

Healesville - Koo Wee Rup Road - Rare plant survey focusing on *Amphibromus fluitans*

Project: 05-69

Report Prepared for:

VicRoads



Ecology Australia Pty Ltd
Flora and Fauna Consultants

www.ecologyaustralia.com.au

admin@ecologyaustralia.com.au

88B Station Street, Fairfield,

Victoria, Australia 3078

Tel: (03) 9489 4191

Fax: (03) 9481 7679

© 2006 Ecology Australia Pty Ltd

This publication is copyright. It may only be used in accordance with the agreed terms of the commission. Except as provided for by the Copyright Act 1968, no part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, without prior written permission of Ecology Australia Pty Ltd.

Document information

This is a controlled document. Details of the document ownership, location, distribution, status and revision history are listed below.

All comments or requests for changes to content should be addressed to the document owner.

Document Information		
Owner	Ecology Australia	
Author	L.V. Crowfoot, C. Campbell and G. W. Carr	
Location	J:\CURRENT PROJECTS\Healesville - Koo Wee Rup Rd 05-69\Reports\Amphibromus fluitans_rare plant survey final.doc	
Distribution	Tony Hillman	VicRoads
	Terry Dexter	VicRoads

Document History			
Status	Changes	By	Date
Draft 1.1	First Draft	L.V. Crowfoot and G.W. Carr	15/12/05
Draft 2.1	Second draft	L.V. Crowfoot	1/2/06
Final	Final report	L.V. Crowfoot	23/2/06

Contents

Summary	1
1 Introduction	2
1.1 Study area	2
2 Methods	4
2.1 Desktop review	4
2.2 Field surveys	4
3 Results	5
3.1 Desktop review of River Swamp Wallaby-grass	5
3.1.1 Biology	5
3.1.2 Ecology	5
3.1.3 Distribution in Victoria	5
3.2 Field survey	8
3.2.1 River Swamp Wallaby-grass	8
3.2.2 Other significant species	8
4 Discussion	14
5 References	15
6 Acknowledgments	16

Figures

Figure 1	Healesville-Koo Wee Rup Road study area (yellow) for the rare plant survey	3
Figure 2	Records of <i>Amphibromus fluitans</i> within Victoria (data and map from DSE 2005b)	7
Figure 3a	Location of site assessments for River Swamp Wallaby-grass within the northern section of the Healesville-Koo Wee Rup Road study area. December 2005.	9
Figure 3b	Location of site assessments for River Swamp Wallaby-grass within the southern section of the Healesville-Koo Wee Rup Road study area. December 2005.	10

Plates

Plate 1.	Common Swamp Wallaby-grass (centre) within a farm dam (Koo Wee Rup) growing amongst *Water Couch and Montpellier Broom * <i>Genista monspessulana</i> . December 2005.	11
Plate 2.	The velocity of water within some drainage lines would inhibit River Swamp Wallaby-grass from establishing. Bunyip River drainage-line complex, December 2005.	11

- Plate 3. Common Reed (pictured growing along the northern stream bank of Bunyip River) is known to outcompete River Swamp Wallaby-grass. December 2005. 12
- Plate 4. Competition from exotic species (Curled dock **Rumex crispus*, *Umbrella Sedge, *Canary Grass pictured) creates an adverse environment for River Swamp Wallaby-grass establishment and persistence. Photo: Deep Creek, December 2005. 12
- Plate 5. Saline conditions are not favourable for River Swamp Wallaby-grass. Estuarine species Australian Salt-grass *Distichlis distichophylla*, Beaded Glasswort *Sarcocornia quinqueflora* ssp. *quinqueflora*, Sea Rush *Juncus kraussii* ssp. *australiensis* (pictured) were frequently recorded within the drainage lines around the Koo Wee Rup Swamp lookout (December 2005). 13

Appendices

- Appendix 1** Species lists from the Healesville – Koo Wee Rup Road study area (December 2005). 17
- Appendix 2** VicRoads Assignment Task Brief 25

Summary

Ecology Australia was commissioned by VicRoads to undertake a rare plant survey focusing on *Amphibromus fluitans* (River Swamp Wallaby-grass) within the Healesville – Koo Wee Rup Road study area. River Swamp Wallaby-grass is listed as Vulnerable under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*. The objective of the study was to survey for species listed under Federal or State legislation that may be issues for the alignment of the proposed road upgrade at this stage of the project. The focus of the survey was on River Swamp Wallaby-grass because it was identified as having a moderate likelihood of occurrence south of the Pakenham Bypass. This report presents the findings of the survey.

Water bodies were strategically sampled to determine if River Swamp Wallaby-grass was present and if habitat was suitable for the species. No River Swamp Wallaby-grass was recorded during the survey. Potentially the most suitable habitat for this species is within farm dams and off-stream water bodies (i.e. because they are still water bodies, with mostly non-turbid water and often reduced weed competition due to stock grazing). Habitat within drains and creek lines was deemed to be unsuitable, based on the: velocity of water flows, level of competition from exotic and some native species, and high saline conditions within the southern section of the Bunyip River drainage-line complex.

No other species listed under the *EPBC Act 1999* or the *FFG Act 1988* was recorded during the survey. One species (*Atriplex paludosa* ssp. *paludosa*) considered to be rare in Victoria was recorded within the southern section of the Bunyip River drainage-line complex.

From the results of the survey it appears very unlikely that River Swamp Wallaby-grass occurs within the study area. However not all areas were accessible and it is suggested that once the preferred road alignment has been chosen and the detailed flora and fauna surveys are underway, that any other potential habitat for this species is thoroughly surveyed.

1 Introduction

Ecology Australia was commissioned by VicRoads (Metropolitan South East Region) to undertake a rare plant survey focusing on *Amphibromus fluitans* (River Swamp Wallaby-grass) in relation to the future upgrade of the Healesville – Koo Wee Rup Road, between the Pakenham Bypass and the South Gippsland Freeway.

A desktop review of a larger study area (Princess Highway to the South Gippsland Highway) identified a number of listed species that had been recorded within 5km of, or potentially having suitable habitat within, the study area (Ecology Australia 2005a). Of these, three species (River Swamp Wallaby-grass, *Dianella amoena* Matted Flax-lily, *Prasophyllum frenchii* Maroon Leek-orchid) listed under the *Environment Protection and Biodiversity Act 1999* (EPBC Act) and/or the *Flora and Fauna Guarantee Act 1988* (FFG Act) were identified as having a moderate likelihood of occurrence.

Within the current study area (i.e. south of the Pakenham Bypass), only River Swamp Wallaby-grass was considered to have a moderate likelihood of occurrence and therefore was the focus of the survey. This species is listed as Vulnerable under *EPBC Act 1999*. This report presents the results of the survey.

It should be noted that a number of species classified by DSE as being rare or threatened were also identified in the desktop review. These species do not have legislative implications for the alignment of the road, but some may potentially occur within the study area. Most are likely to be associated with existing remnants (largely Swamp Scrub – an Endangered EVC), and surveys for these species should be conducted once the systematic survey of remnants to facilitate the choice of a preferred corridor is underway.

