FLORA & FAUNA IMPACT ASSESSMENT - PROPOSED ORANGE PRIVATE HOSPITAL FOREST ROAD, ORANGE

Prepared for
Forest Road Syndicate Pty. Ltd.
by Colin C. Bower PhD

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SUMMARY AND CONCLUSIONS

1. A flora and fauna survey of the proposed Orange Private Hospital complex site on Forest Road, Orange was conducted on 24 and 25 September 2007.

2. The survey was conducted in accordance with the survey and assessment guidelines of the NSW Department of Environment and Climate Change.

3. The flora was assessed in detail on four 20 × 20 m quadrat sites, two on the Project area and two in an adjoining area of open woodland. In addition, seven 'spot samples', encompassing the whole of the development site, were carried out to ensure a comprehensive census of flora species.

4. Fauna was assessed by diurnal and nocturnal (spotlight) searches of the Project Area and a wider Study Area including a large patch of natural woodland on the Agricultural Institute adjoining the development site. Fauna searches focussed on amphibians, reptiles, birds and mammals (excluding bats).

5. Random meander searches were conducted for threatened flora and fauna species listed under the NSW *Threatened Species Conservation Act 1995* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

6. Habitat quality for wildlife was assessed using the 'Biometric' terrestrial biodiversity assessment tool developed by the NSW Department of Environment and Climate Change.

7. Observations of remnant old growth trees indicated that the original plant community on the Study Area comprised an association of Ribbon Gum, *Eucalyptus viminalis* and Apple Box, *Eucalyptus bridgesiana*.

8. The survey recorded 89 vascular plant species on the Study Area, of which 33 (37%) are native and 56 (63%) are introduced. A complete list of plant species is given in Appendix 3.

9. The main plant families represented on the Study Area are the Poaceae (Grasses) (21 species), Asteraceae (Daisies) (15 species), Faboideae (Pea Flowers) (5 species), Caryophyllaceae (Chickweeds and relatives) (4 species) and Malaceae (Apple and relatives) (4 species).

10. The original native vegetation has been almost completely eliminated from the Project Area by past clearing and development. The ground cover vegetation over the entire site is dominated by introduced grass and herb species.

11. The fauna on the Study Area comprised two amphibians, one reptile, 23 birds and three mammals. Most of the fauna were native species, except two birds, the Blackbird and Common Starling, and one mammal, the European Fox.

12. The 'Biometric' habitat value assessment found the habitat on the Project Area was completely degraded when compared with Department of Environment and Climate Change (DECC) benchmarks for the original natural vegetation community for the area.

13. No threatened flora species, populations or communities were found during the surveys. Nor were any species identified that are listed as Rare or Poorly Known in Rare or Threatened Australian Plants (ROTAP) (Briggs and Leigh, 1995).

14. One threatened bird species, the Superb Parrot, *Polytelis swainsonii*, was found in the woodland adjoining the Project Area, and one specimen was observed to overfly the Project Area.

15. Assessments of significance (Seven Part Tests) under s5A of the EP&A Act were conducted on six species whose occurrence on the Study Area could not be categorically excluded by the surveys and habitat value assessment. These included two threatened flora species, Silky Swainson Pea and Narrow Goodenia, and four threatened fauna species, Barking Owl, Regent Honeyeater, Koala and Eastern Bentwing Bat. An assessment of significance was also conducted for the Superb Parrot, which was found by the survey.

16. The Assessments of Significance showed the Project is highly unlikely to have a significant impact on any threatened flora or fauna species.

17. No matters were identified requiring action under SEPP 44 of the NSW *Environmental Planning and Assessment Act 1979*.

18. No matters were identified requiring referral to the Commonwealth under the *Environment Protection and Biodiversity Conservation Act 1999.*

INTRODUCTION

The proposed Orange Private Hospital site is located one kilometre south of Orange on the site of the former Orange Drive-in Theatre on the west side of Forest Road (Lot 1 DP 549856). The Project aims to create a 'non-institutional' Health Precinct that encompasses a private hospital, motel, residential and associated facilities. The development is to be carried out in association with, and parallel to, the development of the new Orange Regional Hospital, that will be located on the eastern side of Forest Road.

FloraSearch was commissioned by the proponents, Forest Road Syndicate Pty. Ltd., to conduct a flora and fauna survey and impact assessment of the proposed hospital site and its immediate surrounds (the Study Area). This assessment is conducted in accordance with Part 3A and Section 5A of the NSW *Environmental Planning and Assessment Act 1979*, NSW *State Environmental Planning Policy No. 44* and the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1995*.

The objectives of the surveys and report were to:

- define, describe and map the vegetation communities occurring on the Study Area;
- compile lists of flora and fauna species found on the Study Area;
- conduct targeted searches for threatened flora and fauna species, populations, and ecological communities, considered possible occurrences within the study area (including those listed under the schedules of the NSW *Threatened Species Conservation Act 1995* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, and any flora species listed as rare or poorly known in *Rare or Threatened Australian Plants* [ROTAP]), and map the location of any threatened species identified;
- assess the condition of the vegetation;
- report on the findings of the flora and fauna surveys;
- assess the potential impact of the Project on threatened flora and fauna species, populations or communities.

Project Footprint

The area to be affected by the Project (the Project Area) is shown in Figure 1, which shows the existing remnants of the Drive-in Theatre infrastructure on the site.

The Investigator

The surveys were carried out by Dr. Colin Bower (trading as FloraSearch). Dr. Bower has over 20 years experience in conducting flora and fauna surveys and impact assessments (see attached CV). In addition, he has lived in the Orange district since 1980 and is very familiar with the local flora and fauna through both his own exploration of the region and his close involvement with the Orange Field Naturalist and Conservation Society. He is coauthor of a handbook on the trees of Central Western NSW, is an associate of the Australian National Herbarium, Canberra, is a member of the Ecological Consultants of NSW (which has exacting membership criteria) and is recognised nationally as an expert on native orchids and their pollination. His expertise has been recognised by the Environmental Defenders Office and the NSW Department of Planning, both of which have used him to review and referee controversial cases.

DESCRIPTION OF STUDY AREA

Project Area (Disturbance Area)

The Project Area is located on generally flat terrain at an altitude of approximately 910 m and was formerly used for a drive-in theatre which closed in 1984. The centre of the site is covered by bitumen, comprising the former viewing area for cars and associated speaker stands. A central building includes the kiosk, screening facilities and offices. Most of the southern side of the site comprises a kerbed and guttered, bitumen sealed entrance road and ticket booths. A largely unsealed exit road runs parallel to the eastern third of the northern boundary. The remaining fifty percent of the site comprises grassed areas to the east and west of the central viewing area. The eastern grassed area includes the screen, while the western area has a large floodlight and septic tank system.

The western grassed area of the site includes two drainage lines; a shallow one extending approximately north west from two concrete water tanks behind the tarmac and central building, and a second in the south west corner which forms a moderately deep gully. These drain into the adjoining land to the west where any runoff water collects in a series of farm dams.

Project Area Surrounds

Cleared privately owned land without buildings or other infrastructure adjoins the southern boundary of the Project Area. The land to the north and west of the Project Area is Crown Land currently used by the Orange Agricultural Institute (NSW Department of Primary Industries) for agricultural research. This land comprises grazing paddocks with scattered remnant old growth eucalypt trees over an improved pasture (Figure 1). The remnant eucalypt trees form an open native woodland, which adjoins the western boundary of the Project Area and extends to the north and north west. A shelterbelt of large Monterey Pine trees (*Pinus radiata*) in the Agricultural Institute adjoins the northern boundary of the Project site.

Land Use

The Study Area has not been used for any purpose for over two decades since the drive-in theatre closed in 1984. Prior to closure, it can be expected that the grassed areas of the site were regularly mown, especially the front areas on the eastern side. The site was also planted to exotic ornamental shrubs and trees along the Forest Road boundary and the entrance driveway. There were also small plantings of native shrubs in a corner garden of the central building. Inspection of the site indicates that construction of the drive-in theatre involved extensive earthworks and shaping of most, if not all of the site. The level of disturbance is considered to be such that no intact natural plant communities would have survived, if any were still present at that time. Nor were there any indications of pre European land use on the Project Area or broader Study Area, although there may have been previous Aboriginal use of the site or nearby areas for a camp, or other activities.

Geology and Soils

The Study Area is underlain by Tertiary volcanic basalt flows separated by layers of volcanic ash from the Mt. Canobolas volcanic complex. The parent rocks in this geological unit may include alkaline olivines, trachytes and some shales and slates (Kovac *et al.*, 1990). The soils on the study area were mainly derived *in situ* from the parent rocks and belong to the Towac Soil Landscape (Kovac *et al.*, 1990). They are dominated by krasnozems comprising dark reddish brown loam topsoils and dark reddish brown clay loam subsoils (Kovac *et al.*, 1990).

Botanical and Biogeographical Regions

The Study Area lies in the north western corner of the South Eastern Highlands Bioregion (Thackway and Cresswell, 1995) which includes the NSW Central Tablelands Botanical Division (Anderson, 1961).

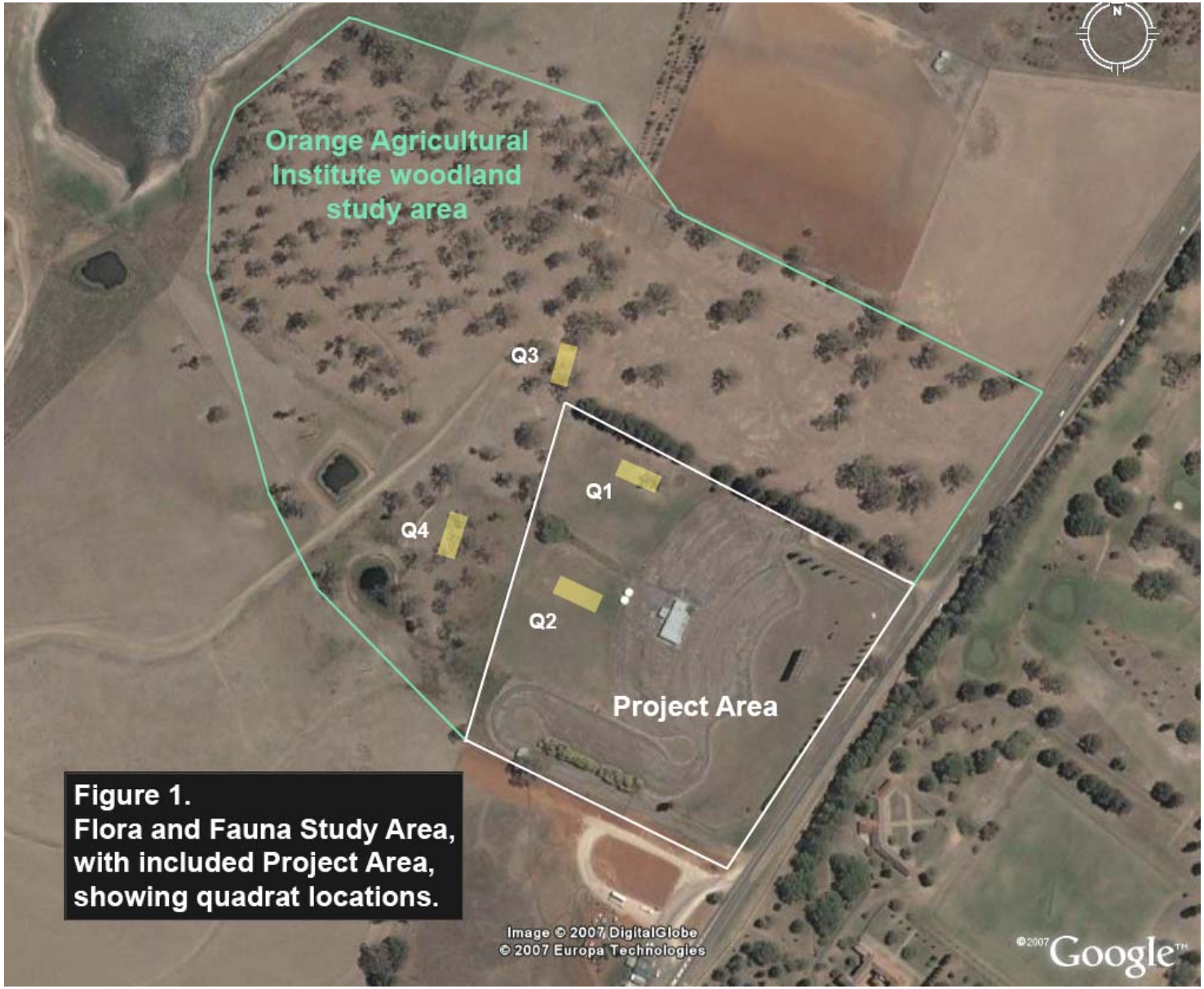

Figure 1.
Flora and Fauna Study Area, with included Project Area, showing quadrat locations.

