996).

Field survey work was conducted mostly from November to April, and not all species of plants and animals can be detected or precisely identified during this period. Consequently, there are bound to be seasonal or infrequent appearances of some species which we have not detected. This is most likely in sites of better ecological condition

(a concept discussed in Section 3.4.1), so such sites should be valued not only for their known biodiversity, but for the high likelihood of species yet to be detected.

Aquatic fauna (e.g. fish, molluscs and crustaceans) have not been included in the survey, so we can conclude little about the state of aquatic biodiversity. We believe it is reasonable to leave further investigation of the aquatic environment to a future study, because management of waterways involves issues which are different (though interrelated) to other environments, and because they are better dealt with on a catchment-wide scale, by organisations such as Melbourne Water, the Environment Protection Authority, and the Catchment and Land Management branch of the Department of Natural Resources and Environment.

3.2 Survey of literature and historical information

Dr Lorimer and Mr Reid have years of flora and fauna records from some sites. In addition, historical records from other sources were sought to minimise the risk of overlooking any species, and to determine what species may have become locally extinct.

The main source of historical records of plants was the computer catalogue of specimens at the National Herbarium of Victoria. These records are generally reliable because nearly all specimens have been identified by expert botanists who recheck their determinations when taxonomy (essentially, the naming of species) changes.

The standard text, *'Flora of Melbourne'* (SGAP, 1993), contains suburb-by-suburb records of indigenous plant species. These records were used as a guide to the regional rarity of species found in Maroondah. We saw in the field almost all plant species recorded for Maroondah in *'Flora of Melbourne'*, except about ten which are presumed extinct (Section 4.2).

The Flora Information System of the Department of Natural Resources and Environment (NRE) contains records of plants in Maroondah from many sources, but there are many erroneous records. The records served as indicators of locations where unusual species should be sought, but we have not accepted records that we have been unable to verify. The same approach was taken to plant lists in park management plans (e.g. Eastfield Park, Hochkins Ridge Flora Reserve and Cheong Wildflower Sanctuary).

NRE also maintains a computer inventory of fauna records called the Atlas of Victorian Wildlife. This was a major source of fauna records.

Several residents provided species lists of flora or fauna in Maroondah. These were of variable accuracy and reliability, and were treated in the same way as the Flora Information System.

A thorough literature survey was conducted to investigate previous studies' classifications of vegetation communities and habitat types. We found that a large proportion of natural and semi-natural sites in Maroondah defy categorisation according to previous publications such as *'Flora of Melbourne'* (SGAP, 1993) and the *'Melbourne Area District 2 Review Descriptive Report'* of the Land Conservation Council (LCC, 1991). We therefore devised a new categorisation, based on our own knowledge of Maroondah's natural areas and supported by analysis of our flora data from the field survey.

In particular, we have included aquatic environments in our categorisation, whereas other authors have often considered only dry-land or occasionally inundated environments. Aquatic environments are not well characterised by their vegetation alone, so we avoid the usual terms such as 'vegetation types' or 'plant communities', and instead use the term 'habitat types' for all environments in this study.

3.3 Finding potential sites

Potential sites of biological significance were sought throughout the municipality on both public and private land.

Aerial photographs at a scale of 1:2,500 were scrutinised to locate all treed areas larger than a typical house allotment. The list of such sites was combined with the personal knowledge of the authors, Council staff and others to obtain an initial list of about 120 sites which were either known to be significant or warranted inspection.

Several additional sites were detected in the course of the inspections, during which we travelled along probably every road in Maroondah where natural or semi-natural vegetation could be found.

3.4 Field survey

Field work was done mostly between November 1995 and April 1996 by all the authors of this report. Kathryn Patterson, B.Sc.(Hons), assisted with nocturnal surveys.

All our records of plants and animals at each site will be lodged with the Department of Natural Resources and Environment's Arthur Rylah Institute, which is the central repository for such data in Victoria.

3.4.1 Vegetation assessment

Delineation of habitat types

One of the first tasks in assessing each site was to determine boundaries between different types of vegetation or habitat. The different types recognised here are described in Section 4.1, and can be split into two categories dominated by water (stream and wetland environments) and eleven dry-land categories. The dry-land categories correspond closely to vegetation 'societies' as defined by Specht *et al.* (1974) and discussed by Frood and Calder (1987, p.11); i.e. 'A series of climax plant communities which have: (i) the same structural characteristics; (ii) the same species as dominants in the uppermost stratum; and 'the same species prominent in the lower strata'.

In the field, we inspected for surface water and for plant species indicative of a particular habitat type (e.g. certain eucalypt species in most of the dry-land habitat types). The land was traversed to find boundaries (or 'ecotones') between the different habitat types, and these were marked on site plans.

For nearly all sites, a separate list of plant species was compiled for each habitat type within the site. Fauna were often recorded only for the site as a whole, not for each habitat type, since most wildlife moves between different types of habitat.

Detection and recording of plant species

Botanists of the Department of Natural Resources and Environment (NRE) generally survey vegetation intensively within sample plots ('quadrats') of about 30 m × 30 m, and more superficially over the majority of the land (e.g. Gullan *et al.*, 1979). This is a sensible method for the vast areas which they often study, but to do so in the much smaller and patchier sites of this study would result in overlooking a significant proportion of the plants present.

We therefore made a concerted attempt to record all detectable indigenous plant species on each site (with the exception of some private land which could only be inspected from the boundary). Introduced species were recorded with differing degrees of thoroughness depending on the state of the vegetation: Only the most serious weeds were noted on very weedy ground.

Assessment of the condition of the vegetation

Human modification of a natural environment generally causes a reduction in biodiversity (i.e. species and genetic variability) and a shift from native to introduced species. Plants are very good indicators of this process; indigenous plants tend to be replaced by weeds, and the total number of plant species declines.

This process goes through several stages. First, a few indigenous plant species that are sensitive to disturbance disappear, while most other species survive and reproduce. With greater disturbance, the number of lost indigenous species increases and some of the remaining ones struggle to reproduce, typically because their seedlings are out-competed by weeds. A stage may then arise where half or more of the indigenous species die out, leaving only hardy species that can survive against weed invasion and loss of native pollinators and insect eaters. If earthworks or similar activities are conducted, only the hardiest plants are likely to survive (such as isolated remnant trees in gardens), and these generally gradually decline because they cannot reproduce effectively (e.g. tree seedlings being mowed).

Because maintenance of biodiversity is such an important issue nationally and within Maroondah, we have introduced a 'biodiversity condition' scale from A to D based on the position of vegetation in the stages of degradation just described. The ratings are designed to be easily determined in the field, using criteria based on two factors:

- the number of indigenous plant species remaining compared with expectations of a pristine site of the same size and habitat type; and
- the ability of the indigenous species present to survive and reproduce.

The rating criteria are:

Rating A: Contains almost all of the indigenous plant species that one could expect to occur in that type of vegetation (taking into account the size of the site); at least 80% of plant species able to reproduce adequately to maintain their numbers. To aid readability, this is sometimes expressed in the text of Volume 2 as 'excellent biodiversity'.

Rating B: Contains at least half of the indigenous plant species that could be expected, but not reaching rating A due to species loss or reproductive failure. Better management and some revegetation can usually raise the rating to A. This is sometimes expressed in the text of Volume 2 as 'good biodiversity'.

Rating C: Contains less than half of the indigenous plant species that could be expected, but more than about 20%; most of the indigenous plants are likely to be able to reproduce successfully. This is sometimes expressed in the text of Volume 2 as 'fair biodiversity'.

Rating D: Contains less than half of the indigenous plant species that could be expected, frequently less than 20%; reproduction of most of the indigenous plants usually seriously impeded. These sites usually have value only for landscape and hardier wildlife. This is sometimes expressed in the text of Volume 2 as 'poor biodiversity'.

In marginal cases, attention is focused on the plant species that are expected to play the most important ecological role, such as the naturally dominant species in the overstorey and understorey. If the loss of biodiversity is particularly evident among the most ecologically important species, the lower ranking is assigned.

We believe that, while this biodiversity condition scale is based solely on plants, it is a reasonable indicator of fauna habitat (and consequently fauna species), and overall genetic biodiversity.

We also believe that the biodiversity condition rating is a good workable indicator of the value of a site for conservation of biodiversity. Note that it differs from indicators of vegetation 'quality' published elsewhere, for the important reason that we do not downgrade a site solely for the presence of weeds. For example, some sites in Maroondah have relatively high numbers of weeds in a stable coexistence with high numbers of indigenous species (e.g. the Freeway reservation site in Bayswater North - Site 64, Volume 2). The biodiversity condition rating may be 'B' in such a case, despite the weediness, because the indigenous plants are secure. A typical 'vegetation quality' indicator would rate such a site as being of poor quality because the significant proportion of weeds makes it unnatural.

By using the biodiversity condition indicator, we are placing value on conservation of biodiversity, not on naturalness. A site such as the one quoted above may disappoint people who value naturalness very highly, but that is a secondary consideration for the objectives of this report (see also Section 5.1).

For each of the 82 sites described in detail in Volume 2, we have estimated the area of the site in each biodiversity condition rating, within each habitat type.

Quadrats

As well as the plant species list for each habitat type in each site, quadrats measuring 30 m × 30 m were chosen in some sites with a high proportion of indigenous flora. The abundance of each detectable plant species was recorded in each quadrat. This provides data which conforms with NRE practices and hence allows direct comparison between data collected in this study and data collected by others from thousands of quadrats across Victoria.

3.4.2 20-minute bird census

This standard survey method involves walking around as much of a site as possible for 20 minutes and recording the number of individuals of each indigenous and introduced species of bird (Loyn, 1986). Identifications were made from sightings or by recognising distinctive calls.

A 20-minute bird census was undertaken for 29 of the sites described in Volume 2. These sites were chosen mainly because they were large enough and of sufficiently good habitat to justify such a survey. We ensured that the sites surveyed were distributed across the entire municipality, and took in the full range of terrestrial and aquatic habitat types.

Concerted bird surveys started as soon as the study began at the end of November, with the majority being carried out in December and early January. Due to relatively high daily temperatures at this time, most censuses were done in the morning, when bird activity and calling are generally greater than in the afternoon. Incidental bird observations were continued to be recorded throughout the study, up to September.

3.4.3 Spotlighting

Most of the mammal fauna of Maroondah (and Australia more generally) are largely or wholly nocturnal. We used the common night-time survey method of searching on foot for animals with a spotlight. A 12 volt spotlight was used, connected to a car battery carried on the observer's back.

Spotlighting for birds and mammals at various times during the night was undertaken at approximately twenty sites between December and March. Sites of relatively large area and sufficiently natural condition, distributed across the municipality in a variety of habitat types, were selected for spotlighting surveys. Surveys were undertaken by one or two people, each with a hand-held spotlight. Between half an hour and two hours were spent at each site. Still nights were chosen for spotlighting to maximise detection of fauna. All birds and mammals sighted were recorded, along with the starting time and duration of the survey, weather conditions and phase of the moon.

3.4.4 Mammal hair survey

Mammal species can be identified by distinct, microscopic structural features of their hair. A notable exception are rats (i.e. the genus *Rattus*), whose hair is often indistinguishable between indigenous and introduced species. During this study, 50 Faunatech Universal Hair Funnel Traps were placed at 28 sites across the municipality. The plastic hair funnel trap has sticky paper inside to which mammals' hairs adhere when they enter the funnel to investigate the bait. Traps were baited with a mixture of rolled oats, honey and peanut butter. Between one and three traps were used at each site and placed within likely mammal habitat on the ground and in trees.

All traps were set on 12th January and picked up for analysis fourteen days later. A recording sheet was filled out for each trap including trap location, habitat description and results. A sample recording sheet is shown in Figure 3. All hair collected was examined and identified as far as possible by mammal hair expert Barbara Triggs.

3.4.5 Frog call survey

The most convenient way of recording the presence of frogs is to use the distinct 'advertisement calls' of males, which are unique to each frog species. Frog call surveys were undertaken at various times between dusk and 1 am at about thirty sites between December and March. Nights during or soon after good rains were favoured. Typically, between five and ten minutes were spent at each site listening to and noting frog species present. Most sites were visited on more than one occasion.

Wetter sites near creeks, ponds, dams etc. were selected preferentially because all frogs must go to water to reproduce. Wooded sites in drier areas were also surveyed for tree-frogs, with some success.

It should be noted that failure to record certain frogs during the survey does not necessarily indicate their absence in Maroondah. Some species, e.g. Southern Toadlet (*Pseudophryne semimarmorata*), may not have been calling during the survey period. Some frog species call at different times of night and not necessarily every single night, and thus it is possible that one or more frog species were present but silent during our surveys.

Figure 3. Sample hair-funnel recording sheet

Maroondah Biological Study

Hair Funnel Recording Sheet

Funnel No. 5

12-26th. Jan. 1996

Location details

Croydon Hills - eastern slope of Narr Maen Creek valley
in the Gooden's property, ca. quarter of the way up the slope.

Klaugs xenica

Habitat description

Tree layer

dominant species: *E. poliothecus*, *E. macro*, *E. gorio* (*E. rubida*, *E. nelli*)

height: 15m

projected foliage cover %: 40.7%

Shrub layer

dominant species: *Exocarpus cupress*

projected foliage cover %: 30-40%

Ground layer

dominant plant group (e.g. native sedge, intro. grass): native grass - *Microstachys* & *Loma* long.

projected foliage cover %: 95%

Results

Hairs of *Brachyotus* - *Isotomus* sp., prob *T. vespertina*

skink

harvestman

insect & plant material

3.4.6 Incidental records

Throughout the study, we noted any occurrences of flora and fauna that were not recorded in the formal surveys for vegetation, birds, mammals and frogs as described above (3.4.1 - 3.4.5). These extra observations include our own incidental records of fauna observed during site inspections in the following categories: birds, mammals, frogs, reptiles and butterflies.

After completion of a 20-minute bird census, the observer continued to record bird species present while still at the site. These observations were included on the *Atlas of Victorian Wildlife* recording sheets following the 20-minute records, with a clear indication of the end of the 20-minute census so that we could keep a tally of how many native and introduced birds were seen within the standard sampling period.

Also incorporated into the site descriptions in Volume 2 are any additional flora and fauna records made by the authors prior to this study.

3.5 Significance ratings

The biological significance of sites, habitat types and species has been assessed according to standard criteria developed by the Australian Heritage Commission, as adapted for biological values by the Department of Natural Resources (Department Conservation and Natural Resources, 1990). The criteria fall under the following headings:

1. *Ecological integrity and viability*: the importance of a site as an exceptionally intact example of its type, or in critical habitat requirements (e.g. breeding sites) at the regional scale or wider;
2. *Richness and diversity*: for places with exceptionally large numbers of species, families, vegetation types etc.;
3. *Rarity*: the importance in conserving species or habitat types that are rare or threatened in the broad sense of these terms;
4. *Representative of a type*: the importance of a particular site or population in demonstrating the principal characteristics or variability of the habitat type or species involved – e.g. showing the features of a habitat type at the limits of its tolerance, or occurring in particularly unusual circumstances); and
5. *Scientific and educational value*: the importance of a site or species in contributing to wider understanding of natural history, by virtue of its use for research, an educational resource, a reference site, a fossil site, etc.

The biodiversity condition rating (Section 3.4.1) is used here as a major determinant of the first two criteria. Rarity within Maroondah is determined from the data gathered in this study, while rarity at broader scales is determined by reference to literature.

The criteria must be considered against different geographical scales; e.g. Is it rare throughout Australia, or just Victoria? This should be done for each of the relevant criteria. The significance is then quoted as the largest geographical scale in which the subject excels by any one of the criteria. For example, a species or site is quoted as biologically significant at the State level if it excels by at least one of the criteria (most commonly rarity) on a state-wide scale, but not from a national perspective.

In this study we have used the following geographical scales for significance assessments:

- National
- State
- Regional
- Municipal
- Local.

Local scale refers to an area with a radius of approximately one kilometre. Municipal scale is a newly devised scale for this study, and refers to the whole of Maroondah. The Municipal scale was created because we aim to guide planning and management on this scale. The Regional scale is taken here to refer to the region used in the standard text, *Flora of Melbourne* (SGAP, 1993), whose boundary passes through Langwarrin, the Dandenong Ranges, Coldstream, Hurstbridge, Craigieburn, Sunbury and the Werribee River.

In a few marginal cases, we have prefixed one of the scales above with 'Low' or 'High' when assigning a significance rating, to indicate that the subject is on the threshold of falling into the next category.

Note that the terms ‘local significance’ and ‘regional significance’ have been used in other biological reports with a range of (sometimes unspecified) geographical scales in mind. This could lead to confusion. For example, a species which is rare in the metropolitan area is sometimes said to be regionally significant, while in the context of the Land Conservation Council reports, it may be said to be not regionally significant if it is more common somewhere in the much larger region defined by that organisation.

Perhaps the most likely source of confusion is that some biological reports use the term ‘local significance’ for a geographical area about as large as the whole of Maroondah. The reader should keep this in mind when comparing different reports.

Significance ratings can be applied to habitat types, sites and species. Every site assessed in the study has been given a biological significance rating, and so has one individual habitat type, namely ‘Herb-rich Plains Grassy Wetland’ (Section 4.1), whose special status is recognised under the *Flora and Fauna Guarantee Act 1988* (nomination number 365). This listing recognises the habitat type’s status as a rare and acutely threatened habitat type state-wide, which we translate to a ranking of State biological significance.

In a few cases, the significance of a site derives overwhelmingly from the presence of a rare habitat type or one or two particularly significant species of plants. We have followed the convention that the significance of a site is never more than one level below that of the most significant species or habitat type for which the site provides viable refuge. For example, a site providing viable habitat for a regionally significant species of flora or fauna is significant at least at the Municipal level.

Note that some indigenous plant species that are locally fairly abundant in Maroondah are nevertheless regionally significant because they are much less common elsewhere in the region. An example is White Stringybark, which is common in forests on the Wicklow Hills Ridge but extremely rare in the rest of the region. Maroondah should not be lulled into complacency about such species just because they are not locally rare; Maroondah is the custodian of these species for the whole region.

4. Survey results

4.1 Habitat types

We have identified thirteen distinct habitat types within Maroondah. We believe that each of these needs to be separately identified for the purposes of assessing conservation status and for making site-specific recommendations of plant species to be used in revegetation projects. A description of the features of each habitat type follows.

HABITAT TYPES - A SUMMARY

1. Wetlands: Aquatic and frequently inundated habitats. Includes abundant rushes, and usually Water Plantain and Slender Knotweed. Water may be still or flowing.
2. ‘Herb-rich Plains Grassy Wetland’, which is the same as the ‘Herb-rich Grassy Wetland (West Gippsland) Community’ recognised under the Flora and Fauna Guarantee Act. This habitat type embraces elements of Types 1, 3 and 5. It is distinguished by abundant Soft Twig-rushes (*Baumea arthropphylla* and sometimes *B. rubiginosa*), with at least some of the following: Golden Spray (*Viminaria juncea*), Water Ribbons (mostly *Triglochin alcockiae*), Prickfoot (*Eryngium vesiculosum*), Shining Buttercup (*Ranunculus glabrifolius*), Hooker’s Fescue (*Austrofestuca hookeriana*) and swamp wallaby-grasses (mainly *Amphibromus archeri*). Swamp Gums may form a patchy or sparse canopy.
3. Swamp Scrub, dominated by Swamp Paperbark or Prickly Tea-tree. This type grows in association with any of the next three habitat types, and often results from natural regeneration after clearing.
4. Manna Gum riparian forest beside perennial streams. (‘Riparian’ means on the banks of streams).

5. Swamp Gum forest, occurring on poorly drained alluvium, often with Swamp Paperbarks present. Two variants: (a) drainage lines in hilly country, and (b) flats (the latter being more consistently wet).
6. Silver-leafed Stringybark forest on poorly drained alluvium, sometimes with Narrow-leafed Peppermints. This habitat type forms a matrix with Types 1-5 (especially 5) on the alluvial flats of Maroondah's main creeks.
7. Messmate Subriparian Forest. On slopes adjacent to perennial streams, dominated by Messmate Stringybark with scattered Red Stringybark, Bundy, Silver-leafed Stringybark, Narrow-leafed Peppermint, Manna Gum and (on wetter sites) Swamp Gum. Purple-sheath Tussock-grass (*Poa ensiformis*) and Tree Everlasting are abundant, and Victorian Christmas Bush is commonly present.
8. Mixed eucalypt forest of Silver-leafed Stringybark, Messmate Stringybark and Narrow-leafed Peppermint forest, from lower slopes to less exposed high ground in undulating terrain. This type sometimes intergrades with Type 13 in the Loughnan-Warranwood Ridge biogeographical zone, or type 9 on undulating terrain.
9. Mixed eucalypt forest of Messmate Stringybark, Red Stringybark and Bundy, with Peppermint and sometimes Yellow Box on deeper soil, White Stringybark on the Wicklow Hills Ridge, or Red Box on the Loughnan-Warranwood Ridge (and then becoming intermediate with Habitat Type 13).
10. Messmate and Peppermint forest (in various proportions) on either south-facing slopes or poorly drained non-alluvial soil.
11. Yellow Box - Candlebark Forest. Dominated by either or both of these trees, often also with Narrow-leafed Peppermint and sometimes with Red Box, on well-drained, more fertile soils.
12. Peppermint and Bundy Woodland: Found adjacent to the previous community, in similar conditions.
13. Box-Stringybark Woodland: Red Stringybark with Red Box and/or Bundy on dry, stony soils, sometimes with Yellow Box on deeper soil, or with Candlebark.

The brief descriptions above are adequate for the categorisation of most natural habitats in Maroondah by someone able to recognise the plant species mentioned. There are some exceptions where the original overstorey has been destroyed or where there is an isolated remnant comprising only the zone of overlap (or 'ecotone') between two or more habitat types. In the site descriptions of Volume 2, areas whose characteristics are intermediate between two habitat types (say, types 5 and 6) are shown as 5/6, and so on.

Note that the features listed above are very useful for identification but may not be the most ecologically important ones. It needs to be kept in mind that some of the most critical components of a habitat type, such as the soil fungi which most plants rely on, are very poorly known to science. For this reason, every habitat type should be regarded as important for the possibility of important features which are yet unknown.

The areas of each habitat type have been estimated or calculated for each of the 82 sites described in detail in Volume 2. These figures have been further broken down into areas at each level of biodiversity condition (categories A to D, Section 3.4.1). The figures for each site are given in Volume 2, and aggregates over all 82 sites, is tabulated in Table 1.

Clearly, Habitat Types 11 and 12 are the rarest, and are also the most degraded (i.e. with a strong bias toward the lower biodiversity ratings). They are also scarce and generally degraded in their range outside Maroondah, which we believe to extend from roughly Templestowe eastward to Chirnside Park. However, Habitat Type 2 (Herb-rich Grassy Wetland, which is recognised under the *Flora and Fauna Guarantee Act 1988*) is the rarest in the broader perspective, having been known previously at a total of 70 ha throughout its range (according to nomination number 365 under the Act).

To translate the number of hectares in the table to a percentage of Maroondah's total area, divide by 61. For example, the total area with vegetation having excellent or good biodiversity is $(47.8+51.5) \div 61 = 1.68\%$.

Table 1. Hectares of Maroondah with different habitat types, subdivided according to biodiversity condition.

Habitat Type	No. Sites	Biodiversity Condition				
		A (excellent)	B (good)	C (fair)	D (poor)	Total, A-D
1	34	0.3	0.1	6.0	5.9	12.2
2	2	2.7	2.5	1.1	1.0	7.3
3	6	0.8	0.5	1.2	0.4	2.9
4	10	0.0	0.3	1.0	4.0	5.3
5	45	5.2	3.2	16.1	26.0	50.4
6	17	6.7	1.1	3.9	2.3	14.0
7	8	0.6	1.7	1.3	1.3	4.9
8	24	5.0	5.1	4.5	9.7	24.4
9	44	7.9	25.1	37.9	35.6	106.5
10	4	2.5	0.7	0.7	0.9	4.8
11	9	0.0	1.2	2.3	1.8	5.4
12	4	0.0	0.5	2.8	0.7	4.0
13	17	16.1	9.5	10.0	20.5	56.2
Total:		47.8	51.5	88.8	110.1	298.3

4.2 Plant species

Appendix A contains a table of Maroondah's 432 reliably recorded indigenous plant species, along with about ten hybrids, subspecies and varieties. Less significant hybrids, such as the many which occur among eucalypts, are omitted. A few of the listed species were not seen during this study, and they are marked in the table, as are species presumed extinct. About ten species can be presumed (to scientific standards) to have become locally extinct, and several other species are probably locally extinct but have not been adequately investigated to meet the scientific criteria. There are about a dozen unlisted species which we believe are probably present in Maroondah but undetected (despite our data base of over 16,000 records, one for each plant at each site). We therefore estimate that there are just over 400 indigenous plant species presently occurring in Maroondah.

Appendix A includes a column showing the number of sites in Maroondah at which each species is found, and (where appropriate) an annotation to show that the presence of the species at a site within Maroondah is significant at the Municipal, Regional, State or National level.

Fifteen of the plant species reliably recorded for Maroondah are rare or threatened at the State or National level: twelve of them listed as such by the Department of Natural Resources and Environment (NRE), three (*Calochilus imberbis*, *Diuris ×palachila* and *Pterostylis ×ingens*) listed as rare in Victoria by Backhouse and Jeanes (1995), and a recently discovered orchid (*Caladenia* sp. aff. *venusta*) not yet listed by NRE.

Two additional names in Appendix A (*Prasophyllum pyriforme* and *Lomandra longifolia* subsp. *exilis*) are listed by the Department of Natural Resources and Environment as rare or threatened, but their status is confused by different interpretations of which plants these names should apply to. The *Prasophyllum* is regarded by Backhouse and Jeanes (1995) as 'widespread and locally common' and secure in Victoria, whereas the same name is listed as endangered nationally by the Department because of the Department's different concept of the plants to which that name applies. Similarly, the *Lomandra* is widespread and secure in Maroondah and eastern Victoria generally, according to the National Herbarium of Victoria's concept of that plant, while the Department lists it as rare in Victoria because of a much narrower concept of the plants included under that name. This study's taxonomy follows the National Herbarium of Victoria, and on that basis the two names mentioned above are not regarded as rare or threatened state-wide.

