APPENDIX F
TERRESTRIAL FAUNA ASSESSMENT

Wilpinjong Coal Mine Modification – Terrestrial Fauna Assessment

A Report by Biodiversity Monitoring Services, July 2013

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EXECUTIVE SUMMARY

1. Land associated with an extension to the Wilpinjong Coal Mine (the Modification) was surveyed for terrestrial vertebrate fauna in November-December 2012.

2. The Modification open cut extension areas comprise eight small extensions to the existing active and/or approved open cut footprints.

3. 31.5 percent (%) (21.9 hectares [ha]) of the Modification open cut extensions is native grassland, 42.9% (29.8 ha) comprises woodland habitats and 25.6% (17.8 ha) is disturbed/weedy land or previously approved for disturbance.

4. A total of 124 fauna species, comprising six amphibians, six reptiles, 85 birds (including one introduced species) and 27 mammals (including seven introduced species) were located during the surveys.

5. Nine threatened fauna species were located during the surveys, namely the Large-eared Pied Bat, Eastern False Pipistrelle, Eastern Bentwing-bat, Eastern Cave Bat, Little Eagle, Brown Treecreeper (eastern subspecies), Grey-crowned Babbler (eastern subspecies), Speckled Warbler and Diamond Firetail. Most of these species are closely associated with woodland habitats, with the Little Eagle also utilising open areas for foraging and woodland for roosting and nesting.

6. An assessment of impacts on threatened species under the NSW *Threatened Species Conservation Act, 1995* was undertaken. It was concluded that it is unlikely that the Modification would significantly impact any of the threatened fauna species because of the small loss of woodland habitat, combined with the on-going management actions and the provision of a Biodiversity Offset.

1.0 INTRODUCTION

1.1 BACKGROUND

The Wilpinjong Coal Mine is an existing open cut coal mining operation situated approximately 40 kilometres (km) north-east of Mudgee, near the Village of Wollar, within the Mid-Western Regional Council Local Government Area, in central New South Wales (NSW) (Figure 1).

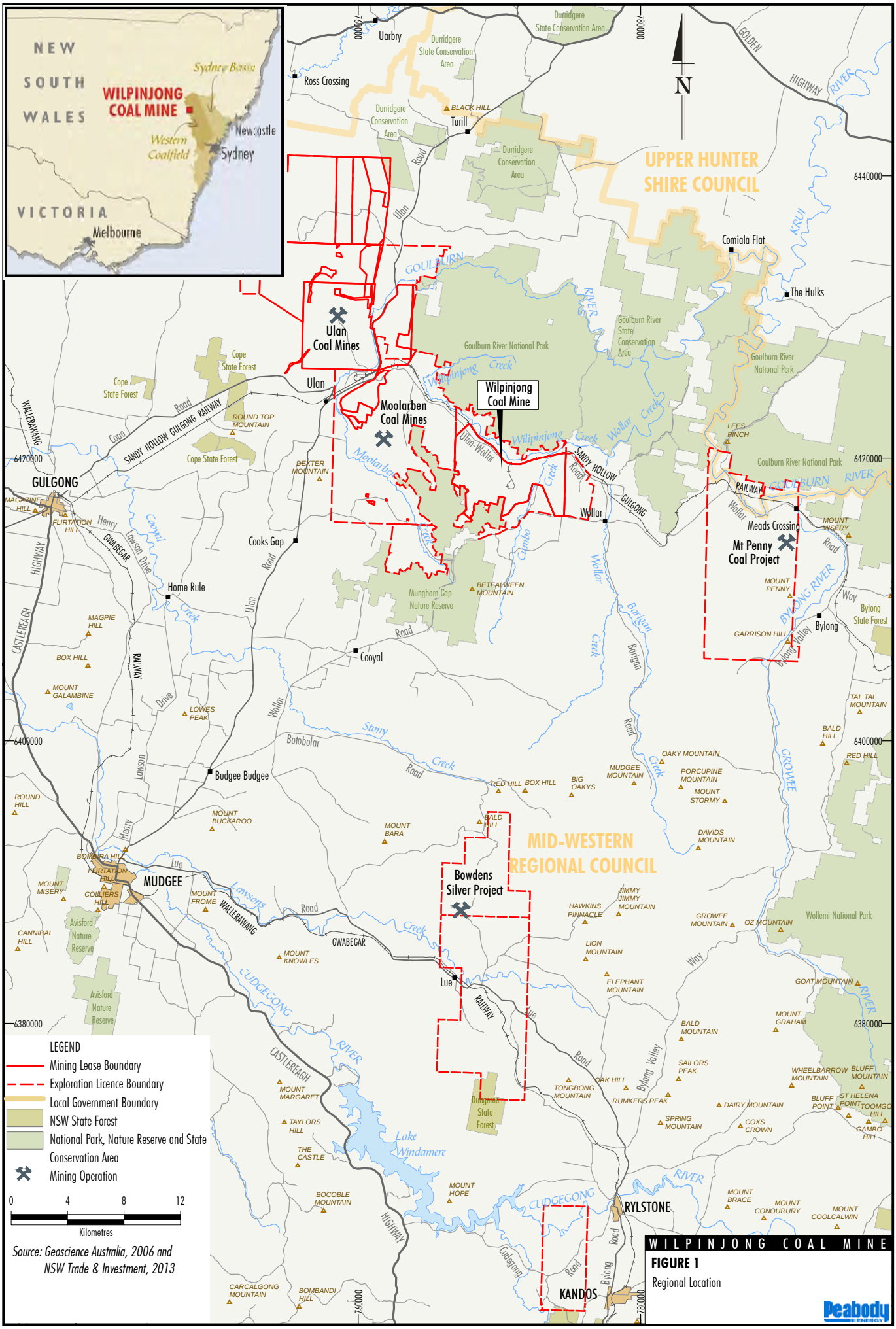
The Wilpinjong Coal Mine is owned and operated by Wilpinjong Coal Pty Limited (WCPL), a wholly owned subsidiary of Peabody Energy Australia Pty Limited. Mining is undertaken within Mining Lease 1573 and the approved open cut and contained infrastructure area at the Wilpinjong Coal Mine comprises approximately 1,920 hectares (ha) (Figure 2).

The Wilpinjong Coal Mine was approved under Part 3A of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act) by the NSW Minister for Planning in February 2006 (Project Approval 05-0021). The mine has been operating since 2006, and is approved to produce up to 15 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal from six open cut pits (Figure 2).

The Wilpinjong Coal Mine produces both washed and unwashed coal products. The coal handling and processing infrastructure has been designed to accommodate the processing of raw coal and the handling of raw (bypass) and washed product coal. The Project Approval currently allows for the beneficiation of up to 8.5 million tonnes (Mt) of ROM coal in the Coal Handling and Preparation Plant (CHPP) per year and up to 12.5 Mtpa of thermal coal products from the Wilpinjong Coal Mine are transported by rail to domestic customers for use in electricity generation and to port for export.

Following a review of mine planning, CHPP capacity, waste rock bulking factors, planned building and demolition works and light vehicle servicing requirements, WCPL has determined that a number of minor alterations to the approved Wilpinjong Coal Mine are required, including:

- development of incremental extensions to the existing open cut pits (Figure 3) that would extend the open cuts by approximately 70 ha and would result in the recovery of approximately 3 Mt of additional ROM coal;
- slightly higher rates of annual waste rock production (from 28 million bank cubic metres [Mbcm] to 33.3 Mbcm) in order to maintain approved ROM coal production;
- minor CHPP upgrades to improve fine coal reject management (installation of a belt press filter) and an increase in the rate of ROM coal beneficiation in the CHPP to 9 Mtpa;
- upgrade of the existing Reverse Osmosis Plant to a Water Treatment Facility with the addition of pre-filtration and flocculation/dosing facilities to improve plant efficiency;
- amendment of the waste emplacement strategy to include:
    - development of an elevated waste rock emplacement landform (up to 450 metres [m] Australian Height Datum) within the footprint of Pit 2 (Figure 3);



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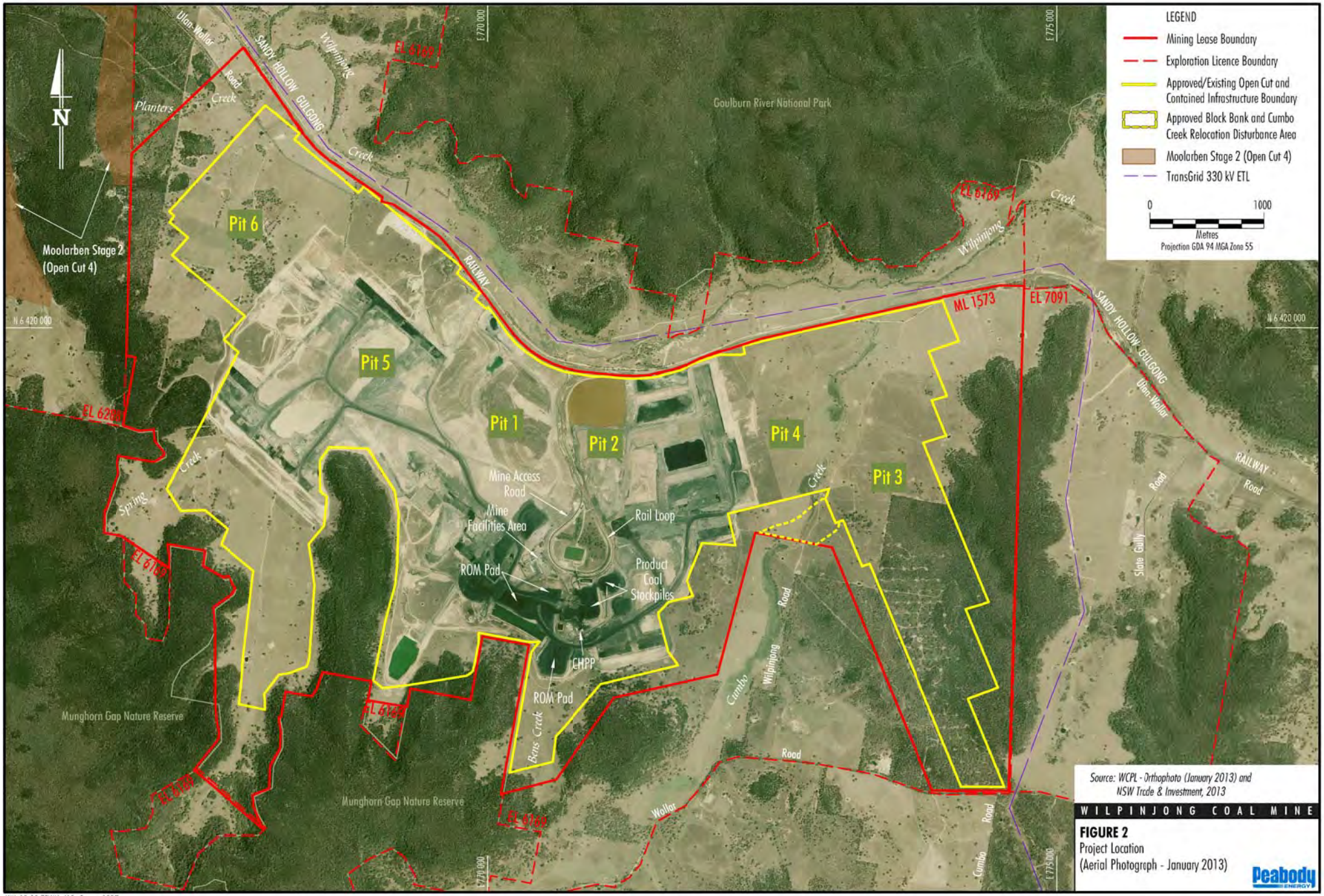

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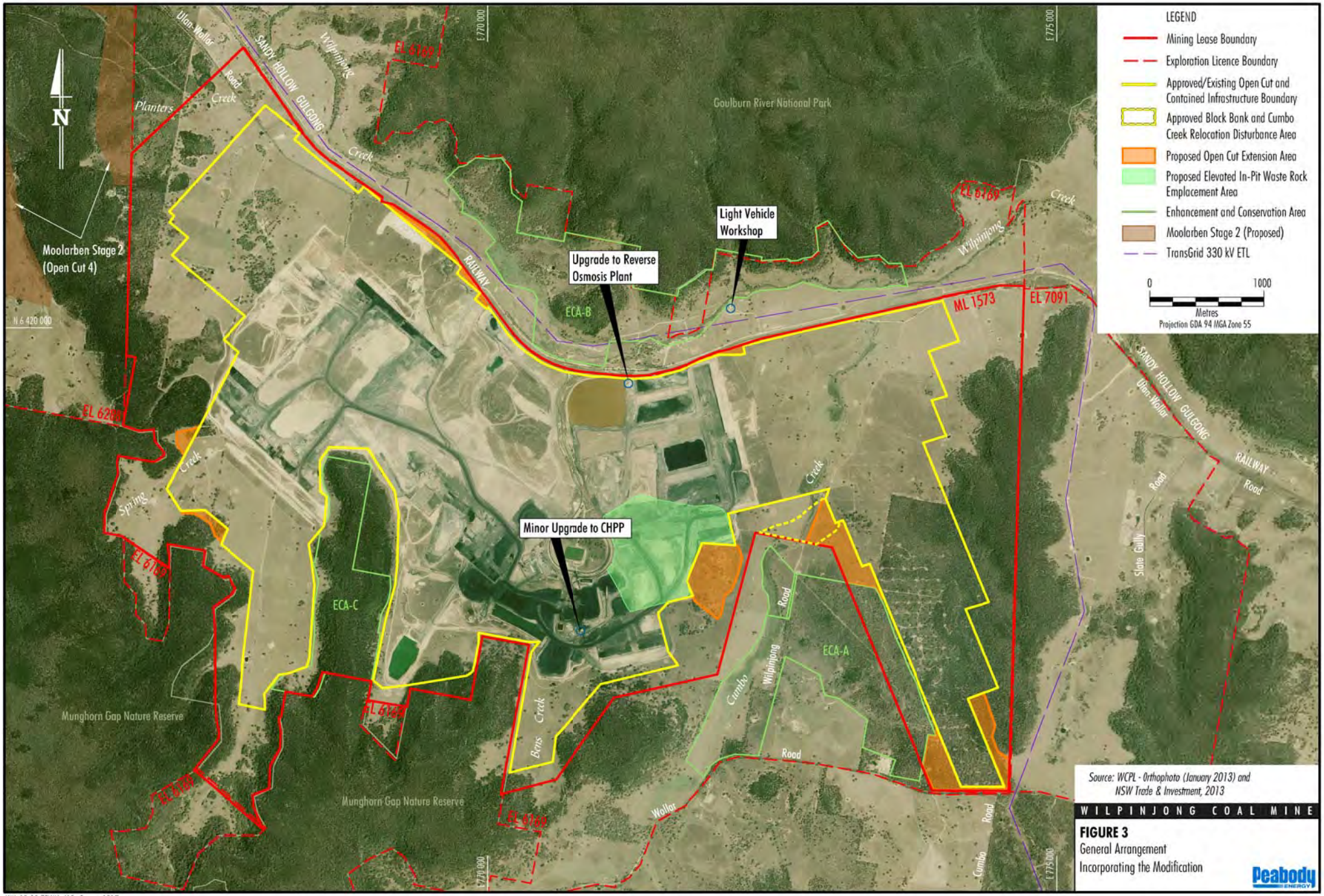

WILPINJONG COAL MINE

FIGURE 3
General Arrangement
Incorporating the Modification

Peabody ENERGY

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  - disposal of some inert building and demolition waste that is produced from off-site building demolition in the approved mine waste rock emplacements;
  - Co-disposal of fine coal reject material produced by the belt press filter with coarse rejects; and
- operation of a light vehicle servicing workshop at an existing farm shed that is located in the north of the Wilpinjong Coal Mine area (Figure 3).

Construction of the belt press filter and augmentation of the existing Reverse Osmosis Plant may require a temporary construction workforce of up to 20 people for periods in 2014.

These variations to the Wilpinjong Coal Mine are being sought via a Modification under section 75W of the EP&A Act (the Modification).

It should be noted that no changes are proposed to the approved rates of production of ROM coal (15 Mtpa) or product coal (12.5 Mtpa) and the current owner-operator mobile fleet would not require augmentation. In addition, the Modification would not require any significant alteration to the existing approved Wilpinjong Coal Mine mining operations and general supporting infrastructure, or current operational workforce of approximately 550 staff and contractors.

A detailed description of the Modification is provided in Section 3 of the main report of the Environmental Assessment (EA).