Climate

The nearest official long-running meteorological station at a similar altitude to the Study Area is Orange Post Office (863m) (1 km N). The climate of the Study Area is generally mild with moderate maximum temperatures in summer, but cold winters and good rainfall by Australian standards. The mean daily maximum temperatures for Orange vary from 10.6 deg C in July to 28.2 deg C in January. The corresponding mean daily minimum temperatures vary from 0.5 deg C in July to 12.4 deg C in January and February. Frosts are common in winter.

Average annual rainfall is 877.6 mm and is spread fairly evenly throughout the year with slight winter dominance. The lowest rainfall tends to be in March and April, with averages of 62.5 and 58.6 mm. The highest average rainfall is in June (97.8 mm), followed by August (85.3 mm) and July (83.9 mm).

Previous Flora and Fauna Studies

There has been no published formal study of the flora of the Orange district or nearby regions. The majority of nearby studies have been associated with environmental impact assessments for various stages of the Cadia and Ridgeway Mines development (Bower and Medd, 1995; Bower, Kenna and Medd, 1998; Bower, 1999). Other relevant publications include Giles (1961) which listed the plants around Mt. Canobolas; Bower, Semple and Harcombe (2002), which discusses the native trees and their associations in Central Western NSW and Hunter (2002) on the vegetation of the Mount Canobolas State Conservation Area.

As for flora, there have been few studies of native fauna in the Orange region. Goldney and Bowie (1987) includes a regional compilation of fauna for Central Western NSW and two assessments of fauna have been made for the Cadia Hill (Fisher and Goldney 1995) and Ridgeway Gold Mines (Resource Strategies 2000) to the south west of Orange.

THREATENED VEGETATION COMMUNITIES, POPULATIONS AND SPECIES

Endangered Ecological Communities

One endangered ecological community listed in the schedules of the NSW *Threatened Species Conservation Act 1995*, the 'White Box Yellow Box Blakely's Red Gum (WBYBBRG) Woodland endangered ecological community', is considered a possible occurrence in the study area. The community is also listed under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* as the 'White Box-Yellow Box-Blakely's Red Gum grassy woodlands and derived native grasslands critically endangered ecological community'.

This community is widespread on the western slopes and tablelands of New South Wales and occurs commonly in the region around Orange. Because it occurs on relatively deep high fertility soils, it has been extensively cleared historically for cropping and grazing over its entire range.

Endangered Populations

Twenty three plant populations are listed as endangered under NSW *Threatened Species Conservation Act 1995*, as at 11 August 2007. None are applicable to the study area.

Threatened Flora and Fauna Species

Tables 1 and 2 show threatened plant and animal species, respectively, as listed in the schedules of the NSW *Threatened Species Conservation Act 1995* (TSC) and the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC) that are considered possible former occurrences within the study area or surrounds. These species were specifically targeted during the survey conducted for this study.

These lists were derived by searching the following data sources within an approximately 20 × 20 km area centred on the Study Area:

- Atlas of NSW Wildlife – Orange and Molong 1:100 000 map sheets.
- BioNet website – Search of NSW National Parks and Wildlife Service, NSW State Forests, Australian Museum and Royal Botanic Gardens Sydney databases.
- NSW Department of Environment and Conservation website – Threatened Species Profiles
- PlantNet website – Royal Botanic Gardens Sydney search engine for information on distribution and habitats of threatened plant species.
- Commonwealth Department of the Environment and Heritage website – Protected Matters search tool.

The above sources produced a list of eleven potential threatened plant species and one endangered ecological community. The distribution and habitats of each of the species and communities was determined from the PlantNet website, DECC Threatened Species Profiles and other sources. Species that occur in specialised habitats not found in the study area were excluded from the list of nine species in Table 1.

Table 1.
Threatened Flora Species

Scientific Name	Common Name	Endangered	Vulnerable	Likelihood of Former Occurrence
Eucalyptus canobolensis	Silver-leaf Candlebark		TSC, EPBC	Low
Eucalyptus pulverulenta	Silver-leafed Mountain Gum		TSC, EPBC	Low
Eucalyptus robertsonii ssp. *hemisphaerica*	A Narrow-leaved Peppermint		TSC, EPBC	Low
Eucalyptus saxicola	Mt. Canobolas Apple Box	TSC		Low
Goodenia macbarronii	Narrow Goodenia		TSC	Low
Lepidium hyssopifolium	Basalt Peppercress	TSC, EPBC		Low
Pultenaea campbellii	New England Bush Pea		EPBC	Moderate
Swainsona sericea	Silky Swainson Pea		TSC	Low
Zieria obcordata	A Zieria		TSC, EPBC	Low

Similarly, the database searches, and filtering for habitat, generated a final list of 20 fauna species considered to have possibly occurred in the Study Area prior to European settlement (Table 2).

Table 2
Threatened Fauna Species

Scientific Name	Common Name	Endangered	Vulnerable	Likelihood of Former Occurrence
Calyptorhynchus lathami	Glossy Black Cockatoo		TSC, EPBC	Low
Chalinobolus dwyeri	Large-eared Pied Bat		TSC, EPBC	High
Climacteris picumnus	Brown Treecreeper		TSC	Low
Grantiella picta	Painted Honeyeater		TSC	High
Lathamus discolor	Swift Parrot	TSC, EPBC		Moderate
Melanodryas cucullata	Hooded Robin		TSC	Low
Miniopterus schreibersii	Eastern Bent-wing Bat		TSC	Moderate
Neophema pulchella	Turquoise Parrot		TSC	Low
Ninox connivens	Barking Owl		TSC	High
Ninox strenua	Powerful Owl		TSC	High
Paralucia spinifera	Bathurst Copper Butterfly	TSC	EPBC	Moderate
Polytelis swainsonii	Superb Parrot		TSC, EPBC	Moderate
Petaurus australis	Yellow-bellied Glider		TSC	Low
Petaurus norfolcensis	Squirrel Glider		TSC	High
Phascolarctos cinereus	Koala		TSC	High
Pyrrholaemus saggitatus	Speckled Warbler		TSC	Low
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat		TSC	Moderate
Stagonopleura guttata	Diamond Firetail		TSC	Low
Tyto novaehollandiae	Masked Owl		TSC	High
Xanthomyza phrygia	Regent Honeyeater	TSC, EPBC		High

METHODS

The methods used in this survey conform with the following published guidelines; *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC 2004), *Guidelines for Threatened Species Assessment* (DEC and DPI 2005) and *Threatened species assessment guidelines: the assessment of significance* (DECC 2007).

Survey Timing and Conditions

The survey was conducted over two days in the field on 24 and 25 September 2007. Prior to the survey there had been good rainfall in May and June, which stimulated plant germination and growth following several years of near continuous drought. Good levels of ground cover by plants were present over the non-bitumenised parts of the site, even though the total winter rain was 27 percent below average (Bureau of Meteorology website, accessed 7.09.2007).

Flora Quadrat Sampling

Four 20 $\times$ 20 m quadrat samples were conducted (Figure 1). Two were carried out in the western grassed part of the Study Area and two in the adjoining woodland on the Orange Agricultural Institute (Figure 1).

Information recorded for each quadrat included the Australian Map Grid (AMG) coordinates using a hand-held GPS (Global Positioning System), slope, aspect, position on the slope, geology, topsoil characteristics, vegetation structure including the height, dominant species and percentage ground cover of each stratum, and observations of any past or recent disturbance including logging, thinning, clearing or weed invasion. Within each quadrat a complete list of vascular plant species was made with a modified Braun-Blanquet rating of cover abundance for each recorded species. Table 3 describes the Braun-Blanquet rating system used in this study.

Table 3
Modified Braun-Blanquet Cover Abundance Rating Scale

Rating	Percent Ground Cover
1	<1
2	1 - 5
3	6 - 25
4	26 - 50
5	51 - 75
6	76 - 100

Flora Species Listing (Spot Sampling)

In addition to the quadrat sample sites, seven spot vegetation samples were conducted over the entire Project Area in order to comprehensively document the flora (Figure 1). All vascular plants were recorded within about a 20 m radius of a central point at which a GPS reading was taken. Where plants could not be quickly identified in the field, a sample was taken back to the laboratory for identification using a binocular microscope and flora keys. The principal reference was the Flora of New South Wales (Ed. G. Harden 1990-2002) and it is used as the primary basis for plant naming in this report.

Table 4 describes the sites in which the spot samples were carried out.

Table 4
Spot Sample Site Characterisitics

Sample No.	Site Characterisitics
1	Tarred exit driveway and adjoining areas between road gutters and fences
2	Tarred viewing area, north side
3	Tarred viewing area, south side
4	Formerly mown grassed area south of screen
5	Formerly mown grassed area around screen and to north
6	Grassed area in north west of Project site
7	Grassed area in south west of Project site

Vegetation Community Determination

The identities of old growth and regenerating eucalypt trees on the Project area and in the adjacent natural woodland were used to determine the native vegetation communities that formerly occurred on the Project area. This approach was feasible because native forest and woodland communities are defined and named by the dominant trees in the uppermost vegetation stratum. The tree communities in the Orange area have been classified by Austin *et al.* (2000).

Flora Random Meander Searches

Targeted searches for threatened flora and fauna species considered possible occurrences within the Study Area were conducted by 4 random meander searches, each of approximately 30 minutes duration. The searches were conducted on the Project Area and in the adjoining eucalypt woodland.

Fauna Survey Methods

Surveys for fauna comprised observational techniques and habitat quality assessment rather than intensive trapping methods:

- Two half hour diurnal fauna searches were conducted on foot on the Project Area for native and introduced mammals and birds.
- Two one hour diurnal searches, one in the early morning and one in the late afternoon, were conducted in the adjoining woodlands for native and introduced mammals and birds.
- Observation of mature trees for any signs of use by arboreal mammals including claw marks, nest hollows etc.
- Nocturnal searches for two hours over two evenings were conducted in the adjoining woodlands for native arboreal mammals and nocturnal birds.
- Two one hour searches for native frogs were conducted over two evenings in farm dams on adjacent Crown land that currently receives water runoff from the Project Area.
- Searches for fauna scats.
- Opportunistic sightings of fauna species while conducting flora surveys.

Habitat Quality

The value of the native vegetation on the Study Area was measured using methodology adapted from the 'BioMetric' terrestrial biodiversity assessment tool (Gibbons *et al.* 2005). 'BioMetric' measurements form part of the input to the NSW Property Vegetation Plan Developer, which is used to assist decision making for applications to clear native vegetation under the NSW *Native Vegetation Act.* This methodology allows the value of vegetation to be assessed in a repeatable fashion for comparison with established benchmarks for each of the vegetation classes defined by Keith (2004).

The four 20 × 20 m flora survey plots were extended to 50 × 20 m for 'Biometric' measurements (Figure 1). The ten condition parameters used in BioMetric to assess site value were measured in each plot. The measurement methods were based on Appendix 3 of the BioMetric Operational Manual (Gibbons *et al.* (2005). The parameters and methodology are:

- Native plant species diversity: - the number of native plant species in the 20 × 20 m subplot.
- Native overstorey cover: – mean percent cover of ground by the foliage of the uppermost vegetation layer; trees or tall shrubs (>1m) at 10 points along a 50 m transect along the long axis of the plot.
- Native midstorey cover: – mean percent cover of ground by the foliage of the middle vegetation layer; tall shrubs (>1m), low trees and regeneration at 10 points along a 50 m transect along the long axis of the plot.
- Native groundcover – grasses: - presence or absence of native grasses at 50 points 1m apart on a 50m transect along the long axis of the plot.
- Native groundcover – shrubs: - mean percent cover of ground by the foliage of low shrubs (>1m) and regeneration at 10 points along a 50 m transect along the long axis of the plot.
- Native groundcover – other: - Presence or absence of native herbs and other groundcover species at 50 points 1m apart on a 50m transect along the long axis of the plot.
- Exotic plant cover: – Presence or absence of exotic grasses at 50 points 1m apart on a 50m transect along the long axis of the plot.

- Number of trees with hollows: - All living and dead standing trees with their centres in the 50 × 20 quadrat were examined for hollows capable of harbouring wildlife. Hollows are defined as tree holes > 5 cm diameter, having depth, and > 1 m above the ground.
- Regeneration: - The proportion of overstorey trees species on the 50 × 20 m quadrat that are regenerating.
- Total length of fallen logs: - The length of fallen logs > 10 cm diam and > 0.5 m long was totalled for the whole 50 × 20 m quadrat.

Fauna Species Listing

A complete list of bird and mammal species observed on the Study Area was compiled.

RESULTS AND DISCUSSION

Vegetation Communities

Observations of remnant native trees on the Project Area and in the adjacent woodlands showed that the original pre-European trees dominating the site were Ribbon Gum, *Eucalyptus viminalis* and Apple Box *Eucalyptus bridgesiana*. Other native trees found in remnant woodlands in the vicinity of Bloomfield Hospital and Bloomfield Park to the South East of the Project Area include Snow Gum, *Eucalyptus pauciflora*, Candlebark, *Eucalyptus rubida*, Black Sally, *Eucalyptus stellulata* and rarely, Black Gum, *Eucalyptus aggregata*. This combination of trees indicates the native vegetation formerly covering the Study Area belonged to the Southern Tableland Wet Sclerophyll Forest class of Keith (2004). Within this vegetation class are numerous vegetation communities; the relevant community for the Study Area is the *Eucalyptus viminalis / Acacia melanoxylon* (Ribbon Gum / Black Wattle) community defined by Austin *et al.* (2000).

