WILPINJONG COAL PROJECT

APPENDIX HB

Terrestrial Fauna Assessment

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WILPINJONG COAL PROJECT

TERRESTRIAL FAUNA ASSESSMENT

PREPARED BY
MOUNT KING ECOLOGICAL SURVEYS

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HB1 INTRODUCTION

Mount King Ecological Surveys was commissioned to conduct a terrestrial fauna assessment for the Wilpinjong Coal Project (the Project), located in the New South Wales (NSW) Western Coalfield approximately 11 kilometres (km) south-east of the Ulan Coal Mines and approximately 185 km north-west of Newcastle (Figure HB-1).

The Project general arrangement is shown on Figure HB-2. A detailed description of the Project is provided in Section 2, Volume 1, of the Project Environmental Impact Statement (EIS).

HB1.1 SURVEY OBJECTIVES

The objectives of the terrestrial fauna surveys (excluding bats) were to:

- conduct terrestrial fauna surveys using recognised survey techniques;
- assess terrestrial fauna species diversity, relative abundance and habitats present within the study area;
- conduct targeted surveys for threatened terrestrial fauna species considered possible occurrences within the study area or surrounds including those listed in the Schedules of the NSW *Threatened Species Conservation Act, 1995* and the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*; and
- report on the findings of the terrestrial fauna surveys.

A bat fauna assessment has been prepared by Greg Richards and Associates (2005) for the Project and is provided as Appendix HC of the Project EIS.

HB1.2 REGIONAL SETTING

The study area is located within the upper reaches of the Hunter Valley Catchment in NSW, near the townships of Wollar and Ulan, about 40 km north-east of Mudgee. The study area is situated in the far north-west of the Sydney Basin Interim Biogeographic Regionalisation for Australia (IBRA) Region (Thackway and Cresswell, 1995; Environment Australia, 2000), and is close to other IBRA Regions, namely, the NSW South Western Slopes and Brigalow Belt South bioregions (Figure HB-3). Consequently, the study area is influenced by environmental characteristics of these nearby IBRA Regions.

As part of the *Bioregionalisation of Eastern New South Wales* (Denny, 2001), the Sydney Basin bioregion has been separated into eleven sub-regions. The biophysical characteristics of the study area are closely associated with the Hunter River valley and the Goulburn River and the area is mainly placed by Denny (2001) within the Goulburn River Hills Sub-Region, which covers approximately 938 square kilometres (km^2) or 3% of the Sydney Basin bioregion (Figure HB-3) (*ibid*). The sub-region is characterised by low hills and plainsland (relief 30-90 m), with some steep-sided palaeo drainage systems (*ibid*). Table HB-1 provides detail on the characteristics of the Goulburn River Hills Sub-Region.

Table HB-1
Characteristics of the Goulburn River Hills Sub-Region

Geology	Mesozoic Sediments (53%); Palaeozoic Sediments (41%); Acid/Intermediate Intrusives (6%)
Soils	Stony Sandy Loams (6%); Massive Red and Yellow Earths (63%); Yellow and Red Texture Contrast Soils (16%); Deep Black Cracking Clays (13%); Stony Sandy Loams (6%)
Present-day Cover	Degraded Grasslands (1%); Dry Forests and Woodlands (39%); Non-forest Systems (22%); Disturbed Forests (38%)
Conservation Areas	Goulburn River National Park (16,602 ha); Munghorn Gap Nature Reserve (4,584 ha)

Source: Denny (2001)

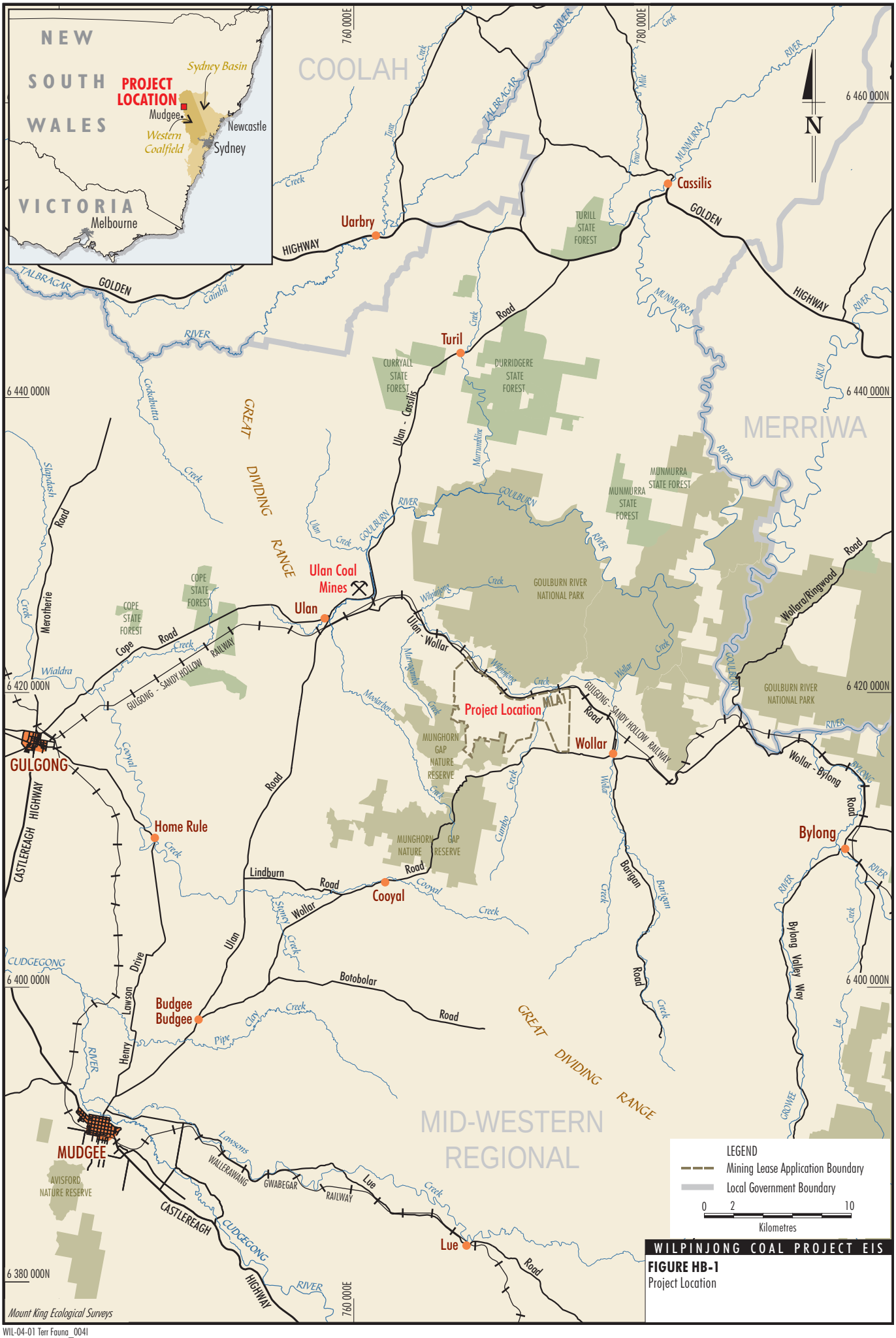

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FIGURE HB-1
Project Location

Mount King Ecological Surveys

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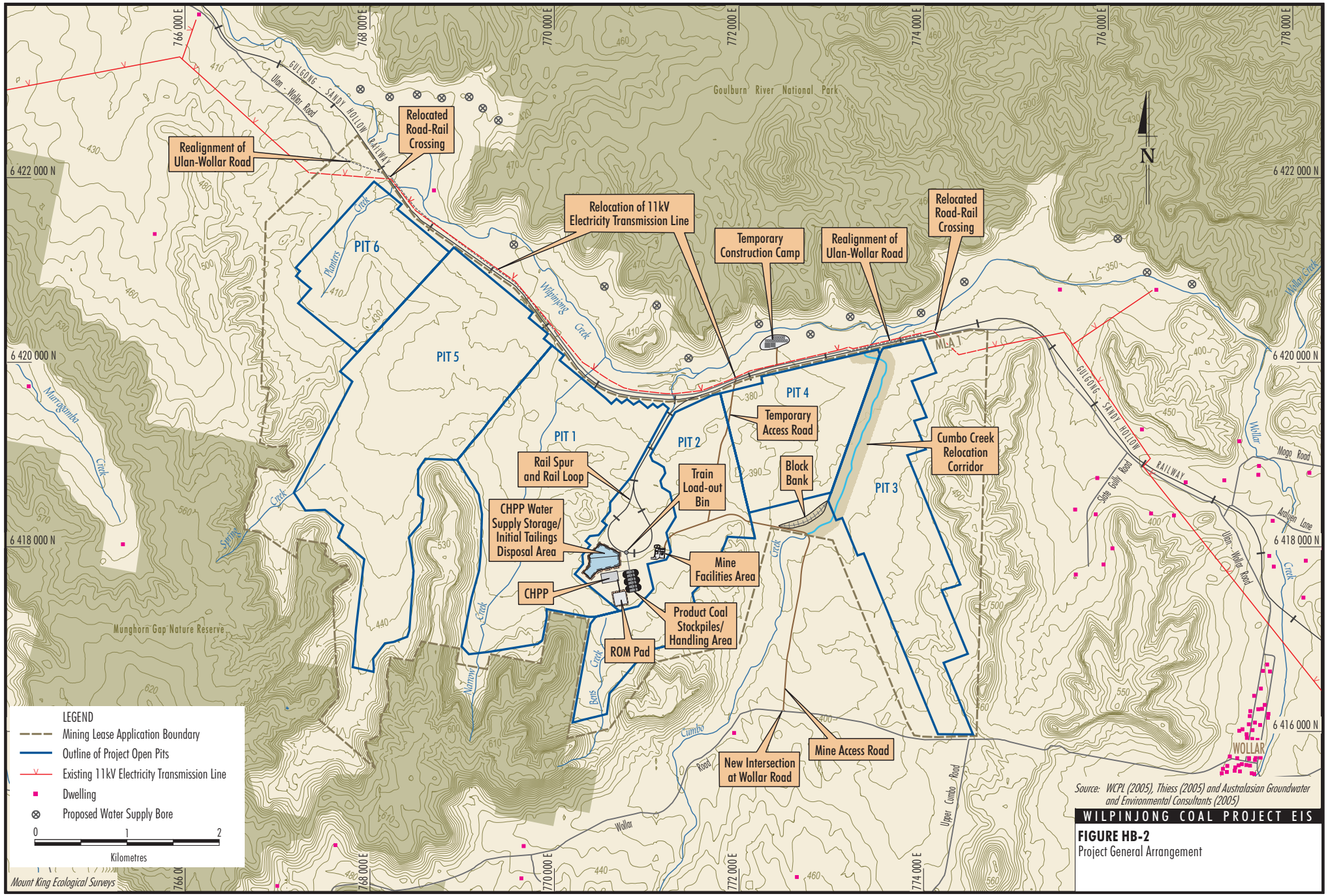

Source: WCPL (2005), Thiess (2005) and Australasian Groundwater and Environmental Consultants (2005)

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FIGURE HB-2
Project General Arrangement

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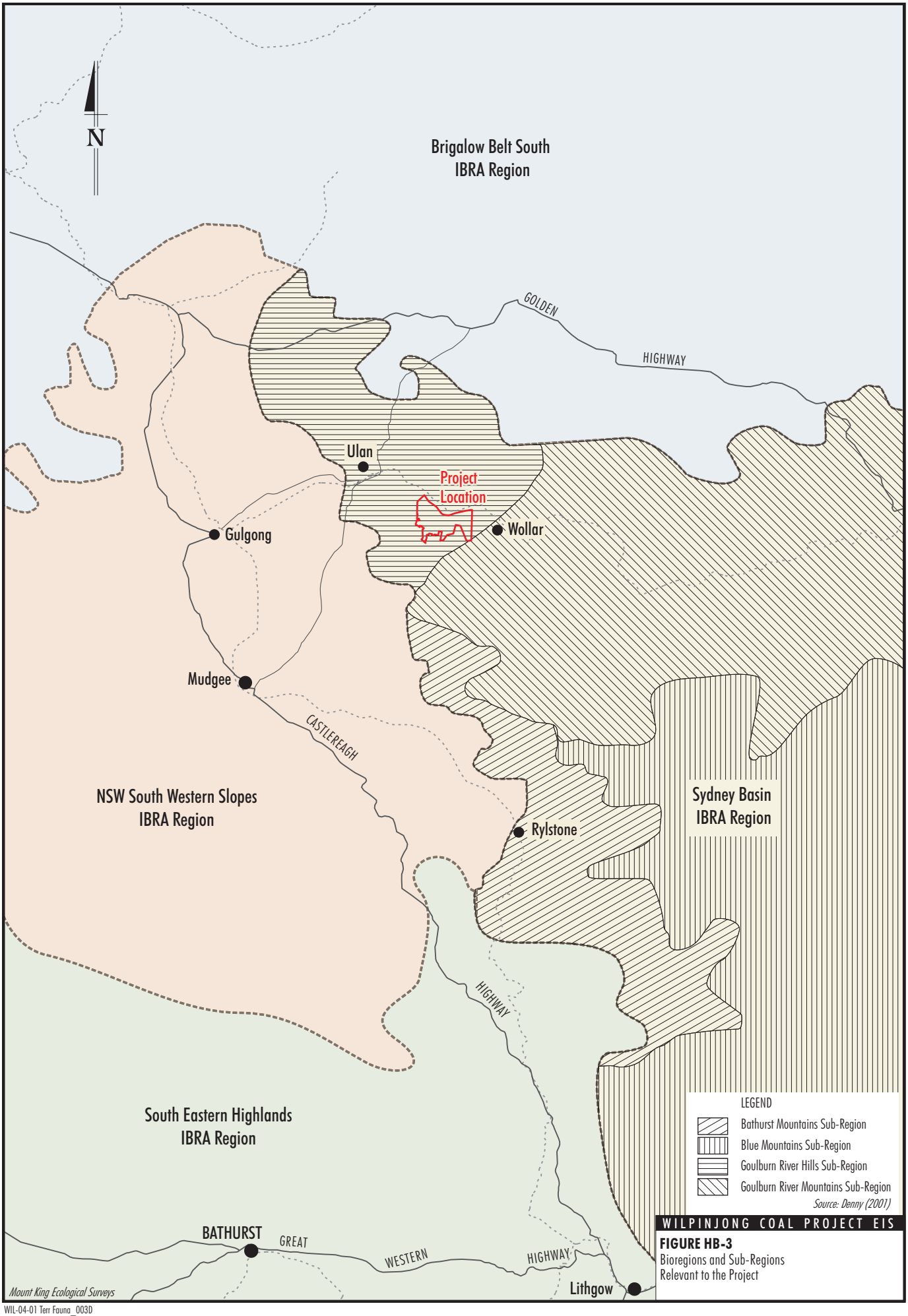

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FIGURE HB-3
Bioregions and Sub-Regions
Relevant to the Project

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Similar to much of the upper reaches of the Hunter Valley Catchment, the faunal assemblages of the study area appear to be influenced by the drier inland environment to the west as well as the more temperate coastal environment to the east. Consequently, the region contains several species known from the eastern edge of their range, as well as species known from the western edge of their range. This aspect of the region is also discussed in *The Fauna of Goulburn River National Park* (NPWS, 2001). NPWS (2001) points out that the region is a crossover point for eastern and western plant and animal species, and cites examples from the following taxa: birds, reptiles, frogs and bats.

This pattern of fauna usage has been noted during surveys of the Kerrabee area on the Goulburn River by Denny (1981). Of the assemblage of avifauna recorded during the Kerrabee area survey, it was estimated that 15% could be classed as inland species and 43% as coastal species (the remainder were regarded as wide-ranging). A similar pattern of faunal use was found at the Ulan Coal Mines, approximately 11 km north-west of the study area. Fauna surveys of the Ulan Coal Mines area have shown that several faunal groups are represented by coastal and inland species, with seven bird species found at the eastern edge of their range and 27 at the western edge of their range (Mount King Ecological Surveys, 1998).

HB1.3 DESCRIPTION OF THE STUDY AREA AND SURROUNDS

The study area mainly comprises a long valley associated with Wilpinjong and Cumbo Creeks. There are steep hills in the south-west (Munghorn Gap Nature Reserve), in the east (Crown land) and in the north (Goulburn River National Park).

The flat valley lands have been extensively cleared and are currently grazed by cattle and sheep. Some cropping occurs, but it is restricted by the lack of surface water. Most natural vegetation is restricted to the steep hills and slopes outside of Project disturbance areas (with the exception of Pit 3). There are some small uncleared areas of remnant vegetation scattered throughout the study area and these are mainly associated with stony outcrops. The vegetation along all the watercourses in the study area has been extensively cleared in the past.

The natural vegetation cover within the study area has been described by FloraSearch (2005) and includes an overstorey dominated by eucalypts (eg. Yellow Box, Blakely's Red Gum, Grey Box, Narrow-leaved Ironbark, White Box and Grey Gum) and Rough-barked Apple. In terms of wildlife habitats, the study area comprises the following:

- Woodland on undulating and level land – dominant canopy species in these areas include Yellow Box, Blakely's Red Gum, Rough-barked Apple and Grey Box.
- Woodland on slopes and steep hills – dominant canopy species in these areas include Narrow-leaved Ironbark, Grey Box, Grey Gum and White Box.
- Rocky hills and escarpment (for example in the Crown land to the east of Pit 3).
- Watercourses – for example Wilpinjong Creek, Cumbo Creek and farm dams – the riparian margins of creeks have predominantly been cleared. There is some low-growing littoral vegetation (eg. rushes) associated with the watercourses and farm dams, however, these habitats have been subject to disturbance by stock.
- Cleared agricultural land with scattered trees – this habitat type is predominant in the Project disturbance areas. Scattered trees within the cleared agricultural land predominantly comprise Eucalypt species (such as Yellow Box, Blakely's Red Gum, and Grey Box) and Rough-barked Apple.

HB2 METHODS

The surveys were undertaken by Dr Martin Denny, Elizabeth Denny and Emma Denny, using Scientific Investigation Licence number S10282 issued by NSW Department of Environment and Conservation. An Animal Research Authority number AW96/033 was issued to Mount King Ecological Surveys by NSW Agriculture to undertake fauna surveys.

HB2.1 SURVEY TIMING

The surveys were undertaken during two seasons in 2004. An autumn survey was undertaken over two periods. The first period was from the 19 to the 28 April, 2004, and the second period was from the 15 to the 27 May, 2004 (total of 23 survey days). A spring survey was undertaken from the 21 to the 29 November 2004 (total of nine days).

The weather for the survey periods was typical of the respective seasons. During the autumn survey, temperatures were slightly higher during the first survey period than the second. Maximum temperatures recorded at the Gulgong meteorological station for the autumn survey period ranged from 19.3 degrees celcius (^{o}C) to 28.5^{o}C in April and from 12.8^{o}C to 21.9 ^{o}C in May (Table HB-2). Minimum temperatures recorded at the Gulgong meteorological station for the autumn survey period ranged from 2.1^{o}C to 11.5^{o}C in April and from 0.5^{o}C to 13.2^{o}C in May (Table HB-2).

There had been little rain recorded in the months prior to the surveys, with only 13.6 millimetres (mm) recorded in March 2004 and 12.4 mm recorded in April 2004, compared to average monthly rainfalls for March (51.5 mm) and April (39.6 mm) (Wollar meteorological station data from the period 1901 to 2004) but approximately 50 mm of rain fell near the end of the second autumn survey period. During the autumn survey period, the Wollar meteorological station recorded a total of 1.0 mm of rain on 19 May, 13.6 mm on 25 May and 33.4 mm of rain on 26 May (Table HB-2). In addition, a total of 8.0 mm of rain fell on the 30 April, prior to the May survey period. Otherwise, most of the two autumn survey periods experienced clear and cool weather.

Prior to the spring survey, monthly rainfall (as recorded at the Wollar meteorological station) was generally on par, or higher than the average monthly rainfall (ie. from May to November 2004). The weather during the spring survey was dry but cloudy, with a small amount of rain (2.0 mm at Wollar) recorded just prior to the commencement of the survey (on the 20 November 2004). The temperatures were higher than those experienced during the autumn survey, with maximum temperatures ranging from 22.5^{o}C to 38.7^{o}C and minimum temperatures ranging from 9.2^{o}C to 17.5^{o}C (Table HB-2).

Table HB-2
Maximum and Minimum Temperatures and Rainfall Recorded During the Surveys

Date	Temperature (^{o}C) Gulgong Post Office[1]		Rainfall (mm)	
	Maximum	Minimum	Gulgong Post Office[1]	Wollar Barrigan St[2]
Autumn Survey				
19/4/04	25.2	7.0	0.0	0.0
20/4/04	27.0	9.5	0.0	0.0
21/4/04	26.1	10.0	0.0	0.0
22/4/04	27.4	11.5	0.0	0.0
23/4/04	28.5	11.5	0.0	0.0
24/4/04	19.5	6.7	0.0	0.0
25/4/04	19.3	3.9	0.0	0.0
26/4/04	23.1	2.1	0.0	0.0
27/4/04	23.6	8.0	0.0	0.0
28/4/04	21.6	10.0	0.0	0.0
15/5/04	21.5	1.9	0.0	0.0
16/5/04	21.0	3.7	0.0	0.0

Table HB-2 (Continued)
Maximum and Minimum Temperatures and Rainfall Recorded During the Surveys

Date	Temperature (°C) Gulgong Post Office[1]		Rainfall (mm)	
	Maximum	Minimum	Gulgong Post Office[1]	Wollar Barrigan St[2]
Autumn Survey				
17/5/04	21.9	1.8	0.0	0.0
18/5/04	20.4	8.8	0.0	0.0
19/5/04	18.0	6.8	1.2	1.0
20/5/04	20.5	0.5	0.0	0.0
21/5/04	21.8	3.1	0.0	0.0
22/5/04	19.3	5.7	0.0	0.0
23/5/04	20.2	5.9	0.0	0.0
24/5/04	19.5	8.9	0.0	0.0
25/5/04	15.7	13.2	16.4	13.6
26/5/04	16.5	9.0	31.2	33.4
27/5/04	12.8	5.3	0.0	0.0
Spring Survey				
21/11/04	22.5	13.7	0.0	0.0
22/11/04	23.8	11.2	0.0	0.0
23/11/04	23.1	9.2	0.0	0.0
24/11.04	25.9	9.4	0.0	0.0
25/11/04	25.6	9.6	0.0	0.0
26/11/04	31.2	9.4	0.0	0.0
27/11/04	34.2	11.1	0.0	0.0
28/11/04	36.9	13.5	0.0	0.0
29/11/04	38.7	17.5	0.0	0.0

Source: Bureau of Meteorology (2005)
[1] Gulgong Post Office (062013) – 149°31'58"E, 32°21'48"S – Elevation 475 m AHD.
[2] Wollar, Barrigan Street (062032) – 149°56'54"E, 32°21'33"S – Elevation 366 m AHD.

HB2.2 FAUNA SURVEY SITES

HB2.2.1 Autumn Survey

Twelve systematic survey sites were established in the study area to survey amphibians, reptiles, birds and mammals (excluding bats) (Figure HB-4). A description of sites 1 to 12 is provided in Attachment HB-A. Figure HB-4 shows the location of survey sites 1 to 12 within the study area. In addition to the systematic survey sites, additional sampling was undertaken throughout the study area. Observations and sampling over the study area during the autumn survey are collectively referred to in this report as site 13.

The detailed fauna survey sites (sites 1 to 12) were selected to sample Project disturbance areas, as well as proximal areas of natural habitat. Each survey site could not be considered as a single point, but was an area of habitat surveyed using a range of techniques. Taking into consideration the use of trap lines and walking transects, the area of each site was estimated as a circle having a radius of 500 m. This gives an area of some 78 ha. Fauna located within this area were allocated to that site.

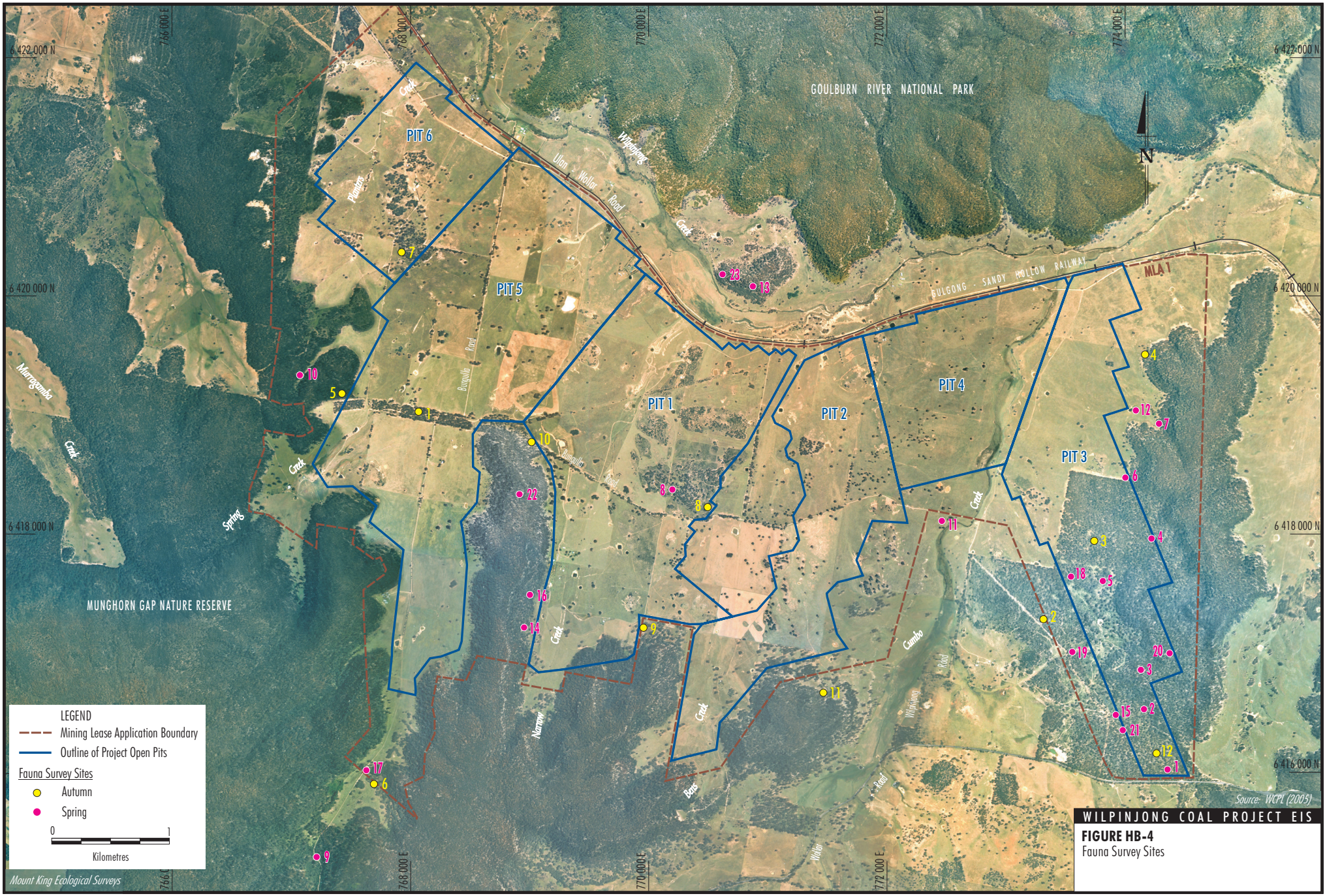

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FIGURE HB-4
Fauna Survey Sites

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HB2.2.2 Spring Survey

The spring survey was undertaken to supplement the detailed surveys conducted in autumn. A total of 23 survey sites were established in the study area (Figure HB-4). These sites were used to survey avifauna, mammals (excluding bats), reptiles and amphibians mainly by observational techniques. A brief description of each site is given in Attachment HB-A. As with the autumn survey sites, fauna located within 500 m of the point locality were allocated to that site.