1.2 SCOPE OF THIS REPORT

This report provides information about the terrestrial vertebrate fauna that are known to occur or could potentially occur within the Modification open cut extension areas based upon recent surveys and from existing fauna records from the surrounding area and the region.

The objectives of the terrestrial fauna surveys 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* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act);
- report on the findings of the terrestrial fauna surveys;
- provide an assessment of potential impacts on threatened fauna species in consideration of the above;
- propose mitigation and management measures to reduce potential impacts on fauna, particularly threatened fauna; and
- propose a Biodiversity Offset for any residual impacts.

2.0 EXISTING ENVIRONMENT

2.1 STUDY AREA

The study area refers to the proposed extensions to the existing open cut pits and surrounds, i.e. areas that are likely to be affected by the Modification, either directly or indirectly. The Modification is described in Section 1.1 and the key component relating to potential fauna impacts consists of eight areas of varying sizes where extensions to the existing open cut pits are proposed. These areas are shown in Figures 3 and 4.

2.2 REGIONAL LOCATION

The study area is located within 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).

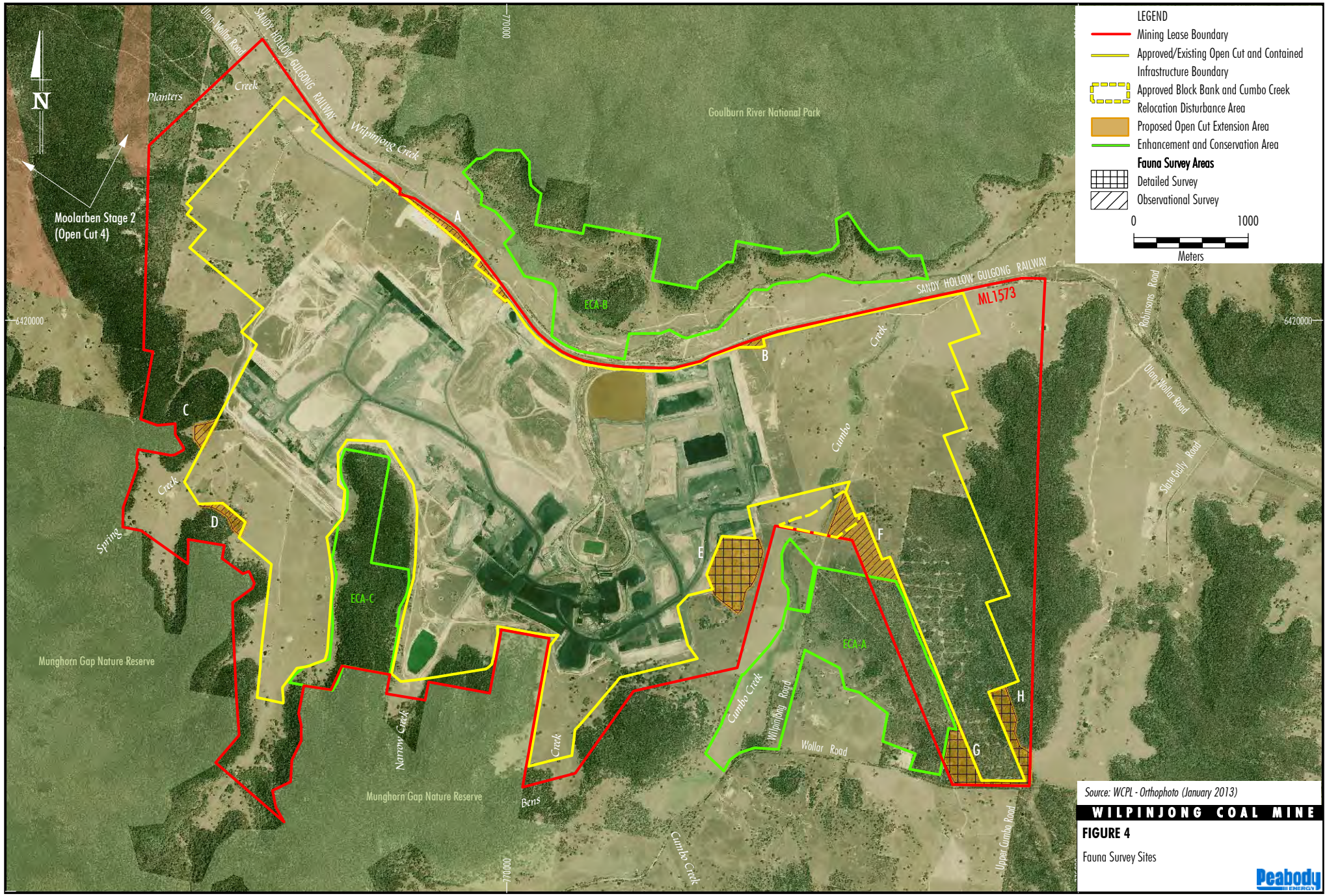
The flat valley lands have been extensively cleared and grazed by cattle and sheep. Most natural vegetation is restricted to the steep hills and slopes outside the current mine area. There are some small uncleared areas of remnant vegetation scattered throughout the study area and these are mainly associated with stony outcrops. The vegetation along all the watercourses in the study area has been cleared in the past.

The Wilpinjong Coal Mine is located within the upper reaches of the Hunter Valley Catchment in the far north-west of the Sydney Basin Interim Biogeographic Regionalisation for Australia (IBRA) Region and close to the Brigalow Belt South and NSW South Western Slopes IBRA Regions (Thackway and Cresswell, 1995; Commonwealth Department of Sustainability, Environment, Water, Population and Communities [SEWPaC], 2013a).

2.3 CLIMATE

There is an on-site meteorological station located at the Wilpinjong Coal Mine. The nearest Bureau of Meteorology (BoM) weather station with a long term rainfall record is located in Wollar (Barigan St) (station number 62032 with records from 1901). Other regional BOM stations are located at Mudgee (approximately 40 km to the south-west) and Gulgong (approximately 30 km to the west).

The Wilpinjong area experiences a temperate climate with an average annual rainfall of approximately 600 millimetres (mm). Whilst rainfall is spread throughout the year, it is on average higher in the summer months and occurs on fewer days (i.e. is more intense). The highest recorded monthly rainfall at Wollar was 391.5 mm recorded in February 1955, which included the highest daily rainfall total of 180.8 mm. The highest daily rainfalls have been recorded during summer (December to February) and in June. The maximum rainfalls recorded in most of the rest of the year have, by comparison, been significantly lower.



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Climate at Gulgong and Mudgee is characterised by warm to hot summers and cold winters (BoM, 2013). The warmest month is January with maximum daily temperatures at Gulgong and Mudgee of approximately 30.9 degrees Celsius (°C) and 31.0°C, respectively, followed by December (29.6°C and 29.8°C, respectively) (BoM, 2013). The coldest month is July with mean daily minimum temperatures of 2.6°C and 1.3°C for Gulgong and Mudgee, respectively (BoM, 2013).

Average annual rainfall is spread fairly evenly through the year, but with a distinct spring/summer dominance (BoM, 2013). Highest rainfall on average is in January (70.5 mm in Gulgong and 66.6 mm in Wollar) and lowest in April for Gulgong (44.2 mm) and Wollar (37.8 mm) (BoM, 2013).

2.4 GEOLOGY AND SOILS

Geology and soils within the Modification open cut extension areas are described by Hunter Eco (2013) as follows. Across the low lying areas of the Wilpinjong mine lease is Permian, Sydney Basin, Illawarra Coal Measures expressed on the surface as quartz-lithic sandstone. This takes up the majority of the lease area and includes most of the Modification open cut extension areas. An exception is a narrow band of Quaternary sediments along the course of Cumbo Creek in the eastern part of the lease and Wilpinjong Creek to the north. The elevated ridges within and outside of the lease are Triassic, Sydney Basin, Narrabeen group. At the south-east is a small area of Permian, Sydney Basin Shoalhaven group and this includes the western third of Modification Area G.

A description of the soils in the Modification open cut extension area is provided in the Agricultural Resource Assessment (McKenzie Soil Management, 2013).

2.5 LANDFORM AND HYDROLOGY

The majority of the study area comprises flat to gently undulating terrain with a few higher hills. The valley flats are bordered by, and penetrate between, steep sandstone ranges; the change in gradient from the valley floor to the ranges is usually quite sharp. Long narrow valleys may penetrate between sandstone ranges.

2.6 LAND USE

The current land use in the study area and surrounds is mining and some limited grazing. The Modification open cut extension areas are located immediately adjacent to existing mining areas associated with the approved Wilpinjong Coal Mine. Historically, the land use within the study area would have been stock grazing on pastures comprising a mix of native and introduced grasses (FloraSearch, 2005).

2.7 VEGETATION

Where present, the natural vegetation cover within the study area includes an overstorey dominated by eucalypts (e.g. Yellow Box [*Eucalyptus melliodora*], Blakely's Red Gum [*Eucalyptus blakelyi*], Grey Box [*Eucalyptus moluccana*], Narrow-leaved Ironbark [*Eucalyptus crebra*], White Box [*Eucalyptus albens*] and Grey Gum [*Eucalyptus punctata*] and Rough-barked Apple [*Angophora floribunda*]). The vegetation within each of the eight Modification open cut extension areas (Areas A to H) has been described by Hunter Eco (2013) and is summarized in Table 1.

By calculating the areas shown in Table 1, it is concluded that 57.1 percent (%) of the Modification open cut extensions is Disturbance-non-native, approved mine disturbance, dams or grassland and the remaining 42.9% is Shrubby White Box Woodlands, Grassy White Box Woodlands, Narrow-leaved Ironbark Forest, Caley's Ironbark Wood, Sandstone Range Woodlands and Coast Grey Box Woodlands. The major habitat types within the Modification open cut extension areas can be considered to be grasslands and woodland with some areas of rocky outcropping in Areas H.

Approximately 5.5 ha of Modification Area F is already approved for disturbance under the existing Part 3A Major Project Approval (Figure 3). This area was intended to be a Cumbo Creek diversion although ground disturbance has not yet occurred. This area is included in the Modification open cut extensions. However since disturbance is approved, this area of clearance is not included in vegetation calculations throughout this report.

Table 1: Vegetation Communities within each Modification open cut extension area

Veg Code	Community	Key Native Dominant Tree Species	Area (ha)
	Areas A and B		
0	Disturbance – non-native		**5.8**
		Total Area A and B	**5.8**
	Area C		
7a	Derived Grassland – weedy		1.8
7d	Derived Grassland – other native		0.03
5b	Shrubby White Box Woodlands	*E. albens* ± *E. moluccana* ± *C. endlicheri*	0.7
		Total Area C	**2.53**
	Area D		
5b	Shrubby White Box Woodlands	*E. albens/C. endlicheri* ± *A. floribunda* ± *E. moluccana* ± *E. crebra*	1.9
7c	Derived Grassland – box-gum shrubby		1.1
		Total Area D	**3.0**
	Area E		
5a	Grassy White Box Woodlands	*E. albens* ± *E. moluccana* ± *C. endlicheri*	2.2
5b	Shrubby White Box Woodlands	*E. albens* ± *E. moluccana* ± *C. endlicheri*	5.0
7a	Derived grassland – weedy		4.7
7b	Derived grassland – box-gum grassy		8.4
7d	Derived grassland – other native		0.7
		Total Area E	**21.0**
	Area F		
2	Coast Grey Box Woodlands	*E. moluccana* ± *E. crebra* ± *A. floribunda*	0.3
7d	Derived grassland – other native		16.8*
		Total Area F	**17.1**
	Area G		
2	Coast Grey Box Woodlands	*E. moluccana* ± *E. crebra* ± *A. floribunda*	2.1
4	Narrow-leaved Ironbark Forest	*E. crebra*/C. endlicheri ± *E. macrorhyncha* ± *A. floribunda* ± *E. caleyi*	5.3
4a	Caley's Ironbark Woodland	*E. caleyi/C. endlicheri*	3.0
		Total Area G	**10.4**
	Area H		
2	Coast Grey Box Woodlands	*E. moluccana* ± *E. crebra* ± *A. floribunda*	1.1
5b	Shrubby White Box Woodlands	*E. albens*/C. endlicheri ± *A. floribunda* ± *E. moluccana* ± *E. crebra*	6.9
6	Sandstone Range Shrubby Woodlands	*E. punctata/E. sparsifolia/ C. endlicheri*	1.3
7d	Derived grassland – other native		0.4
		Total Area H	**9.7**
GRAND TOTAL			**69.5**
Total excluding approved mine disturbance (including Disturbance – non-native) and weedy grassland			**51.7**

* **Note: 5.5 ha of this community is Approved mine disturbance and not included in vegetation calculations.**

3.0 METHODS

As can be seen from Figure 4, the Modification is made up of eight small distinct areas (Areas A to H). Six of these areas (Modification Areas C to H) still retain some natural vegetation found in the region, while the other two areas (Modification Areas A and B) are located within cleared paddocks with substantial past disturbance.

Following a desktop review of the available habitats and possible threatened species within the study area, all Modification open cut extension areas were surveyed at a level appropriate to the habitat available within each area.

Detailed survey sites were established within Modification Areas E, G and H whilst Areas C, D and F were inspected on several occasions where fauna and habitat condition was recorded (Figure 4). Detailed survey sites were conducted in areas of woodland/forest habitat. Observational surveys were undertaken within Modification Areas A and B as these small areas are located beside the Wollar Road and were observed on a daily basis. The habitat present within Modification Areas A and B has been previously disturbed by ancillary activities of the approved mine.

The surveys were undertaken by Dr Martin Denny and Andrew Lothian using National Park and Wildlife Service Scientific Licence No. S10282, Animal Care and Ethics Committee Approval No. AW96/033, between the 26 November to 1 December 2012.

Further detail on the desktop review and surveys methods is provided in Sections 3.1 and 3.2, respectively. Section 3.3 describes the desktop assessment of potential threatened fauna species.

3.1 DESKTOP REVIEW

A desktop investigation was carried out to identify terrestrial fauna/habitat that may be present within the study area and surrounds. A review of existing data was undertaken and a list of potential threatened fauna species that could occur within the Modification open cut extension areas was developed. The databases reviewed included:

- a review of the previous fauna survey investigations undertaken within the study area and surrounds for the *Wilpinjong Coal Project Environmental Impact Statement* (herein referred to as the EIS) (WCPL, 2004) conducted by Mount King Ecological Surveys (MKES) (2005);
- a review of the previous bat survey investigation undertaken within the study area and surrounds conducted by Greg Richards and Associates Pty Ltd (2005);
- a search of the NSW Office of Environment and Heritage (OEH) (2012) Atlas of NSW Wildlife database for records of threatened fauna within the locality (sourced 4 December 2012) (Attachment A);
- a search of the SEWPaC (2012) Protected Matters database for matters of national environmental significance within the locality (sourced 4 December 2012) (Attachment A);
- a search of the Australian Museum (2012) collections database (sourced 11 December 2012) (Attachment A);

- a search of the BirdLife Australia (2012) database for records of threatened birds within the locality (sourced 3 December 2012) (Attachment A);
- an examination of vegetation maps and reports regarding the vegetation of the Wilplinjong Coal Mine area and surrounds (FloraSearch, 2005);
- an examination of current and historical aerial photographs of the study area and surrounds; and
- an examination of topographic maps of the study area and surrounds.

The desktop review resulted in a list of threatened species that could potentially be impacted by the Modification based on previous records (i.e. previous surveys and database results) and potential habitat within the study area. These threatened species were targeted during field surveys (Section 3.2) and are discussed in Section 3.3.

3.2 FIELD SURVEYS

3.2.1 Survey Timing

The surveys were conducted across six days from 26 November 2012 to 1 December 2012. The weather during the survey was hot and mainly dry. Minimum temperatures recorded by the on-site meteorological station ranged from 15.5 to 23.5°C, while maximum temperatures ranged from 29.5 to 38.8°C (Table 2). Rain fell on three days and ranged from 0.3 to 4.6 mm (Table 2).

Table 2: Maximum and Minimum Temperatures and Rainfall Recorded During the Surveys (weather information from Gulgong BoM Site)

Date	Temperature (°C)		Rainfall (mm)
	Minimum	Maximum	
26/11/2012	17.2	35.2	0
27/11/2012	17.4	29.5	0.3
28/11/2012	16.0	29.9	0
29/11/2012	15.5	34.6	4.6
30/11/2012	19.8	38.8	0
1/12/2012	23.5	38.2	0.6

Source: BoM (2013)

3.2.2 Fauna Survey Sites

The locations of the three detailed and five observational survey sites are shown on Figure 4. The three detailed survey sites were at Modification Areas E, G and H. The two sites in the western part of the study area within Modification Areas C and D contained woodland habitat, but were considered too small to warrant detailed survey sites and were therefore subject to observational surveys. Modification Areas A, B and F, are predominantly disturbed paddocks (Table 1) and were therefore subject to observational surveys.