Rare and threatened plant species are officially categorised as follows (ANZECC, 1993; NRE):

X- Presumed Extinct: not definitely located for fifty years despite thorough searching, or else all known habitats have been destroyed more recently;

E- Endangered: in danger of extinction within twenty years, or suspected to be extinct but not meeting the criteria for category X;

V- Vulnerable: likely to soon move into category E unless current threats are stopped;

R- Rare: rare, but not otherwise at risk;

S- Poorly known: suspected (but not definitely known) to fall into a category above.

Table 2 lists Maroondah's plants that fall into the above criteria at the State or National level. The status in Maroondah has been assigned by Dr Lorimer, as have all status levels for *Caladenia* aff. *venusta*.

Table 2. Plants of Maroondah that are Rare and Threatened State-wide or Nationally

Scientific Name	Common Name	National Status	Victorian Status	Status in Maroondah
<i>Bracteantha</i> sp. aff. <i>subundulata</i>	Swamp Everlasting		V	E
<i>Burnettia cuneata</i>	Lizard Orchid	R	R	X
<i>Caladenia flavovirens</i>	Summer Spider-orchid		R	X
<i>Caladenia lindleyana</i>	Lindley's Spider-orchid		R	E
<i>Caladenia</i> aff. <i>venusta</i> (Kilsyth South)	Kilsyth Sth. Spider-orchid	E	E	E
<i>Calochilus imberbis</i>	Naked Beard-orchid		R	X
<i>Danthonia procera</i>	Tall Wallaby-grass		K	V
<i>Diuris behrii</i>	Golden Cowslips		V	V
<i>Diuris</i> × <i>palachila</i>	Broad-tip Diuris		R	X
<i>Diuris punctata</i>	Purple Diuris		V	E
<i>Euprasia collina</i> subsp. <i>trichocalycina</i>	Purple Eyebright		R	X
<i>Prasophyllum lindleyanum</i>	Green Leek-orchid		V	X
<i>Pterostylis grandiflora</i>	Cobra Greenhood		R	X
<i>Pterostylis</i> × <i>ingens</i>	Sharp Greenhood		R	E
<i>Spirodela punctata</i>	Thin Duckweed		V	E

Species listed as regionally significant by Beauglehole (1983) are listed as regionally significant in Appendix A, as are species that are recorded in *Flora of Melbourne* at less than about six extant locations (after discounting records of non-viable populations). Species not detected in either of those studies are also taken to be regionally significant (except where this results solely from a change in taxonomy since the dates of publication).

Species are regarded as significant at the Municipal level if they are not known from more than three or four locations in Maroondah at which they could be reasonably expected to survive more than one or two decades without the implementation of conservation measures.

Assigning a level of significance to species defies any simple numerical rule, and a degree of professional judgement has to be applied in many cases. One complication is the duration and level of thoroughness of the search for the species. For example, the Austral Carrot (*Daucus glochidiatus*) is an annual plant whose numbers are expected to vary greatly from year to year, and a much longer survey than this might detect more than the two presently known populations in Maroondah. Of course we sought historical records of any such species, but records of Austral Carrot and similar species are scarce because of the plants' inconspicuousness.

Another complication in assessing a species' significance is the need to take into account its population numbers and reproductive biology. For example, Elderberry Panax (*Polyscias sambucifolia*) occurs at thirteen sites in Maroondah, which might look superficially as though it is secure. However, all (or almost all) populations contain only one individual. Although the plants can be long-lived and spread by suckering, their isolation means they are not reproducing properly and their long-term future is very insecure. Silver Banksia and several other species are in a similar situation.

Population dynamics are particularly important factors to consider in assessing the significance of orchids. Many species appear only after fire, or in a good year. This makes their detection in a one-year study like this very difficult. Also, in many cases, the fire which is required to stimulate an orchid's reproduction will probably never

come, now that Maroondah is so urbanised. The specialised pollinating insects are probably also in serious decline, and the increasing distances between the remaining plants may be too great for the insects to cover. The net result is that orchids generally are in serious decline around Melbourne (Backhouse and Jeanes 1995) and very few orchid species in Maroondah can be regarded as secure.

One is immediately struck by the large proportion of plant species in Appendix A that are listed as significant at the Municipal level or above – almost three-quarters of the total. Most of these species are present at very few sites, and many have only critically small populations. This is not a natural situation: it is a clear indication that Maroondah faces massive loss of plant species in the next decade or two, unless special action is taken.

The description of each of Sites 1-82 in Volume 2 includes a list of the site's plant species which are significant at the Municipal level or higher.

In addition to the seven species listed above as presumed extinct in Maroondah, our survey shows that there are at least several other species extinct from Maroondah but not regarded as rare or threatened at the State or National scale. Many more species are threatened with local extinction in the next decade, and several species are likely to have become extinct in the past few years.

Orchids represent a very high proportion of plant species that are extinct, rare or threatened in Maroondah. As well as the eleven species in Table 2, they include *Caladenia clavigera*, *C. phaeoclavia*, *C. pusilla*, *C. tentaculata*, *Cryptostylis leptochila*, *Microtis atrata*, *M. rara*, *Pterostylis* aff. *rufa*, *P. furcata*, *P. plumosa* and *Thelymitra luteocilium*. The past presence of nearly all of these is validated by specimens at the National Herbarium of Victoria. Only two (*Caladenia phaeoclavia* and *P. aff. rufa*) have been reliably recorded in recent decades.

Environmental weeds are a major cause of loss of indigenous plant species (not to mention fauna). A table of environmental weed species in Maroondah appears in Appendix B. Plants have been categorised as environmental weeds if they are listed as such by Carr *et al.* (1992a), or (in very few other cases) if they are manifestly affecting the natural environment. There is a column to show the severity of each species in a state-wide context (as per Carr *et al.*) and in a municipal context (using our informed judgement). Some weed species are less serious in Maroondah than in other parts of the state, and so our municipal ranking is lower than that of Carr *et al.* A few weed species are more serious than realised by Carr *et al.*; for example, it was thought in 1992 that the only infestation in Victoria of Square-stem St John's Wort (*Hypericum tetrapterum*) was in Yellingbo, but Dr Lorimer has since discovered several other outbreaks, including in Maroondah along Jumping Creek, Waranwood and Bungalook Creek, Bayswater North.

4.3 Bird species

Eighty-nine species of birds (80 indigenous, 9 introduced) were recorded first-hand during the study. An additional 38 species (37 indigenous, 1 introduced) recorded in Maroondah by the authors outside the study period, or received from other sources (as per Section 3.2) are accepted as sufficiently likely and contemporary to be included. In total, 127 bird species (117 indigenous, 10 introduced) are included on the bird list in Appendix C. Bird species accepted from other sources are annotated.

A summary of species recorded in grid squares that include any part of Maroondah has been extracted from the *Atlas of Victorian Wildlife* database. This list has been the major source of additional bird species not recorded by the authors. However, not all species on the *Atlas of Victorian Wildlife* list have been accepted for the extended Maroondah list for this study. The Swift Parrot and Regent Honeyeater records are known to have been located just outside Maroondah and are therefore omitted here. Another 31 species on the *Atlas of Victorian Wildlife* list have been omitted because we consider they are of doubtful contemporary occurrence in Maroondah, and at least some of these probably never occurred inside the municipality.

Maroondah is essentially an urban area with extremely fragmented remnant habitat (see Section 5.2.2 and the key map on p.5 of Volume 2), and we regard nearly all indigenous bird species recorded in the municipality as being biologically significant at the municipal level. The exceptions are a few hardy, urbanised species such as Australian Magpie, Little Raven and Red Wattlebird.

The Land Conservation Council's *Melbourne Area District 2 Review Descriptive Report* (LCC, 1991) provides a regional context for bird species recorded from Maroondah. Twenty species regarded by the Land Conservation Council as uncommon and two as rare in the Melbourne area are annotated in Appendix C.

Four bird species recorded here have not previously been recorded by the *Atlas of Victorian Wildlife* for the relevant grid squares. They are the Royal Spoonbill, Australian Shelduck, Black-winged Stilt and Olive Whistler.

Anecdotal evidence suggests that some Maroondah bird species have become less frequent in the municipality in the last 15 years. This is likely to be a continuation of a trend that would have progressed throughout the history of rural and urban development. Loss of remnant vegetation (Section 5.2.1) and the severing of habitat corridor links between bushland sites (Section 5.2.2) are likely to be exacerbating this trend.

4.4 Mammal Species

Nine species of mammals (six indigenous, three introduced) were positively recorded first-hand during this study: Short-beaked Echidna, Common Brushtail Possum, Common Ringtail Possum, Black Wallaby, White-striped Freetail Bat, Water Rat, European Rabbit, House Mouse and Red Fox. An additional 16 species (13 indigenous, 3 introduced) recorded in Maroondah by the authors outside the study period, or accepted from other sources (see Section 3.4.6) are included as well. In total, 25 mammal species (19 indigenous, 6 introduced) are included in the mammal list in Appendix D. Southern Brown Bandicoots were common in the south-eastern corner of Maroondah until the 1980s, but are now presumed to have been killed out by pets.

We regard every indigenous mammal species recorded in Maroondah as being biologically significant at the municipal level, with the exceptions of the Common Brushtail Possum and Common Ringtail Possum, which are extremely adaptable to the urban environment.

As with birds, the Land Conservation Council's *Melbourne Area District 2 Review Descriptive Report* (LCC, 1991) provides a regional context for mammal species recorded from Maroondah. Three species regarded by the Land Conservation Council as uncommon and one as rare in the Melbourne area are annotated in Appendix D.

One mammal species on the Maroondah list, the Water Rat, was seen by the authors in Mullum Mullum Creek in Ringwood, and has not been previously recorded by the *Atlas of Victorian Wildlife* for Maroondah or its surrounds.

Both nationally and locally, mammals are the most threatened group of animals. In Maroondah, the Koala, Swamp Wallaby and Echidna are all endangered with extinction within ten years or so, based on the sightings we are aware of, the habitat we have found for these animals, and the attacks by dogs which we have witnessed and been told about.

4.5 Frog species

Using the method outlined in 3.4.5, seven species of indigenous frogs were recorded first-hand during the study: Southern Brown Tree Frog, Whistling Tree Frog, Peron's Tree Frog, Victorian Smooth Froglet, Southern Bullfrog (or Pobblebonk Frog), Spotted Marsh Frog, and Common Froglet. In addition, Southern Toadlet has been accepted from the *Atlas of Victorian Wildlife* as being likely to occur in Maroondah, and Carr *et al.* (1992b) reported the Striped Marsh-frog at Bungalook Conservation Reserves in Kilsyth South. The list of Maroondah frog species appears in Appendix E.

Intense urbanisation has led to severely depleted frog habitat in Maroondah, causing us to rate the seven frog species listed for the municipality as being biologically significant at the municipal level. None of the frog species recorded in Maroondah are considered uncommon or rare at the regional level (LCC, 1991).

4.6 Butterfly species

A survey of insects and other invertebrates was outside the scope of this report. However, because butterflies are conspicuous and relatively easy to identify, they were recorded incidentally during the survey work. Butterflies are also popular and mostly easy to identify, so they provided a good opportunity for the general public to contribute to the survey and learn from the experience.

Thirty species of butterflies, skippers and darts (twenty-nine indigenous, one introduced) were observed (Appendix F). Other skippers are likely to be present, but cannot be identified without killing them (which was not done in this study).

The rarest of the butterflies recorded is the Chaostola Skipper, collected at Harper's Bush in Heathmont by entomologist John Burns probably in the 1960s (Paget 1985). It is rare at least regionally and perhaps at the national level as well.

The lack of thorough comparative studies of butterfly species in Melbourne make it difficult to rate the biological significance of other butterfly species. However, because of the dependence of most butterfly larvae on specific indigenous food plants, habitat fragmentation in Maroondah (Section 5.2.2) leads us to suggest that most butterfly species are biologically significant at least at the municipal level. Possible exceptions are adaptable species such as the Common Grass Blue and Common Brown, whose larvae have been able to use introduced food plants, thus increasing their survival prospects in urban areas.

Most Maroondah butterfly species would now find their larval food plants confined to small isolated pockets of remnant vegetation. A prime example is the Sword-grass Brown butterfly, now an uncommon or rare species in Maroondah due to depletion of its favoured larval food plant, the Red-fruit Saw-sedge (*Gahnia radula*).

4.7 Reptile species

The Blotched Blue-tongued Lizard was observed in this study, and the Common Blue-tongued Lizard was reported by Yugovic *et al.* (1990) and the Atlas of Victorian Wildlife. The majority of skinks sighted in this study were not identified to species level. We found dead specimens of the two common skink species, Southern Water Skink (*Sphenomorphus tympanum*) and Garden Skink (*Lampropholis guichenoti*). Yugovic *et al.* found a Delicate Skink (*Lampropholis delicata*), and the Weasel Skink (*Saproscincus mustelinus*) has been observed by Mr Steve Malcolm (local reptile enthusiast) in Ringwood and by Carr *et al.* (1992b) in Kilsyth South. McCoy's Skink (*Nannoscincus maccayi*) was also reported by Carr *et al.* (1992b).

A single snake was observed but not identified; however there are reliable records of the White-lipped Snake and the Lowland Copperhead. A single tortoise was sighted during the current study (Common Long-necked Tortoise), and numerous records of tortoise sightings were supplied by local children.

The Atlas of Victorian Wildlife, and the concerted reptile study by Yugovic *et al.*, record no more species of reptiles than those listed above. It is likely that there are more reptile species within Maroondah, and a detailed survey aimed specifically at detecting reptiles would be required to confirm this. It seems clear that Maroondah's reptile fauna is not very diverse by Australian standards.

4.8 Sites

Volume 2 includes detailed descriptions and maps of 82 sites of biological significance recommended for listing in the Maroondah Planning Scheme (Section 0), and brief information about an additional 50 sites which are of Local biological significance but not recommended for listing.

The former sites (numbers 1-82) are shown on a key map on p.5 of Volume 2, which shows the distribution and size of Maroondah's most biologically significant areas. (However, note that size can sometimes be misleading, as in the case of golf courses which are large overall but have proportionally little natural habitat due to fragmentation by fairways, greens and driving ranges). The 50 other sites (numbers 83-132) are all either small or very patchy, and collectively contain much less natural and semi-natural habitat than Sites 1-82.

Table 1 in Section 4.1 gave a summary of the distribution and total areas of the various habitat types in Sites 1-82. It can be inferred from the table that:

- the total area with vegetation having excellent biodiversity is 0.8% of Maroondah's total area;
- the total area with vegetation having excellent or good biodiversity represents 1.6%;
- the total area with vegetation having at least fair biodiversity represents 3.1%; and

- the total area of vegetation in any of the conditions A-D (even with just a few indigenous species that are not able to reproduce) represents 4.9% of Maroondah.

Because Sites 1-82 represent the overwhelming majority of native vegetation in Maroondah, the percentages above would be almost the same if statistics were calculated for all of Maroondah's native vegetation, not just Sites 1-82. (Native vegetation in this context means naturally occurring plants such as trees, shrubs, wildflowers and grasses, but not if planted and not weeds).

The majority of the native vegetation in Sites 1-82 (and in Maroondah overall) occurs on public land. The largest areas on private land are the Rudolf Steiner School in Warranwood (Site 8), Maroondah's two Environmental Living Zones (Sites 16 and 37), and the neighbourhood of Cloverlea and Tereddin Drives in Kilsyth South (Site 67). The last of these contains the only habitat of State significance on private land in Maroondah (totalling approximately 4 ha, all in biodiversity condition A).

The vast majority of the 82 sites described in detail in Volume 2 contain at least one indigenous plant or animal which is rare or threatened in Maroondah. This highlights a very important point:

Most of Sites 1-82 contain plant and/or animal species that are rare or threatened in Maroondah. In the case of about three-quarters of these eighty-two sites, the loss of the site would either render a species extinct from Maroondah (or more widely), or leave it at great risk of becoming so.

(By 'great risk', we mean that the species would remain at only one or two other sites, usually with small and insecure populations).

Maroondah is therefore at the stage where many indigenous species of flora and fauna are poorly conserved and threatened with local extinction. Some local extinctions seem inevitable unless the present rate of loss of native vegetation (Section 5.2.3) is curtailed.

A few of Sites 83 to 132 also contain plants that are locally threatened, but these sites would be adequately protected by basic measures that ought to apply throughout the municipality as recommended in Section 5.3.

5. Management of significant sites, flora and fauna

5.1 Objectives

The purpose of this section is to identify and justify recommended actions aimed at achieving two general objectives:

- conserving biodiversity, and
- serving the expectations and wishes of community and Council for what natural areas should provide.

The importance of conserving biodiversity was discussed in Section 1.3 and our adoption of biodiversity conservation as a primary objective is consistent with the Federal Government's National Biodiversity Strategy (DEST, 1996) and the National State of the Environment Report (Alexander and Taylor, 1996). The other objective above is discussed in the next subsection.

5.1.1 Serving the community's expectations

From our attendance at the Maroondah *Festival of the Foothills* and at meetings of the umbrella group of 'Friends groups', *Maroondah Bushlinks*, it was clear that nature-minded residents have the following goals, expectations and wishes for what Maroondah's natural areas provide them:

- contact with nature, peace, enjoyment, beauty and a sense of one's place in the world;
- somewhere to exercise (walk, run, cycle etc.) among indigenous birds, animals and wildflowers;
- an opportunity to learn about native flora and fauna;
- a link with the past, before urbanisation;
- an opportunity to observe rare flora and fauna, such as the thrill of seeing a Koala or Echidna;
- a consistent, treed landscape providing a sense of local identity integrated with nature; and

- a local contribution to conservation of Australia's unique flora and fauna.

In the cases of the first three or four items above, people frequently indicated that they wanted somewhere with these features within easy walking distance of their home (say, a few hundred metres). These sites in their neighbourhood are for daily or weekly enjoyment, and a site which is biologically significant at the Local level would suffice for most people. People generally indicated that they also made use of sites with higher biological significance within Maroondah, which they visited by vehicle less frequently than weekly.

As found in the Maroondah Open Space Strategy (1996), residents of Ringwood and Kilsyth South are particularly keen to have more bushland areas in their neighbourhood. This confirms our observation that many people want to enjoy nature within walking distance, and feel dissatisfied if that is not possible.

One of the goals of the recommendations below is therefore to conserve and nurture bushland of all levels of significance so that bushland is available to the maximum number of residents within an easy walk from their homes. This also supports the popular desire for treed local landscapes.

Another goal is to place particular attention on the top few biologically significant sites so that residents can experience the best of natural values (e.g. seeing rare birds in abundance) within a few kilometres of their homes.

The other desires and expectations listed are automatically satisfied if Maroondah's bushland is managed to conserve its biodiversity.

5.1.2 Balancing conflicting interests

Unfortunately, the objectives discussed above sometimes conflict with the wishes of individuals or interest groups.

The most important conflict is between the community desire for a treed landscape with native wildlife, and the wish of some individuals or families to remove vegetation for various reasons. This conflict is particularly apparent in the case of some land developers who contend (against the evidence) that their developments are more attractive to prospective purchasers if the blocks are completely bare.

Another major conflict occurs between pet owners and the interests of flora, fauna and nature lovers. For example, many people bring dogs by car to Bungalook Conservation Reserves for exercising or even for hunting practice, which seriously impairs the site's suitability for wildlife and people who wish to see it.

It is Council's job to balance the wishes of individuals against the values discussed above. Sections 5.2 and 5.3 are intended to guide Council to support the values above while leaving the opportunity to respond to the individuals on a case by case basis.

5.2 Issues

This section discusses environmental problems that threaten native flora, fauna and sites of biological significance in Maroondah. Specific, numbered recommendations arising from these issues are listed in section 5.3. Where a recommendation relates specifically to an issue identified in this Section, the recommendation's number is given in square brackets, e.g. '[R23]'. Each recommendation is given a suggested level of importance (high, medium, low) and urgency (short, medium and long time frames, corresponding to weeks, months and a year or more).

5.2.1 The role of private land

As the National Strategy for the Conservation of Australia's Biological Diversity (DEST, 1996) says, 'Australia's biological diversity and the threats to it extend across tenure and administrative boundaries. ... The conservation of biological diversity is best achieved in-situ and requires integrated and consistent approaches across freehold and leasehold and other Crown lands'.

Maroondah has many bushland reserves, mostly owned by Council and managed well. However well the reserves are managed, this is not enough to conserve the municipality's biodiversity. Many plant species are only found on private land, and the majority of wildlife, including those in reserves, rely at least partly on private land. Some private citizens have demonstrated an ability to convert degraded land to prime habitat, and some people have done so inadvertently (e.g. the excellent wetland which arose from the abandonment of the old horse pond on the

de Felice land, Site 72 in Volume 2). Alternatively, and more commonly, citizens diminish the amount of wildlife and habitat either directly through acts such as vegetation destruction or indirectly through such things as irresponsible pet ownership or dumping of garden refuse in nearby bush. It is therefore important for Council not to rely on reserves for nature conservation, but to seriously address issues of private land such as vegetation removal.

The National Strategy for the Conservation of Australia's Biological Diversity (DEST, 1996) recommends and lists measures to 'ensure that adequate, efficient and cost effective incentives exist to conserve biological diversity. These would include the use of appropriate market instruments and appropriate economic adjustments for owners and managers, such as fair adjustment measures for those whose property rights are affected when areas of significance to biological diversity are threatened'. The measures include cost reimbursements and rate rebates to encourage people to improve conservation of native vegetation. This statement from the Federal Government suggests that financial support may be available to Council for such measures.

A group of land managers whose activities are particularly important for biodiversity and nature conservation in Maroondah are four golf facilities: Croydon Golf Club, Croydon Public Golf Course, Heathmont Golf Park and Eastfield Golf Club. Each of these is a site of biological significance. The Australian Golf Union and the Australian Turfgrass Research Institute (ATRI) are jointly developing an Environmental Strategy for Australian Golf Courses (ESAGC) to provide practical guidelines on environmental issues related to golf courses. (Refer to Susan Wyndham at ATRI, Ph. (02) 9736-1233). The strategy is intended to guide golf courses toward environmental management plans, which we believe have the potential to improve the security, viability and habitat value of these significant sites. Environmental management plans should be encouraged by Council, and would also provide a promotional opportunity for course management. [R97]

5.2.2 Habitat fragmentation

The distribution across the municipality of the 82 sites shown on the key map of Volume 2, p.5 illustrates the fragmented nature of remnant vegetation in Maroondah. Some sites are linked, often tenuously, by habitat corridors along creeks, roads and railway lines. Others sites are isolated by urban or industrial development.

A typical example of fragmentation is occurring around Sites 3 and 4 of this study, near the northern end of Glenvale Rd, Ringwood. The native vegetation there has Regional biological significance and is linked to bushland in the neighbouring City of Manningham. However, current urban development on both sides of the municipal boundary is fragmenting the bushland and reducing the viability of sites of biological significance.

Comparative studies of birds over time suggest that some species are declining in Maroondah as links between sites break down. John Reid's observations since 1978 in the Dandenong Valley section of the municipality suggest that some migratory and nomadic bird species have become less frequent in the last seventeen years. A number of species, including Pallid Cuckoo, Fan-tailed Cuckoo, Shining Bronze-Cuckoo, Golden Whistler, Rufous Whistler, and Olive-backed Oriole, appear to be declining in this area. A likely explanation is that sites which were formerly visited by these species on a regular seasonal basis are now too isolated from each other and from major habitat corridors.

This explanation is supported by Baker (1989) who describes a comparative study of bird species of Blackburn Lake (completely isolated from other bushland), and the Mullum Mullum bushland in Mitcham (connected to the Yarra River at Warrandyte by a corridor of vegetation along Mullum Mullum Creek). Baker states that both sites are of similar size and geographic location and considers both to offer similar habitat. Of the 100 or so indigenous bird species residing in or regularly visiting the Mullum Mullum bushland, 28 were absent or in significantly lower numbers at the ecologically isolated site of Blackburn Lake. It is perhaps significant that 23 of this total (82%) are migratory or nomadic birds which tend to move along corridors of native vegetation.

The reduced abundance of native birds that results from fragmentation causes an increase in pest insects which were previously kept in check.

Fragmentation of habitat also means that flora and fauna become especially vulnerable to drastic disturbance such as fire, drought and possible climate change, because there is no adjacent refuge from which to recolonise. This includes plants which colonise bare ground through wind-borne seed from unaffected areas, particularly the important early colonisers in the daisy family (which store very little seed in the soil). [R77]

Inbreeding is another problem of fragmented sites. Fauna need to be able to travel to find mates from other populations, and some plants need to be pollinated or have their seeds dispersed by insects or birds travelling between populations of the plants. [R71]

As sites become more fragmented, the ratio of boundary length to area increases. Such sites have longer boundaries than less fragmented sites of equivalent area. This exposes them to more edge effects such as weed invasion, unsupervised pets, nutrient-rich run-off from gardens, and waste dumping.

The full range of negative environmental impacts of habitat fragmentation is discussed in more detail in the review article by Saunders *et al.* (1991). These CSIRO scientists end their article with the conclusion that the ecological health of remnants of native vegetation is critically dependent on the broader landscape in which they occur, and it is no longer appropriate to treat remnants as independent from their modified surroundings. In the Maroondah context, this means (in part) that the measures which need to be taken to conserve flora, fauna and significant sites cannot be confined to the significant sites alone; there are measures such as pet control and tree retention which need to be applied throughout the municipality.

To improve the links between areas of remnant native vegetation, Maroondah City Council's Roadside Conservation and Street Tree Strategy (O'Neill, 1996) includes a map of 'proposed indigenous roadsides'. The network of treed roads on this map provides a good basis for linking bushland sites. However, the roadsides which are included vary greatly in habitat value and biodiversity condition, and O'Neill does not identify this variation because biological significance was not part of his study. For example, we have rated the Mt Dandenong Road median strip east of Velma Grove as a site of biological significance, but not the vegetation along Canterbury Road west of the Heathmont shops; whereas O'Neill (1996) ranks these two areas equally. [R55]

The Maroondah Open Space Strategy (1996) recognises 'open space corridors and bushland areas' as being significant for pedestrians, cyclists and for conservation.