1.1 Study area

The study area is defined as a 100 m strip either side of the existing Healesville - Koo Wee Rup Road. The study area extends from Pakenham Bypass to the South Gippsland Highway, and also includes the Bunyip River drainage-line complex, Sybella Avenue and the area between them (Figure 1). In an attempt to detect River Swamp Wallaby-grass, four types of water bodies were targeted during the survey:

1. The drain that runs parallel to Healesville - Koo Wee Rup Road
2. Farm Dams
3. Deep Creek
4. Bunyip River drainage-line complex

Pre-1750 modelling occurring within the Gippsland Plain Bioregion of the vegetation indicates that the study area once supported Swampy Woodland, Swamp Scrub and Swampy Riparian Woodland

(DSE 2005a). Most of this area would have been part of the Koo Wee Rup Swamp, which has been extensively cleared and is now predominately a pastoral landscape (Ecology Australia 2005a, b). Small remnants of Swamp Scrub occur along drainage and creek lines, the most significant being the Koo Wee Rup Swamp lookout, located in the south-west corner of the study area.

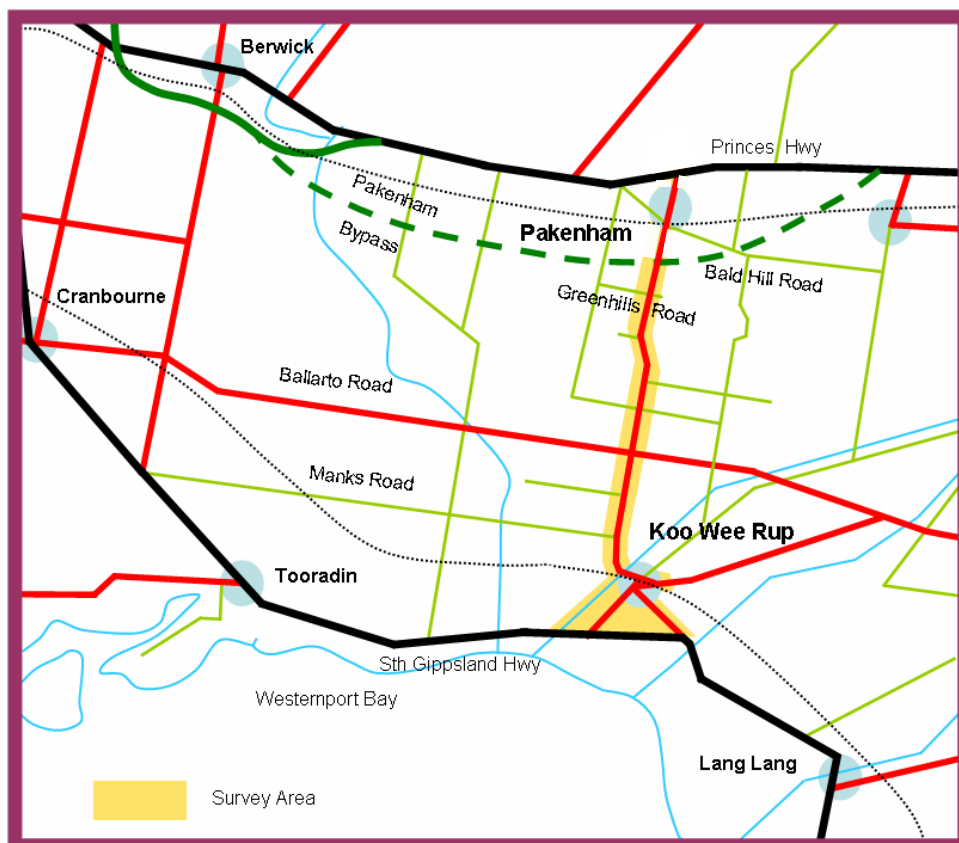


Figure 1 Healesville-Koo Wee Rup Road study area (yellow) for the rare plant survey

2 Methods

2.1 Desktop review

The Flora Information System (FIS) database (DSE 2005b) was interrogated for occurrences of *Amphibromus fluitans* within Victoria, in particular those that occur within south-east Melbourne.

A report on the ecology, distribution and management of *A. fluitans* within and around the Albury Bypass study area (by Ecology Australia, Carr 2006) was also reviewed as part of this project.

2.2 Field surveys

The study area was visited on 6, 16 and 20 December 2005 by botanists. Dams, drains and creek lines were strategically sampled to determine if habitat was suitable for *Amphibromus fluitans* and whether the species was present. At all sites, species lists of vegetation occurring within and surrounding the water bodies were compiled (see Appendix 1) and GPS waypoints recorded. Samples from all *Amphibromus* populations detected were collected and identified to species in the laboratory.

Limitations

Due to the large area occupied by creek lines and drains, the whole area could not be sampled. This was partially overcome by determining whether habitat was suitable for River Swamp Wallaby-grass at selected sampling points. As many dams as possible were assessed, but we were unable to get permission to access a number of properties, thus, further surveys may be required when the alignment is finalised.

Plant names

Plant names used in this report follow Ross and Walsh (2003), unless otherwise indicated. An asterisk (*) denotes exotic species.

3 Results

3.1 Desktop review of River Swamp Wallaby-grass

3.1.1 Biology

Amphibromus fluitans (River Swamp Wallaby-grass) is a cool-season amphibious or aquatic perennial grass with a loosely tufted – stoloniferous habit. Flowering occurs in spring to summer, and if sufficient water persists, several flowering events may occur (Carr 2006).

Seeds are dispersed externally by waterfowl, thus long-distance dispersal is possible, enabling this species to establish in farm dams where many populations have been recorded in Victoria and New South Wales. Seed germination occurs on mud or in shallow water, normally in autumn, but it can germinate at other times in response to inundation. Dispersal can also be vegetative, via flood waters (Carr 2006).

3.1.2 Ecology

River Swamp Wallaby-grass has a very wide ecological amplitude. It naturally occurs on floodplains, occupying off-stream wetlands, along small perennial streams and has been found widely in constructed wetlands, farm dams and artificial impoundments (Carr 2006). It can occupy more-or-less permanently wet habitats with free water, or the wetlands can dry out completely over summer. Plants do not need free water (inundations) to persist in a wetland but effectively behave as amphibious opportunists (Carr 2006).

Previous research has shown that River Swamp Wallaby-grass is found predominately in clear water, and that turbid water is unsuitable for the species (Carr 2006). Furthermore, saline conditions are also considered unfavourable.

Serious competitive weed species are capable of eliminating River Swamp Wallaby-grass (Carr 2005); such species often includes Water Couch (**Paspalum distichum*), Paspalum (**Paspalum dilatatum*), Canary-grass (**Phalaris aquatica*), Jointed Rush (**Juncus articulatus*), Marsh Yellow-cress (**Rorippa palustris*), European Watercress (**Nasturtium officinale*), Umbrella Sedge (**Cyperus eragrostis*), Yorkshire Fog (**Holcus lanatus*) and Prairie Grass (**Bromus catharticus*).

River Swamp Wallaby-grass is resilient to grazing and disturbance by stock, kangaroos and waterfowl. Stock grazing even allows its persistence in pastures by reducing competition from exotic species (mostly grasses) (Carr 2006).