3.2.3 Fauna Survey Techniques

The survey methods followed the guidelines developed and issued by the OEH and by SEWPaC including:

- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft* (NSW Department of Environment and Conservation [DEC], 2004);
- *Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna Amphibians* (NSW Department of Environment and Climate Change [DECC], 2009);
- *Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999* (SEWPaC, 2010a);
- *Survey guidelines for Australia's threatened bats: Guidelines for detecting bats listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999* (SEWPaC, 2010b);
- *Survey guidelines for Australia's threatened frogs: Guidelines for detecting frogs listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999* (SEWPaC, 2010c);
- *Survey Guidelines for Australia's Threatened Mammals* (SEWPaC, 2011a); and
- *Survey Guidelines for Australia's Threatened Reptiles* (SEWPaC, 2011b).

A desktop review (Section 3.1) and field surveys (Section 3.2) were conducted to determine the fauna species and habitat present within the study area and surrounds. A summary of the various techniques used is given in Table 3 and the survey methods used within each of the Modification open cut extension areas (Areas A to H) is given in Section 3.2.4 (Table 4).

Table 3: Survey Methodology Used

Methodology Employed	Fauna Group Targeted			
	Mammals	Birds	Reptiles	Amphibians
Detailed Survey Methods (Areas E, G and H only)				
Glider Traps	✓	-	-	-
Pitfall Traps	✓	-	✓	✓
Reptile Funnel Traps	-	-	✓	-
Spotlighting	✓	✓	✓	✓
Remote Cameras	✓	✓	✓	✓
Call Detection and Playback	✓	✓	-	✓
Harp Traps	✓	-	-	-
Observational Survey Methods (All Areas)				
Elliott Traps	✓	-	✓	✓
Tree-mounted Traps	✓	✓	✓	-
Cage Traps	✓	✓	✓	-
Ground and Arboreal Hair Funnels	✓	-	-	-
Bird Surveys	-	✓	-	-
Herpetological Searches	-	-	✓	✓
Bat Call Detection	✓	-	-	-
Animal Track Recognition	✓	✓	✓	-
Opportunistic Observations	✓	✓	✓	✓

Table 3: Survey Methodology Used (Continued)

Methodology Employed	Fauna Group Targeted			
	Mammals	Birds	Reptiles	Amphibians
Observational Survey Methods (All Areas) (Continued)				
Scat Analysis	✓	✓	✓	-
Habitat Analysis	-	-	-	-
Scat and Owl Pellet Identification	✓	✓	-	-
Scat and Owl Pellet Analysis	✓	✓	✓	-
Scratches	✓	✓	✓	-
Burrows and Nests	✓	✓	✓	-
Sand Plots	✓	✓	✓	-
Point Surveys	-	✓	-	-
Direct Observation/Visual Encounter Surveys	✓	✓	✓	✓

The following sections describe the techniques used in detail.

Elliott Trapping

At each detailed survey site there were 25 small (8 x 10 x 33 centimetre [cm]) Elliott traps laid in straight lines for five days throughout the habitats. This is equivalent to 100 trap nights over four consecutive nights at each site. The traps were baited with a mixture of rolled oats, peanut butter and bacon fat, and a small piece of dacron was placed within each trap (as protection against the cold). A freezer bag was placed over the end of each trap to prevent the contents becoming wet from rain. At each trap site a description of the physical characteristics of the habitat within a 1 m radius was noted. This information is used in the analysis of habitat values. A large Elliott trap (Plate 1) was placed at each site (totalling four trap nights per night). The large Elliott traps were baited with chicken, apple and a muesli bar.

Plate 1: Glider Trap and Large Elliott Trap within Modification Area H

Tree-mounted Elliott Traps

To sample small arboreal mammals, five small Elliott traps were mounted on trees at equal distances along each transect (20 trap nights over four consecutive nights at each detailed survey site). Aluminium tree mounts were attached to trees and a baited Elliott trap was 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. Again, dacron and freezer bags were used to protected fauna species from cold and wet conditions.

Cage Traps

Tomahawk cage traps were laid on the ground and on a platform attached to trees at each detailed survey site (Plates 2 and 3). The number of Tomahawk traps varied at each site according to the presence of trees large enough to hold a cage trap. The Tomahawk traps were baited with chicken, apple and a muesli bar.

Plate 2: Drift Line Setup within Modification Area H

Plate 2 also shows a drift line setup, remote camera and reptile funnels.

Plate 3: Tree and Ground-mounted Tomahawks

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. Five hair funnels were set out at each detailed survey site for four nights and baited with a mixture of rolled oats, peanut butter and bacon fat. Where possible, some of the hair funnels were set onto 'habitat trees' (these are considered to be trees that showed signs of use by arboreal marsupials and have obvious hollows).

Glider Traps

Tree-mounted plastic tubes were used to capture small arboreal mammals (e.g. Squirrel Glider). These act as vertically mounted pit traps and were baited with a mixture of rolled oats, peanut butter and honey. Two traps were placed at each detailed survey site over four consecutive nights (Plate 1).

Pitfall Traps

Pit traps were constructed from a 20 litre bucket and combined with a 20 m drift fence made from fly-screen wire mesh (Plate 2). These were used where the ground could be dug to a depth to accommodate the buckets. Pit traps were established at two sites (i.e. Modification Areas G and H) and used for five days.

Reptile Funnel Traps

Reptile funnel traps are basically an enlarged rectangular fish trap (about 75 cm long and 18 cm wide) made from plastic netting over a wire frame with a funnel at each end (Plate 2). Each trap uses a screen of sun-shade cloth to protect any captures. Reptile funnels were used at Modification Area H where the soil was too hard for digging.

Spotlighting

Spotlighting from a moving vehicle was undertaken along tracks within the study area. Spotlighting on foot was also undertaken at some detailed fauna survey sites (i.e. Modification Areas G and H).

Remote Cameras

Digital Scouting Cameras (Plate 2) with infrared illumination were set up at Modification Areas E, G and H and run for three to five days. In addition, a remote camera was set up at a small bait station to record any fauna attracted to the bait. A variation of the established techniques was trialled using a remote camera above a drift fence. The camera at site H3 focused on a cork tile which provided a surface for reptiles to cross. The contrast in temperature between the cold-blooded animal and the warm tile could trigger the camera.

Bird Surveys

In addition to the results obtained from general observations and spotlighting, listening and observing periods were undertaken at all sites. 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 (point surveys). At each site up to four periods of observation were undertaken (two in the morning and two in the late afternoon).

Call Detection and Playback

Calls of several species of arboreal marsupials and nocturnal birds were broadcast during the night at Modification Areas G and H. Calls were broadcast through a megaphone for approximately five minutes, with a 10 minute listening time. Calls from the Koala (*Phascolarctos cinereus*), Sugar Glider (*Petaurus breviceps*), Squirrel Glider (*Petaurus norfolcensis*), Yellow-bellied Glider (*Petaurus australis*), Bush Stone-curlew (*Burhinus grallarius*), Powerful Owl (*Ninox strenua*), Masked Owl (*Tyto novaehollandiae*), Tawny Frogmouth (*Podargus strigoides*), Barking Owl (*Ninox connivens*), Eastern Grass Owl (*Tyto capensis*), Australian Owlet-nightjar (*Aegotheles cristatus*), Barn Owl (*Tyto alba*), Southern Boobook (*Ninox boobook*) and the Spotted Nightjar (*Eurostopodus mystacalis*) were broadcast.

Herpetological Searches

Systematic searches for reptiles and amphibians were undertaken within each habitat type at each survey site. 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. Searches for amphibians took place at night using spotlights (particularly after the one day of rain) and recognition of characteristic calls. Spotlighting searches were also undertaken for reptiles, particularly in areas of rock.

Bat Call Detection

An Anabat II Bat Detector with a Compact Flash Storage ZCAIM was placed at Modification Areas E and G for one night and recorded any bat calls. Bat calls were analysed by Glenn Hoye, FBN Bat Surveys PL.

Harp Traps

Harp traps usually consist of a 1.8 m square frame made of aluminium mounted on adjustable legs. Monofilament fishing line is strung vertically in the frame in two banks, with the lines c. 2.5 cm apart and the banks separated by c. 10 cm, and with the lines of each bank offset. Below the bottom of the frame is a canvas catch bag lined with plastic. Traps are usually placed in vegetation corridors, over water tanks, and at cave or mine entrances. Bats fly into the fishing lines and slide down into the catch bag from which they cannot escape (Plate 4). Harp traps were placed within Modification Areas G and H.

Plate 4: Setting up the Harp Trap within Modification Area G

Animal Track Recognition

Areas of sand on tracks (sand plots) were inspected for evidence of animal movement. Paw prints and other animal signs e.g. scratches, were identified and recorded.

Opportunistic Observations and Scat Analysis

Any sightings of fauna were recorded whilst moving throughout the survey area (Visual Encounter/Direct Observation) and located using a Global Positioning System. Any scats and owl casts were collected and identified, and their contents analysed.

Burrows and nests observed were noted and identified, where possible. Sand plots were used where the ground surface permitted. Point surveys were conducted within Modification areas E, F, G and H

3.2.4 Survey Effort

A summary of the number of trap nights undertaken for each survey technique and the methods used in each Modification open cut extension area are shown in Table 4.

Table 4: Survey Effort Undertaken at each Survey Site as Number of Trap Nights and Person Days

Survey Method	Areas E, G and H Detailed Survey Methods	Areas C, D and F Observational Survey Methods
Ground Elliott Traps (small)	300 trap nights	-
Tree-mounted Elliott Traps	60 trap nights	-
Large Elliott Traps	20 trap nights	
Cage Traps	64 trap nights	-
Hair Funnels	60 trap nights	-
Glider Traps	24 trap nights	-
Pitfall Traps	10 trap days	-
Reptile Funnel Traps	8 trap nights	-
Spotlighting	3 hours; 12.4 km	-
Remote Cameras	28 trap nights	-
Bird Surveys	10 person days	6 person days
Call Detection and Playback	2 nights	-
Herpetological Searches	10 person days – at least 30 minutes in multiple locations	6 person days
Bat Call Detection	2 nights	-
Habitat Structural Analysis	Conducted in each habitat type	-
Harp Traps	2 nights	-
Animal Track Recognition	10 person days where encountered	6 person days where encountered
Bird Surveys	Conducted in each habitat type (approximately 10 person days)	Conducted in each habitat type (approximately 6 person days)
Marsupial Call Detection and Playback	2 nights	-
Diurnal and Nocturnal Bird Call Detection and Playback	2 nights	-
Opportunistic Observations	10 person days	6 person days
Scat Analysis	10 person days where encountered	6 person days where encountered
Scat and Owl Pellet Identification and Analysis	10 person days where encountered	6 person days where encountered
Scratches	10 person days where encountered	6 person days where encountered

Table 4: Survey Effort Undertaken at each Survey Site as Number of Trap Nights and Person Days (Continued)

Survey Method	Areas E, G and H Detailed Survey Methods	Areas C, D and F Observational Survey Methods
Burrows and Nests	10 person days where encountered	6 person days where encountered
Sand Plots	10 person days where encountered	6 person days where encountered
Point Surveys	10 person days	4 person days
Visual Encounter Surveys	10 person days	4 person days
Direct Observation	10 person days	6 person days

3.3 TARGETED SURVEYS FOR THREATENED SPECIES

Records were extracted from the NSW Wildlife Atlas (OEH, 2012), BirdLife Australia (2012), Australian Museum (2012) and the EPBC Act protected matters search tool (SEWPaC, 2012), as described in Section 3.1, for threatened fauna species and populations recorded within a 20 square kilometre search area centred on the study area. The results of these database searches are presented in Attachment A.

The database results and threatened species records of species previously recorded within or surrounding the study area (Attachment A) were used as a guide to determine which threatened populations or species (or their habitats) might be present within the study area and surrounds. Habitat requirements of threatened species listed in the database results were reviewed and if habitat resources for the species were present within the study area then this species was also considered to possibly occur within the study area/surrounds for the purpose of the surveys.

The assessment of threatened fauna species likelihood of occurrence within the study area and surrounds is provided in Table 5. A total of 43 threatened fauna species are assessed in Table 5. Threatened species that have the potential to occur within the study area (i.e. excluding those with an “unlikely” rating) are further assessed in Section 6.0.

The following species, although listed in Attachment A as they or their habitat were predicted to occur in the EPBC Act protected matters search (SEWPaC, 2012), were excluded from assessment in Table 5 due to a lack of necessary habitat components (i.e. wetland habitat), namely the: Murray Cod (*Maccullochella peelii*), Australasian Bittern (*Botaurus poiciloptilus*) and Australian Painted Snipe (*Rostratula australis*). These species are not discussed further in this report.

All of the field survey techniques listed in Section 3.2 were considered appropriate to identify all threatened species listed in Table 5.

3.4 HABITAT ASSESSMENT

As each Elliott trap was laid in the detailed survey sites (i.e. in Modification Areas E, G and H) habitat components within the trap site were 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 1 m radius around each trap. For example, if 15 trap sites out of a trap line of 20 Elliott traps contained a shrub, then it was estimated that the shrub cover in that survey site was 75%.

Table 5: Threatened Fauna Likelihood of Occurrence

Scientific Name	Common Name	Conservation Status[1]		Habitat Preference	Species Previously Recorded within the Study Area or Surrounds?	Likelihood of Occurrence
		TSC Act	EPBC Act			
Amphibians						
Mixophyes iteratus	Giant Barred Frog	E	E	Deep, damp leaf litter in rainforests, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1,000 m (OEH, 2013a).	No. This species is predicted to occur in the EPBC Act protected matters search only (SEWPaC, 2012) and there is only one database record in the region (OEH, 2012).	Unlikely to occur in the Modification open cut extension areas due to a lack of records within or surrounding the study area and the occurrence of only marginal potential habitat resources.
Litoria booroolongensis	Booroolong Frog	E	E	Permanent streams with some fringing vegetation cover (OEH, 2013a).	No. This species is predicted to occur in the EPBC Act protected matters search only (SEWPaC, 2012).	Unlikely to occur in the Modification open cut extension areas due to a lack of records within or surrounding the study area and the occurrence of only marginal potential habitat resources.
Reptiles						
Aprasia parapulchella	Pink-tailed Worm-lizard	V	V	Under small rocks embedded in the soil.	This species has not been recorded within the study area or immediate surrounds. This species is predicted to occur in the EPBC Act protected matters search only (SEWPaC, 2012).	Unlikely.
Hoplocephalus bungaroides	Broad-headed Snake	E	V	Rocky outcrops and adjacent sclerophyll forest and woodland.	No. This species is predicted to occur in the EPBC Act protected matters search only (SEWPaC, 2012).	Unlikely due to a lack of records within or surrounding the study area and the occurrence of only marginal potential habitat resources.

Table 5: Threatened Fauna Likelihood of Occurrence (Continued)

Scientific Name	Common Name	Conservation Status[1]		Habitat Preference	Species Previously Recorded within the Study Area or Surrounds?	Likelihood of Occurrence
		TSC Act	EPBC Act			
Birds						
Leipoa ocellata	Malleefowl	E	V	Semi-arid to arid shrublands and low woodlands (SEWPaC, 2013b).	No. This species is predicted to occur in the EPBC Act protected matters search only (SEWPaC, 2012) and there is only one database record in the region (OEH, 2012).	Although there is a record from nearby Goulburn River National Park it is highly unlikely that this species could occur in the Modification open cut extension areas due to lack of suitable preferred habitat and no records in the region.
Lophoictinia isura	Square-tailed Kite	V	-	Eucalypt woodland, open forest and heath-woodland (Morcombe, 2004).	Yes. Recorded surrounding Modification Area F and to the east of Modification Area C during previous surveys (MKES, 2005) and listed as occurring in database results (OEH, 2012; BirdLife Australia, 2012).	Possible to occur in the Modification open cut extension areas given that the species was recorded within the study area during past survey and the occurrence of potential habitat resources.
Hieraaetus morphnoides	Little Eagle	V	-	Woodland, forest, farmland, grasslands, crops, treeless dune fields, and recently logged areas (OEH, 2013a).	Yes. Recorded at two locations surrounding the study area during previous surveys (MKES, 2005) and listed as occurring in database results (OEH, 2012; BirdLife Australia, 2012).	Located during present surveys and previous surveys.
Calyptorhynchus lathami	Glossy Black-cockatoo	V	-	Forest and woodland with abundant Casuarina trees (Morcombe, 2004).	Yes. Recorded at one location near Area C and within Area G during previous surveys (MKES, 2005) and listed as occurring in database results (OEH, 2012; BirdLife Australia, 2012). Located in adjoining Slate Gully (Lesryk, 2013).	Likely to occur in the Modification open cut extension areas. Previously recorded within the study area surrounds.
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	Alpine woodland and dense, tall, wet forests of mountains and gullies (Morcombe, 2004).	Yes. Recorded at one location surrounding the study area during previous surveys (MKES, 2005) and listed as occurring in database results (OEH, 2012; BirdLife Australia, 2012).	Possible to occur in the Modification open cut extension areas given that the species was recorded within the study area surrounds during past survey and the occurrence of potential habitat resources.