However, very few native trees remain on the Project Area, such that the original native vegetation community has been almost entirely removed. All remaining trees are confined to the western quarter of the site, mostly on the western fence line, except for a large Ribbon Gum to the north west of the drive-in viewing area. The trees on the western fence are juvenile Ribbon Gums and Apple Boxes, 30 to 40 in all, up to 4m high. These have seeded from adult trees on the other side of the fence.

The Project Area comprises two broad vegetation associations, both man-made (anthropogenic):

1. Exotic grassland
2. Tarmac community

In addition, there are various planted shrubs and trees remaining from former landscaping of the Project area when it was a functioning drive-in theatre.

Exotic Grassland

The grassed areas at the front and rear of the Project area have similar overall species composition of grasses and herbs. However, the area fronting Forest Road appears to have been maintained as a regularly mown lawn with ornamental shrub and tree plantings when the drive-in was operating, while the rear was unmown or irregularly slashed and has exotic weedy shrubs that are absent from the front. The rear of the site also differs in having some wetter drainage lines that support willows and some rush and sedge species.

Two flora quadrats (Appendix 1, quadrats 1 and 2) and two spot samples (Appendix 2, samples 6 and 7) were conducted at the rear of the site, while two spot samples were conducted at the front (Appendix 2, samples 4 and 5).

The Braun-Blanquet ratings for the quadrats provide an estimate of the relative cover abundance of each species. The dominant species are introduced grasses, Paspalum, *Paspalum dilatatum*; Canary Grass, *Phalaris aquatica* and Cocksfoot, *Dactylis glomerata.* Other common introduced grass and herb species are Sweet Vernal Grass, *Anthoxanthum odoratum*, Flatweed, *Hypochaeris radicata*; St. John's Wort, *Hypericum perforatum*; White Clover, *Trifolium repens*; Vetch, *Vicia sativa* and Lambs Tongue, *Plantago lanceolata*. The main native species present are Couch, *Cynodon dactylon*, a Wallaby Grass, *Austrodanthonia racemosa* and Grassland Cranesbill, *Geranium retrorsum*. Other relatively common, but scattered, native ground cover species are Kangaroo Grass, *Themeda australis*, Knob Sedge, *Carex inversa*; Austral Cranesbill, *Geranium solanderi* and Cotton Fireweed, *Senecio quadridentatus*.

Only two species of native shrubs were present; Biddy Bush, *Cassinia arcuata*, which is often regarded as a weed, and Silver Wattle, *Acacia dealbata*, both in low numbers. Introduced weedy shrubs and trees in the grassland at the rear of the Project area include Crack Willow, *Salix fragilis*; Hawthorn, *Crataegus monogyna*; Sweet Briar, *Rosa rubiginosa* and Blackberry, *Rubus fruticosus* species complex. Other introduced weedy shrub and tree species were associated with a large Monterey Pine, *Pinus radiata*, windbreak on the Agricultural Institute along the northern fence line of the Project area. Seedling pines from this windbreak have invaded the adjacent parts of the Project area and provided shelter for the Silver-leaf Cotoneaster, *Cotoneaster pannosus*; Firethorn, *Pyracantha crenulata* and Crabapple, *Malus domestica*.

Damp drainage lines at the rear of the site support the natives, Tall Sedge, *Carex appressa* and the rush, *Juncus australis*, along with a range of introduced damp habitat species including Crack Willow, *Salix fragilis*; the grasses, Yorkshire Fog, *Holcus lanatus* and Paspalum, *Paspalum dilatatum*, and Swamp Dock, *Rumex crispus*.

Tarmac Community

A distinctive plant community inhabits the bitumenised drive-in viewing area and the entrance and exit driveways. These areas have been colonised by plants since the drive-in closed over 20 years ago. They were sampled in this survey by spot samples 1 to 3 (Appendix 2).

Plants have colonised cracks in the tarmac, cracks at the bases of the speaker stands and shallow accumulations of soil in the swales of the undulating surface. Many of the plants on the tarmac are not found in the surrounding grasslands and appear to be species that can tolerate the extremes of heat and dryness imposed by the dark tar surface. Introduced species found only on the tarmac include Wild Aster, *Aster subulatus*; Flaxleaf Fleabane, *Conyza bonariensis*; Tall Fleabane, *Conyza sumatrensis*; Spreading Pearlwort, *Sagina procumbens* and Sandspurry, *Spergularia rubra*. A number of native species were also found only on the tarmac including Jersey Cudweed, *Pseudognaphalium luteoalbum*; Tufted Bluebell, *Wahlenbergia communis*; a rush, *Juncus subsecundus*; Windmill Grass, *Chloris truncata* and Hairy Panic, *Panicum effusum*. In addition, the tarmac supported a range of other introduced native herb and grass species that also occurred in the grassland areas of the site (Appendix 2). In addition, the tarmac is widely covered in thallose lichens and patches of moss, the latter confined to shaded places.

Ornamentals

Old plantings of ornamental trees and shrubs occur along the Forest Road boundary fence, beside the entrance and exit driveways and in a corner garden of the central building of the old drive-in theatre. Along the Forest Road boundary from south to north is a large hedge of Photinia, *Photinia glabra*, a tight row of ornamental pines, possibly a *Thuja* species and a row of Lombardy Poplars, *Populus nigra*. Between this row of plantings and the fence are old garden beds with a prostrate species of Juniper, *Juniperus* sp. The entrance driveway is lined on the north side with a dense row of *Thuja occidentalis* 'lutea'. A further row of Lombardy Poplars is adjacent to the exit driveway. The ornamental garden associated with the central building includes large native Rosemary Grevilleas, *Grevillea rosmarinifolia*, which have seeded to produce volunteer plants in the tarmac area and the northern edges of the western grassland.

The grassland areas also support small amounts of introduced ornamental bulbs and herbs that may have escaped from gardens, possibly before the drive-in was built. These include Daffodills, *Narcissus pseudonarcissus*; Grape Hyacinth, *Muscari armeniacum* and Horehound, *Plectranthus caninus*.

Flora Species

A complete list of the plant species found on the Study Area is given in Appendix 3. A total of 89 species was recorded, of which 33 (37%) are native and 56 (63%) are introduced. The main plant families represented are the Poaceae (Grasses) (21 species), Asteraceae (Daisies) (15 species), Faboideae (Pea flowers) (5 species), Caryophyllaceae (Chickweeds and relatives) (4 species) and Malaceae (Apple and relatives) (4 species).

Condition of the Vegetation

The natural plant community that formerly occurred on the Study Area has been almost entirely eliminated by past land uses. The current vegetation can best be described as rank or overgrown exotic grassland with large amounts of dead, ungrazed foliage.

Only a single old growth eucalypt tree remains along with less than 40 juvenile trees that have recolonised the Project area over the western fence line. In addition, about 30 native grass and herb species persist on the site, many in very low numbers. These natives are resilient widespread species that commonly occur on highly disturbed sites. The former native community has lost most of its original diversity and has no capacity to recover to its original condition on the Study Area. The dominance of the flora list by introduced species, and the low number and abundance of native species, attests to the high degree of disturbance to the native vegetation of the Study Area.

Fauna

A total of 29 fauna species was recorded on the wider Study Area, and 19 on the Project area (Appendix 4). The fauna comprised two amphibians, one reptile, 23 birds and 3 mammals (Appendix 4). Most of the fauna observed were native species (26), and three were introduced. The latter comprised two birds, the Eurasian Blackbird, *Turdus merula* and the Common Starling, *Sturnus vulgaris*, and the Fox, *Vulpes vulpes* (Appendix 4). Apart from a dead specimen of the Eastern Snake-necked Turtle, *Chelodina longicollis*, all fauna observed on the Project area were birds, some 18 species.

Many of the birds on the Project area were utilising the few trees and shrubs for feeding and roosting, and a few, including the Superb Parrot, *Polytelis swainsonii*, and the Black-faced

Cuckoo-shrike, *Coracina novaehollandiae*, simply flew overhead without landing. A pair of Magpie Larks, *Grallina cyanoleuca*, was nesting in the single old growth Ribbon Gum. Also, a pair of Rufous Songlarks, *Cinclorhamphus mathewsi*, had established a territory in the Project area and is expected to nest there.

Although two native macropods, the Eastern Grey Kangaroo, *Macropus giganteus*, and the Swamp Wallaby, *Wallabia bicolor*, were present in the Crown Land woodland to the north west of the Project area, they are unlikely to utilise the development site due to the presence of a fauna-proof fence around the Agricultural Institute. Despite the apparent favourability of the Crown Land woodlands adjoining the Project area for nocturnal native arboreal mammals and birds, none were detected.

Fauna Habitat Value Assessment

Assessment of habitat complexity was undertaken using the NSW Department of Environment and Conservation's 'BioMetric' Terrestrial Biodiversity Assessment Tool (Gibbons *et al*. 2005). Ten variables were assessed and the data is summarised in Table 5.

The data collected in the field is compared in Table 5 with benchmark data for pristine examples of the pre-European vegetation community that formerly occurred on the Study Area, viz. the 'Southern Tableland Wet Sclerophyll Forests' of Keith (2004). The benchmark data was obtained from http://www.nationalparks.nsw.gov.au/images/BioMetric_benchmark_data.xls.

On most measures the habitat value of the Study Area does not compare favourably with pristine habitat. This is to be expected given past disturbances to the Project area and wider Study Area, including almost complete clearing of the Project site and it's development as a drive-in theatre, and the semi-clearing, grazing, and pasture improvement of the Agricultural Institute area. Native plant species richness is well below the benchmark on the Project area and only half of the benchmark in the Crown woodland (Table 5).

On all measures the habitat quality of the Project area compares very poorly with the benchmarks and can be regarded as completely degraded. The adjoining Crown Woodland areas meet the benchmarks only for native overstorey cover and native ground cover (other), while fallen logs are about half the benchmark value. Quadrat 4, that returned a high habitat value for native ground cover (other), was a normally wet site with a high cover of the native Tall Sedge, *Carex appressa*. This site is not typical of the Crown woodland as a whole, but was sampled because of its proximity to the Project area, from which it receives runoff water. However, with respect to all other measures, including two measures of native groundcover, and others for absence of exotic groundcover species, the presence of tree hollows for wildlife dens and nests, and the presence of tree regeneration, the Crown woodland not only fails to approach the benchmark, but mostly returned zero readings. Overall, the Project area and nearby Crown woodlands have very limited habitat value compared to the original native vegetation community on the site.

Table 5
Habitat Quality Data

Vegetation type	No. of replicates	Recorded Values			Benchmarks	
		Lower	Upper	Average	Lower	Upper
Native plant species richness (number of species)						
Project area	2	2	6	4	12	-
Crown woodland	2	5	9	7	12	-
Native overstorey cover (%)						
Project area	2	0	0	0	15	35
Crown woodland	2	26.5	28.5	27.5	15	35
Native midstorey cover (%)						
Project area	2	0	0	0	15	25
Crown woodland	2	0	0	0	15	25
Native groundcover – grasses (%)						
Project area	2	0	12.0	6.0	10	40
Crown woodland	2	0	0	0	10	40
Native groundcover – shrubs (%)						
Project area	2	0	0	0	10	40
Crown woodland	2	0	0	0	10	40
Native groundcover – other (%)						
Project area	2	0	0	0	20	70
Crown woodland	2	0	62.0	31.0	20	70
Exotic plant cover (%)						
Project area	2	58	96	77	0	0
Crown woodland	2	12	88	50	0	0
Number of trees with hollows						
Project area	2	0	0	0	10	-
Crown woodland	2	2	2	2	10	-
Regeneration (proportion of tree species)						
Project area	2	0	1	-	All	-
Crown woodland	2	0	0	-	All	-
Total length of fallen logs (m)						
Project area	2	0	5	2.5	40	-
Crown woodland	2	10	28	19	40	-

Threatened Flora Species

No species listed as threatened under the NSW *Threatened Species Conservation Act, 1995* or the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* was found during the surveys. Nor were any species identified that are listed as Rare or Poorly Known in *Rare or Threatened Australian Plants* (ROTAP) (Briggs and Leigh, 1995).

All except two of the threatened flora species, listed in Table 1 as possibly having occurred in the Study Area pre European settlement, are trees or shrubs, and hence would have been easily detected by the survey, if they were present. The survey confirmed the absence of these species. Two species in Table 1, Narrow-leaf Goodenia and Silky Swainson Pea, are small, relatively inconspicuous native herbs. As such, it is possible they could have been overlooked, especially as the survey was conducted prior to the flowering times of both species, when they are more conspicuous.