3.1.3 Distribution in Victoria

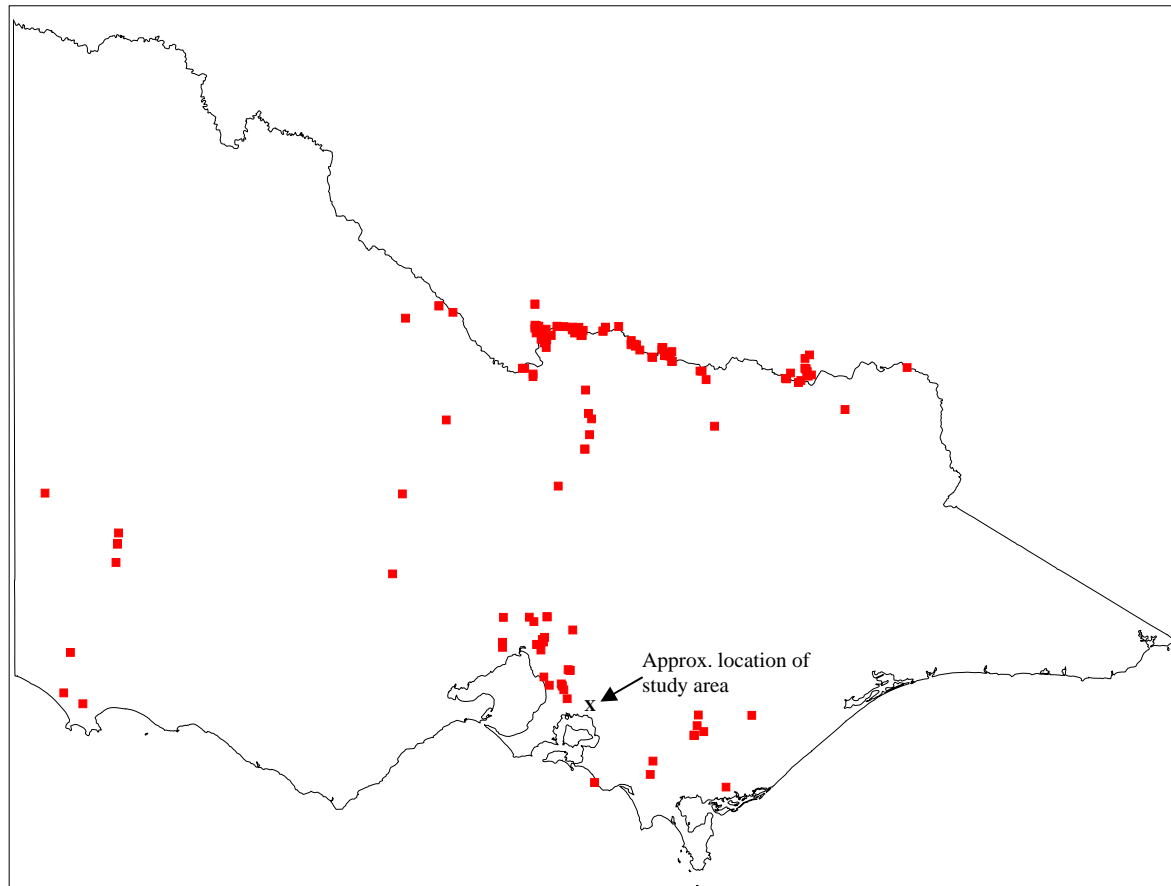
In Victoria River Swamp Wallaby-grass is widespread in the south-west, but with relatively few records to the east of Melbourne (Figure 2). In northern Victoria populations are known from the

Murray River Floodplain and constructed wetlands (Carr 2006). The closest records to the study area are 15 – 25 km away, they include:

- South Gippsland Highway, Cranbourne – one record in 1990
- Evans Road, Cranbourne – one record in 1998
- Western Port Highway, Lyndhurst – two records in 1990
- Abbots Road, Dandenong South – one record in 1993
- Mornington Peninsula Highway, Bangholme – one record in 1993.

V *Amphibromus fluitans*
River Swamp Wallaby-grass

State border and coast
Species Record



Data: Flora Information System, Biodiversity and Natural Resources, DSE - May 2005 - © Viridans Biological Databases

100 km

Figure 2 Records of *Amphibromus fluitans* within Victoria (data and map from DSE 2005b)

3.2 Field survey

3.2.1 River Swamp Wallaby-grass

A total of 42 sites were assessed to determine whether River Swamp Wallaby-grass was present and/or whether suitable habitat occurs within the study area (Figure 3). The species was not recorded during the survey. Potentially the most suitable habitat for this species locally is within farm dams and off-stream water bodies (i.e. because they are still water bodies, with mostly non-turbid water and often reduced weed competition as a result of stock grazing, see Section 3.1). The common relative Common Swamp Wallaby-grass (*Amphibromus nervosus*) was frequently recorded (Plate 1). Other species recorded within these dams included: *Water Couch, *Canary Grass, Water Buttons (*Cotula coronopifolia*), *Umbrella Sedge, Common Spike-sedge (*Eleocharis acuta*), Narrow-leaf Cumbungi (*Typha domingensis*), Water Starwort (*Callitriche stagnalis*), Common Blown-grass (*Lachnagrostis filiformis* s.l.) and Annual Beard-grass (*Polypogon monspeliensis*) (Appendix 1).

It is evident that habitat is unsuitable for River Swamp Wallaby-grass along drainage lines, the Bunyip River (and associated drains) and Deep Creek. We believe that the reasons for this include:

- The velocity of the flow; most drainage lines appear to have quite a fast flow of water during at least part of the year (Plate 2), which would inhibit the establishment or persistence of River Swamp Wallaby-grass (it is a species of still water bodies);
- Nutrient enrichment in the drains results in an adverse competitive environment with native plant species such as Cumbungi *Typha* spp. and Common Reeds *Phragmites australis* and with exotic species (particularly *Water Couch, *Paspalum, *Umbrella Sedge and *Canary-grass) because of their very vigorous and lush growth would rapidly smother River Swamp Wallaby-grass plants (Plates 3 and 4); and
- River Swamp Wallaby-grass requires non-turbid, non-saline water, and whilst the greater part of the creeks and drainage lines have good water quality, the saline conditions within the drains around the Koo Wee Rup Swamp lookout (Plate 5), and several hundred metres upstream of the Bunyip River drainage-line complex, is another factor we believe precludes its establishment and growth.

3.2.2 Other significant species

No other species listed under the *EPBC Act* 1999 or the *FFG Act* 1988 was recorded during the survey.

Atriplex paludosa ssp. *paludosa* was opportunistically recorded at the southern end of the Bunyip River drainage-line complex (Site 41). This species is classified as rare in Victoria (DSE 2005c). It is a species of saline environments (often associated with coastal saltmarsh vegetation) which has colonised the southern section of the study area as a result of tidal influence.



Figure 3a Location of site assessments for River Swamp Wallaby-grass within the northern section of the Healesville-Koo Wee Rup Road study area. December 2005.