Table 5: Threatened Fauna Likelihood of Occurrence (Continued)

Scientific Name	Common Name	Conservation Status[1]		Habitat Preference	Species Previously Recorded within the Study Area or Surrounds?	Likelihood of Occurrence
		TSC Act	EPBC Act			
Birds (Continued)						
Glossopsitta pusilla	Little Lorikeet	V	-	Open eucalypt forests and woodlands (OEH, 2013a).	Yes, within the Modification open cut extension areas. Recorded within and adjacent to Modification Area G (MKES, 2005); and other locations surrounding the study area during previous surveys (MKES, 2005); and listed as occurring in database results (OEH, 2012; BirdLife Australia, 2012; Australian Museum, 2012).	Possible to occur in the Modification open cut extension areas given that the species was recorded within the study area surrounds during past survey and the occurrence of potential habitat resources. Located in adjoining Slate Gully (Lesryk, 2013).
Neophema pulchella	Turquoise Parrot	V	-	Open woodlands and eucalypt forests with a ground cover of grasses and under storey of low shrubs (OEH, 2013a).	Yes. Recorded surrounding the study area during previous surveys (MKES, 2005) and listed as occurring in database results (OEH, 2012; BirdLife Australia, 2012).	Possible to occur in the Modification open cut extension areas given that the species was recorded within the study area during past survey and the occurrence of potential habitat resources.
Lathamus discolor	Swift Parrot	E	E	Dry sclerophyll eucalypt forests and woodlands (SEWPaC, 2013b).	Yes. Listed as occurring in database results (OEH, 2012) and is predicted to occur in the EPBC Act protected matters search (SEWPaC, 2012).	Possible to occur in the Modification open cut extension areas given that records of this species exist in the region and the occurrence of potential habitat resources.
Polytelis swainsonii	Superb Parrot	V	V	Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest (OEH, 2013a).	No. This species is only predicted to occur in the EPBC Act protected matters search (SEWPaC, 2012).	Possible to occur in the Modification open cut extension areas as it utilises woodland habitats. No records from immediate area.
Tyto novaehollandiae	Masked Owl	V	-	Diverse range of wooded habitat (OEH, 2013a).	Yes. One individual has been recorded to the south-west of the study area during previous surveys (MKES, 2005) and listed as occurring in database results (OEH, 2012). Located in adjoining Slate Gully (Lesryk, 2013).	Possible to occur in the Modification open cut extension areas due to the presence of records of this species near the study area and the occurrence of potential habitat resources.
Ninox strenua	Powerful Owl	V	-	Forests and woodlands (DEC, 2006).	This species has not been recorded within the study area, but has been recorded in the surrounds in the OEH (2012) and BirdLife Australia (2012) database results.	Possible to occur in the Modification open cut extension areas due to potential habitat resources.

Table 5: Threatened Fauna Likelihood of Occurrence (Continued)

Scientific Name	Common Name	Conservation Status[1]		Habitat Preference	Species Previously Recorded within the Study Area or Surrounds?	Likelihood of Occurrence
		TSC Act	EPBC Act			
Birds (Continued)						
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-	Eucalypt woodlands (including Box-Gum Woodland) and dry open forest (OEH, 2013a).	Yes. Recorded adjacent to Area C and within Areas G and H during previous surveys (MKES, 2005); surrounding the study area during previous surveys (MKES, 2005); and listed as occurring in database results (OEH, 2012; BirdLife Australia, 2012).	Located during present surveys and by previous surveys.
Chthonicola sagittata	Speckled Warbler	V	-	Eucalyptus dominated communities that have a grassy understorey (OEH, 2013a).	Yes. Recorded at two locations surrounding the study area during previous surveys (MKES, 2005) and listed as occurring in database results (OEH, 2012; BirdLife Australia, 2012; Australian Museum, 2012).	Located during present surveys and by previous surveys.
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-	Drier open forests or woodlands dominated by box and ironbark eucalypts. Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks and tea-trees (OEH, 2013a).	Yes. Recorded adjacent to Modification Areas C and within Area G during previous surveys (MKES, 2005); and listed as occurring in database results (OEH, 2012; BirdLife Australia, 2012; Australian Museum, 2012). Located in adjoining Slate Gully (Lesryk, 2013).	Likely to occur in the Modification open cut extension areas. Previously recorded within the study area.
Anthochaera Phrygia	Regent Honeyeater	CE	E	Temperate eucalypt woodlands and open forests (OEH, 2013a)	Yes. This species was previously recorded within the OEH (2012) and BirdLife Australia (2012) database results and is predicted to occur in the EPBC Act protected matters search (SEWPaC, 2012).	Possible to occur in the Modification open cut extension areas due to the potential habitat resources.
Grantiella picta	Painted Honeyeater	V	-	Forest, dry scrub and woodland (often with abundant mistletoe) (Morcombe, 2004).	Yes. Recorded near Modification Areas G and H during previous surveys (MKES, 2005) and listed as occurring in database results (OEH, 2012; BirdLife Australia, 2012).	Likely to occur in the Modification open cut extension areas. Previously recorded near the study area.
Certhionyx variegatus	Pied Honeyeater	V	-	Arid woodland, mallee, acacia scrub, spinifex and drier heath (Morcombe, 2004).	Yes. Recorded at one location surrounding the study area in the OEH (2012) database results.	Unlikely to occur in the Modification open cut extension areas, as range is to the west and utilise Acacia woodlands not available at study area

Table 5: Threatened Fauna Likelihood of Occurrence (Continued)

Scientific Name	Common Name	Conservation Status[1]		Habitat Preference	Species Previously Recorded within the Study Area or Surrounds?	Likelihood of Occurrence
		TSC Act	EPBC Act			
Birds (Continued)						
Epthianura albifrons	White-fronted Chat	V	-	Salt marsh and other damp areas with low vegetation (BirdLife Australia, 2013).	Yes. Recorded surrounding the study area in the OEH (2012) and BirdLife Australia (2012) database results.	Unlikely to occur in the Modification open cut extension areas, as no records from immediate area and preferred habitat either not available or severely disturbed by grazing and clearing
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	-	Lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee (OEH, 2013a).	Yes. Recorded surrounding the study area during previous surveys (MKES, 2005); and listed as occurring in database results (OEH, 2012; BirdLife Australia, 2012).	Likely to occur in the Modification open cut extension areas. Previously recorded near the study area.
Petroica rodinogaster	Pink Robin	V	-	Rainforest, wet eucalypt forest, tree-fern gullies of ranges and more open country when it winters (Morcombe, 2004).	Yes. Recorded at one location surrounding the study area in the OEH (2012) database results.	Unlikely to occur in the Modification open cut extension areas as out of range and preferred habitat of rainforest not available.
Petroica boodang	Scarlet Robin	V	-	Forests, woodlands; and heavier vegetation when breeding (OEH, 2013a).	Yes. Recorded surrounding the study area in the OEH (2012) and BirdLife Australia (2012) database results. Located in adjoining Slate Gully (Lesryk, 2013).	Likely to occur in the Modification open cut extension areas, as preferred habitats and known from immediate area.
Petroica phoenicea	Flame Robin	V	-	Rainforest, wet eucalypt forest, woodland and more open woodland and farmland when it winters (Morcombe, 2004).	Yes. Recorded at one location surrounding the study area in the BirdLife Australia (2012) database results.	Likely to occur in the Modification open cut extension areas, as preferred habitats and known from immediate area.
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-	Open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands (OEH, 2013a).	Yes. Recorded surrounding the study area in the OEH (2012) and BirdLife Australia (2012) database results.	Located during present surveys.
Daphoenositta chrysoptera	Varied Sittella	V	-	Eucalypt forests and woodlands (OEH, 2013a).	Yes. Recorded surrounding the study area in the OEH (2012), BirdLife Australia (2012) and Australian Museum (2012) database results.	Likely to occur in the Modification open cut extension areas, as preferred habitats and known from immediate area.

Table 5: Threatened Fauna Likelihood of Occurrence (Continued)

Scientific Name	Common Name	Conservation Status[1]		Habitat Preference	Species Previously Recorded within the Study Area or Surrounds?	Likelihood of Occurrence
		TSC Act	EPBC Act			
Birds (Continued)						
Stagonopleura guttata	Diamond Firetail	V	-	Grassy eucalypt woodlands, open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities (OEH, 2013a).	Yes. Recorded adjacent to Area C and H and surrounding the study area during previous surveys (MKES, 2005) and listed as occurring in database results (OEH, 2012; BirdLife Australia, 2012; Australian Museum, 2012).	Located during present surveys.
Mammals						
Dasyurus maculatus	Spotted-tailed Quoll	V	E	Rainforest, open forest, woodland, coastal heath and inland riparian forest (OEH, 2013a).	No. Species is predicted to occur in the EPBC Act protected matters search only (SEWPaC, 2012) and listed as occurring in database results (OEH, 2012).	Unlikely to occur in the Modification open cut extension areas due to a lack of records within or near the study area.
Phascolarctos cinereus	Koala	V	V	Eucalypt forests and woodlands (OEH, 2013a).	Yes. Recorded surrounding the study area in the OEH (2012) database results and is predicted to occur in the EPBC Act protected matters search (SEWPaC, 2012).	Likely to occur in the Modification open cut extension areas as recent sighting in the surrounds of the study area and presence of potential habitat resources.
Petaurus norfolcensis	Squirrel Glider	V	-	Forest and woodland with habitat hollows and nectar resources (Van Dyck and Strahan, 2008).	Yes. Recorded surrounding the study area during previous surveys (MKES, 2005) and listed as occurring in database results (OEH, 2012).	Possible to occur in the Modification open cut extension areas due to the presence of records of this species within the study area and the occurrence of potential habitat resources.
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	Rocky escarpments (OEH, 2013a).	Yes. Recorded surrounding the study area in the OEH (2012) database results and is predicted to occur in the EPBC Act protected matters search (SEWPaC, 2012).	Unlikely to occur in the Modification open cut extension areas due to a lack of records within or near the study area.
Pteropus poliocephalus	Grey-headed Flying Fox	V	V	Mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest (OEH, 2013a).	No. Species is predicted to occur in the EPBC Act protected matters search only (SEWPaC, 2012). The closest known camp site is approximately 120 km east (Singleton).	Unlikely to occur in the Modification open cut extension areas due to a lack of records within or near the study area.

Table 5: Threatened Fauna Likelihood of Occurrence (Continued)

Scientific Name	Common Name	Conservation Status[1]		Habitat Preference	Species Previously Recorded within the Study Area or Surrounds?	Likelihood of Occurrence
		TSC Act	EPBC Act			
Mammals (Continued)						
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Wet and dry forests, grasslands, shrublands, Mallee and open woodlands (Churchill, 2008).	Yes. Recorded near Area G and surrounding the study area during previous surveys (Greg Richards and Associates Pty Ltd, 2005) and recorded surrounding the study area in database results (OEH, 2012).	Possible to occur in the Modification open cut extension areas due to the presence of records of this species near the study area and the occurrence of potential habitat resources.
Mormopterus norfolkensis	Eastern Freetail-bat	V	-	Rainforest, Melaleuca forest, monsoon forest, tall open forest, River Red Gum and Yellow Box woodlands, riparian open forest and dry sclerophyll forest (Churchill, 2008).	Yes. Recorded surrounding the study area during previous surveys (Greg Richards and Associates Pty Ltd, 2005).	Possible to occur in the Modification open cut extension areas due to the presence of records of this species near the study area and the occurrence of potential habitat resources.
Miniopterus australis	Little Bentwing-bat	V	-	Moist eucalypt forest, rainforest or dense coastal Banksia scrub (OEH, 2013a).	Yes. Recorded surrounding the study area during previous surveys (Greg Richards and Associates Pty Ltd, 2005) and listed as occurring in database results (OEH, 2012).	Possible to occur in the Modification open cut extension areas due to the presence of records of this species near the study area.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	Rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, Melaleuca forests and open grasslands (Churchill, 2008).	Yes. Recorded near Area G and surrounding the study area during previous surveys (Greg Richards and Associates Pty Ltd, 2005) and listed as occurring in database results (OEH, 2012).	Located during present survey within Area G.
Nyctophilus corbeni	Corben's/ South-eastern Long-eared Bat	V	V	Rainforest, wet and dry sclerophyll forest, paperbark forest and open grasslands (OEH, 2013a).	Yes. Recorded surrounding the study area in the OEH (2012) database results and is predicted to occur in the EPBC Act protected matters search (SEWPaC, 2012).	Possible to occur in the Modification open cut extension areas due to the presence of records of this species near the study area and the occurrence of potential habitat resources.
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Dry sclerophyll forests and woodlands, sub-alpine woodland, the edge of rainforest, wet sclerophyll forest and sandstone outcrop country (Churchill, 2008).	Yes. Recorded surrounding the study area during previous surveys (Greg Richards and Associates Pty Ltd, 2005); is listed as occurring in database results (OEH, 2012); and predicted to occur in the EPBC Act protected matters search (SEWPaC, 2012).	Located during present survey within Area E.

Table 5: Threatened Fauna Likelihood of Occurrence (Continued)

Scientific Name	Common Name	Conservation Status[1]		Habitat Preference	Species Previously Recorded within the Study Area or Surrounds?	Likelihood of Occurrence
		TSC Act	EPBC Act			
Mammals (Continued)						
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	Wet sclerophyll and coastal mallee, tall and wet forests where trees are more than 20 m high (Churchill, 2008).	Yes. Recorded near the Modification Area H and surrounding the study area during previous surveys (Greg Richards and Associates Pty Ltd, 2005) and listed as occurring in database results (OEH, 2012).	Located during present survey within Area G.
Vespadelus troughtoni	Eastern Cave Bat	V	-	Dry open forest and woodland, near cliffs or rocky overhangs (OEH, 2013a).	Recorded in region on database records (OEH, 2012). Located in adjoining Slate Gully (Lesryk, 2013).	Located during present surveys within Area E.
Pseudomys novaehollandiae	New Holland Mouse	-	V	Open heathland, open woodland with a heathland understorey and vegetated sand dunes (SEWPaC, 2013b).	This species has not been recorded within the study area or immediate surrounds. This species is predicted to occur in the EPBC Act protected matters search only (SEWPaC, 2012).	Unlikely as closest known record is 50 km east of ML 1573 on the eastern side of Goulburn River National Park.

Note: Threatened species locations are shown Attachment B.

[1] Threatened fauna species status under the TSC Act and/or EPBC Act (current at 14 February 2013).
V = Vulnerable; E = Endangered; CE = Critically Endangered.

3.5 STATISTICAL ANALYSIS OF RESULTS

Because of the accumulation of data under formal survey conditions (consistent survey effort and techniques at survey areas E, G and H, and generally over the entire Modification open cut extension areas) it is possible to calculate some comparisons and relationships from the results of the survey.

Total numbers and species richness (number of species per site) are the simplest measures used to determine biodiversity of a site. However, these indices miss the information that some species may be rare and others common. The Simpson's Index of Diversity (D) takes into account both the abundance patterns and the species richness of a community. 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). It was possible to calculate Simpson's Index of Diversity for mammal, bird and reptile populations from each survey site for most survey periods.

An Evenness score was also calculated. Evenness is a measure of the relative abundance of different species making up the richness of an area. A low value for Evenness means that the sample is dominated by a large number of one or two species. A high Evenness value means that most species in the sample have a similar abundance.

4.0 RESULTS

4.1 FAUNA LOCATED

A total of 124 fauna species, comprising six amphibians, six reptiles, 85 birds (including one introduced species) and 27 mammals (including seven introduced species) were located during the surveys of the study area. A complete list of species recorded during the surveys is provided in Attachment C.