5.2.3 Vegetation clearing and damage

The Executive Summary of '*Australia: State of the Environment 1996*' (Alexander and Taylor, 1996) states:

- 'Habitat modification, particularly removal of native vegetation for agriculture, urban development and forestry has been, and still is, the most significant cause of loss of biodiversity'.

It has been found that remnant native vegetation or areas with natural tree cover occupy 5% of the municipality. This figure drops to 3% if one excludes sites with only a handful of hardy native plant species and little chance of natural regeneration.

Our study found that Maroondah is seriously afflicted in this regard, by urban development and piecemeal clearance by residents. As shown in Section 4.8, about 3% of Maroondah's original natural vegetation remains (excluding areas with just a few indigenous species), and this figure has fallen markedly in the last few years. For example, in 1995:

- the Ringwood Bypass construction removed several hectares of semi-natural vegetation;
- three housing estate developments cleared over five hectares between them;
- Melbourne Water cleared several thousand square metres to replace Little Bungalook Creek with a pipe; and
- Council permits were issued for the removal of over 150 indigenous trees.

All of these were done under permit, although some of the permit holders appear to have exceeded their permission. Also in 1995, almost a hectare of native vegetation of very high significance (State or Regional) in Kilsyth South was cleared without a permit, and we are aware of several incidents of individual trees removed illegally without a Council permit. Many more trees and understorey vegetation were cleared for construction of houses and associated purposes such as driveways, without any legal requirement for a permit.

This rate of clearing should be curtailed, particularly in sites of biological significance. [R8, R9, R27-R32]

There are three main reasons for clearing. As reflected in the 1995 statistics, residential development is the biggest reason, although this must soon decline because there remain only a few hectares of native vegetation available for residential development (unless Council uses measures such as rezoning to facilitate denser

development [R10, R11]). Road construction is spasmodic, but the combination of arterial road construction and widening of existing roads is likely to become the greatest destroyer over the next decade. Clearing and tree removal by residents is the next greatest cause of loss of native vegetation.

These main causes of native vegetation removal are considered in the following subsections.

Housing development and construction

Bulldozing for urban housing has been the greatest cause of native vegetation loss in Maroondah for decades. Apart from the obvious effects, bulldozing can remove corridor links, alter drainage patterns, increase siltation of drainage lines and waterways, physically damage the roots and limbs of nearby trees, and leave neighbouring vegetation vulnerable to storm damage and weed invasion.

Most residential development in Maroondah involves allotment sizes of less than 1,500 m². On lots this small, most or all native vegetation originally present is cleared for house construction, driveways, paths, fences and services. Any vestiges of native vegetation left after a house is constructed are usually replaced by a traditional European style of garden that is environmentally insignificant or even threatens the natural environment, e.g. by introducing environmental weeds.

Larger allotments allow much greater opportunity for retaining native vegetation *provided that* additional dwellings are not put on the allotments. [R10, R11].

A 1990 example of remnant vegetation being subdivided for urban housing is the Urban Land Authority's (ULA) Hillsborough Estate in South Croydon (via Olympus Drive). A considerable effort was initially made to save remnant trees, but many were eventually lost in storms and because the property boundaries and driveway crossovers were positioned where trees were in the way.

Where an attempt is made to retain trees, the protection of groups rather than isolated individuals is far more likely to be successful, as trees in groups protect each other from climatic extremes [R17]. Once isolated by the removal of surrounding vegetation, trees become far more prone to dieback and storm damage, and they lose some of their attractiveness to wildlife. At the Hillsborough Estate, about 20% of the mature trees retained have been blown over so far.

On a more recent ULA subdivision in Croydon South, Belmont Park Estate, the most natural remnant vegetation was set aside in reserves, while roads and property boundaries were adjusted to allow the retention of as many trees outside the reserves as possible. No trees have fallen in storms and many mature trees still provide habitat for the Galahs and Eastern Rosellas which were resident prior to subdivision.

This demonstrates that native vegetation loss from residential development can be reduced if the biologically significant features are known and taken into account when road alignment, property boundaries, building envelopes and underground service routes are planned [R12].

Limiting the size of machinery to the smallest possible for the completion of the required tasks reduces damage to bark and trunks where large machines cannot readily be manoeuvred between retained trees. The only vegetation that should be removed during subdivision works is that which must be removed for the installation of roads, services and fences [R13]. Careless or deliberate damage to adjacent biologically significant land, such as has happened at Warranwood Reserve, is clearly unacceptable.

Vegetation which cannot be saved from land development despite careful planning may sometimes be removed and relocated within the site or to another suitable site, or else material can be gathered for propagation [R19].

Once a site has been prepared for a house, a technique known as pier and beam construction can be used to minimise or prevent tree root damage and the consequent risk from an unsafe tree.

House construction on sloping sites can cause greater environmental damage than flat sites if the cut-and-fill method is used. Excavated fill should be removed from the property, not spread over surrounding vegetation. Drainage lines should be used as a landscape feature, not filled. Council controls on vegetation removal should treat burial of native vegetation the same way as clearing. House construction methods such as split level or pole construction are preferable to cut-and-fill.

Large recreational accessories such as swimming pools and tennis courts add greatly to the amount of clearing on blocks with native vegetation. So little native vegetation is left in reasonable condition in Maroondah that the best sites deserve protection from this cause of clearing. Under the planning overlays that are recommended here to cover Sites of Biological Significance [R8, R9], vegetation on these sites could not be destroyed without a permit. Such a permit cannot be legally issued without due consideration of a full range of factors concerning the values for which the land has been included under the overlay.

Road construction

Threats of imminent significant damage to Maroondah's biodiversity come from the Ringwood Bypass Road and the proposed Scoresby Freeway, Eastern and Northern Arterial Roads. Volume 2 provides guidance for Council on the possible consequences of these roads.

The proposed Healesville Freeway is not planned for the short or medium term, but if it is eventually constructed, it will destroy one of metropolitan Melbourne's most biologically significant sites (Site 64 in Volume 2).

Widening and reconstruction of primary and secondary roads is likely to destroy a considerable amount of significant roadside vegetation in the next few years. The south side of Canterbury Rd west of Dorset Rd is presently signposted as a 'significant roadside' and is very vulnerable to roadwork, as are parts of Colchester Rd south of Collier Rd (the main locality for the Pale-fruited Ballart in Maroondah), Liverpool Rd, Bayswater Rd and others.

Two minor roads – Oban and Glenvale Rds, Ringwood (near their intersection) – present a risk of loss of biodiversity on the Municipal scale, should their highly significant natural roadside vegetation be damaged. The latter is the only place in Maroondah where the Plum-leaved Pomaderris grows.

These issues have been addressed in part by the Roadside Conservation and Street Tree Strategy for Maroondah (O'Neill, 1996), except that it was beyond the strategy's brief to identify some of the significant biological attributes of particular roadsides mentioned in this report [R55].

Removal of native vegetation from residential land

One main reason for unnecessary clearing and habitat damage is residents' misunderstandings about the safety of trees. Many trees are needlessly destroyed by people who wrongly believe that all eucalypt trees, not just particular species, are dangerous because they drop limbs.

The decision about whether to remove a tree or not often needs to balance the risk of damage or injury against the harm to the environment and landscape from the tree's removal. Council has to consider its potential legal liability if it refuses a permit to remove or lop a tree which does, eventually, cause harm.

Although indigenous trees are retained by many property owners, understorey species are often severely damaged or removed to reduce potential fire hazards, to improve visibility and security, for children's play areas and, most frequently, to make the property look 'neat' or 'orderly'.

Remnant patches of native vegetation are currently subjected to a number of detrimental processes which could be prevented or reduced. If native vegetation is mowed too frequently and/or too low, understorey plants are damaged and some indigenous plant species are eliminated. It also reduces the available habitat for small fauna and prevents seedling recruitment, ultimately leading to tree canopy loss as older trees die and are not replaced through natural regeneration. The removal of fallen timber also reduces the habitat value of remnant vegetation. [R31]

Grazing

Grazing by livestock, including horses, can destroy indigenous understorey species, and trees may be ring-barked by bored or hungry animals. The nutrients and seeds in horse manure can cause outbreaks of weeds such as White Clover and exotic grasses, as can fodder brought from elsewhere. However, brief, light grazing at the right time of year can be beneficial to certain types of native vegetation. [R14]

There has been at least one case in Maroondah where owners of a site of Regional biological significance were warned to stop clearing in contravention of the Planning Scheme and responded by introducing cattle to destroy the remaining vegetation.

Dead Trees

Although recently dead trees are less likely to fall over or drop limbs than live trees, they may become dangerous over a decade or so and are often unsuitable in residential settings. This is unfortunate, because dead trees are essential to some native birds and mammals for nesting. They also provide the main (if not sole) sites for nesting, roosting or vantage points of many other birds and animals. The issues are discussed in '*Land for Wildlife Note No. 38*', available from the Department of Natural Resources and Environment.

While dead trees are usually unacceptable on smaller residential allotments, it would be highly desirable to retain them on larger allotments and Council land as long as they present no risk to people or property. [R31, R32].

Regulation and enforcement

A permit system applies to vegetation removal, based on the State and Local sections of the Maroondah Planning Scheme. It is not presently uniform across the municipality because of its origins in four earlier planning schemes. Some people either ignore the permit system or take an unreasonably broad interpretation of the exemption for trees which are immediately dangerous.

Victorian Councils are often reluctant to prosecute breaches of the regulations and permit conditions concerning vegetation removal because of the cost of doing so and the weak penalty (if any) which is usually imposed by the Administrative Appeals Tribunal or Magistrates Court (Moss and Lorimer, 1996). This is probably partly due to ineffective use of the legal instruments available to Councils. In 1996, Maroondah City Council tried for the first time the use of an Interim Enforcement Order, which proved effective. The use of bonds attached to planning permits is also likely to be effective in discouraging breaches. Both measures are to be encouraged [R30].

A poor excuse which is sometimes used by Councils to avoid acting on breaches of vegetation removal controls is that there's no point because a tree cannot be brought back. This is analogous to the police refusing to act against a murderer because the corpse can't be revived. These sorts of excuse should not be tolerated in Maroondah.

5.2.4 Roadsides

In addition to vegetation removal for road construction and widening (Section 5.2.3), roadside native vegetation may be damaged by maintenance of roads, footpaths, cables and underground services.

The Maroondah Environment Strategy describes why roadside native vegetation should be valued and conserved. Maroondah City Council has a Roadside Conservation and Street Tree Strategy (O'Neill, 1996) which identifies the associated issues and provides a set of recommendations for dealing with them. It also identifies roadsides in need of protection or revegetation. Many of the biological issues related to roadsides can be dealt with by following the recommendations in the Strategy [R55]. The rest of this subsection describes issues not specifically identified in the Strategy. Additional discussion and detail can be found in the book by the Roadsides Conservation Committee (1995).

Maintenance of roads and roadside services generally requires machinery, equipment and various materials and supplies, and the damage which may occur to roadside vegetation is often attributable to the storing of machinery, equipment and materials, rather than the works themselves. Activities often cause unnecessary damage by extending beyond the minimum area required. [R58].

Where sites of biological significance abut roads proposed for works of any kind, indigenous vegetation should be protected from damage. Machinery is apt to compact soil, crush plants, and leave wheel ruts which hold water and encourage weed growth. Damage is also caused by parking of vehicles, stockpiling of materials, and using the roadside as a machinery servicing area [R58]. Trees may suffer injuries such as the tearing off of bark or limbs by machinery. Machinery can also spread weed seed and disease organisms in soil carried from other sites. [R59].

Trees are often retained during road works, only to die later as a result of damage caused by trenching through roots, changes to soil surface levels or the installation of kerb and channel where previously there was an earth-

formed gutter, thus reducing availability of water to tree roots. (See the companion report, *'Notable Trees of Maroondah'*, Moss and Lorimer, 1996).

Material from roadside pits is sometimes left on the nature strip. This often initiates a weed infestation, and sometimes buries indigenous vegetation. [R62].

Damage to roadside trees by pruning for overhead cables has become a major issue in the community. Efforts are being made to replace cables to minimise the damage.

Sometimes it is impossible to avoid some clearing of roadside vegetation. The damage can be ameliorated by replanting, but care must be taken on biologically significant roadsides to use indigenous species, and mulch which does not contain seeds of weedy plants such as Willow-leaved Hakea. [R74]

The practice of using herbicide or steam to kill vegetation on road edges is rapidly replacing the traditional method of edge clipping. The herbicide or steam kills native vegetation very effectively, and leaves few plants other than Couch, Gorse and similar hardy weeds. Between sprays, short-lived weeds such as thistles are encouraged. The sparsely vegetated ground is left vulnerable to erosion if it is sloped. This is occurring even in a site of State biological significance. Some road edges with healthy indigenous vegetation have been converted to eroded, weedy road edges in one or two years. The practice of spraying indigenous vegetation on road edges should cease. [R63]

Recognition of biologically significant roadsides by utilities and neighbouring residents can help to minimise damage. For this reason, several roadsides in Maroondah are signposted as 'Significant Roadside Areas' or as sites in need of special treatment. Several other roadsides would qualify for such signs if accreditation was sought from the Roadside Conservation Advisory Committee. [R64]

5.2.5 Fire hazard and fire management

Statutory fire prevention notices require the slashing of all vegetation with stems thinner than about 10 cm. This is often counterproductive in the medium- to long-term when applied to native vegetation, because it can encourage a transition from indigenous plants to faster-growing weeds which produce more flammable material that dries out more thoroughly in the fire danger period. In the shorter term, cutting vegetation simply converts green, standing material to dry, fallen material, with little if any improvement in fire risk until the material rots (which may take so long that the fire danger period has passed). The effect on the environment is to progressively eliminate many indigenous plant species and prevent young trees growing to replace older ones which must eventually die.

The objective of bushfire fuel management should be to keep the amount of fuel low and to encourage slower-growing, perennial species in preference to weeds (which are often fast-growing and annual). The most effective method in native undergrowth is to cut fine material (thickness less than about 5 mm) and remove it or compost it somewhere safe. The larger plants left uncut are slower to catch fire, and they compete well with the smaller, more flammable plants for moisture and nutrients. This is fortunately also the best method from an environmental point of view.

The traditional fire hazard clearance notices issued by Councils prescribe a particular height to which vegetation must be cut. This is appropriate for non-native vegetation, but for native vegetation, it is often counter-productive. It would be preferable if notices for native vegetation were directed toward achieving a specified level of fine fuel (sticks, grass and leaves). The difficulty is that most land owners need to learn what that means and how to do it. The Country Fire Authority can help develop a plan for this objective [R34].

Fire is needed in many of Council's bushland reserves to maintain their biodiversity and/or to minimise fire hazard. Staff do not have skills to coordinate burning, so it would be desirable to develop at least basic expertise and liaise closely with brigades whose help and approval will be required. [R35, R36]

5.2.6 Weeds

The weeds of concern in this study are 'environmental weeds'; that is, plants which impair the biodiversity or ecological functions of natural habitat types. They are widely regarded as one of the most serious nature

conservation problems in Victoria and Australia (see Carr *et al.* (1992a) for references). In Maroondah, we regard environmental weeds as the second-worst threat to nature and biodiversity, next to native vegetation removal (Section 5.2.3).

The main threats to Maroondah by environmental weeds are:

- out-competing mature indigenous plants;
- preventing germination and establishment of indigenous plants;
- making habitat less fit for native fauna and more fit for introduced fauna, including pests which further threaten indigenous plants; and
- altering the cycling of nutrients and organic matter.

These processes are interrelated.

Some of the environmental weeds detected in this study (Appendix B) have permanently established themselves in the local flora, with negligible chance of eradication. Because this report is oriented toward action, we concentrate here on the most serious environmental weeds that could plausibly be eradicated or thoroughly controlled with a concerted (but not unreasonable) amount of effort.

We begin by focussing on weeds that are ranked ‘very serious’ (level 1) in Appendix B. Some of these, such as Large Quaking-grass (one of the most serious), cannot be realistically targeted for eradication because they are too ubiquitous and intractable. Others, such as Monterey (or Radiata) Pine, cannot be targeted because the species are popular with too many people. Some of the remainder are declared noxious under the *Catchment and Land Protection Act 1994* (the responsibility of the Department of Natural Resources and Environment), as follows:

Table 3. Environmental weeds in the ‘very serious’ category that are declared noxious.

Scientific Name	Common Name
<i>Allium triquetrum</i>	Angled Onion
<i>Chrysanthemoides monilifera</i>	Boneseed
<i>Crataegus monogyna</i>	Hawthorn
<i>Cytisus scoparius</i>	English Broom
<i>Genista monspessulana</i>	Montpellier Broom
<i>Hypericum tetrapterum</i>	Square-stemmed St Johns Wort
<i>Rubus discolor</i>	Blackberry
<i>Ulex europaeus</i>	Gorse or Furze
<i>Watsonia meriana</i>	Bulbil Watsonia

This is only an interim list until the Catchment and Land Protection Board revises it. The Department of Natural Resources and Environment is responsible for administering the Catchment and Land Protection Act, and they look to local government to act as an intermediary between itself and the community.

The list above leaves out a group of environmental weeds, shown in Table 4, that are very serious, tractable, not likely to draw strong opposition to eradication, and not presently regulated. These properties are ideal for a municipal eradication campaign.

Because all the species in Table 4 are available from plant nurseries, the nurseries need to be persuaded not to sell them (as recognised in the draft *Maroondah Environment Strategy*) [R39]. These species should not be allowed to be planted in Maroondah. A publicity campaign needs to be conducted to encourage participation of both nurseries and land owners in the eradication campaign, and to explain what control measures ought to be taken.

Since few Cotoneasters are grown in Maroondah other than the species listed, it may be best to simplify the list by including all Cotoneasters.

Prohibition of the planting of species in Table 4 can be done with a Local Law [R37]. As the Department reviews its interim list of noxious weeds, it should give consideration to adding some or all of the species in Table 4 [R38].

Table 4. Environmental weeds in the ‘very serious’ category that are also tractable, not likely to draw strong opposition to eradication, and not presently regulated

Scientific Name	Common Name
<i>Acacia elata</i>	Cedar Wattle
<i>Acacia longifolia</i>	Sallow Wattle
<i>Cortaderia selloana</i>	Pampas Grass
<i>Cotoneaster divaricatus</i>	Cotoneaster
<i>Cotoneaster glaucophyllus</i>	Cotoneaster
<i>Cotoneaster pannosus</i>	Cotoneaster
<i>Fraxinus angustifolia</i>	Desert Ash
<i>Lonicera japonica</i>	Japanese Honeysuckle
<i>Pittosporum undulatum</i>	Sweet Pittosporum
<i>Tradescantia albiflora</i>	Wandering Jew

Note that prohibition of certain plants failed in the former Shire of Eltham, due to support from several quarters for the continued cultivation of some of the species involved. This is not surprising, given that plants such as Cootamundra Wattle were included – plants of high popularity and low or moderate severity as environmental weeds. Prohibition of plants in the list above should not incur much objection, and should withstand whatever objections do arise because of the very serious character of the weeds.

A publicity and control campaign should be jointly organised between the Department of Natural Resources and Environment, Maroondah City Council, and perhaps adjoining Councils (consistent with the draft *Maroondah Environment Strategy*). It would be sensible to target some of the species in Table 3 as well as the species in Table 4, but the total from both tables would perhaps be too much for an effective campaign. If the list is to be reduced, Sweet Pittosporum and the three Cotoneasters should remain because they were found in this study to be causing the most serious environmental harm.

Council already has a concept for a weed campaign, called ‘Weed Wise’. It includes the ideas of collaboration with neighbouring municipalities, publicity on one or two species every six months or so, and encouraging weed removal by offering free replacement plants of similar species which are not environmental weeds. [R40]

The draft *Maroondah Environment Strategy* recommends investigating methods of collection and sale of materials not currently being recycled, such as weeds for composting. Weed collections in Maroondah would make it easier for people to participate in an eradication campaign.

Apart from environmental weeds being naturally spread, dumping of garden refuse, clippings and soil is the next greatest cause of spread.

During this study, this kind of dumping was noted in most bushland reserves within Maroondah. Many exotic weed invasions at these reserves can be attributed to the careless discarding of clippings and prunings which readily take root (e.g. grass, Wandering Jew) or those which retain fruits or seeds (e.g. grass clippings, Sweet Pittosporum). Garden soil is also often dumped containing bulbs of introduced species such as *Watsonia* and Angled Onion. All of these species are serious environmental weeds. In most cases, the garden refuse was placed just inside fences which backed residential blocks. In some instances, felled trees had been dragged onto sites from residential blocks. Many Christmas trees were also found dumped in reserves following the Christmas period. In most cases there is clear evidence that neighbours are responsible.

In some instances, residents prefer to dump garden waste and litter in nearby bush rather than pay to discard the waste. It is important that residents are made aware of the detrimental effects they cause to the environment by dumping garden and general refuse in neighbouring areas of bush [R94], and encouraged to dispose of refuse in an appropriate way [R41, R48].

5.2.7 Pests

The following pests are having a detrimental impact on the native fauna and flora:

Feral cats pose a serious threat to native animals in Maroondah. Feral cats kill prey up to their own body size, and their diet in Victoria includes over 18 species of native birds, 24 mammal species, and 3 reptile species (Seebeck *et al.*, 1991). Frogs and numerous invertebrate animals also contribute to a feral cat's diet (Anon, 1991). Many feral cats carry and transmit infectious diseases such as toxoplasmosis and sarcosporidiosis, that can debilitate and kill native animals, livestock and humans (Anon, 1991). To reduce the problem of feral cats in Maroondah, existing feral cats must be eliminated [R47], and domestic cats should be desexed to prevent unwanted kittens that become feral.

Foxes are voracious predators that kill native birds and small native mammals.

Common (or Indian) Mynas, Noisy Miners, Spotted Doves, Starlings exclude native fauna from nest sites.

Blackbirds disperse berry-bearing weeds such as Blackberries, Cotoneaster, Hawthorn and Sweet Pittosporum in their droppings. They are also aggressive toward some native birds, and their scratching destroys indigenous plant seedlings.

Mallards (a foreign species of duck) are capable of interbreeding with the native Black Duck. Mallards and their hybrid offspring were recorded on several occasions during this study. They are regarded as a mild threat to the native species.

Common Brushtail Possums and Ringtail Possums often become a domestic nuisance by living in the roof cavity of houses.

Feral Honey Bees inhabit tree hollows, thus reducing the available nest sites for native birds and possums. Honey bees also compete with native bees for nectar (Douglas 1977), and harvest nectar from some species without effecting pollination (Taylor and Whelan 1988).

Rabbits are in very large numbers in the northernmost parts of Maroondah. They graze some areas intensively, particularly sites which are regenerating following a fire or other disturbance. They contribute greatly to soil disturbance through their burrows and scratching. In turn, the disturbance caused by rabbits leaves areas open for weed invasion. Increased revegetation will encourage indigenous predatory fauna such as kites, falcons and hawks [R77].

Slugs and snails: Orchids are the group of indigenous plants that have suffered the greatest level of local extinctions in Maroondah (Section 4.2). They are also extremely susceptible to damage from introduced slugs and snails, and the two observations may be related. Slugs and snails are certainly causing great damage to this most threatened group of plants, but the magnitude of the effect has not been scientifically studied as far as we can tell.

Rodents (mice and introduced rats) are almost certainly present in most remnant vegetation in Maroondah. These animals compete with native rodents and small marsupials for ecological resources, and are very difficult to eradicate from indigenous vegetation. Controls on rubbish dumping will remove some of the attractants for these species. Revegetation will encourage native predators such as Kookaburras [R77].

5.2.8 Tree dieback

'Dieback' is a term used to describe the most obvious symptom exhibited by a tree in response to a wide range of environmental, pest or disease related stresses. In its broadest sense, the term is applied to any native or exotic species exhibiting twig and branch death starting at the branch tips and working down toward the trunk. A good discussion of the problem is given by Jones and Elliot (1986).

One serious cause of dieback is the extremely virulent soil-borne disease, Cinnamon Fungus (*Phytophthora cinnamomi*), which is widespread through southern Australia. It can kill more than 25% of the overstorey species and 50-75% of the understorey species. It spreads through moist soils and favours warm, moist conditions, spreading rapidly after heavy rains in summer. It is almost inactive at temperatures below 15°C.

Cinnamon Fungus is often spread on road making machinery moving from contaminated sites to new projects elsewhere, and also in contaminated fill and gravel used in road construction.

Although no specific soil tests have been conducted, we strongly suspect that *Phytophthora cinnamomi* is present between Gibson Rd and Kerry Rd, Warranwood (Site 14) because there is massive dieback occurring mainly to plant species known to be particularly susceptible to the fungus.

Earthmoving machinery and tractors can readily transmit fungi and diseases, as can introduction of contaminated soil or road gravel. Measures should be taken to minimise the risk to sites of biological significance. [R50].

Soil compaction and surface level changes within a tree's root zone are frequently a problem for trees close to newly constructed buildings or those under construction. The parking of vehicles or stockpiling of materials on a tree's root zone will compact the soil, reducing its oxygen exchange capacity and starving the roots of oxygen. Vehicles and heavy equipment should therefore not be placed under trees [R58]. More details on the effects of soil compaction and alteration of soil surface levels can be found in the section titled 'Preserving our heritage' of '*Notable Trees of Maroondah*' by Moss and Lorimer (1996).

Elm Leaf Beetle (ELB) is a pest that attacks almost all species and varieties of elm tree, and has expanded its range at an exponential rate during the last three years. This very serious pest causes defoliation and eventual death if uncontrolled. During the summer of 1995-96, Helen Moss monitored the extent of Maroondah's ELB infestation, and only one elm tree of an estimated 20,000 in the municipality showed no signs of infestation. It is expected that the full extent of the ELB problem in Maroondah will be revealed in October-December 1996 when the larvae become very active and voraciously eat the trees' new leaves.

Maroondah City Council prepared an information sheet titled '*SOS (Save Our Streetscapes) from Elm Leaf Beetle*' in 1995. It explains the life cycle, control methods and other information about the ELB.