Figure 3b Location of site assessments for River Swamp Wallaby-grass within the southern section of the Healesville-Koo Wee Rup Road study area. December 2005.



Plate 1. Common Swamp Wallaby-grass (centre) within a farm dam (Koo Wee Rup) growing amongst *Water Couch and Montpelliar Broom **Genista monspessulana*. December 2005.



Plate 2. The velocity of water within some drainage lines would inhibit River Swamp Wallaby-grass from establishing. Bunyip River drainage-line complex, December 2005.



Plate 3. Common Reed (pictured growing along the northern stream bank of Bunyip River) is known to outcompete River Swamp Wallaby-grass. December 2005.



Plate 4. Competition from exotic species (Curled dock *Rumex crispus*, *Umbrella Sedge, *Canary Grass pictured) creates an adverse environment for River Swamp Wallaby-grass establishment and persistence. Photo: Deep Creek, December 2005.



Plate 5. Saline conditions are not favourable for River Swamp Wallaby-grass. Estuarine species Australian Salt-grass *Distichlis distichophylla*, Beaded Glasswort *Sarcocornia quinqueflora* ssp. *quinqueflora*, Sea Rush *Juncus kraussii* ssp. *australiensis* (pictured) were frequently recorded within the drainage lines around the Koo Wee Rup Swamp lookout (December 2005).

4 Discussion

River Swamp Wallaby-grass is widely distributed in Victoria. This species may have once occurred throughout the Pakenham – Koo Wee Rup region before the Koo Wee Rup Swamp was drained and indigenous vegetation cleared. There are currently six records of River Swamp Wallaby-grass within 25km of the study area.

Within the study area the most suitable potential habitat for this species occurs within farm dams, however only the common relative *Amphibromus nervosus* was recorded. Habitat within drains and creeklines was deemed to be unsuitable, based on the:

1. velocity of water flow;
2. level of competition from exotic and some native species; and
3. salinity of water at the southern end of the Bunyip River drainage-line complex.

From the results of the survey we believe that it is very unlikely that River Swamp Wallaby-grass occurs within the study area. However not all areas were accessible (e.g. on private property where access permission was not granted or unable to be accessed by foot) and it is suggested that once the preferred road alignment has been chosen and the detailed flora and fauna surveys are underway, that any other potential habitat for this species, particularly within farm dams, is thoroughly surveyed.

5 References

- Carr, G. W. (2006). Recovery and compensation measures for loss of the Williams Road habitat of Floating Swamp Wallaby Grass (*Amphibromus fluitans*). Report prepared for VicRoads. (Ecology Australia Pty Ltd, Fairfield.).
- Department of Sustainability and Environment (2005a). Sites of Biodiversity Significance (Biosites) and Ecological Vegetation Classes (EVCs): Port Phillip and Westernport Region. Maps and Reports on CD-ROM. (Department of Sustainability and Environment: Melbourne).
- Department of Sustainability and Environment (2005b). The Victoria Flora Information System CD-ROM. (Department of Sustainability and Environment: Melbourne).
- Department of Sustainability and Environment (2005c). Advisory list of rare or threatened plants in Victoria – 2005. (Department of Sustainability and Environment: Melbourne)
- Ecology Australia (2005a). Healesville – Koo Wee Rup Road – Flora and Fauna Issues, Desktop Review. Report prepared for VicRoads. (L. V. Crowfoot, D. G. Quin and A. R. G. McMahon, Ecology Australia Pty Ltd, Fairfield).
- Ecology Australia (2005b). Healesville – Koo Wee Rup Road – Southern Brown Bandicoot Survey. Draft report prepared for VicRoads. (C. Wilson, D. G. Quin and E. Moysey, Ecology Australia Pty Ltd., Fairfield).
- Ross, J.H. and Walsh, N.G. (2003). A Census of the Vascular Plants of Victoria, 7th Edn. (National Herbarium of Victoria, Royal Botanic Gardens: South Yarra, Victoria).

6 Acknowledgments

We would like to thank the following people for their assistance in the preparation of the report:

- Andrew McMahon, Jamie McMahon, Darren Quin and Christina Renowden (Ecology Australia);
- Terry Dexter and Tony Hillman (VicRoads).

Appendix 1 Species lists from the Healesville – Koo Wee Rup Road study area
(December 2005).

Site 1: Drain near Soldiers Road #1

**Bromus diandrus*
**Bromus hordeaceus* ssp. *hordeaceus*
**Callitriche stagnalis*
**Cyperus eragrostis*
**Daucus carota*
**Echinochloa* sp.
**Galium aparine*
**Holcus lanatus*
**Phalaris aquatica*
**Poa pratensis*
**Ranunculus sceleratus* ssp. *sceleratus*
**Raphanus raphanistrum*
**Vicia sativa* ssp. *sativa*
Alisma plantago-aquatica
Epilobium hirtigerum
Lachnagrostis filiformis sl.
Persicaria descipens
Phalaris minor
Phragmites australis

Site 2: Deep Creek

**Bromus catharticus*
**Cyperus eragrostis*
**Dactylis glomerata*
**Glyceria declinata*
**Juncus articulatus*
**Melaleuca ericifolia*
**Paspalum distichum*
**Phalaris aquatica*
**Rubus anglocandicans*
**Rumex conglomeratus*
**Trifolium fragiferum* var. *fragiferum*
Alisma plantago-aquatica
Eleocharis acuta
Lycopus australis
Persicaria decipiens
Phragmites australis
Potamogeton ochreatus
Schoenoplectus tabernaemontani

Site 3: Koo Wee Rup Road Drain

**Aster subulatus*
**Callitriche stagnalis*
**Holcus lanatus*
**Melaleuca ericifolia*
**Phalaris aquatica*
**Polypogon monseliensis*
**Rorippa palustris*
**Rubus anglocandicans*
Gahnia sieberiana

Lemna disperma
Lomandra longifolia ssp. *longifolia*
Phragmites australis
**Helminthotheca echioides*
**Paspalum distichum*

Site 4: Bunyip River drainage-line complex

**Aster subulatus*
**Callitriche stagnalis*
**Cyperus eragrostis*
**Daucus carota*
**Galium aparine*
**Genista linifolia*
**Holcus lanatus*
**Lotus* sp.
**Nasturtium officinale*
**Phalaris aquatica*
**Raphanus raphanistrum*
**Rubus anglocandicans*
**Rumex crispus*
**Vicia sativa* ssp. *sativa*
Alternanthera denticulata
Geranium sp.
Melaleuca ericifolia
Persicaria descipens
Phragmites australis
Triglochin procera (broad-erect leaves)

Site 5: Bunyip River drainage-line complex

**Callitriche stagnalis*
**Cyperus eragrostis*
**Dactylis glomerata*
**Daucus carota*
**Genista monspessulana*
**Glyceria declinata*
**Holcus lanatus*
**Nasturtium officinale*
**Paspalum distichum*
**Phalaris aquatica*
**Polypogon monseliensis*
**Raphanus raphanistrum*
**Rorippa palustris*
**Rubus anglocandicans*
**Rumex conglomeratus*
**Rumex crispus*
Alisma plantago-aquatica
Juncus amabilis
Lemna disperma

Site 6: Bunyip River drainage-line complex

**Cyperus eragrostis*
**Melaleuca ericifolia*
**Phalaris aquatica*
**Rubus anglocandicans*
**Salix rubens*
Lycopus australis
Phragmites australis
Triglochin procera (broad-erect leaves)
**Raphanus raphanistrum*
**Rorippa palustris*
**Tradescantia fluminensis*
**Watsonia meriana* var. *bulbillifera*
Alisma plantago-aquatica
Juncus amabilis
Verbena sp.