4.2 THREATENED FAUNA SPECIES

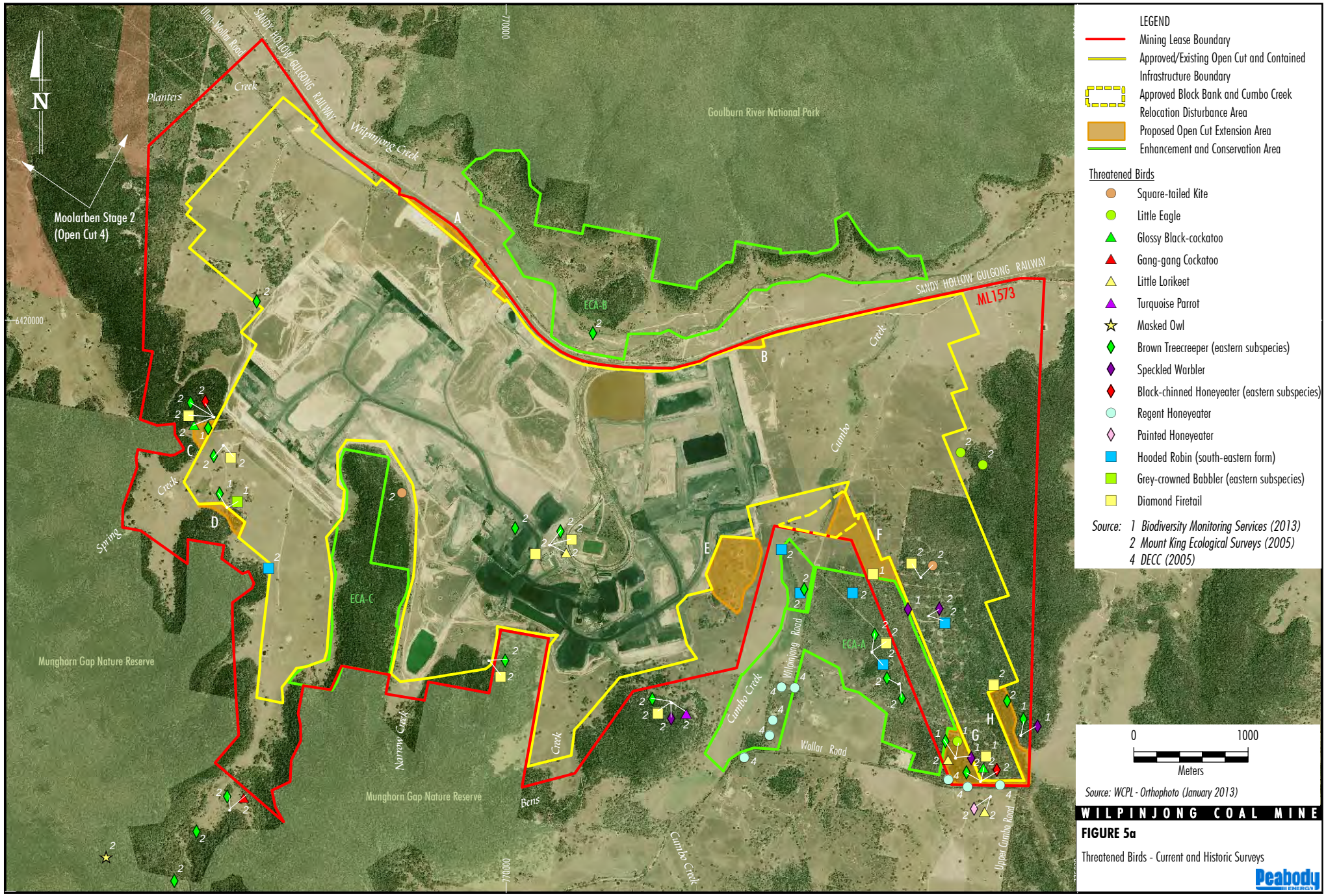
Nine threatened fauna species were located during the surveys, namely the: Large-eared Pied Bat, Eastern False Pipistrelle, Eastern Bentwing-bat, Eastern Cave Bat, Little Eagle, Brown Treecreeper (eastern subspecies), Grey-crowned Babbler (eastern subspecies), Speckled Warbler and Diamond Firetail. Most of these species are closely associated with woodland habitats, with the Little Eagle also utilising open areas for foraging and woodland for roosting and nesting. Such species are often located within remnant areas of woodland. Other than the Grey-crowned Babbler (eastern subspecies), the woodland bird species listed above were also recorded during the 2004 surveys for the EIS (MKES, 2005). Of the threatened bats, the Large-eared Pied Bat, Eastern Bentwing-bat and Eastern Cave Bat are mainly associated with caves whilst the Eastern False Pipistrelle utilises tree hollows. As there are no caves, roosts or potential roosts known in the Modification open cut extension areas, the cave dwelling bats are considered to have been using the habitat to forage.

The locations of the nine species, along with records from previous surveys, are shown on Figures 5a and 5b and the co-ordinates of where they were recorded are provided in Table 6.

4.3 HABITAT ASSESSMENT

The Modification open cut extension areas comprise two key habitat types (grassland and woodland). The grassland areas have been heavily disturbed by post-clearing and grazing. Some areas retain native groundcover species while other areas are heavily weed infested.

The woodland areas vary from low disturbance to high disturbance due to selective logging, grazing and rubbish dumping. Overall, the woodland areas provide more habitat opportunities than the grassland areas, although they are not in pristine condition.



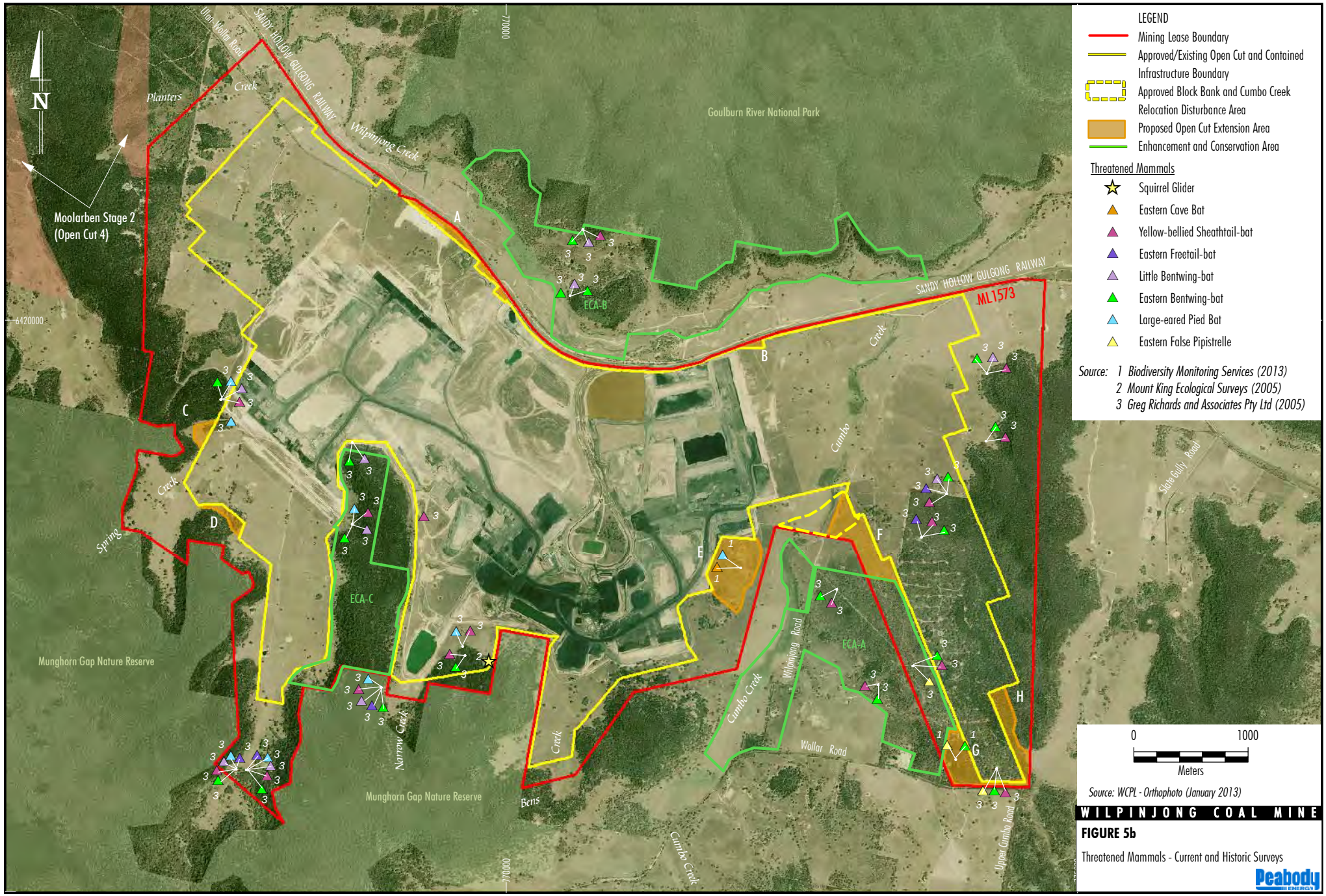
WILPINJONG COAL MINE

FIGURE 5a

Threatened Birds - Current and Historic Surveys

Peabody ENERGY

WIL-12-12_75WMod12_Fauna_203D



WILPINJONG COAL MINE

FIGURE 5b

Threatened Mammals - Current and Historic Surveys

Peabody ENERGY

WIL-12-12_75WMod12_Fauna_204D

Table 6: Threatened Fauna Species Recorded During the Current Surveys

Scientific Name	Common Name	Conservation Status under the TSC Act[1]	Survey Area	No. of Individuals Recorded	Habitat Type	Co-ordinates (AMG WSG94)	
						Easting	Northing
Birds							
Hieraaetus morphnoides	Little Eagle	V	Area G	1	Woodland	773936	6416153
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	Area G	3	Woodland	773936	6416153
			Area G	7	Woodland	774506	6416355
			Area C	1	Woodland	767394	6419050
			Area D	2	Woodland	767559	6418350
Chthonicola sagittata	Speckled Warbler	V	Area C	11	Woodland	773936	6416153
			Area G	2	Woodland	774506	6416355
			Opportunistic	1	Woodland	773518	6417456
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	Area D	4	Woodland	767559	6418350
Stagonopleura guttata	Diamond Firetail	V	Opportunistic	1	Grassland	773211	6417766
			Opportunistic	1	Woodland	774202	6416170
Mammals							
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	Area G	-	Woodland	773936	6416153
Chalinolobus dwyeri	Large-eared Pied Bat	V	Area E	-	Woodland/ Grassland	772056	6417831
Falsistrelle tasmaniensis	Eastern False Pipistrelle	V	Area G	-	Woodland	773936	6416153
Vespadelus troughtoni	Eastern Cave Bat	V	Area E	-	Woodland/ Grassland	772056	6417831

[1] Threatened fauna species status under the TSC Act (current at 14 February 2013). V = Vulnerable.

The results of the habitat assessment are shown in Table 7. Although there are differences between the amounts of habitat cover between three detailed survey sites, there are no significant differences between the habitat characteristics (non-parametric Kruskal-Wallis One Way Analysis of Variation on Ranks).

Measurements of habitat characteristics derived from trap site descriptions have been used to provide an index of habitat complexity that can be helpful in determining the values of the habitats surveyed in the study area. One system used to assess habitat values is that developed by Catling and Burt (1995), called the Habitat Complexity Score. This system scores the following parameters: tree cover; tall and low shrub cover; ground herbage; litter cover; and logs/rocks. The scores range from 0 to 3, with a maximum score for all parameters of 18. The habitat complexity scores for each survey site are provided in Table 8.

Table 7: Habitat Characteristics of Woodland within Modification Areas E, G and H

	Modification Areas		
% Cover	**Area E**	**Area G**	**Area H**
Tree	36	40	40
Tall Shrubs	24	20	8
Tall Saplings	0	40	0
Low Shrubs	76	68	52
Low Saplings	4	8	4
Cutting Grass	12	4	0
Grass	72	80	84
Forb	56	20	48
Fern	20	4	0
Vine	0	0	4
Litter	96	96	76
Log	72	52	32
Rock	32	0	28

Table 8: Habitat Complexity Scores for Woodland within Modification Areas E, G and H

Parameter	**Modification Area**		
	Area E	**Area G**	**Area H**
Tree Cover	2	2	2
Tall Shrub Cover	0	3	2
Low Shrub Cover	3	3	3
Ground Herbage	3	3	3
Litter	3	3	3
Logs/Rocks	2	2	3
Total	**13**	**16**	**16**

Although there are no large differences between the three woodland survey sites, the habitat complexity is lowest at Area E. This is due to the lack of understorey resulting from previous clearing and stock grazing.

4.4 SEPP 44 KOALA HABITAT

According to NSW *State Environmental Planning Policy No. 44 – Koala Habitat Protection, 2000* (SEPP 44), land can be considered as potential Koala habitat if certain feed tree species are present. Potential Koala habitat means areas of native vegetation where the trees of the 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. Schedule 2 of SEPP 44 lists a number of eucalypt species that are considered to be Koala feed trees.

These include White Box and Grey Box both of which are present within the Modification open cut extension areas (Hunter Eco, 2013). Although the area may be considered potential habitat, it cannot be classed as core habitat for Koalas.

Core Koala habitat means an area of land with a resident population of Koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.

Despite targeted surveys, there is no evidence that Koalas utilise the Modification open cut extension areas either at present, or historically. There has been a recent sighting of a Koala at the end of Wilpinjong Road indicating that this species does utilise the local area. However, despite several surveys there is no evidence of their presence in the Modification open cut extension areas from characteristic tree scratches and scats. A single Koala sighting occurred at nearby Ulan Coal Mines in 2012, but there have been no other sightings despite continued surveys for the last 30 years. It is concluded that the Modification open cut extension areas may be classed as potential habitat (provided that 15% of the trees species are classed as Koala feed trees) but it is not a Koala core habitat.

There are 11 records for the Gulgong 1:100 000 map sheet in the OEH wildlife database, of which most are from the 1950s with the latest in 2011. According to Dan Lunney (OEH, *pers. comm.*), Koalas (including females) have been known to move 20 km to new sites and that the one sighting in the area is notable but not unusual. It was also noted that there have been several occasions of Koalas found that were raised by people and released in the wrong areas.

Considering the dearth of sightings in the immediate and surrounding area it is unlikely that a viable population exists in or near Wilpinjong Coal Mine and that the single animal sighted was an individual moving between areas.

4.5 TREE HOLLOWS

Trees were inspected at each Modification area (except Areas A, B and F which do not contain mature trees) to determine the approximate proportion of tree hollows. Hollows observed were recorded as either small (e.g. cracks in dead branches, loose bark), medium (small noticeable holes in tree trunks or pipes) or large (obvious hollows usually in tree trunks and in large broken branches). A sample of trees at each area was inspected and any hollows noted. This provided a proportion of hollows in trees for each area. The results from the tree hollow survey are given in Table 9.

Table 9: Proportion of Tree Hollows in Each Modification Area

Modification Area	Proportion of Tree Hollows in a Sample from Each Modification Area	Number of Hollows Recorded		
		Small	Medium	Large
Area A	No mature trees present	0	0	0
Area B	No mature trees present	0	0	0
Area C	Small number of trees, ~30% tree hollows	0	1	1
Area D	All young trees, no tree hollows noted	0	0	0
Area E	Small number of trees, ~30% tree hollows	0	1	1
Area F	No mature trees present	0	0	0
Area G	Number of mature trees, 39% hollows	5	3	2
Area H	Number of mature trees, 30% hollows	5	3	2

4.6 STATISTICAL ANALYSIS OF FAUNA SURVEY RESULTS

Table 10 provides the results from calculations of biodiversity indices for the four faunal groups surveyed (i.e. amphibians, reptile, birds and mammals). Species Richness represents the number of species recorded. An indicator of Evenness is produced to describe how close in numbers each species in an environment are. A low Evenness value (approaching 0) indicates that a single species dominates while a high value means that all species are represented in approximately even numbers. Simpson's Index of Diversity describes how many species there are and takes into account Evenness. A Simpson's Index of Diversity value of 1 indicates there are many species with similar abundances while a low value (approaching 0) indicates that there are few species with very varied abundances.

Table 10: Biodiversity Indices for Fauna Groups in 2004 and 2012 at Wilpinjong Coal Mine

Fauna Groups	Evenness	Simpson's Index of Diversity	Number Recorded	Species Richness
2012 (Current Survey)				
Amphibians	0.668	0.602	25	6
Reptiles	0.828	0.710	13	6
Birds	0.816	0.957	1252	85
Mammals	0.607	0.628	133	27
2004 (MKES, 2005)				
Amphibians	0.918	0.444	3	2
Reptiles	0.959	0.867	14	9
Birds	0.829	0.962	862	90
Mammals	0.744	0.787	171	12

The values obtained are typical of that from similar surveys in the surrounding regions, and are similar to that obtained during the previous surveys conducted for the EIS in 2004 (MKES, 2005). Table 10 and Figures 6a to 6c show the biodiversity indices for the two surveys at Wilpinjong Coal Mine (i.e. the current survey and the survey conducted by MKES in 2004 for the EIS). There are no significant differences between the two samples (paired t-tests and non-parametric Wilcoxon Signed Rank Test).