The spring survey aimed to assess as much of the study area as possible, including Project disturbance areas and proximal areas. Thus, the information from the spring survey supplemented that obtained during the autumn survey, in terms of the area sampled and seasonal differences in fauna species composition.

HB2.3 FAUNA SURVEY TECHNIQUES

The techniques used during the surveys generally follow the draft survey guidelines produced by the NSW National Parks and Wildlife Service (NPWS) and SMEC (2003). Although these guidelines were in draft form and still subject to review, they provide an important direction on survey methodology, including suggested survey effort. Exceptions to these guidelines are explained in the relevant sections below. Sections HB2.3.1.1 to HB2.3.1.12 detail the survey techniques used throughout the autumn survey while Sections HB2.3.3.1 to HB2.3.3.7 detail the survey techniques used throughout the spring survey.

HB2.3.1 Autumn Survey

HB2.3.1.1 Elliott Trapping

Small Elliott Traps

Twenty-five small (8 x 10 x 33 centimetres [cm]) Elliott traps were laid along transects at sites 1 to 12. The traps were set for four consecutive nights at each site, providing 100 trap nights per site, as suggested in the draft survey guidelines (NPWS and SMEC, 2003). The traps were baited with a mixture of rolled oats, peanut butter and bacon fat wrapped in butter muslin (to prevent loss of bait from ants), and a small piece of dacron was placed within each trap (as protection against the cold). At each trap site, a description of the physical characteristics of the habitat within a one metre radius was noted. This information was used in the analysis of habitat complexity (Section HB2.4).

To sample any small arboreal mammals, small Elliott traps were mounted on trees at equal distances along each transect at each site (sites 1 to 12). Aluminium tree mounts were attached to trees and a baited Elliott trap attached to the mount. The tree trunk and trap were sprayed with a honey-water mixture to assist in attracting any nectar or sap feeding arboreal mammals. As suggested by the draft survey guidelines, six tree-mounted traps were set at each site, giving 24 trap nights over four consecutive nights. However, at site 1, 23 tree-mounted small Elliott traps were set out for four nights (92 trap nights), and seven tree-traps were set out for four nights at sites 5 and 9 (28 trap nights each). Site 1 (Figure HB-4) comprised a long narrow area of mature trees that could potentially be used as a corridor by small arboreal marsupials.

Large Elliott Traps

The draft survey guidelines suggest 100 trap nights over 3-4 consecutive nights for large (16x16x46 cm) Elliott traps. However, experience with using large Elliott traps on the ground in the Central Tablelands has shown that they are generally unproductive. For example, large Elliott traps have been placed on the ground during annual fauna monitoring surveys at the nearby Ulan Coal Mines, and no animals have been captured over the last five years. The only animal captured in large Elliott traps has been a Common Brushtail Possum in a tree-mounted trap in 2003 (1.5% capture rate).

As a result, a lower emphasis was placed on the use of large Elliott traps, with only two being used at each site (sites 1 to 12) over a period of four days (eight trap-nights at each site). However, additional large traps were used at each site (as described in Section HB2.3.1.2). These traps were 'Tomahawk' cage traps measuring 19x19x51 cm (ie. equivalent in size to large Elliott traps).

HB2.3.1.2 Cage Traps

Small Cage Traps

At each site, six to nine Tomahawk traps were set for a period of four nights. Three to five of these traps were placed on specially designed tree-mounts at each site, and the remaining traps were placed on the ground (see Attachment HB-B for details). All traps were baited with a mixture of rolled oats, peanut butter and bacon fat wrapped in butter muslin. As can be evidenced from the results, this setup was very successful during the present survey. A similar setup at the Ulan Coal Mines gave a trapping rate of 12.5%. The overall survey effort using a combination of large Elliott and Tomahawk cage traps at each site during the present survey is provided in Attachment HB-B.

Large Cage Traps

Two large cage traps were placed at each site (sites 1 to 12), giving a survey effort of eight trap nights over four consecutive nights at each site. The traps were baited with fruit and chicken, and one end was covered by a plastic bag, to prevent the bait being taken through the cage. Lower numbers of large cage traps were used, as the smaller cage traps (Tomahawk traps) achieved higher trap rates.

HB2.3.1.3 Spotlighting

Two forms of spotlighting transect were undertaken. All tracks were spotlighted from a moving vehicle. In addition, spotlighting on foot was undertaken at survey sites 1 to 12, in addition to several dams and parts of the watercourses in the study area. Some 6.5 hours of spotlighting were undertaken by vehicle (over a total of 33.1 km) and 7 hours on foot (a total of 13.5 hours).

HB2.3.1.4 Hair Funnels

Hair funnels (from Faunatech) were used instead of large and small hair tubes. The design of the tapered hair funnels is such that both large and small animals can be detected by a single funnel. Studies by Lindenmayer *et al.* (1999) of three types of hair tubes concluded that the hair funnel could be used to detect a range of species, particularly possums and antechinus. Six to ten hair funnels were set out at sites 1 to 12 for a period of four nights and baited with a mixture of rolled oats, peanut butter and bacon fat wrapped in butter muslin. The number of hair funnels established at each site varied depending on the availability of suitable habitat. The overall survey effort for each site is provided in Attachment HB-B. Where possible, some of the hair funnels were set onto 'habitat trees' (these were considered to be trees that showed signs of use by arboreal marsupials and had obvious hollows). Hair samples were identified by Elizabeth Denny.

HB2.3.1.5 Bird Surveys

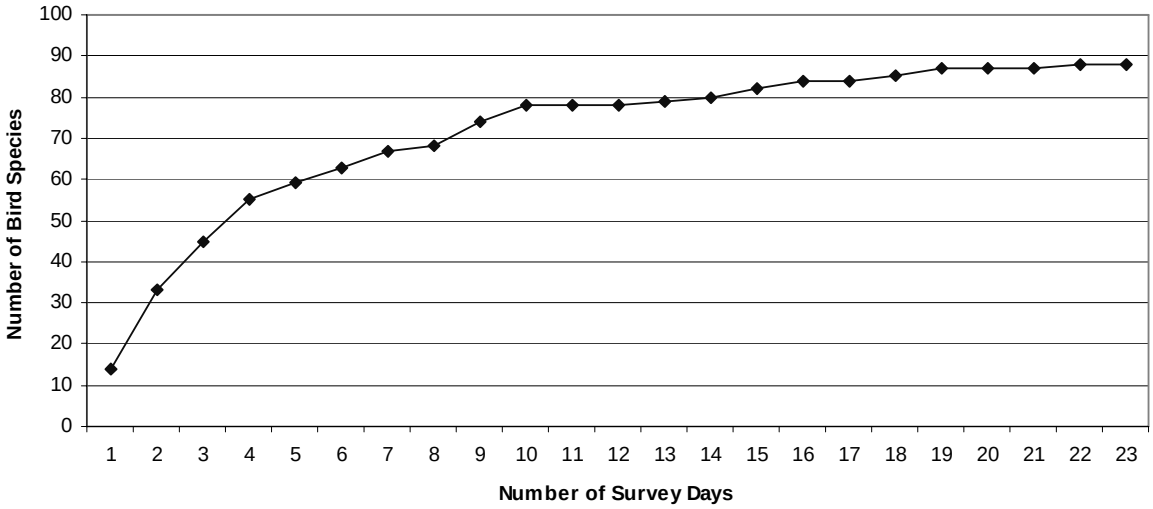
In addition to the results obtained from general observations and spotlighting, listening and observing periods were undertaken at the 12 systematic survey sites. Taking into consideration the discussion in the draft survey guidelines (NPWS and SMEC, 2003) on methods to survey diurnal birds, an area-search method was used at each site. A 30 minute search was used where the observer walked around each site, as well as observing and listening for calls from a single point. The usual search time is 20 minutes, but this was increased to 30 minutes to increase the likelihood of recording more species.

Recent studies (e.g. Craig, 2004) have shown that an area search of 30 minutes duration detected a similar number of species as line transects and point counts, but gave higher estimates of overall bird density. The difference is possibly due to the longer survey period (30 minutes instead of 20 minutes) and the greater chance of detection for cryptic species.

Four periods of formal bird observations were undertaken (two in the morning and two in the late afternoon) at sites 1 to 12. It is suggested in the draft survey guidelines that a 'species-time curve approach' be used to ensure appropriate survey effort is implemented. The species accumulation curve for all the sightings of bird species for the entire survey period shows that the number of species located had levelled off by about day 10 (thereby indicating that the survey methodology used was appropriate to adequately survey bird fauna). Figure HB-5 provides the species accumulation curve for the number of bird species recorded across sites 1 to 12.

In addition to the opportunistic and formal observations, four bird observation sessions were undertaken at several dams and along Cumbo and Wilpinjong Creeks. These sessions lasted for 20 minutes each.

Figure HB-5
Cumulative Frequency of Bird Species Identified During the Autumn Survey



HB2.3.1.6 Call Broadcasting

Calls of several species of nocturnal bird were broadcast during the night at survey sites 1,3,4,8 and 10. Calls were broadcast through a megaphone for approximately five minutes, with a ten minute listening time. Calls from the Powerful Owl (*Ninox strenua*), Masked Owl (*Tyto novaehollandiae*), Sooty Owl (*Tyto tenebricosa*), Tawny Frogmouth (*Podargus strigoides*), Barking Owl (*Ninox connivens*), Barn Owl (*Tyto alba*), Southern Boobook (*Ninox boobook*), Australian Owlet-nightjar (*Aegotheles cristatus*), and the White-throated Nightjar (*Eurostopodus mystacalis*) as well as the Squirrel Glider (*Petaurus norfolcensis*), Common Brushtail Possum (*Trichosurus vulpecula*) and Koala (*Phascolarctos cinereus*) were broadcast. Because some of the sites were less than one kilometre from an adjoining site, call broadcasting at one site covered other sites. A total of five call broadcasting sessions were undertaken at the abovementioned survey sites.

HB2.3.1.7 Pitfall Traps

Pitfall traps with drift fences could only be established at three fauna survey sites (2, 3 and 12) due to the ground being too stony to allow digging to sufficient depth to use a 20 litre (L) or 10 L bucket at sites 4, 5, 7, 8, 9, 10 and 11, and due to some sites being grazed by cattle or sheep (to avoid any damage to stock at sites 1, 5, 6 and 7). Pitfall traps were constructed from 20 L buckets combined with drift-fences made from fly-screen wire mesh. Five pitfall traps were established at site 2 and six pitfall traps were established at site 3, for a period of four nights. Six pitfall traps were established at site 12 for a period of five nights (Attachment HB-B).

HB2.3.1.8 Herpetological Searches

Systematic searches for reptiles and amphibians were undertaken within each habitat type at all survey sites (sites 1 to 13). Litter was raked and rocks and logs turned over. Loose bark was prised from the trunks of dead trees. Each search took approximately 30 minutes and was repeated at each site on two separate occasions. Searches for amphibians took place at night using spotlights (particularly after rain) and recognition of characteristic calls. These searches took approximately 30 minutes. Opportunistic observations of any bodies of water were also undertaken. The spotlighting searches described above were also undertaken for reptiles. A total of 13 hours were spent searching for reptiles (in addition to the spotlighting surveys) and four hours searching for amphibians during the survey.

HB2.3.1.9 Sand Plots

Six sand plots were established at all fauna survey sites (sites 1 to 13) by smoothing an area of sand measuring about one metre by three metres. All sand plots were established on tracks where there was evidence of animal movement. The sand was smoothed over in the evening and inspected for tracks the following morning. The sand plots were monitored for four days (a total of 24 plot days per site).

HB2.3.1.10 Opportunistic Observations

Any sightings of fauna were recorded whilst moving throughout the study area and located using a Global Positioning System (GPS).

HB2.3.1.11 Estimation of Local Population Status

The bird surveys implemented during the baseline surveys enabled assessment of the local population status of each bird species. As well as documenting the location of each species sighted (using a GPS unit), the numbers sighted, as well as the behaviour and habitat being utilized, were also recorded. From these records it was possible to provide an estimate of the population status of each bird species.

The method used to estimate local population status of each bird species located within the study area was that originally used by the Queensland National Parks and Wildlife Service when undertaking regional fauna surveys (eg. mammals, birds and reptiles of the Warwick District, Kirkpatrick 1966). Four ratings indicating abundance were estimated, the broad basis for each being based on numbers observed during each visit to the area.

The four ratings are:

- Abundant: usually in large numbers at each visit.
- Common: always at least one, often more, observed during each visit.
- Uncommon: not every visit, but more than twice during the survey period.
- Scarce: not more than twice during the survey period.

HB2.3.1.12 Estimation of Diversity

Diversity is an ecological measurement of both species richness and evenness. Species richness is a measure of the number of different species present in a particular area. Evenness compares the similarity of the population size of each of the species present. Common measures of species diversity include the Simpsons Diversity Index. This index measures the probability that two individuals randomly selected from a sample will belong to the same species (or some category other than species). In this report, Simpson's Index of Diversity is expressed as 1-D. The higher the Simpson's 1-D score, the greater the diversity. Bird survey data obtained by the formal bird surveys (ie. area search method) at sites 1 to 12 was utilised to calculate Simpson's Index of Diversity for the bird populations recorded at each survey site.

HB2.3.2 Survey Effort for Autumn Survey

A summary of the number of trap/plot-nights undertaken during the autumn survey with each survey technique is given in Table HB-3. Survey effort at each autumn survey site is detailed in Attachment HB-B. As described in Section HB2.2.2, the spring survey was undertaken to supplement the detailed surveys conducted in autumn and utilised mainly observational techniques. The observational techniques for the spring survey are described in Section HB2.3.3.

Table HB-3
Number of Trap/Plot-nights Undertaken Using Different Techniques

Survey Technique	Number of Trap/Plot-nights
Small Ground Elliott Traps	1,200
Large Elliott Traps	96
Small Tree-mounted Elliott Traps	364
Large Cage Traps	96
Tomahawk Traps on Ground	136
Tomahawk Traps in Tree	208
Pitfall Traps	74 (80 m of drift fence)
Hair Funnels	376
Sand Plots	312

A total of 33.1 km were traversed undertaking spotlighting from a vehicle (some 6.5 hours). A further seven hours of spotlighting was conducted on foot. In addition to the spotlighting, a total of 13 hours were spent searching for reptiles and four hours for amphibians during the survey. Five broadcasting sessions were also undertaken at sites 1, 3, 4, 8 and 10.

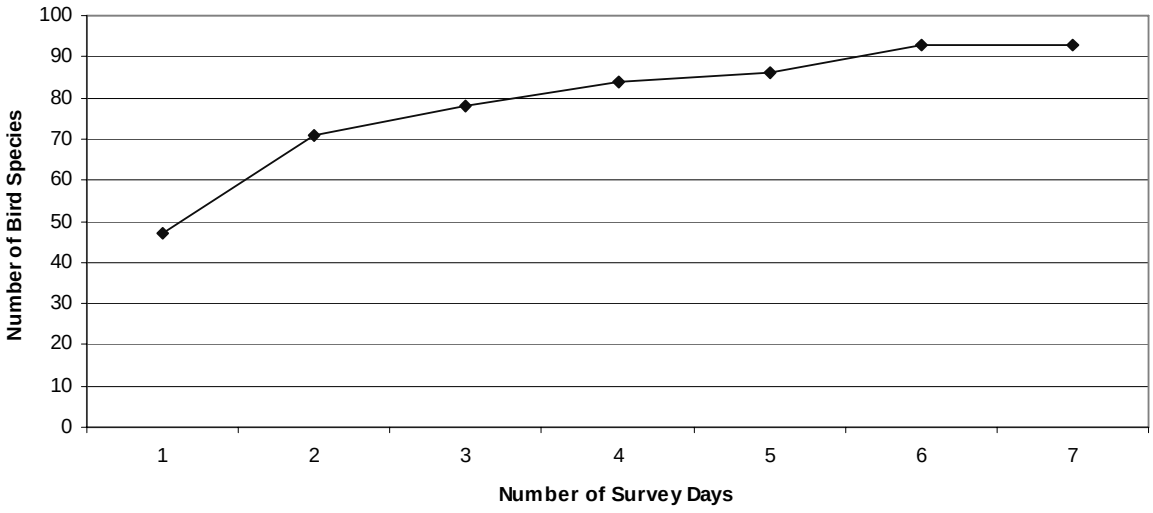
HB2.3.3 Spring Survey

HB2.3.3.1 Bird Surveys

In addition to the results obtained from general observations and spotlighting, listening and observing periods were undertaken at the 23 survey sites. Similar to the bird surveys conducted in autumn, an area-search method was utilised during the spring bird surveys. A 30 minute search was used where the observer walked around each site, as well as observing and listening for calls from a single point. To provide the greatest coverage of the study area, a high number of sites were sampled during the survey period. To achieve this, each site was surveyed once only (in either the morning or late afternoon), with the exception of site 9 which was sampled in the morning and late afternoon.

Figure HB-6 provides the species accumulation curve for the number of bird species recorded at sites 1 to 23. The species accumulation curve indicates that the number of species located had levelled off by about day five (thereby indicating that the survey methodology used was appropriate to adequately survey bird fauna).

Figure HB-6
Cumulative Frequency of Bird Species Identified During the Spring Survey



HB2.3.3.2 Herpetological Searches

Systematic searches for reptiles and amphibians were undertaken within each habitat type at all survey sites (ie. sites 1 to 23). Litter was raked and rocks and logs turned over. Loose bark was prised from the trunks of dead trees. Each search took approximately 30 minutes. Searches for amphibians took place at night using spotlights and recognition of characteristic calls. These searches took approximately 30 minutes. Opportunistic observations of any bodies of water were also undertaken. The spotlighting searches described above and in Section HB2.3.3.5 were also undertaken for reptiles. A total of 18 hours were spent searching for reptiles (in addition to the spotlighting surveys) and six hours searching for amphibians during the survey.

HB2.3.3.3 Sand Plots

Twenty-three sand plots were established during the spring survey across all fauna survey sites (sites 1 to 23) by smoothing an area of sand measuring about one metre by three metres. All sand plots were established on tracks where there was evidence of animal movement. The sand was smoothed over in the evening and inspected for tracks the following morning. The sand plots were monitored for a single day and night (a total of 1 plot day per site).

HB2.3.3.4 Opportunistic Observations

Any sightings of fauna were recorded whilst moving throughout the study area and located using a GPS.

HB2.3.3.5 Spotlighting

Two forms of spotlighting transect were undertaken. Tracks were spotlighted from a moving vehicle. In addition, spotlighting on foot was undertaken at survey sites 3, 4, 8, 9, 10, 11, 15, 17 and 19, and at several dams and parts of the watercourses in the study area. Some 6.7 hours of spotlighting were undertaken by vehicle (over a total of 19.6 km) and 4.5 hours on foot (a total of 11.2 hours).

HB2.3.3.6 Call Broadcasting

Calls of several species of nocturnal bird were broadcast during the night at survey sites 3, 4, 8 and 9. Calls were broadcast through a megaphone for approximately five minutes, with a ten minute listening time. Calls from the Powerful Owl (*Ninox strenua*), Masked Owl (*Tyto novaehollandiae*), Sooty Owl (*Tyto tenebricosa*), Tawny Frogmouth (*Podargus strigoides*), Barking Owl (*Ninox connivens*), Barn Owl (*Tyto alba*), Southern Boobook (*Ninox boobook*), Australian Owlet-nightjar (*Aegotheles cristatus*), and the White-throated Nightjar (*Eurostopodus mystacalis*) as well as the Squirrel Glider (*Petaurus norfolcensis*), Common Brushtail Possum (*Trichosurus vulpecula*) and Koala (*Phascolarctos cinereus*) were broadcast. Because some of the sites were less than one kilometre from an adjoining site, call broadcasting at one site covered other sites. Calls of the Regent Honeyeater (*Xanthomyza phrygia)* were broadcast during the daytime at sites 1 and 15. A total of four call broadcasting sessions were undertaken at the abovementioned survey sites.

HB2.3.3.7 Tree Hollow Inspection

Obvious hollows in tree trunks and branches were inspected, where practicable, with the use of a light scope (MSPI Series, Inline Systems). The light scope comprises a 2 m fibre optic cable with a light source. The cable was fed into numerous hollows and its contents viewed via optic eyepiece.

HB2.4 ASSESSMENT OF HABITAT COMPLEXITY

Two methods were used to measure the habitat characteristics/complexity. These are detailed in Sections HB2.4.1 and HB2.4.2 below. All measurements for each parameter surveyed were combined and the 25th and 75th percentiles calculated. The mean for each parameter measurement for each site was then calculated and ranked on the basis of whether the mean was below the 25th percentile (ranked as having a low habitat complexity), between the 25th and 75th percentiles (having a moderate habitat complexity), or above the 75th percentile (having a high habitat complexity). It was then possible to calculate an overall score for habitat complexity for each site.

HB2.4.1 Habitat Assessment of Trap Sites

As each small Elliott trap was laid, a description of the trap site was recorded. A description was made of the upper, middle and lower storey vegetation, as well as the ground cover, within an area formed by a one metre radius around each trap. For example, if 20 trap sites out of a trap line of 25 Elliott traps contained a shrub, then it was estimated that the shrub cover in that survey site was 80%. This method was only used at sites 1 to 12 during the autumn survey as no traps were utilised during the spring survey.

HB2.4.2 Transect Habitat Assessment

The second method involved a 50 m walking transect at autumn survey sites 1, 2, 3, 4, 5, 6, 7, 8, 9, 11 and 12, and at spring survey sites 9, 16, 18, 19, 20, 21, 22 and 23. Within each transect, the following habitat characteristics were measured:

Tree Density — The number of trees within one metre each side of the observer are counted. This provides a value for the number of trees per 100 m^2, and a density of trees per hectare (ha) is calculated.

Tree Height — Height of each tree counted is estimated to the nearest metre.

Tree Diameter — The diameter of the tree trunk, at breast height, is measured for each tree counted.

Proportion of Trees with Hollows — Each tree counted is inspected and any hollows, large or small, are noted.

Stag Density — The number of stags within one metre each side of the observer are counted. This provides a value for the number of stags per 100 m^2, and a density of stags per ha is calculated.

Shrub Density — The number of shrubs within one metre each side of the observer are counted. This provides a value for the number of shrubs per 100 m^2, and a density of shrubs per ha is calculated.

Shrub Height — The height of each shrub counted is measured to the nearest 10 cm.

Sapling Density — The number of saplings within one metre each side of the observer are counted. This provides a value for the number of shrubs per 100 m^2, and a density of shrubs per ha is calculated.

Log Area — The length and diameter of each log located within the 50 m x 2 m transect was measured and multiplied to give an estimate of the amount of area at each site that was covered by logs. The % log cover was calculated by dividing log area by the area of the transect (100 m^2).

Five 0.25 m^2 quadrats were also used to measure the following ground cover parameters:

- % grass cover;
- % forb cover;
- % stick cover;
- % rock cover;
- grass height to the nearest cm;
- forb height to the nearest cm;
- % litter cover; and
- litter weight as grams (g)/m^2.

HB2.5 TARGETED SURVEYS FOR THREATENED SPECIES

Table HB-4 provides a list of threatened species recorded in the wider region, together with a summary of the survey techniques used to target these species. A proportion of the species listed in Table HB-4 are considered unlikely to occur in the study area, as there is little to no preferred habitat (eg. wet forests and wetlands). However, they were included to ensure that all threatened species that are known from the wider region were targeted during the surveys.

HB3 RESULTS AND DISCUSSION

HB3.1 FAUNA SPECIES

Terrestrial fauna species recorded at each survey site by the autumn and spring surveys are provided in Attachments HB-C and HB-D, respectively, while a list of fauna species known to occur in the surrounding region is provided in Attachment HB-E.

HB3.1.1 Amphibians

A total of six amphibian species were recorded by the autumn and spring surveys (Table HB-5). Three amphibian species were recorded during the autumn survey, namely, the Common Eastern Froglet, Long-thumbed Frog and Striped Marsh Frog (Attachment HB-C). All three species are known to be active during autumn. All three species were located within Cumbo Creek, whilst the Common Eastern Froglet and Spotted Marsh Frog were also located along Wilpinjong Creek and at some farm dams. The conditions at most farm dams were not amenable to frogs, as cattle had heavily disturbed any littoral vegetation. The cool climatic conditions experienced during the autumn survey would have limited amphibian activity, while the drier than average conditions experienced by the region during the autumn survey would have affected population numbers of amphibians.

Three additional amphibian species were recorded during the spring surveys. These were all tree frogs (*Litoria* ssp.), namely Peron's Tree Frog, Broad-palmed Frog and Rocket Frog. All were located within dams scattered over the area, as well as in pools along Cumbo and Wilpinjong Creeks. Eggs from the Broad-palmed Frog were found in Wilpinjong Creek (site 23 [spring]).