Awareness of the problem by Council and the general community will be vital to an effective response. In September, just prior to the emergence of adult beetles, Council should publicise the ELB problem and distribute the information sheet widely so that residents can respond to signs of infestation on their elm trees. [R96, R95] Council itself should also attempt to control ELB on Elm trees in Council-owned land [R48].

A complex problem contributing to tree dieback in some of Maroondah's biologically significant sites involves the interaction of Bell Miners, Psyllid insects, loss of shrubby understorey vegetation, and in many cases an increase in soil nutrients. The ecology of the problem is discussed by Buchanan (1989). Eastfield Park (Volume 2, Site 61) was a prime example of this problem, until weed removal and regeneration works commenced in 1990 [R77]. Tree health improved nearby after a large number of pines and Sweet Pittosporums had been removed and indigenous plants started regenerating profusely.

Bell Miners are very aggressive small birds which form communal territories and feed on leaf damaging Psyllid insects. Psyllids are tiny, sedentary, sap sucking insects which live on eucalypt leaves. They produce a protective cover, or 'lerp' under which they live for most of their lives. Bell Miners eat the lerps and sometimes the nymph of the Psyllid, but usually the insect is left, allowing them to increase in numbers.

The Bell Miner's aggressive behaviour keeps at bay most of the other birds which would normally consume psyllids, and thus the psyllid population is no longer limited by natural means (Low, 1994). As the Psyllid numbers increase, the foliage damage they cause becomes unsustainable and the host trees start to die. As leaves are shed by afflicted trees, Psyllids start to decline in number, and under natural conditions the Bell Miners would move on. However, Bell Miners cannot move to other areas if the bushland is fragmented [R77], which means that there is no recovery period for afflicted trees where other birds would normally move in if Bell Miners were absent, and virtually eliminate the Psyllid population.

Dense shrubs normally provide protection from the Bell Miner for small birds, and these small birds are normally important in controlling the Psyllid population. The loss of shrubby understorey vegetation, generally through lack of periodic burning or from removal as a fire hazard, exacerbates this complex problem by reducing suitable habitat for small birds.

Increased soil nutrient levels from urban stormwater, garden runoff, pet faeces and other sources cause eucalypts to produce increased quantities of soft, sappy growth which provide an ideal food supply for leaf eating or sap sucking insects. This soft growth contains higher than normal amounts of nitrogen, an essential component for the production of amino acids. Insects such as Psyllids that live on this enriched diet grow and reproduce more rapidly, which in turn increases the level of insect damage to trees.

5.2.9 Cats and dogs

Pets such as cats and dogs have a severe impact on fauna in Maroondah through hunting, spreading disease, disturbing nests, harassing wildlife, and frightening wildlife from their habitat.

Indigenous plants may be trampled or dug up by pets, and soil disturbance from scratching provides an ideal seed bed for weeds. Also, nutrients in cat and dog faeces contaminate soil and waterways.

During this study, we have witnessed and been reliably informed of attacks by pet dogs on Koalas and Wallabies (or perhaps one Wallaby several times) in Maroondah. At least one of the Koalas was killed. [R54]

Although many cat owners insist that their pet does not wander, studies have shown that domestic cats often travel as far or further than feral cats – up to 11 km in a night. This means that a cat at large anywhere in Maroondah is within hunting range of a site of biological significance. Even well-fed cats catch 25 creatures per year on average. Cats also spread toxoplasmosis and other diseases which may be innocuous to cats but fatal to wildlife.

Cats are presently regulated under the *Domestic (Feral and Nuisance) Animals Act 1995*. The Act makes it easy for Council to prohibit cats roaming at large, either at all times or at night only, and optionally restricted to certain areas.

The Act also requires that a cat owner must not allow their cat to visit the property of anyone who makes it known that they object to such visits. Cat owners who receive such notification normally have to confine their cat at home (except for supervised excursions), since there is no way to stop a cat visiting just one property. It may be that people who object to cats visiting their land are so numerous that almost any cat at large would violate at least one person's legal right to keep cats out. A brief public survey would soon determine if this is so, in which case logic dictates that Council should treat cats the same as dogs; i.e. not permitted to roam at large anywhere at any time [R51]. Considerations of biodiversity, animal welfare and nature conservation also suggest that cats should be prohibited from roaming. Of course, some cat owners object to this. [R52]

Cats and dogs clearly conflict severely with the values of sites of biological significance. For this reason, they are totally prohibited from the Environmental Living Zone in Christmas Hills (Shire of Yarra Ranges). Regardless of any Local Law which Maroondah City Council makes to regulate cat ownership in the municipality as a whole, there is a very strong case for prohibiting cats from roaming at large in sites of biological significance that are recognised in the Planning Scheme. On public land of extremely high biological significance (Regional level or above, representing only a handful of sites in Maroondah), it is clearly justified to totally prohibit cats and dogs [R52].

To control feral cats, some Councils in South Australia are using a method in which cats are subject to a routine feeding program, then tranquilliser is introduced to the food, cats are collected and sorted into apparently owned and stray/feral, and the latter destroyed (Copley, 1991).

The effects of dogs at large on wildlife are of much wider concern than just Maroondah. Nillumbik and Manningham Councils, Melbourne Parks & Waterways, and interest groups such as obedience clubs have recently united to form a 'Dog Education Team' and a 'No Dog Sanctuary Team'. These teams may well devise methods of dealing with dogs at large that are useful in Maroondah. Their progress can be monitored through Conservation Ranger, Glen Jameson, at Westerfolds Park – phone (03) 9846-4499.

5.2.10 Nutrient seepage

Most introduced grasses and typical garden plants thrive on elevated levels of phosphorus and nitrogen, so gardeners apply fertiliser to encourage them. By contrast, indigenous plants are adapted to Maroondah's low natural levels of soil nutrients, and some even exhibit a toxic response to elevated phosphorus levels. When fertiliser is applied to a garden on a slope above native vegetation, the nutrients migrate downhill, poison or debilitate some of the indigenous plants, and provide good conditions for weeds to take over.

The nutrients either build up in the soil and cause increasing damage, or else migrate downhill where they eventually pollute a creek.

These are extremely common problems in Maroondah's bushland reserves and creeks. In some cases (e.g. Cherry Tree Grove Reserve, Croydon), vegetation damage has been so serious that a ditch has been cut to intercept the nutrient flow, which is diverted into a creek. It would clearly be better to prevent the problem at the source, but this is very difficult. The Shire of Yarra Ranges includes Planning Scheme requirements for retention of waste (including nutrients) on site, but where this requirement applies, it is often breached. [R16]

Melbourne Water, the Environment Protection Authority and the Catchment and Land Management branch of the Department of Natural Resources and Environment have expertise and jurisdiction in this problem. They should be consulted by Council to see if practical measures exist to ameliorate the problem.

5.2.11 Drainage works and waterway degradation

Storm water and runoff from nearly all of Maroondah drains to the major creeks via pipes. Heavy machinery has been used to install underground pipes in all but the smallest of gullies in Maroondah, destroying almost all remnant vegetation in their path. Above the pipes, the ground surface has typically been reshaped to form a broad channel carrying peak flow during storms.

This process continued until 1995-6, when Little Bungalook Creek in Kilsyth South was excavated and piped by Melbourne Water. There are probably no more natural creeks left to excavate in Maroondah. [R65]

Ditches, dykes and more pipes have been installed on flood plains to drain former wetlands and reduce the incidence of flood.

After such radical alteration, it is usually impossible to retain or restore the vegetation to its previous state, because the specific environmental requirements have been lost. The original vegetation of Maroondah's flood plains and valleys (Figure 2) has therefore been decimated. The aquatic habitat value of the streams has been mostly lost too, partly because of the modified creek beds, flows and surroundings, and partly because retarding basins and pipes now prevent the migration required by some of the aquatic fauna.

The one consolation is that natural aquatic ecosystems are much easier to re-establish than terrestrial ecosystems, so that wetlands created artificially often develop a rich biodiversity of indigenous organisms with little or no human intervention. One of the best examples in the region is the wetland which arose from the abandonment of the old horse pond on the de Felice land (Volume 2, Site 72). The pond now teems with aquatic fauna, as well as several regionally rare aquatic plants. Water birds make liberal use of dams and artificial ponds throughout Maroondah. Artificial creation of wetlands is discussed by Romanowski (1993).

Several municipal councils (e.g. Monash) are reverting heavily modified creeks or drains back to meandering courses lined with vegetation. Dandenong Creek and sections of Mullum Mullum Creek and the Croydon Main Drain would be good candidates for the same treatment. [R69]

5.2.12 Special protection for rare or threatened flora and fauna

This study has found that most native mammals and a high proportion of indigenous plant species are threatened with extinction from Maroondah within ten years or so, but this threat can be overcome and it is reasonable to aim to retain all presently existing native fauna and flora species until at least the year 2020 (which is a strategic target date for Council). [R4]

Each species threatened with extinction from Maroondah requires an action plan specifying the measures to be put in place for the species to survive until 2020. Action plans may include propagation or pollination of plants, pest eradication programs, resident education campaigns and so on, depending on the species and the nature of the threats to it. The highly endangered Kilsyth South Spider-orchid (*Caladenia* aff. *venusta*) needs a large action plan including scientific research, while at the other end of the spectrum, *Crassula helmsii* simply requires propagation and introduction to more sites. These action plans would ideally be prepared jointly between Council and the Department of Natural Resources and Environment. [R70]

Many sites of biological significance in Volume 2 contain one or more plant species that are present in such small numbers that they are vulnerable to inbreeding and freak events. The population sizes of these species need to be

increased. Sometimes pollen, seed or whole plants will need to be introduced from a nearby site in the same biogeographical zone so that outbreeding can occur. [R71]

5.2.13 Wildlife 'Rescue'

There is an undoubted need for animal rescue in situations where no alternative exists, but enthusiasm for the task must be tempered with due regard for the ultimate security and survival of the species concerned.

This is illustrated by the example of a Koala found on a residential property in The Pass, Croydon, by a resident alerted by barking dogs. The resident felt Koalas did not belong in a residential area like Croydon, so contacted a wildlife sanctuary who captured the animal and released it many kilometres away several days later. Koalas are territorial animals which usually live in loose family groups. This Koala was removed from its home range and family when it was 'rescued'. Such dislocation may well lead to the death of the animal.

5.2.14 Harvesting of indigenous plants

Collection of seeds, divisions and cuttings from indigenous flora are essential for the propagation of new plants for revegetation work, and the rescue of plants from destruction by roadworks or land development is highly desirable. However, excessive and inappropriate harvesting is occurring and should be combated. Indigenous plant material is a scarce resource and over-harvesting can impair natural regeneration on the collection site.

Over-harvesting of propagation material apparently occurs both by individual collectors (or groups) taking too much, and by the cumulative effect of multiple groups harvesting the same sites. Much of it is evidently illegal.

The Department of Natural Resources and Environment issues permits for the taking of plant material from wild plants for propagation or other purposes, and attaches terms and conditions to these permits. One of the conditions is that permission for collecting must be sought from relevant managing authorities or land owners. Council manages most of the native vegetation on public land in Maroondah, and therefore must be aware of the activities of collectors of propagation material [R81-R85]. There should be no blanket approval for collection on all Council owned land because some species and sites are particularly sensitive to harvesting.

Some plants that have been rescued from road works and the like are being kept indefinitely in nurseries or backyards. In this situation, they can serve no ecological function, which defeats the purpose of rescuing them. They should instead be returned to their original habitat (if it still exists) or relocated [R80,R19].

A terrible case concerns the Tall Lobelia, which is an attractive annual plant that is rare in Maroondah and has never been successfully propagated anywhere. When a small group of plants was located in Loughie's Bushland (Site 3 in Volume 2) during this study, several plants were illegally removed, presumably by an acquisitive plant hobbyist. Removing the plants endangered the population by reducing an already small number and by preventing gene exchange among the plants. Any seed the plants may have set prior to removal could not be shed on site, the place where they were most likely to find their extremely specialised germination requirements. The plants would have died within weeks.

5.2.15 Revegetation

Previous sections explain how native vegetation in Maroondah is dwindling and becoming increasingly fragmented and degraded. While it is in no way a substitute for retention of native vegetation, the losses are being ameliorated by replanting of some biologically degraded areas.

For example, work has begun on a joint project between Maroondah City Council and Melbourne Parks and Waterways to restore habitat gaps between existing patches of remnant vegetation along Dandenong Creek. Additional plantings along the creek are planned for later in 1996. A planting was undertaken by Council along the Belgrave railway line to provide a buffer for a patch of locally rare Silver Banksia. Indigenous plantings are occurring regularly in many of Council's bushland reserves, often with community involvement.

In recent years, there has been an increasing trend of using indigenous species for revegetation projects, as supported under the Federal Government's *National Strategy for the Conservation of Australia's Biological Diversity* (DEST, 1996). This should be continued and extended. Occasionally, species that are indigenous to one

part of the municipality are used inappropriately for revegetation in a quite different area. An example is the planting along Dandenong Creek of Red Box trees (*Eucalyptus polyanthemos*), which occur naturally in Maroondah only in the dry, stony hills of the Loughnan-Warranwood Ridge (Section 2.3).

It is almost always strongly desirable to determine the native vegetation of a proposed planting site and select species appropriate for that type. (Exceptions occur where the environment is too greatly altered to again support its original type of vegetation). Dr Lorimer is presently preparing lists of species suitable for planting in different habitat types in the different biogeographical zones of Maroondah. [R74-R76]

Planting projects are an excellent way of involving school and community groups in local activities and habitat restoration. However, it is common for the groups and schools to participate only in the actual planting, whereas most of the work required in such projects occurs before and after the planting, in activities such as seed collection, propagation, site selection, species choice, weeding, spraying, protection with tree guards etc. Too often, the people who organise the planting do not adequately consider the expense, planning, time, labour and lead-time to make the project successful in the medium to long term.

Various community groups in Maroondah hold regular working bees to remove weeds and plant indigenous species at selected sites. This is a valuable opportunity for community involvement and ownership of local projects and provides a useful, conscientious and skilled adjunct to Council's own park management staff. The relevant staff at Council support these groups in a number of ways, including permission to work on sites and removal of weed waste and rubbish after working bees.

As the *National Strategy for the Conservation of Australia's Biological Diversity* (DEST, 1996) says, 'Although all levels of government have clear responsibility, the cooperation of conservation groups, resource users, indigenous peoples, and the community in general is critical to the conservation of biological diversity'. [R87-R89]

Current management of some sites is preventing on-site regeneration from plants growing there naturally. An example is the median strip along Mt Dandenong Road in Ringwood where seedlings from a stand of remnant eucalypts are unable to persist due to regular mowing. This site contrasts with a section of the same road further east in Croydon (Volume 2, Site 38) where fencing, restricted mowing and hand-weeding have enabled seedling regeneration to occur.

There is potential along Dandenong Creek and Mullum Mullum Creek to allow thickets of Swamp Paperbark to extend by root suckers into mowed clearings. Slight modifications to current mowing would be required to allow these plants to spread.

Removal of large pine trees at Dexters Bush in Heathmont (Site 77) was followed by spectacular regeneration from soil-stored seed. This management approach could be used at other sites in Maroondah, such as Site 78 (Alexanders' Bush).

5.3 Recommendations

The following are Dr Lorimer's recommendations arising from the discussion in Section 5.2 of issues related to Maroondah's native flora and fauna. Recommendations are grouped and individually numbered (R1, R2, ...) for reference. Each one is given a suggested level of importance (high, medium, low) and urgency (short, medium and long time frames, corresponding to weeks, months and a year or more).

Implementation

- R1 Council should consider each of the following recommendations with a view to their adoption. (High importance, short time frame).
- R2 Council should prescribe target dates and consider the allocation of resources for implementation of the adopted recommendations. (High importance, medium time frame).

- R3 Council should nominate an officer or committee of Council to oversee implementation and report to Council periodically. This could be combined with the implementation of the Maroondah Environment Strategy. (High importance, medium time frame).

Strategic planning for conservation

- R4 Council's Municipal Strategic Statement should recognise the importance of arresting the decline of natural habitat in Maroondah (as described earlier in this report), along with a general goal of ensuring that all species of indigenous flora and fauna presently in Maroondah will still be represented in Maroondah in the year 2020. References to the present report may help Council to provide justification for these policies. (Medium importance, medium time frame, easy and cheap to implement).
- R5 Council should collaborate with neighbouring Councils to pursue the Federal Department of the Environment, Sport and Territories' commitment that 'Local governments will be encouraged to cooperate with each other to develop bioregional biological diversity management plans, with assistance from State and Territory governments' (DEST, 1996). An initial goal for a biological diversity management plan could be a 'Greening Plan' (Greening Australia, 1995) for the eastern and north-eastern Melbourne fringe based on this report. (Medium importance, medium time frame).
- R6 Council should initiate the development of a strategy to protect, improve and extend habitat corridors linking sites of biological significance in a habitat network. The development of the strategy should involve schools, community groups, Melbourne Water, Yarra Valley Water, Parks Victoria, the Public Transport Corporation and other statutory bodies with land holdings within the municipality. This strategy is recommended to focus on the following corridors: Dandenong Creek, Mullum Mullum Creek, Croydon Main Drain, and the Belgrave Railway Line. (Medium importance, medium time frame).
- R7 Council should keep a file of information on each of its bushland reserves. The file should include, among other things, cross-references to drawings elsewhere in Council, records of all management activities, and the species and provenance (the ancestral place of origin in the wild) of all plantings at the reserve. (Medium importance, medium time frame, cheap to implement).

Recognition of sites of biological significance in the Town Planning process

Council is already committed by its 1995 Corporate Plan to recognise sites of biological significance in the Maroondah Planning Scheme. During the public review period for this document, the State government released the Victoria Planning Provisions (VPPs), which constrain the ways in which that may be achieved. The following recommendations take those constraints into account, and should be addressed as part of the wider process of preparing a Planning Scheme in conformity with the VPPs.

- R8 Council should recognise Sites 1 to 82 of Volume 2 as Sites of Biological Significance in the Maroondah Planning Scheme, each one included under a Vegetation Protection Overlay as provided under the Victoria Planning Provisions. Each site should become an identified site of nature conservation significance as referenced under clause 42.02-3 of the VPPs. Clause 42.02-1 requires a schedule to contain a statement of the significance of the vegetation to be protected, and this would be most easily done by reference to the present report (particularly the site descriptions in Volume 2). The boundaries of the sites should match those in Volume 2 of this report. (Highest importance, short time frame).
- R9 Sites 83 onward of Volume 2 should be included as far as possible within the Significant Landscape Overlay under VPP clause 42.03. This should be done in conjunction with the translation of the present Landscape Protection Area and Environmental Living Zones into their successors under the VPPs. (High importance, short time frame).
- R10 Council should include within its Municipal Strategic Statement a policy (along the lines of Statement of Planning Policy No. 3 for the Dandenongs and Upper Yarra) that, for any of the sites in Volume 2 which are

recognised to be biologically significant at the Municipal level or above, Council will not support amendments to the Planning Scheme which increase the allowable density of allotments. This responds to recommendation 1.5.2c of the Federal Government's *National Strategy for the Conservation of Australia's Biological Diversity* (DEST, 1996).

(High importance, short time frame).

- R11 Council should recognise in its a local planning policies that fragmentation of natural habitat is a major cause of decline of indigenous flora and fauna, and that this is a likely outcome if multi-unit development occurs in the 82 Sites of Biological Significance identified in the schedule to the Vegetation Protection Overlay. (Medium importance, short time frame).
- R12 When a planning application is received for a site of nature conservation significance included under the Vegetation Protection Overlay, clause 42.02-3 of the VPPs requires Council to consider a range of factors such as 'the role of native vegetation in conserving flora and fauna'. To allow this to be done adequately, Council should include a local planning policy that, in considering such planning applications, a biologist's report will be required to identify: (a) biologically significant features on and adjacent to the subject land; (b) how they are affected by the proposed application; and (c) what has been done to minimise damage. Environmental Effects Statement legislation may provide a model for guidelines. Volume 2 provides much of the information needed for such reports. (High importance, short time frame).
- R13 Planning permits for land in recognised Sites of Biological Significance should require that damage to native vegetation be kept to the minimum required for the development to occur, consistent with the objectives of the Vegetation Protection Overlay. This should be expressed in a local planning policy, along with a recognition that consideration should be given to minimising the size of the area affected and the degree of soil disturbance and compaction (which may vary according to the size or type of machinery used). (High importance, medium time frame, low cost to Council).
- R14 Council should investigate how to recognise in its planning procedures that animal husbandry (grazing), soil cultivation or similar activities on native vegetation in Sites of Biological Significance can be taken, *prima facie*, to constitute destruction of that native vegetation. This should be made clear to owners of affected sites [R90]. (Medium importance, short time frame).
- R15 Council should investigate how bonds may be used in circumstances where a planning permit is issued for works that may adversely affect recognised Sites of Biological Significance. This includes developments on adjacent land which have the potential to affect the significant site. (Medium importance, short to medium term, low cost).
- R16 Council should adopt a local planning policy that planning permits for development of land immediately uphill of a recognised Site of Biological Significance should include the requirement for a cut-off drain to divert run-off and nutrients, wherever this is possible. This excludes cases where flow of water must not be redirected. (Medium importance, short to medium term).
- R17 Council should recognise that building envelopes can be a significant tool to apply on new subdivision plans for recognised Sites of Biological Significance (SOBS), aiming to maximise biodiversity conservation and conserve native vegetation in the largest possible patch(es). This should be extended to land adjoining SOBS, when this is likely to provide protection for the SOBS. (Low to medium importance, short to medium time frame).
- R18 When subdivision applications arise within recognised Sites of Biological Significance, Council should negotiate to reserve as much as possible of the biologically significant land as Public Open Space, with highest priority on the most significant parts. Exceptions will be where the potentially reserved land would be too small or not ecologically viable. (High importance, short to long time frame).
The most urgent case involves the De Felice development at Site 72 of Volume 2.
- R19 Where the retention of a biologically significant plant is not possible in the light of a development that is subject to a Planning Permit, Council should consider the benefit of requiring as a permit condition that the

plant be relocated either elsewhere on the site, or to a site to the satisfaction of Council (within the same habitat type and biogeographic region). This should apply particularly to recognised Sites of Biological Significance, where significant plant species have been identified, but it should also be applied to other land if the presence of a rare species is known. (Medium importance, medium to long time frame).

Other measures to be applied to Sites of Biological Significance

- R20 To prevent the likely clearing of some of Maroondah's most significant habitat, Council's highest priority should be to investigate the purchase and reservation of Maroondah's most significant vacant private allotments. The most important of these are in Tereddin Drive, Kilsyth South (State significance – Site 67 in vol. 2) and northern Ringwood west of the Oban Woods development (Regional significance – Site 3), in both cases adjacent to existing nature reserves. Because the significance of these sites exceeds the local scale, support should be garnered from State and Federal sources. A third site of high priority is Alexander's Bush in Heathmont (Site 78), with whom Council has already discussed possible purchase. (High importance, medium term).
- R21 Council should refer to its Local Laws Review Committee our recommendation that cats should not be at large in any of Sites of Biological Significance 1-82, and that cats' ability to roam over large distances be taken into account. (High importance, short time frame).
- R22 Council should develop a schedule for the preparation of management plans for all of its land in recognised Sites of Biological Significance. (Low importance, medium time frame).
- R23 Council should actively encourage that underground services in recognised Sites of Biological Significance should be installed by boring as much as possible rather than digging trenches. (Medium importance, medium time frame).
- R24 Council should review its specifications for appropriate times, heights and frequencies of slashing in the conditions of contracts involving slashing of Council land recognised as Sites of Biological Significance. This revision could benefit from cooperation with agencies such as Yarra Valley Water, who have expressed interest. (Medium importance, medium to long time frame).
- R25 Council should seek ways to make new or prospective purchasers of Sites of Biological Significance aware of the land's significance. (Medium importance, medium to long time frame).

Financial instruments to support biodiversity

- R26 Council should investigate charging lower rates or other incentives to properties whose long-term activities and commitments significantly assist Council's goals in conserving flora and fauna. This corresponds to a recommendation of the Department of Environment, Sport and Territories in the National Strategy for the Conservation of Australia's Biodiversity (DEST, 1996, p.26), so they should be approached for funding assistance. (Low importance, medium to long time frame).

Other native vegetation protection measures

- R27 Permit applications for vegetation removal, destruction or lopping should be assessed by someone with appropriate qualifications, including consideration of the vegetation's role in buffering adjacent sites or providing habitat for wildlife. (Medium importance, commencing in the short to medium term)
- R28 Council works involving damage or clearing of native vegetation should only occur after approval by a designated Council officer based on a professional assessment of the environmental consequences. A procedure for reinstatement works should be agreed before the works are approved. (High importance, medium time frame).

Effective enforcement and penalties for illegal clearing

- R29 Any removal, destruction or lopping of native vegetation conducted under permit should be inspected by a Council officer during or as soon as possible after the action. (Medium importance, medium time frame).
- R30 Where the controls on vegetation removal etc. are being violated, Council should immediately consider options under the Planning & Environment Act (e.g. an Enforcement Order). No retrospective permits should be issued. (High importance, medium time frame).

Dead trees

- R31 Council should only remove large, dead trees from public land when it is declared unsafe by someone with appropriate qualifications. Dead trees are important habitat for many birds and mammals (particularly bats). Fallen logs can also be valuable habitat and their removal should be considered in that light. (Low to medium importance, medium time frame).
- R32 Council should encourage retention of dead trees on private land, including the offer of inspection by a properly qualified person to assess safety and habitat value. (This should be approved by Council's insurer). This is in accord with the *Maroondah Environment Strategy*. (Low importance, medium to long time frame).

Local Law No.1

- R33 Native vegetation should be specifically excluded from being designated 'unsightly' under Local Law No.1. 'Native vegetation' should instead be defined as under existing planning schemes, or (for example) as any area where indigenous plant species represent at least half the number of species present or half the plant material which is under consideration. (Medium importance, medium to long time frame).

Fire hazard notices

- R34 Council should pursue with the Country Fire Authority the twin objectives of (a) specifying fire hazard reduction standards in terms of the amount of fine, flammable material per unit area, and (b) educating affected land owners to understand why and how these standards are to be achieved. (Medium importance, medium to long time frame).