Site 7: Bunyip River drainage-line complex

**Aster subulatus*
**Callitriche stagnalis*
**Conyza sumatrensis*
**Cyperus eragrostis*
**Holcus lanatus*
**Melaleuca ericifolia*
**Nasturtium officinale*
**Paspalum distichum*
**Phalaris aquatica*
**Rorippa palustris*
**Rubus anglocandicans*
**Rumex conglomeratus*
**Rumex crispus*
Alisma plantago-aquatica
Eleocharis acuta
Persicaria decipiens
Potamogeton pectinatus
Schoenoplectus tabernaemontani
Triglochin procera (broad-erect leaves)
Triglochin procera (narrow-floating leaves)
Typha domingensis

Site 8: Bunyip River drainage-line complex

**Conyza sumatrensis*
**Cyperus eragrostis*
**Elytrigia repens*
**Glyceria declinata*
**Holcus lanatus*
**Hypochoeris radicata*
**Melaleuca ericifolia*
**Paspalum distichum*
**Phalaris aquatica*
**Rorippa palustris*

**Rubus anglocandicans*
**Rumex conglomeratus*
Acaena novae-zealandiae
Eleocharis acuta
Eleocharis sphacelata
Juncus amabilis
Lachnagrostis filiformis sl.
Lycopus australis
Persicaria decipiens
Phragmites australis
Schoenoplectus tabernaemontani
Triglochin procera (narrow-floating leaves)

Site 9: Bunyip River drainage-line complex

**Aster subulatus*
**Callitriche stagnalis*
**Daucus carota*
**Genista linifolia*
**Holcus lanatus*
**Hypochoeris radicata*
**Melaleuca ericifolia*
**Paspalum distichum*
**Phalaris aquatica*
**Polypogon monseliensis*
**Rubus anglocandicans*
**Rumex conglomeratus*
**Rumex crispus*
Acaena novae-zealandiae
Lachnagrostis filiformis sl.
Lemna disperma
Phragmites australis
Triglochin procera (broad-erect leaves)

Site 10: Koo Wee Rup Road drain (west)

**Agrostis capillaris* sl.
**Avena* sp.
**Bromus catharticus*
**Cynodon dactylon* var. *dactylon*
**Cyperus eragrostis*
**Dactylis glomerata*
**Daucus carota*
**Holcus lanatus*
**Lolium rigidum*
**Paspalum distichum*
**Plantago lanceolata*
**Rubus anglocandicans*
**Rumex crispus*
**Sporobolus africanus*
Acacia melanoxylon
Lomandra longifolia ssp. *longifolia*

Site 11: Koo Wee Rup Road drain (east)

**Bromus catharticus*
**Callitriche stagnalis*
**Cyperus eragrostis*
**Dactylis glomerata*
**Daucus carota*
**Holcus lanatus*
**Juncus articulatus*
**Paspalum distichum*
**Prunella vulgaris*
**Rubus anglocandicans*
Eleocharis acuta
Persicaria decipiens
Phragmites australis
Triglochin procera (broad-erect leaves)

Site 12: Drain in paddock

**Agrostis capillaris* sl.
**Anthoxanthum odoratum*
**Cynodon dactylon* var. *dactylon*
**Cynosurus echinatus*
**Holcus lanatus*
**Hypochoeris radicata*
**Hypochoeris radicata*
**Lolium rigidum*
**Paspalum dilatatum*
**Polypogon monseliensis*
Eleocharis acuta
Lachnagrostis filiformis sl.
Phragmites australis
Schoenus apogon
Typha domingensis

Site 13: Koo Wee Rup Road drain (west)

**Agrostis capillaris* sl.
**Anthoxanthum odoratum*
**Avena* sp.
**Bromus catharticus*
**Cyperus eragrostis*
**Dactylis glomerata*
**Daucus carota*
**Galium aparine*
**Holcus lanatus*
**Juncus articulatus*
**Lolium rigidum*
**Paspalum dilatatum*
**Paspalum distichum*
**Pennistemon clandestinum*
**Phalaris aquatica*
**Plantago coronopus*
**Plantago lanceolata*

**Rubus anglocandicans*
**Rumex crispus*
**Sporobolus africanus*
**Vicia sativa* ssp. *sativa*
Acacia melanoxylon
Acaena novae-zealandiae
Eleocharis acuta
Lomandra longifolia ssp. *longifolia*
Melaleuca ericifolia
Oxalis sp.
Themeda triandra

Site 13a: Drain in paddock

**Bromus catharticus*
**Callitriche stagnalis*
**Cyperus eragrostis*
**Hordeum* sp.
**Paspalum dilatatum*
**Rumex crispus*
Phragmites australis
Triglochin procera (broad-erect leaves)

Site 14: Deep Creek (east)

**Agrostis capillaris* sl.
**Aster subulatus*
**Bromus catharticus*
**Bromus hordeaceus* ssp. *hordeaceus*
**Cyperus eragrostis*
**Daucus carota*
**Genista linifolia*
**Lolium perenne*
**Paspalum dilatatum*
**Paspalum distichum*
**Pennistemon clandestinum*
**Phalaris aquatica*
**Phalaris minor*
**Plantago lanceolata*
**Rumex conglomeratus*
**Rumex crispus*
**Trifolium pratense*
**Ulex europaeus*
**Vicia sativa* ssp. *sativa*
**Vulpia bromoides*
Alisma plantago-aquatica
Eleocharis acuta
Geranium sp.
Hemarthria uncinata var. *uncinata*
Juncus amabilis
Oxalis perennans
Persicaria decipiens
Schoenoplectus tabernaemontani

Site 15: Deep Creek (west)

**Agrostis capillaris* sl.
**Agrostis stolonifera*
**Aster subulatus*
**Cyperus eragrostis*
**Daucus carota*
**Festuca arundinacea*
**Geranium dissectum*
**Glyceria declinata*
**Lolium perenne*
**Nasturtium officinale*
**Paspalum dilatatum*
**Paspalum distichum*
**Plantago lanceolata*
**Rubus anglocandicans*
**Rumex conglomeratus*
**Rumex crispus*
**Trifolium pratense*
**Vicia sativa* ssp. *sativa*
Acacia melanoxylon
Juncus gregiflorus
Melaleuca ericifolia
Microleana stipoides var. *stipoides*
Persicaria decipiens
Persicaria hydropiper
Phragmites australis
Typha domingensis