Table HB-4
Threatened Terrestrial Fauna Recorded from the Wider Region

Common Name	Scientific Name	Conservation Status		NPWS Atlas of NSW Wildlife [3]	Regional Studies				Birds Australia[6]	HBOC[7]	Australian Museum[8]	Methods Used to Detect Species
		TSC Act[1]	EPBC Act[2]		MGNR[4]	GRNP[5]	MKES[9]	Donachy[10]				
Amphibians												
Giant Burrowing Frog	*Heleioporus australiacus*	V	V	●								General observation, recognition, spotlighting, searching preferred habitat
Giant Barred Frog	*Mixophyes iteratus*	E1	E	●				●				
Red-crowned Toadlet	*Pseudophryne australis*	V	-	●								
Reptiles												
Pink-tailed Legless Lizard	*Aprasia parapulchella*	V	V	●		●						Searching and spotlighting in preferred habitats, litter raking, pit trapping, inspecting rocky areas
Rosenberg's Goanna	*Varanus rosenbergi*	V	-	●								
Broad-headed Snake	*Hoplocephalus bungaroides*	E1	V	●								
Little Whip Snake	*Suta flagellum*	V	-	●	●							
Birds												
Malleefowl	*Leipoa ocellata*	E1	V	●		●						General observation, locating characteristic mounds
Blue-billed Duck	*Oxyura australis*	V	-				●					General observation at water bodies
Square-tailed Kite	*Lophoictinia isura*	V	-	●	●	●		●	●			General observation
Black-breasted Buzzard	*Hamirostra melanosternon*	V	-	●								General observation
Red-tailed Black-Cockatoo	*Calyptorhynchus banksii*	V	E				●					General observation, call recognition
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V	-	●	●	●	●	●	●	●		General observation, call recognition, signs of feeding
Swift Parrot	*Lathamus discolor*	E1	E	●	●					●		General observation, call recognition
Turquoise Parrot	*Neophema pulchella*	V	-	●	●	●	●		●	●		General observation, call recognition
Barking Owl	*Ninox connivens*	V	-	●	●	●	●					General observation, call recognition, spotlighting, call broadcasting, pellet recognition
Powerful Owl	*Ninox strenua*	V	-	●	●	●		●	●	●		
Sooty Owl	*Tyto tenebricosa*	V	-	●								
Masked Owl	*Tyto novaehollandiae*	V	-	●		●						
Brown Treecreeper (eastern subsp.)	*Climacteris picumnus victoriae*	V	-	●	●	●	●		●	●		General observation, call recognition
Speckled Warbler	*Pyrrholaemus sagittatus*	V	-	●	●		●					General observation, call recognition
Regent Honeyeater	*Xanthomyza phrygia*	E1	E	●	●	●			●	●		General observation, call recognition, call broadcasting
Black-chinned Honeyeater (eastern subsp.)	*Melithreptus gularis gularis*	V	-	●	●	●	●		●	●	●	General observation, call recognition

Table HB-4 (Continued)
Threatened Terrestrial Fauna Recorded from the Wider Region

Common Name	Scientific Name	Conservation Status		NPWS Atlas of NSW Wildlife [3]	Regional Studies				Birds Australia [6]	HBOC [7]	Australian Museum [8]	Methods Used to Detect Species
		TSC Act [1]	EPBC Act [2]		MGNR [4]	GRNP [5]	MKES [9]	Donachy [10]				
Birds (Continued)												
Painted Honeyeater	*Grantiella picta*	V	-	•	•				•	•		General observation, call recognition
Pied Honeyeater	*Certhionyx variegatus*	V	-		•							General observation, call recognition
Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	V	-	•	•	•		•	•	•		General observation, call recognition
Grey-crowned Babbler (eastern subsp.)	*Pomatostomus temporalis temporalis*	V	-	•	•	•	•			•		General observation, call recognition
Diamond Firetail	*Stagonopleura guttata*	V	-	•	•	•		•	•	•	•	General observation, call recognition
Mammals (excluding bats)												
Spotted-tailed Quoll	*Dasyurus maculatus*	V	E	•								Cage traps, tree-mounted traps, spotlighting, hair tubes
Koala	*Phascolarctos cinereus*	V	-	•	•							General observation, scat recognition, call broadcasting, scratch recognition
Yellow-bellied Glider	*Petaurus australis*	V	V	•								Cage traps, tree-mounted traps, spotlighting, hair tubes, hair tubes
Squirrel Glider	*Petaurus norfolcensis*	V	-	•	•	•	•					Cage traps, tree-mounted traps, spotlighting, hair tubes, call broadcasting, hair tubes
Parma Wallaby	*Macropus parma*	V	-	•								Cage traps, spotlighting, hair tubes, sand plots
Brush-tailed Rock-wallaby	*Petrogale penicillata*	E1	V	•		•	•					Cliff-line inspection in preferred habitat, scat recognition

1 Status under the NSW *Threatened Species Conservation Act, 1995* (current as at 19 January 2005).
E1 Endangered V Vulnerable

2 Status under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (current as at 19 January 2005).
E Endangered V Vulnerable

3 NPWS Atlas of NSW Wildlife Records for the Gulgong (8833), Merriwa (8933), Mudgee (8832) and Mount Pomany (8932) 1: 100,000 map sheets (12 January 2005).

4 NPWS (2002) *Vertebrate Fauna of Munghorn Gap Nature Reserve*. Conservation Assessment and Data Unit: Central Directorate, NSW National Parks and Wildlife Service.

5 NPWS (2001) *The Fauna of Goulburn River National Park*. Conservation Assessment and Data Unit: Central Directorate, NSW National Parks and Wildlife Service.

6 Birds Australia Database Records for the Search Area – 149°44' to 150°00'E by 32°15' to 32°28'S (June 2004).

7 Hunter Bird Observers Club Database Records for the Search Area – 149°44' to 150°00'E by 32°15' to 32°28'S (June 2004).

8 Australian Museum Database Records for the Search Area – 149°44' to 150°00'E by 32°15' to 32°28'S (July 2004).

9 Mount King Ecological Surveys (1998) *Ulan Coal Mine Ltd Proposed Mine Expansion Project Species Impact Statement.* Appendix A Mining Lease Application No. 80 Development Application and Environmental Impact Statement.

10 Ms Donachy of Badgers Bend, Wollar Road, Ulan. Personal records from July 1997 to December 2003.

Table HB-5
Amphibians Recorded by the Surveys

Common Name	Scientific Name
Long-thumbed Frog	*Limnodynastes fletcheri*
Striped Marsh Frog	*Limnodynastes peronii*
Common Eastern Froglet	*Crinia signifera*
Peron's Tree Frog	*Litoria peronii*
Rocket Frog	*Litoria nasuta*
Broad-palmed Frog	*Litoria latopalmata*

An additional fifteen amphibian species have been recorded in the surrounding region, including 11 at the nearby Ulan Coal Mines, which is similar in size and diversity of habitats (Attachment HB-E). The assemblage of frogs includes many species at the edge of their range (eg. Tylers Tree Frog, Painted Burrowing Frog, Northern Banjo Frog and Ornate Burrowing Frog) (Attachment HB-E).

The record for the Giant Barred Frog (listed as Vulnerable under the NSW *Threatened Species Conservation Act, 1995*) by Kerrie Donachy of Badgers Bend, Wollar Road, Ulan is the only record for this species in the region. The Giant Barred Frog was once found from near Narooma on the south coast of NSW northwards along the eastern escarpment to south-eastern Queensland, but there are no present-day records from the Hunter region southwards (Mahony *et al*., 1996). Habitat preferences of this species include riparian vegetation, subtropical and dry rainforest and wet sclerophyll forest with deep leaf litter provided by canopy vegetation.

HB3.1.2 Reptiles

A total of 17 reptile species were recorded by the autumn and spring surveys (Table HB-6). Twelve reptile species were located during the autumn survey and eight during the spring survey (Attachments HB-C and HB-D). The cool conditions during both autumn and spring are likely to have discouraged activity from this faunal group. As well as low species diversity, numbers of reptiles were also low, with only single individuals of most species recorded. Two burrowing reptile species were located at site 12 in autumn (Prong-snouted Blind Snake and Blackish Blind Snake) and a third species from site 5 in spring (Two-clawed Worm-skink). Surprisingly, there were only a few species active during the spring survey (some Garden Sun-Skinks and Eastern Bearded Dragons were observed on warm days).

Table HB-6
Reptiles Recorded by the Surveys

Common Name	Scientific Name
Eastern Snake-necked Turtle	*Chelodina longicollis*
Jacky Lashtail	*Amphibolurus muricatus*
Eastern Bearded Dragon	*Pogona barbata*
Common Dtella	*Gehyra variegata*
Lace Monitor	*Varanus varius*
Two-clawed Worm-skink	*Anomalopus leuckartii*
Litter Skink	*Carlia foliorum*
Southern Rainbow Skink	*Carlia tetradactyla*
Copper-tailed Ctenotus	*Ctenotus taeniolatus*
Grass Sun-Skink	*Lampropholis guichenoti*
Dark-flecked Garden Sunskink	*Lampropholis delicata*
Southern Lerista	*Lerista bougainvillii*
Common Dwarf Skink	*Menetia greyii*
Prong-snouted Blind Snake	*Ramphotyphlops bituberculata*
Blackish Blind Snake	*Ramphotyphlops nigrescens*
Red-bellied Black Snake	*Pseudechis porphyriacus*
Eastern Brown Snake	*Pseudonaja textilis*

An additional 49 reptile species have been recorded in the surrounding region (Attachment HB-E), including 22 at the nearby Ulan Coal Mines over 10 years of surveys (Attachment HB-E). In the event surveys were conducted over a similar timeframe, it is anticipated that the surveys would result in similar species diversity.

HB3.1.3 Birds

Bird Species Richness

A total of 123 bird species were recorded during the autumn and spring surveys (Table HB-7). A total of 91 bird species were located during the autumn survey and 92 during the spring survey (Attachments HB-C and HB-D). An additional 128 bird species have been recorded in the surrounding region (Attachment HB-E). Surveys at Goulburn River National Park have recorded 175 bird species (NPWS, 2001), while surveys at the Munghorn Gap Nature Reserve have recorded 202 species (NPWS, 2002). Surveys at the Ulan Coal Mines have recorded 170 species (Attachment HB-E).

The lower bird species richness recorded in the study area compared with records from the surrounding region (namely, the Goulburn River National Park, Munghorn Gap Nature Reserve and at the Ulan Coal Mines) is likely to be due to:

a) The lower diversity of habitats within the study area. Heath and wet sclerophyll forest were not found in the study area and natural water bodies were limited.

b) The disturbed nature of the study area. The majority of the study area was cleared and used for stock grazing and/or cropping. The remaining 'natural' vegetation had been disturbed by clearing and logging in the past, and present-day stock grazing. There was little to no littoral vegetation associated with the water bodies, and most water edges were highly disturbed by cattle.

c) The presence of residences throughout the study area. Human activity tends to attract introduced predators and the Red Fox was recorded from 11 of the 12 autumn survey sites, and the Cat from two of the sites. These introduced species are likely to have had an effect on the diversity and abundance of native fauna (including birds) in the study area.

d) The drier than average conditions experienced in the region at the time of the autumn survey.

Assemblage of Bird Species

The assemblage of bird species located within the study area can be considered as typical of that found within the western slopes of NSW. The presence of species usually found further west (eg. Inland Thornbill and Apostlebird) indicate a move towards the coast by some species during the drier than average conditions experienced prior to and during the autumn survey. However, bird species associated with moister conditions were still found in the study area (eg. Satin Bowerbird and Little Lorikeet). Several species at the western edge of their range were also recorded (eg. Gang-gang Cockatoo and Australian King Parrot).

Woodland birds dominated the assemblage of birds recorded within the study area, with all survey sites sampling woodland remnants disturbed to varying degrees. The proportion of bird species dependant on woodland habitat located during the autumn survey was 66% and 66% during the spring survey (Attachment HB-F). Many of the bird species located were those that are considered to be declining along the western slopes of NSW due to land clearing. In particular, threatened bird species such as Diamond Firetail, Speckled Warbler, Brown Treecreeper and the Hooded Robin were found at several of the sites, and, in the case of the Diamond Firetail, in relatively high numbers (up to 20 individuals during the autumn survey). Reid (1999) classed the woodland birds in the NSW 'sheep-wheat belt' into three conservation categories, based upon their population status in this region. Bird species could be declining, increasing or stable, depending whether their population numbers were falling, rising or remaining stable over time (Attachment HB-F). The proportion of bird species with a conservation status that is worsening (ie. a decreaser) in the region located during the autumn survey was 17% and 16% during the spring survey (Attachment HB-F). This pattern is typical of areas of land in the Central Tablelands and Western Slopes that still retain patches of woodland. The highest proportion of bird species with a worsening status were found at sites 2, 3, 5, 9 and 12 during the autumn surveys. These are all sites that sample continuous woodland habitat.

Table HB-7
Local Population Status of Birds Species Recorded by the Surveys

Common Name	Scientific Name	Local Population Status	
		Autumn	Spring
Emu	*Dromaius novaehollandiae*	Common	Common
Australasian Grebe	*Tachybaptus novaehollandiae*	Not recorded	Scarce
Pacific Black Duck	*Anas superciliosa*	Uncommon	Uncommon
Australian Wood Duck	*Chenonetta jubata*	Abundant	Abundant
White-faced Heron	*Egretta novaehollandiae*	Uncommon	Common
Wedge-tailed Eagle	*Aquila audax*	Uncommon	Not recorded
Swamp Harrier	*Circus approximans*	Uncommon	Not recorded
Black-shouldered Kite	*Elanus axillaris*	Scarce	Not recorded
Whistling Kite	*Haliastur sphenurus*	Scarce	Not recorded
Square-tailed Kite	*Lophoictinia isura*	Uncommon	Not recorded
Brown Falcon	*Falco berigora*	Uncommon	Not recorded
Nankeen Kestrel	*Falco cenchroides*	Uncommon	Uncommon
Peregrine Falcon	*Falco peregrinus*	Scarce	Scarce
Black Falcon	*Falco subniger*	Scarce	Not recorded
Brown Goshawk	*Accipiter fasciatus*	Not recorded	Scarce
Grey Goshawk	*Accipiter novaehollandiae*	Not recorded	Scarce
Little Eagle	*Hieraaetus morphnoides*	Not recorded	Scarce
Painted Button-quail	*Turnix varia*	Not recorded	Scarce
Masked Lapwing	*Vanellus miles*	Uncommon	Uncommon
Peaceful Dove	*Geopelia placida*	Uncommon	Not recorded
Crested Pigeon	*Ocyphaps lophotes*	Common	Common
Common Bronzewing	*Phaps chalcoptera*	Abundant	Abundant
Sulphur-crested Cockatoo	*Cacatua galerita*	Abundant	Abundant
Gang-gang Cockatoo	*Callocephalon fimbriatum*	Scarce	Not recorded
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	Scarce	Not recorded
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	Scarce	Not recorded
Galah	*Eolophus roseicapillus*	Abundant	Abundant
Australian King-Parrot	*Alisterus scapularis*	Uncommon	Common
Turquoise Parrot	*Neophema pulchella*	Scarce	Not recorded
Eastern Rosella	*Platycercus adscitus eximius*	Abundant	Abundant
Red-rumped Parrot	*Psephotus haematonotus*	Abundant	Abundant
Little Lorikeet	*Glossopsitta pusilla*	Scarce	Uncommon
Pallid Cuckoo	*Cuculus pallidus*	Uncommon	Uncommon
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	Not recorded	Scarce
Horsefield's Bronze-cuckoo	*Chalcites basalis*	Not recorded	Uncommon
Southern Boobook	*Ninox novaeseelandiae*	Scarce	Uncommon
Masked Owl	*Tyto novaehollandiae*	Not recorded	Scarce
Barn Owl	*Tyto alba*	Scarce	Not recorded
Tawny Frogmouth	*Podargus strigoides*	Scarce	Uncommon
White-throated Nightjar	*Eurostopodus mystacalis*	Scarce	Scarce
Australian Owlet-nightjar	*Aegotheles cristatus*	Scarce	Not recorded
Laughing Kookaburra	*Dacelo novaeguineae*	Common	Abundant
Sacred Kingfisher	*Todiramphus sanctus*	Not recorded	Uncommon
Rainbow Bee-eater	*Merops ornatus*	Not recorded	Common
Superb Lyrebird	*Menura novaehollandiae*	Scarce	Scarce
Brown Treecreeper	*Climacteris picumnus*	Common	Abundant
White-throated Treecreeper	*Cormobates leucophaeus*	Scarce	Uncommon
Superb Fairy-wren	*Malurus cyaneus*	Abundant	Abundant

Table HB-7 (Continued)
Local Population Status of Birds Species Recorded by the Surveys

Common Name	Scientific Name	Local Population Status	
		Autumn	Spring
Variegated Fairy-wren	*Malurus lamberti*	Abundant	Common
Spotted Pardalote	*Pardalotus punctatus*	Scarce	Uncommon
Striated Pardalote	*Pardalotus striatus*	Not recorded	Scarce
Pilotbird	*Pycnoptilus floccosus*	Not recorded	Uncommon
Brown Thornbill	*Acanthiza pusilla*	Not recorded	Uncommom
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	Abundant	Common
Striated Thornbill	*Acanthiza lineata*	Uncommon	Uncommon
Yellow Thornbill	*Acanthiza nana*	Abundant	Common
Buff-rumped Thornbill	*Acanthiza reguloides*	Uncommon	Abundant
Inland Thornbill	*Acanthiza apicalis*	Scarce	Not recorded
Chestnut-rumped Thornbill	*Acanthiza uropygialis*	Not recorded	Uncommon
Southern Whiteface	*Aphelocephala leucopsis*	Uncommon	Uncommon
Chestnut-rumped Heathwren	*Calamanthus pyrrhopygius*	Scarce	Not recorded
Western Gerygone	*Gerygone fusca*	Uncommon	Not recorded
White-throated Gerygone	*Gerygone olivacea*	Not recorded	Uncommon
Rockwarbler	*Origma solitaria*	Scarce	Scarce
Speckled Warbler	*Pyrrholaemus sagittatus*	Scarce	Scarce
Red Wattlebird	*Anthochaera carunculata*	Not recorded	Scarce
Eastern Spinebill	*Acanthorhynchus tenuirostris*	Scarce	Not recorded
Fuscous Honeyeater	*Lichenostomus fuscus*	Uncommon	Not recorded
Yellow-faced Honeyeater	*Lichenostomus chrysops*	Not recorded	Scarce
White-eared Honeyeater	*Lichenostomus leucotis*	Scarce	Scarce
Yellow-tufted Honeyeater	*Lichenostomus melanops*	Scarce	Common
White-plumed Honeyeater	*Lichenostomus penicillatus*	Uncommon	Abundant
Noisy Miner	*Manorina melanocephala*	Abundant	Abundant
Black-chinned Honeyeater	*Melithreptus gularis gularis*	Uncommon	Not recorded
Little Friarbird	*Philemon citreogularis*	Uncommon	Scarce
Noisy Friarbird	*Philemon corniculatus*	Not recorded	Abundant
White-cheeked Honeyeater	*Phylidonyris nigra*	Scarce	Not recorded
Painted Honeyeater	*Grantiella picta*	Not recorded	Scarce
Brown Honeyeater	*Lichmera indistincta*	Not recorded	Uncommon
Eastern Yellow Robin	*Eopsaltria australis*	Uncommon	Uncommon
Hooded Robin	*Melanodryas cucullata*	Uncommon	Uncommon
Jacky Winter	*Microeca fascinans*	Abundant	Common
White-browed Babbler	*Pomatostomus superciliosus*	Abundant	Uncommon
Spotted Quail-thrush	*Cinclosoma punctatum*	Not recorded	Scarce
Grey Shrike-thrush	*Colluricincla harmonica*	Uncommon	Uncommon
Golden Whistler	*Pachycephala pectoralis*	Uncommon	Not recorded
Rufous Whistler	*Pachycephala rufiventris*	Scarce	Abundant
Magpie-lark	*Grallina cyanoleuca*	Abundant	Uncommon
Restless Flycatcher	*Myiagra inquieta*	Scarce	Not recorded
Satin Flycatcher	*Myiagra cyanoleuca*	Not recorded	Scarce
Willie Wagtail	*Rhipidura leucophrys*	Common	Abundant
Grey Fantail	*Rhipidura albiscapa*	Not recorded	Abubdant
Rufous Fantail	*Rhipidura rufifrons*	Not recorded	Uncommon
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	Abundant	Common
White-bellied Cuckoo-shrike	*Coracina papuensis*	Uncommon	Not recorded

Table HB-7 (Continued)
Local Population Status of Birds Species Recorded by the Surveys

Common Name	Scientific Name	Local Population Status	
		Autumn	Spring
White-winged Triller	*Lalage tricolor*	Not recorded	Uncommon
Olive-backed Oriole	*Oriolus sagittatus*	Not recorded	Uncommon
Dusky Woodswallow	*Artamus cyanopterus*	Abundant	Common
Masked Woodswallow	*Artamus personatus*	Uncommon	Not recorded
White-browed Woodswallow	*Artamus superciliosus*	Not recorded	Common
Black-faced Woodswallow	*Artamus cinereus*	Not recorded	Uncommon
Pied Butcherbird	*Cracticus nigrogularis*	Uncommon	Uncommon
Grey Butcherbird	*Cracticus torquatus*	Scarce	Not recorded
Australian Magpie	*Gymnorhina tibicen*	Abundant	Abundant
Pied Currawong	*Strepera graculina*	Uncommon	Common
Australian Raven	*Corvus coronoides*	Uncommon	Abundant
Little Raven	*Corvus mellori*	Common	Not recorded
White-winged Chough	*Corcorax melanorhamphos*	Abundant	Abundant
Apostlebird	*Struthidea cinerea*	Scarce	Not recorded
Satin Bowerbird	*Ptilonorhynchus violaceus*	Uncommon	Not recorded
Common Starling (I)	*Sturnus vulgaris*	Abundant	Abundant
Welcome Swallow	*Hirundo neoxena*	Uncommon	Abundant
Fairy Martin	*Petrochelidon ariel*	Scarce	Uncommon
Tree Martin	*Petrochelidon nigricans*	Not recorded	Abundant
Australian Reed-Warbler	*Acrocephalus australis*	Not recorded	Uncommon
Brown Songlark	*Cincloramphus cruralis*	Not recorded	Scarce
Mistletoebird	*Dicaeum hirundinaceum*	Scarce	Not recorded
Singing Bushlark	*Mirafra javanica*	Not recorded	Scarce
Australian Pipit	*Anthus australis*	Common	Abundant
Red-browed Finch	*Neochmia temporalis*	Uncommon	Uncommon
Beautiful Firetail	*Stagonopleura bella*	Scarce	Not recorded
Diamond Firetail	*Stagonopleura guttata*	Abundant	Uncommon
Double-barred Finch	*Taeniopygia bichenovii*	Uncommon	Uncommon

(I) Introduced species

There was a paucity of bird species associated with water bodies and grassland. Few larks or quail species were located during the survey, and it is considered likely that the drier that average conditions experienced during the autumn survey has affected the availability of habitat for these species. Similarly, few water birds or waders were located during the survey, and this is likely to be due to the lack of habitat in good condition within the study area and the availability of water.

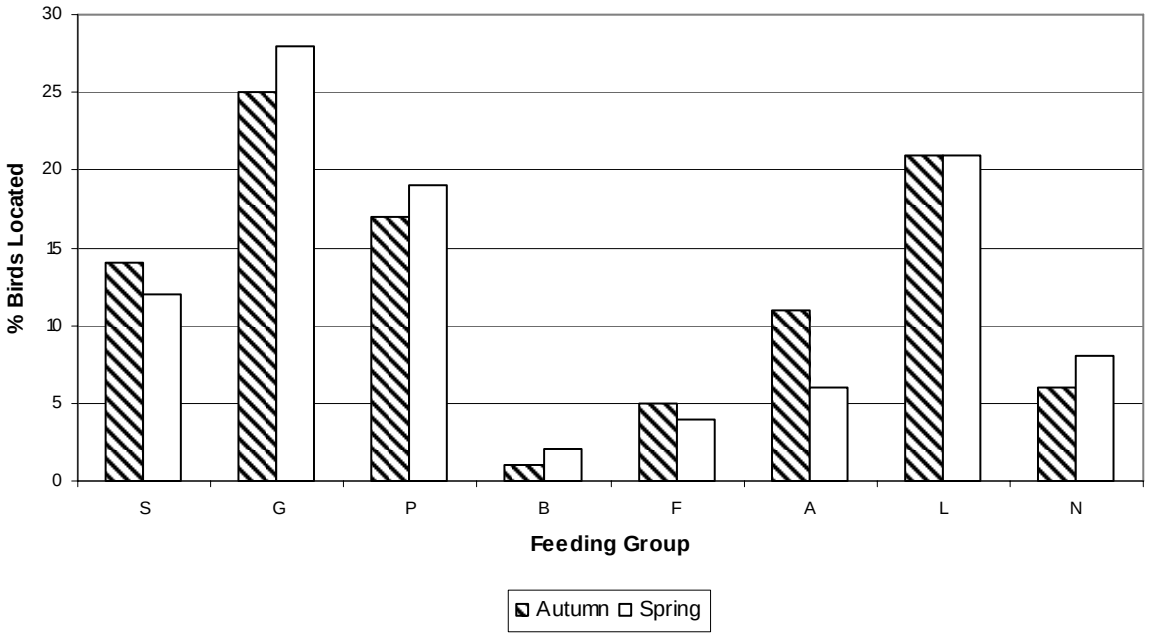
Six nocturnal bird species were located during the surveys (Southern Boobook, Masked Owl, Barn Owl, Tawny Frogmouth, White-throated Nightjar and Australian Owlet-nightjar) either by call response or during spotlighting. Although there was a high diversity of raptors (12 species), the numbers were low. During the first survey period in autumn, the area experienced a locust plague. However, this did not appear to increase the numbers of small raptors (eg. Nankeen Kestrel, Brown Falcon) in the area, although there were high numbers of the Australian Magpie feeding on these insects. Again, it is considered likely that the drier that average conditions experienced during the autumn survey affected the occurrence of nocturnal and raptor species.

There were some unusual sightings during the spring survey. In particular, the sighting of several Pilotbirds in the lower slopes of a steep hill near spring sites 10 and 22. The only other record for this species in the surrounding area has been recorded at the Ulan Coal Mines. These birds were distinguished from Rock Warblers by the lack of a white chin and their association with the litter scratchings of the Superb Lyrebird. The Painted Honeyeater is also an infrequent record for the region (although there are records for this species in the Atlas of NSW Wildlife, Munghorn Gap Nature Reserve, Birds Australia database and Hunter Bird Observers Club database within the surrounding area [Table HB-4]).