Threatened Plant Communities

The evidence of remnant trees adjacent to the Study Area indicates that the 'White Box Yellow Box Blakely's Red Gum (WBYBBRG) Woodland endangered ecological community', listed under the NSW TSC Act, and as the 'White Box-Yellow Box-Blakely's Red Gum grassy woodlands and derived native grasslands critically endangered ecological community' listed under the Commonwealth EPBC Act, did not formerly occur on the site. No other threatened vegetation communities were present.

Threatened Fauna Species

One threatened bird species was found by the survey. However, the fauna survey techniques were not designed to detect all potential threatened species, particularly bats and owls. Rather, the approach taken was to conduct an assessment of the value of the habitats on the Study Area for threatened fauna. The 'Biometric' habitat value assessment (Table 5) showed the natural values of the Study Area are highly degraded as a result of past land use practices. The following list summarises key wildlife habitat values that have been lost:

- There is no native shrub layer
- Native grasses and herbs are reduced to a minor component of the ground cover
- The ground cover is dominated by introduced species
- The Project area lacks trees with hollows suitable for wildlife dens and bird nesting

Other site characteristics that operate against most wildlife are:

- The relatively small size of the natural Crown woodland remnants
- The lack of connectivity of the Study Area with major patches of natural bushland
- Continued grazing of the Crown woodland

These factors indicate that the habitat is unsuitable for native fauna that require:

- Relatively large natural areas to maintain viable population sizes
- Natural shrub and ground cover vegetation layers
- Native grasses

By contrast, the habitats on the Crown lands adjoining the Project area have the following positive values:

- A relatively continuous old growth woodland
- High foliage and branches in the remnant old growth trees
- The presence of tree hollows in the old growth eucalypts

These factors provide suitable habitat for:

- Birds that feed by gleaning insects from foliage
- Birds and possums that nest in dense foliage and upper branches
- Wildlife (birds, bats and arboreal mammals) dependent on hollows for nest sites and dens

Table 6
Analysis of Habitat Suitability of the Study Area for Threatened Fauna Species.
(X = factor missing or unsuitable, √ = factor present, NA = not applicable)

Species	Factor					Special Requirements	Comments	Habitat Suitable?
	Area	Shrub Layer	Ground Cover	Tree Canopy	Hollows			
Bathurst Copper Butterfly	NA	X	NA	NA	NA	Larvae feed on *Bursaria spinosa* foliage.	Larval food source is absent from Study Area	No
Glossy Black Cockatoo	X	NA	NA	√	X	Needs large supply of *Allocasuarina* fruits		No
Superb Parrot	√	NA	√	√	√	Forages on ground mainly	Nests in high tree hollows	Yes
Swift Parrot	NA	NA	NA	√	NA	Requires winter flowering eucalypts	Migratory species, favoured food trees in the NSW Central West, Red Ironbark and White Box, are not in the Study Area	No
Turquoise Parrot	√	√	X	√	√	Low nest hollow in dead tree	Feeds on native ground cover species at boundary of native forest and grassland, dry forests and woodlands.	No
Barking Owl	√ (30-200 ha)	NA	NA	√ (for roosting)	√	Need open spout-like hollows for nesting	Could use Study Area	Possible
Masked Owl	X	NA	NA	√	X	Large vertical hollow in tall eucalypt	Forests and dense woodlands, sedentary and territorial	No
Powerful Owl	X (800-1000 ha)	NA	NA	√	X	Nests in very large trees	Feeds mainly on tree dwelling possums and gliders. Needs large tracts of bushland.	No
Hooded Robin	√ (10-20 ha)	X	X (feeds on ground)	√ (for nesting)	NA	Scattered trees, fallen timber	An open woodland species, not in dense habitats	No
Speckled Warbler	√	X	X	√	NA	Nests on rough ground below grass cover	A bird of open eucalypt woodlands in rocky country	No
Diamond Firetail	√	√	X	√	NA	Native grass seed	Open, grassy native woodlands	No
Brown Treecreeper	?	NA	X	√	NA	Requires leaf litter, fallen branches for foraging	Open, grassy native woodlands and dry forests with rough-barked trees.	No

Species	Factor					Special Requirements	Comments	Habitat Suitable?
	Area	Shrub Layer	Ground Cover	Tree Canopy	Hollows			
Painted Honeyeater	NA	NA	NA	✓	NA	Needs large supply of mistletoe flowers and fruits	Nomadic species	No
Regent Honeyeater	NA	NA	NA	✓	NA	Flowering eucalypts	Nomadic, feeds mainly on nectar	Possible visitor only
Koala	X	NA	NA	✓	NA	Preferred food trees, which include *Eucalyptus viminalis,* must be present	Food trees present in Study Area, but too few in number and area	Possible
Squirrel Glider	X	✓	NA	X	X	Requires old growth Box woodlands	Requires numerous hollows within an area for nesting and refuge	No
Yellow-bellied Glider	X	NA	NA	✓	✓	Feeds mainly on sap, nectar and pollen	Nests in high tree hollows	No
Eastern Bent-wing Bat	?	NA	NA	✓	NA	Obligate cave-dweller, maternal roost at Borenore Caves	Nomadic	May forage in Study Area, but not dependent on it.
Large-eared Pied Bat	?	NA	NA	✓	NA	Caves for roosting and breeding	Forages in continuous forests and woodlands, not found in more open habitats	No
Yellow-bellied Sheathtail Bat	X	NA	NA	✓	✓	Roosts communally in large tree hollows in tall trees	Requires extensive patches of dense vegetation	No

The above considerations can be applied to the threatened species listed in Table 2 to determine whether suitable habitat exists for them on the Study Area. This analysis, given in Table 6, and using the habitat value results presented in Table 5, shows that for most threatened fauna species, one or more critical habitat requirements are missing from the Study Area. Consequently, most of the threatened fauna species are considered unlikely to occur in the Study area or to be able to establish viable populations in it.

Table 7 lists the threatened fauna species that may possibly inhabit the Study Area because the necessary resources appear to be available on the Project area or adjoining Crown woodlands. In addition, some nomadic threatened species may occasionally visit and utilise the Study Area temporarily.

Table 7
Threatened Fauna Species that may Possibly Inhabit or Utilise the Study Area

Scientific Name	Common Name
Polytelis swainsonii	Superb Parrot
Ninox connivens	Barking Owl
Xanthomyza phrygia	Regent Honeyeater
Phascolarctos cinereus	Koala
Miniopterus schreibersii	Eastern Bent-wing Bat

IMPACT ASSESSMENT

This section provides an assessment of the impacts of the proposed project on flora and fauna based on the preceding survey findings and analysis. The assessment is based on consideration of Section 5A of the NSW *Environmental Planning and Assessment Act (1979)* (EP&A Act), NSW *State Environmental Planning Policy No. 44* (SEPP 44) and the Commonwealth *Environmental Protection and Biodiversity Conservation Act (1995)* (EPBC Act).

EP&A Act – Section 5A.

Flora

No threatened flora species was found by the surveys. However, the possible presence of two threatened native herbs, Silky Swainson Pea and Narrow-leaf Goodenia, could not be discounted due to their inconspicuous nature when not in flower. These two species are therefore subjected to assessments for significant impact under Section 5A of the EP&A Act 1979 (Seven Part Tests) (see below).

Threatened Communities

No threatened vegetation communities were found on the Study Area, or are likely to have once occurred there.

Fauna

Analysis of the suitability of the habitats on the Study Area for 20 threatened fauna, that may potentially have utilised the Study Area in pre European times, indicated the site was unsuitable for 15 species, but may provide suitable habitat, if only intermittently, for five others; Koala, Eastern Bent-wing Bat, Barking Owl, Superb Parrot and Regent Honeyeater. These five species are subjected to assessments for significant impact under Section 5A of the EP&A Act 1979 (Seven Part Tests) (see below).

ASSESSMENT OF SIGNIFICANCE

Two threatened flora and five threatened fauna species are individually subjected to Seven Part Tests of Significance in this section. In considering these tests, it is important to distinguish the Project area (the development site) from the broader Study Area which includes the immediate surrounds of the Project. The Project area will be directly modified by the development, whereas the surrounding areas may be affected indirectly, if at all. The potential impact of the Project on threatened flora will be assessed with regard to their possible presence on the Project Area and the broader Study Area. By contrast, it is considered unlikely that any of the threatened fauna depend on the Project Area, but that their possible occurrence relates to the woodlands on the adjoining Crown Land.

Narrow Goodenia (*Goodenia macbarronii*)

Backgound

Narrow Goodenia occurs on the western or inland slopes of the Great Dividing Range from the Darling Downs in Queensland to north eastern Victoria (DECC 2005a). It occurs widely on the tablelands, western slopes and western plains of NSW (DECC 2005a). It is listed as Vulnerable in NSW and Threatened in Victoria. It was listed as Vulnerable under the Commonwealth EPBC Act until 14 December 2006, when it was delisted.

Narrow Goodenia is an annual, or short-lived perennial herb growing to 30 or 40 cm high (Berwick 2003, DECC 2005a). It favours damp sites in dry open forests and woodlands and may be common after periods of high winter rainfall. It is generally associated with open sites that remain moist through summer such as drainage lines, small creeks, soaks, swamp and lagoon margins, alluvial fans, soaks and other moist areas, particularly on sandy soils. It is also known to colonise moist, disturbed areas, such as roadside drains and grazing paddocks. It appears to tolerate grazing by cattle. Populations may be quite dense and crowded in favoured sites and fluctuate widely depending on seasonal conditions (DEH 2006).

In recommending the delisting of the Narrow Goodenia under the EPBC Act the Threatened Species Scientific Committee concluded that:

'The Narrow Goodenia is distributed from south-eastern Queensland to northern Victoria over a distance of approximately 1640 km. Its extent of occurrence is approximately 437 000 km^2. It has been reported from at least 70 locations across its range in the ten years between 1990 and 2000.

The total population size of the species at any given location may exceed tens of thousands of individuals in response to seasonal conditions. The species is an annual or short-lived perennial that appears to experience natural large fluctuations in population size and area of occupancy, and can be very abundant with appropriate seasonal conditions. It appears to be resilient to, and its habitat enhanced by, some forms of disturbance such as roadworks and grazing.

Populations are currently known from nature conservation areas across its range, including at least two in Victoria, eight in NSW and one in Queensland. It has been reported to be seasonally widespread and abundant in some of these areas.'

Narrow Goodenia has been included for assessment in this report due to a record in the Millthorpe area (DECC 2005a), which is about 20 km SSW of Orange.

Factors of Assessment

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

If a viable population of the Narrow Goodenia occurred on the Project area, the development would likely cause the extinction of that population due to extensive modification of the site. However, several factors indicate that a viable population of *Goodenia macbarronii* is highly unlikely to occur on the site, or in the immediate surrounds (Study Area);

1. The Study Area does not have the sandy soils that are normally associated with this species.
2. The vegetation community native to the Study Area is not known to support this species, which occurs in drier habitat types.
3. The Project site does not have open gullies or soak areas suitable for the Narrow Goodenia. Rather the drainage lines are heavily choked with introduced grasses and weeds that would not permit establishment and growth of Narrow Goodenia. Open gullies and soaks may occur elsewhere in the Study Area, due to sheep grazing, but are precluded from supporting the Narrow Goodenia by points 1 and 2 above. In addition, the Agricultural Institute lands are heavily grazed by sheep, which appear to exclude Narrow Goodenia.

Therefore, it is considered highly unlikely that a viable population of Narrow Goodenia exists on the Project area.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

No endangered population of *Goodenia macbarronii* is listed for the subject area in Part 2 of Schedule 1 of the NSW TSC Act.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

As noted under factor (a) above, habitat suitable for *Goodenia macbarronii* does not occur on the Project area. Therefore the Project will not remove or modify habitat of *G. macbarronii*.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

The habitat requirements for *Goodenia macbarronii* are described above. As previously established, no known habitat for this species occurs on the Project area or surrounds. Therefore, an area of known (or potential) habitat is unlikely to become isolated from current interconnecting areas of habitat for this species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The considerations outlined under factor (a) above indicate that habitat for *Goodenia macbarronii* does not occur on the Study Area. Therefore, any natural habitat removed by the Project is not likely to be important for the long-term survival of *Goodenia macbarronii*.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No areas of Critical Habitat listed in the Registers of Critical Habitat maintained by the Directors General of the Departments of Environment and Climate Change or Primary Industries occur on the Study Area.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No Recovery Plan or Threat Abatement Plan for the Narrow Goodenia has been published in NSW. However, the Threatened Species Profile for Narrow Goodenia lists nine strategies and ten priority actions needed to recover this species (DECC 2005a).

However, since it has been established above that habitat suitable for Narrow Goodenia does not occur in the Study Area, recovery actions do not need to be invoked. Therefore, the proposed development is not inconsistent with the objectives or actions of a recovery plan or threat abatement plan for this species, or the Priorities Action Statement.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed action does not constitute all or part of a key threatening process (KTP) because the Project site has already been almost completely degraded and alienated by past land use activities. None of the 31 KTPs listed on the NSW Department of Environment and Climate Change website (accessed 10 October 2007) are relevant to the Project. Nor is the Project likely to enhance the operation of any KTPs in the surrounding woodland remnants.