Ecological burning

- R35 Council should conduct ecological burns on its own Sites of Biological Significance in conformity with management plans (or as practicable where a management plan does not exist). (Medium to high importance, long time frame).
- R36 Council should issue a permit for an ecological burn on private land where the applicant has the approval of the local fire brigade and the Department of Natural Resources and Environment. The Department and brigades would need to be informed that Council is taking this step. (Medium importance, long time frame).

Weeds

- R37 Council should consider prohibition by Local Law of the planting of the ten environmental weeds in Table 4. (High importance, medium to long time frame).
- R38 Council and the Department of Natural Resources and Environment should jointly plan a campaign of publicity and weed control works directed toward eradication or firm control of the ten species in Table 4. (High importance, medium time frame).

- R39 Council should discourage plant nurseries from selling Environmental weeds with severity rating 1, 2 or 3 in Appendix B. (Medium to high importance, long time frame).
- R40 Council should develop the 'Weed Wise' program which is described in Section 5.2.6. (Medium importance, medium time frame).
- R41 Council should consider implementing a periodic kerb-side collection service for all plant waste (i.e. prunings, weeds, etc. from both native and introduced species) in the whole municipality. (Low importance, medium time frame).
- R42 Council should investigate commissioning a large hot compost heap in order to destroy noxious weeds such as Ivy, thus ensuring the Council mulch heap is not contaminated by noxious weeds. (Low importance, medium time frame).
- R43 When and if Council has available a green waste processing facility that can receive weeds, Council should consider providing residents in or near Sites of Biological Significance with free access for disposal of environmental weeds. (Medium importance, long time frame).

Pests

- R44 Council should keep well informed about the progress of the Rabbit Calicivirus Disease and cooperate with the Department of Natural Resources and Environment to perform any complementary control activities or publicity recommended by the Department when the virus arrives in Maroondah. (High importance, short time frame).
- R45 Council should request the Department of Natural Resources and Environment to conduct a fox control program in Maroondah, concentrating on areas with high significance for their fauna. (Medium importance, medium to long time frame).
- R46 Council or its agent should eradicate any feral beehive or wasp nest on its own land, and advise residents of contractors who they can use to eradicate hives or swarms on their land. (Low importance, medium to long time frame).
- R47 Council and the Department of Natural Resources and Environment should jointly investigate a program to control feral cats in Maroondah. (Low importance, long time frame).

Tree dieback

- R48 Council should make every effort to control Elm Leaf Beetle infestations on Elm trees in Council land. Methods are discussed in Council's ELB information sheet. See also R95 and R96. (Medium importance, medium time frame).
- R49 Revegetation projects should aim to restore a shrubby understorey, especially where the Bell Miner birds and Psyllid insects are dominant. (Medium importance, long time frame).
- R50 Whenever Council approves a permit application involving machinery operating in a site of biological significance, the applicant should be provided with a copy of the brochure '*Phytophthora Root Rot... the plant killer*' (Appendix G; also available from the Department of Natural Resources and Environment, Phone 9450-8647) and asked to follow its recommendations. (Low to medium importance, short to medium time frame).

Cats and dogs

- R51 Council should review its recent public survey data concerning cats to estimate the number of residents who object to cats visiting their land. If these people are so close together that almost any cat at large in Maroondah is likely to visit at least one property whose owner objects, then the Local Laws Review

Committee should consider prohibiting cats roaming at large anywhere at any time. If the cat objectors are sparser, a night curfew should be implemented throughout Maroondah.

(High importance, short time frame).

R52 Council's Local Laws Review Committee should consider our recommendation to totally prohibit cats and dogs from Council's *Land for Wildlife* properties. Other owners of public land in the same category should be encouraged to do likewise. (High importance, short time frame).

R53 Council should refer to its Local Laws Review Committee our recommendation that cats should not be at large in any of Sites of Biological Significance 1-82 (except on the owner's property, if that is within a Site). (High importance, short time frame).

R54 The existing prohibition on dogs at large should be enforced, particularly in areas of high biological significance. (Low to medium importance, medium to long time frame).

Roadsides

R55 The recommendations in Section 3.4 of the *Roadside Conservation and Street Tree Strategy* (O'Neill, 1996) should be implemented in conjunction with the recommendations of this report (see R1-R3). Special attention needs to be given to sites identified in this report whose significance was unknown at the time of the Strategy's preparation. (Medium importance, medium to long time frame).

R56 When proposed works on roads or roadsides may affect native vegetation (including individual trees), the agency involved (including Council) should be required to obtain approval from a Council officer who has (or seeks advice of someone who has) expertise to assess the environmental consequences. (High importance, medium time frame).

R57 The Council officer's permission for any major works should be subject to payment of a bond (except in the case of Council works) to cover the cost of remedying any environmental damage. (Medium importance, medium to long time frame).

R58 The Council officer should define the boundaries of road works and storage areas, and specify temporary fences as appropriate. Storage areas should not be under trees, to prevent soil compaction and consequent tree death. (High importance, medium time frame).

R59 Machinery should be operated from the road surface whenever possible, not from the nature strip. (Medium importance, medium time frame).

R60 The size of the machines used should be determined by the requirements of the work. Excessively large machines lack manoeuvrability and their use increases the likelihood of vegetation damage. (Medium importance, medium to long time frame).

R61 Where services or drainage pipes are to be installed in sensitive areas, Council should encourage boring under trees, rather than trenching. If possible, services should be installed under or immediately behind the kerb. (Medium importance, medium time frame).

R62 Council should adopt the policy that waste from drainage pits or road grading will not be left on nature strips. (Medium importance, medium time frame).

R63 Council should adopt the policy that indigenous vegetation on road edges will not be treated with herbicide or steam. VicRoads should be requested to adopt the same policy. (Medium importance, medium time frame).

R64 Council should apply to the Roadside Conservation Advisory Committee for 'Significant Roadside Area' signs for all roadsides designated as Sites of Biological Significance in Volume 2, to ensure that their status is not overlooked. (Low importance, long time frame).

Drainage works

- R65 Council should avoid barrel draining of Maroondah's ephemeral or permanent waterways. (High importance, medium time frame).
- R66 Where drainage works are required, for example to mitigate erosion problems, minimal damage must be done to existing vegetation, and there should be provision for revegetation of the site following the completion of earthworks. (High importance, medium to long time frame).
- R67 Council should investigate the installation of litter traps at major points where litter enters drains and waterways. (Medium importance, long time frame).
The biological motivation is that wildlife in the streams and Port Phillip Bay will not be killed or injured by entanglement, and there is a strong aesthetic motivation as well.
- R68 Where runoff water from new subdivisions is to be piped to an existing waterway, provision should be made to slow the runoff rate to minimise erosion. (Low importance, medium to long time frame).
- R69 Council and Melbourne Water should review the projects elsewhere in Victoria and NSW which are presently reinstating drains back to streams and wetlands, with a view toward doing the same to Maroondah's main creeks. (The Australian Conservation Foundation can provide advice). (Low to medium importance, long time frame).

Special protection for rare or threatened flora and fauna

- R70 Action plans should be developed over time for each species of flora or fauna that is depleted or threatened in the municipality. Species that are rare or threatened at the Regional scale or above should be dealt with in conjunction with the Department of Natural Resources and Environment. (High importance, medium to long time frame).
- R71 Council should seek to auspice threatened species programs for bolstering population numbers, out-crossing with other populations and using horticulture to introduce threatened species to additional sites. (High importance, long time frame).
- R72 For security, information about the location of species that are rare at the Municipal scale or more widely should be exempted from public access under the Freedom of Information Act. (High importance, short time frame).
This is done in the Department of Natural Resources and Environment.

Revegetation

- R73 Council should liaise with Melbourne Water and Melbourne Parks & Waterways to prepare species selection guidelines for revegetation of flood-plains and beside creeks. (High importance, short to medium time frame).
The City of Knox is planning a meeting for the same purpose, and it may be mutually beneficial for the councils to collaborate.
- R74 In reserves that are recognised sites of biological significance, Council and Friends groups should generally plant species only from the range of species recorded from the habitat types present in the reserve concerned. Rare exceptions will occur where the physical environment is dramatically altered, in which case species should be chosen from habitat types with similar characteristics (particularly drainage and aspect) to the current environment. (High importance, medium time frame).
- R75 Council should insist that plants provided to it for planting on Council land should be derived from parents in the same biogeographical zone as the planting site (see Section 2). (Medium importance, medium time frame).

- R76 When Council receives a public inquiry about selection of indigenous plants to be grown, the inquirer's attention should be drawn to R74 and R75. (Medium importance, medium time frame).
- R77 Council should continue to identify and implement revegetation projects that extend existing sites and rehabilitate gaps between sites. (Medium importance, continuing from present practice).
- R78 Council should identify sites where fencing and/or reduced mowing can be used to allow natural regeneration. (Medium importance, long time frame).
- R79 Council should liaise with VicRoads to prepare species selection guidelines for roadside plantings. (Medium importance, long time frame).

Harvesting of indigenous plants

- R80 All plants rescued from sites to be developed should be relocated to a safe area on the same site, or potted up for transplanting into other suitable sites. Plants must not be kept indefinitely by their collectors. (High importance, medium to long term).
- R81 Council should inform all people who are known to collect propagating material from Council land (both private and commercial collectors) that they must apply in writing to Council for a collecting permit. (Medium importance, medium to long term).
- R82 Applications for permission to collect propagation material must include what species are to be collected, which locations they are to be collected from, and what use is proposed for the plants produced. (Medium importance, medium to long term).
- R83 Permits for collecting plant propagation material should expire one year after the date of issue. (Medium importance, medium to long term).
- R84 Permits for collecting plant propagation material must stipulate that excessive pruning, breaking or damage to plants is to be avoided; that plant material, including seeds, must not be collected from small populations; and that the permit may be rescinded at any time should its conditions be breached. (Medium importance, medium to long term).
- R85 Council should require that permits must be carried at all times while collecting. (Medium importance, medium to long term).

Removal of wildlife

- R86 Any native animals rescued should be released as close as possible to their site of capture, as soon as practicable. (High importance, medium term).

Supporting 'Friends' groups

- R87 Council should continue to make available to Friends groups the assistance of a Council officer or agent with expertise in bushland management. The officer or agent should attend occasional working bees of each Friends group. (High importance, continuing current practice).
- R88 Council should offer support to Friends Groups such as funding for ongoing administrative expenses and materials including office supplies, photocopying, printing, postage, newsletter production and hire of meeting facilities. (High importance, continuing current practice).
- R89 Council should provide Friends Groups with any available information which would assist the group in its activities on their reserve. [R7] (High importance, continuing current practice).

Publicity and promotion

- R90 Council should prepare a brochure explaining what a recognised Site of Biological Significance is, what it means to an owner of a site on private land, the importance of protecting significant sites, and basic information about what protection typically involves. Attention should be drawn to the requirement of a permit for removal, lopping and destruction of vegetation, including by grazing, burying or other means. (High importance, medium time frame).
- R91 The brochure above should be sent to owners and neighbours of Sites of Biological Significance, with appropriate cover letters. Personal approaches should also be made, including (where appropriate) the offer of a visit to the site by a Council appointee. Council should also consider organising a seminar on the subject for the same group of people. (High importance, medium time frame).
- R92 Council should advertise and increase public awareness of the controls over native vegetation removal, destruction and lopping. (High importance, medium time frame).
- R93 There should be a publicity campaign about the ten priority weed species in Table 4, in line with R38. (High importance, medium to long time frame).
- R94 A public awareness program should be run to alert residents to the problems caused by dumping garden waste in native vegetation (particularly bushland reserves). (Medium importance, medium time frame).
- R95 The Elm Leaf Beetle information sheet (Moss 1995) should be supplied to all residents on request. (Medium importance, medium time frame).
- R96 A press release on Elm Leaf Beetle should be prepared by the Council in September, to remind residents who own elm trees to watch for signs of infestation. (Medium importance).
- R97 Council should encourage golf courses to prepare environmental management plans in accordance with the forthcoming Environmental Strategy for Australian Golf Courses, and provide assistance where possible. (Low importance, medium to long time frame).

6. Future revision of significant sites

Site of biological significance can either lose or gain significance through changes at the site. Widespread depletion of habitat can also make the remaining habitat more significant. It is also possible that some sites may have been missed in this study (although it is very unlikely that we have missed anything significant above the Local level, except perhaps a small population of an extremely rare plant or animal).

It is therefore important to anticipate the need to review the Planning Scheme's proposed list of sites. This would normally occur in response to a case put to Council by someone concerning a specific site.

The few other municipalities which recognise sites of significance do not seem to have established a protocol. This became a problem in the Shire of Yarra Ranges when applications were made for deletion of sites in 1993-4, and the matter was referred to the Environmental Management Consultative Committee of the Upper Yarra Valley and Dandenong Ranges Authority. Unfortunately, the Authority was disbanded before the matter was resolved.

Changing the list in the Planning Scheme has to be done as a Planning Amendment, which imposes various requirements on the process. After being approached to make an amendment, Council is free to either reject the approach or go ahead and exhibit an Amendment. It is recommended that Council should not exhibit an amendment without a recommendation from a biologist. In most cases, the cost of the biologist's report would be reasonably borne by the person seeking the amendment, in which case the credentials and intellectual independence of the biologist should be checked.

The amendment would have to be advertised, which should be done through the local press. Submissions should be accepted over a period of at least two months, and preferably until the following December to allow detection of birds and plants which are hard to detect except in spring. Council would then consider the amendment in the light of the submissions received. When evidence of important biological considerations has appeared during the exhibition period, Council should receive a biologist's advice on the importance and reliability of the evidence. Council can then:

- approve the amendment
- have it referred to a planning panel
- abandon it.

There is no time limit to make a decision.

7. Bibliography

- Alexander N. and Taylor R. (Eds.) (1996). Executive Summary to the report 'Australia: State of the Environment 1996'. An independent report presented to the Commonwealth Minister for the Environment by the State of the Environment Advisory Council. CSIRO Publishing, Collingwood.
- Anon (1991). 'Conference Proceedings: The Impact of Cats on Native Wildlife'. 'Conclusions, Recommendations and Resolution'. Endangered Species Unit, Australian Nature Conservation Agency.
- Appleby C. (1989). Some problems of conservation of *Diuris punctata* in the Melbourne area. *Orchadian* 9(9):205-7.
- ANZECC (1993). 'Threatened Australian Flora'. Australian and New Zealand Environment and Conservation Council, Canberra.
- Backhouse G.N. and Jeanes J.A. (1995). 'The Orchids of Victoria'. 1st Edition. Miegunyah Press, Melbourne. 388 pp.
- Baker S. (1989). Wildlife: A corridor study. In: 'Koonung-Mullum: Forestway not Freeway!' (Eds. S. Baker and B. MacDonald). Natural History Network, Melbourne.
- Beaglehole A.C. (1983). 'The Distribution and Conservation of Vascular Plants in the Melbourne Area, Victoria'. Western Victorian Field Naturalists Clubs Association, Portland, Victoria. 156 pp.
- Buchanan R.A. (1989). 'Bush Regeneration: Recovering Australian Landscapes'. 1st Edition. TAFE Student Learning Publications, New South Wales. 259 pp.
- Carr G.W., Yugovic J.V. and Robinson K.E. (1992a). *Environmental Weed Invasions in Victoria: Conservation and Management Implications*. 1st Edition. Department of Conservation & Environment, Melbourne.
- Carr G.W., McMahon A.R.G., Schulz M. (1992b). *Vegetation and Management of Tereddan Drive Reserve, Kilsyth South, Victoria*. Report prepared by Ecological Horticulture Pty. Ltd. For Montrose Environmental Group inc.
- Christidis L. and Boles W.E. (1994). *The Taxonomy and Species of Birds of Australia and its Territories*. Royal Australasian Ornithologists Union, Melbourne.
- Conn B.J. (1993). Natural regions and vegetation of Victoria. In: 'Flora of Victoria, Volume 1, Introduction', D.B. Foreman and N.G. Walsh, Eds. 1st Edition. Royal Botanic Gardens, Melbourne.
- Conservation, Forests and Lands (1989). Floristic Vegetation Map of the Melbourne Area.
- Copley, P. (1991). Feral and Domestic Cats in South Australia. SA National Parks and Wildlife Service. In: Anon (1991).
- Dept of Conservation and Environment (1990). 'Remnant Native Grassland and Grassy Woodlands of the Melbourne Area: An Action Plan for Conservation Based on Biological Values'. Melbourne. 145 pp.
- DEST (1996). 'The National Strategy for the Conservation of Australia's Biological Diversity'. Commonwealth Dept of the Environment, Sport and Territories, Canberra. 54 pp. + 32 colour plates.
- Division of Animal Health (1988). 'Vertebrate Pest Control Manual'. Department of Agriculture NSW, Division of Animal Health.
- Douglas A.M. (1977) Some inimical effects of the domestic bee on the native flora and fauna. *The Western Australian Naturalist* 14(1):1-2.
- Flora and Fauna Guarantee Scientific Advisory Committee (1996). 'Final Recommendation on a Nomination for Listing. Herb-rich Plains Grassy Wetland (West Gippsland) Community'. Item No. C2021. Victorian Dept of Natural Resources and Environment : Melbourne.

- Fraser V. (1994). 'Turning a New Leaf - A Conservation Strategy for Croydon'. ISBN 0 646 21444 6. City of Croydon. 266 pp.
- Frood D. and Calder D.M. (1987). 'Nature Conservation in Victoria', volume 1. Victorian National Parks Association, Melbourne. 210 pp.
- Greening Australia (1995). '*Local Greening Plans: a Guide for Vegetation and Biodiversity Management*'. Greening Australia, Canberra. 144 pp.
- Gullan P.K., Parkes D.M., Morton A.G. and Bartley M.J. (1979). '*Sites of Botanical Significance in the Upper Yarra Region*'. Ministry for Conservation, Melbourne. 328 pp.
- Jones D.L. and Elliot W.R. (1986) '*Pests, Diseases and Ailments of Australian Plants*'. 1st Edition. Lothian, Melbourne.
- LCC (Land Conservation Council) (1991) '*Melbourne Area District 2 Review Descriptive Report*'. ISBN 0-7241-9264-6. 397 pp.
- Low T. (1994). Invasion of the savage honey-eaters. *Australian Natural History* **24**(10):26-33.
- Loyn R.H. (1986). The 20-minute search – a simple method for censusing forest birds. *Corella* **10**:58-60.
- McMahon A.R.G., Frood D., Bedggood S.E. and Carr G.W. (1989). '*A Review of the Sites of Botanical Significance in the Upper Yarra Valley and Dandenong Ranges Region*'. Report No.26 of the Upper Yarra Valley and Dandenong Ranges Authority, Lilydale, Victoria. 152 pp.
- Moss H (1995) '*SOS (Save Our Streetscapes) from Elm Leaf Beetle*' Information Sheet. Maroondah City Council.
- Moss H. and Lorimer G.S. (1996). '*Notable Trees of Maroondah*'. Maroondah City Council, Ringwood, Victoria.
- Newsome, A. (1991). '*The Impact of Cats on Native Wildlife Feral Cats: An Overview*'. CSIRO Division of Wildlife & Ecology. In: Anon (1991).
- O'Neill J.J. (1995). '*Description of the Physical Environment of the City of Maroondah*'. Maroondah City Council, Ringwood, Victoria. 8 pp.
- O'Neill J.J. (1996). '*Roadside Conservation and Street Tree Strategy*'. Maroondah City Council, Ringwood, Victoria. 41 pp.
- Paget A.N. (1985). Report on Harper's Bush, Heathmont. Copy obtained from Mrs Joan Harper, missing first section.
- Roadsides Conservation Committee (1995). '*Roadside Management Planning: Background and Guidelines*'. Roadside Conservation Committee of Victoria, Melbourne. (Loose-leaf folder).
- Saunders D.A., Hobbs R.J. and Margules D.R. (1991). Biological consequences of ecosystem fragmentation: A review. *Conservation Biology* **5**:18-32.
- Seebeck J., Greenwood L. and Ward D. (1991). '*Cats in Victoria*'. Department of Conservation and Environment, Victoria. In: Anon (1991).
- Romanowski N. (1993). Creating or restoring a wetlands area. Chapter 4 in '*Flora of Melbourne*', Revised Edition. Hyland House : Melbourne.
- SGAP (Society for Growing Australian Plants) (1993). '*Flora of Melbourne*', Revised Edition. Hyland House : Melbourne.
- Specht R.L., Roe E.M. and Boughton V.H. (1974). Conservation of the major plant communities of Australia and Papua – New Guinea. *Aust J. Bot. Suppl.* **7**:667.
- Taylor G. and Whelan R.J. (1988) Can honeybees pollinate *Grevillea*? *Australian Zoologist* **24**(4):193-196

- UYVDRA (1981). 'Review Panel Report on the Upper Yarra Valley and Dandenong Ranges Regional Strategy Plan', Volume 1. Upper Yarra Valley and Dandenong Ranges Authority, Lilydale. 253 pp.
- Walsh N.G. and Entwistle T.J. (1994). '*Flora of Victoria. Volume 2, Ferns and Allied Plants, Conifers and Monocotyledons*'. Inkata Press, Chatswood, NSW. 946 pp.
- Ward D., Curran K., Scopel M., Bull H., and Paris V. (1990). Weed control on the western face of the Dandenong Ranges. In: '*Managing Native Bushlands: Proceedings of Conference.*' Croydon Conservation Society and City of Croydon.
- Willis J.H. (1970). '*A Handbook to Plants in Victoria*', 2nd Edition. 481 pp. Melbourne University Press, Melbourne.
- Yugovic J.V., Crosby D.F., Ebert K, Lillywhite P., Saddlier S.R., Schulz M., Vaughan P.J., Westaway K. and Yen A.L. (1990). '*Flora and Fauna of the Koonung and Mullum Mullum Valleys (Proposed Eastern Arterial Road and Ringwood Bypass) Victoria*'. Dept Conservation, Forests and Lands, Melbourne. 158 pp.

Appendix A - Indigenous plant species of Maroondah

Species with an asterisk (*) were not seen by Dr Lorimer, but are accepted as reliable, usually validated by a specimen or a recent photograph. Species preceded by an obelisk (†) are validated by a specimen at the National Herbarium of Victoria, have not been positively recorded for at least fifty years, and are therefore assumed to be extinct in Maroondah. All other species have been seen and confirmed by Dr Lorimer. Several additional species are suspected but not confirmed to exist in Maroondah, and are therefore omitted from the list.

Wherever possible, scientific and common names of plants in this report follow '*Flora of Victoria*' and currently accepted taxonomy of the National Herbarium of Victoria. Where '*Flora of Victoria*' has not yet published a common name, we default to Beauglehole (1983) and then to the names used by the Arthur Rylah Institute.

The column headed 'Total No. of Sites' shows how many of the approximately 140 surveyed sites are known to have supported the species in the last few years. The next column shows how many of these sites are reserves where the plants are in no imminent threat (a rather arbitrary determination, in some cases, since reserves provide various levels and kinds of protection, from very weak to quite strong).

The entries in the 'Significance' column refer to the species' status as rare or threatened at the following levels: 'N' for National; 'S' for State; 'R' for Regional (corresponding to the region of '*Flora of Melbourne*') and 'M' for Municipal. See also the comments in Section 4.2.

Specimens of nearly all unusual plant species found in this study have been collected and will be lodged at the National Herbarium of Victoria (abbreviated 'MEL' below) as permanent records. Species that are poorly understood by science are discussed below the table.

Scientific Name	Common Name	Total No. of Sites	No. of Reserves	Significance Level	Comments on significance
<i>Acacia acinacea</i>	Gold-dust Wattle	1	0	M	
<i>Acacia aculeatissima</i>	Thin-leaf Wattle	12	5		
<i>Acacia brownei</i>	Heath Wattle	1	1	R	
<i>Acacia dealbata</i>	Silver Wattle	29	14		
<i>Acacia genistifolia</i>	Spreading Wattle	3	2	M	
<i>Acacia implexa</i>	Lightwood	16	6		
<i>Acacia leprosa</i> (Dandenong Range variant)	Cinnamon Wattle	20	9	S	A large proportion of the wild populations occur in Maroondah. See footnote.
<i>Acacia mearnsii</i>	Black Wattle	>70	37		
<i>Acacia melanoxylon</i>	Blackwood	>90	45		
<i>Acacia mucronata</i>	Narrow-leaf Wattle	4	1	M	
<i>Acacia myrtifolia</i>	Myrtle Wattle	34	19		
<i>Acacia paradoxa</i>	Hedge Wattle	33	14		
<i>Acacia pycnantha</i>	Golden Wattle	34	17		
<i>Acacia stricta</i>	Hop Wattle	31	13		
<i>Acacia ulicifolia</i>	Juniper Wattle	12	6	R	
<i>Acacia verticillata</i>	Prickly Moses	44	28		
<i>Acaena echinata</i>	Sheep's Burr	13	4		
<i>Acaena novae-zelandiae</i>	Bidgee-widgee	70	36		
<i>Acianthus caudatus</i>	Mayfly Orchid	3	1	R	
<i>Acianthus pusillus</i>	Small Mosquito Orchid	1	1	M	
<i>Acrotriche serrulata</i>	Honey-pots	57	24		
<i>Adiantum aethiopicum</i>	Common Maidenhair	28	17		
<i>Agrostis aemula</i>	Purplish Blown Grass	3	2	R	See Beauglehole (1983).
<i>Agrostis avenacea</i>	Common Blown Grass	28	12		
<i>Alisma plantago-aquatica</i>	Water Plantain	32	19		
<i>Allocasuarina littoralis</i>	Black Sheoke	11	5	M	Most Maroondah populations comprise only one or two plants.
<i>Almaleea subumbellata</i>	Wiry Bush-pea	2	1	R	
<i>Alternanthera denticulata</i>	Lesser Joyweed	7	4	M	
<i>Amphibromus archeri</i>	Pointed Swamp Wallaby-grass	3	1	R	Only 3 localities in metro Melbourne outside Maroondah.