By applying information from bird studies undertaken in the western slopes of NSW and elsewhere it is possible to assign each terrestrial bird species to particular categories that cover feeding guilds, conservation status in the western slopes and their pattern of movement. This assessment is provided in Attachment HB-F. Attachment HB-F indicates that the dominant feeding groups within the study area were birds feeding on insects on the ground or in the foliage of trees, as well as generalist carnivores and seed eaters. Birds dependent upon nectar (nectarivores), fruit (frugivores) and insects in bark (bark feeders) were proportionately low (6%, 5% and 1%, respectively) in autumn, although there was a slight rise in the proportion of bark feeders (2%) and nectarivores (8%) and a slight decline in frugivores (4%) during the spring survey (Figure HB-7 and Attachment HB-F). As few trees and shrubs were in blossom or fruiting during the autumn and spring surveys, this is to be expected.

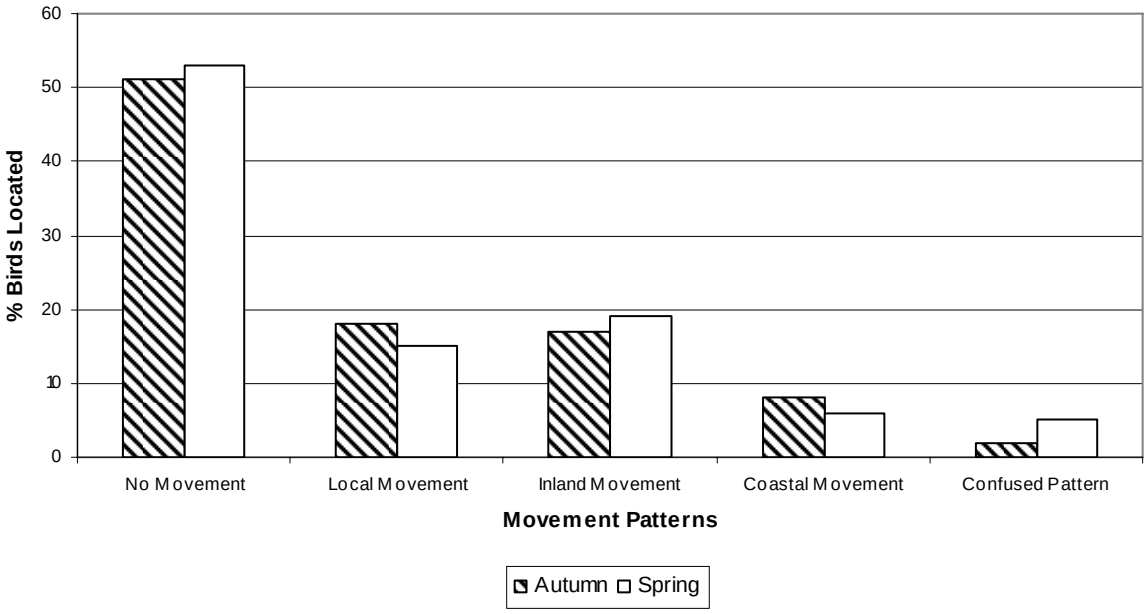
Most birds located during the autumn and spring surveys were classified as having no discernible pattern of movement by Griffieon and Clarke (2002), with local and inland movement patterns being dominant with the remaining bird species (Figure HB-8 and Attachment HB-F). There was a slight reduction during spring in the proportion of bird species that exhibit a pattern of movement. During autumn 43% of the bird species located are classed as having a movement pattern (ie. either classed as having a local, inland or coastal movement), whilst in spring the proportion was 40%. The slight decrease was mainly attributed to a decrease in bird species considered to have a local or coastal movement pattern during the spring survey (Figure HB-8).

Figure HB-7
Seasonal Differences in Avifaunal Feeding Groups Recorded by the Surveys



Feeding Group: S – Seed Eater; G – Ground Insectivore; P – Generalist Predator/Carnivore
B – Bark Feeder; F – Frugivore; A – Aerial Feeder; L – Foliage Feeder
N - Nectarivore

Figure HB-8
Seasonal Differences in Movement Patterns of Avifauna Recorded by the Surveys



Movement Patterns (Griffieon and Clarke, 2002)

No Movement –	no particular pattern of movement is discernable from existing data.
Local Movement –	birds where their ranges do not change significantly in their extents between periods but for which local variations do occur.
Inland Movement –	there are two sub-groups, birds that undertake predominantly north-south movements, and those that move either to the north-west or in a circle (called inland, non-cardinal-direction patterns).
Coastal Movement –	these are generally aligned or defined by the coast of eastern Australia.
Confused Pattern –	there is little information about this pattern, except that some form of movement does occur.

Local Population Status

Using the methodology described in Section HB2.3.1.11, a local population status was given to each bird species located during the surveys (Table HB-7). During the autumn survey, 20 bird species were found to be relatively abundant, 7 bird species to be common, 32 species to be uncommon and 32 species to be scarce (Table HB-7). During the spring survey, 23 species were classed as abundant, 14 species common, 33 species uncommon and 22 species as scarce. There was an increase in the proportion of bird species classed as abundant (25% in spring, 22% in autumn) and common (15% in spring, 8% in autumn) during the spring survey, indicating an increase in the number of birds recorded for many species relative to that recorded during the autumn surveys.

There were some changes in the population status of bird species between the autumn and spring surveys (Table HB-7). Table HB-7 shows that 41% of the species increased their population status between autumn and spring, 33% decreased their status and the population status of 25% of the bird species remained stable. These calculations included those species only recorded during one of the two seasons.

Avifauna Diversity

It was possible to compare the bird species diversity at the autumn survey sites 1 to 12 using the results from the formal bird surveys (i.e. four 0.5 hr observation sessions at each site), using the Simpson's Index of Diversity. The results of the indices are shown in Table HB-8.

Table HB-8
Simpson's Index of Diversity for Avifauna Recorded at the 12 Autumn Survey Sites

Site	Simpson's (1 - D)	Total Numbers (Mean of four survey sessions)	Species Richness
1	0.6105	23.25	9
2	0.7745	29.0	18
3	0.9097	10.75	15
4	0.8423	15.5	15
5	0.8902	19.5	16
6	0.8183	21.75	13
7	0.8458	27.5	11
8	0.8672	22.5	18
9	0.892	9.5	13
10	0.7708	6.0	9
11	0.9191	21.5	21
12	0.8469	5.75	10

Site 11 (SI = 0.9191) had the highest bird diversity during the autumn survey whilst the lowest bird diversity was recorded at sites 1 (SI = 0.6105), 2 (SI = 0.7745) and 10 (0.7708). In terms of bird species richness, site 11 (n=21) had the highest species richness, followed by sites 2 (n=18) and 8 (n=18) and sites 1 (n=9), 10 (n=9) and 12 (n=10) had the lowest species richness.

A similar analysis of the results from the spring bird survey, using a single formal survey session (ie. one 0.5 hr observation session) at each site (sites 1 to 23), provides the following bird species diversities (Table HB-9).

Table HB-9
Simpson's Index of Diversity for Avifauna Recorded at the 23 Spring Survey Sites

Site	Simpson's (1 - D)	Total Numbers	Species Richness
1	0.858	18	9
2	0.861	27	10
3	0.518	9	4
4	0.75	4	4
5	0.76	10	6
6	0.834	34	14
7	0.843	11	7
8	0.867	32	13
9	0.866	41	16
10	0.653	12	4
11	0.81	20	8
12	0.80	25	11
13	0.845	20	10
14	0.80	20	7
15	0.745	14	6
16	0.826	11	6

Table HB-9 (Continued)
Simpson's Index of Diversity for Avifauna Recorded at the 23 Spring Survey Sites

Site	Simpson's (1 - D)	Total Numbers	Species Richness
17	0.881	23	10
18	0.673	18	5
19	0.826	11	6
20	0.815	9	6
21	0.79	9	5
22	0.915	47	16
23	0.859	16	9

Site 22 (SI = 0.915) had the highest bird diversity during the spring survey whilst the lowest bird diversity was recorded at site 3 (SI = 0.518). In terms of bird species richness, sites 22 and 9 had the highest species richness (n = 16) and sites 3, 4 and 10 (n = 4) had the lowest species richness.

HB3.1.4 Native Mammals

A total of 12 native mammal species were recorded by the autumn and spring surveys (Table HB-10). All native mammal species were located during the autumn survey with no additions from the spring survey (Attachments HB-C and HB-D). An additional 14 species have been recorded in the surrounding region (Attachment HB-E).

Table HB-10
Terrestrial Native Mammals Recorded by the Surveys

Common Name	Scientific Name
Short-beaked Echidna	*Tachyglossus aculeatus*
Yellow-footed Antechinus	*Antechinus flavipes*
Sugar Glider	*Petaurus breviceps*
Squirrel Glider	*Petaurus norfolcensis*
Common Brushtail Possum	*Trichosurus vulpecula*
Common Ringtail Possum	*Pseudocheirus peregrinus*
Common Wombat	*Vombatus ursinus*
Eastern Grey Kangaroo	*Macropus giganteus*
Common Wallaroo	*Macropus robustus*
Red-necked Wallaby	*Macropus rufogriseus*
Swamp Wallaby	*Wallabia bicolor*
Southern Bush Rat	*Rattus fuscipes*

The assemblage of terrestrial mammals is typical of that found in this region. Native ground mammals are dominated by the Yellow-footed Antechinus, rather than the Brown or Dusky Antechinus that are mainly found towards the coast. A single capture of a young Southern Bush Rat indicated the presence of this species, but in low numbers. It is possible that the drier than average conditions experienced during the autumn survey affected the populations of rodents. However, the Yellow-footed Antechinus appears to have successfully survived the dry period experienced prior to the autumn survey. Many of the antechinuses captured were young and in good condition. The Yellow-footed Antechinus was captured in nearly all sites during the autumn survey, including the open highly disturbed autumn site 1. Some were captured in Elliott traps laid on the ground, whilst others were captured in tree-mounted Elliott traps. Trapping rates varied between sites although several sites (autumn sites 2, 3 and 8) had rates higher than usually expected (Attachment HB-G). This indicates relatively high populations of Yellow-footed Antechinus in some parts of the study area. The mean body measurements of captured Yellow-footed Antechinuses are provided in Attachment HB-G.

The results for the tree-mounted Elliott traps indicated that higher trapping rates were associated with this type of survey technique in comparison with ground Elliott traps (Attachment HB-G). Antechinuses utilize trees as part of their biotope, and are extremely agile moving about the trunks of trees, particularly rough-barked trees. Some released animals ran under the loose bark on ironbark trees.

There were relatively high numbers of arboreal marsupials recorded within the study area during the autumn survey, particularly the Common Brushtail Possum. Common Brushtail and Ringtail Possums were regularly spotlighted throughout the study area, and the Squirrel Glider was spotlighted at autumn site 9 when responding to a call broadcast. Fewer Common Brushtail and Ringtail Possums were observed during the spring survey spotlighting transects.

There was also evidence of gliders from the hair analysis at autumn sites 7 and 8 (Attachment HB-G). Capture rates for the Common Brushtail Possum were obtained from the tree-mounted Tomahawk traps at each autumn survey site. These possums were captured at four sites during the autumn survey (sites 4, 7, 9 and 11). The capture rates were 11.2, 2.3, 2.3 and 19 captures per 100 trap-nights respectively.

HB3.2 INTRODUCED SPECIES

A total of 11 introduced species were recorded by the autumn and spring surveys (Table HB-11). Nine introduced species were located during the autumn survey (Attachment HB-C) and eight during the spring survey. The only introduced bird species located within the study area was the Common Starling (Table HB-11). During the autumn survey, this bird was located at Site 1, a narrow strip of trees within extensive cleared paddocks; paddocks near Cumbo Creek, and within the open pastures forming part of autumn Site 13. This bird was recorded in high numbers and was classed as locally abundant in both the autumn and spring surveys (Table HB-7). The Red Fox was relatively common throughout the study area in autumn, being recorded from 12 out of the 13 autumn survey sites (Attachment HB-C). There were signs of the presence of Feral Pigs and Goats in some sites. The presence of the Cat was recorded from two sites in autumn, and the Rabbit was recorded throughout the study area during both the autumn and spring surveys. Several active Rabbit warrens were observed, and the number of Rabbits observed increased during the spring survey.

One Black Rat was captured in a tree-mounted Elliott trap and no House Mice were located during the autumn survey. It is possible that drier than average conditions leading up to the autumn survey affected the populations of rodents, including introduced species. Several House Mice however, were recorded during the spring survey.

Table HB-11
Introduced Species Recorded by the Surveys

Common Name	Scientific Name
Common Starling	*Sturnus vulgaris*
Black Rat	*Rattus rattus*
House Mouse	*Mus musculus*
Dog	*Canis familiaris*
Red Fox	*Vulpes vulpes*
Cat	*Felis catus*
Goat	*Capra hircus*
Feral Pig	*Sus scrofa*
Brown Hare	*Lepus capensis*
Rabbit	*Oryctolagus cuniculus*
European Cattle	*Bos taurus*

Scats from introduced predators were collected and analysed by Elizabeth Denny. The results of the analysis indicated that the major component of the diet for the Foxes during the autumn survey was insects. High numbers of grasshoppers were present during the autumn survey (Attachment HB-G).

HB3.3 THREATENED FAUNA SPECIES

Eleven threatened species were recorded by the autumn and spring surveys (Table HB-12), including ten birds and one mammal. The locations at which the threatened species were recorded are shown on Figure HB-9. The records for each species are described separately below.

Table HB-12
Threatened Species Recorded by the Surveys

Common Name	Scientific Name	Conservation Status		Easting	Northing	Number of Individuals
		TSC Act[1]	EPBC Act[2]			
Black-chinned Honeyeater	*Melithreptus gularis gularis*	V	-	774154	6415962	1
				767444	6419156	2
Painted Honeyeater	*Grantiella picta*	V	-	774243	6415830	1
Brown Treecreeper	*Climacteris picumnus victoriae*	V	-	773205	6417093	1
				774154	6415962	1
				772610	6417647	1
				771450	6416651	3
				769850	6417020	2
				771450	6416651	1
				769850	6417020	2
				767816	6420170	2
				767444	6419156	2
				767582	6415711	2
				769850	6417020	1
				770383	6418033	1
				771453	6416650	2
				767582	6415711	1
				767525	6418907	2
				770759	6419890	1
				773444	6416818	1
				773434	6416814	1
				774384	6416669	1
				770080	6418180	6
				767098	6415090	2
				767290	6415520	1
Diamond Firetail	*Stagonopleura guttata*	V	-	773205	6417093	2
				773205	6417093	6
				769850	6417020	1
				771453	6416650	2
				769850	6417020	6
				771453	6416650	1
				767444	6419156	1
				770383	6418033	20+
				770383	6418033	6
				770383	6418033	5
				767526	6418901	20
				773630	6417745	1
				770256	6417954	1
				774266	6416810	1
				773205	6417093	1
Glossy Black-cockatoo	*Calyptorhynchus lathami*	V	-	767444	6419156	2
				774154	6415962	2

Table HB-12 (Continued)
Threatened Species Recorded by the Surveys

Common Name	Scientific Name	Conservation Status		Easting	Northing	Number of Individuals
		TSC Act[1]	EPBC Act[2]			
Hooded Robin	*Melanodryas cucullata cucullata*	V	-	773033	6417613	1
				773205	6417093	3
				773205	6417093	1
				772574	6417612	1
				773205	6417093	2
				772410	6417995	2
				767920	6417829	3
				773700	6417412	2
Speckled Warbler	*Pyrrholaemus sagittatus*	V	-	771453	6416650	1
				773700	6417412	1
Square-tailed Kite	*Lophoictinia isura*	V	-	773630	6417745	1
				773630	6417745	2
				769090	6418492	1
Masked Owl	*Tyto novaehollandiae*	V	-	766500	6415300	1
Turquoise Parrot	*Neophema pulchella*	V	-	771453	6416650	1
Squirrel Glider	*Petaurus norfolcensis*	V	-	769850	6417020	1

[1] NSW *Threatened Species Conservation Act, 1995*
[2] Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*
V Vulnerable

a. Black-chinned Honeyeater (eastern subspecies)

There were two records of this species in the study area. During the autumn survey an individual was heard calling in site 12, in an area where some ironbark trees retained some blossom. Another two individuals were sighted foraging in the upper tree canopy high on a hill at autumn site 5. This species was not recorded during the spring survey.

b. Painted Honeyeater

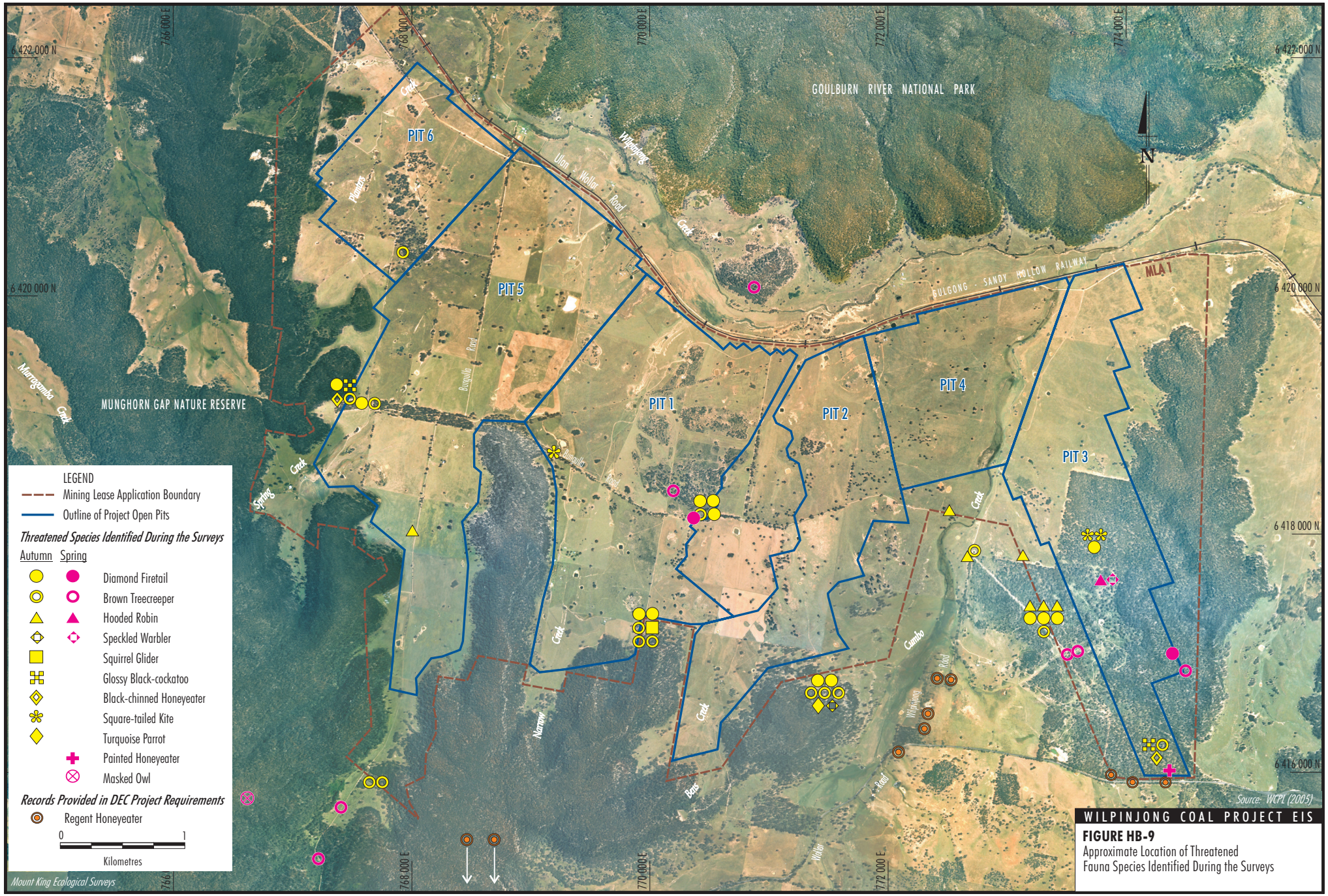
An individual Painted Honeyeater was sighted during the spring survey at site 1, close to autumn site 12. It was foraging within the upper canopy of ironbark trees. This species was not recorded during the autumn survey.

c. Brown Treecreeper (eastern subspecies)

There were 22 sightings of this species during the surveys (although several sightings were recorded at the same locations), nearly all within wooded areas (Figure HB-9 and Table HB-12). An exception was an individual sighted in trees at a cliffline at spring site 13. This treecreeper was more commonly seen than the White-throated Treecreeper.

d. Diamond Firetail

This was the most common finch found in the study area during the autumn survey and was classed as locally abundant during the autumn survey although uncommon during the spring survey. During the autumn survey, flocks of 20 or more were observed in wooded areas close to cleared land (ie. mainly on the edge of patches of woodland habitat) (Figure HB-9 and Table HB-12). There were only two sightings of this species during the spring survey.



WILPINJONG COAL PROJECT EIS

FIGURE HB-9
Approximate Location of Threatened Fauna Species Identified During the Surveys

WIL-04-01 Terr Fauna_002N

e. Glossy Black-cockatoo

There were two sightings of this species in the study area during the autumn survey (Figure HB-9 and Table HB-12), and it was possible that the same pair were observed at different sites. Both sightings were within woodland habitat. The most common black-cockatoo in the area was the Yellow-tailed Black-cockatoo, whereas slightly further west (at the Ulan Coal Mines), the Glossy Black-cockatoo is more common. This species was not recorded during the spring survey.

f. Hooded Robin

This species was located throughout the study area, but never in large numbers (Figure HB-9 and Table HB-12). Most sightings of the Hooded Robin were at the interface between woodland and grassland (cleared) habitat. Two individuals were sighted during the spring survey in regrowth shrubby vegetation at the edge of Grey Box Woodland (site 5).

g. Speckled Warbler

There were only two sightings of this species, one in some scattered trees on the side of a hill at autumn site 11, and another during the spring survey within regrowth shrubby vegetation at site 5 (Figure HB-9 and Table HB-12).

h. Square-tailed Kite

This species was observed flying over the edges of wooded habitat at several sites during the autumn survey (Figure HB-9 and Table HB-12). It appeared to be hawking for insects etc within the grassland. This species was not recorded during the spring survey.

i. Turquoise Parrot

Only one sighting was made of this species, at the edge of the woodland habitat at autumn site 11 (Figure HB-9 and Table HB-12). This species was not recorded during the spring survey.

j. Masked Owl

A Masked Owl responded to call broadcasting at site 9 during the spring survey. The call came from a densely vegetated gully to the north-west of the broadcast site. This species was not recorded during the autumn survey.

k. Squirrel Glider

Although there was much evidence of the presence of small arboreal marsupials throughout the study area (eg. from scratches on tree trunks), there was only one sighting of a Squirrel Glider (Figure HB-9 and Table HB-12). This was at site 9, in response to a call broadcast during the autumn survey. Hairs from a Sugar Glider were found in a hair funnel at site 7, and hair belonging to the *Petaurus* genus was located at site 8 during the autumn survey. During the initial spotlighting at site 8 in spring, it was noted that logging of mature native vegetation (conducted between the autumn and spring surveys) had effectively removed the habitat potential of this site. As a result, no trapping survey was conducted at spring site 8.

l. Regent Honeyeater

Although no Regent Honeyeaters were observed during the autumn or spring surveys, there are records of their presence within the study area. Known records of the Regent Honeyeater in the area (as provided in the Department of Environment and Conservation's requirements for the Project) are shown on Figure HB-9. David Geering from the Regent Honeyeater Recovery Team verbally provided information about the distribution of records in and near the study area. There are records for the Regent Honeyeater along the southern end of Wilpinjong Road, as well as along Wollar Road and Cumbo Road. An inspection of part of the study area by David Geering indicated habitat for the Regent Honeyeater is present within the study area. The distribution of potential habitat for the Regent Honeyeater within the study area closely follows vegetation communities containing box tree species (particularly White Box) that are growing on the valley floor and lower slopes.

HB3.4 SEPP 44 – KOALA HABITAT PROTECTION

In response to a state-wide decline of Koala populations, the Department of Urban Affairs and Planning (now Department of Infrastructure, Planning and Natural Resources [DIPNR]) gazetted the State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) in January 1995.

The policy aims to "*encourage the conservation of proper management of areas of natural vegetation that provide habitat for Koalas, to ensure permanent free-living populations over their present range and to reverse the current trend of population decline*."

In order to determine whether SEPP 44 applies to the Project, it is necessary to consider the following points:

(1) *Does the subject land occur in a Local Government Area identified in Schedule 1?*

The Project and surrounds are located within the recently formed Mid Western Regional Local Government Area. The Project and surrounds were formerly located within the Local Government Area of Mudgee, which is listed within Schedule 1 of SEPP 44.

(2) *Is the landholding to which the DA applies greater than 1 hectare in area?*

The Project Development Application area is larger than 1 hectare in area.

(3) *Is the land potential Koala habitat? That is, does the site "contain areas of native vegetation where the trees of types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component?*"

Potential Koala food trees in accordance with Schedule 2 of SEPP 44, present within the study area include Grey Gum (*E. punctata*) and White Box (*E. albens*) (FloraSearch, 2005). These species represent less than 15% of the upper or lower strata tree component in the Development Application area. Based on this the land is not potential Koala habitat.

(4) *Is there core Koala habitat on the subject land and is there a requirement for the preparation of a Plan of Management for the identified core Koala habitat?*

SEPP 44 describes core Koala habitat as an area of land with a resident population of Koalas, evidenced by attributes such as breeding females (ie. females with young) and recent sightings of and historical records of, a population.

There was no evidence of the presence of Koalas within the study area. No characteristic scratches or faecal pellets were observed, despite searching smooth-barked trees and the base of trees at each survey site during each survey. Discussions with local residents revealed that Koalas were known from the district in the past, but have not been seen locally for many years. It is unlikely that any Koala currently uses the study area.

The study area does not fall within the definition of core Koala habitat. The study area does not have a resident population of Koalas and there are no recent records of a population occurring in the area. Hence, there is no requirement for the preparation of a Plan of Management.

Based on the above, it is concluded that the provisions of SEPP 44 do not apply.

HB3.5 HABITAT COMPLEXITY

The results of the habitat complexity assessment conducted at autumn survey sites 1 to 12, and at spring survey sites 9, 16, 18, 19, 20, 21, 22 and 23 are provided in Attachment HB-A. The assessment of various habitat characteristics enabled the complexity of the habitats at each site to be given a ranking of either high, moderate or low complexity. These rankings are based upon the assumption that a habitat of high complexity has one or more of the following characteristics:

- high structural diversity of the vegetation (ie. high tree, shrub and sapling densities; tall and large trees and shrubs);
- high proportion of tree hollows; and
- high ground cover, including grass and forb cover, litter weight and log cover.