As can be seen from Figure 6a, the Simpson's Index of Diversity is similar for the two surveys. The 2004 survey (MKES, 2005) sampled a larger area of undisturbed bushland compared to 2012 and expended a greater survey effort. However, based on the results, the remaining areas of natural habitat still support a similar diversity of bird species (Figure 6a). The diversity is also similar for native mammals, although fewer mammals were located in 2012 compared to the 2004 surveys (MKES, 2005). The surveys in 2012 were undertaken in summer, a time when small ground mammals are scarce. This is due to fewer movements by mammals during this time as they are caring for their young. Relatively high numbers of these species were captured in 2004 (MKES, 2005) (e.g. 35 captures of Yellow-footed Antechinus in 2004 and only one in 2012). More reptiles were located in 2004 (MKES, 2005), possibly due to the greater survey effort undertaken to find this fauna group. However, greater numbers and diversity of frogs occurred in 2012 (Figure 6b). This was possibly due to the lack of waterbodies in the area, as nearly all frogs were located at one dam within Modification Area F in 2012.

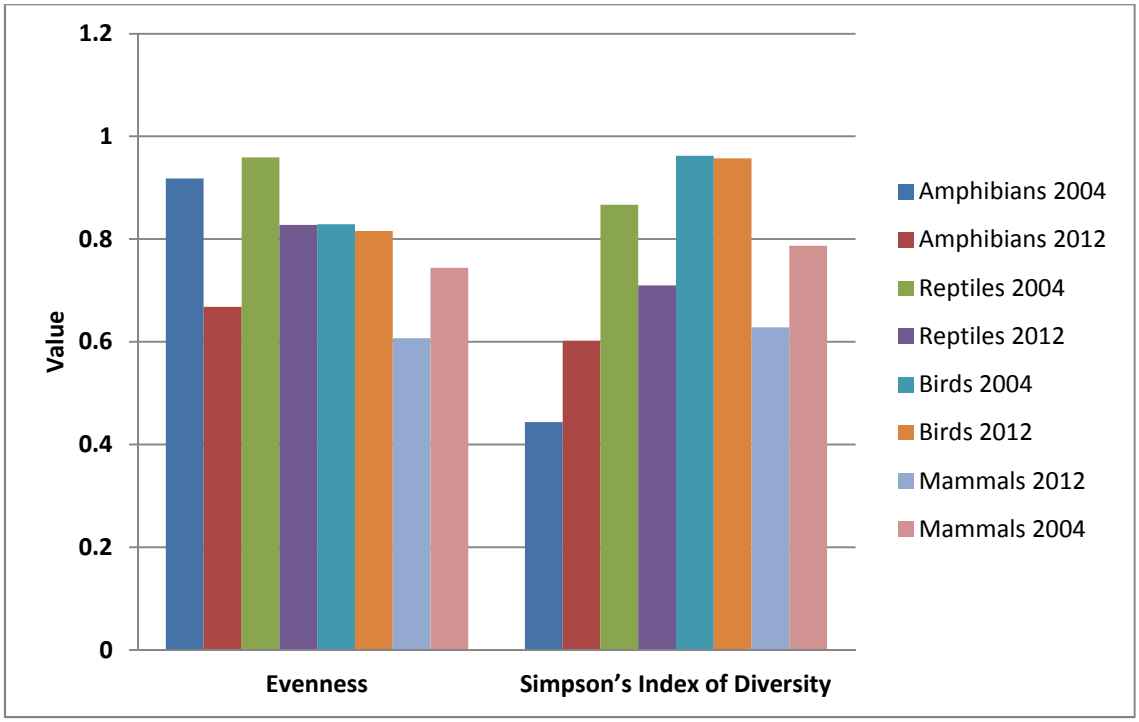


Figure 6a: Biodiversity Indices for Fauna Groups at Wilpinjong Coal Mine in 2004 and 2012 - Evenness and Simpson's Index of Diversity

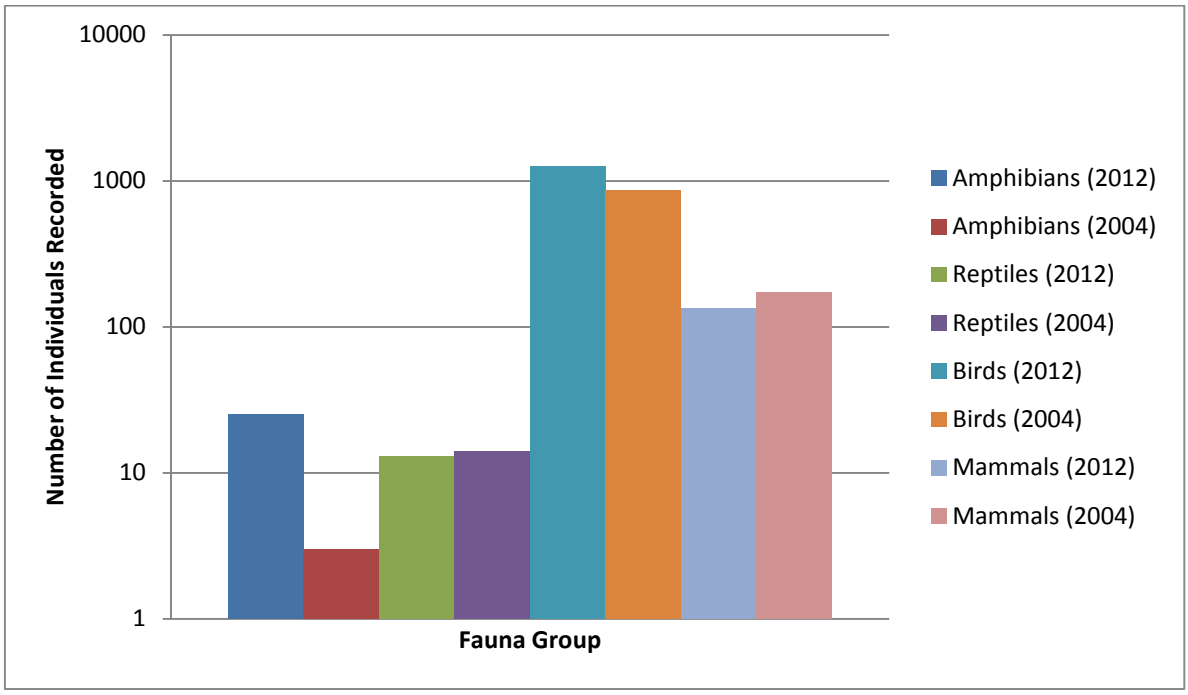


Figure 6b: Biodiversity Indices for Fauna Groups at Wilpinjong Coal Mine in 2004 and 2012 - Number of Individuals Recorded

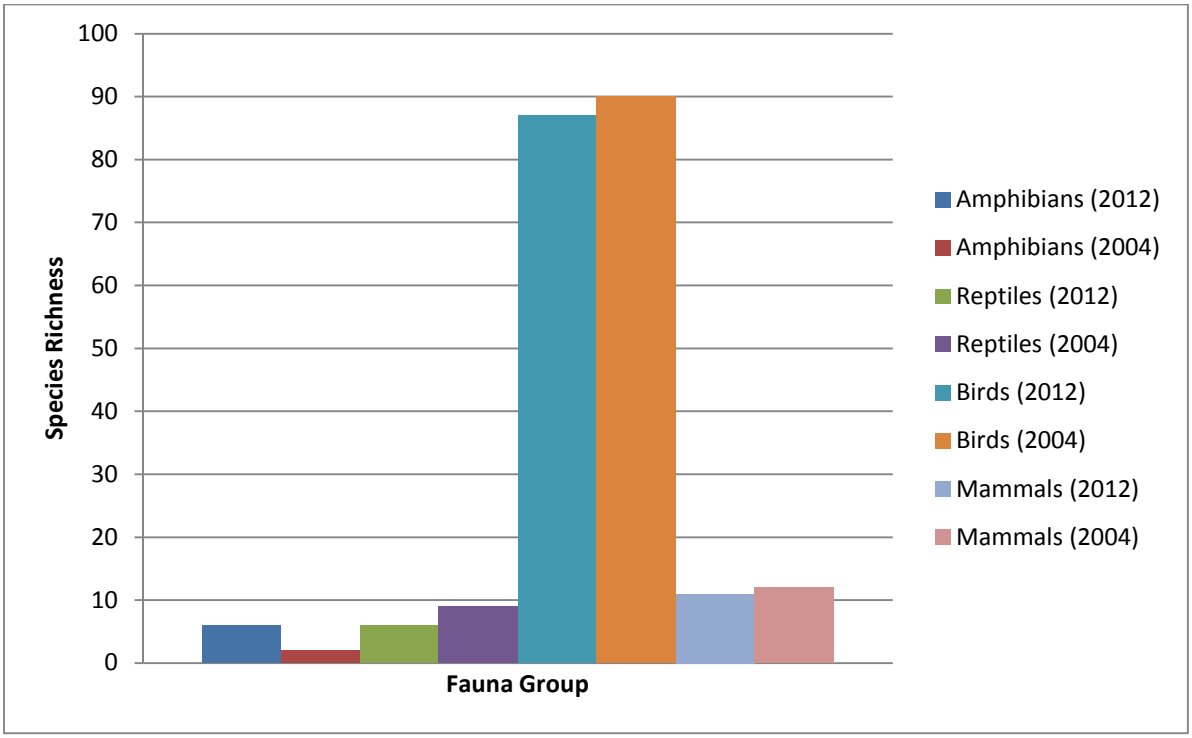


Figure 6c: Biodiversity Indices for Fauna Groups at Wilpinjong Coal Mine in 2004 and 2012 - Species Richness

Even though there are no significant differences between the results from the two surveys, some differences and similarities are apparent.

5.0 IMPACT EVALUATION

The Modification would result in the same types of potential impacts on biodiversity as the existing approved mine (e.g. land clearance and indirect impacts) albeit to a much lower extent. This section describes the magnitude, extent and significance of potential impacts from the Modification in accordance with the *Draft Guidelines for Threatened Species Assessment* (DEC and NSW Department of Primary Industries, 2005).

5.1 LAND CLEARANCE

5.1.1 Loss of Native Vegetation

Clearing native vegetation is a key threatening process listed under the TSC Act and the EPBC Act and is recognised as a key factor contributing to the loss of biological diversity. The final determination of the NSW Scientific Committee describes impacts from loss and/or degradation of habitat following clearing and fragmentation of native vegetation. These can include increases in land salinisation, alteration of riparian zones, increased edge habitat, genetic isolation and loss of leaf litter and logs. Some of these results are applicable to the situation occurring within the Modification open cut extension areas, but the degree of vegetation loss due to clearing and modification must be placed into context.

The Modification would require the removal of 51.7 ha of native vegetation and this is outlined in Table 11. However, the vegetation to be cleared is located immediately adjacent to an operational mine and would not increase edge effects, connectivity or movement corridors.

Table 11: Summary of Vegetation Classes to be Cleared by the Modification

Vegetation Class	Area (ha)
Grassy White Box Woodlands (EEC/CEEC)	2.2
Derived Grassland - Box-gum grassy (EEC/CEEC)	8.4
Woodland other	27.6
Grassland other (excludes weedy)	13.5
TOTAL	51.7

Note: excludes 17.8 ha of approved mine disturbance (including Disturbance – non-native), derived grassland – weedy and existing water management structures.

EEC = Endangered Ecological Community.

CEEC = Critically Endangered Ecological Community.

5.1.2 Loss of Fauna Habitat

The Modification would result in the loss of approximately 29.8 ha of woodland habitat and 21.9 ha of grassland (Table 11). There is a small amount of steep slope habitat (rocky outcrops) within Area H (1.3 ha) that would be disturbed by the Modification. Although there are steep slopes within Area E, little rocky outcrop habitat occurs. No watercourse or wetland would be affected by the Modification activities.

5.1.3 Loss of Hollow-bearing Trees, Removal of Dead Wood and Dead Trees

Loss of hollow-bearing trees and removal of dead wood and dead trees are listed as a Key Threatening Process on Schedule 3 of the TSC Act.

Mature and old hollow-bearing trees offer other valuable resources. Mature trees provide more flowers, nectar, fruit and seeds than younger trees, and a complex substrate that supplies diverse habitats for invertebrate populations. When hollow-bearing trees collapse or shed limbs they also provide hollow logs that serve as important foraging substrates and shelter sites. Loss of such trees can impact upon the survival of the wide range of fauna species that use tree hollows of varying sizes for nesting and roosting, including a number of threatened species.

Dead wood and dead trees provide essential habitat for a wide variety of native animals and are important to the functioning of many ecosystems. The removal of dead wood can have a range of environmental consequences, including the loss of habitat (as they often contain hollows used for shelter by animals), disruption of ecosystem process and soil erosion. Removal of dead old trees (either standing or on the ground) results in the loss of important habitat such as hollows and decaying wood for a wide variety of vertebrates, invertebrates and microbial species.

A survey of tree hollows within each area shows that some trees in Areas C, E, G and H contain hollows (Table 9). Although there are only a few trees in Area C, approximately 30% show obvious hollows – these are in trees that have been retained during the clearing of the area for pasture. Area E shows a similar picture i.e. few trees retained of which about 30% contain hollows.

The trees in Areas G and H show a variety of ages and consequently hollows. About 30-40% of the trees inspected had some form of hollow, although half were considered as small. Small hollows are associated with broken branches and peeling bark that provide shelter for small fauna such as microbats.

5.1.4 Bushrock

Bushrock removal is the removal of natural surface deposits of rock from rock outcrops or from areas of native vegetation.

Bushrock serves many purposes in the natural environment. It provides habitat for many plants and animals, some of which are threatened. Many animals use rocks and rock environments for shelter, to hide from predators, find food, avoid extreme weather conditions and escape bushfires. Bushrock is also known to provide egg-laying sites for reptiles. Loss of bushrock can impact upon the survival of a number of fauna and flora species considered threatened. One rocky outcrop occurs within the Area H, approximately 1.3 ha. However given the lack of records of species that would utilise this habitat, it is unlikely that the removal of bushrock would have a significant impact.

5.1.5 Loss of Individual Animals

The activities associated with the Modification can result in the loss of individual animals either directly during construction activities or indirectly by loss of preferred habitats.

5.1.6 Impacts on Habitat Connectivity

Modification Areas C, D, G and H are located at the edges of continuous areas of woodland and their loss would not affect habitat connectivity. Areas A, B and E are either open grassland or isolated patches of woodland habitat. Loss of these areas would not affect habitat connectivity.

5.1.7 SEPP 44 Koala Habitat

Both White Box (*Eucalyptus albens*) and Grey Box (*Eucalyptus punctata*) occur within the Modification open cut extension areas and the area could be classed as potential habitat. A single Koala was sighted near the Wilpinjong Coal Mine indicating that this species could occur in the study area. Despite several surveys in and near the Modification open cut extension areas no Koalas have been sighted. However given that the extent of loss of potential Koala habitat is small, and the lack of records (Section 4.4) it is unlikely that the Modification could result in a significant impact upon a Koala population, if one occurs in the region.

5.2 INDIRECT IMPACTS

5.2.1 Introduced Flora and Fauna

The creation of disturbed land could attract introduced species such as House Mice, Red Fox, Feral Pig, Rabbit and Cat to the area.

However, it is planned to ensure a clean, rubbish-free environment is maintained, as well as a pest management strategy consistent with the current management strategies implemented at the mine site. Consequently the presence of introduced fauna should be low.

5.2.2 Noise and Blasting

Studies have shown that excessive and sudden noise can affect the presence and breeding ability of certain fauna species. However, it is also found that many species adapt to human activities and readily habituate to noise.

Noise and blasting currently occur at the Wilpinjong Coal Mine. However, a range of fauna species (including bats) are known to inhabit land within and surrounding the existing developments (Wilpinjong Coal Mine, Ulan Coal Mines) (Figures 5a and 5b; Attachments B1 to B6). There would be no change to the range of blast sizes at the Wilpinjong Coal Mine for the Modification (SLR Consulting Pty Ltd, 2013). Further, noise and blasting mitigation and management measures would be implemented as part of the Modification.

It is considered that the impact of noise and blasting generated by the Wilpinjong Coal Mine, incorporating the Modification, on vertebrate fauna adjacent to the area is likely to be minimal.