Scientific Name	Common Name	Total No. of Sites	No. of Reserves	Significance Level	Comments on significance
<i>Amphibromus neesii</i>	Southern Swamp Wallaby-grass	1	0	R	
<i>Amphibromus nervosus</i>	Veined Swamp Wallaby-grass	1	1	R	
<i>Amyema pendulum</i>	Drooping Mistletoe	21	9		
<i>Amyema quandang</i>	Grey Mistletoe	2	2	R	
<i>Aphelia gracilis</i>	Slender Aphelia	1	1	R	
<i>Aphelia pumilio</i> *	Dwarf Aphelia	1	1	R	
<i>Arthropodium ?milleflorum</i> *	Vanilla-lily	0	0	M	
<i>Arthropodium strictum</i>	Chocolate-lily	57	29		
<i>Asperula conferta</i>	Common Woodruff	1	1	M	
<i>Astroloma humifusum</i>	Cranberry Heath	9	4	M	
<i>Austrofestuca hookeriana</i>	Hooker Fescue	6	5	R	
<i>Azolla filiculoides</i>	Pacific Azolla	2	0	M	
<i>Banksia marginata</i>	Silver Banksia	13	7	M	Maroondah populations not reproducing.
<i>Baumea acuta</i>	Pale Twig-rush	2	1	R	
<i>Baumea arthropophylla</i>	Fine Twig-rush	3	2	R	
<i>Baumea rubiginosa</i>	Soft Twig-rush	4	2	R	
<i>Baumea tetragona</i>	Square Twig-rush	3	2	R	
<i>Billardiera scandens</i>	Common Apple-berry	67	35		
<i>Blechnum cartilagineum</i>	Gristle Fern	1	1	M	
<i>Blechnum minus</i>	Soft Water-fern	1	1	R	
<i>Bossiaea prostrata</i>	Creeping Bossiaea	31	15		
<i>Brachyscome cardiocarpa</i>	Swamp Daisy	5	3	R	
<i>Brachyscome decipiens</i>	Field Daisy	1	1	R	See Beaglehole (1983).
<i>Bracteantha</i> sp. aff. <i>subundulata</i>	Swamp Everlasting	1	0	S	Vulnerable state-wide.
<i>Brunonia australis</i>	Blue Pincushion	24	13		
<i>Bulbine bulbosa</i>	Yellow Bulbine-lily	6	4	M	
<i>Burchardia umbellata</i>	Milkmaids	36	17		
† <i>Burnettia cuneata</i>	Lizard Orchid	0	0	N	Last record 1921, at MEL.
<i>Bursaria spinosa</i>	Sweet Bursaria	>80	35		
<i>Caesia parviflora</i>	Pale Grass-lily	31	17		
<i>Caladenia caerulea</i> *	Blue Caladenia	1	1	R	
<i>Caladenia carnea</i> var. <i>carnea</i>	Pink Fingers	1	0	M	
<i>Caladenia catenata</i> *	White Caladenia	0	0	R	See Backhouse and Jeanes (1995). Last record 1921, at MEL.
† <i>Caladenia clavigera</i>	Plain-lip Spider-orchid	0	0	R	See Backhouse and Jeanes (1995).
<i>Caladenia congesta</i>	Black-tongue Caladenia	1	1	R	See Backhouse and Jeanes (1995).
<i>Caladenia deformis</i> *	Bluebeard Caladenia	0	0	R	See Backhouse and Jeanes (1995).
<i>Caladenia flavovirens</i> *	Summer Spider-orchid	0	0	S	Rare nationally.
<i>Caladenia gracilis</i>	Musky Caladenia	1	1	R	
<i>Caladenia iridescens</i>	Bronze Caladenia	3	1	R	
<i>Caladenia lindleyana</i> *	Lindley's Spider-orchid	1	1	S	Rare statewide.
<i>Caladenia menziesii</i> *	Hare Orchid	0	0	M	
<i>Caladenia phaeoclavia</i>	Brown-clubbed Spider-orchid	1	0	M	One plant only, rescued from a development site in 1995, now in a pot.
<i>Caladenia praecox</i>	Early Caladenia	1	1	R	
<i>Caladenia pusilla</i> *	Tiny Caladenia	1	1	R	
† <i>Caladenia tentaculata</i>	Large Green-comb Spider-orchid	0	0	R	Last record 1935, at MEL.
<i>Caladenia</i> aff. <i>venusta</i>	Kilsyth South Spider-orchid	1	0	N	Not known outside Maroondah.
<i>Calochilus campestris</i>	Copper Beard-orchid	1	1	R	See Backhouse and Jeanes (1995).
<i>Calochilus imberbis</i> *	Naked Beard-orchid	0	0	S	Reported by J.H. Willis (1970).
<i>Calochilus paludosus</i>	Red Beard-orchid	3	1	R	See Backhouse & Jeanes (1995).
<i>Calochilus robertsonii</i>	Purplish Beard-orchid	5	2	M	
<i>Calochlaena dubia</i>	Common Ground-fern	8	5	M	
<i>Calystegia marginata</i>	Forest Bindweed	1	1	R	
<i>Calystegia sepium</i>	Large Bindweed	4	2	M	May include adventive populations.
<i>Carex appressa</i>	Tall Sedge	18	10		

Scientific Name	Common Name	Total No. of Sites	No. of Reserves	Significance Level	Comments on significance
<i>Carex breviculmis</i>	Short-stem Sedge	34	16		
<i>Carex fascicularis</i>	Tassel Sedge	4	2	R	
<i>Carex gaudichaudiana</i>	Fen Sedge	4	2	R	
<i>Carex inversa</i>	Common Sedge	9	6		May include adventive populations.
<i>Cassinia aculeata</i>	Common Cassinia	66	34		
<i>Cassinia arcuata</i>	Drooping Cassinia	66	27		
<i>Cassinia longifolia</i>	Shiny Cassinia	21	13		
<i>Cassytha glabella</i>	Slender Dodder-laurel	2	0	M	
<i>Cassytha melantha</i>	Coarse Dodder-laurel	20	10		
<i>Cassytha pubescens</i>	Downy Dodder-laurel	35	19		
<i>Centella cordifolia</i>	Centella	33	17		
<i>Centipeda minima</i>	Spreading Sneezeweed	2	1	R	
<i>Centrolepis aristata</i>	Pointed Centrolepis	4	3	M	
<i>Centrolepis fascicularis</i> *	Tufted Centrolepis	0	0	R	
<i>Centrolepis strigosa</i>	Hairy Centrolepis	3	1	M	
<i>Chamaescilla corymbosa</i>	Blue Squill	8	6	M	
<i>Cheilanthes austrotenuifolia</i> *	Green Rock Fern	2	2	M	
<i>Chiloglottis reflexa</i>	Autumn Bird-orchid	1	1	R	
<i>Chiloglottis</i> sp. A	Mountain Bird-orchid	1	1	R	Possibly introduced in soil.
<i>Chiloglottis trapeziformis</i> *	Dainty Bird-orchid	0	0	R	Last record 1943, at MEL.
<i>Chiloglottis valida</i>	Common Bird-orchid	7	4	M	
<i>Chionochloa pallida</i>	Silvertop Wallaby-grass	73	33		
<i>Chorizandra cymbaria</i>	Heron Bristle-rush	1	1	R	See Beaglehole (1983).
<i>Chrysocephalum semipapposum</i>	Clustered Everlasting	8	3	R	The local form has finer leaves than most around Melbourne.
<i>Clematis aristata</i>	Mountain Clematis	36	19		
<i>Clematis microphylla</i>	Small-leafed Clematis	9	6		
<i>Comesperma ericinum</i>	Heath Milkwort	5	3	R	All populations bar one are very small.
<i>Comesperma volubile</i>	Love Creeper	15	9		
<i>Coprosma quadrifida</i>	Prickly Currant-bush	46	23		
<i>Correa glabra</i>	Rock Correa	1	0	M	Possibly not naturally occurring.
<i>Correa reflexa</i>	Common Correa	36	19		
<i>Craspedia variabilis</i>	Variable Billy-buttons	3	1	M	
<i>Crassula decumbens</i>	Spreading Crassula	1	0	M	
<i>Crassula helmsii</i>	Swamp Crassula	3	1	M	
<i>Crassula sieberiana</i>	Sieber Crassula	1	1	M	
<i>Cryptostylis subulata</i>	Large Tongue-orchid	8	4	M	
<i>Cyathea australis</i>	Rough Tree-fern	15	8		
<i>Cynoglossum suaveolens</i>	Sweet Hound's-tongue	3	2	M	
<i>Cyrtostylis reniformis</i>	Small Gnat-orchid	1	1	M	Approaching Regional significance.
<i>Danthonia caespitosa</i>	Common Wallaby-grass	7	3		
<i>Danthonia eriantha</i>	Hill Wallaby-grass	2	0	M	
<i>Danthonia geniculata</i>	Kneed Wallaby-grass	8	4	M	
<i>Danthonia laevis</i>	Smooth Wallaby-grass	27	13		
<i>Danthonia linkii</i> var. <i>fulva</i>	Leafy Wallaby-grass	44	20		
<i>Danthonia linkii</i> X ? <i>tenuior</i>	a Wallaby-grass	3	2	R	Only known from 3 sites outside M'dah.
<i>Danthonia penicillata</i>	Slender Wallaby-grass	>65	29		
<i>Danthonia pilosa</i> var. <i>pilosa</i>	Velvet Wallaby-grass	31	18		
<i>Danthonia procera</i>	Tall Wallaby-grass	1	1	S	
<i>Danthonia racemosa</i>	Clustered Wallaby-grass	36	13		
<i>Danthonia semiannularis</i>	Tasmanian Wallaby-grass	28	13		
<i>Danthonia setacea</i>	Bristly Wallaby-grass	58	23		
<i>Danthonia tenuior</i>	Purplish Wallaby-grass	50	18		
<i>Daucus glochidiatus</i>	Austral Carrot	2	2	M	Easily overlooked.
<i>Daviesia latifolia</i>	Hop Bitter-pea	9	4	M	
<i>Daviesia leptophylla</i>	Narrow-leaf Bitter-pea	41	15		
<i>Derwentia derwentiana</i>	Derwent Speedwell	3	3	R	
<i>Deyeuxia densa</i>	Heath Bent-grass	2	1	R	
<i>Deyeuxia quadriseta</i>	Reed Bent-grass	>60	32		

Scientific Name	Common Name	Total No. of Sites	No. of Reserves	Significance Level	Comments on significance
<i>Dianella longifolia</i>	Pale Flax-lily	43	23		
<i>Dianella revoluta</i> var. <i>revoluta</i>	Black-anther Flax-lily	75	34		
<i>Dianella tasmanica</i>	Tasman Flax-lily	17	10		
<i>Dichelachne rara</i>	Common Plume-grass	23	7		
<i>Dichelachne sieberiana</i>	Plume-grass	14	5		
<i>Dichondra repens</i>	Kidney-weed	35	14		
<i>Dillwynia cinerascens</i>	Grey Parrot-pea	57	24		
<i>Dipodium roseum</i>	Hyacinth Orchid	30	18		
<i>Diuris behrii</i>	Golden Cowslips	1	0	S	Vulnerable state-wide.
<i>Diuris corymbosa</i> *	Wallflower Orchid	5	1	M	
<i>Diuris lanceolata</i> *	Golden Moths, Merwan	0	0	M	Last record 1933, at MEL.
<i>Diuris ×palachila</i> *	Broad-tip Diuris	0	0	S	Last record 1915, at MEL.
<i>Diuris pardina</i>	Leopard Orchid	4	1	M	
<i>Diuris punctata</i> *	Purple Diuris	0	0	S	See Appleby (1989). Vulnerable in Vic.
<i>Diuris sulphurea</i>	Tiger Orchid	3	2	M	
<i>Drosera peltata</i> subsp. <i>auriculata</i>	Erianellam, Tall Sundew	41	21		
<i>Drosera peltata</i> subsp. <i>peltata</i>	Pale Sundew	3	2	M	
<i>Drosera pygmaea</i>	Tiny Sundew	3	2	R	
<i>Drosera whittakeri</i>	Scented Sundew	20	9		
<i>Echinopogon ovatus</i>	Common Hedgehog-grass	4	2	M	
<i>Eleocharis acuta</i>	Common Spike-rush	5	3	M	
<i>Eleocharis sphacelata</i>	Tall Spike-rush	10	4		
<i>Elymus scabrus</i>	Common Wheat-grass	15	4		
<i>Empodisma minus</i>	Spreading Rope-rush	8	6	M	
<i>Epacris gunnii</i>	Ace of Spades	1	1	R	
<i>Epacris impressa</i>	Common Heath	65	34		
<i>Epilobium billardierianum</i> subsp. <i>billardierianum</i>	Robust Willow-herb	1	0	M	
<i>Epilobium billardierianum</i> subsp. <i>cinereum</i>	Variable Willow-herb	10	4		
<i>Epilobium hirtigerum</i>	Hairy Willow-herb	34	16		
<i>Eragrostis benthamii</i> *	Love-grass	0	0	R?	Last record 1959, at MEL. Not universally accepted as a distinct species.
<i>Eragrostis brownii</i>	Common Love-grass	29	10		
<i>Eriochilus cucullatus</i> *	Parson's Bands	1	1	M	Last record 1924, at MEL.
<i>Eryngium vesiculosum</i>	Prickfoot	2	1	R	See Beauglehole (1983).
<i>Eucalyptus cephalocarpa</i>	Silver-leafed Stringbark	>60	>28		
<i>Eucalyptus globoidea</i>	White Stringybark	>16	7	R	Maroondah contains most of the region's specimens of this species.
<i>Eucalyptus goniocalyx</i>	Long-leaf Box	>75	>35		
<i>Eucalyptus macrorhyncha</i>	Red Stringybark	>60	24		
<i>Eucalyptus melliodora</i>	Yellow Box	>35	19		
<i>Eucalyptus obliqua</i>	Messmate	>80	>40		
<i>Eucalyptus ovata</i>	Swamp Gum	>65	>35		
<i>Eucalyptus polyanthemus</i> subsp. <i>vestita</i>	Red Box	>25	9		
<i>Eucalyptus radiata</i>	Narrow-leaf Peppermint	>90	>45		
<i>Eucalyptus rubida</i>	Candlebark	15	6		
<i>Eucalyptus viminalis</i> subsp. <i>viminalis</i>	Manna Gum	13	7		
<i>Euchiton gymnocephalus</i>	Creeping Cudweed	13	5		
<i>Euchiton involucratum</i>	Star Cudweed	21	7		
<i>Euchiton sphaericus</i>	Annual Cudweed	5	0	M	
† <i>Euphrasia collina</i> subsp. <i>trichocalycina</i>	Purple Eyebright	0	0	S	Last record 1924, at MEL. Rare state-wide.
<i>Exocarpos cupressiformis</i>	Cherry Ballart	>90	>40		
<i>Exocarpos strictus</i>	Pale-fruit Ballart	5	4	M	Approaching Regional significance.
<i>Gahnia radula</i>	Thatch Saw-sedge	>100	>45		

Scientific Name	Common Name	Total No. of Sites	No. of Reserves	Significance Level	Comments on significance
<i>Gahnia sieberiana</i>	Red-fruit Saw-sedge	16	11		
<i>Galium binifolium</i>	Reflexed Bedstraw	1	1	R	
<i>Galium gaudichaudii</i>	Rough Bedstraw	7	4	M	
<i>Galium propinquum</i>	Maori Bedstraw	1	0	M	Approaching Regional significance.
<i>Gastrodia sesamoides</i>	Cinnamon Bells	>7	>5	M	Approaching Regional significance.
<i>Genoplesium despectans</i> *	Sharp Midge-orchid	1	1	R	In serious decline around Melbourne.
<i>Genoplesium morrisii</i>	Bearded Midge-orchid	1	0	R	
<i>Geranium homeanum</i>	Northern Cranesbill	2	1	R	
<i>Geranium potentilloides</i>	Cinquefoil Cranesbill	14	8		
<i>Geranium solanderi</i> (2 forms)	Austral Cranesbill	8	5	M	About to be described as 2 species.
<i>Glossodia major</i>	Wax-lip Orchid	6	2	M	
<i>Glyceria australis</i>	Australian Sweet-grass	8	4		
<i>Glycine clandestina</i>	Twining Glycine	19	9		
<i>Glycine microphylla</i>	Small-leaf Glycine	2	1	R	
<i>Gompholobium huegelii</i>	Common Wedge-pea	11	4	M	All local populations are very small.
<i>Gonocarpus humilis</i>	Shade Raspwort	3	1	M	
<i>Gonocarpus micranthus</i>	Creeping Raspwort	5	4	M	
<i>Gonocarpus tetragynus</i>	Common Raspwort	>85	>40		
<i>Goodenia elongata</i>	Lanky Goodenia	6	5	R	
<i>Goodenia humilis</i>	Swamp Goodenia	3	1	M	
<i>Goodenia lanata</i>	Trailing Goodenia	26	15		
<i>Goodenia ovata</i>	Hop Goodenia	55	33		
<i>Goodia lotifolia</i> *	Golden Tip	0	0	M	The last known plants were bulldozed in 1995-6.
<i>Gratiola peruviana</i>	Austral Brooklime	2	1	M	
<i>Gratiola pubescens</i>	Glandular Brooklime	10	6	R	See Beauglehole (1983).
<i>Gynatrix pulchella</i>	Hemp Bush	5	4	M	
<i>Hakea nodosa</i>	Yellow Hakea	9	4	M	Local populations often very small.
<i>Hakea decurrens</i>	Bushy Needlewood	1	1	M	
<i>Hakea ulicina</i>	Furze Hakea	8	6	M	
<i>Hardenbergia violacea</i>	Purple Coral-pea	38	14		
<i>Helichrysum scorpioides</i>	Button Everlasting	23	11		
<i>Hemarthria uncinata</i>	Mat Grass	14	7		
<i>Hibbertia empetrifolia</i>	Tangled Guinea-flower	3	1	R	
<i>Hibbertia obtusifolia</i>	Grey Guinea-flower	1	1	R	
<i>Hibbertia riparia sensu lato</i>	Erect Guinea-flower	18	8		
<i>Histiopteris incisa</i> *	Bat's Wing Fern	1	1	M	Probably now extinct in Maroondah.
<i>Hovea linearis</i>	Common Hovea	33	13		
<i>Hydrocotyle callicarpa</i> *	Small Pennywort	1	1	M	
<i>Hydrocotyle foveolata</i>	Yellow Pennywort	4	4	M	
<i>Hydrocotyle hirta</i>	Hairy Pennywort	7	5		
<i>Hydrocotyle laxiflora</i>	Stinking Pennywort	7	3		
<i>Hydrocotyle sibthorpioides</i>	Shining Pennywort	2	1	M	More commonly found in lawns.
<i>Hypericum gramineum</i>	Small St John's Wort	53	23		
<i>Hypericum japonicum</i>	Matted St John's Wort	2	1	R	
<i>Hypolepis ?muelleri</i>	Marsh Ground-fern	1	1	R	
<i>Hypolepis ?rugosula</i>	Ruddy Ground-fern	1	0	M	
<i>Hypoxis hygrometrica</i> var. <i>hygrometrica</i>	Golden Weather-glass	6	2	M	
<i>Hypoxis vaginata</i>	Sheath Star	3	2	M	
<i>Imperata cylindrica</i>	Blady Grass	11	7		
<i>Indigofera australis</i>	Austral Indigo	9	5		
<i>Isolepis fluitans</i>	Floating Club-rush	2	1	M	
<i>Isolepis hookeriana</i>	Grassy Club-rush	8	4		Likely to have been undersampled.
<i>Isolepis inundata</i>	Swamp Club-rush	40	20		
<i>Isolepis marginata</i>	Little Club-rush	3	2	M	
<i>Isolepis platycarpa</i>	a Club-rush	12	9		
<i>Isotoma fluviatilis</i>	Swamp Isotome	3	2	R	
<i>Juncus amabilis</i>	Hollow Rush	>40	19		

Scientific Name	Common Name	Total No. of Sites	No. of Reserves	Significance Level	Comments on significance
<i>Juncus australis</i>	Austral Rush	12	6	R	Maroondah may be a local stronghold.
<i>Juncus bufonius</i>	Toad Rush	>25	12		
<i>Juncus ?caespiticius</i>	Grassy Rush	2	1	R	
<i>Juncus flavidus</i>	Yellow Rush	2	1	M	
<i>Juncus fockei</i>	Slender Joint-leaf Rush	17	6		
<i>Juncus gregiflorus</i>	Green Rush	37	21		
<i>Juncus holoschoenus</i>	Joint-leaf Rush	1	0	M	
<i>Juncus pallidus</i>	Pale Rush	65	33		
<i>Juncus pauciflorus</i>	Loose-flower Rush	19	13		
<i>Juncus planifolius</i>	Broad-leaf Rush	25	12		
<i>Juncus procerus</i>	Tall Rush	26	15		
<i>Juncus sarophorus</i>	Broom Rush	>50	23		
<i>Juncus subsecundus</i>	Finger Rush	22	8		
<i>Kennedia prostrata</i>	Running Postman	8	1	M	
<i>Kunzea ericoides</i>	Burgan	>70	>30		
<i>Lagenifera gracilis</i>	Slender Lagenifera	19	11		
<i>Lagenifera stipitata</i>	Common Lagenifera	11	5		
<i>Lemna disperma</i>	Common Duckweed	9	2	M	
<i>Lepidosperma elatius</i>	Tall Sword-sedge	33	18		
<i>Lepidosperma filiforme</i>	Common Rapier-sedge	4	3	R	
<i>Lepidosperma gunnii</i>	Slender Sword-sedge	28	14	R?	Maroondah is probably the main stronghold for the Melbourne area.
<i>Lepidosperma laterale</i>	Variable Sword-sedge	32	16		
<i>Leptorhynchos tenuifolius</i>	Wiry Buttons	21	6		
<i>Leptospermum continentale</i>	Prickly Tea-tree	>70	38		
<i>Leptospermum lanigerum</i>	Woolly Tea-tree	3	2	M	
<i>Leucopogon virgatus</i>	Common Beard-heath	25	14		
<i>Lindsaea linearis</i>	Screw Fern	22	14		
<i>Linum marginale</i>	Native Flax	12	3		Can tolerate disturbance.
<i>Lobelia alata</i>	Angled Lobelia	21	15		
<i>Lobelia gibbosa</i> var. <i>gibbosa</i>	Tall Lobelia	3	2	R	
<i>Lomandra filiformis</i> subsp. <i>coriacea</i>	Wattle Mat-rush	>80	>40		
<i>L. filiformis</i> subsp. <i>filiformis</i>	Wattle Mat-rush	>40	18		
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	90	47		Includes both of the Vic. Subspecies.
<i>Lomandra multiflora</i>	Many-flowered Mat-rush	4	2	M	
<i>Ludwigia peploides</i>	Clove-strip	1	1	R	
<i>Luzula meridionalis</i> var. <i>densiflora</i>	Common Woodrush	1	1		
<i>L. meridionalis</i> var. <i>flaccida</i>	Common Woodrush	1	1		
<i>L. meridionalis</i> var. <i>meridionalis</i> *	Common Woodrush	0	0		Cited in 'Flora of Melbourne'.
<i>L. meridionalis</i> var. <i>indet.</i>	Common Woodrush	10	5		
<i>Lyperanthus suaveolens</i>	Brown-beaks	3	1	M	
<i>Lythrum hyssopifolia</i>	Small Loosestrife	34	16		
<i>Mazus pumilio</i> *	Swamp Mazus	1	1	R	
<i>Melaleuca ericifolia</i>	Swamp Paperbark	>35	22		
<i>Microlaena stipoides</i>	Weeping Grass	>100	>50		
<i>Microseris scapigera</i> spp. agg.	Yam-daisy	2	2	M	Only a few plants left in Maroondah.
<i>Microtis atrata</i> *	Yellow Onion-orchid	0	0	R	See Backhouse and Jeanes (1995). Last record 1926, at MEL.
<i>Microtis parviflora</i>	Slender Onion-orchid	36	16		
† <i>Microtis rara</i>	Sweet Onion-orchid	0	0	R	
<i>Microtis unifolia</i>	Common Onion-orchid	2	1	M	
<i>Muellerina eucalyptoides</i>	Creeping Mistletoe	6	4	M	
<i>Myriophyllum crispatum</i>	Upright Milfoil	2	1	R	
<i>Myriophyllum simulans</i>	Amphibious Milfoil	1	0	R	
<i>Olearia argophylla</i>	Musk Daisy-bush	1	0	M	
<i>Olearia glandulosa</i>	Swamp Daisy-bush	1	1	R	