As described in Section HB2.4, it is possible to rank the habitat assessment results, by assigning a value to the calculated percentiles for each characteristic (ie. below the 25th percentile the score is one, between the 25th and 75th percentiles, the score is two, and above the 75th percentile the score is three). The scores are then added and the totals again divided into the three ranges of percentiles to provide a ranking of low to high habitat complexity.

The habitat characteristics derived from a description of each Elliott trap site were: Tree cover; Shrub cover; Sapling cover; Grass cover; Forb cover; Litter cover; Log cover; Rock cover. These were only obtained during the autumn survey. The habitat characteristics derived from each transect were: Tree height; Tree DBH; Tree density; Percentage of trees with hollows; Shrub height; Shrub density; Sapling density; Stag density; Grass cover; Forb cover; Litter cover; Stick cover; Log area; Grass height; Forb height; Litter weight.

The derived habitat scores are shown for the 12 autumn survey sites in Table HB-13.

Table HB-13
Habitat Complexity Scores for Remnant Vegetation within Autumn Survey Sites

Survey Site	Habitat Complexity	
	Trap Data	Transect Data
1	Moderate	Moderate
2	High	High
3	Moderate	Moderate
4	Low	Low
5	High	Low
6	High	Moderate
7	Moderate	High
8	Moderate	High
9	Moderate	Low
10	Low	Not measured
11	Moderate	High
12	Low	High

Statistical analysis was undertaken to determine whether there were any differences between the autumn survey sites for the habitat characteristics measured. This analysis showed that there were no significant differences between sites, with the exception of:

- tree diameter (DBH) at site 9 which was significantly higher than at sites 5, 1, 2 and 6;
- grass cover at site 1 which was significantly higher than at most other sites;
- stick cover which was significantly higher at site 12 than most other sites; and
- litter cover which was significantly higher at sites 1, 2 and 6 than the other sites.

A similar analysis was undertaken for the habitat characteristics recorded from transects undertaken at a sample of sites (namely, sites 9, 16, 18, 19, 20, 21, 22 and 23) during the spring survey (Table HB-14 and Attachment HB-A).

Table HB-14
Habitat Complexity Scores for Remnant Vegetation within Spring Survey Sites

Survey Site	Habitat Complexity
9	High
16	Low
18	Moderate
19	Moderate
20	Moderate
21	Low
22	High
23	Moderate

It is possible to combine some of the results from the autumn and spring habitat surveys. Little change would occur between April and November to the following characteristics: tree height, tree DBH, tree density, shrub density, sapling density, stag density, % hollows, litter cover, litter weight and log area. Consequently, these characteristics could be used to provide an overall picture of the habitat found within remnant vegetation in the study area (Table HB-15).

Table HB-15
Habitat Characteristics of the Remnant Vegetation within the Study Area

Habitat Characteristic	Mean	Standard Deviation
Tree Height (m)	12.4	1.18
Tree DBH (cm)	33.4	9.46
Tree Density (/ha)	983	338
Shrub Density (/ha)	1721	1552
Sapling Density (/ha)	285	298
Stag Density (/ha)	117	107
% Hollows	18.4	15.92
% Litter	78.9	18.05
Litter Weight (g)	525	131.5
Log Area (%)	0.714	0.565

Following the habitat complexity assessment, an assessment was conducted to determine whether the survey sites located within Project disturbance areas were any different to those located in immediate proximity to the Project disturbance areas. This assessment was based on the habitat complexity data collected during the autumn and spring surveys (ie. autumn sites 1, 2, 3, 4, 5, 6, 7, 8, 9, 11 and 12 and spring sites 9, 16, 18, 19, 20, 21, 22 and 23). Table HB-16 outlines the survey sites (for which transect habitat complexity data was collected) located within and immediately proximal to Project disturbance areas.

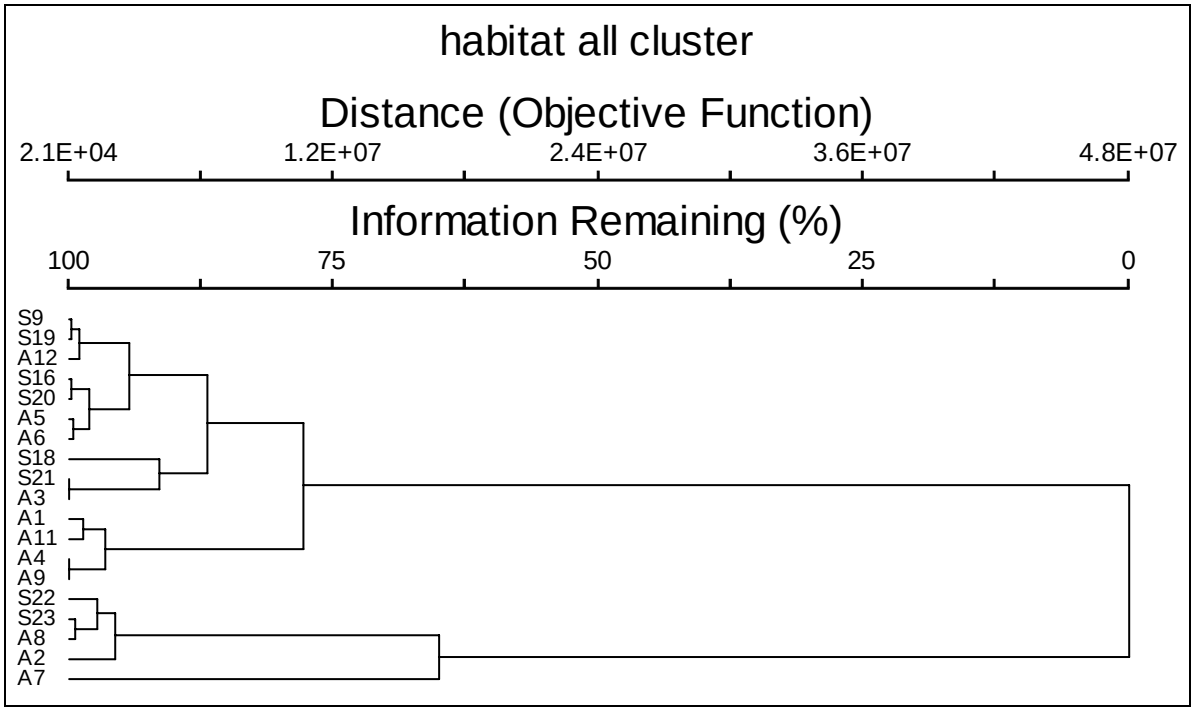
Table HB-16
Survey Sites Located Within and Immediately Proximal to Project Disturbance Areas

Survey Period	Within	Proximal To
Autumn	1*, 3*, 7*, 8*, 9*, 12*	2*, 4*, 5*, 6*, 10*, 11
Spring	1, 2, 3, 4, 5, 6, 8, 14, 18*, 20*	7, 9*, 10, 11, 12, 13, 15, 16*, 17, 19*, 21*, 22*, 23

* Indicates that transect habitat complexity data was collected

Applying Hierarchical Cluster Analysis using Ward's Method it is possible to group (cluster) those sites that have habitat characteristics that area most similar. This is shown in Figure HB-10.

Figure HB-10
Hierarchical Cluster Analysis of Habitat Characteristics for all Survey Sites Sampled



A – Autumn survey sites
S – Spring survey sites

Figure HB-10 shows four main clusters of sites, with each cluster showing those sites that have similar habitat characteristics. Inspection of each cluster shows that the sites represent those from both inside and immediately proximal to the Project disturbance area, thus indicating that there are no significant differences in the habitat characteristics between the remnant vegetation either inside or immediately proximal to the Project disturbance area.

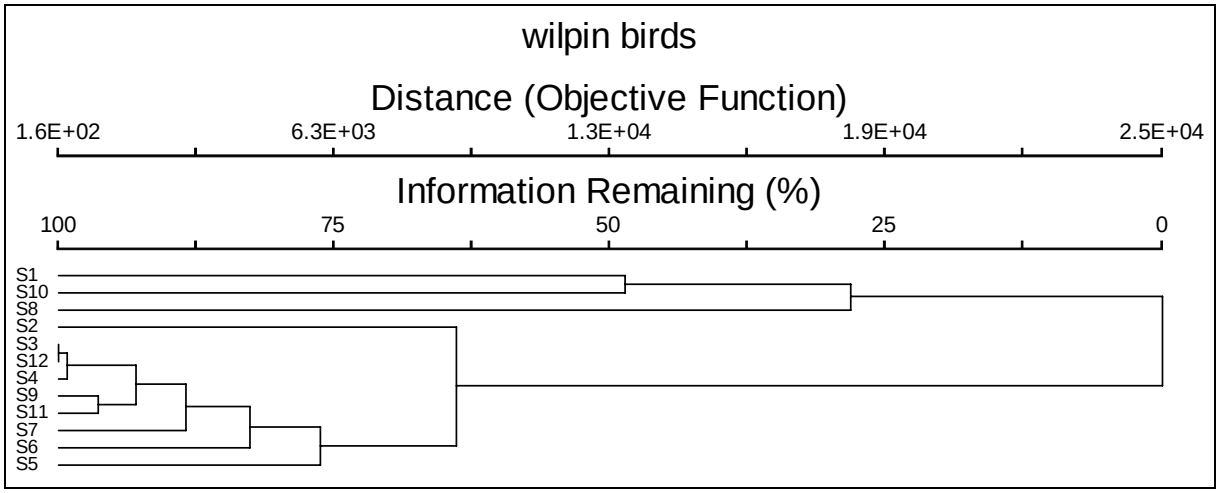
The assessment of habitat complexity indicates that habitat complexity is highly variable across the study area, having a low habitat complexity in some areas and a moderate or high habitat complexity in others. From a broader perspective, larger remnants situated in the surrounding area (eg. within Munghorn Gap Nature Reserve and Goulburn River National Park) would be expected to have a greater habitat complexity than those situated within the Project disturbance areas and those immediately proximal to the Project disturbance areas.

HB3.6 DISTRIBUTION OF FAUNA WITHIN THE STUDY AREA

A similar approach to that used on habitat characteristics can be used on fauna data, particularly avifauna.

Using the data from the spring survey, it is possible to apply a Hierarchical Cluster Analysis using Ward's Method to the bird species and numbers recorded from each site. The result is shown in Figure HB-11.

Figure HB-11
Hierarchical Cluster Analysis of Avifauna Data from the Spring Sites



A – Autumn survey sites
S – Spring survey sites

Again, Figure HB-11 shows that each cluster with similar bird assemblages comprises sites representing those from both inside and those immediately proximal to the Project disturbance area (ie. there are no significant differences in the bird assemblages from the remnant vegetation either inside or immediately proximal to the area proposed to be disturbed).

Analysis of the distribution of threatened species within or immediately proximal to the Project disturbance area also shows that nine threatened species were found both within and immediately proximal to the Project disturbance area. Analysis of the species diversities in the sites within and immediately proximal to the Project disturbance area shows that the threatened species richness for both areas is the same (9), but the threatened species Simpson's Diversity Index for the sites immediately proximal to the Project disturbance area is higher than that calculated for the sites inside the Project disturbance area (0.713 compared to 0.526). However, there were greater numbers of individual threatened birds within the Project disturbance area (due to high numbers of Diamond Firetail found during the autumn survey).

This approach to assessing the wildlife potential of the land within the study area shows that the areas of remnant vegetation immediately proximal to the Project disturbance areas have similar habitat characteristics and fauna assemblages as that found within the Project disturbance areas . Thus, the land within the Project disturbance area is not 'unique'. Rather, it is similar to that land immediately surrounding it. Further, from a broad perspective, larger remnants situated in the surrounding area (eg. within Munghorn Gap Nature Reserve and Goulburn River National Park) would be expected to have a higher wildlife potential than those situated within the Project disturbance areas and the immediately proximal to the Project disturbance areas.

HB4 POTENTIAL IMPACTS AND MITIGATION MEASURES

Potential impacts and mitigation measures associated with the Project are outlined below. A detailed assessment of Project impacts and mitigation measures is provided in Section 4, Volume 1 of the Project EIS.

The likely impacts of the Project on threatened terrestrial fauna species have been assessed by Eight Part Tests of Significance and are provided in Appendix HE of the Project EIS.

HB4.1 POTENTIAL IMPACTS

Potential impacts of the Project on terrestrial vertebrate fauna primarily relate to:

Habitat Disturbance – Five major habitat types were identified within the study area, *viz*., woodland on undulating and level land, woodland on slopes and steep hills, rocky hills and escarpment, watercourses and cleared agricultural land with scattered trees. All habitat types provide (to varying degrees) opportunities for foraging, breeding, nesting, predator avoidance and movement between areas for vertebrate fauna. These opportunities would be reduced as a result of the vegetation clearance activities associated with the Project. Vegetation Clearance is classed as a Threatening Process under the NSW *Threatened Species Conservation Act, 1995*.

Barrier Effects – Vegetation clearance can fragment existing vegetation remnants and create barriers to the movement/dispersal of fauna.

Hydrological Effects – Some water sources within the study area would be disturbed as a result of the development.

Introduced Fauna Species – There is potential for introduced fauna species to be attracted to the study area through the disturbance of natural habitats and increased refuge and scavenging areas. These factors could result in an increase in the population or concentration of feral species in and around the Project. In particular, there is the potential for an increase in the numbers of Red Fox as a result of activity in the study area. Predation by the Red Fox is classed as a Threatening Process under the NSW *Threatened Species Conservation Act, 1995*.

Fauna and Noise Emissions – The Project would increase the existing level of noise, which has the potential to disrupt the routine activities of vertebrate fauna.

Fauna and Road/Rail Traffic – The movement of vehicles (both within the study area and associated with coal transport) has the potential to increase the incidence of fauna mortality via vehicular strike.

Fauna and Artificial Lighting – Little information is available on the potential impacts of lighting on wildlife. Potential impacts of lighting associated with the Project on fauna however are likely to relate to alteration of forage zones, primarily for insectivorous bird and bat species.

HB4.2 MITIGATION MEASURES

A number of measures have been developed to mitigate the potential impacts of the Project on terrestrial vertebrate fauna including:

- As part of the Project, enhancement and conservation areas would be established (Section 5, Volume 1 of the Project EIS). These areas would include remnant native vegetation located outside of the Project disturbance areas and within WCPL owned land. Enhancement and conservation areas would be managed to maintain and enhance the inherent conservation values of these remnants.
- The open cut mining operations area would be revegetated progressively, with areas of endemic woodland vegetation (including upper, mid and lower storey species).

- The Project would include the creation of native vegetation links and habitat corridors, including those between enhancement and conservation areas, rehabilitation areas, existing remnant vegetation, Munghorn Gap Nature Reserve and Goulburn River National Park.
- A Flora and Fauna Management Plan would be prepared prior to construction. The Plan would include activities to be conducted in the enhancement and conservation areas. Initiatives would be developed for the enhancement and conservation areas to conserve the regional biodiversity, whilst enhancing the habitat available to flora and fauna. Management measures may include weed control, feral animal control, stock access management and expansion of remnants (through revegetation or stock access). Further detail regarding the contents of the Flora and Fauna Management Plan is provided in Section 5, Volume 1 of the Project EIS.
- Although not located during the surveys, the Regent Honeyeater is known to occur within the south-eastern corner of the study area (Figure HB-9) and has been regularly recorded in the Mudgee-Munghorn Gap-Wollar area (DEC, 2004). The Project would implement a number of measures that are consistent with the Draft National and NSW Recovery Plan for the Regent Honeyeater (DEC, 2004). For example, enhancement and conservation areas would be established which contain potential habitat for this species, while the Project rehabilitation and revegetation measures would be designed to achieve an increase in the potential habitat available to this species in the long-term. Rehabilitation of the open pit mining area would be undertaken progressively and would be designed to create native vegetation links between areas of remnant vegetation. Plantings of key tree species (eg. Yellow Box, Blakely's Red Gum) would also be undertaken as soon as practicable within the enhancement and conservation areas, where appropriate, and within rehabilitation areas.
- Monitoring of fauna, including threatened species, would be undertaken in accordance with the Flora and Fauna Management Plan that would be developed for the Project prior to construction. The monitoring programme would include monitoring within the enhancement and conservation areas. Monitoring may include fauna species diversity and abundance or, alternatively, indicator species to measure the effectiveness of the enhancement and conservation measures.
- Remnant patches of native vegetation immediately adjoining Project disturbance areas would be delineated and clearly marked to prevent accidental damage during construction and operation.
- Any disturbance to drainage systems and associated vegetation would be conducted in accordance with integrated erosion and sediment control initiatives.
- A clean, rubbish-free environment would be maintained to discourage scavenging and reduce the potential for colonisation of these areas by non-endemic fauna (eg. introduced rodents, birds).
- Feral animal control strategies would be implemented and would include, where practicable, control measures recommended in the relevant threat abatement plans (eg. the NSW Threat Abatement Plan for Predation by the Red Fox [NPWS 2001]).
- Speed limits would be imposed on vehicles using roads and tracks within the mining lease area, to reduce the potential for vehicle strike of native fauna.
- Employees would undergo an education programme during induction, on flora and fauna resources of the site and surrounds.

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ATTACHMENT HB-A

DETAILS OF THE FAUNA AND HABITAT COMPLEXITY SURVEY SITES

AUTUMN SURVEY:

Site 1 (767958E; 6418835S)

Open flat area traversed by Bungulla Road and surrounded by cleared grazed land. The site was grazed by sheep and cattle at the time of the survey. Overstorey species include Grey Box, Yellow Box and Blakely's Red Gum.

Habitat Characteristic	Mean	Standard Deviation (n)
Tree Ht (m)	12.7	2.81 (13)
Tree Density (/ha)	1079	
Tree DBH (cm)	27.8	13.51 (13)
% hollows	18	
Shrub Density (/ha)	0	
Shrub Ht (cm)		
Sapling Density (/ha)	0	
Sapling Ht (m)		
Stag Ht (m)	9.5	1.91 (4)
Stag Density (/ha)	332	
% grass	92.0	17.89 (5)
% forb	6.4	3.51 (5)
% rocks	0	
% sticks	6.0	4.18 (5)
Grass Ht (cm)	8.6	4.04 (5)
Forb Ht (cm)	3.4	0.55 (5)
% litter	100	0 (5)
Litter Weight (g/m^2)	824	317.9 (5)
% log cover	0.5	

Site 2 (773205E; 6417093S)

Flat area of regrowth woodland (overstorey species include Yellow Box and Blakely's Red Gum) surrounded by cleared paddocks. Part of the area has been recently cleared.

Habitat Characteristic	Mean	Standard Deviation (n)
Tree Ht (m)	13.7	1.63 (6)
Tree Density (/ha)	714	
Tree DBH (cm)	23.5	13.14 (6)
% hollows	5	
Shrub Density (/ha)	3332	
Shrub Ht (cm)	118.6	41.76 (28)
Sapling Density (/ha)	476	
Sapling Ht (m)	1.5	1.39 (4)
Stag Density (/ha)	238	
Stag Ht (m)	11	1.4 (2)
% grass	24.6	18.46 (5)
% forb	5	5 (5)
% rocks	0	
% sticks	11	4.2 (5)
Grass Ht (cm)	25.5	21.44 (5)
Forb Ht (cm)	5.3	4.16 (5)
% litter	96	6.5 (5)
Litter Weight (g/m^2)	572	124.6 (5)
% log cover	0.34	

Site 3 (773630E; 6417745S)

Flat area of woodland that has been logged in the past. Overstorey species include Narrow-leaved Ironbark, Black Cypress Pine, Yellow Box, Blakely's Red Gum and Grey Box.

Habitat Characteristic	Mean	Standard Deviation (n)
Tree Ht (m)	13.4	1.59 (8)
Tree Density (/ha)	664	
Tree DBH (cm)	31.7	8.97 (8)
% hollows	15	
Shrub Density (/ha)	1826	
Shrub Ht (cm)	119	32.2 (22)
Sapling Density (/ha)	0	
Sapling Ht (m)		
Stag Density (/ha)	0	
Stag Ht (m)		
% grass	56	23.0 (5)
% forb	3.4	2.30 (5)
% rocks	0	
% sticks	14	4.2 (5)
Grass Ht (cm)	33	14.0 (5)
Forb Ht (cm)	5.2	2.22 (5)
% litter	81	26.1 (5)
Litter Weight (g/m^2)	456	262.8 (5)
% log cover	0.44	

Site 4 (774056E; 6419318S)

Steep side of hill with cliff-line and rocky outcrops. Located next to cleared grazed paddock. Overstorey species include Grey Box and Sandstone Range Communities. The site has been disturbed by logging and grazing by cattle.

Habitat Characteristic	Mean	Standard Deviation (n)
Tree Ht (m)	12.8	1.56 (9)
Tree Density (/ha)	639	
Tree DBH (cm)	33.8	8.88 (9)
% hollows	12.5	
Shrub Density (/ha)	0	
Shrub Ht (cm)		
Sapling Density (/ha)	71	
Sapling Ht (m)	8.0	
Stag Density (/ha)	0	
Stag Ht (m)		
% grass	10	5.0 (5)
% forb	5.4	4.56 (5)
% rocks	7	9.7 (5)
% sticks	4	2.2 (5)
Grass Ht (cm)	14.6	9.32 (5)
Forb Ht (cm)	9.2	5.74 (5)
% litter	37	24.4 (5)
Litter Weight (g/m^2)	320	159.4 (5)
% log cover	0.74	

Site 5 (767444E; 641915S)

Steep side of hill surrounded on one side by cleared and grazed paddocks and the other by a narrow cleared valley. The site has been logged in the past and is grazed by cattle. The site samples Sandstone Range Communities (mainly Grey Box, White Box and Black Cypress Pine).

Habitat Characteristic	Mean	Standard Deviation (n)
Tree Ht (m)	11.5	2.39 (16)
Tree Density (/ha)	960	
Tree DBH (cm)	21.9	9.75 (16)
% hollows	8	
Shrub Density (/ha)	540	
Shrub Ht (cm)	117	38.5 (9)
Sapling Density (/ha)	480	
Sapling Ht (m)	6	1.8 (8)
Stag Density (/ha)	60	
Stag Ht (m)	12	
% grass	32	30.9 (5)
% forb	9.4	7.70 (5)
% rocks	14.2	16.15 (5)
% sticks	6.6	7.7 (5)
Grass Ht (cm)	8.8	2.39 (5)
Forb Ht (cm)	5.2	3.90 (5)
% litter	66	23.0 (5)
Litter Weight (g/m^2)	428	259.8 (5)
% log cover	1.37	

Site 6 (767582E; 6415711S)

Located within a large valley, overstorey species include Rough-barked Apple, White Box and Black Cypress Pine. The site lies between cleared grazed land and Munghorn Gap Nature Reserve.

Habitat Characteristic	Mean	Standard Deviation (n)
Tree Ht (m)	11.4	2.98 (14)
Tree Density (/ha)	1162	
Tree DBH (cm)	25.5	16.40 (14)
% hollows	10	
Shrub Density (/ha)	747	
Shrub Ht (cm)	149	35.4 (9)
Sapling Density (/ha)	581	
Sapling Ht (m)	1.7	2.24 (7)
Stag Density (/ha)	0	
Stag Ht (m)		
% grass	68	29.7 (5)
% forb	9.8	16.9 (5)
% rocks	0	
% sticks	3.8	3.89 (5)
Grass Ht (cm)	6.6	3.91 (5)
Forb Ht (cm)	4.2	2.06 (5)
% litter	97	4.5 (5)
Litter Weight (g/m^2)	572	233.5 (5)
% log cover	0.39	

Site 7 (767816E; 6420170S)

A relatively small hill, located about 500 m from Mittaburra homestead, still retaining its original vegetation, although the site has been logged and is grazed by cattle. Overstory species include Narrow-leaved Ironbark and Black Cypress Pine.

Habitat Characteristic	Mean	Standard Deviation (n)
Tree Ht (m)	13.2	1.79 (5)
Tree Density (/ha)	835	
Tree DBH (cm)	36.4	4.39 (5)
% hollows	20	
Shrub Density (/ha)	6012	
Shrub Ht (cm)	124	41.7 (36)
Sapling Density (/ha)	167	
Sapling Ht (m)	6.0	
Stag Density (/ha)	167	
Stag Ht (m)	8.0	
% grass	11.0	9.6 (5)
% forb	9.6	9.61 (5)
% rocks	18.4	10.14 (5)
% sticks	8.4	5.03 (5)
Grass Ht (cm)	9.7	2.06 (5)
Forb Ht (cm)	17.2	19.10 (5)
% litter	62	14.8 (5)
Litter Weight (g/m^2)	440	135.6 (5)
% log cover	2.67	

Site 8 (770383E; 6418033S)

A low hill surrounded by cleared and grazed paddocks supporting Rough-barked Apple and Narrow-leaved Ironbark. The site is grazed by cattle and has been logged in the past. There is a small unoccupied dwelling on the site.

Habitat Characteristic	Mean	Standard Deviation (n)
Tree Ht (m)	13.4	2.50 (10)
Tree Density (/ha)	1250	
Tree DBH (cm)	39.0	16.78 (10)
% hollows	15	
Shrub Density (/ha)	3250	
Shrub Ht (cm)	93.3	27.02 (26)
Sapling Density (/ha)	625	
Sapling Ht (m)	3.8	1.60 (5)
Stag Density (/ha)	125	
Stag Ht (m)	6.0	
% grass	24	28.1 (5)
% forb	3.0	4.5 (5)
% rocks	8	7.6 (5)
% sticks	9.4	6.84 (5)
Grass Ht (cm)	10.5	11.03 (5)
Forb Ht (cm)	12.5	4.95 (5)
% litter	57	20.5 (5)
Litter Weight (g/m^2)	640	453.2 (5)
% log cover	0.93	

Site 9 (769850E; 6417020S)

Located on the low talus slope of a steep hill next to a large cleared grazed paddock. The site is grazed by cattle and has been logged in the past. There are rocky outcrops and overstorey species include White Box.

Habitat Characteristic	Mean	Standard Deviation (n)
Tree Ht (m)	12.2	2.74 (10)
Tree Density (/ha)	625	
Tree DBH (cm)	57.4	26.14 (10)
% hollows	11	
Shrub Density (/ha)	0	
Shrub Ht (cm)		
Sapling Density (/ha)	0	
Sapling Ht (m)		
Stag Density (/ha)	187	
Stag Ht (m)	8	3.5 (3)
% grass	30	6.1 (5)
% forb	17	13.9 (5)
% rocks	11	16.7 (5)
% sticks	5.4	2.88 (5)
Grass Ht (cm)	9.8	1.48 (5)
Forb Ht (cm)	13.2	4.55 (5)
% litter	67	29.9 (5)
Litter Weight (g/m^2)	356	183.5 (5)
% log cover	0.46	

Site 10 (768898E; 6418577S)

Located on the low talus slope of a steep hill next to cleared grazed paddocks, the site is highly disturbed by grazing cattle, logging and fallen trees (probably due to high winds). There are rocky outcrops and the dominant overstorey species is White Box.