Silky Swainson Pea (*Swainsona sericea*)

Backround

Silky Swainson Pea is a prostrate or low growing herb to 10 cm high. Plants are densely hairy, including the 2 to 7 cm long leaves with 5 to 13 leaflets. It has upright racemes of 2 to 8 purple pea flowers. *Swainsona sericea* is listed as Vulnerable in NSW and Threatened in Victoria. Silky Swainson Pea was formerly widespread on the tablelands, inland slopes and plains of New South Wales, particularly in the southern two thirds of the state. Most of the records of this species are quite old; it has rarely been found in more recent surveys, suggesting it has declined markedly in distribution and abundance. The total population in NSW was considered to comprise less than 10,000 individuals at the time of its listing as Vulnerable (DEC 1999). It has been included in this assessment owing to a 1992 record about 10 km north of Orange (Bionet, accessed 10 October 2007).

The known habitats of *Swainsona sericea* are varied:

- Natural temperate grassland and Snow Gum (*Eucalyptus. pauciflora*) woodland on the Monaro Tableland (DECC 2005b).
- Box-Gum woodlands on the Southern Tablelands and South West Slopes (DECC 2005b).
- Sometimes associated with Cypress pines (*Callitris* spp.) (DECC 2005b).
- Semi-arid Sand Dune Hummock Pine Woodland, commonly in dune blowouts (Earl *et al.* 2003).
- Grassy ecosystems of the Northern and Wimmera Plains of Victoria, on heavy gilgai soils (Earl *et al.* 2003).

Most known populations of Silky Swainson Pea in NSW, Victoria and the ACT occur on roadsides, in cemeteries, railway easements or reserves. It appears to be susceptible to grazing.

Threats to this species include land clearing, roadworks, grazing, residential development (rural and urban) and weed invasion.

Factors of Assessment

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

If a viable population of the Silky Swainson Pea occurred on the Study Area, the development would likely cause its extinction due to extensive modification of the site. However, Silky Swainson Pea is considered unlikely to occur on the Study Area due to past and current land use patterns. The Crown Lands adjoining the Project area have been intensively grazed by sheep at least since the establishment of the Agricultural Institute in 1980. This, coupled with the sowing of improved pastures, would have eliminated any Silky Swainson Pea plants that may once have been present.

The Project Area has also been subjected to extreme habitat modification and intensive land use. The almost complete removal of the original grassy woodland vegetation community makes it highly unlikely that any Silky Swainson Pea plants would have survived, if they had ever been present. In addition, no foliage (grey coloured, silky hairy, pinnate leaves) resembling that of Silky Swainson Pea was found during the site survey.

It is therefore concluded that the proposed development is highly unlikely to place a viable local population of the Silky Swainson Pea at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

No endangered population of *Swainson sericea* is listed for the subject area in Part 2 of Schedule 1 of the NSW TSC Act.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

As noted under factor (a) above, the original native grassy woodland habitat has been almost completely eliminated from both the broader Study Area and the Project area. Any removal of potential habitat for Silky Swainson Pea will be very small, estimated at less than 10 m^2 dominated by Kangaroo Grass, *Themeda australis*, if indeed Silky Swainson Pea ever occurred naturally on the Project area.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

Known habitat for *Swainsona sericea* is extremely limited on the Central Tablelands and Central Western Slopes of NSW (Bionet, accessed 10 October 2007) and is already highly fragmented. No known habitat patches suitable for *Swainsona sericea* are contiguous with the Project area. Therefore, loss of any potential habitat for *Swainsona sericea* on the Project area will not result in further fragmentation or isolation of known Silky Swainson Pea habitat.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The considerations outlined under factors (a) and (d)(i) above indicate that potential habitat for *Swainsona sericea* is very limited on the Study Area. Therefore, any potential habitat removed by the Project is not likely to be important for the long-term survival of *Swainsona sericea*.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No areas of Critical Habitat listed in the Registers of Critical Habitat maintained by the Directors General of the Departments of Environment and Climate Change or Primary Industries occur on the Study Area.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No Recovery Plan or Threat Abatement Plan for the Silky Swainson Pea has been published in NSW. However, the Threatened Species Profile for Silky Swainson Pea lists six specific actions needed to recover this species (DECC 2005b). In addition, a comprehensive suite of strategies to enhance the conservation of threatened species has been outlined in the NSW Priorities Action Statement.

However, since it has been established above that potential habitat for Silky Swainson Pea is highly unlikely to occur in the Study Area, and the species was not found during the field survey, recovery actions do not need to be invoked. Therefore, the proposed development is not inconsistent with the objectives or actions of a recovery plan or threat abatement plan for this species, or the Priorities Action Statement.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed action does not constitute all or part of a key threatening process (KTP) because the Project site has already been almost completely degraded and alienated by past land use activities. None of the 31 KTPs listed on the NSW Department of Environment and Climate Change website (accessed 10 October 2007) are relevant to the Project. Nor is the Project likely to enhance the operation of any KTPs in the surrounding woodland remnants.

Superb Parrot (*Polytelis swainsonii*)

Background

The Superb Parrot is a large, bright green, conspicuous species found mainly on the western slopes of the Great Dividing Range and the eastern Riverine Plains in NSW (Bionet, accessed 11 October 2007). The species requires hollows in large trees for breeding, usually in Box-Gum woodlands and River Red Gum forests (Webster 1988, DECC 2005c). It breeds mainly in the southern areas of its range from September to January and part of the population migrates to the northern NSW inland after the breeding season. The species tends to nest in small colonies, and may have several nests in the same tree. While the dominant food source is grass seeds gathered on the ground, Superb Parrots also eat herbaceous material, fruits, berries, nectar, buds, flowers, insects and wheat. The birds are active flyers and may travel up to 10 km to feeding areas.

During the survey for this study, four pairs of Superb Parrots were observed in the Ribbon Gum (*Eucalyptus viminalis*) / Apple Box (*Eucalyptus bridgesiana*) woodland to the north west of the Project Area on the Orange Agricultural Institute. One pair was inspecting potential nest hollows in an old growth Ribbon Gum about 75 m from the Project Area. Three pairs were observed feeding together on the ground nearby in the vicinity of the stockyards. On one occasion a single bird flew over the Project Area without landing; no birds were observed to land in trees or on the ground in the Project Area. The open eucalypt woodland adjacent to the Project area is suitable for nesting by Superb Parrots due to the presence of mature old growth trees with hollows and it is possible the four pairs observed represent a resident breeding population. These trees also appear to support nesting by a large suite of other parrot species, including Red-rumped Grass Parrots, Sulphur-crested Cockatoos, Galahs, Crimson Rosellas and Eastern Rosellas (Appendix 4).

The nearest official records of Superb Parrots to the Study Area are for the Belgravia area north of Orange, the Panuara area south of Orange, the Cargo area south west of Orange and the Molong area west of Orange (Bionet, accessed 11 October 2007).

Threats to the long term survival of the Superb Parrot in the wild include (DECC 2005c):

- Clearing of old growth woodland trees
- Loss of hollow-bearing trees (death, storms, firewood collection)
- Non-replacement of nesting and food trees
- Takeover of hollows by feral bees and introduced birds
- Illegal trapping

Factors of Assessment

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

A colony of Superb Parrots was found to occur on the Study Area, adjacent to the Project site. However, while there was no indication during the survey that the birds utilised the development site, it is possible they may utilise it as a food resource at times, e.g. when grass seeds mature.

It is considered unlikely that the Project will place the Superb Parrot population in the Study Area at risk of extinction for the following reasons;

- There are no potential nesting trees for the Superb Parrot on the Project Area.
- The Project will not reduce the number of nest sites available to the Superb Parrot in the Study Area.
- While the development may reduce the feeding area available to the Superb Parrot, the development site is unlikely to be critical to the survival of the species in the Study Area, because the Project Area is very small relative to the area of woodland available on the Agricultural Institute, including additional areas further north of the woodland shown in Figure 1. In addition, Superb Parrots may forage very widely, up to 10 km from the nest (DECC 2005c), and therefore have very large foraging areas available to them. The potential feeding resources on the development site are likely to represent a minute proportion of the foraging area for this population.
- No activities expected to take place in the normal running of the hospital are likely to result in abandonment of the adjoining woodland by the Superb Parrot population.
- However, noise, dust and high levels of on-site activity during construction may disrupt breeding and result in desertion of nearby nests. It is conceivable the population may abandon the area entirely, but more likely would move to other parts of the woodland, providing suitable nesting trees are available. Disruption during construction, if it occurred, may only be temporary, with the birds returning when construction ceased.

It is concluded that the proposed development is unlikely to place a viable local population of the Superb Parrot at risk of extinction. However, there is potential for disruption of breeding during the Project construction phase and possible temporary abandonment of the adjoining woodland by the population.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

No endangered population of *Polytelis swainsonii* is listed for the subject area in Part 2 of Schedule 1 of the NSW TSC Act.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

As noted under factor (a) above, the Project area does not contain any nest hollows suitable for the Superb Parrot and therefore is not breeding habitat. In addition, the potential feeding habitat for Superb Parrots on the Project Area is insignificant in relation to both the foraging area available to the local population and the species as a whole.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

The Project may result in the loss of one mature Ribbon Gum tree and approximately 40 juvenile Ribbon Gum and Apple Box trees. These trees are marginal to a large block of open eucalypt woodland to the north and north west of the Project Area. The trees on the Project Area do not form part of a corridor between the adjoining woodland and other woodland or bushland patches in the district. Therefore, the Project will not result in further fragmentation or isolation of Superb Parrot habitat.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The Project Area has been almost entirely cleared historically of its natural vegetation. The remaining single mature Ribbon Gum tree and the juvenile trees on the fence lines are marginal to the main woodland habitat of the Superb Parrot population on the Agricultural Institute. These trees are not considered critical to the long-term survival of the Superb Parrot in the locality.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No areas of Critical Habitat listed in the Registers of Critical Habitat maintained by the Directors General of the Departments of Environment and Climate Change or Primary Industries occur on the Study Area.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No Recovery Plan or Threat Abatement Plan for the Superb Parrot has been published in NSW. However, the Threatened Species Profile for Superb Parrot lists eleven strategies and 21 priority actions needed to recover this species (DEC 2005c).

Since it has been established above that potential habitat for Superb Parrot is very limited at best on the Project Area, recovery actions do not need to be invoked. Therefore, it is considered that the proposed development is not inconsistent with the objectives or actions of a recovery plan or threat abatement plan for this species, or the Priorities Action Statement.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Key threatening processes (KTPs) relevant to the Superb Parrot are:

1. Clearing of native vegetation
2. Competition from feral honeybees
3. Infection by Psittacine circoviral (beak and feather) disease affecting endangered psittacine species and populations
4. Loss of hollow bearing trees
5. Predation by feral cats
6. Predation by the European red fox

The above listed threatening processes, if operating, have potential to impact on the Superb Parrot population on the Study Area.

1. Native Vegetation Clearance

Since the Project Area has already lost virtually all of its original vegetation, there will be minimal further loss of native vegetation comprising one mature Ribbon Gum and less than 40 seedling and juvenile eucalypts. This represents a minimal level of vegetation clearance that will not have a significant effect on the core woodland habitat of the Superb Parrot on the Study Area.

2. *Competition by feral honeybees*

The proposed development is unlikely to increase the incidence of feral honeybee hive establishment in hollows utilised by Superb parrots.

3. Infection by Psittacine circoviral (beak and feather) disease affecting endangered psittacine species and populations

The proposed development is unlikely to increase the incidence of Psittacine circoviral disease among Superb Parrots on the Study Area.

4. *Loss of hollow bearing trees*

The Project area lacks hollow-bearing trees. Therefore, this KTP will not be associated with the Project.

5. and 6. *Predation by feral cats and the European red fox*.

Survival of feral cats and foxes is often enhanced near human habitation due to access to food scraps, pet food etc. An increased cat and fox population near the development may pose additional risks for the local Superb Parrot population. However, it can be expected that high levels of hygiene in the hospital precinct would reduce the possibility of inadvertently encouraging feral cats and foxes. Nevertheless, it will be important for the hospital administration to actively avoid this risk to the local Superb Parrot population.

Barking Owl (*Ninox connivens*)

Background

The Barking Owl is a medium-sized species of Hawk-owl. Males grow to 45 cm and are larger than the female. The wings and tail are barred, the underside is white with brown vertical streaks and the back is grey to greyish brown with white spots on the wings. The face is flat with large yellow eyes. The most distinctive feature of the Barking Owl is the dog-like call, sounding like a double bark, repeated frequently. Males and females often perform duets with the female's call shorter and higher pitched than the male. It is also known to emit high-pitched tremulous screams early in the breeding season, giving it the name 'screaming woman bird'.

Most records for the Barking Owl are on the western slopes of the Great Dividing Range and on the narrow Coastal Plains in NSW. Records are sparser in dense escarpment forests and on the tablelands (Bionet, accessed 11 October 2007) (DECC 2005d). Overall, Barking Owls appear to prefer open woodlands and forests, and timbered watercourses (DECC 2005d). They roost by day in dense understorey trees or below the dense canopy of tall trees (DECC 2005d). Barking Owls require hollows in large, old eucalypts for nesting. Pairs of birds occupy large territories (30 to 200 ha) all year round.