5.2.3 Artificial Lighting

Artificial lighting for the Wilpinjong coal mine, incorporating the Modification, has the potential to affect the behavioural patterns of some fauna species e.g. attracting birds and bats to feed at lights.

Although such situations can result in increased predation, there is no evidence of this phenomenon within the lighting set-up at the existing Wilpinjong Coal Mine and it is unlikely that the impacts from artificial lighting resulting from the Modification would be different or would add to any potential impact.

5.2.4 Dust

Excessive dust generation can impact on the health and viability of surrounding vegetation and indirectly affect fauna populations. Such an impact would be limited and any dust effects would be mitigated by a rigorous suppression regime through regular watering of roads and soil stockpiles, emplacements and other active areas within the Modification open cut extension areas consistent with current practices at the mine.

5.3 CUMULATIVE IMPACTS ON BIODIVERSITY

5.3.1 Loss of Native Vegetation

The Modification would result in the loss of approximately 51.7 ha of native vegetation. This is in addition to native vegetation that has been approved for removal in previous phases of mining at Wilpinjong Coal Mine as well as that removed from Moolarben and Ulan Coal Mines in the nearby area. Even with all past and proposed disturbances, the cumulative proportions of the extant vegetation of all types that would be disturbed are very small when considered on a regional basis. Close to Wilpinjong Coal Mine are two conservation areas (Goulburn River National Park and Munghorn Gap Nature Reserve) providing 76,900 ha of conserved native vegetation. The Enhancement and Conservation Areas (ECAs) established as part of the original Wilpinjong Coal Mine application (shown on Figures 3 and 4) provide 480 ha, incorporating 295 ha of existing native remnant woodland and 185 ha of grassland to be rehabilitated back to woodland. In addition, about 210.8 ha will be set aside as part of the Biodiversity Offset. As such, a cumulative impact is considered unlikely to be significant.

5.3.2 Loss of Habitats

Concomitant with the loss of native vegetation is the loss of habitats for native fauna. In addition to the removal of a proportion of the vegetation communities in the general area is the loss of some steep slope and rocky outcrop landscape. However, the loss is relatively small in comparison with the extent of the native vegetation and associated habitats within the region. In addition, about 210.8 ha will be set aside as part of the Biodiversity Offset. As such, a cumulative impact is considered unlikely to be significant.

5.3.3 Loss of Threatened Fauna

The threatened fauna known to occur within or near the Modification open cut extension areas include those species with specific habitat preferences and small home ranges. The loss of local populations of these species can have a cumulative impact upon their long-term survival.

Consequently, it is important that mitigation measures be undertaken to ensure any population of threatened fauna is retained in the area. The removal of preferred habitats will possibly require the re-location of such species likely to be affected by the Modification, if located.

6.0 THREATENED SPECIES ASSESSMENT

6.1 SPECIES THREATENED UNDER THE TSC ACT

Table 5 in Section 3.3 provides a list of threatened fauna species listed under the TSC Act which have been recorded within the wider region. This list of threatened fauna species was refined to exclude threatened fauna unlikely to occur and/or be impacted by the Modification. The refined list is provided in Table 12 and each of these threatened species are assessed in Section 6.3.

Table 12: Threatened Fauna Species that could Potentially be Impacted by the Modification

Scientific Name	Common Name	Conservation Status[1]	
		TSC Act	EPBC Act
Birds			
Lophoictinia isura	Square-tailed Kite	V	-
Hieraaetus morphnoides	Little Eagle	V	-
Calyptorhynchus lathami	Glossy Black-cockatoo	V	-
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-
Glossopsitta pusilla	Little Lorikeet	V	-
Neophema pulchella	Turquoise Parrot	V	-
Lathamus discolor	Swift Parrot	E	E
Polytelis swainsonii	Superb Parrot	V	V
Tyto novaehollandiae	Masked Owl	V	-
Ninox strenua	Powerful Owl	V	-
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-
Chthonicola sagittata	Speckled Warbler	V	-
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-
Anthochaera phrygia	Regent Honeyeater	CE	E
Grantiella picta	Painted Honeyeater	V	-
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	-
Petroica boodang	Scarlet Robin	V	-
Petroica phoenicea	Flame Robin	V	-
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-
Daphoenositta chrysoptera	Varied Sittella	V	-
Stagonopleura guttata	Diamond Firetail	V	-
Mammals			
Phascolarctos cinereus	Koala	V	V
Petaurus norfolcensis	Squirrel Glider	V	-
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-
Mormopterus norfolkensis	Eastern Freetail-bat	V	-
Miniopterus australis	Little Bentwing-bat	V	-
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-
Nyctophilus corbeni	Corben's/South-eastern Long-eared Bat	V	V

Table 12: Threatened Fauna Species that could potentially be Impacted by the Modification (Continued)

Scientific Name	Common Name	Conservation Status[1]	
		TSC Act	EPBC Act
Mammals (Continued)			
Chalinolobus dwyeri	Large-eared Pied Bat	V	V
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-
Vespadelus troughtoni	Eastern Cave Bat	V	-

Note: Threatened species locations are shown on Figures 5a and 5b.

[1] Threatened fauna species status under the TSC Act and/or EPBC Act (current at 14 February 2013).
V = Vulnerable; E = Endangered; CE = Critically Endangered.

An Assessment of Significance in accordance with the *Guidelines for Threatened Species Assessment* (Department of Environment and Conservation and Department of Primary Industries, July 2005) of these species (Section 6.3) determined that there would be no significant impact as a result of the Modification.

6.2 THREATENED SPECIES ASSESSMENT GUIDELINES

An assessment of which of the threatened species that are known or likely to occur are likely to be directly or indirectly affected by the proposal is described in the *Draft Guidelines for Threatened Species Assessment* (Department of Environment and Conservation and Department of Primary Industries, July 2005). This document identifies matters which are relevant to the assessment of impacts to threatened species, populations, or ecological communities, or their habitats arising from a development proposal assessed under Part 3A of the *Environmental Planning and Assessment Act 1979*. According to the Draft Guidelines for Threatened Species Assessment any assessment of a development is based on:

- whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts will maintain or improve biodiversity values.
- whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or ecological community.
- whether or not the proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction.
- whether or not the proposal will adversely affect critical habitat.

The following factors, in accordance with Appendix 3 in the Draft *Guidelines for Threatened Species Assessment* (Department of Environment and Conservation and Department of Primary Industries, July 2005) are considered to determine the likelihood of a significant impact:

Identifying potential effects of the proposal on threatened species, populations or ecological communities, or their habitats

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

a) displaces or disturbs threatened species and/or populations
b) disrupts the breeding cycle
c) disturbs the dormancy period
d) disrupts roosting behaviour
e) changes foraging behaviour
f) affects migration and dispersal ability
g) disrupts pollination cycle;
h) disturbs seedbanks;
i) disrupts recruitment (ie. germination and establishment of plants);
j) affects the interaction between threatened species and other species in the community (eg. pollinators, host species, mychorrizal associations).

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

a) disturbs any permanent, semi-permanent or ephemeral water bodies;
b) degrades soil quality;
c) clears or modifies native vegetation;
d) introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;
e) removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;
f) affects natural revegetation and recolonisation of existing species following disturbance; and

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

How is the proposal likely to affect current disturbance regimes?

a) modifies the intensity and frequency of fires;
b) modifies flooding flows.

How is the proposal likely to affect habitat connectivity?

a) creates a barrier to fauna movement;
b) removes remnant vegetation or wildlife corridors;
c) modifies remnant vegetation or wildlife corridors.

How is the proposal likely to affect critical habitat?

a) removes or modifies key habitat features;
b) affects natural revegetation or recolonisation of existing species following disturbance;
c) introduces weeds, vermin or feral species
d) generates or disposes of solid, liquid or gaseous waste;
e) uses pesticides, herbicides, other chemicals.

Of the six factors to consider, three are of a more general nature. These are:

How is the proposal likely to affect current disturbance regimes?

a) modifies the intensity and frequency of fires;

b) modifies flooding flows.

Fire and flood control and management will be undertaken and it is unlikely that the development would affect either fire frequency or flooding regimes.

How is the proposal likely to affect habitat connectivity?

a) creates a barrier to fauna movement;

b) removes remnant vegetation or wildlife corridors;

c) modifies remnant vegetation or wildlife corridors.

The proposal would not create a barrier to the movement as more mobile fauna will still be able to move around, across or over the Modifiation Area.

The proposal will only remove a small amount of remnant vegetation. It is estimated that about 29.8 ha of the woodland vegetation in the Modification Area will be removed by the development. Modification Areas C, D, G and H are located at the edges of continuous areas of woodland and their loss would not affect habitat connectivity. Areas A, B, E and F are either open grassland or isolated patches of woodland habitat. Loss of these areas would not affect habitat connectivity.

How is the proposal likely to affect critical habitat?

No critical fauna habitat occurs within the vicinity of the study area as designated by the Register of Critical Habitat held by the Commonwealth Minister of the Environment, Heritage and Arts and the Register of Critical Habitat held by the Director-General of the OEH. Therefore, the Project would not affect any critical habitat.

The remaining three factors are relevant to the Threatened species located or expected within the Modification Area. **Table 12** lists 31 threatened species known or with potential to occur and the Section 6.3 applies the three factors to each group of fauna with similar habitat preferences and behaviours.

6.3 THREATENED SPECIES ASSESSMENT FOR TSC ACT LISTED SPECIES

6.3.1 Birds of Prey

Two birds of prey have the potential to be impacted by the Modification, namely the Square-tailed Kite (*Lophoictinia isura*) and Little Eagle (*Hieraaetus morphnoides*) and are assessed below.

Both the Little Eagle and Square-tailed Kite are distributed through most of Australia and are mainly found where open country intergrades with woodland and forest. The Little Eagle was recorded within Modification Area G by the Modification surveys. The Little Eagle was also recorded within the proposed Biodiversity Offset (Attachment D).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

It is unlikely that the Modification would adversely affect the lifecycleof either species such that a viable local population of the species is likely to be placed at risk of extinction. There would be a small loss of woodland habitat (29.8 ha), on-going management actions and the provision of a Biodiversity Offset. Limited breeding habitat, i.e. woodland or forest near water, is available. Further, there are numerous regional records of the Little Eagle and Square-tailed Kite within the greater surrounds including within Munghorn Gap Nature Reserve and Goulburn River National Park (Attachment B1). The Little Eagle was also recorded within the proposed Biodiversity Offset (Attachment D).

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Only a small amount of woodland habitat (29.8 ha) will be removed and no area of habitat will be isolated. Further, there is a large amount of woodland habitat conserved in the surrounding area. These species are highly mobile and known to use this habitat in the greater surrounds including within Munghorn Gap Nature Reserve and Goulburn River National Park (Attachment B1). The Little Eagle was also recorded within the proposed Biodiversity Offset (Attachment D). As such, it is considered unlikely that there would be a significant impact on the habitat of these species. It is also considered that no habitat within the Modification open cut extension areas is essential to the long-term survival of these species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Neither the Square-tailed Kite nor the Little Eagle is at the limits of their known distribution.

6.3.2 Parrots

Six parrot species have the potential to be impacted by the Modification, namely the Glossy Black-cockatoo (*Calyptorhynchus lathami*), Gang-gang Cockatoo (*Callocephalon fimbriatum*), Little Lorikeet (*Glossopsitta pusilla*), Turquoise Parrot (*Neophema pulchella*), Swift Parrot (*Lathamus discolor*) and Superb Parrot (*Polytelis swainsonii*) and are assessed below.

All six species of parrot are widely distributed throughout eastern NSW and all except the Superb Parrot area have known records from the surrounding area (Attachment B2). None were located within the Modification open cut extension areas during these surveys. All species are associated with woodland and grassland habitats. The Little Lorikeet was recorded within the proposed Biodiversity Offset (Attachment D).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

There were very few hollow-bearing trees recorded within the Modification open cut extension areas (Table 9), which may provide breeding and roosting habitat for these species. However, a large amount of potential habitat remains in the locality which all but the Superb Parrot are known to utilise (Attachment B2). Further, the Little Lorikeet was recorded within the proposed Biodiversity Offset (Attachment D). It is unlikely that the Modification would adversely affect the lifecycle of any of these

species to the extent of making a viable local population extinct. There would be a small loss of woodland habitat (29.8 ha), combined with the - going management actions and the provision of the Biodiversity Offset.

As such it is considered unlikely that the Modification would have an adverse effect on the lifecycle of these species such that a viable local population of the species is likely to be placed at risk of extinction.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Only a small amount of woodland habitat (29.8 ha) will be removed and, given that clearance would be an extension of existing approved disturbance, no area of habitat will be fragmented or isolated. Further, there is considered to be very few hollow-bearing trees within the Modification open cut extension areas (Table 9), which would potentially provide breeding and foraging habitat. These species are highly mobile and there is a large amount of woodland habitat conserved in the surrounding area which all but the Superb Parrot is known to utilise (Attachment B2). Further, the Little Lorikeet was recorded within the proposed Biodiversity Offset (Attachment D). As such it is considered unlikely that there would be a significant impact on the habitat of these species. It is considered that no habitat within the Modification open cut extension areas is essential to the long-term survival of these species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

None of the parrots are at the limits of their known distribution.

6.3.3 Woodland Bird Species

Five woodland bird species have the potential to be impacted by the Modification, namely the Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*), Speckled Warbler (*Chthonicola sagittata*), Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*), Varied Sittella (*Daphoenositta chrysoptera*) and Diamond Firetail (*Stagonopleura guttata*) and are assessed below.

All five bird species are associated with woodland habitats, with the Diamond Firetail also utilising grasslands. These five species are found throughout eastern NSW. The Brown Treecreeper (eastern subspecies) was recorded within Modification Areas C, D and G and surrounds. The Speckled Warbler was recorded within Modification Area G and surrounds. The Grey-crowned Babbler (eastern subspecies) was recorded within Modification Area D and the Diamond Firetail was recorded within Modification Area F and near Modification Area G (Figure 5a). The Varied Sittella was not recorded within or near the Modification open cut extension areas, but is known from the greater surrounds (Attachment B3).

The Brown Treecreeper (eastern subspecies), Speckled Warbler, Varied Sittella and Diamond Firetail were recorded within the proposed Biodiversity Offset (Attachment D).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

There would be small loss of woodland habitat (29.8 ha) (i.e. potential nesting, breeding and/or foraging habitat) as a result of the Modification.

However, large areas of potential habitat area available in the surrounds which these species are known to utilise (Attachment B3). The Brown Treecreeper (eastern subspecies), Speckled Warbler, Varied Sittella and Diamond Firetail were recorded within the proposed Biodiversity Offset (Attachment D). Further, these species are highly mobile and there would be on-going management actions and the provision of a Biodiversity Offset.

As such it is considered unlikely that the Modification would have an adverse effect on the lifecycle of the species such that a viable local population of these species is likely to be placed at risk of extinction.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Only a small amount of woodland habitat will be removed (29.8 ha) and no area of habitat will be fragmented or isolated.

These species are highly mobile and there is a large amount of woodland habitat conserved in the surrounding area which these species are known to utilise (Attachment B3). The Brown Treecreeper (eastern subspecies), Speckled Warbler, Varied Sittella and Diamond Firetail were recorded within the proposed Biodiversity Offset (Attachment D).

As such it is considered unlikely that there would be a significant impact on the habitat of these species. It is considered that no habitat within the Modification area is essential to the long-term survival of these species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

None of the woodland bird species are at the limits of their known distribution.

6.3.4 Honeyeaters

Three honeyeater species have the potential to be impacted by the Modification, namely the Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis gularis*) and Regent Honeyeater (*Anthochaera phrygia*) and Painted Honeyeater (*Grantiella picta*) and are assessed below.

All three honeyeater species are associated with woodland habitats, and are found throughout eastern NSW. None of these species were recorded by Modification surveys. David Geering from the Regent Honeyeater Recovery Team verbally provided information about the distribution of records in and near the study area in 2004. These records are along the southern end of Wilpinjong Road, as well as along Wollar Road and Cumbo Road (Figure 5a).The Black-chinned Honeyeater was also recorded within the proposed Biodiversity Offset (Attachment D).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

It is unlikely that the Modification would adversely affect the lifecycle of the three species to the extent of making a viable local population extinct because of the small loss of woodland habitat (compared to the available habitat in the surrounding area), combined with the on-going management actions and the provision of a Biodiversity Offset. These species are known from multiple locations in the greater surrounds (Attachment B4). The Black-chinned Honeyeater was also recorded within the proposed Biodiversity Offset (Attachment D).