Site 16: Dam #1

**Agrostis capillaris* sl.
**Bromus catharticus*
**Bromus hordeaceus* ssp. *hordeaceus*
**Cirsium vulgare*
**Cyperus eragrostis*
**Holcus lanatus*
**Hordeum* sp.
**Hypochoeris radicata*
**Lolium rigidum*
**Lotus* sp.
**Paspalum distichum*
**Phalaris aquatica*
**Plantago lanceolata*
**Polygonum aviculare*
**Polypogon monseliensis*
**Rumex conglomeratus*
**Trifolium repens*
Juncus amabilis

Site 17: Dam #2

**Bromus catharticus*
**Cirsium vulgare*

**Holcus lanatus*
**Paspalum dilatatum*
**Paspalum distichum*
**Phalaris aquatica*
**Plantago lanceolata*
Epilobium hirtigerum
Juncus amabilis
Lemna disperma

Site 18: Dam #3

**Bromus hordeaceus* ssp. *hordeaceus*
**Callitriche stagnalis*
**Cirsium vulgare*
**Cyperus eragrostis*
**Geranium dissectum*
**Helminthotheca echioides*
**Holcus lanatus*
**Juncus articulatus*
**Lolium perenne*
**Lotus* sp.
**Paspalum dilatatum*
**Paspalum distichum*
**Phalaris aquatica*
**Plantago lanceolata*
**Plantago lanceolata*
**Rubus anglocandicans*
**Rumex conglomeratus*
Amphibromus nervosus
Eleocharis acuta
Juncus amabilis
Juncus bufonius
Lachnagrostis filiformis sl.
Lemna disperma
Lythrum hyssopifolia
Ranunculus sp.
Typha domingensis

Site 19: Koo Wee Rup Road drain (east)

**Anthoxanthum odoratum*
**Bromus hordeaceus* ssp. *hordeaceus*
**Callitriche stagnalis*
**Cyperus eragrostis*
**Daucus carota*
**Glyceria declinata*
**Juncus articulatus*
**Paspalum dilatatum*
**Paspalum distichum*
**Raphanus raphanistrum*
**Rubus anglocandicans*
Alisma plantago-aquatica
Alternanthera denticulata

Epilobium hirtigerum
Lachnagrostis filiformis sl.
Lemna disperma
Persicaria decipiens
Potamogeton tricarinatus s.l.
Ricciocarpos natans
Themeda triandra

Site 20: Drain near Soldiers Road #2

**Bromus diandrus*
**Callitriche stagnalis*
**Cirsium vulgare*
**Cyperus eragrostis*
**Dactylis glomerata*
**Daucus carota*
**Ehrharta erecta* var. *erecta*
**Geranium dissectum*
**Holcus lanatus*
**Juncus articulatus*
**Phalaris aquatica*
**Raphanus raphanistrum*
**Vicia sativa* ssp. *sativa*
Lachnagrostis filiformis sl.
Lemna disperma
Melaleuca ericifolia
Phragmites australis
Ricciocarpos natans

Site 21: Dam #4

**Agrostis capillaris* sl.
**Callitriche stagnalis*
**Echinochloa* sp.
**Holcus lanatus*
**Hypochoeris radicata*
**Lolium rigidum*
**Lotus* sp.
**Paspalum dilatatum*
**Paspalum distichum*
**Rubus anglocandicans*
Eleocharis acuta
Epilobium hirtigerum
Juncus bufonius
Lachnagrostis filiformis sl.
Lythrum hyssopifolia

Site 22: Koo Wee Rup Road (west side)

**Bromus catharticus*
**Bromus diandrus*
**Bromus hordeaceus* ssp. *hordeaceus*
**Callitriche stagnalis*
**Centaureum erythraea*

**Cyperus eragrostis*
**Daucus carota*
**Holcus lanatus*
**Hypochoeris radicata*
**Lolium perenne*
**Paspalum distichum*
**Plantago lanceolata*
**Raphanus raphanistrum*
**Vulpia bromoides*
Alisma plantago-aquatica
Epilobium hirtigerum
Phragmites australis
Pteridium esulentum
Ranunculus sp.
Triglochin procera (broad-erect leaves)

Site 23: Dam #5

**Cirsium vulgare*
**Cyperus eragrostis*
**Daucus carota*
**Galium aparine*
**Holcus lanatus*
**Juncus articulatus*
**Paspalum distichum*
**Raphanus raphanistrum*
Alternanthera denticulata
Amphibromus nervosus
Eleocharis acuta
Eleocharis sphacelata
Lachnagrostis filiformis sl.
Persicaria decipiens
Phragmites australis
Typha domingensis

Site 24: Drain along Rossiter Road

**Bromus catharticus*
**Cirsium vulgare*
**Cyperus eragrostis*
**Dactylis glomerata*
**Daucus carota*
**Ehrharta erecta* var. *erecta*
**Ehrharta longifolia*
**Galium aparine*
**Holcus lanatus*
**Hypochoeris radicata*
**Lycium ferocissimum*
**Paspalum distichum*
**Phalaris aquatica*
**Plantago lanceolata*
**Rubus anglocandicans*
**Rumex conglomeratus*

Acacia melanoxylon

Alisma plantago-aquatica

Persicaria decipiens

Phragmites australis

Site 25: Dam #6

**Agrostis capillaris* sl.

**Anthoxanthum odoratum*

**Bromus catharticus*

**Cirsium vulgare*

**Geranium dissectum*

**Glyceria declinata*

**Holcus lanatus*

**Lolium rigidum*

**Paspalum distichum*

**Plantago lanceolata*

**Polypogon monseliensis*

**Rumex conglomeratus*

**Rumex crispus*

**Sonchus oleraceus*

Eleocharis acuta

Epilobium hirtigerum

Lythrum hyssopifolia

Typha domingensis

Site 26: Dam #7

**Cotula coronopifolia*

**Cyperus eragrostis*

**Genista linifolia*

**Holcus lanatus*

**Hypochoeris radicata*

**Juncus articulatus*

**Paspalum distichum*

Amphibromus nervosus

Eleocharis acuta

Epilobium hirtigerum

Lachnagrostis filiformis sl.

Persicaria decipiens

Schoenoplectus tabernaemontani

Typha domingensis

Site 27: Dam #8

**Cotula coronopifolia*

**Paspalum dilatatum*

**Paspalum distichum*

**Phalaris aquatica*

Eleocharis acuta

Typha domingensis

Site 28: Drain off Sybella Ave.

**Agrostis capillaris* sl.

**Briza minor*

**Bromus hordeaceus* ssp. *hordeaceus*

**Callitriche stagnalis*

**Cirsium vulgare*

**Cotula coronopifolia*

**Cyperus eragrostis*

**Glyceria declinata*

**Hordeum leporinum*

**Hypochoeris radicata*

**Juncus articulatus*

**Lolium rigidum*

**Malva parviflora*

**Paspalum distichum*

**Phalaris aquatica*

**Plantago lanceolata*

**Polypogon monseliensis*

**Raphanus raphanistrum*

**Rumex conglomeratus*

**Rumex crispus*

**Sisymbrium officinale*

**Vicia sativa* ssp. *sativa*

**Vulpia bromoides*

Eleocharis acuta

Epilobium hirtigerum

Persicaria decipiens

Ranunculus sp.