Threats to the Barking Owl include:

- Loss of habitat through clearing or degradation
- Loss of hollow-bearing trees through forestry, firewood gathering etc.
- Effects of habitat degradation on prey species

Factors of Assessment

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Barking Owls were not located in the Study Area during the survey and have not been recorded in the vicinity previously. However, the open woodland habitat is considered to be suitable for Barking Owls and the mature old growth trees provide potential nesting sites.

In the event that a pair Barking Owls occurred on the Study Area, it is considered unlikely that the Project would place them at risk of extinction for the following reasons;

- There are no potential nesting trees for Barking Owls on the Project Area.
- The Project will not reduce the number of nest sites available to Barking Owls in the Study Area.
- While the development may reduce the feeding area available to Barking Owls, the development site is unlikely to be critical to the survival of the species in the Study Area, if they were to occur, because the Project Area is very small relative to the area of woodland available on the Agricultural Institute.
- No activities expected to take place in the normal running of the hospital are likely to result in abandonment of the adjoining woodland by Barking Owls, if they were to occur.
- However, noise, dust and high levels of on-site activity during construction may disrupt breeding and result in desertion of a nearby nest, if one were to occur. It is conceivable that a pair may abandon the area entirely, but more likely would move to

other parts of the woodland, providing suitable nesting trees are available. Hollands (1991) reported desertion of a nest by Barking Owls after minimal disturbance. Disruption during construction, if it occurred, may only be temporary, with the birds returning when the disturbance ceased (Hollands 1991).

It is concluded that the proposed development is unlikely to place a viable local population of the Barking Owl at risk of extinction. However, there is potential for disruption of breeding during the Project construction phase and possible temporary abandonment of the adjoining woodland by a breeding pair.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

No endangered population of *Ninox connivens* is listed for the subject area in Part 2 of Schedule 1 of the NSW TSC Act.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

As noted under factor (a) above, the Project area does contain any nest hollows suitable for Barking Owls and therefore is not potential breeding habitat. In addition, the potential feeding habitat for Barking Owls on the Project Area is insignificant in relation to both the foraging area available to any local population and the species as a whole.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

The Project may result in the loss of one mature Ribbon Gum tree and approximately 40 juvenile Ribbon Gum and Apple Box trees. These trees are marginal to a large block of open eucalypt woodland to the north and north west of the Project Area. The trees on the Project Area do not form part of a corridor between the adjoining woodland and other woodland or bushland patches in the district. Therefore, the Project will not result in further fragmentation or isolation of Barking Owl habitat.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The Project Area has been almost entirely cleared historically of its natural vegetation. The remaining single mature Ribbon Gum tree and the juvenile trees on the fence lines are marginal to the main potential woodland habitat of the Barking Owl on the Agricultural Institute. These trees are not considered critical to the long-term survival of the Barking Owl in the locality, if it were to occur.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No areas of Critical Habitat listed in the Registers of Critical Habitat maintained by the Directors General of the Departments of Environment and Climate Change or Primary Industries occur on the Study Area.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

The Draft Recovery Plan for the Barking Owl (NPWS 2003) includes five recovery objectives and 20 actions and the Threatened Species Profile for the Barking Owl (DECC 2005d) lists nine strategies and 17 priority actions needed to recover this species.

However, since it has been established above that potential habitat for Barking is absent on the Project Area, recovery actions do not need to be invoked. Therefore, it is considered that the proposed development is not inconsistent with the objectives or actions of the recovery plan for this species.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Key threatening processes (KTPs) relevant to the Barking Owl are (NPWS 2003):

1. Clearing of native vegetation
2. Competition from feral honeybees
3. Loss of hollow bearing trees
4. Predation by feral cats
5. Predation by the European red fox

The above listed threatening processes, if operating, have potential to impact on a Barking Owl pair, if present on the Study Area.

1. Native vegetation Clearance

Since the Project Area has already lost virtually all of its original vegetation, there will be minimal further loss of native vegetation comprising one mature Ribbon Gum and less than 40 seedling and juvenile eucalypts. This represents a minimal level of vegetation clearance that will not have a significant effect on the core woodland habitat of the Barking Owl on the Study Area, if it were present.

2. *Competition by feral honeybees*

The proposed development is unlikely to increase the incidence of feral honeybee hive establishment in hollows utilised by Barking Owls, if they were present.

3. *Loss of hollow bearing trees*

The Project area lacks hollow-bearing trees. Therefore, this KTP will not be associated with the Project.

4. and 5. *Predation by feral cats and the European red fox*.

Survival of feral cats and foxes is often enhanced near human habitation due to access to food scraps, pet food etc. An increased cat and fox population near the development may pose additional risks for any local Barking Owl population, particularly predation on inexperienced juvenile birds (NPWS 2003). However, it can be expected that high levels of hygiene in the hospital precinct would reduce the possibility of inadvertently encouraging feral cats and foxes. Nevertheless, it will be important for the hospital administration to actively avoid this risk to any local Barking Owl population.

Regent Honeyeater (*Xanthomyza phrygia*)

Background

The Regent Honeyeater is a striking medium-sized black and yellow honeyeater. It inhabits the open box-gum woodlands of the NSW western slopes extending into southern Queensland and Victoria north of the Great Dividing Range (DECC 2005e). Formerly very widespread, it is now confined to a few main breeding areas; Chiltern-Wodonga in north east Victoria, the Capertee Valley, Bundarra-Barraba district, Warrumbungles NP, Pilliga NR, Central Coast and parts of the Hunter Valley of NSW (NPWS 1999).

Outside the breeding season, it is nomadic, roaming widely in search of favoured flowering eucalypts and mistletoes, on whose nectar it feeds. Regent honeyeaters feed mainly on the nectar of a variety of eucalypt and mistletoe species, but predominantly depend on Red Ironbark, White Box and Yellow Box. The nearest official records of Regent Honeyeaters to the Study Area are Cargo, west of Orange, and Kerrs Creek, north of Orange (Bionet, accessed 11 October 2007).

Threats to the Regent Honeyeater include:

- Further loss and fragmentation of the Box-Gum woodlands of the NSW western slopes.
- Prevention of regeneration of critical native tree species by overgrazing.
- Forestry management in Box-Ironbark areas that removes mature flowering trees.

Factors of Assessment

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Regent Honeyeaters were not located in the Study Area during the survey and have not been recorded in the vicinity previously. However, the open woodland habitat, when in flower, may be potentially suitable for nomadic Regent Honeyeaters.

Should Regent Honeyeaters utilise the Study Area, it is considered unlikely that the Project would place them at risk of extinction for the following reasons;

- Any visiting Regent Honeyeaters will be nomads that can leave the area in the event that it becomes unsuitable.
- The Project will not significantly reduce the number of mature flowering trees available for Regent Honeyeaters in the Study Area. Only one mature Ribbon Gum occurs on the Project Area by contrast with large patches in the adjoining woodlands.

- No activities expected to take place in the normal running of the hospital are likely to result in effects on the adjoining woodland that are detrimental to Regent Honeyeaters, if they were to occur there.
- However, noise, dust and high levels of on-site activity during construction may disrupt feeding and result in avoidance of areas close to the Project Area, if they were to occur. It is unlikely they would abandon the area entirely, rather moving to other parts of the woodland, providing suitable flowering trees were available. Disruption during construction, if it occurred, would only be temporary, with the birds returning when the disturbance ceased.

It is concluded that the proposed development would not place a viable local population of the Regent Honeyeater at risk of extinction. However, there is potential for disruption of feeding activity during the Project construction phase and possible temporary abandonment of the adjoining woodland.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

No endangered population of *Xanthomyza phrygia* is listed for the subject area in Part 2 of Schedule 1 of the NSW TSC Act.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

As noted above, the Project area does not contain significant food resources for the Regent Honeyeater. There is only one mature Ribbon Gum tree that may be a suitable food source when in flower. However, Ribbon Gums are not known to be a favoured food tree for this species (DECC 2005e). By contrast, the author has observed feeding by Regent Honeyeaters in Apple Box, mature trees of which are widespread in the Crown Lands adjoining the Project Area. In addition, the potential feeding habitat for Regent Honeyeaters on the Project Area is insignificant in relation to both the foraging area available nearby and in the region generally. Therefore the potential amount of Regent Honeyeater habitat that may be removed by the Project is considered to be negligible.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

The Project may result in the loss of one mature Ribbon Gum tree and approximately 40 juvenile Ribbon Gum and Apple Box trees. These trees are marginal to a large block of open eucalypt woodland to the north and north west of the Project Area. The trees on the Project Area do not form part of a corridor between the adjoining woodland and other woodland or bushland patches in the district. Therefore, the Project will not result in further fragmentation or isolation of Regent Honeyeater habitat.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The Project Area has been almost entirely cleared historically of its natural vegetation. The remaining single mature Ribbon Gum tree and the juvenile trees on the fence lines are marginal to the main potential woodland habitat of the Regent Honeyeater on the Agricultural Institute. These Project Area trees are not considered critical to the long-term survival of any Regent Honeyeaters that may visit the locality.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No areas of Critical Habitat listed in the Registers of Critical Habitat maintained by the Directors General of the Departments of Environment and Climate Change or Primary Industries occur on the Study Area.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

The Threatened Species Profile for the Regent Honeyeater (DECC 2005e) lists eleven strategies and 38 priority actions aimed at recovering this species.

However, it has been established above that negligible potential habitat, and no known habitat, for Regent Honeyeaters is present on the Project Area. In addition, the adjoining woodland areas are not known to be utilised by Regent Honeyeaters and do not represent the most favoured habitat types for this species (DECC 2005e). Therefore, it is considered that recovery actions do not need to be invoked and that the proposed development is not inconsistent with the priority actions recommended for this species.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Only two listed key threatening processes (KTPs) (NPWS 2003) are considered to be relevant to the Regent Honeyeater:

1. Clearing of native vegetation
2. Competition from feral honeybees

The above listed threatening processes, if operating, have potential to impact on a Regent Honeyeaters, if present on the Study Area.

1. Native Vegetation Clearance

Since the Project Area has already lost virtually all of its original vegetation, there will be minimal further loss of native vegetation comprising one mature Ribbon Gum and less than 40 seedling and juvenile eucalypts. This represents a minimal level of vegetation clearance that will not have a significant effect on the core potential woodland habitat of the Regent Honeyeater on the Study Area, if it were present.

2. *Competition by feral honeybees*

There is concern that feral honeybees consume nectar resources that may otherwise be utilised by native animals and insects, including the Regent Honeyeater. The proposed

development is considered unlikely to increase the incidence of feral honeybees in the Study Area.

Koala (*Phascolarctos cinereus*)

Background

The koala is a thickset bear-like marsupial that spends most of its life in the branches and canopies of eucalyptus trees. It feeds on the foliage of many eucalypt and non-eucalypt species, but shows distinct preferences for a limited number of species including the Ribbon Gum, which is widespread in the Study Area. Koalas sleep in tree forks during the day and are mainly active at night, often moving across the ground between trees. Home ranges (2 to several hundred hectares) are small when food is abundant, but much larger when it is dispersed. The koala is distributed from north east Queensland through eastern NSW and Victoria to south eastern South Australia. In NSW the distribution is mainly coastal, but extends sparsely across the tablelands into the inland (DECC 2005f).

Threats to the koala include:

- Loss of habitat through urbanisation and clearing.
- Predation by domestic and feral dogs.
- Wildfires.
- Impact with motor vehicles when crossing roads.

Factors of Assessment

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Koalas were not located in the Study Area during the survey and have not been recorded in the vicinity in recent years, but are likely to have formerly occurred on the site. The open woodland habitat is considered to be potentially suitable for Koalas, due to the presence of Ribbon Gums, *Eucalyptus viminalis*, a favoured food species.

Should Koalas utilise the Study Area, it is considered unlikely that the Project would place them at risk of extinction for the following reasons;

- The Project will not significantly reduce the number of food trees available for Koalas in the Study Area. Only one mature Ribbon Gum occurs on the Project Area by contrast with several hundreds in the adjoining woodlands.
- No activities expected to take place in the normal running of the hospital are likely to result in effects on the adjoining woodland that are detrimental to Koalas, if they were to occur there.
- However, noise, dust and high levels of on-site activity during construction could disrupt feeding and result in avoidance of areas close to the Project Area, if they were to occur. It is unlikely they would abandon the area entirely, rather moving to other parts of the woodland with suitable food trees. Disruption during construction, if it occurred, would only be temporary, with Koalas returning when the disturbance ceased.