Habitat Characteristic*	Mean
Tree Density (% cover)	48%
% hollows	10%
Shrub Density (% cover)	4%
Sapling Density (% cover)	0%
% grass	20%
% forb	40%
% litter	96%
% log cover	64%
% rocks	12%

* Habitat characteristics taken from trap location data

Site 11 (771453E; 6416650S)

Located on the edge of steep hills, the site covers the low talus slope and a small rocky gully with some rocky outcrops. There is a small watercourse that supports native trees as well as introduced peppercorn trees indicating the area may have contained a homestead in the past. The site is next to cleared grazed paddocks, and is grazed by cattle. Dominant overstorey species include White Box and Black Cypress Pine.

Habitat Characteristic	Mean	Standard Deviation (n)
Tree Ht (m)	13.6	2.46
Tree Density (/ha)	830	
Tree DBH (cm)	41.9	14.98
% hollows	30	
Shrub Density (/ha)	498	
Shrub Ht (cm)	151.7	61.13
Sapling Density (/ha)	0	
Sapling Ht (m)		
Stag Density (/ha)	166	
Stag Ht (m)	3.5	0.71
% grass	36.0	31.89
% forb	14.0	8.22
% rocks	4.0	6.52
% sticks	16.4	14.66
Grass Ht (cm)	11.8	7.69
Forb Ht (cm)	14.0	8.22
% litter	70.0	24.34
Litter Weight (g/m^2)	648.0	369.2
% log cover	0.72	

Site 12 (774154E; 6415962S)

Located at the south-eastern end of the study area, this site is on level ground close to Wollar Road and Upper Cumbo Road. The land slopes up to a low hill at the eastern edge of the site. The site has been logged and grazed in the past, but is not actively disturbed at present. A track passes through the middle of the site. The overstorey is dominanted by Grey Box.

Habitat Characteristic	Mean	Standard Deviation (n)
Tree Ht (m)	12.6	2.61
Tree Density (/ha)	948	
Tree DBH (cm)	36.7	7.71
% hollows	67	
Shrub Density (/ha)	1343	
Shrub Ht (cm)	117.1	29.1
Sapling Density (/ha)	0	
Sapling Ht (m)		
Stag Density (/ha)	158	
Stag Ht (m)	12	2.8
% grass	21	18.5
% forb	18.2	20.08
% rocks	0	
% sticks	16	4.2
Grass Ht (cm)	20	14.6
Forb Ht (cm)	18.2	20.08
% litter	89	15.2
Litter Weight (g/m^2)	600	316.2
% log cover	0.78	

SPRING SURVEY:

Site 1 (774243E; 6415830N)

This site is located at the southern edge of pit 3, close to Wollar Road. Overstorey species include Grey Box (on level ground) and White Box and Black Cypress Pine on the lower slopes of the sandstone hill to the east. The habitat characteristics were similar to those measured in autumn site 12.

Site 2 (774048E; 6416333N)

This site is located slightly north of spring site 1 and overstorey species include Grey Box,White Box and Black Cypress Pine. The habitat characteristics were similar to that measured in autumn site 12.

Site 3 (774023E; 6416666N)

Still within pit 3, site 3 was located further up the slope of the sandstone hill. Overstorey species include White Box and Black Cypress Pine.

Site 4 (774109E; 6417768N)

Site 4 is located at the eastern edge of pit 3 close to a borehole. Overstorey species include Grey Box and Narrow-leaved Ironbark that had been logged in the past.

Site 5 (773700E; 6417412N)

Site 5 is located within an open area that had been cleared in the past and was regenerating. The area supported several large Narrow-leaved Ironbark trees in flower, with a dense understorey of shrubs. Dominant overstorey species include Narrow-leaved Ironbark, Black Cypress Pine and Grey Box.

Site 6 (773890E; 6418280N)

Also located at the eastern edge of pit 3, site 6 sampled part of a steep slope on the edge of the sandstone hill. Dominant overstorey species include Grey Box, Narrow-leaved Ironbark, White Box and Black Cypress Pine and comprises scattered trees with a sparse understorey. There are numerous sandstone outcrops within the site.

Site 7 (774172E; 6418734N)

Site 7 is located within a narrow valley beside a steep slope on the edge of the sandstone hill outside pit 3. Overstorey species include Grey Gum and Broad-leaved Ironbark. The site comprises a steep hill with a cliffline and rocky gully on the edge of cleared land.

Site 8 (770080E; 6418180N)

Site 8 is within pit 1 and located close to site 8 used in the autumn survey. The site was at the northern edge of a small hill with Rough-barked Apple and Narrow-leaved Ironbark. The site was partially cleared and contained an abandoned dwelling. Many of the mature trees surveyed during the autumn survey had been logged in the period between the two surveys.

Site 9 (767098E; 6415090N)

Site 9 is located at the southern end of a narrow valley in the Wyangle property and is outside pit 5. The site comprised some cleared land surrounded by steep slopes. White Box and Black Cypress Pine are dominant overstorey species.

Habitat Characteristic	Mean	Standard Deviation (n)
Tree Ht (m)	14.1	3.14
Tree Density (/ha)	667	
Tree DBH (cm)	48.5	19.14
% hollows	25	
Shrub Density (/ha)	1000	
Shrub Ht (cm)	187	31.4
Sapling Density (/ha)	167	
Sapling Ht (m)	4.0	1.41
Stag Density (/ha)	250	
Stag Ht (m)	6.7	2.89
% grass	30.0	33.73
% forb	11.0	7.62
% rocks	2.4	2.51
% sticks	9.0	4.18
Grass Ht (cm)	11.0	7.62
Forb Ht (cm)	6.6	2.88
% litter	86	11.4
Litter Weight (g/m^2)	688	332
% log cover	1.03	

Site 10 (766958E; 6419143N)

Site 10 is also outside pit 5 and was located close to autumn site 5 within a narrow valley between steep hills. The valley floor is cleared but the hill slopes supported White Box, Black Cypress Pine and Grey Gum. The vegetation has been logged in the past and the area was grazed by cattle.

Site 11 (772348E; 6417917N)

This site sampled a length of Cumbo Creek and its surrounds. The land has been cleared with a few scattered old trees indicating the original vegetation cover of Yellow Box and Blakely's Red Gum. The edges of the creek support dense stands of rushes. The site is outside of any proposed pits, but is close to the proposed mine access road.

Site 12 (773978E; 6418844N)

Site 12 is located at a small dam within cleared paddocks. The site is close to a steep hill just outside pit 3. The small dam was observed in the late afternoon/evening.

Site 13 (770759E; 6419890N)

Site 13 along with and site 23 sample a small hill to the north of Wilpinjong Creek. The steep slopes support Sandstone Range Communities. The land at the base of the hill is cleared and grazed. There are several clifflines on the upper slope. The site is outside the Project disturbance area.

Site 14 (768967E; 6417021N)

Site 14 samples a steep hill slope just outside pit 1. The base of the hill has been cleared and contains regrowth shrubs. The steep slope supports White Box and Black Cypress Pine and contains some scattered rocky outcrops.

Site 15 (773810E; 6416289N)

Located outside pit 3, the overstorey of site 15 includes Grey Box, which has been logged. The site incorporated a small dam that was observed during the late afternoon/evening.

Site 16 (768982E; 6417295N)

Site 16 is located close to site 14 and also samples a steep hill slope just outside pit 1. The base of the hill has been cleared and contains regrowth shrubs. The steep slope supports White Box and Black Cypress Pine and contains some scattered rocky outcrops.

Habitat Characteristic	Mean	Standard Deviation (n)
Tree Ht (m)	10.3	1.77
Tree Density (/ha)	1272	
Tree DBH (cm)	21.1	9.12
% hollows	7.1	
Shrub Density (/ha)	1182	
Shrub Ht (cm)	122.3	53.49
Sapling Density (/ha)	545	
Sapling Ht (m)	4.6	0.92
Stag Density (/ha)	0	
Stag Ht (m)		
% grass	12.0	10.95
% forb	6.4	6.11
% rocks	4.2	6.38
% sticks	5.2	3.19
Grass Ht (cm)	13.6	6.58
Forb Ht (cm)	11.7	15.65
% litter	64	11.4
Litter Weight (g/m^2)	480	146.3
% log cover	0.24	

Site 17 (767514E; 6415822N)

Site 17 is located just on the southern edge of pit 5 and close to autumn site 6 and comprises partly cleared Rough-barked Apple and grassland as well as a small dam.

Site 18 (773433E; 6417448N)

Site 18 is at the western edge of pit 3. Overstorey species include Blakely's Red Gum. Most trees were relatively young and there was a dense shrubby understorey.

Habitat Characteristic	Mean	Standard Deviation (n)
Tree Ht (m)	11.7	1.87
Tree Density (/ha)	1500	
Tree DBH (cm)	24.2	14.64
% hollows	0	
Shrub Density (/ha)	2250	
Shrub Ht (cm)	142.2	28.61
Sapling Density (/ha)	1125	
Sapling Ht (m)	5.4	1.33
Stag Density (/ha)	125	
Stag Ht (m)	10.0	
% grass	62.0	21.68
% forb	8.0	6.71
% rocks	0	
% sticks	5.4	2.88
Grass Ht (cm)	22.4	18.93
Forb Ht (cm)	9.4	4.83
% litter	94	13.42
Litter Weight (g/m^2)	332	41.5
% log cover	0.362	

Site 19 (773444E; 6416818N)

Site 19 is outside pit 3 within an area containing Narrow-leaved Ironbark and Black Cypress Pine. The area has been previously cleared and most trees are relatively young, but there are numerous older trees and a dense shrubby understorey.

Habitat Characteristic	Mean	Standard Deviation (n)
Tree Ht (m)	12.7	2.12
Tree Density (/ha)	667	
Tree DBH (cm)	39.7	16.23
% hollows	12.5	
Shrub Density (/ha)	1083	
Shrub Ht (cm)	119.6	34.12
Sapling Density (/ha)	167	
Sapling Ht (m)	1.6	
Stag Density (/ha)	167	
Stag Ht (m)	6.0	
% grass	57.0	33.47
% forb	7.4	3.71
% rocks	0	
% sticks	10.4	11.33
Grass Ht (cm)	10.6	3.78
Forb Ht (cm)	4.6	1.67
% litter	100	
Litter Weight (g/m^2)	428	183.6
% log cover	0.554	

Site 20 (774265E; 6416805N)

Located within pit 3, the overstorey of site 20 has been logged and includes White Box and Black Cypress Pine on the lower slopes of a sandstone range.

Habitat Characteristic	Mean	Standard Deviation (n)
Tree Ht (m)	11.8	2.09
Tree Density (/ha)	1100	
Tree DBH (cm)	27.4	9.89
% hollows	9.1	
Shrub Density (/ha)	1100	
Shrub Ht (cm)	158.4	35.85
Sapling Density (/ha)	0	
Sapling Ht (m)		
Stag Density (/ha)	300	
Stag Ht (m)	6.7	3.05
% grass	38.0	32.71
% forb	7.4	3.71
% rocks	0	
% sticks	14.0	6.52
Grass Ht (cm)	7.4	2.51
Forb Ht (cm)	5.4	4.34
% litter	92	17.9
Litter Weight (g/m^2)	516	125.2
% log cover	0.841	

Site 21 (773870E; 6416156N)

Located outside pit 3, site 21 is close to site 15. Overstorey species include Grey Box.

Habitat Characteristic	Mean	Standard Deviation (n)
Tree Ht (m)	13.0	2.38
Tree Density (/ha)	583	
Tree DBH (cm)	34.1	11.29
% hollows	29	
Shrub Density (/ha)	1916	
Shrub Ht (cm)	141	95.9
Sapling Density (/ha)	167	
Sapling Ht (m)	3.2	2.55
Stag Density (/ha)	0	
Stag Ht (m)		
% grass	23	12.04
% forb	3.4	2.3
% rocks	0	
% sticks	9.4	6.84
Grass Ht (cm)	7.0	1.73
Forb Ht (cm)	6.0	4.24
% litter	100	0
Litter Weight (g/m^2)	592	83.2
% log cover	0.417	

Site 22 (768797E; 6418139N)

Site 22 is located at the side and top of the range extending from Munghorn Gap Nature Reserve and is outside pit 1 and 5. The vegetation comprises mainly Sandstone Range Communities on the top with logged White Box and Black Cypress Pine on the slopes. There are numerous clifflines on the upper slopes.

Habitat Characteristic	Mean	Standard Deviation (n)
Tree Ht (m)	12.8	2.82
Tree Density (/ha)	1625	
Tree DBH (cm)	37	15.8
% hollows	46	
Shrub Density (/ha)	3625	
Shrub Ht (cm)	125.8	47.83
Sapling Density (/ha)	125	
Sapling Ht (m)	9	
Stag Density (/ha)	250	
Stag Ht (m)	7.0	7.07
% grass	25.4	21.23
% forb	8	8.4
% rocks	0	
% sticks	9.4	6.84
Grass Ht (cm)	4.0	1.41
Forb Ht (cm)	7.3	5.03
% litter	78	28.4
Litter Weight (g/m^2)	620	196.5
% log cover	0.72	

Site 23 (770507E; 6419987N)

Located on the mid to upper slope of a steep hill to the north of Wilpinjong Creek, site 23 is close to autumn site 13. The vegetation comprises mainly Sandstone Range Communities with cleared land at the base of the hill and some pools of water in the Creek.

Habitat Characteristic	Mean	Standard Deviation (n)
Tree Ht (m)	9.5	1.29
Tree Density (/ha)	1571	
Tree DBH (cm)	27.6	11.45
% hollows	9.1	
Shrub Density (/ha)	2999	
Shrub Ht (cm)	107.3	42.11
Sapling Density (/ha)	428	
Sapling Ht (m)	5.7	1.53
Stag Density (/ha)	0	
Stag Ht (m)		
% grass	20.4	20.45
% forb	19	28.8
% rocks	24	26.1
% sticks	4.6	3.51
Grass Ht (cm)	17.5	9.71
Forb Ht (cm)	17	7.48
% litter	64	25.1
Litter Weight (g/m^2)	472	157.9
% log cover	0.06	

ATTACHMENT HB-B

SURVEY EFFORT UNDERTAKEN AT EACH AUTUMN SURVEY SITE

Attachment HB-B
Survey Effort Undertaken at Each Survey Site during the Autumn Survey

Method	1	2	3	4	5	6	7	8	9	10	11	12	13
Elliott Type A on Ground (TN)	100	100	100	100	100	100	100	100	100	100	100	100	NA
Elliott Type B (TN)	8	8	8	8	8	8	8	8	8	8	8	8	NA
Tree Elliotts (TN)	92	24	24	24	28	24	24	24	28	24	24	24	NA
Large Cage Traps (TN)	8	8	8	8	8	8	8	8	8	8	8	8	NA
Tomahawk Traps on Ground (TN)	12	12	12	12	8	8	8	8	12	8	20	16	NA
Tree Tomahawks	12	16	16	16	20	20	20	20	16	20	16	16	NA
Hair Funnels (TN)	32	24	32	32	32	32	32	32	32	32	40	24	NA
Pitfall Traps (TN)	-	20	24	-	-	-	-	-	-	-	-	30	NA
Herpetological Searches (hours)	2 x 0.5	2 x 0.5	2 x 0.5	2 x 0.5	2 x 0.5	2 x 0.5	2 x 0.5	2 x 0.5	2 x 0.5	2 x 0.5	2 x 0.5	2 x 0.5	-
Bird Surveys (hours)[1]	4 x 0.5	4 x 0.5	4 x 0.5	4 x 0.5	4 x 0.5	4 x 0.5	4 x 0.5	4 x 0.5	4 x 0.5	4 x 0.5	4 x 0.5	4 x 0.5	4 x 0.5
Sand Plots (PN)	24	24	24	24	24	24	24	24	24	24	24	24	24

TN Trap Nights
PN Plot Nights
[1] Note that the table only outlines the formal bird surveys undertaken at autumn survey sites 1 to 12. It does not include the 20 minute bird surveys undertaken at dams/creeks, nor opportunistic sightings (refer Section HB2.3.1.5).

ATTACHMENT HB-C

FAUNA RECORDED WITHIN THE STUDY AREA BY THE AUTUMN SURVEY

Attachment HB-C
Terrestrial Fauna Recorded Within the Study Area by the Autumn Survey

Common Name	Scientific Name	Survey Site												
		1	2	3	4	5	6	7	8	9	10	11	12	13
Amphibians[1]														
Long-thumbed Frog	*Limnodynastes fletcheri*													X
Striped Marsh Frog	*Limnodynastes peronii*													X
Common Eastern Froglet	*Crinia signifera*													X
Reptiles[2]														
Eastern Snake-necked Turtle	*Chelodina longicollis*		X											X
Jacky Lashtail	*Amphibolurus muricatus*													X
Eastern Bearded Dragon	*Pogona barbata*													X
Common Dtella	*Gehra variegata*		X											
Lace Monitor	*Varanus varius*	X												
Litter Skink	*Carlia folioforum*								X	X				
Copper-tailed Ctenotus	*Ctenotus taeniolatus*												X	
Grass Sun-Skink	*Lampropholis guichenoti*				X					X				
Prong-snouted Blind Snake	*Ramphotyphlops bituberculata*												X	
Blackish Blind Snake	*Ramphotyphlops nigrescens*												X	
Red-bellied Black Snake	*Pseudechis porphyriacus*													X
Eastern Brown Snake	*Pseudonaja textilis*													X
Birds[3]														
Emu	*Dromaius novaehollandiae*							X						X
Pacific Black Duck	*Anas superciliosa*								X					X
Australian Wood Duck	*Chenonetta jubata*										X			X
White-faced Heron	*Egretta novaehollandiae*	X	X											
Wedge-tailed Eagle	*Aquila audax*									X	X			
Swamp Harrier	*Circus approximans*								X					X
Black-shouldered Kite	*Elanus axillaris*													X
Whistling Kite	*Haliastur sphenurus*								X					
Square-tailed Kite [V]	*Lophoictinia isura*			X							X			
Brown Falcon	*Falco berigora*													X
Nankeen Kestrel	*Falco cenchroides*	X			X						X	X		X
Peregrine Falcon	*Falco peregrinus*								X					X

Attachment HB-C (Continued)
Terrestrial Fauna Recorded Within the Study Area by the Autumn Survey

Common Name	Scientific Name	Survey Site												
		1	2	3	4	5	6	7	8	9	10	11	12	13
Birds (Continued)														
Black Falcon	*Falco subniger*													X
Masked Lapwing	*Vanellus miles*													X
Peaceful Dove	*Geopelia placida*									X				
Crested Pigeon	*Ocyphaps lophotes*	X						X			X			
Common Bronzewing	*Phaps chalcoptera*	X			X	X	X	X	X	X	X	X		X
Sulphur-crested Cockatoo	*Cacatua galerita*	X					X	X	X			X	X	X
Gang-gang Cockatoo	*Callocephalon fimbriatum*						X							
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*						X							
Glossy Black-Cockatoo [V]	*Calyptorhynchus lathami*					X							X	
Galah	*Eolophus roseicapillus*	X		X	X	X			X	X	X	X		X
Australian King-Parrot	*Alisterus scapularis*				X					X		X		
Turquoise Parrot [V]	*Neophema pulchella*											X		
Eastern Rosella	*Platycercus adscitus eximius*	X		X	X	X	X	X	X	X	X	X		X
Red-rumped Parrot	*Psephotus haematonotus*	X	X		X	X			X	X	X	X		X
Little Lorikeet	*Glossopsitta pusilla*								X					
Pallid Cuckoo	*Cuculus pallidus*											X		
Southern Boobook	*Ninox novaeseehollandiae*													X
Barn Owl	*Tyto alba*									X				
Tawny Frogmouth	*Podargus strigoides*													X
White-throated Nightjar	*Eurostopodus mystacalis*								X					
Australian Owlet-nightjar	*Aegotheles cristatus*													X
Laughing Kookaburra	*Dacelo novaeguineae*	X	X	X		X	X	X			X	X	X	X
Superb Lyrebird	*Menura novaehollandiae*						X							X
Brown Treecreeper	*Climacteris picumnus victoriae*	X	X			X	X	X	X	X		X	X	X
White-throated Treecreeper	*Cormobates leucophaeus*		X											
Superb Fairy-wren	*Malurus cyaneus*		X			X	X	X	X			X		X
Variegated Fairy-wren	*Malurus lamberti*		X			X						X		
Spotted Pardalote	*Pardalotus punctatus*											X		

Attachment HB-C (Continued)
Terrestrial Fauna Recorded Within the Study Area by the Autumn Survey

Common Name	Scientific Name	Survey Site												
		1	2	3	4	5	6	7	8	9	10	11	12	13
Birds (Continued)														
Striated Thornbill	*Acanthiza lineata*	X							X			X		
Yellow Thornbill	*Acanthiza nana*			X		X	X		X				X	X
Buff-rumped Thornbill	*Acanthiza reguloides*			X										
Inland Thornbill	*Acanthiza apicalis*					X								
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	X	X			X	X		X	X		X	X	X
Southern Whiteface	*Aphelocephala leucopsis*													X
Chestnut-rumped Heathwren	*Calamanthus pyrrhopygius*		X											
Western Gerygone	*Gerygone fusca*													X
Rockwarbler	*Origma solitaria*											X		
Speckled Warbler [V]	*Pyrrholaemus sagittatus*											X		
Eastern Spinebill	*Acanthorhynchus tenuirostris*						X							
Fuscous Honeyeater	*Lichenostomus fuscus*									X			X	
White-eared Honeyeater	*Lichenostomus leucotis*						X							
Yellow-tufted Honeyeater	*Lichenostomus melanops*						X							
White-plumed Honeyeater	*Lichenostomus penicillatus*		X		X			X	X	X		X	X	
Noisy Miner	*Manorina melanocephala*	X		X	X	X	X	X	X	X	X	X	X	X
Black-chinned Honeyeater [V]	*Melithreptus gularis gularis*					X							X	
Little Friarbird	*Philemon citreogularis*		X	X									X	
White-cheeked Honeyeater	*Phylidonyris nigra*												X	
Eastern Yellow Robin	*Eopsaltria australis*	X	X	X		X			X					
Hooded Robin [V]	*Melanodryas cucullata*		X											X
Jacky Winter	*Microeca fascinans*		X	X		X			X	X		X		X
White-browed Babbler	*Pomatostomus superciliosus*	X		X		X	X			X		X	X	
Grey Shrike-thrush	*Colluricincla harmonica*		X						X	X		X	X	
Golden Whistler	*Pachycephala pectoralis*			X					X					
Rufous Whistler	*Pachycephala rufiventris*		X								X		X	
Magpie-lark	*Grallina cyanoleuca*	X		X		X	X	X	X		X			X
Restless Flycatcher	*Myiagra inquieta*									X				X
Willie Wagtail	*Rhipidura leucophrys*	X		X		X	X	X	X	X		X		

Attachment HB-C (Continued)
Terrestrial Fauna Recorded Within the Study Area by the Autumn Survey

Common Name	Scientific Name	Survey Site												
		1	2	3	4	5	6	7	8	9	10	11	12	13
Birds (Continued)														
Dusky Woodswallow	*Artamus cyanopterus*		X			X				X				X
Masked Woodswallow	*Artamus personatus*		X											X
Pied Butcherbird	*Cracticus nigrogularis*						X		X			X		X
Grey Butcherbird	*Cracticus torquatus*											X		X
Australian Magpie	*Gymnorhina tibicen*	X	X	X	X	X	X	X	X	X	X	X	X	X
Pied Currawong	*Strepera graculina*			X			X					X	X	
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	X	X	X		X			X	X		X		X
White-bellied Cuckoo-shrike	*Coracina papuensis*									X				X
Australian Raven	*Corvus coronoides*				X	X			X		X		X	
Little Raven	*Corvus mellori*					X	X		X		X	X	X	X
White-winged Chough	*Corcorax melanorhamphos*	X	X				X	X	X	X	X	X	X	X
Apostlebird	*Struthidea cinerea*													X
Satin Bowerbird	*Ptilonorhynchus violaceus*						X					X		
Common Starling (I)	*Sturnus vulgaris*	X												X
Welcome Swallow	*Hirundo neoxena*		X		X				X		X	X		X
Fairy Martin	*Petrochelidon ariel*													X
Mistletoebird	*Dicaeum hirundinaceum*												X	
Australian Pipit	*Anthus australis*	X				X			X					X
Red-browed Finch	*Neochmia temporalis*		X						X					X
Beautiful Firetail	*Stagonopleura bella*								X					
Diamond Firetail [V]	*Stagonopleura guttata*	X	X	X		X			X	X		X		
Double-barred Finch	*Taeniopygia bichenovii*		X			X						X		
Mammals[4]														
Short-beaked Echidna	*Tachyglossus aculeatus*		X		X	X		X			X		X	
Yellow-footed Antechinus	*Antechinus flavipes*	X	X	X			X		X	X	X	X	X	
Sugar Glider	*Petaurus breviceps*							X						
Squirrel Glider [V]	*Petaurus norfolcensis*									X				

Attachment HB-C (Continued)
Terrestrial Fauna Recorded Within the Study Area by the Autumn Survey

Common Name	Scientific Name	Survey Site												
		1	2	3	4	5	6	7	8	9	10	11	12	13
Mammals (Continued)														
Common Brushtail Possum	*Trichosurus vulpecula*	X	X	X	X			X		X	X	X		
Common Ringtail Possum	*Pseudocheirus peregrinus*					X	X				X			
Common Wombat	*Vombatus ursinus*	X	X	X	X	X	X		X		X	X	X	X
Eastern Grey Kangaroo	*Macropus giganteus*	X	X	X	X	X	X	X	X	X	X	X	X	X
Common Wallaroo	*Macropus robustus*				X	X	X	X			X			X
Red-necked Wallaby	*Macropus rufogriseus*		X	X	X				X					
Swamp Wallaby	*Wallabia bicolor*						X							
Southern Bush Rat	*Rattus fuscipes*											X		
Black Rat (I)	*Rattus rattus*							X						
Dog (I)	*Canis familiaris*												X	
Red Fox (I)	*Vulpes vulpes*	X	X	X	X	X	X		X	X	X	X	X	X
Cat (I)	*Felis catus*					X			X					X
Goat (I)	*Capra hircus*				X					X				
Feral Pig (I)	*Sus scrofa*						X							
European Cattle (I)	*Bos taurus*	X			X	X	X	X	X	X	X	X		X
Rabbit (I)	*Oryctolagus cuniculus*	X	X	X		X	X	X	X	X	X	X		X