Scientific Name	Common Name	Total No. of Sites	No. of Reserves	Significance Level	Comments on significance
<i>Olearia lirata</i>	Snow Daisy-bush	14	8		
<i>Olearia myrsinoides</i>	Silky Daisy-bush	24	13		
<i>Olearia ramulosa</i> var. <i>ramulosa</i>	Twiggy Daisy-bush	1	1	M	
<i>Opercularia ovata</i>	Broad-leaf Stinkweed	17	8		
<i>Opercularia varia</i>	Variable Stinkweed	44	20		
† <i>Orthoceras strictum</i>	Horned Orchid	0	0	R	
<i>Ottelia ovalifolia</i>	Swamp Lily	1	0	R	
<i>Oxalis perennans</i>	Grassland Wood-sorrel	56	23		
<i>Ozothamnus ferrugineus</i>	Tree Everlasting	66	37		
<i>Ozothamnus obcordatus</i>	Grey Everlasting	2	1	R	
<i>Ozothamnus rosmarinifolius</i>	Rosemary Everlasting	1	1	R	
<i>Pandorea pandorana</i>	Wonga Vine	21	13		
<i>Patersonia fragilis</i>	Short Purple-flag	3	2	R	
<i>Patersonia occidentalis</i>	Long Purple-flag	12	6	M	Approaching Regional significance.
<i>Pelargonium inodorum</i>	Kopata	2	1	M	Fire dependent.
<i>Pentapogon quadrifidus</i>	Five-awned Spear-grass	7	3		Post-disturbance opportunist.
<i>Persicaria decipiens</i>	Slender Knotweed	30	19		
<i>Persicaria hydropiper</i>	Water-pepper	8	7		
<i>Persicaria lapathifolia</i>	Pale Knotweed	1	1	?	Possibly not native to Maroondah.
<i>Persicaria praetermissa</i>	Spotted Knotweed	3	1	R	
<i>Persoonia juniperina</i>	Prickly Geebung	8	4	M	
<i>Phragmites australis</i>	Common Reed	24	10		
† <i>Phylloglossum drummondii</i>	Pigmy Clubmoss	0	0	R	Last record 1901 (MEL 2021326)
<i>Pimelea curviflora</i>	Curved Rice-flower	2	2	M	
<i>Pimelea humilis</i>	Common Rice-flower	53	21		
<i>Pimelea linifolia</i> ssp. <i>linifolia</i>	Slender Rice-flower	3	1	R	
<i>Plantago varia</i>	Variable Plantain	11	4	M	
<i>Platylobium formosum</i>	Handsome Flat-pea	13	8	M	Small populations, on the edge of range.
<i>Platylobium obtusangulum</i>	Common Flat-pea	64	29		
<i>Poa clelandii</i>	Matted Tussock-grass	1	1	R	See Beauglehole (1983).
<i>Poa ensiformis</i>	Purple-sheath Tussock-grass	32	23		
<i>Poa labillardierei</i>	Common Tussock-grass	11	9		Greatly depleted.
<i>Poa morrisii</i>	Velvet Tussock-grass	58	33		
<i>Poa rodwayi</i> *	a species of Tussock-grass	0	0	M	Subject to taxonomic uncertainty.
<i>Poa sieberiana</i> var. <i>sieberiana</i>	Grey Tussock-grass	>30	17		
<i>Poa tenera</i>	Slender Tussock-grass	21	13		
<i>Polyscias sambucifolia</i>	Elderberry Panax	13	6	M	Usually one individual per site.
<i>Polystichum proliferum</i>	Mother Shield-fern	9	6	M	Rarely more than one plant per site.
<i>Pomaderris aspera</i>	Hazel Pomaderris	5	4	M	
<i>Pomaderris prunifolia</i>	Plum-leaf Pomaderris	1	1	R	
<i>Pomaderris racemosa</i>	Cluster Pomaderris	5	5	M	
<i>Poranthera microphylla</i>	Small Poranthera	65	31		
<i>Potamogeton crispus</i>	Curly Pondweed	1	1	R	See Beauglehole (1983).
<i>Potamogeton ochreatus</i>	Blunt Pondweed	9	4		Insensitive to disturbance.
<i>Potamogeton tricarlinatus</i>	Floating Pondweed	2	0	R	
<i>Prasophyllum australe</i> *	Austral Leek-orchid	0	0	M	Last record 1944 (MEL.2029928)
<i>Prasophyllum colemaniae</i> *	Lilac Leek-orchid	0	0	R	Last record 1928, at MEL.
† <i>Prasophyllum lindleyanum</i>	Green Leek-orchid	0	0	S	Last record 1921, at MEL.
<i>Prasophyllum odoratum</i> *	Sweet Leek-orchid	0	0	R	Last record 1944 (MEL 2029929)
<i>Prasophyllum pyriforme</i>	Gaping Leek-orchid	1	1	R	Subject to taxonomic revision.
<i>Prostanthera lasianthos</i>	Victorian Christmas-bush	19	12		
<i>Pseudognaphalium luteoalbum</i>	Jersey Cudweed	2	1	M	
<i>Pteridium esculentum</i>	Austral Bracken	>80	>45		
<i>Pterostylis alpina</i>	Mountain Greenhood	2	1	M	
<i>Pterostylis furcata</i> *	Sickle Greenhood	0	0	R	

Scientific Name	Common Name	Total No. of Sites	No. of Reserves	Significance Level	Comments on significance
<i>Pterostylis grandiflora</i> *	Cobra Greenhood	0	0	S	Bulldozed in Hochkins Ridge Flora Reserve in the mid-1980s.
<i>Pterostylis ×ingens</i>	Sharp Greenhood	1	0	S	A single colony. Rare state-wide.
<i>Pterostylis longifolia</i>	Tall Greenhood	11	7		Possibly overlooked at other sites.
<i>Pterostylis nana</i> *	Dwarf Greenhood	1	1	M	
<i>Pterostylis nutans</i>	Nodding Greenhood	15	8		Declining in some sites.
<i>Pterostylis parviflora</i>	Tiny Greenhood	1	1	M	
<i>Pterostylis</i> sp. aff. <i>parviflora</i>	Red-tipped Greenhood	2	0	R	
<i>Pterostylis pedunculata</i>	Maroon-hood	3	2	M	
† <i>Pterostylis plumosa</i>	Bearded Greenhood	0	0	R	See Backhouse & Jeanes (1995).
<i>Pterostylis</i> aff. <i>rufa</i> *	Rusty-hood	1	1	R	
<i>Pultenaea forsythiana</i>	Eastern Prickly Bush-pea	3	2	R	
<i>Pultenaea gunnii</i>	Golden Bush-pea	50	29		
<i>Pultenaea scabra</i>	Rough Bush-pea	2	2	M	
<i>Ranunculus glabrifolius</i>	Shining Buttercup	2	1	R	
<i>Ranunculus inundatus</i> *	River Buttercup	1	1	R	
<i>Ranunculus lappaceus</i>	Australian Buttercup	4	2	M	
<i>Rubus parvifolius</i>	Small-leaf Bramble	12	8		
<i>Rumex brownii</i> *	Slender Dock	1	1	M	
<i>Schoenus apogon</i>	Common Bog-rush	>65	28		
<i>Schoenus lepidosperma</i>	Slender Bog-rush	3	3	R	
<i>Schoenus maschalinus</i>	Leafy Bog-rush	2	1	R	
<i>Schoenus tesquorum</i>	Soft Bog-rush	4	1	R	
<i>Selaginella uliginosa</i>	Swamp Selaginella	3	1	R	
<i>Senecio glomeratus</i>	Annual Fireweed	25	14		
<i>Senecio hispidulus</i> var. <i>hispidulus</i>	Rough Fireweed	31	14		
<i>Senecio linearifolius</i>	Fireweed Groundsel	1	1	M	
<i>Senecio minimus</i>	Shrubby Fireweed	28	14		
<i>Senecio quadridentatus</i>	Cotton Fireweed	>25	>10		
<i>Senecio tenuiflorus</i>	Narrow Groundsel	>25	>15		
<i>Sigesbeckia orientalis</i>	Indian Weed	1	0	R	
<i>Solanum aviculare</i>	Kangaroo Apple	2	1	M	
<i>Solanum laciniatum</i>	Large Kangaroo Apple	10	6		Favoured by disturbance.
<i>Solenogyne dominii</i>	Solenogyne	2	0	M	
<i>Sphaerolobium minus</i>	Globe-pea	6	3	R	
<i>Spiranthes sinensis</i>	Ladies' Tresses	1	0	R	Depleted state-wide.
<i>Spirodela punctata</i>	Thin Duckweed	3	0	S	
<i>Spyridium parvifolium</i>	Australian Dusty Miller	20	11		
<i>Stackhousia monogyna</i>	Candles	14	7		
<i>Stipa ?mollis</i>	a Spear-grass	1	1	M	
† <i>Stipa nodosa</i>	Knotty Spear-grass	0	0	R	Last record 1929, at MEL.
<i>Stipa pubinodis</i>	a Spear-grass	23	10		
<i>Stipa rudis</i> subsp. <i>australis</i>	Veined Spear-grass	2	1	R	
<i>Stipa rudis</i> subsp. <i>nervosa</i> *	Veined Spear-grass	0	0	R	
<i>Stipa rudis</i> subsp. <i>rudis</i>	Veined Spear-grass	>100	>45		
<i>Stylidium graminifolium</i>	Grass Trigger-plant	44	26		
<i>Stylidium inundatum</i>	Hundreds and Thousands	1	1	R	
<i>Tetrarrhena juncea</i>	Forest Wire-grass	25	11		
<i>Tetradlea ciliata</i>	Pink-bells	16	11	M	Depleting rapidly.
<i>Thelionema caespitosum</i>	Tufted Blue-lily	6	3	M	Approaching Regional significance.
† <i>Thelymitra carnea</i>	Salmon Sun-orchid	0	0	R	Last record 1923, at MEL.
<i>Thelymitra holmesii</i>	Slender Blue Swamp Sun-orchid	2	1	R	
<i>Thelymitra ixioides</i>	Dotted Sun-orchid	3	1	M	
<i>Thelymitra luteocilium</i> *	Fringed Sun-orchid	0	0	R	See Willis (1970).
<i>Thelymitra media</i>	Tall Sun-orchid	1	1	M	
<i>Thelymitra pauciflora</i>	Slender Sun-orchid	>15	>10		Subject to taxonomic splitting.
<i>Thelymitra rubra</i>	Salmon Sun-orchid	3	2	M	

Scientific Name	Common Name	Total No. of Sites	No. of Reserves	Significance Level	Comments on significance
<i>Themeda triandra</i>	Kangaroo Grass	>80	>35		
<i>Thysanotus patersonii</i>	Twining Fringe-lily	10	8		
<i>Thysanotus tuberosus</i>	Common Fringe-lily	10	6		
<i>Tricoryne elatior</i>	Yellow Rush-lily	49	24		
<i>Triglochin alcockiae</i>	Water-ribbons	3	1	R	
<i>Triglochin procerum</i> spp. agg.	Water-ribbons	1	0	M	This may be <i>T. alcockiae</i> .
<i>Triglochin striatum</i> (2 forms)	Streaked Arrow-grass	7	5	M	
<i>Typha domingensis</i>	Cumbungi	16	11		
<i>Typha orientalis</i>	Cumbungi	20	12		
<i>Utricularia australis</i>	Yellow Bladderwort	1	0	R	See Beauglehole (1983).
<i>Utricularia dichotoma</i>	Purple Bladderwort	2	1	R	See Beauglehole (1983).
<i>Veronica calycina</i>	Hairy Speedwell	6	3	M	
<i>Veronica gracilis</i>	Slender Speedwell	6	2	M	
<i>Veronica plebeia</i>	Trailing Speedwell	4	3	M	
<i>Villarsia reniformis</i>	Running Marsh-flower	2	1	R	
<i>Viminaria juncea</i>	Golden Spray	4	1	R	More common on Mornington Penin.
<i>Viola betonicifolia</i>	Showy Violet	1	1	R	
<i>Viola cleistogamoides</i>	Hidden Violet	1	0	R	
<i>Viola hederacea</i>	Ivy-leaf Violet	47	23		
<i>Wahlenbergia gracilis</i>	Sprawling Bluebell	13	6		
<i>Wahlenbergia gymnoclada</i>	Naked Bluebell	2	2	R	
<i>Wahlenbergia multicaulis</i>	Tadgell's Bluebell	4	2	R	
<i>Wahlenbergia stricta</i>	Tall Bluebell	8	5		Approaching Municipal significance.
<i>Wolffia australiana</i>	Tiny Duckweed	1	0	R	
<i>Wurmbea dioica</i> subsp. <i>dioica</i>	Common Early Nancy	6	3	M	
<i>Xanthorrhoea minor</i>	Small Grass-tree	54	26		
<i>Xanthosia dissecta</i>	Cut-leaf Xanthosia	28	15		

Poorly understood species

Acacia leprosa (Dandenong Range variant): Only recently recognised by MEL, this variant is proposed by botanist David Cameron for listing as rare at the State level.

Dichelachne spp.: *Flora of Victoria* (Walsh & Entwistle, 1994) recognise both *Dichelachne rara* and *D. sieberiana*. The distinguishing characteristics they quote are confounding in Maroondah, with characteristics of both species sometimes seen in individual plants. We have used those characteristics to assign one or other name to each of our specimens, but with misgivings that there are scant grounds for recognition of two species.

Geranium solanderi: is an amalgam of several distinct taxa. Two of these were recorded by us, and they are soon to be scientifically described as separate species.

Juncus holoschoenus: The distinction between *Juncus holoschoenus* and *J. fockei* is obscure. An expert on this group, L.A.S. Johnson, identified some herbarium specimens from the eastern suburbs of Melbourne as the latter species, and some years later changed all of his former identifications to *J. holoschoenus*, despite the fact that his current botanical key indicates otherwise. Regardless, there are two distinct taxa in Maroondah - one whose capsules are narrowly acute and exceed the

sepals by about 1 mm, and the other with obtuse capsules that barely exceed the sepals. By the key in *Flora of Victoria* (Walsh and Entwistle, 1994), the former would be regarded as *J. fockei* and the latter as *J. holoschoenus*. The former is common in wetlands across Maroondah, but the latter is known from only a single specimen, collected in this study at the de Felice development site in Bayswater North (Volume 2, Site 72), where it is unlikely to survive the shopping centre car park which is destined for that spot. In the species list, we have opted to conform with Johnson's herbarium determinations and list both Maroondah taxa as *J. holoschoenus*, but with misgivings.

Lepidosperma: The name *Lepidosperma laterale* is widely applied to a range of forms that vary greatly from one another, particularly in size. Such a broad interpretation of *L. laterale* is unsatisfactory in the field as it fails to account for the apparent ecological variation that suggests more than one taxon is involved. In addition, the distinction between *L. laterale* and *L. gunnii* at the small-size extreme and between *L. laterale* and *L. elatius* at the large-size extreme is unclear. We have collected specimens which span the full range between these extremes. It is recognised that some botanists may call the largest of our Maroondah specimens *L. laterale* var. *majus* (a name not presently accepted by the National Herbarium of Victoria) even though we use the name *L. elatius*.

Oxalis perennans: Some botanists recognise *O. exilis* as a distinct species from *O. perennans*, but the distinguishing characteristics of both species are often not discernible. We therefore lump these two entities together in a broad concept of *O. perennans*.

Patersonia fragilis: The plants in Maroondah which are presently included under this name have almost flat leaves, in contrast to the almost terete (cylindrical) leaves of typical *P. fragilis*. They are likely to be recognised as a new, separate species in the next few years.

Prasophyllum pyriforme: This name is currently used to include plants formerly recorded at several sites in Maroondah as *P. frenchii*. Further investigation is needed to determine its taxonomic status; some authors treat it as conspecific with the South Australian *P. constrictum* (Backhouse and Jeanes, 1995).

Stipa ?mollis: This locally very rare plant is closest to *S. mollis* but does not fit the full description in *Flora of Victoria*.

Thelymitra pauciflora: There are three distinct taxa in this group in Maroondah, characterised by leaves which are slender, broad or costate (ridged).

Triglochin striatum: Plants with narrow, cylindrical leaves and plants with flat, strap-like leaves are included under this name by current convention. Plants with narrow, cylindrical leaves (typical *T. striatum*) were only recorded at two sites in Maroondah. All other records of *T. striatum* in Maroondah were of plants with flat, strap-like leaves. Conn and Aston (in Walsh and Entwisle, 1994) state that this form probably constitutes a distinct (as yet unnamed) species.

Typha spp.: The only species of *Typha* recorded with certainty during the study are the indigenous *T. orientalis* and *T. domingensis*. The introduced *T. latifolia* has been identified by another observer (V. Stajsic) from one of Dr Lorimer's collections from Maroondah, but like all specimens examined by us, it shed pollen as single grains, not in the tetrads which are said to be characteristic of *T. latifolia*. The identity of the *Typhas* in Maroondah with near-black female spikes remains uncertain.

Appendix B - Environmental weeds of Maroondah

Weeds covered by the Catchment and Land Protection Act are asterisked. The third column categorises severity in Victoria generally, from Carr, Yugovic and Robinson (1992), and the fourth column is an equivalent categorisation for Maroondah. The categories are:

1. very serious threat to one or more vegetation formations;
2. serious threat to one or more vegetation formations;
3. potential threat to one or more vegetation formations;
4. not a threat, but may have negative visual impact.

Scientific Name	Common Name	Severity in Victoria generally	Severity in Maroondah
<i>Acacia baileyana</i>	Cootamundra Wattle	1	3
<i>Acacia decurrens</i>	Early Black Wattle	1	2
<i>Acacia elata</i>	Cedar Wattle	1	1
<i>Acacia floribunda</i>	White-sallow Wattle	3	3
<i>Acacia longifolia</i>	Sallow Wattle	1	1
<i>Acacia retinodes</i>	Wirilda	2	3
<i>Acer negundo</i>	Box Elder	3	3
<i>Acer pseudoplatanus</i>	Sycamore Maple	1	3
<i>Acetosella vulgaris</i>	Sheep Sorrel	2	3
<i>Agapanthus praecox</i> ssp. <i>orientalis</i>	Agapanthus, African Lily	2	2
<i>Agrostis capillaris</i>	Brown-top Bent	1	1
<i>Aira caryophylla</i>	Silvery Hair-grass	2	2
<i>Aira cupaniana</i>	Small Hair-grass	3	4
<i>Aira elegans</i>	Elegant Hair-grass	2	3
<i>Alisma lanceolata</i>	Water Plantain	3	3
<i>Allium triquetrum</i> *	Angled Onion	1	1
<i>Anagallis arvensis</i>	Pimpernel	2	3
<i>Anomatheca laxa</i>	Anomatheca		2
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass	1	1
<i>Arbutus unedo</i>	Strawberry Tree	3	3
<i>Arctotheca calendula</i>	Cape Weed	2	3
<i>Arrhenatherum elatius</i>	False Oat-grass	3	3
<i>Asphodelus fistulosus</i> *	Onion Weed	2	4
<i>Aster subulatus</i>	Aster-weed	2	2
<i>Atriplex prostrata</i>	Hastate Orache	2	2
<i>Briza maxima</i>	Large Quaking-grass	1	1
<i>Briza minor</i>	Lesser Quaking-grass	3	3
<i>Bromus catharticus</i>	Prairie Grass	1	2
<i>Bromus diandrus</i>	Great Brome	1	2
<i>Bromus hordeaceus</i>	Soft Brome	2	3
<i>Callitriche stagnalis</i>	Water Starwort	3	2
<i>Calystegia silvatica</i>	Greater Bindweed	2	2
<i>Carex disticha</i>	Brown Sedge		2
<i>Centaureum erythraea</i>	Common Centaury	2	2
<i>Centaureum tenuiflorum</i>	Branched Centaury	2	3
<i>Cerastium glomeratum</i>	Mouse-ear Chickweed	2	3
<i>Chrysanthemoides monilifera</i> ssp. <i>monilifera</i> *	Boneseed	1	1
<i>Cicendia filiformis</i>	Slender Cicendia	3	3
<i>Cicendia quadrangularis</i>	Square Cicendia	3	3
<i>Cirsium vulgare</i>	Spear Thistle	2	2
<i>Conyza albida</i>	Fleabane	2	2
<i>Conyza bonariensis</i>	Tall Fleabane		3
<i>Coprosma repens</i>	Taupata or Mirror-bush	1	2
<i>Coprosma robusta</i>	Karamu	1	2
<i>Cordyline australis</i>	New Zealand Cabbage Tree	3	3
<i>Cortaderia selloana</i>	Pampas Grass	1	1
<i>Cotoneaster divaricatus</i>	Cotoneaster	1	1
<i>Cotoneaster glaucophyllus</i>	Cotoneaster	1	1

Scientific Name	Common Name	Severity in Victoria generally	Severity in Maroondah
<i>Cotoneaster pannosus</i>	Cotoneaster	1	1
<i>Cotula coronopifolia</i>	Water Buttons	2	2
<i>Crassula multicava</i>	a Crassula	3	3
<i>Crataegus monogyna</i> *	Hawthorn	1	1
<i>Crepis capillaris</i>	Smooth Hawksbeard	2	3
<i>Cynodon dactylon</i>	Bermuda Couch	1	2
<i>Cyperus congestus</i>	Dense Flat-sedge		3
<i>Cyperus eragrostis</i>	Drain Flat-sedge	2	2
<i>Cyperus tenellus</i>	Tiny Flat-sedge	3	3
<i>Cytisus scoparius</i> *	English Broom	1	1
<i>Dactylis glomerata</i>	Cocksfoot	2	2
<i>Egeria densa</i>	Dense Waterweed	2	2
<i>Ehrharta erecta</i>	Panic Veldt Grass	1	1
<i>Ehrharta longiflora</i>	Annual Veldt Grass	1	3
<i>Epilobium ciliatum</i>	Glandular Willow-herb	3	3
<i>Erica lusitanica</i>	Spanish Heath	1	1
<i>Erica quadrangularis</i>	Angled Heath	2	2
<i>Euphorbia peplus</i>	Petty Spurge		3
<i>Festuca arundinacea</i>	Tall Fescue	2	2
<i>Fraxinus angustifolia</i>	Desert Ash	1	1
<i>Fuchsia magellanica</i>	Fuchsia	3	4
<i>Fumaria officinalis</i>	Fumitory		3
<i>Galium aparine</i>	Cleavers	1	2
<i>Gamochaeta purpurea</i> sensu Ross(1993)	Spiked Cudweed	2	3
<i>Genista linifolia</i> *	Flax-leaved Broom	1	2
<i>Genista monspessulana</i> *	Montpellier Broom	1	1
<i>Gladiolus undulatus</i>	Wild Gladiolus	1	2
<i>Grevillea rosmarinifolia</i>	Rosemary Grevillea	2	2
<i>Hakea salicifolia</i>	Willow-leaved Hakea	1	1
<i>Hedera helix</i>	Ivy	1	1
<i>Helminthotheca echioides</i>	Ox-tongue	2	3
<i>Holcus lanatus</i>	Yorkshire Fog	1	1
<i>Hypericum tetrapterum</i> *	Square-stem St John's Wort	3	1
<i>Hypochoeris radicata</i>	Cat's Ear	2	1
<i>Ilex aquifolium</i>	Holly	1	3
<i>Jasminum</i> sp.	Jasmine		3
<i>Juncus articulatus</i>	Jointed Rush	1	1
<i>Juncus capitatus</i>	Dwarf Rush	3	4
<i>Juncus imbricatus</i>	Folded Rush		2
<i>Juncus microcephalus</i>	Tiny Rush	2	2
<i>Juncus tenuis</i>	Slender Rush		3
<i>Lactuca serriola</i>	Prickly Lettuce	3	4
<i>Leontodon taraxacoides</i>	Hairy Hawkbit	2	1
<i>Lepidium africanum</i>	Common Pepper-cress	3	3
<i>Leycesteria formosa</i>	Himalayan Honeysuckle	1	3
<i>Ligustrum</i> sp.	a Privet		3
<i>Linum trigynum</i>	French Flax	3	2
<i>Lolium perenne</i>	Perennial Rye-grass	2	2
<i>Lonicera japonica</i>	Japanese Honeysuckle	1	1
<i>Lotus corniculatus</i>	Bird's-foot Trefoil	1	2
<i>Lotus suaveolens</i>	Hairy Bird's-foot Trefoil	2	2
<i>Lotus uliginosus</i>	Greater Bird's-foot Trefoil	1	2
<i>Lythrum junceum</i>	Mediterranean Loosestrife		3
<i>Myosotis sylvatica</i>	Wood Forget-me-not	2	2
<i>Myrsiphyllum asparagoides</i>	Bridal Creeper	1	1
<i>Myrsiphyllum scandens</i>	Asparagus Fern	1	1
<i>Nassella trichotoma</i> *	Serrated Tussock	1	2
<i>Omalanthus populifolius</i>	Bleeding Heart Tree		3
<i>Oxalis incarnata</i>	Pale Wood-sorrel	2	1
<i>Paspalum dilatatum</i>	Paspalum	1	1
<i>Paspalum distichum</i>	Water Couch	1	1
<i>Passiflora cinnabarina</i>	Red Passion-flower	3	2

Scientific Name	Common Name	Severity in Victoria generally	Severity in Maroondah
<i>Passiflora mollissima</i>	Banana Passionfruit	1	2
<i>Pennisetum clandestinum</i>	Kikuyu	1	1
<i>Persicaria maculosa</i>	Persicaria	3	3
<i>Phalaris aquatica</i>	Toowoomba Canary-grass	1	3
<i>Pinus pinaster</i>	Maritime Pine	1	3
<i>Pinus radiata</i>	Monterey Pine	1	1
<i>Piptatherum miliaceum</i>	Rice Millet	3	3
<i>Pittosporum undulatum</i>	Sweet Pittosporum	1	1
<i>Plantago coronopus</i>	Buck's-horn Plantain	2	2
<i>Plantago lanceolata</i>	Ribwort	2	2
<i>Prunus cerasifera</i>	Cherry-plum	1	3
<i>Pyracantha crenulata</i>	Nepal Firethorn	1	3
<i>Ranunculus repens</i>	Creeping Buttercup	2	2
<i>Raphiolepis ?indica</i>	Raphiolepis		2
<i>Romulea rosea</i> var. <i>australis</i>	Common Onion-grass	1	1
<i>Rorippa nasturtiumaquaticum</i>	Two-row Watercress	2	2
<i>Rosa rubiginosa</i>	Sweet Briar	1	3
<i>Rubus discolor</i> *	Blackberry	1	1
<i>Rumex conglomeratus</i>	Clustered Dock	2	2
<i>Rumex crispus</i>	Curled Dock	2	2
<i>Salix babylonica</i>	Weeping Willow	2	2
<i>Salix</i> spp.	unidentified Willow		1
<i>Selaginella kraussiana</i>	Garden Selaginella	3	3
<i>Sieglingia decumbens</i>	Heath Grass	3	3
<i>Sisyrinchium iridifolium</i>	Striped Rush-leaf	3	2
<i>Solanum nigrum</i>	Black Nightshade	2	2
<i>Solanum pseudocapsicum</i>	Madeira Winter-cherry	1	3
<i>Sonchus oleraceus</i>	Sow-thistle	2	2
<i>Sporobolus indicus</i>	Indian Rat-tail Grass	2	3
<i>Stipa neesiana</i>	Chilean Spear-grass	1	3
<i>Taraxacum</i>	Dandelion	3	3
<i>Tradescantia albiflora</i>	Wandering Jew	1	1
<i>Tragopogon porrifolius</i>	Salsify	3	3
<i>Trifolium campestre</i>	Hop Clover	2	3
<i>Trifolium dubium</i>	Suckling Clover	2	3
<i>Trifolium repens</i>	White Clover	1	1
<i>Tropaeolum majus</i>	Nasturtium	3	3
<i>Ulex europaeus</i> *	Gorse, Furze	1	1
<i>Viburnum tinus</i>	Laurustinus	3	3
<i>Vicia sativa</i> ssp. <i>nigra</i>	Narrow-leaf Vetch	3	2
<i>Vinca major</i>	Blue Periwinkle	1	2
<i>Viola odorata</i>	Fragrant Violet	3	3
<i>Vulpia bromoides</i>	Squirrel-tail Fescue	1	2
<i>Vulpia myuros</i>	Rat's-tail Fescue	2	4
<i>Watsonia borbonica</i> *	Rosy Watsonia	2	2
<i>Watsonia meriana</i> *	Bulbil Watsonia	1	1
<i>Zantedeschia aethiopica</i>	White Arum Lily	1	3

Appendix C - Bird species of Maroondah

The following list includes all reliable bird records since 1980 that we have been able to find for Maroondah. Introduced species are preceded with an asterisk.