It is concluded that the proposed development would not place a viable local population of the Koala at risk of extinction, if any were present. However, there is potential for disruption of

feeding activity during the Project construction phase and possible temporary abandonment of the adjoining woodland.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

No endangered population of *Phascolarctos cinereus* is listed for the subject area in Part 2 of Schedule 1 of the NSW TSC Act.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

As noted above, the Project area does not contain significant food resources for the Koala. There is only one suitable food tree on the Project Area, a mature Ribbon Gum. In addition, the potential feeding habitat for Koalas on the Project Area is insignificant relative to both the foraging area available nearby and in the region generally. Therefore the potential amount of Koala habitat that may be removed by the Project is considered to be negligible.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

The Project may result in the loss of one mature Ribbon Gum tree and approximately 40 juvenile Ribbon Gum and Apple Box trees. These trees are marginal to a large block of open eucalypt woodland to the north and north west of the Project Area. The trees on the Project Area do not form part of a corridor between the adjoining woodland and other woodland or bushland patches in the district. Therefore, the Project will not result in further fragmentation or isolation of Koala habitat.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The Project Area has been almost entirely cleared historically of its natural vegetation. The remaining single mature Ribbon Gum tree and the juvenile trees on the fence lines are marginal to the main potential woodland habitat of the Koala on the Agricultural Institute. These Project Area trees are not considered critical to the long-term survival of any Koalas, if they were to occur in the vicinity.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No areas of Critical Habitat listed in the Registers of Critical Habitat maintained by the Directors General of the Departments of Environment and Climate Change or Primary Industries occur on the Study Area.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

The Threatened Species Profile for the Koala (DECC 2005f) lists fifteen strategies and 32 priority actions aimed at recovering this species.

However, it has been established above that negligible potential habitat, and no known habitat, for Koalas is present on the Project Area. In addition, the adjoining woodland areas are not known to be utilised by Koalas. Therefore, it is considered that recovery actions do not need to be invoked and that the proposed development is not inconsistent with the priority actions recommended for this species.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Only three listed key threatening processes (KTPs) (NPWS 2003) are considered to be relevant to the Koala:

1. Clearing of native vegetation
2. Ecological consequences of high frequency fires
3. Exotic vines and scramblers

The above listed threatening processes, if operating, have potential to impact on Koalas, if present on the Study Area.

1. Native Vegetation Clearance

Since the Project Area has already lost virtually all of its original vegetation, there will be minimal further loss of native vegetation comprising one mature Ribbon Gum and less than 40 seedling and juvenile eucalypts. This represents a minimal level of vegetation clearance that will not have a significant effect on the core potential woodland habitat of the Koala on the Study Area, if it were present.

2. Ecological consequences of high frequency fires

Fires, especially wildfires, can have severe consequences for Koalas. They can be directly killed, or their food trees can be killed or defoliated leading to starvation. Given the current land use, sheep grazing, in the woodland adjoining the Project Area, and the consequent very low levels of fire fuel on the ground, the risk of fire is very low. The proposed development is not considered likely to result in an increased fire risk.

3. *Exotic vines and scramblers*

Exotic vines and scramblers may completely cover and choke out areas of native vegetation. This may make it very difficult for koalas to move around their habitat and in extreme cases may kill food plants. However, vines and scramblers are mainly a problem in coastal areas along watercourses and are not considered likely to become a problem on the Study Area, even if vines and scramblers are incorporated into the landscaping of the hospital.

It is conclude that the Project will not result in the operation of any KTPs for the Koala.

Eastern Bentwing Bat (*Miniopterus schreibersii*)

Background

The Eastern Bentwing Bat is a small insectivorous species, with a head and body length of only 6 cm, wingspan of 30 cm, and weighing only 20 grams. In NSW, it is largely confined to the eastern third of the State (DECC 2005g). Eastern Bentwing Bats roost and breed mainly in caves, but also mine shafts, storm water tunnels and buildings. The bats forage for flying insects above the canopy of forests and woodlands at night. Breeding occurs in maternity caves in spring and summer each year, after which the population disperses up to 300 km away. The Borenore Caves, approximately 14 km west of Orange is a known maternity cave for the Eastern Bentwing Bat. Therefore, it is likely this species forages over the Study Area.

Threats to Eastern Bentwing Bats are (DECC 2005g):

- Damage or disturbance to breeding and roosting caves.
- Loss of foraging habitat.
- The use of pesticides close to foraging areas.
- Predation by feral cats and foxes.

Factors of Assessment

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Eastern Bentwing Bats were not located, or searched for, in the Study Area during the survey. However, the species is known to occur in the region from bat surveys (Richards 2000, 2006) and the presence of a breeding colony at Borenore Caves (Richards 2000), 14 km west of Orange. Surveys in recent years have demonstrated the presence of Eastern Bentwing bats in low numbers in the Cadia area, 25 km south of Orange (Richards 2000), and on Black Rock Ridge, 35 km south west of Orange (Richards 2006). The Study Area, combined with similar habitat south of Bloomfield Hospital, is considered to be potentially suitable foraging habitat for Eastern Bentwing Bats, due to the relatively large area of natural woodland.

Should Eastern Bentwing Bats utilise the Study Area, it is considered unlikely that the Project would place them at risk of extinction for the following reasons;

- The Project will not significantly reduce the number of woodland trees available for Eastern Bentwing Bats in the Study Area. Only one mature eucalypt occurs on the Project Area by contrast with large patches in the adjoining woodlands.
- No activities expected to take place in the normal running of the hospital are likely to result in effects on the adjoining woodland that are detrimental to Eastern Bentwing Bats, if they were to occur there.
- Eastern Bentwing Bats forage over very wide areas, and have many other suitable foraging areas, often much larger and of higher quality, available to them in the region.

It is concluded that the proposed development would not place a viable local population of the Eastern Bentwing Bat at risk of extinction, if any were present.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

No endangered population of *Miniopterus schreibersii* is listed for the subject area in Part 2 of Schedule 1 of the NSW TSC Act.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

As noted above, the Project area does not contain significant foraging resources for the Eastern Bentwing Bat. There is only one woodland tree on the Project Area, a mature Ribbon Gum. In addition, the potential feeding habitat for Eastern Bentwing Bats on the Project Area is insignificant relative to both the foraging area available nearby and in the region generally. Therefore the potential amount of Eastern Bentwing Bat habitat that may be removed by the Project is considered to be negligible.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

The Project may result in the loss of one mature Ribbon Gum tree and approximately 40 juvenile Ribbon Gum and Apple Box trees. These trees are marginal to a large block of open eucalypt woodland to the north and north west of the Project Area. The trees on the Project Area do not form part of a corridor between the adjoining woodland and other woodland or bushland patches in the district. Therefore, the Project will not result in further fragmentation or isolation of Eastern Bentwing Bat habitat.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The Project Area has been almost entirely cleared historically of its natural vegetation. The remaining single mature Ribbon Gum tree and the juvenile trees on the fence lines are marginal to the main potential woodland habitat of the Eastern Bentwing Bat on the Agricultural Institute. These Project Area trees are not considered critical to the long-term survival of Eastern Bentwing Bats, if they were to occur in the vicinity.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No areas of Critical Habitat listed in the Registers of Critical Habitat maintained by the Directors General of the Departments of Environment and Climate Change or Primary Industries occur on the Study Area.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

The Threatened Species Profile for the Eastern Bentwing Bat (DECC 2005g) lists 11 strategies and 25 priority actions aimed at recovering this species.

However, it has been established above that negligible potential habitat, and no known habitat, for Eastern Bentwing Bats is present on the Project Area. However, it is likely the adjoining woodland areas are utilised by Eastern Bentwing Bats, but are highly unlikely to be adversely affected by the Project. Therefore, it is considered that recovery actions do not need to be invoked and that the proposed development is not inconsistent with the priority actions recommended for this species.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Only one listed key threatening processes (KTPs) (NPWS 2003) is considered to be relevant to Eastern Bentwing Bats on the Study Area:

1. Clearing of native vegetation

The above listed threatening process, if operating, has potential to impact on Eastern Bentwing Bats, if they utilise the Study Area.

1. Native Vegetation Clearance

Since the Project Area has already lost virtually all of its original vegetation, there will be minimal further loss of native vegetation comprising one mature Ribbon Gum and less than 40 seedling and juvenile eucalypts. This represents a minimal level of vegetation clearance that will not have a significant effect on the core potential woodland habitat of the Eastern Bentwing Bat on the Study Area, if it were present.

It is concluded that the Project will not result in the operation of any KTPs for the Eastern Bentwing Bat.

SEPP 44

SEPP 44 aims to protect habitat utilised by the Koala, *Phascolarctos cinereus*, which is known to have occurred formerly in the Orange area, and still occurs in isolated parts of the Cabonne Shire. Ribbon Gum, *Eucalyptus viminalis*, is a favoured Koala food tree listed in Schedule 2 of SEPP 44. A large patch of remnant natural Ribbon Gum woodland occurs on the Study Area. SEPP 44 requires consideration of the Study Area as potential Koala habitat.

Since the vegetated parts of the Study Area exceed one hectare in size and may have 15 percent or more coverage by Ribbon Gums, the Study Area is considered to be potential Koala habitat. However, the area does not have an extant Koala population, and none is known to occur nearby. Accordingly, the Study Area is not ‘core’ Koala habitat and a SEPP 44 plan of management is not required.

EPBC Act

No matters requiring referral to the Commonwealth Department of Environment and Water Resources relating to Commonwealth listed threatened species and ecological communities, migratory species or wetlands of international importance, were revealed by this study.

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APPENDIX 1.
Quadrat Flora Species List and Relative Abundance (Braun-Blanquet Ratings)

Scientific Name	Common Name	Quadrat Number			
		1	2	3	4
CLASS MAGNOLIOPSIDA					
SUBCLASS MAGNOLIIDAE					
Asteraceae					
**Chondrilla juncea*	Skeleton Weed				1
**Cirsium vulgare*	Spear Thistle	1	1	1	1
**Conyza sumatrensis*	Tall Fleabane		1		1
**Hypochaeris glabra*	Smooth Catsear	1		1	1
**Hypochaeris radicata*	Flatweed	1	2	1	2
**Taraxacum officinale*	Dandelion	1	1	1	1
Boraginaceae					
**Echium plantagineum*	Paterson's Curse			1	
Campanulaceae					
Wahlenbergia communis	Tufted Bluebell		1		
Caryophyllaceae					
**Cerastium glomeratum*	Mouse-ear Chickweed	1	1	1	1
**Stellaria media*	Common Chickweed			1	
Clusiaceae					
**Hypericum perforatum*	St Johns Wort	3	2		
Fabaceae: Faboideae					
**Trifolium repens*	White Clover		2	2	1
**Trifolium* sp.					4
**Trifolium subterraneum*	Subterraneum Clover		1	2	1
**Vicia sativa*	Vetch	3	2	3	1
Geraniaceae					
Geranium retrorsum	Grassland Cranesbill	2	1		
Geranium sp.				1	
Malaceae					
**Crataegus monogyna*	Hawthorn	2	1		1
**Malus domestica*	Apple	1		1	1
Myrtaceae					
Eucalyptus bridgesiana	Apple Box				3
Eucalyptus viminalis	Ribbon Gum	4		4	3
Onagraceae					
Epilobium billardierianum	Smooth Willowherb		2		
Oxalidaceae					
Oxalis sp.	A Woodsorrel			1	
Plantaginaceae					
**Plantago lanceolata*	Lambs Tongue	2	3	1	3
Polygonaceae					
**Acetosella vulgaris*	Sorrel		1		
Rumex brownii	Swamp Dock			1	1
**Rumex crispus*	Curled Dock	1			
Portulacaceae					
Montia fontana subsp. *chondrosperma*	Water Blinks				3
Rosaceae					
Acaena novae-zelandiae	Bidgee Widgee			1	

Rubiaceae					
Asperula conferta	Common Woodruff				1
Scientific Name	**Common Name**	**Quadrat Number**			
		1	**2**	**3**	**4**
Verbenaceae					
Verbenaceae					
**Verbena bonariensis*	Purpletop		1		
SUBCLASS LILIIDAE					
Amaryllidaceae					
**Narcissus pseudonarcissus*	Daffodil		1		
Cyperaceae					
Carex appressa	Tall Sedge				4
Carex inversa	Knob Sedge	1	1		2
Juncaceae					
Juncus australis	A Rush		1		3
Poaceae					
**Agrostis capillaris*	Browntop Bent		1		
**Anthoxanthum odoratum*	Sweet Vernal Grass		2		
Austrodanthonia racemosa	Wallaby Grass		2		
Cynodon dactylon	Couch		3		
**Dactylis glomerata*	Cocksfoot	3	2	4	2
**Holcus lanatus*	Yorkshire Fog		1	1	3
**Lolium perenne*	Ryegrass			2	3
**Lolium* sp.	Ryegrass				3
Microlaena stipoides	Weeping Grass				1
**Paspalum dilatatum*	Paspalum	1	4		1
**Phalaris aquatica*	Phalaris	4	1	4	1
**Poa annua*	Winter Grass				1
**Vulpia* sp.	Fescue	1		1	2

* Introduced Species

APPENDIX 2.
Spot Sample Flora Species List (Species Present)