Schoenus apogon

Site 29: Dam #9

**Agrostis capillaris* sl.

**Callitriche stagnalis*

**Cirsium vulgare*

**Genista monspessulana*

**Glyceria declinata*

**Holcus lanatus*

**Hypochoeris radicata*

**Lolium rigidum*

**Lotus* sp.

**Paspalum distichum*

**Phalaris aquatica*

**Polypogon monseliensis*

**Rubus anglocandicans*

**Rumex conglomeratus*

**Sonchus oleraceus*

Amphibromus nervosus

Austrodanthonia racemosa var. *racemosa*

Eleocharis acuta

Eleocharis sphacelata

Lachnagrostis filiformis sl.

Lythrum hyssopifolia
Phragmites australis
Salix sp.
Trifolium fragiferum var. *fragiferum*

Site 30: Dam #10
**Agrostis capillaris* sl.
**Cyperus eragrostis*
**Hordeum leporinum*
**Lolium rigidum*
**Rumex pulcher*
Amphibromus nervosus
Eleocharis acuta

Site 31: Dam #11
**Hordeum leporinum*
**Lolium rigidum*

Site 32: Dam #12
**Agrostis capillaris* sl.
**Callitriche stagnalis*
**Cotula coronopifolia*
**Hordeum leporinum*
**Hypochoeris radicata*
**Lolium rigidum*
**Lotus* sp.
**Polypogon monseliensis*
**Rumex conglomeratus*
**Trifolium fragiferum* var. *fragiferum*
Ranunculus sp.

Site 33: Dam #13
**Agrostis capillaris* sl.
**Bromus hordeaceus* ssp. *hordeaceus*
**Cotula coronopifolia*
**Glyceria declinata*
**Holcus lanatus*
**Lolium rigidum*
**Paspalum distichum*
**Polypogon monseliensis*
Amphibromus nervosus
Eleocharis acuta
Juncus bufonus
Ranunculus sceleratus ssp. *sceleratus*

Site 34: Bunyip River drainage-line complex
**Agrostis capillaris* sl.
**Cyperus eragrostis*
**Daucus carota*
**Holcus lanatus*
**Nasturtium officinale*

**Phalaris aquatica*
**Raphanus raphanistrum*
**Rubus anglocandicans*
**Rumex conglomeratus*
**Rumex crispus*
**Vicia sativa* ssp. *sativa*
Alisma plantago-aquatica
Melaleuca ericifolia
Persicaria decipiens
Phragmites australis
Triglochin procera (broad-erect leaves)

Site 35: Bunyip River drainage-line complex
**Anthoxanthum odoratum*
**Daucus carota*
**Lotus* sp.
**Paspalum dilatatum*
**Plantago lanceolata*
**Rubus anglocandicans*
**Watsonia meriana* var. *bulbillifera*
Elymus scaber var. *scaber*
Juncus amabilis
Melaleuca ericifolia
Phragmites australis
Salix sp.

Site 36: Bunyip River drainage-line complex
**Agrostis capillaris* sl.
**Aira* sp.
**Anagallis arvensis* var. *arvensis*
**Anthoxanthum odoratum*
**Aster subulatus*
**Briza maxima*
**Briza minor*
**Callitriche stagnalis*
**Cirsium vulgare*
**Cyperus eragrostis*
**Daucus carota*
**Genista monspessulana*
**Holcus lanatus*
**Hypochoeris radicata*
**Lolium rigidum*
**Paspalum dilatatum*
**Phalaris aquatica*
**Plantago lanceolata*
**Polypogon monseliensis*
**Romulea rosea*
**Rubus anglocandicans*
**Rumex conglomeratus*
**Vulpia* sp.
Lachnagrostis filiformis sl.

Melaleuca ericifolia
Phragmites australis
Senecio hispidulus
Senecio quadridentatus

Site 37: Bunyip River drainage-line complex

**Cyperus eragrostis*
**Daucus carota*
**Nasturtium officinale*
**Paspalum distichum*
**Phalaris aquatica*
**Rumex crispus*
Eleocharis acuta
Poa labillardierei var. *labillardierei*
Potamogeton pectinatus
Schoenoplectus tabernaemontani
Triglochin procera (narrow-floating leaves)
Typha domingensis

Site 38: Bunyip River drainage-line complex

**Cyperus eragrostis*
**Daucus carota*
**Genista linifolia*
**Paspalum distichum*
**Phalaris aquatica*
Alisma plantago-aquatica
Eleocharis acuta
Juncus sp.
Melaleuca ericifolia
Phragmites australis
Poa labillardierei var. *labillardierei*
Schoenoplectus tabernaemontani

Site 39: Bunyip River drainage-line complex

**Atriplex prostrata*
**Phalaris aquatica*
Clematis microphylla
Gahnia trifida
Juncus kraussii ssp. *australiensis*
Melaleuca ericifolia
Phragmites australis
Poa labillardierei var. *labillardierei*
Suaeda australis

Site 40: Bunyip River drainage-line complex

**Agrostis capillaris* sl.
**Bromus catharticus*
**Daucus carota*
**Holcus lanatus*
**Plantago coronopus*
Juncus kraussii ssp. *australiensis*

Melaleuca ericifolia
Phragmites australis
Poa labillardierei var. *labillardierei*
Ranunculus sp.
Samolous repens
Sarcocornia quinqueflora ssp. *quinqueflora*
Suaeda australis
Triglochin striata

Site 41: Bunyip River drainage-line complex

**Nasturtium officinale*
**Phalaris aquatica*
**Rubus anglocandicans*
Atriplex paludosa ssp. *paludosa*
Gahnia trifida
Melaleuca ericifolia
Phragmites australis
Poa labillardierei var. *labillardierei*
Sarcocornia quinqueflora ssp. *quinqueflora*
Suaeda australis

Site 42: Bunyip River drainage-line complex

**Daucus carota*
**Genista linifolia*
**Nasturtium officinale*
**Parapholis strigosa*
Austrodanthonia sp.
Distichlis distichophylla
Gahnia trifida
Juncus kraussii ssp. *australiensis*
Poa labillardierei var. *labillardierei*
Samolous repens
Sarcocornia quinqueflora ssp. *quinqueflora*
Selliera radicans

Appendix 2 VicRoads Assignment Task Brief

3.02.1 Purpose

Ecology Australia will undertake flora and fauna surveys along the Healesville - Koo Wee Rup Road reservation and immediate surrounds. The primary purpose of the surveys will be to determine the presence/absence of rare plants (particularly River Swamp Wallaby-grass) and of the Southern Brown Bandicoot.

3.02.2 Background

A planning study is being undertaken to determine options for the future upgrading of the Healesville - Koo Wee Rup Road (refer Figure 1). It is expected that the development of Healesville - Koo Wee Rup Road will consist of the duplication of the existing road between the Pakenham Bypass and McDonalds Drain. At the southern end it is proposed to construct a bypass of Koo Wee Rup on a new alignment to the west of the township between McDonalds Drain and the South Gippsland Highway.

A flora and fauna desktop review has been undertaken for the route by Ecology Australia. The findings of this review are contained in a report dated July 2005.