[1] Nomenclature for amphibian species in accordance with Robinson (1993)
[2] Nomenclature for reptile species in accordance with Swan *et al.* (2003)
[3] Nomenclature for bird species in accordance with Pizzey and Knight (2003) and Schodde and Mason (1999)
[4] Nomenclature for mammal species in accordance with Menkhorst (2001)
(I) Introduced species
[V] Listed as Vulnerable under the NSW *Threatened Species Conservation Act, 1995*

ATTACHMENT HB-D

FAUNA RECORDED WITHIN THE STUDY AREA BY THE SPRING SURVEY

Attachment HB-D
Terrestrial Fauna Recorded Within the Study Area by the Spring Survey

Common Name	Scientific Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Opportunistic Observations
Amphibians[1]																									
Broad-palmed Frog	*Litoria latopalmata*		X	X								X		X		X						X		X	
Rocket Frog	*Litoria nasuta*											X													
Peron's Tree Frog	*Litoria peronii*		X	X				X				X	X			X						X	X		
Common Eastern Froglet	*Crinia signifera*																								X
Reptiles[2]																									
Eastern Snake-necked Turtle	*Chelodina longicollis*		X	X				X					X			X						X			
Eastern Bearded Dragon	*Pogona barbata*																								X
Two-clawed Worm-skink	*Anomalopus leuckartii*					X						X							X						
Southern Rainbow Skink	*Carlia tetradactyla*					X													X						
Litter Skink	*Carlia foliorum*										X														
Dark-flecked Garden Sunskink	*Lampropholis delicata*		X	X												X						X			
Southern Lerista	*Lerista bougainvillii*	X	X													X						X			
Common Dwarf Skink	*Menetia greyii*								X																
Birds[3]																									
Emu	*Dromaius novaehollandiae*									X				X										X	
Pacific Black Duck	*Anas superciliosa*							X					X												
Australian Wood Duck	*Chenonetta jubata*							X					X												
Australasian Grebe	*Tachybaptus novaehollandiae*							X					X												
White-faced Heron	*Egretta novaehollandiae*											X		X										X	
Brown Goshawk	*Accipiter fasciatus*							X					X												
Grey Goshawk	*Accipiter novaehollandiae*									X															
Little Eagle	*Hieraaetus morphnoides*							X					X												
Nankeen Kestrel	*Falco cenchroides*						X	X				X	X												
Peregrine Falcon	*Falco peregrinus*																X								
Painted Button-quail	*Turnix varia*	X	X													X						X			
Masked Lapwing	*Vanellus miles*																								X
Crested Pigeon	*Ocyphaps lophotes*							X					X		X		X								
Common Bronzewing	*Phaps chalcoptera*							X						X	X		X	X					X	X	

Attachment HB-D (Continued)
Terrestrial Fauna Recorded Within the Study Area by the Spring Survey

Common Name	Scientific Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Opportunistic Observations
Birds (Continued)																									
Sulphur-crested Cockatoo	*Cacatua galerita*	X	X	X	X	X		X		X			X	X	X	X	X		X			X		X	
Galah	*Eolophus roseicapillus*	X										X		X	X		X	X				X	X		
Australian King-Parrot	*Alisterus scapularis*							X					X		X		X								
Little Lorikeet	*Glossopsitta pusilla*	X																				X			
Eastern Rosella	*Platycercus adscitus eximius*		X	X				X		X		X	X	X	X		X	X			X		X	X	
Red-rumped Parrot	*Psephotus haematonotus*					X			X			X							X				X		
Fan-tailed Cuckoo	*Cacomantis flabelliformis*									X															
Pallid Cuckoo	*Cuculus pallidus*									X															
Horsefield's Bronze-Cuckoo	*Chalcites basalis*									X														X	
Southern Boobook	*Ninox novaeseelandiae*		X	X						X						X						X			
Masked Owl[V]	*Tyto novaehollandiae*																								X
Tawny Frogmouth	*Podargus strigoides*														X		X								
White-throated Nightjar	*Eurostopodus mystacalis*									X															
Laughing Kookaburra	*Dacelo novaeguineae*		X	X	X	X	X		X	X						X		X	X	X		X	X		
Sacred Kingfisher	*Todiramphus sanctus*							X					X												
Rainbow Bee-eater	*Merops ornatus*		X	X					X					X		X						X		X	
Superb Lyrebird	*Menura novaehollandiae*																						X		
Brown Treecreeper	*Climacteris picumnus*		X	X					X	X				X				X		X	X				
White-throated Treecreeper	*Cormobates leucophaeus*		X	X							X					X						X			
Superb Fairy-wren	*Malurus cyaneus*					X			X			X		X					X					X	
Variegated Fairy-wren	*Malurus lamberti*					X			X					X				X	X					X	
Spotted Pardalote	*Pardalotus punctatus*		X	X												X						X			
Striated Pardalote	*Pardalotus striatus*																						X		
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*		X	X				X					X			X						X	X		
Striated Thornbill	*Acanthiza lineata*						X	X																	
Yellow Thornbill	*Acanthiza nana*		X	X			X									X						X			
Brown Thornbill	*Acanthiza pusilla*		X	X			X									X						X			
Buff-rumped Thornbill	*Acanthiza reguloides*			X			X							X	X		X				X	X			
Chestnut-rumped Thornbill	*Acanthiza uropygialis*		X	X																	X				

Attachment HB-D (Continued)
Terrestrial Fauna Recorded Within the Study Area by the Spring Survey

Common Name	Scientific Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Opportunistic Observations
Birds (Continued)																									
Southern Whiteface	*Aphelocephala leucopsis*		X	X			X									X						X			
White-throated Gerygone	*Gerygone olivacea*					X		X					X						X						
Rockwarbler	*Origma solitaria*						X																		
Pilotbird	*Pycnoptilus floccosus*																						X		
Speckled Warbler[V]	*Pyrrholaemus sagittatus*					X													X						
Red Wattlebird	*Anthochaera carunculata*																						X		
Painted Honeyeater[V]	*Grantiella picta*	X																				X			
Yellow-faced Honeyeater	*Lichenostomus chrysops*													X											
White-eared Honeyeater	*Lichenostomus leucotis*		X	X												X					X				
Yellow-tufted Honeyeater	*Lichenostomus melanops*									X															
White-plumed Honeyeater	*Lichenostomus penicillatus*								X											X			X		
Brown Honeyeater	*Lichmera indistincta*	X	X													X						X			
Noisy Miner	*Manorina melanocephala*		X	X					X						X	X	X					X			
Little Friarbird	*Philemon citreogularis*		X	X																	X				
Noisy Friarbird	*Philemon corniculatus*		X	X			X	X	X				X	X	X	X	X	X		X	X	X		X	
Eastern Yellow Robin	*Eopsaltria australis*	X												X								X			
Hooded Robin[V]	*Melanodryas cucullata*					X													X						
Jacky Winter	*Microeca fascinans*								X										X						
White-browed Babbler	*Pomatostomus superciliosus*																			X					
Spotted Quail-thrush	*Cinclosoma punctatum*				X	X													X						
Grey Shrike-thrush	*Colluricincla harmonica*	X	X	X												X				X	X	X			
Rufous Whistler	*Pachycephala rufiventris*		X	X		X	X		X		X			X	X	X	X		X		X	X	X		
Magpie-lark	*Grallina cyanoleuca*							X		X			X					X					X		
Satin Flycatcher	*Myiagra cyanoleuca*	X																				X			
Grey Fantail	*Rhipidura albiscapa*	X	X				X			X				X	X	X	X					X	X		
Willie Wagtail	*Rhipidura leucophrys*	X	X			X		X	X	X	X	X	X			X	X	X	X	X		X	X		
Rufous Fantail	*Rhipidura rufifrons*	X					X																		
Dusky Woodswallow	*Artamus cyanopterus*					X												X	X						

Attachment HB-D (Continued)
Terrestrial Fauna Recorded Within the Study Area by the Spring Survey

Common Name	Scientific Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Opportunistic Observations
Birds (Continued)																									
White-browed Woodswallow	*Artamus superciliosus*					X												X	X						
Black-faced Woodswallow	*Artamus cinereus*					X													X						
Pied Butcherbird	*Cracticus nigrogularis*								X			X													
Australian Magpie	*Gymnorhina tibicen*		X	X	X	X	X		X			X			X	X	X	X	X	X		X	X		
Pied Currawong	*Strepera graculina*	X	X		X			X		X			X		X	X	X					X			
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	X	X				X	X	X			X	X		X	X	X					X			
White-winged Triller	*Lalage tricolor*																	X							
Olive-backed Oriole	*Oriolus sagittatus*														X		X								
Australian Raven	*Corvus coronoides*																						X		
White-winged Chough	*Corcorax melanorhamphos*	X	X	X	X	X	X		X		X			X	X	X	X		X	X		X			
Common Starling(I)	*Sturnus vulgaris*											X													
Welcome Swallow	*Hirundo neoxena*								X	X								X							
Fairy Martin	*Petrochelidon ariel*													X				X					X		
Tree Martin	*Petrochelidon nigricans*					X	X											X	X						
Brown Songlark	*Cincloramphus cruralis*																		X						
Australian Reed-Warbler	*Acrocephalus australis*											X													
Singing Bushlark	*Mirafra javanica*																								X
Australian Pipit	*Anthus australis*											X						X							
Red-browed Finch	*Neochmia temporalis*								X																
Diamond Firetail[V]	*Stagonopleura guttata*			X					X												X				
Double-barred Finch	*Taeniopygia bichenovii*													X										X	
Mammals[4]																									
Short-beaked Echidna	*Tachyglossus aculeatus*					X	X								X		X		X	X					
Yellow-footed Antechinus	*Antechinus flavipes*						X																		
Common Brushtail Possum	*Trichosurus vulpecula*		X	X	X	X										X			X	X	X	X			
Common Ringtail Possum	*Pseudocheirus peregrinus*	X	X	X												X				X	X	X			
Common Wombat	*Vombatus ursinus*	X	X	X		X		X	X	X	X	X	X	X	X		X		X	X	X		X	X	
Eastern Grey Kangaroo	*Macropus giganteus*	X		X	X	X	X	X	X	X		X			X		X	X					X	X	

Attachment HB-D (Continued)
Terrestrial Fauna Recorded Within the Study Area by the Spring Survey

Common Name	Scientific Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Opportunistic Observations
Mammals (Continued)																									
Common Wallaroo	*Macropus robustus*					X		X			X		X						X	X			X		
Red-necked Wallaby	*Macropus rufogriseus*		X	X	X	X			X					X		X			X	X		X	X	X	
Swamp Wallaby	*Wallabia bicolor*					X													X						
House Mouse(I)	*Mus musculus*									X															
Dog(I)	*Canis familiaris*								X														X		
Red Fox(I)	*Vulpes vulpes*													X	X		X						X	X	
Goat(I)	*Capra hircus*			X											X		X								
Feral Pig(I)	*Sus scrofa*	X	X													X						X			
Brown Hare(I)	*Lepus capensis*														X		X								
Rabbit(I)	*Oryctolagus cuniculus*	X	X	X				X	X				X	X			X	X		X	X	X	X	X	

[1] Nomenclature for amphibian species in accordance with Robinson (1993)
[2] Nomenclature for reptile species in accordance with Swan *et al.* (2003)
[3] Nomenclature for bird species in accordance with Pizzey and Knight (2003) and Schodde and Mason (1999)
[4] Nomenclature for mammal species in accordance with Menkhorst (2001)
(I) Introduced species
[V] Listed as Vulnerable under the NSW *Threatened Species Conservation Act, 1995*

ATTACHMENT HB-E

FAUNA RECORDS FROM THE SURROUNDING REGION

Attachment HB-E
Fauna Records from the Surrounding Region

Scientific Name	Common Name[1]	Atlas Records[2]	GRNP[3]	MGNR[4]	Donachy[5]	Ulan Coal Mines[6]
Amphibians						
Litoria caerulea	Green Tree Frog	X	X		X	
Litoria fallax	Eastern Dwarf Tree Frog	X	X		X	
Litoria latopalmata	Broad-palmed Frog	X	X		X	X
Litoria lesueuri	Lesueur's Frog	X	X		X	X
Litoria nasuta	Rocket Frog					X
Litoria peronii	Peron's Tree Frog	X	X	X	X	X
Litoria tyleri	Tyler's Tree Frog		X		X	X
Litoria verreauxii	Verreaux's Tree Frog	X		X	X	
Limnodynastes dumerilii	Eastern Banjo Frog	X	X	X	X	X
Limnodynastes fletcheri	Long-thumbed Frog	X				X
Limnodynastes ornatus	Ornate Burrowing Frog	X	X		X	X
Limnodynastes peronii	Striped Marsh Frog	X	X		X	X
Limnodynastes tasmaniensis	Spotted Marsh Frog	X	X		X	X
Limnodynastes terraereginae	Northern Banjo Frog	X	X		X	X
Neobatrachus sudelli	Painted Burrowing Frog	X	X	X	X	X
Pseudophryne bibronii	Bibron's Toadlet	X	X	X	X	X
Uperoleia fusca	Dusky Toadlet	X	X		X	X
Uperoleia laevigata	Smooth Toadlet	X	X		X	X
Uperoleia rugosa	Wrinkled Toadlet					X
Crinia signifera	Common Eastern Froglet	X	X	X	X	X
Mixophyes iteratus	Giant Barred Frog[V]	X			X	
Reptiles						
Chelodina longicollis	Eastern Snake-necked Turtle	X	X		X	X
Emydura signata			X			
Amphibolurus muricatus	Jacky Lashtail	X	X	X	X	X
Amphibolorus nobbi	Nobbi Dragon	X	X	X	X	X
Physignathus lesueurii	Eastern Water Dragon	X	X			X
Pogona barbata	Eastern Bearded Dragon	X	X	X	X	X
Pogona vitticeps	Central Bearded Dragon				X	
Rankinia diemensis	Mountain Heath Dragon	X	X	X		
Gehyra variegata	Common Dtella					X
Diplodactylus vittatus	Eastern Stone Gecko	X	X	X	X	X
Oedura lesueurii	Lesueur's Velvet Gecko	X	X	X	X	X
Oedura robusta	Robust Velvet Gecko	X			X	X
Phyllurus platurus	Broad-tailed Gecko	X	X	X		X
Underwoodisaurus milii	Thick-tailed Gecko	X	X	X	X	
Aprasia parapulchella	Pink-tailed Worm-lizard[V]	X	X			
Delma plebeia	Legless Lizard		X			
Pygopus lepidopodus	Southern Scaly-foot				X	
Lialis burtonis	Burton's Snake-lizard	X	X			X
Varanus rosenbergi	Rosenberg's Goanna[V]	X				
Varanus gouldii	Sand Monitor	X	X		X	X
Varanus varius	Lace Monitor	X	X		X	X
Anomalopus leuckartii	Two-clawed Worm-skink	X	X	X	X	X
Bassiana platynota	Red-throated Cool-skink	X	X	X		X

Attachment HB-E (Continued)
Fauna Records from the Surrounding Region

Scientific Name	Common Name[1]	Atlas Records[2]	GRNP[3]	MGNR[4]	Donachy[5]	Ulan Coal Mines[6]
Reptiles (Continued)						
Carlia tetradactyla	Southern Rainbow Skink	X	X	X	X	X
Carlia vivax	Tussock Rainbow Skink		X		X	
Cryptoblepharus virgatus	Cream-striped Shining-skink	X	X			X
Ctenotus robustus	Robust Ctenotus	X	X	X	X	X
Ctenotus taeniolatus	Copper-tailed Ctenotus	X	X	X	X	X
Ctenotus uber	Spotted Ctenotus	X				
Egernia cunninghami	Cunningham's Spiny-tailed Skink	X		X		X
Egernia modesta	Eastern Ranges Rock-skink	X	X			
Egernia striolata	Tree-crevice Skink	X				
Egernia whitii	White's Rock-skink	X	X	X	X	X
Egernia saxatilis	Black Rock Skink					X
Eulamprus quoyii	Eastern Water-skink		X		X	
Eulamprus tenuis	Bar-sided Forest-skink	X	X			X
Lampropholis delicata	Dark-flecked Garden Sunskink	X	X	X		X
Lampropholis guichenoti	Grass Sun-Skink	X			X	
Lerista bougainvillii	Southern Lerista	X	X	X		X
Lygisaurus foliorum	Tree-base Litter-skink	X	X			
Menetia greyii	Common Dwarf Skink	X	X		X	X
Morethia boulengeri	South-eastern Morethia Skink	X	X	X	X	X
Pseudemoia entrecasteauxii	Tussock Cool-skink	X				
Saproscincus mustelinus	Weasel Shadeskink	X				X
Tiliqua scincoides	Eastern Blue-tongued Lizard	X	X		X	X
Tiliqua rugosa	Shingleback Lizard	X			X	X
Ramphotyphlops bituberculata	Prong-snouted Blind Snake					X
Ramphotyphlops nigrescens	Blackish Blind Snake	X		X	X	
Ramphotyphlops proximus	Proximus Blind Snake	X				
Morelia spilota	Diamond Python	X	X			X
Boiga irregularis	Eastern Brown Tree Snake	X	X			
Acanthophis antarcticus	Southern Death Adder	X				
Brachyurophis australis	Eastern Shovel-nosed Snake	X		X		
Cacophis squamulosus	Golden-crowned Snake	X	X			
Cryptophilus nigrescens	Eastern Small-eyed Snake					X
Demansia psammophis	Yellow-faced Whipsnake	X	X		X	X
Furina diadema	Red-naped Snake	X	X		X	
Hoplocephalus bungaroides	Broad-headed Snake[E1]	X				
Pseudechis guttatus	Spotted Black Snake	X	X		X	
Pseudechis porphyriacus	Red-bellied Black Snake	X	X		X	X
Pseudonaja textilis	Eastern Brown Snake	X	X		X	X
Suta flagellum	Little Whip Snake[V]	X				
Suta spectabilis	Spectacled Hooded Snake	X		X		
Suta spectabilis dwyeri	Variable Black-naped Snake	X	X			
Vermicella annulata	Eastern Bandy-bandy	X	X	X		

Attachment HB-E (Continued)
Fauna Records from the Surrounding Region

Scientific Name	Common Name[1]	Atlas Records[2]	GRNP[3]	MGNR[4]	Donachy[5]	Ulan Coal Mines[6]
Birds						
Dromaius novaehollandiae	Emu	X	X	X	X	X
Alectura lathami	Australian Brush-turkey	X	X			
Leipoa ocellata	Malleefowl[E1]	X	X			
Coturnix pectoralis	Stubble Quail	X	X	X		X
Coturnix ypsilophora	Brown Quail	X	X	X	X	
Anas gracilis	Grey Teal	X	X	X		X
Anas castanea	Chestnut Teal					X
Anas rhynchotis	Australasian Shoveler	X				X
Anas superciliosa	Pacific Black Duck	X	X	X	X	X
Aythya australis	Hardhead			X		X
Chenonetta jubata	Australian Wood Duck	X	X	X	X	X
Cygnus atratus	Black Swan			X		X
Dendrocygna eytoni	Plumed Whistling-Duck					X
Malacorhynchus membranaceus	Pink-eared Duck	X				X
Oyxyura australis	Blue-billed Duck[V]					X
Poliocephalus poliocephalus	Hoary-headed Grebe			X		X
Tachybaptus novaehollandiae	Australasian Grebe	X	X	X		X
Anhinga melanogaster	Darter	X			X	X
Phalacrocorax carbo	Great Cormorant	X	X			X
Phalacrocorax melanoleucos	Little Pied Cormorant	X	X	X		X
Phalacrocorax sulcirostris	Little Black Cormorant	X	X	X		X
Phalacrocorax varius	Pied Cormorant	X	X			
Pelecanus conspicillatus	Australian Pelican	X		X	X	X
Ardea alba	Great Egret		X	X	X	X
Ardea ibis	Cattle Egret					X
Ardea pacifica	White-necked Heron	X	X	X	X	X
Egretta garzetta	Little Egret					X
Egretta novaehollandiae	White-faced Heron	X	X	X	X	X
Nycticorax caledonicus	Nankeen Night Heron	X		X		
Platelea flavipes	Yellow-billed Spoonbill	X	X	X	X	X
Platelea regia	Royal Spoonbill					X
Plegadis falcinellus	Glossy Ibis	X				
Threskiornis spinicollis	Straw-necked Ibis	X	X	X	X	X
Threskiornis molucca	Australian White Ibis	X		X		
Accipiter cirrocephalus	Collared Sparrowhawk	X	X	X		X
Accipiter fasciatus	Brown Goshawk	X	X	X		X
Accipiter novaehollandiae	Grey Goshawk	X		X		X
Aquila audax	Wedge-tailed Eagle	X	X	X	X	X
Circus assimilis	Spotted Harrier	X		X		X
Circus approximans	Swamp Harrier		X		X	X
Elanus axillaris	Black-shouldered Kite	X	X	X	X	X
Haliaeetus leucogaster	White-bellied Sea-Eagle	X	X			
Haliastur sphenurus	Whistling Kite	X	X	X	X	X
Hieraaetus morphnoides	Little Eagle	X	X	X	X	X
Lophoictinia isura	Square-tailed Kite[V]	X	X	X	X	
Milvus migrans	Black Kite	X		X		X

Attachment HB-E (Continued)
Fauna Records from the Surrounding Region

Scientific Name	Common Name[1]	Atlas Records[2]	GRNP[3]	MGNR[4]	Donachy[5]	Ulan Coal Mines[6]
Birds (Continued)						
Hamirostra melanosternon	Black-breasted Buzzard[V]	X				
Falco berigora	Brown Falcon	X	X	X	X	X
Falco cenchroides	Nankeen Kestrel	X	X	X	X	X
Falco longipennis	Australian Hobby	X	X	X	X	X
Falco peregrinus	Peregrine Falcon	X	X	X		X
Falco subniger	Black Falcon	X		X		
Fulica atra	Eurasian Coot	X	X	X	X	X
Gallinula tenebrosa	Dusky Moorhen	X	X	X	X	
Porphrio porphyrio	Purple Swamphen	X	X		X	X
Rallus pectoralis	Lewin's Rail	X		X		X
Turnix pyrrhothorax	Red-chested Button-quail	X		X		X
Turnix varia	Painted Button-quail	X	X	X		
Turnix velox	Little Button-quail	X		X		
Himantopus himantopus	Black-winged Stilt					X
Elseyornis cinctus	Red-kneed Dotterel					X
Elseyornis melanops	Black-fronted Dotterel	X	X	X		X
Vanellus miles	Masked Lapwing	X	X	X	X	X
Vanellus tricolor	Banded Lapwing	X	X	X		
Larus novaehollandiae	Silver Gull			X		X
Geopelia humeralis	Bar-shouldered Dove	X				
Geopelia placida	Peaceful Dove	X	X	X		X
Geopelia cuneata	Diamond Dove	X	X		X	X
Leucosarcia melanoleuca	Wonga Pigeon	X	X	X		
Macropygia amboinensis	Brown Cuckoo-Dove			X		
Ocyphaps lophotes	Crested Pigeon	X	X	X	X	X
Phaps chalcoptera	Common Bronzewing	X		X	X	X
Phaps elegans	Brush Bronzewing	X	X	X		
Streptopelia chinensis	Spotted Turtle-Dove (I)			X		
Columbia livia	Feral Rock Dove (I)	X	X	X	X	
Cacatua galerita	Sulphur-crested Cockatoo	X	X	X	X	X
Cacatua sanguinea	Little Corella	X				
Callocephalon fimbriatum	Gang-gang Cockatoo	X	X	X		
Calyptorhynchus banksii	Red-tailed Black-Cockatoo[V]					X
Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo	X	X	X		
Calyptorhynchus lathami	Glossy Black-Cockatoo[V]	X	X		X	X
Eolophus roseicapillus	Galah	X	X	X	X	X
Nymphicus hollandicus	Cockatiel	X		X		
Alisterus scapularis	Australian King-Parrot	X	X	X	X	X
Aprosmictus erythropterus	Red-winged Parrot	X		X		X
Glossopsitta concinna	Musk Lorikeet	X	X	X		
Glossopsitta pusilla	Little Lorikeet	X	X	X		
Lathamus discolor	Swift Parrot [E1]	X		X		
Melopsittacus undulatus	Budgerigar	X		X		
Neophema pulchella	Turquoise Parrot[V]	X	X	X		X
Platycercus adscitus eximius	Eastern Rosella	X	X	X	X	X

Attachment HB-E (Continued)
Fauna Records from the Surrounding Region

Scientific Name	Common Name[1]	Atlas Records[2]	GRNP[3]	MGNR[4]	Donachy[5]	Ulan Coal Mines[6]
Birds (Continued)						
Platycercus elegans	Crimson Rosella	X	X	X		X
Psephotus haematonotus	Red-rumped Parrot	X	X	X	X	X
Trichoglossus haematodus	Rainbow Lorikeet	X				
Cacomantis flabelliformis	Fan-tailed Cuckoo	X	X	X		X
Cacomantis variolosus	Brush Cuckoo	X	X	X		X
Chalcites basalis	Horsfield's Bronze-Cuckoo	X	X	X		
Chalcites lucidus	Shining Bronze-Cuckoo	X	X	X		X
Chalcites osculans	Black-eared Cuckoo	X		X		
Cuculus pallidus	Pallid Cuckoo	X	X	X		X
Eudynamys scolopacea	Common Koel	X	X		X	X
Scythrops novaehollandiae	Channel-billed Cuckoo	X	X	X		
Centropus phasianinus	Pheasant Coucal					X
Ninox connivens	Barking Owl[V]	X	X			X
Ninox novaeseelandiae	Southern Boobook	X	X	X	X	X
Ninox strenua	Powerful Owl[V]	X	X	X	X	
Tyto alba	Barn Owl	X	X	X		X
Tyto novaehollandiae	Masked Owl[V]	X	X			
Tyto tenebricosa	Sooty Owl[V]	X				
Podargus strigoides	Tawny Frogmouth	X	X	X	X	X
Eurostopodus mystacalis	White-throated Nightjar	X		X		X
Caprimulgus guttatus	Spotted Nightjar					X
Aegotheles cristatus	Australian Owlet-nightjar	X	X	X	X	
Apus pacificus	Fork-tailed Swift		X		X	X
Hirundapus caudacutus	White-throated Needletail	X	X	X		X
Alcedo azurea	Azure Kingfisher	X	X		X	
Dacelo novaeguineae	Laughing Kookaburra	X	X	X	X	X
Todiramphus pyrrhopygia	Red-backed Kingfisher	X		X		
Todiramphus sanctus	Sacred Kingfisher	X	X	X		X
Merops ornatus	Rainbow Bee-eater	X	X	X	X	X
Eurystomus orientalis	Dollarbird	X	X	X		X
Menura novaehollandiae	Superb Lyrebird	X	X	X	X	X
Climacteris erythrops	Red-browed Treecreeper	X		X		
Climacteris picumnus	Brown Treecreeper[V]	X	X	X		X
Cormobates leucophaeus	White-throated Treecreeper	X	X	X		X
Malurus cyaneus	Superb Fairy-wren	X	X	X	X	X
Malurus lamberti	Variegated Fairy-wren	X	X	X		X
Pardalotus punctatus	Spotted Pardalote	X	X	X	X	X
Pardalotus striatus	Striated Pardalote	X	X	X	X	X
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	X	X	X	X	X
Acanthiza lineata	Striated Thornbill	X	X	X		X
Acanthiza nana	Yellow Thornbill	X	X	X	X	X
Acanthiza pusilla	Brown Thornbill	X	X	X		X
Acanthiza reguloides	Buff-rumped Thornbill	X	X	X		X
Acanthiza uropygialis	Chestnut-rumped Thornbill					X
Aphelocephala leucopsis	Southern Whiteface	X	X	X	X	X