Scientific Name	Common Name	Spot Sample						
		1	2	3	4	5	6	7
CLASS MAGNOLIOPSIDA								
SUBCLASS MAGNOLIIDAE								
Asteraceae								
**Achillea millefolium*	Yarrow					•		
**Aster subulatus*	Wild Aster		•					
Cassinia arcuata	Sifton Bush		•	•				
**Chondrilla juncea*	Skeleton Weed			•	•	•		
**Cirsium vulgare*	Spear Thistle				•	•		•
**Conyza bonariensis*	Flaxleaf Fleabane		•	•				
**Conyza sumatrensis*	Tall Fleabane	•	•	•				
Cotula australis	Carrot Weed	•				•		
Euchiton sphaericus	Star Cudweed			•				
**Hypochaeris glabra*	Smooth Catsear	•		•	•	•		
**Hypochaeris radicata*	Flatweed	•	•		•		•	•
**Lactuca serriola*	Prickly Lettuce	•						
Pseudognaphalium luteoalbum	Jersey Cudweed		•	•				
Senecio quadridentatus	Cotton Fireweed	•	•		•	•		•
**Taraxacum officinale*	Dandelion	•		•	•		•	•
Boraginaceae								
**Echium plantagineum*	Paterson's Curse				•	•		
Brassicaceae								
**Erophila verna*	Whitlow	•						
Campanulaceae								
Wahlenbergia communis	Tufted Bluebell		•	•				
Caryophyllaceae								
**Cerastium glomeratum*	Mouse-ear Chickweed	•	•	•	•	•		
**Sagina procumbens*	Spreading Pearlwort		•					
**Spergularia rubra*	Sandspurry		•	•				
Clusiaceae								
Hypericum gramineum	Small St. Johns Wort	•						•
**Hypericum perforatum*	St. Johns Wort		•		•	•	•	
Crassulaceae								
Crassula sieberiana	Australian Stonecrop		•					
Fabaceae: Faboideae								
**Cytisus scoparius*	Scotch Broom							•
**Trifolium repens*	White Clover	•						
**Trifolium subterraneum*	Subterraneum Clover	•				•		•
**Vicia sativa*	Vetch	•						•
Fabaceae: Mimosoideae								
Acacia dealbata	Silver Wattle							•
Geraniaceae								
Geranium retrorsum	Grassland Cranesbill				•		•	
Geranium solanderi	Austral Crane's Bill	•						•
Lamiaceae								
**Lamium amplexicaule*	Dead Nettle				•	•		
Plectranthus caninus	Horehound				•	•		

Scientific Name	Common Name	Spot Sample						
		1	2	3	4	5	6	7
Malaceae								
**Cotoneaster pannosus*	Silver-leaf Cotoneaster	•					•	
**Crataegus monogyna*	Hawthorn						•	•
**Pyracantha crenulata*	Firethorn			•				
Myrtaceae								
Eucalyptus bridgesiana	Apple Box			•			•	•
Eucalyptus viminalis	Ribbon Gum	•					•	•
Onagraceae								
Epilobium billardierianum	Smooth Willowherb	•	•	•		•		•
Oxalidaceae								
Oxalis sp.	A Woodsorrel				•	•		
Plantaginaceae								
**Plantago lanceolata*	Lambs Tongue	•	•	•	•	•	•	•
Pinaceae								
**Pinus radiata*	Radiata Pine	•					•	
Polygonaceae								
**Acetosella vulgaris*	Sorrel	•	•					
Rumex brownii	Swamp Dock		•					•
**Rumex crispus*	Curled Dock					•	•	•
Portulacaceae								
Montia fontana subsp. *chondrosperma*	Water Blinks					•		
Proteaceae								
Grevillea rosmarinifolia	Rosemary Grevillea		•	•			•	
Rosaceae								
**Rosa rubiginosa*	Sweet Briar							•
**Rubus fruticosus* spp. agg.	Blackberry	•					•	•
Rubiaceae								
Asperula conferta	Common Woodruff						•	•
Salicaceae								
**Populus nigra*	Lombardy Poplar	•						
**Salix fragilis*	Crack Willow						•	
Verbenaceae								
**Verbena bonariensis*	Purpletop		•					
SUBCLASS LILIIDAE								
Cyperaceae								
Carex appressa	Tall Sedge							•
Carex inversa	Knob Sedge					•	•	
Hyacinthaceae								
**Muscari armeniacum*	Grape Hyacinth							•
Juncaceae								
Juncus australis	A Rush						•	
Juncus subsecundus	A Rush	•	•					
Orchidaceae								
Microtis sp.	An Onion Orchid							•
Poaceae								
**Agrostis capillaris*	Browntop Bent		•	•			•	•
**Anthoxanthum odoratum*	Sweet Vernal Grass					•	•	
Austrodanthonia racemosa var. *racemosa*	Wallaby Grass	•				•	•	
**Bromus cartharticus*	Praire Grass	•			•			

Scientific Name	Common Name	Spot Sample						
		1	2	3	4	5	6	7
**Bromus molliformis*	Soft Brome					•		
Chloris truncata	Windmill Grass	•	•	•				
Cynodon dactylon	Couch						•	
**Dactylis glomerata*	Cocksfoot	•		•	•	•	•	•
**Holcus lanatus*	Yorkshire Fog	•	•	•				•
**Lolium perenne*	Ryegrass	•			•			
**Lolium rigidum*	Wimmera Ryegrass	•						
Panicum effusum	Hairy Panic	•						
**Paspalum dilatatum*	Paspalum				•	•	•	•
**Phalaris aquatica*	Phalaris	•			•	•	•	•
**Poa annua*	Winter Grass	•						
**Poa bulbosa*	Bulbous Poa	•						
Poa labillardieri	Tussock Grass					•		•
Themeda australis	Kangaroo Grass					•	•	
**Vulpia* sp.	Fescue	•	•	•	•	•		

* Introduced

APPENDIX 3.
Complete Flora List, Forest Road Study Area

Scientific Name	Common Name
CLASS CONIFEROPSIDA	
Cupressaceae	
**Juniperus communis*	Common Juniper
**Thuja occidentalis* 'lutea'	Northern Whitecedar
CLASS MAGNOLIOPSIDA **SUBCLASS MAGNOLIIDAE**	
Asteraceae	
**Achillea millefolium*	Yarrow
**Aster subulatus*	Wild Aster
Cassinia arcuata	Sifton Bush
**Chondrilla juncea*	Skeleton Weed
**Cirsium vulgare*	Spear Thistle
**Conyza bonariensis*	Flaxleaf Fleabane
**Conyza sumatrensis*	Tall Fleabane
Cotula australis	Carrot Weed
Euchiton sphaericus	Star Cudweed
**Hypochaeris glabra*	Smooth Catsear
**Hypochaeris radicata*	Flatweed
**Lactuca serriola*	Prickly Lettuce
Pseudognaphalium luteoalbum	Jersey Cudweed
Senecio quadridentatus	Cotton Fireweed
**Taraxacum officinale*	Dandelion
Boraginaceae	
**Echium plantagineum*	Paterson's Curse
Brassicaceae	
**Erophila verna*	Whitlow
Campanulaceae	
Wahlenbergia communis	Tufted Bluebell
Caryophyllaceae	
**Cerastium glomeratum*	Mouse-ear Chickweed
**Sagina procumbens*	Spreading Pearlwort
**Spergularia rubra*	Sandspurry
**Stellaris media*	Common Chickweed
Clusiaceae	
Hypericum gramineum	Small St. Johns Wort
**Hypericum perforatum*	St. Johns Wort
Crassulaceae	
Crassula sieberiana	Australian Stonecrop
Fabaceae: Faboideae	
**Cytisus scoparius*	Scotch Broom
**Trifolium repens*	White Clover
**Trifolium* sp.	
**Trifolium subterraneum*	Subterraneum Clover
**Vicia sativa*	Vetch
Fabaceae: Mimosoideae	
Acacia dealbata	Silver Wattle
Geraniaceae	

Geranium retrorsum	Grassland Cranesbill
Geranium solanderi	Austral Crane's Bill
Geranium sp.	
Scientific Name	**Common Name**
Lamiaceae	
**Lamium amplexicaule*	Dead Nettle
**Plectranthus caninus*	Horehound
Malaceae	
**Cotoneaster pannosus*	Silver-leaf Cotoneaster
**Crataegus monogyna*	Hawthorn
**Malus domestica*	Apple
**Photinia glabra*	Photinia
**Pyracantha crenulata*	Firethorn
Myrtaceae	
Eucalyptus bridgesiana	Apple Box
Eucalyptus viminalis	Ribbon Gum
Onagraceae	
Epilobium billardierianum	Smooth Willowherb
Oxalidaceae	
Oxalis sp.	A Woodsorrel
Plantaginaceae	
**Plantago lanceolata*	Lambs Tongue
Pinaceae	
**Pinus radiata*	Radiata Pine
Polygonaceae	
**Acetosella vulgaris*	Sorrel
Rumex brownii	Swamp Dock
**Rumex crispus*	Curled Dock
Portulacaceae	
Montia fontana subsp. c*hondrosperma*	Water Blinks
Proteaceae	
Grevillea rosmarinifolia	Rosemary Grevillea
Rosaceae	
Acaena novae-zelandiae	Bidgee Widgee
**Rosa rubiginosa*	Sweet Briar
**Rubus fruticosus* spp. agg.	Blackberry
Rubiaceae	
Asperula conferta	Common Woodruff
Salicaceae	
**Populus nigra*	Lombardy Poplar
**Salix fragilis*	Crack Willow
Verbenaceae	
**Verbena bonariensis*	Purpletop
SUBCLASS LILIIDAE	
Amaryllidaceae	
**Narcissus pseudonarcissus*	Daffodil
Cyperaceae	
Carex appressa	Tall Sedge
Carex inversa	Knob Sedge
Hyacinthaceae	
**Muscari armeniacum*	Grape Hyacinth
Juncaceae	

Juncus australis	A Rush
Juncus subsecundus	A Rush
Orchidaceae	
Microtis sp.	An Onion Orchid

Scientific Name	Common Name
Poaceae	
**Agrostis capillaris*	Browntop Bent
**Anthoxanthum odoratum*	Sweet Vernal Grass
Austrodanthonia racemosa var. *racemosa*	Wallaby Grass
**Bromus cartharticus*	Praire Grass
**Bromus molliformis*	Soft Brome
Chloris truncata	Windmill Grass
Cynodon dactylon	Couch
**Dactylis glomerata*	Cocksfoot
**Holcus lanatus*	Yorkshire Fog
**Lolium perenne*	Ryegrass
**Lolium rigidum*	Wimmera Ryegrass
**Lolium* sp.	Ryegrass
Microlaena stipoides	Weeping Grass
Panicum effusum	Hairy Panic
**Paspalum dilatatum*	Paspalum
**Phalaris aquatica*	Phalaris
**Poa annua*	Winter Grass
**Poa bulbosa*	Bulbous Poa
Poa labillardieri	Tussock Grass
Themeda australis	Kangaroo Grass
**Vulpia* sp.	Fescue

* Introduced Species

No. Native Species	33
% Native Species	37.1
No. Introduced Species	56
% Introduced Species	62.9
Total Species	89

APPENDIX 4.
Fauna Species List, Forest Road Study Area

Scientific Name	Common Name	Conservation Status		Location	
		TSC Act	EPBC Act	Drive-in	Crown Land
Amphibians					
Crinia signifera	Common Eastern Froglet				●
Limnodynastes tasmaniensis	Spotted Grass Frog				●
Reptiles					
Chelodina longicollis	Eastern Snake-necked Turtle			● (d)	●
Birds					
Anas superciliosa	Black Duck				●
Chenonetta jubata	Australian Wood Duck			●	
Ocyphaps lophotes	Crested Pigeon			●	
Cacatua galerita	Sulphur-crested Cockatoo				●
Eolophus roseicapillus	Galah			●	●
Platycercus adscitus eximius	Eastern Rosella			●	●
Platycercus elegans	Crimson Rosella			●	●
Polytelis swainsonii	Superb Parrot	V	V	●	●
Psephotus haematonotus	Red-rumped Parrot				●
Dacelo novaeguineae	Laughing Kookaburra			●	
Pardalotus punctatus	Spotted Pardalote				● (n)
Pardalotus striatus	Striated Pardalote			●	●
Entomyzon chrysops	Yellow faced Honeyeater			●	
Manorina melanocephala	Noisy Minor			●	● (n)
Grallina cyanoleuca	Magpie Lark			● (n)	●
Rhipidura albiscapa	Grey Fantail				●
Rhipidura leucophrys	Willie Wagtail			●	
Coracina novaehollandiae	Black-faced Cuckoo-Shrike			●	
Gymnorhina tibicen	Australian Magpie			●	●
Petrochelidon ariel	Fairy Martin			●	●
Cinclorhamphus mathewsi	Rufous songlark			●	●
**Turdus merula*	Eurasian Blackbird			●	
**Sturnus vulgaris*	Common Starling			●	●
Mammals					
Macropus giganteus	Eastern Grey Kangaroo				●
Wallabia bicolor	Swamp Wallaby				●
**Vulpes vulpes*	Fox				●

* Introduced
(n) Nesting observed
(d) Deceased