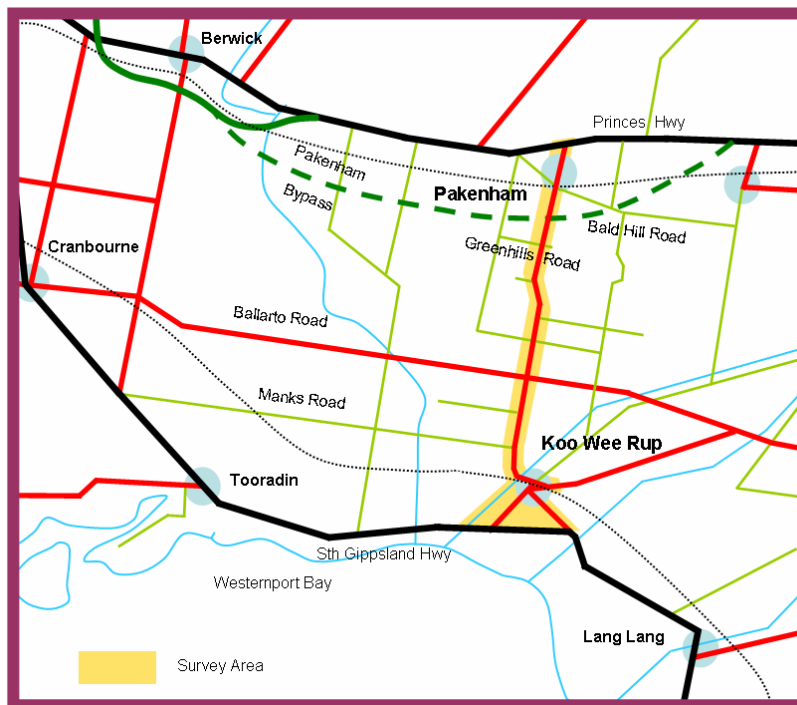


Figure 1 : Healesville – Koo Wee Rup Road, Princes Highway to South Gippsland Highway

3.02.03 Services to be Provided by the Consultant

Standard Requirements

a) VicRoads' Environment Strategy

The VicRoads' Environment Strategy sets the environment policy framework within which VicRoads operates and consultants should be familiar with the Strategy.

b) Permits

The Consultant shall ensure that they have all necessary permits for undertaking the investigations and that all work be carried out in accordance with these permits.

Survey Tasks

Field work, collation of data and reporting as set out in the Proposal.

The rare plant survey would be undertaken in October/November. The main species in question is River Swamp Wallaby grass, which is best surveyed at this time.

The Southern Brown Bandicoot work would entail a hair tube survey of Swamp Scrub remnants along the existing road and top banks of the watercourses/drains at Koo Wee Rup where considerable remnant vegetation is present, and at the intersection of Rossiter Road and the South Gippsland Highway. This work would involve two zoologists placing the hair tubes in the field over two days, leaving the tubes in place for two weeks, collecting them, and sending the hair tube wafers with hair samples to Dr. Hans Brunner for identification of the hair. This would be undertaken in early to mid-spring (September and/or October) to avoid hotter months when the by-catch of reptiles is higher.

The study area for the survey shall include:

- The existing road reservation for Healesville-Koo Wee Rup Road between the Pakenham Bypass and McDonald's Drain, and a 100 m wide strip each side of the reservation boundary.
- The area bounded by McDonalds Drain (Bunyip River), South Gippsland Highway and Sybella Avenue plus a 100m wide strip along the north-west edge of McDonalds Drain (Bunyip River).

3.02.04 Information to be Supplied by Corporation to Consultant

VicRoads will provide copies of all previous reports and other relevant information.

VicRoads will provide available aerial photos (if required) and plans showing the corridors.

Whilst not expected to be required, VicRoads will arrange, as far as possible, access to private property or will inform the consultant where access is not available or of any known special requirements for access. The Consultant will be fully responsible for contacting all owners prior to entering their property.

VicRoads will co-ordinate liaison with other specialist consultants as required.

3.02.05 Information to be Provided by the Consultant to the Corporation

The consultant shall supply VicRoads with a report for each survey, as set out in 3.02.08, Deliverables.

HP It is anticipated that the Southern Brown Bandicoot survey will be completed within two (2) weeks of the commencement of the contract. A draft report will be presented to VicRoads within two (2) weeks. VicRoads will review the report and within two (2) weeks accept, reject or suggest amendments to it for inclusion into the final report. A final report shall then be submitted within two (2) weeks from the date of receipt of VicRoads response to the draft report.

It is anticipated that the Rare Plant (River Swamp Wallaby grass) survey and draft report will be completed within eight (8) weeks of the commencement of the contract. VicRoads will review the report and within two (2) weeks accept, reject or suggest amendments to it for inclusion into the final report. A final report shall then be submitted within two (2) weeks from the date of receipt of VicRoads response to the draft report.

3.02.06 Methodology

a) General

The Consultant shall conduct the Assignment in accordance with the methodology submitted to and approved by VicRoads, prior to the commencement of the survey.

b) Liaison with VicRoads

On all contractual matters, the Consultant shall liaise only with the Superintendent or the Superintendent's Representative.

The VicRoads Superintendent's Representative for the assignment will be Mr Tony Hillman. The contact details are as follows:

Phone: (03) 9881 8078
Email: tony.hillman@roads.vic.gov.au

3.02.07 Reporting

The Consultant shall notify VicRoads immediately on the commencement and completion of any field work or discovery of any significant issues which arise as a result of the investigations and notify VicRoads immediately of any other issues that VicRoads should be made aware of.

3.02.08 Deliverables

Draft and Final Reports

- One bound copy and one unbound copy of the Draft Report should be presented to VicRoads for comment and review.

- Three bound and one unbound copy of the Final Report should be presented to VicRoads including colour plans as deemed required.
- An electronic copy of the Final Report should be provided to VicRoads on a disc in Microsoft Word format and in Adobe Portable Document File (pdf) format.
- All reports shall contain an executive summary
- All reports shall contain a copy of the Consultant Task Brief as an Appendix (i.e. Section 3.02 of this contract)
- All reports shall conform to the following requirements:-
 - Binding margin : 25mm
 - Open margin : 10mm
 - In practical terms, provide the 25mm margin on both sides of each page so that VicRoads can produce double-sided documents.
 - Top margin : 10mm
 - Bottom margin : 10mm
 - Start each section on the right hand page.
 - Have fonts generally no smaller than 12 point.
 - Start Chapter 1 on the right hand page. Start all other chapters as they occur.
 - First page of Chapter 1 is Page 1.
 - All preceding pages to be in Roman numerals.
 - Odd numbered pages to be right hand pages.
 - Be consistent with style. Use Commonwealth Style manual or similar.
 - Minimise use of colour figures and photographs. Colour figures should be capable of being reproduced in black and white.
 - Supply clean artwork (not photography)
 - Supply unfolded plans if greater than A4 size.
 - Supply loose photographic prints.
 - Where continuous alignment drawings are broken down to A3 size drawings, all annotation and text shown on the continuous alignment drawings must be self contained within each A3 drawing.