Entries in the third column are as follows:

L: Listed under the Flora and Fauna Guarantee Act;

N: Recorded during this study, but not previously recorded for Maroondah in the Atlas for Victorian Wildlife;

RV: Rare in Victoria generally (one species - Powerful Owl);

RR: Rare throughout the Land Conservation Council's Melbourne Study Area District 2 (LCC, 1991);

U: Uncommon in the same region (LCC, 1991).

The date of the most recent reliable record of each species in the above categories is given in the fourth column. The source of each record is given in the last column, with a tick for those seen in this study, 'AVW' for the Atlas of Victorian Wildlife, and GSL or JCR for observations of G. Lorimer or J. Reid before they began this study.

Ordering follows Christidis and Boles (1994).

Common Name	Scientific Name	Conservation Status	Last seen	Source of Record
Black Swan	<i>Cygnus atratus</i>			AVW
Australian Shelduck	<i>Tadorna tadornoides</i>	U,N	1981	M. Baber
Wood Duck or Maned Goose	<i>Chenonetta jubata</i>			✓
*Mallard	<i>Anas platyrhynchos</i>			✓
Pacific Black Duck	<i>Anas superciliosa</i>			✓
Grey Teal	<i>Anas gracilis</i>			✓
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>			✓
Hoary-headed Grebe	<i>Poliiocephalus poliocephalus</i>			AVW
Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>			✓
Great Cormorant	<i>Phalacrocorax carbo</i>			✓
Australian Pelican	<i>Pelecanus conspicillatus</i>			✓
White-faced Heron	<i>Egretta novaehollandiae</i>			✓
White-necked Heron	<i>Ardea pacifica</i>	U	1994	JCR
Great Egret	<i>Ardea alba</i>			✓
Cattle Egret	<i>Ardea ibis</i>	U	1995	JCR
Nankeen Night Heron	<i>Nycticorax caledonicus</i>	U	1996	✓
Australian White Ibis	<i>Threskiornis molucca</i>			✓
Straw-necked Ibis	<i>Threskiornis spinicollis</i>			AVW
Royal Spoonbill	<i>Platalea regia</i>	N	1996	✓
Yellow-billed Spoonbill	<i>Platalea flavipes</i>			✓
Black-shouldered Kite	<i>Elanus axillaris</i>			✓
Whistling Kite	<i>Haliastur sphenurus</i>	U	1977	AVW
Brown Goshawk	<i>Accipiter fasciatus</i>			✓
Wedge-tailed Eagle	<i>Aquila audax</i>	U	1977	AVW
Little Eagle	<i>Hieraaetus morphnoides</i>	U	1991	AVW
Brown Falcon	<i>Falco berigora</i>			✓
Australian Hobby	<i>Falco longipennis</i>	U	1995	JCR
Peregrine Falcon	<i>Falco peregrinus</i>	U	1980	AVW
Nankeen Kestrel	<i>Falco cenchroides</i>			AVW
Buff-banded Rail	<i>Gallirallus philippensis</i>	RR	1996	R.Nieuwenhuis
Purple Swamphen	<i>Porphyrio porphyrio</i>			✓
Dusky Moorhen	<i>Gallinula tenebrosa</i>			✓
Eurasian Coot	<i>Fulica atra</i>			✓
Black-winged Stilt	<i>Himantopus himantopus</i>	U,N	1997	M. Baber
Black-fronted Dotterel	<i>Elseyornis melanops</i>	U	1996	✓
Banded Lapwing	<i>Vanellus tricolor</i>	R	1990?	Carr <i>et al</i> (1992b)
Masked Lapwing	<i>Vanellus miles</i>			✓
Silver Gull	<i>Larus novaehollandiae</i>			✓
*Rock Dove	<i>Columba livia</i>			✓

Common Name	Scientific Name	Conservation Status	Last seen	Source of Record
* Spotted Turtle-Dove	<i>Streptopelia chinensis</i>			✓
Common Bronzewing	<i>Phaps chalcoptera</i>			✓
Yellow-tailed Black-Cockatoo	<i>Calyptorhynchus funereus</i>			✓
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>			✓
Galah	<i>Cacatua roseicapilla</i>			✓
Long-billed Corella	<i>Cacatua tenuirostris</i>			AVW
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>			✓
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>			✓
Musk Lorikeet	<i>Glossopsitta concinna</i>	U	1996	✓
Little Lorikeet	<i>Glossopsitta pusilla</i>	U	1996	✓
Australian King-Parrot	<i>Alisterus scapularis</i>	U	1996	✓
Crimson Rosella	<i>Platycercus elegans</i>			✓
Eastern Rosella	<i>Platycercus eximius</i>			✓
Pallid Cuckoo	<i>Cuculus pallidus</i>			AVW
Fan-tailed Cuckoo	<i>Cacomantis flabelliformis</i>			✓
Horsfield's Bronze-Cuckoo	<i>Chrysococcyx basalis</i>			AVW
Shining Bronze-Cuckoo	<i>Chrysococcyx lucidus</i>			AVW
Powerful Owl	<i>Ninox strenua</i>	L, RV	1994	GSL
Southern Boobook	<i>Ninox novaeseelandiae</i>			AVW
Tawny Frogmouth	<i>Podargus strigoides</i>			✓
Australian Owlet-nightjar	<i>Aegotheles cristatus</i>			AVW
White-throated Needletail	<i>Hirundapus caudacutus</i>			✓
Fork-tailed Swift	<i>Apus pacificus</i>			AVW
Laughing Kookaburra	<i>Dacelo novaeguineae</i>			✓
Sacred Kingfisher	<i>Todiramphus sanctus</i>			✓
White-throated Treecreeper	<i>Cormobates leucophaeus</i>			✓
Superb Fairy-wren	<i>Malurus cyaneus</i>			✓
Spotted Pardalote	<i>Pardalotus punctatus</i>			✓
Striated Pardalote	<i>Pardalotus striatus</i>			✓
White-browed Scrubwren	<i>Sericornis frontalis</i>			✓
Weebill	<i>Smicrornis brevirostris</i>			✓
Brown Thornbill	<i>Acanthiza pusilla</i>			✓
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>			✓
Yellow Thornbill	<i>Acanthiza nana</i>			✓
Striated Thornbill	<i>Acanthiza lineata</i>			✓
Red Wattlebird	<i>Anthochaera carunculata</i>			✓
Little Wattlebird	<i>Anthochaera chrysoptera</i>			✓
Bell Miner	<i>Manorina melanophrys</i>			✓
Noisy Miner	<i>Manorina melanocephala</i>			✓
Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>			✓
White-eared Honeyeater	<i>Lichenostomus leucotis</i>			✓
White-plumed Honeyeater	<i>Lichenostomus penicillatus</i>			✓
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>			AVW
White-naped Honeyeater	<i>Melithreptus lunatus</i>			S. Baker
New Holland Honeyeater	<i>Phylidonyris novaehollandiae</i>			✓
Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>			✓
Jacky Winter	<i>Microeca fascians</i>			S. Baker
Scarlet Robin	<i>Petroica multicolor</i>			AVW,JCR
Flame Robin	<i>Petroica phoenicea</i>			AVW,JCR
Rose Robin	<i>Petroica rosea</i>			AVW,JCR
Pink Robin	<i>Petroica rodinogaster</i>			AVW
Eastern Yellow Robin	<i>Eopsaltria australis</i>			✓
Varied Sittella	<i>Daphoenositta chrysoptera</i>			AVW
Crested Shrike-tit	<i>Falcunculus frontatus</i>			✓
Olive Whistler	<i>Pachycephala olivacea</i>	N	1995	J.S. Lorimer
Golden Whistler	<i>Pachycephala pectoralis</i>			✓
Rufous Whistler	<i>Pachycephala rufiventris</i>			✓
Grey Shrike-thrush	<i>Colluricincla harmonica</i>			✓
Leaden Flycatcher	<i>Myiagra rubecula</i>	U	1989	AVW
Satin Flycatcher	<i>Myiagra cyanoleuca</i>	U	1992	AVW
Magpie-lark	<i>Grallina cyanoleuca</i>			✓
Rufous Fantail	<i>Rhipidura rufifrons</i>			AVW
Grey Fantail	<i>Rhipidura fuliginosa</i>			✓
Willie Wagtail	<i>Rhipidura leucophrys</i>			✓

Common Name	Scientific Name	Conservation Status	Last seen	Source of Record
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>			✓
Olive-backed Oriole	<i>Oriolus sagittatus</i>			✓
Dusky Woodswallow	<i>Artamus cyanopterus</i>			✓
Grey Butcherbird	<i>Cracticus torquatus</i>			✓
Australian Magpie	<i>Gymnorhina tibicen</i>			✓
Pied Currawong	<i>Strepera graculina</i>			✓
Grey Currawong	<i>Strepera versicolor</i>			✓
Australian Raven	<i>Corvus coronoides</i>			AVW
Little Raven	<i>Corvus mellori</i>			✓
White-winged Chough	<i>Corcorax melanorhamphos</i>	U	1996	✓
* House Sparrow	<i>Passer domesticus</i>			✓
Red-browed Finch	<i>Neochmia temporalis</i>			✓
* European Greenfinch	<i>Carduelis chloris</i>			AVW
* European Goldfinch	<i>Carduelis carduelis</i>			✓
Mistletoebird	<i>Dicaeum hirundinaceum</i>			✓
Welcome Swallow	<i>Hirundo neoxena</i>			✓
Clamorous Reed Warbler	<i>Acrocephalus stentoreus</i>	U	1995-6	✓
Golden-headed Cisticola	<i>Cisticola exilis</i>	N	1996	✓
Silvereye	<i>Zosterops lateralis</i>			✓
Bassian Thrush	<i>Zoothera lunulata</i>			AVW
* Common Blackbird	<i>Turdus merula</i>			✓
* Song Thrush	<i>Turdus philomelos</i>			✓
* Common Starling	<i>Sturnus vulgaris</i>			✓
* Common Myna	<i>Acridotheres tristis</i>			✓

Appendix D - Mammal species of Maroondah

The following list includes all reliable mammal records which we have been able to find for Maroondah. The last three columns follow the same convention as Appendix C, with the additional notation 'Vul' for the Spot-tailed Quoll to indicate that it is a recognised Vulnerable species throughout Victoria, as well as being listed under the Flora and Fauna Guarantee Act.

Common Name	Scientific Name	Conservation Status	Last seen	Source of Record
Short-beaked Echidna	<i>Tachyglossus aculeatus</i>			✓
Spot-tailed Quoll	<i>Dasyurus maculatus</i>	Vul,L	1980	AVW
Brown Antechinus	<i>Antechinus stuartii</i>			AVW
Common Brushtail Possum	<i>Trichosurus vulpecula</i>			✓
Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>			✓
Sugar Glider	<i>Petaurus breviceps</i>			AVW
Eastern Grey Kangaroo	<i>Macropus giganteus</i>		1996	G.Anderson
Koala	<i>Phascolarctos cinereus</i>	U	1995	H. Moss
Black Wallaby	<i>Wallabia bicolor</i>			✓
Eastern Grey Kangaroo	<i>Macropus giganteus</i>	U	1995	H. Moss
White-striped Freetail Bat	<i>Tadarida australis</i>			✓
Lesser Long-eared Bat	<i>Nyctophilus geoffroyi</i>			AVW
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>			AVW
Chocolate Wattled Bat	<i>Chalinolobus morio</i>			AVW
Southern Forest Bat	<i>Vespadelus regulus</i>			AVW
Little Forest Bat	<i>Vespadelus vulturnus</i>			AVW
Large Forest Bat	<i>Vespadelus darlingtoni</i>			AVW
Water Rat	<i>Hydromys chrysogaster</i>			✓
Bush Rat	<i>Rattus fuscipes</i>			AVW
Introduced:				
Black Rat	<i>Rattus rattus</i>			AVW
Brown Rat	<i>Rattus norvegicus</i>			AVW
House Mouse	<i>Mus musculus</i>			AVW
European Rabbit	<i>Oryctolagus cuniculus</i>			✓
Red Fox	<i>Canis vulpes</i>			✓
Cat (feral)	<i>Felis catus</i>			AVW

Appendix E - Frog species of Maroondah

The following frog species have been recorded in Maroondah, with ticks to indicate those detected in this study, 'AVW' for the Atlas of Victorian Wildlife, and CMS for Carr, McMahon and Schulz (1992). All species are indigenous, and none is officially recognised as rare or threatened.

Common Name	Scientific Name	Source of Record
Southern Brown Tree Frog	<i>Litoria ewingii</i>	✓
Verreaux's (Whistling) Tree Frog	<i>Litoria verreauxii verreauxii</i>	✓
Peron's Tree Frog	<i>Litoria peronii</i>	✓
Common Froglet	<i>Crinia signifera</i>	✓
Victorian Smooth Froglet	<i>Geocrinia victoriana</i>	✓
Southern Bullfrog or Pobblebonk	<i>Limnodynastes dumerilii</i>	✓
Striped Marsh Frog	<i>Limnodynastes peroni</i>	CMS
Spotted Marsh Frog	<i>Limnodynastes tasmaniensis</i>	✓
Southern Toadlet	<i>Pseudophryne semimarmorata</i>	AVW

Appendix F - Butterfly species of Maroondah

The only non-indigenous butterfly below is the Cabbage White.

Names denoted by an obelisk (†) were recorded by John Burns and quoted in a 1985 report by A. Paget.

Common Name	Scientific Name
Symmomus Skipper	<i>Trapezites symmumus</i>
Eliena Skipper†	<i>Trapezites eliena</i>
Phigalia Skipper†	<i>Trapezites phigalia</i>
Dispar Skipper	<i>Dispar compacta</i>
Doubleday's Skipper	<i>Toxidia doubledayi</i>
Flame Skipper†	<i>Hesperilla idothea</i>
Donnysa Skipper†	<i>Hesperilla donnysa</i>
Chaostola Skipper†	<i>Hesperilla chaostola</i>
Spotted Skipper	<i>Hesperilla ornata</i>
Yellow-banded Dart	<i>Ocybadistes walkeri sothis</i>
White Grassdart	<i>Taractrocera papyria</i>
Dingy Swallowtail	<i>Papilio anactus</i>
Orchard Butterfly	<i>Papilio aegaeus</i>
Wood White	<i>Delias aganippe</i>
Imperial White	<i>Delias harpalyce</i>
Caper White	<i>Anaphaeis java</i>
Cabbage White	<i>Pieris rapae</i>
Cyril's Brown	<i>Argynnis cyrila</i>
Eastern Ringed Xenica	<i>Geitoneura acantha</i>
Klug's Xenica	<i>Geitoneura klugii</i>
Common Brown	<i>Heteronympha merope</i>
Shouldered Brown	<i>Heteronympha penelope</i>
Sword-grass Brown	<i>Tisiphone abeona</i>
Australian Painted Lady	<i>Vanessa kershawi</i>
Australian Admiral	<i>Vanessa itea</i>
Meadow Argus	<i>Junonia villida</i>
Common Imperial Blue	<i>Jalmenus evagora</i>
Common Dusky Blue	<i>Candalides hyacinthinus</i>
Pea Blue	<i>Lampides boeticus</i>

Common Grass-blue *Zizina labradus*

Appendix G - Sample *Phytophthora* Brochure

Is it easy to see if an area has *phytophthora* root rot?

Not always, but we can suspect *phytophthora* root rot is the cause of the destruction in any area that has a mixture of dying susceptible plants and healthy resistant plants. A laboratory test is needed for a confident diagnosis.

Heathlands, coastal woodlands and dry eucalypt forests are the most vulnerable plant communities. The fungus rarely attacks all susceptible plants in an area at the one time. Often plants are seen in various stages of dying. If plants are all at the same stage of decay there is quite likely another reason for their condition (for example, water-logging, drought, or salinity).

The active disease front, with its autumn colours of dying plants, is often the most obvious sign that an area is infected with *phytophthora* root rot. The disease symptoms vary from plant to plant. For example, banksia leaves slowly go yellow, grass trees (*Xanthorrhoea* spp.) collapse dramatically and eucalypts die back slowly from the branch tips.



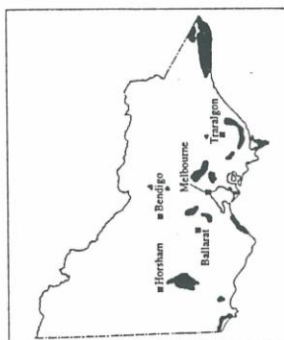
Since it is sometimes hard to see infected areas it is best to assume that all mud can potentially carry the disease.

Is *phytophthora* root rot a problem in Victoria?

In Victoria, *phytophthora* root rot occurs across coastal forests, woodlands and heathlands, and in the Grampians. The disease appears in about 10% of Victorian state forests, national parks, conservation reserves and roadside reserves. It also appears in some nurseries and many home gardens.

Large areas of forest in the southern foothills, the Otways, and south and east Gippsland are infected. It is a serious problem in the Grampians, Lower Glenelg, Brisbane Ranges, Kinglake, Point Nepean (Green Bush), Wilsons Promontory and Croajingolong National Parks, and a number of other parks such as Angahook-Lorne and Lake Tyers. Most infected plant communities grow on soil low in organic matter and with poor drainage, which contributes to disease development.

Research has shown that, in Victoria, the disease can cause the death of more than 25% of the overstorey plant species and 50-75% of the understorey plant species. Colourful wildflowers pollinated by birds and insects are replaced by drab communities of grasses and sedges pollinated by wind. Populations of birds and insects are therefore affected, as are small mammals which prefer to live in dense heath understorey.



Areas of forest and heathland in Victoria which are known to contain sites infected with *Phytophthora*.

How can you help stop the spread of *phytophthora* root rot?

- Always start your trip with clean, dirt-free gear (machinery, vehicles, boots, bushwalking and camping gear, etc.). The soil may be infected.
- Stick to formed tracks. Moving off infected tracks into uninfected areas will spread the disease.
- Leave your campsite with clean gear. Brush soil off tent floor, wash tent-pegs, toilet trowel etc.
- Obey track (road) closed signs. They may have been closed to prevent the disease from being spread to healthy areas.
- Where possible, pass through the uninfected areas first and infected areas last.
- Avoid driving in areas when soils are wet and sticky.
- Clean boots before leaving a diseased area – don't take them home to clean.
- Soil and gravel for landscaping or road works should only be taken from uninfected areas.
- Protect your garden by not digging up bush plants that may be carrying the disease. It is illegal to remove plants from national parks and reserves.
- Use wash down stations if they are provided.



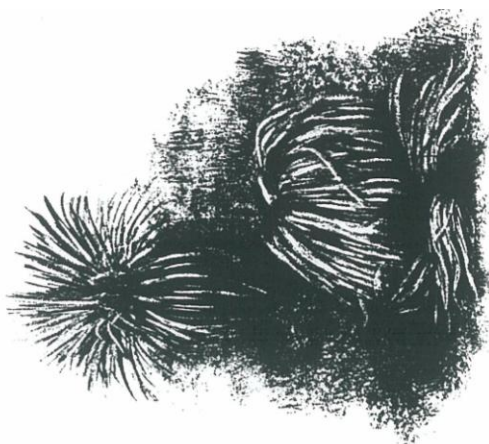
Cleaning tent pegs



This brochure was produced through the co-operation of the Australian Nature Conservation Agency, Canberra, Parks and Wildlife Service, Tasmania and the Department of Conservation and Natural Resources, Victoria.
Reprinted with amendments by the Department of Conservation and Natural Resources, Victoria, May 1994.

PHYTOPHTHORA

ROOT ROT



... the plant killer

What is phytophthora root rot?

Phytophthora (fy-toff-thor-a) root rot, also known as cinnamon fungus and jarrah dieback, is a very serious plant disease that destroys many of our native plants. It affects over 1,000 plant species world-wide including some of our horticultural crops and garden plants.

The disease is caused by a microscopic fungus, *Phytophthora cinnamomi*, that lives in the soil and in plant roots.

It is thought to have come from south-east Asia and was most likely introduced to southern Australia by European settlers.

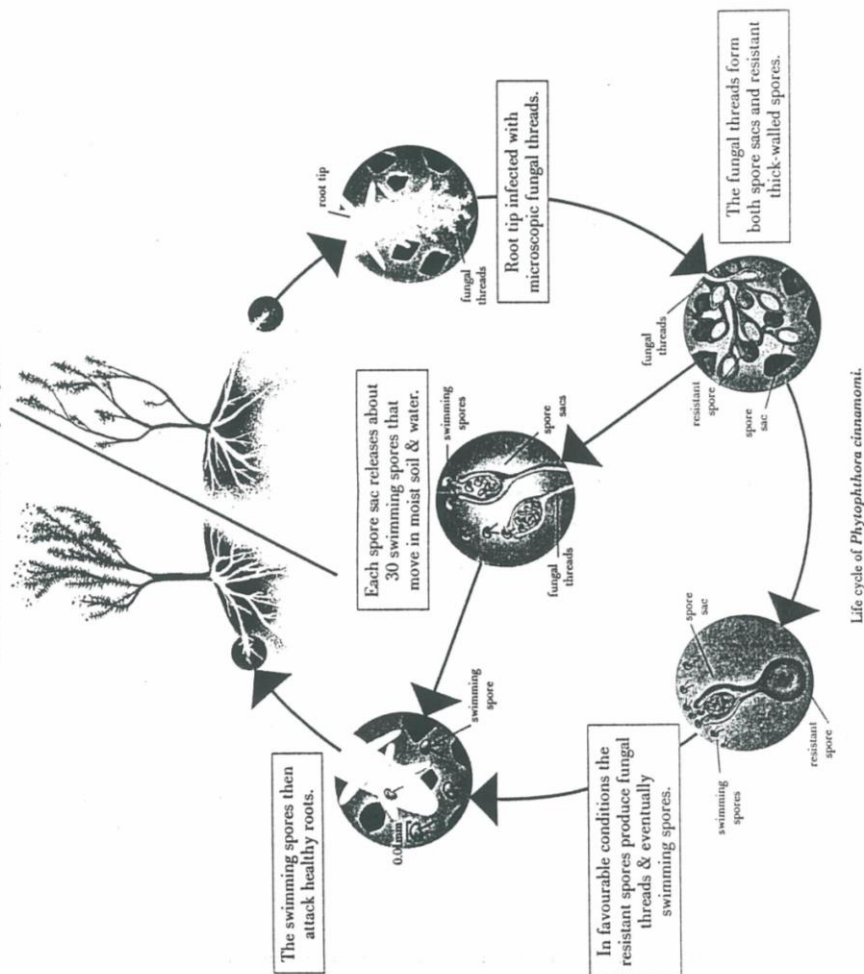
Phytophthora root rot is best known as the cause of the jarrah dieback epidemic in Western Australia where over 200,000 hectares of jarrah forest suffered gradual decline and death.

How does it kill plants?

The fungus infects and rots the roots of plants. Since plants take up nutrients and water through their roots, any root damage will affect their growth and survival.

Usually the disease attacks the small feeder roots first. Not all plants succumb. In susceptible plants the fungus spreads through the root system causing rot. Occasionally the base of the stem is also affected. Some plants die very quickly whereas others may only show signs of the disease after periods of stress (for example drought).

What is the disease's life cycle?



How does it survive and spread?

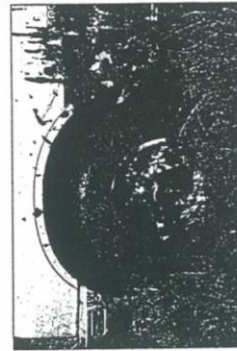
Two main spore types help the disease to survive. The swimming spore (zoospore) moves in moist soil and water and the more resistant thick-walled spore (chlamydospore) can survive much drier conditions for several months. The fungus can also reproduce quickly, which further increases its chance of survival.

The disease naturally spreads downhill with the movement of water and soil. Rates of up to 400 metres per year have been recorded.

People have dramatically increased the spread of the fungus by moving infected soil, gravel and plant material. Changing soil drainage patterns may also help spread the disease.

The disease can be transferred in mud on the underbodies and wheels of cars and machines. In more remote areas muddy bushwalking gear such as tents, tent pegs, gaiters, toilet trowels and boots help transfer the disease.

The more soil that is moved the greater the risk of starting a new infection.



Glossary

Alluvial	adjective referring to soil deposited by a stream or floodwater.
Biodiversity	the range of flora, fauna, ecological communities and genetic material.
Biogeography	the study of the geographical distributions of different types of flora and fauna, and the geographical factors which influence those distributions.
Cadastral	adjective, pertaining to the area and property boundaries on a land title.
Ecotone	the boundary between different vegetation types or habitat types.
Herb	in botanical terminology (and hence this report), a plant without any woody parts; e.g. an orchid, lily, rush or grass.
Invertebrate	fauna without backbones, such as insects, spiders, crustaceans and molluscs.
Perennial	adjective. A perennial stream or water body is one which does not normally dry out.
Provenance	of plants raised by humans, the ancestral place of origin in the wild, often expressing the location and type of habitat.
Riparian	adjective, meaning ‘occurring beside a stream’. A riparian zone occurs along a stream and is directly influenced by the flowing water. A subriparian zone may occur adjacent to this.
Vertebrate	fauna with backbones, including mammals, birds, amphibians, reptiles and fish.
Vestigial	adjective. Native vegetation is said to have become vestigial if it retains only a few indigenous plant species, which are inevitably the most hardy ones.