Attachment HB-E (Continued)
Fauna Records from the Surrounding Region

Scientific Name	Common Name[1]	Atlas Records[2]	GRNP[3]	MGNR[4]	Donachy[5]	Ulan Coal Mines[6]
Birds (Continued)						
Calamanthus pyrrhopygius	Chestnut-rumped Heathwren	X	X	X		
Gerygone fusca	Western Gerygone	X	X	X		X
Gerygone mouki	Brown Gerygone	X		X		
Gerygone olivacea	White-throated Gerygone	X	X	X		X
Origma solitaria	Rockwarbler	X	X	X		X
Pycnoptilus floccosus	Pilotbird					X
Pyrrholaemus sagittatus	Speckled Warbler[V]	X	X	X		X
Sericornis frontalis	White-browed Scrubwren	X	X	X	X	X
Smicrornis brevirostris	Weebill	X	X	X	X	X
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	X	X	X		X
Acanthorhynchus tenuirostris	Eastern Spinebill	X	X	X		X
Anthochaera carunculata	Red Wattlebird	X	X	X		X
Anthochaera chrysoptera	Little Wattlebird					X
Certhionyx niger	Black Honeyeater	X				
Certhionyx variegatus	Pied Honeyeater[V]			X		
Entomyzon cyanotis	Blue-faced Honeyeater	X	X	X		
Grantiella picta	Painted Honeyeater[V]	X		X		
Lichenostomus chrysops	Yellow-faced Honeyeater	X	X	X	X	X
Lichenostomus fuscus	Fuscous Honeyeater	X	X	X	X	
Lichenostomus leucotis	White-eared Honeyeater	X	X	X	X	X
Lichenostomus melanops	Yellow-tufted Honeyeater	X	X	X		X
Lichenostomus ornatus	Yellow-plumed Honeyeater			X		
Lichenostomus penicillatus	White-plumed Honeyeater	X	X	X	X	X
Lichmera indistincta	Brown Honeyeater	X	X			
Manorina melanocephala	Noisy Miner	X	X	X	X	X
Manorina melanophrys	Bell Miner	X	X			
Meliphaga lewinii	Lewin's Honeyeater	X	X	X		X
Meliphaga virescens	Singing Honeyeater					X
Melithreptus brevirostris	Brown-headed Honeyeater	X	X	X	X	X
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subsp.) [V]	X	X	X		X
Melithreptus lunatus	White-naped Honeyeater	X	X	X		X
Myzomela sanguinolenta	Scarlet Honeyeater	X	X	X		X
Philemon citreogularis	Little Friarbird	X		X		
Philemon corniculatus	Noisy Friarbird	X	X	X	X	X
Phylidonyris nigra	White-cheeked Honeyeater	X		X		X
Phylidonyris novaehollandiae	New Holland Honeyeater	X	X	X		
Phylidonyris pyrrhoptera	Crescent Honeyeater	X		X		
Plectorhyncha lanceolata	Striped Honeyeater		X	X	X	X
Xanthomyza phrygia	Regent Honeyeater [E1]	X	X	X		
Epthianura albifrons	White-fronted Chat	X		X		
Epthianura tricolor	Crimson Chat	X		X		
Eopsaltria australis	Eastern Yellow Robin	X	X	X	X	X
Melanodryas cucullata	Hooded Robin[V]	X	X	X	X	
Microeca fascinans	Jacky Winter	X	X	X	X	X
Petroica boodang	Scarlet Robin	X	X	X		

Attachment HB-E (Continued)
Fauna Records from the Surrounding Region

Scientific Name	Common Name[1]	Atlas Records[2]	GRNP[3]	MGNR[4]	Donachy[5]	Ulan Coal Mines[6]
Birds (Continued)						
Petroica goodenovii	Red-capped Robin	X	X	X		X
Petroica phoenicea	Flame Robin	X	X	X		X
Petroica rosea	Rose Robin	X	X	X		
Pomatostomus superciliosus	White-browed Babbler	X	X	X		X
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern ssp.) [V]	X	X	X		X
Cinclosoma punctatum	Spotted Quail-thrush	X	X	X		X
Psophodes olivaceus	Eastern Whipbird	X	X	X	X	X
Daphoenositta chrysoptera	Varied Sittella	X	X	X		X
Colluricincla harmonica	Grey Shrike-thrush	X	X	X	X	X
Falcunculus frontatus	Eastern Shrike-tit	X	X	X		X
Oreoica gutturalis	Crested Bellbird	X	X	X		
Pachycephala pectoralis	Golden Whistler	X	X	X		X
Pachycephala rufiventris	Rufous Whistler	X	X	X	X	X
Dicrurus bracteatus	Spangled Drongo	X				
Grallina cyanoleuca	Magpie-lark	X	X	X	X	X
Monarcha melanopsis	Black-faced Monarch	X				
Myiagra cyanoleuca	Satin Flycatcher	X		X		X
Myiagra inquieta	Restless Flycatcher	X	X	X	X	X
Myiagra rubecula	Leaden Flycatcher	X	X	X		X
Rhipidura albiscapa	Grey Fantail	X	X	X		X
Rhipidura leucophrys	Willie Wagtail	X	X	X	X	X
Rhipidura rufifrons	Rufous Fantail	X	X	X		
Artamus cyanopterus	Dusky Woodswallow	X	X	X		X
Artamus superciliosus	White-browed Woodswallow	X	X	X		X
Artamus personatus	Masked Woodswallow	X		X		X
Artamus cinereus	Black-faced Woodswallow				X	X
Cracticus nigrogularis	Pied Butcherbird	X	X	X		X
Cracticus torquatus	Grey Butcherbird	X	X	X	X	X
Gymnorhina tibicen	Australian Magpie	X	X	X	X	X
Strepera graculina	Pied Currawong	X	X	X	X	X
Strepera versicolor	Grey Currawong	X		X		
Coracina maxima	Ground Cuckoo-shrike	X		X		
Coracina novaehollandiae	Black-faced Cuckoo-shrike	X	X	X	X	X
Coracina papuensis	White-bellied Cuckoo-shrike	X	X	X		X
Coracina tenuirostris	Cicadabird	X	X	X		
Lalage tricolor	White-winged Triller	X	X	X	X	X
Oriolus sagittatus	Olive-backed Oriole	X	X	X		X
Corvus coronoides	Australian Raven	X	X	X	X	X
Corvus mellori	Little Raven	X		X		X
Corcorax melanorhamphos	White-winged Chough	X	X	X	X	X
Struthidea cinerea	Apostlebird					
Ptilonorhynchus violaceus	Satin Bowerbird	X	X	X		
Turdus merula	Eurasian Blackbird (I)			X		
Zoothera lunulata	Bassian Thrush	X	X	X		

Attachment HB-E (Continued)
Fauna Records from the Surrounding Region

Scientific Name	Common Name[1]	Atlas Records[2]	GRNP[3]	MGNR[4]	Donachy[5]	Ulan Coal Mines[6]
Birds (Continued)						
Acridotheres tristis	Common Myna (I)					
Sturnus vulgaris	Common Starling (I)	X	X	X	X	X
Hirundo neoxena	Welcome Swallow	X	X	X	X	X
Petrochelidon ariel	Fairy Martin	X	X	X	X	X
Petrochelidon nigricans	Tree Martin	X	X	X		X
Cheramoeca leucosternus	White-backed Swallow	X	X	X		X
Pycnonotus jocosus	Red-whiskered Bulbul (I)		X	X		
Zosterops lateralis	Silvereye	X	X	X		X
Cincloramphus mathewsi	Rufous Songlark	X	X	X		
Cincloramphus cruralis	Brown Songlark	X	X	X		X
Cisticola exilis	Golden-headed Cisticola			X		X
Megalurus timoriensis	Tawny Grassbird		X			
Acrocephalus australis	Australian Reed-Warbler	X	X	X	X	X
Alauda arvensis	Eurasian Skylark (I)	X				X
Mirafra javanica	Singing Bushlark	X		X		
Dicaeum hirundinaceum	Mistletoebird	X	X	X	X	X
Passer domesticus	House Sparrow (I)	X	X	X	X	X
Passer montanus	Eurasian Tree Sparrow (I)				X	
Anthus australis	Australian Pipit	X	X	X		X
Lonchura punctulata	Nutmeg Mannikin			X		
Neochmia modesta	Plum-headed Finch	X		X		
Neochmia temporalis	Red-browed Finch	X	X	X	X	X
Stagonopleura bella	Beautiful Firetail	X	X			
Stagonopleura guttata	Diamond Firetail[V]	X	X	X	X	
Taeniopygia bichenovii	Double-barred Finch	X	X	X	X	X
Taeniopygia guttata	Zebra Finch	X		X		
Carduelis carduelis	European Goldfinch (I)	X	X	X		
Mammals						
Ornithorhynchus anatinus	Platypus	X				
Tachyglossus aculeatus	Short-beaked Echidna	X	X	X	X	X
Antechinus flavipes	Yellow-footed Antechinus	X	X	X		X
Antechinus stuartii	Brown Antechinus	X	X			
Dasyurus maculatus	Spotted-tailed Quoll[V]	X				
Sminthopsis murina	Common Dunnart	X				X
Acrobates pygmaeus	Feathertail Glider	X	X	X		
Petaurus australis	Yellow-bellied Glider[V]	X				
Petaurus breviceps	Sugar Glider	X	X	X		X
Petaurus norfolcensis	Squirrel Glider[V]	X	X	X		X
Trichosurus caninus	Mountain Brushtail Possum	X				
Trichosurus vulpecula	Common Brushtail Possum	X	X	X		X
Petauroides volans	Greater Glider	X	X	X		X
Pseudocheirus peregrinus	Common Ringtail Possum	X	X	X		X
Phascolarctos cinereus	Koala[V]	X		X		
Vombatus ursinus	Common Wombat	X	X	X	X	X
Macropus giganteus	Eastern Grey Kangaroo	X	X	X	X	X
Macropus robustus	Common Wallaroo	X	X		X	X

Attachment HB-E (Continued)
Fauna Records from the Surrounding Region

Scientific Name	Common Name[1]	Atlas Records[2]	GRNP[3]	MGNR[4]	Donachy[5]	Ulan Coal Mines[6]
Mammals (Continued)						
Macropus rufogriseus	Red-necked Wallaby	X	X	X	X	X
Petrogale penicillata	Brush-tailed Rock-wallaby[E1]	X	X			X
Wallabia bicolor	Swamp Wallaby	X	X	X	X	X
Hydromys chrysogaster	Water Rat	X				
Mus musculus	House Mouse (I)	X	X	X		X
Rattus rattus	Black Rat (I)	X	X	X		X
Rattus fuscipes	Southern Bush Rat	X	X	X		X
Pseudomys novaehollandiae	New Holland Mouse	X	X			
Canis familiaris	Dog (I)	X	X	X	X	X
Vulpes vulpes	Red Fox (I)	X	X	X	X	X
Felis catus	Cat (I)	X	X	X	X	X
Bos taurus	European Cattle (I)	X	X			X
Capra hircus	Goat (I)	X	X	X		X
Sus scrofa	Feral Pig (I)	X	X	X	X	X
Lepus capensis	Brown Hare (I)	X	X	X	X	X
Oryctolagus cuniculus	Rabbit (I)	X	X	X	X	X
Cervus dama	Fallow Deer (I)					X

[1] Nomenclature for amphibian species in accordance with Robin.son (1993).
Nomenclature for reptile species in accordance with Swan *et al.* (2003).
Nomenclature for bird species in accordance with Pizzey and Knight (2003).
Nomenclature for mammal species in accordance with Menkhorst (2001).

[2] DEC Atlas of NSW Wildlife records for the area within 50 km of the study area.

[3] NPWS (2001) *The Fauna of Goulburn River National Park*. Conservation Assessment and Data Unit: Central Directorate, NSW National Parks and Wildlife Service.

[4] NPWS (2002) *Vertebrate Fauna of Munghorn Gap Nature Reserve*. Conservation Assessment and Data Unit: Central Directorate, NSW National Parks and Wildlife Service.

[5] Ms Donachy of Badgers Bend, Wollar Road, Ulan. Personal records from July 1997 to December 2003.

[6] Mount King Ecological Surveys (2003) *Ulan Underground Mine Extensions – Terrestrial and Aquatic Fauna Monitoring Programme to satisfy Conditions of Consent for ML 1341 and ML 1468*. Report to Ulan Coal Mines Ltd

(I) Introduced species

[V] Listed as Vulnerable under the NSW *Threatened Species Conservation Act, 1995*

[E1] Listed as Endangered under the NSW *Threatened Species Conservation Act, 1995*

ATTACHMENT HB-F

CHARACTERISTICS OF THE AVIFAUNA ASSEMBLAGE

Attachment HB-F
Foraging, Movement and Conservation Status Characteristics of the Avifauna Assemblage

The bird species recorded by the surveys were classified into one of eight feeding groups according to their foraging habits, diet and substrate (as used by Martin *et al,* 2004). The foraging groups were seed eaters, generalist predators/carnivores, nectorivores, foliage feeders, ground insectivore feeders, frugivores, bark foragers and aerial feeders. Reid (1999) classed the woodland birds in the NSW 'sheep-wheat belt' into three conservation categories, based upon their population status in this region. Bird species could be declining, increasing or stable, depending whether their population numbers were falling, rising or remaining stable over time. Reid (2000) has also classed bird species known to occur in the western slopes of NSW and Victoria as woodland or non-woodland birds. Woodland birds are those species that are observed frequently or more often in larger woodland remnants than in agricultural landscapes with scattered trees and small woodland patches only.

Finally, it is possible to describe the pattern of movement of bird species in eastern Australia as a result of analysis of the Australian Bird Atlas data by Griffieon and Clarke (2002). There are five broad patterns of bird movement identified by Griffieon and Clarke (2002). These are:

- Local Movement - birds where their ranges do not change significantly in their extents between periods but for which local variations do occur.
- Inland Movement – there are two sub-groups, birds that undertake predominantly north-south movements, and those that move either to the north-west or in a circle (called inland, non-cardinal-direction patterns).
- Coastal Movement – these are generally aligned or defined by the coast of eastern Australia.
- Confused Pattern – there is little information about this pattern, except that some form of movement does occur.
- No Movement – no particular pattern of movement is discernable from existing data.

The assessment of the feeding group, conservation status and movement pattern of bird species recorded in the study area is provided in the table below. Not all bird species located during the surveys are assessed, as the foraging habits and conservation status of water birds (and the Brown Songlark) were not provided by the authors referred to above.

Characteristics of Terrestrial Bird Species Recorded in the Study Area

Common Name	Feeding Group	Conservation Status	Woodland Birds	Movement Pattern
Emu	G	D	No	L
Wedge-tailed Eagle	P	S	No	N
Swamp Harrier	P	S	No	I
Black-shouldered Kite	P	I	No	N
Whistling Kite	P	D	W	N
Square-tailed Kite	P	D	No	C
Brown Falcon	P	I	No	I
Nankeen Kestrel	P	I	No	I
Peregrine Falcon	P	S	W	C
Black Falcon	P	S	No	C
Brown Goshawk	P	S	W	I
Grey Goshawk	P	S	No	N
Little Eagle	P	S	W	I
Painted Button-quail	S	D	W	N
Peaceful Dove	S	I	W	L
Crested Pigeon	S	I	No	N
Common Bronzewing	S	S	W	N
Sulphur-crested Cockatoo	S	I	No	N
Gang-gang Cockatoo	S	S	No	N

Characteristics of Terrestrial Bird Species Recorded in the Study Area (continued)

Common Name	Feeding Group	Conservation Status	Woodland Birds	Movement Pattern
Yellow-tailed Black-Cockatoo	S	?	No	L
Glossy Black-Cockatoo	S	D	W	L
Galah	S	I	No	N
Australian King-Parrot	S	S	No	N
Turquoise Parrot	S	D	W	N
Eastern Rosella	S	I	W	N
Red-rumped Parrot	S	I	W	N
Little Lorikeet	N	S	W	L
Pallid Cuckoo	L	S	No	I
Fan-tailed Cuckoo	L	S	W	Co
Horsefield's Bronze Cuckoo	L	S	W	I
Southern Boobook	P	S	W	I
Masked Owl	P	D	W	?
Barn Owl	P	S	No	C
Tawny Frogmouth	P	S	No	N
White-throated Nightjar	A	?	W	?
Australian Owlet-nightjar	A	S	W	N
Laughing Kookaburra	P	S	W	N
Sacred Kingfisher	P	S	W	I
Rainbow Bee-eater	P	S	No	I
Superb Lyrebird	G	S	No	N
Brown Treecreeper	G	D	W	N
White-throated Treecreeper	B	S	W	N
Superb Fairy-wren	G	S	W	L
Variegated Fairy-wren	G	S	No	L
Spotted Pardalote	L	S	W	L
Striated Pardalote	L	S	W	I
Brown Thornbill	L	S	W	N
Yellow-rumped Thornbill	G	I	W	L
Chestnut-rumped Thornbill	L	D	W	N
Striated Thornbill	L	S	W	N
Yellow Thornbill	L	S	W	N
Buff-rumped Thornbill	L	S	W	N
Inland Thornbill	L	S	W	N
Southern Whiteface	L	D	W	N
Chestnut-rumped Heathwren	G	S	No	N
Western Gerygone	L	S	W	L
White-throated Gerygone	L	S	W	I
Pilotbird	G	?	W	N
Rockwarbler	G	?	No	N
Red Wattlebird	N	S	W	L
Speckled Warbler	G	D	W	N
Eastern Spinebill	N	S	W	L
Fuscous Honeyeater	F	S	W	N
White-eared Honeyeater	B	S	W	N
Yellow-tufted Honeyeater	L	S	W	N

Characteristics of Terrestrial Bird Species Recorded in the Study Area (continued)

Common Name	Feeding Group	Conservation Status	Woodland Birds	Movement Pattern
White-plumed Honeyeater	L	I	W	N
Yellow-faced Honeyeater	L	S	W	Co
Noisy Miner	L	I	W	N
Black-chinned Honeyeater	L	D	W	I
Little Friarbird	N	S	W	I
Noisy Friarbird	N	S	W	L
White-cheeked Honeyeater	N	?	W	N
Brown Honeyeater	N	S	W	N
Painted Honeyeater	F	D	W	?
Eastern Yellow Robin	G	D	W	N
Hooded Robin	G	D	W	N
Jacky Winter	G	D	W	N
White-browed Babbler	G	D	W	N
Spotted Quail-thrush	G	S	No	N
Grey Shrike-thrush	B	S	W	N
Golden Whistler	L	S	W	Co
Rufous Whistler	L	D	W	I
Magpie-lark	G	I	No	N
Restless Flycatcher	G	D	W	L
Satin Flycatcher	G	S	No	Co
Grey Fantail	A	S	W	Co
Rufous Fantail	A	S	No	Co
Willie Wagtail	A	I	No	L
White-browed Woodswallow	A	D	W	I
Black-faced Woodswallow	A	I	No	N
Dusky Woodswallow	A	D	W	Co
Masked Woodswallow	A	S	No	I
Pied Butcherbird	P	I	No	N
Grey Butcherbird	P	S	W	N
Australian Magpie	G	I	W	N
Pied Currawong	P	I	No	N
Black-faced Cuckoo-shrike	L	I	W	I
White-bellied Cuckoo-shrike	L	S	W	N
White-winged Triller	L	S	W	I
Olive-backed Oriole	L	S	W	I
Australian Raven	G	I	W	N
Little Raven	G	I	No	N
White-winged Chough	G	I	W	N
Apostlebird	G	S	W	N
Singing Bushlark	G	S	No	L
Satin Bowerbird	F	?	No	N
Common Starling	G	I	No	N
Welcome Swallow	A	I	No	I
Fairy Martin	A	I	No	I
Tree Martin	A	S	W	I

Characteristics of Terrestrial Bird Species Recorded in the Study Area (continued)

Common Name	Feeding Group	Conservation Status	Woodland Birds	Movement Pattern
Mistletoebird	F	S	W	L
Australian Pipit	G	I	No	L
Red-browed Finch	G	S	W	L
Beautiful Firetail	G	?	W	N
Diamond Firetail	G	D	W	N
Double-barred Finch	S	S	W	I

Feeding Group:
S – Seed Eater
G – Ground Insectivore
P – Generalist Predator/Carnivore
B – Bark Feeder
F – Frugivore
A – Aerial feeder
L – Foliage Feeder
N - Nectorivore

Conservation Status:
D – Decreaser
I – Increaser
S – Stable
? – Not listed

Woodland Birds:
No – Not Dependent on Woodland
W – Use Woodland Extensively

Movement Pattern:
N – No Movement, Co – Coastal Movement, I – Inland Movement, L – Local Movement
C – Confused Pattern, ? – Not listed

Summary of Characteristics

a. Autumn Survey

Characteristic	% of Birds Located	Characteristic	% of Birds Located
Feeding Group		**Conservation Status**	
Seed Eater	14	Decreaser	17
Ground Insectivore	25	Increaser	22
Generalist Carnivore	17	Stable	55
Bark Forager	1	Not listed	6
Frugivore	5	**Woodland Birds**	
Aerial Feeder	11	Not Dependent on Woodland	34
Foliage Forager	21	Use Woodland Extensively	66
Nectorivore	6	**Movement Pattern**	
		No Movement	51
		Local Movement	18
		Inland Movement	17
		Coastal Movement	8
		Confused Pattern	2
		Not listed	3

b. Spring Survey

Characteristic	% of Birds Located	Characteristic	% of Birds Located
Feeding Group		**Conservation Status**	
Seed Eater	12	Decreaser	16
Ground Insectivore	28	Increaser	22
Generalist Carnivore	19	Stable	53
Bark Forager	2	Not listed	8
Frugivore	4	**Woodland Birds**	
Aerial Feeder	6	Not Dependent on Woodland	34
Foliage Forager	21	Use Woodland Extensively	66
Nectorivore	8	**Movement Pattern**	
		No Movement	53
		Local Movement	15
		Inland Movement	19
		Coastal Movement	6
		Confused Pattern	5
		Not listed	2

ATTACHMENT HB-G

SURVEY TRAPPING RATES, MEASUREMENTS AND RESULTS OF HAIR AND SCAT ANALYSES

Trapping Rates during the Autumn Survey for Ground and Tree-mounted Elliott Traps

Site	Trapping Rates (captures per 100 trap-nights)		
	Ground Elliott	Tree-mounted Elliott	Overall
1	0.5	0	0.25
2	6.0	20.5	13.2
3	8.0	16.5	12.4
4	0	0	0
5	0	0	0
6	1.0	0	0.5
7	0	1.0	0.5
8	9.0	12.5	10.7
9	3.0	0	1.5
10	0	4.0	2.0
11	6.0	0	3.0
12	5.0	8.2	6.6
Mean	3.2	5.2	4.2

Mean Body Measurements of Yellow-footed Antechinus Trapped During the Autumn Survey

Parameter	Sex	
	Female	Male
Weight (g)	21.87	32.38
Head Length (cm)	3.16	3.45
Foot Length (cm)	1.75	1.87
Tail Length (cm)	8.29	9.26
Head-Body Length (cm)	9.01	10.38
Number	23	22

Analysis of Hair Samples taken from the Hair Funnels during the Autumn Survey

Date	Survey Site	Hair Sample
19/05/04	8	*Petaurus* sp.
23/05/04	7	*Petaurus breviceps*
23/05/04	7	*Trichosaurus vulpecula*
27/05/04	3	*Trichosaurus vulpecula*
26/05/04	2	*Trichosaurus vulpecula*
27/05/04	3	*Antechinus flavipes*

Results from Introduced Predator Scat Analysis

Scat	Date	Site	Mammal	Species	Bird	Reptile	Insect	Veg	Other
Fox	27.04.04	10	10	Rabbit	0	0	90	0	0
Fox	24.04.04	6	0	-	0	0	100	0	0
Fox	22.05.04	5	0	-	0	0	100	0	0
Fox	28.04.04	8	0	-	0	0	100	0	0
Fox	24.04.04	12	80	Rabbit, Common Brushtail Possum	0	5	10	5	0
Fox	22.05.04	2	0	-	0	0	100	0	0
Fox	21.04.04	3	25	Rabbit	0	0	25	0	0
Fox	22.05.04	5	0	-	0	0	100	0	0
Cat	20.05.04	5	100	Yellow-footed Antechinus, Rabbit	0	0	0	0	0
Fox	19.05.04	8	0	-	0	0	100	0	0
Fox	22.05.04	772681/641795*	0	-	0	0	100	0	0
Fox	22.05.04	5	0	-	0	0	100	0	0
Fox	22.05.04	5	10	Yellow-footed Antechinus, Rabbit	0	0	100	0	0
Fox	22.05.04	4	0	-	0	0	100	0	0
Fox	22.05.04	4	60	House Mouse	0	0	40	0	0
Fox	19.05.04	5	30	Rabbit	0	0	70	0	0
Fox	18.05.04	8	50	Common Brushtail Possum	0	0	50	0	0
Fox	21.05.04	5	20	Rabbit	0	0	80	0	0
		%Volume	21.4				75.8		
n = 18		% Occurrence	50%				94%		
* UTM									