As such it is considered unlikely that the Modification would have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Only a small amount of woodland habitat (29.8 ha) will be removed and no area of habitat will be isolated or fragmented. There is a large amount of woodland habitat conserved in the surrounding area which these species are known to utilise (Attachment B4). The Black-chinned Honeyeater was also recorded within the proposed Biodiversity Offset (Attachment D). As such it is considered unlikely that there would be a significant impact on the habitat of these species. It is considered that no habitat within the Modification open cut extension areas is essential to the long-term survival of these species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

None of the three honeyeater species are at the limits of their known distribution.

6.3.5 Robins

Three robin species have the potential to be impacted by the Modification, namely the Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*), Scarlet Robin (*Petroica boodang*) and Flame Robin (*Petroica phoenicea*) and are assessed below.

None of the robin species were found within the Modification open cut extension areas. These species are associated with woodland habitat and are distributed throughout eastern NSW. The Scarlet Robin and Hooded Robin were recorded within the proposed Biodiversity Offset (Attachment D).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

It is unlikely that the Modification would adversely affect the lifecycle of the four species to the extent of making a viable local population extinct because of the small loss of woodland habitat (29.8 ha) (compared to the available habitat in the surrounding area), combined with the on-going management actions and the provision of a Biodiversity Offset. Further, none of these species were recorded by Modification surveys within the Modification open cut extension areas and only one, the Hooded Robin (south-eastern form) was recorded in the locality. These species are

known to utilise habitat in the greater surrounds (Attachment B4). The Scarlet Robin and Hooded Robin were recorded within the proposed Biodiversity Offset (Attachment D).

As such it is considered unlikely that the Modification would have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Only a small amount of woodland habitat (29.8 ha) would be removed and no area of habitat will be isolated or fragmented. There is a large amount of woodland habitat conserved in the surrounding area which all of these species are known to utilise (Attachment B4). Further, only one of these species (the Hooded Robin [south-eastern form]) was recorded within the locality despite multiple surveys, and it was not recorded within the Modification open cut extension areas (Figure 5a). The Scarlet Robin and Hooded Robin were recorded within the proposed Biodiversity Offset (Attachment D).

As such it is considered unlikely that there would be a significant impact on the habitat of these species. It is considered that no habitat within the Modification open cut extension areas is essential to the long-term survival of these species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

No robin species is at the limit of their known distribution.

6.3.6 Owls

Two owl species have the potential to be impacted by the Modification, namely the Masked Owl (*Tyto novaehollandiae*) and the Powerful Owl (*Ninox strenua*) and are assessed below.

Neither species were found within the Modification open cut extension areas, but are known from the surrounding region. The Masked Owl has been recorded from Slate Gully, to the east of the Modification (Lesryk 2013). These species are associated with woodland habitat, with the Powerful Owl using tree hollows for nesting and the Masked Owl will use ledges and overhangs for nesting. Both are distributed throughout eastern NSW.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

It is unlikely that the Modification would adversely affect the lifecycle of the two species to the extent of making a viable local population extinct because of the small loss of woodland habitat (29.8 ha) (compared to the available habitat in the surrounding area) and no preferred nesting habitat for the Masked Owl will be disturbed, combined with the on-going management actions and the provision of a Biodiversity Offset. Further, neither species were recorded by Modification surveys within the Modification open cut extension areas and only the Masked Owl was recorded in the locality.

It is considered unlikely that the Modification would have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Only a small amount of woodland habitat (29.8 ha) would be removed and no area of habitat will be isolated or fragmented. There is a large amount of woodland habitat conserved in the surrounding area which all of these species are known to utilise (Attachment B3). Further, only one of these species (the Masked Owl) was recorded within the locality despite multiple surveys, and it was not recorded within the Modification open cut extension areas.

As such it is considered unlikely that there would be a significant impact on the habitat of these species. It is considered that no habitat within the Modification open cut extension areas is essential to the long-term survival of these species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Neither the Masked Owl nor Powerful Owl is at the limits of their distribution.

6.3.7 Squirrel Glider (*Petaurus norfolcensis*)

The Squirrel Glider is associated with woodland habitats and use tree hollows for shelter and breeding. This species is found throughout eastern NSW but was not located within the Modification open cut extension areas.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

There was a low number of hollow bearing trees recorded within the Modification open cut extension areas (Table 9) which the Squirrel Glider would potentially utilise for breeding, nesting and roosting. It is unlikely that the Modification would adversely affect the lifecycle of the Squirrel Glider because of the small loss of woodland habitat (29.8 ha). (compared to the available habitat in the surrounding area)

As such it is considered unlikely that the Modification would have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Only a small amount of woodland habitat will be removed (29.8 ha) in which a low number of hollow-bearing trees were recorded (Table 9). No area of habitat would be isolated or fragmented. Further, there is a large amount of woodland habitat conserved in the surrounding area which the Squirrel Glider is known to utilise (Attachment B5).

As such it is considered unlikely that there would be a significant impact on the habitat of this species. It is considered that no habitat within the Modification open cut extension areas is essential to the long-term survival of this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Squirrel Glider is not at the limit of its known distribution.

6.3.8 Tree-Dwelling Bats

Four tree-dwelling bat species have the potential to be impacted by the Modification, namely the Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*), Eastern Freetail-bat (*Mormopterus norfolkensis*), Corben's/South-eastern Long-eared Bat (*Nyctophilus corbeni*) and Eastern False Pipistrelle (*Falsistrellus tasmaniensis*). The Eastern False Pipistrelle was recorded within Modification Area G by the current surveys (Figure 5b).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

It is unlikely that the Modification would adversely affect the lifecycle of these four species because of the small loss of woodland habitat (29.8 ha) and there are very few hollow-bearing trees within the Modification open cut extension areas (Table 9), which would provide potential roost sites for these species. Further, there are large areas of woodland habitat in the greater surrounds, which the Yellow-bellied Sheathtail-bat, Corben's/South-eastern Long-eared Bat and the Eastern False Pipistrelle are known to utilise (Attachment B6).

As such it is considered unlikely that the Modification would have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Only a small amount of woodland habitat will be removed (29.8 ha) and no area of habitat will be isolated or fragmented. There is a large amount of woodland habitat conserved in the surrounding area which the Yellow-bellied Sheathtail-bat, Corben's/South-eastern Long-eared Bat and the Eastern False Pipistrelle are known to utilise (Attachment B6).

As such it is considered unlikely that there would be a significant impact on the habitat of these species. It is considered that no habitat within the Modification open cut extension areas is essential to the long-term survival of these species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

None of the three tree-dwelling bats are at the limits of their known distribution.

6.3.9 Cave-Dwelling Bats

Four cave-dwelling bat species have the potential to be impacted by the Modification, namely the Eastern Cave Bat (*Vespadelus troughtoni*), Little Bentwing-bat (*Miniopterus australis*), Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) and Large-eared Pied Bat (*Chalinolobus dwyeri*) and are assessed below. The Eastern Cave Bat and Large-eared Pied Bat were recorded within Modification Area E. The Eastern Bentwing-bat was recorded within Modification Area G (Figure 5b).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The four species roost in caves, mines and overhangs as well as buildings. The Modification will not impact upon such habitats with only about 1.3 ha of steep slope habitat possibly being disturbed. None of this habitat contains caves or overhangs.

As such it is considered unlikely that the Modification would have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Only a small amount of steep slope habitat will be removed and no area of habitat will be isolated or fragmented. None of this habitat contains caves or overhangs. There is a larger amount of woodland/forest habitat that these four species are known to utilise (Attachment B6). As such it is considered unlikely that there would be a significant impact on the habitat of these species. It is considered that no habitat within the Modification open cut extension areas is essential to the long-term survival of these species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

None of the four cave-dwelling species are at the limits of their known distribution.

6.3.10 Koala (*Phascolarctus cinearis*)

The Koala is associated with woodland habitats and with a set of preferred feed trees. The potential for habitat for this species to occur within the Modification is assessed in Section 4.4. It is concluded that the Modification does contain potential Koala habitat but no core Koala habitat (Section 4.4). A single Koala has previously been sighted at the end of Wilpinjong Road, near the Modification areas but was not recorded during current surveys.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

It is unlikely that the Modification would adversely affect the Koala. There would be a small loss of woodland habitat (29.8 ha) none of which is determined to be core habitat (Section 4.4). Further, this species is known from multiple records in the greater surrounds (Attachment B5). As such it is considered unlikely that the Modification would have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Only a small amount of woodland habitat (29.8 ha) will be removed none of which is considered core habitat (Section 4.4) and no area of habitat will be isolated or fragmented. There is a large amount of woodland habitat conserved in the surrounding area which the Koala is known to utilise (Attachment B5). As such it is considered unlikely that there would be a significant impact on the habitat of this species. It is considered that no habitat within the Modification open cut extension areas is essential to the long-term survival of this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Koala is not at the limit of its known distribution.

7.0 MANAGEMENT, MITIGATION AND OFFSET MEASURES

The management and mitigation measures for the Modification would be an extension of existing measures implemented for the Wilpinjong Coal Mine, with Project Approval 05-0021, granted by the NSW Minister for Planning in February 2006. Section 7.1 details these existing management measures which would also apply to the Modification.

7.1 CURRENT MANAGEMENT AND MITIGATION MEASURES

Various management plans that were developed for the Wilpinjong Coal Mine will be adopted to assist in managing the Modification open cut extension areas. The existing fauna-related management plans that would apply to the Modification at Wilpinjong Coal Mine will include the approved *Rehabilitation Management Plan* (WCPL, 2006) and the *Bushfire Management Plan* (EcoLogical, 2011). Details of these management plans relating to fauna are detailed in Sections 7.1.1 and 7.1.2, respectively.

7.1.1 Rehabilitation Management Plan

The Rehabilitation Management Plan was approved by NSW Department of Planning and Infrastructure (DP&I) on 15 September 2011. It includes the following relevant objectives and principles:

- progressive site rehabilitation;
- revegetation and regeneration within the ECAs;
- protecting the ECAs;
- creek rehabilitation;
- a Vegetation Clearance Protocol, including pre-clearance surveys and managing impacts on fauna;
- a Threatened Species Management Protocol (TSMP);
- landscaping within the Modification open cut extension areas to minimise visual impacts;
- conservation and re-use of topsoil;
- collection and propagation of seed for rehabilitation works;
- salvage and re-use of material from clearing required for the Modification for habitat enhancement;
- weed and animal pest control;
- restrictions on site access; and
- bushfire management.

Those principles and/or objectives listed within the Rehabilitation Management Plan that are most relevant to fauna are detailed below.

Progressive Site Rehabilitation

Progressive rehabilitation would include the placement of topsoil to act as a germination medium for vegetation and as a seed source. Species to be planted in the rehabilitated landforms would be a mixture of native and introduced locally successful tree, grass and legume species. Locally collected tree and shrub seed will be used where practical.

Enhancement and Conservation Areas

Management measures to be implemented within the ECAs include enhancement strategies such as fencing, selective planting of native vegetation if required, weed and animal pest control, bushfire management, salvaging of important habitat features (e.g. large hollows) and the use of artificial roosting/nesting boxes for fauna, particularly threatened fauna. The selective planting would aim to enlarge remnant vegetation and link existing remnant vegetation. Native vegetation would be selectively placed along creeks where required.

Regeneration areas would be established on WCPL-owned land to create a corridor between the surrounding protected areas of Goulburn River National Park and Munghorn Gap Nature Reserve, the ECAs and rehabilitated woodlands.

Monitoring

A number of techniques will be utilised to monitor the performance of the rehabilitation areas, ECAs and regeneration areas including visual monitoring and flora surveys. These would determine if there is a need of any maintenance and/or contingency measures. A series of monitoring locations have been set up in the ECAs to monitor vegetation in September 2007. A similar program was established in the first rehabilitation areas on the Wilpinjong Coal Mine site in September 2009.

Terrestrial fauna surveys would be conducted to sample fauna species diversity and abundance in the rehabilitation areas, ECAs and regeneration areas. Systematic surveys sites would monitor amphibians, reptiles, birds and mammals and at least one survey site would be established in each major habitat type present within each ECA, *viz.*:

- creek line and riparian habitats;
- woodland/open forest; and
- predominantly cleared land previously used for grazing.

Corresponding survey sites will also be established in areas of equivalent habitat type adjacent to the rehabilitation areas, ECAs and regeneration areas to provide analogue sites. These analogue sites will provide comparative data so that the long-term progress of the ECAs can be determined.

Vegetation Clearance Protocol

General fauna management strategies to be implemented to minimise impacts on threatened fauna would include:

- delineation of areas to be cleared of remnant revegetation. Vegetation adjoining the proposed clearance areas will be clearly marked to prevent accidental damage during vegetation clearance activities or Wilpinjong Coal Mine works;
- pre-clearance surveys;
- managing impacts on fauna; and
- vegetation clearance procedures including restrictions on clearing times for fauna breeding seasons.

Pre-clearance surveys include habitat assessments which involve the inspection of potential habitat features (i.e. hollow openings, cracks, loose bark and/or wombat burrows) located within the proposed disturbance areas. Trees containing habitat features are referred to as potential habitat trees and would be retained wherever practicable. Following the identification of potential habitat trees, preliminary and secondary habitat assessments would be undertaken to determine appropriate fauna management strategies. Weed infestations would be noted during pre-clearance surveys.

In the case that threatened species are observed during habitat assessment, the TSMP would be initiated.

Threatened Species Management Protocol

A TSMP would facilitate implementation of threatened species management strategies to minimise potential impacts on threatened flora and fauna species.

In the event a threatened species under the TSC Act or the EPBC Act is identified in the Wilpinjong Coal Mine, the Modification open cut extension areas or immediate surrounds, the TSMP will be initiated. TSMP strategies would involve threat abatement, capture and release, location and provision of habitat resources.

Threat abatement would aim to alleviate threatening processes, dependant on the flexibility of mine planning. Captured threatened fauna species would be released into proximal suitable habitat. Further, there is an option which would involve the relocation of roosting/nesting resources to proximal suitable habitat.

Salvage of Habitat Material

Cleared vegetative material would be reused for a number of purposes including fauna habitat. These habitat features include logs, fallen timber and hollows and would be salvaged where practicable to provide habitat features in rehabilitation areas, regeneration areas and ECAs.

Weed and Animal Pest Control

A weed and feral animal control program will be implemented to control the occurrence of invasive species and would include the following:

Weed Control

- regular inspections of WCPL-owned lands to identify areas requiring the implementation of weed management measures;
- implementation of weed management measures including mechanical removal and application of approved herbicides in authorised areas when conditions are favourable;
- control of noxious weeds identified on WCPL-owned land in accordance with the relevant NSW Department of Trade and Investment, Regional Infrastructure and Services NSW control category and the relevant regional weed management plan;
- follow-up inspections to determine effectiveness of weed management measures and requirement for further measures;
- minimising transportation of weeds; and
- on-going consultation with relevant agencies regarding weed occurrence and management technologies.

Feral Animal Control

- pest control measures (e.g. the destruction of rabbit burrows, feral cat trapping and baiting of foxes and wild dogs);
- maintenance of a clean, rubbish-free environment, particularly around administration and contractor areas in order to discourage scavenging and reduce the potential for colonisation of these areas by non-endemic fauna (e.g. rodents);
- mandatory pest control for any declared pests (i.e. rabbits, pigs and wild dogs) known to occur on WCPL-owned land;
- no domestic pets such as cats or dogs will be permitted to be brought onto the site; and
- pest control in accordance with any Pest Control Orders issued under the NSW *Rural Lands Protection Act, 1998*.

7.1.2 Bushfire Management Plan

The previously approved Bushfire Management Plan includes the following management approaches:

- management zones which divides the area based on location of assets, topography, landuse and potential bushfire hazard;
- prevention of ignition; and
- management of access.

Those principles and/or objectives listed within the Bushfire Management Plan that are most relevant to fauna are detailed below.

Prevention of Ignition

All employees and the Wilpinjong Coal Mine Land Manager would be responsible for reporting and monitoring fire hazards and for the prevention of fire. Management measures such as the identification of fire ignition risks, the reduction of fuel and community consultation would be utilised to reduce the risk of ignition.

7.2 OFFSET MEASURES

7.2.1 Proposed Biodiversity Offset

As part of the development proposal for the Modification, it is proposed to provide a Biodiversity Offset to compensate for the residual impacts of the Modification following implementation of the mitigation and management measures.

Preliminary investigations by Hunter Eco (Hunter Eco, 2013) has resulted in two areas being highlighted as most appropriate areas for offsetting the vegetation and fauna habitat within the Modification open cut extension areas, including the NSW EEC White Box, Yellow Box, Blakely's Red Gum Grassy Woodland/Commonwealth CEEC White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Offset Areas D and E) (Figure 7). The two areas, both north-east of Wilpinjong Coal Mine, provide approximately 210.8 ha of native vegetation and fauna habitats. This consists of:

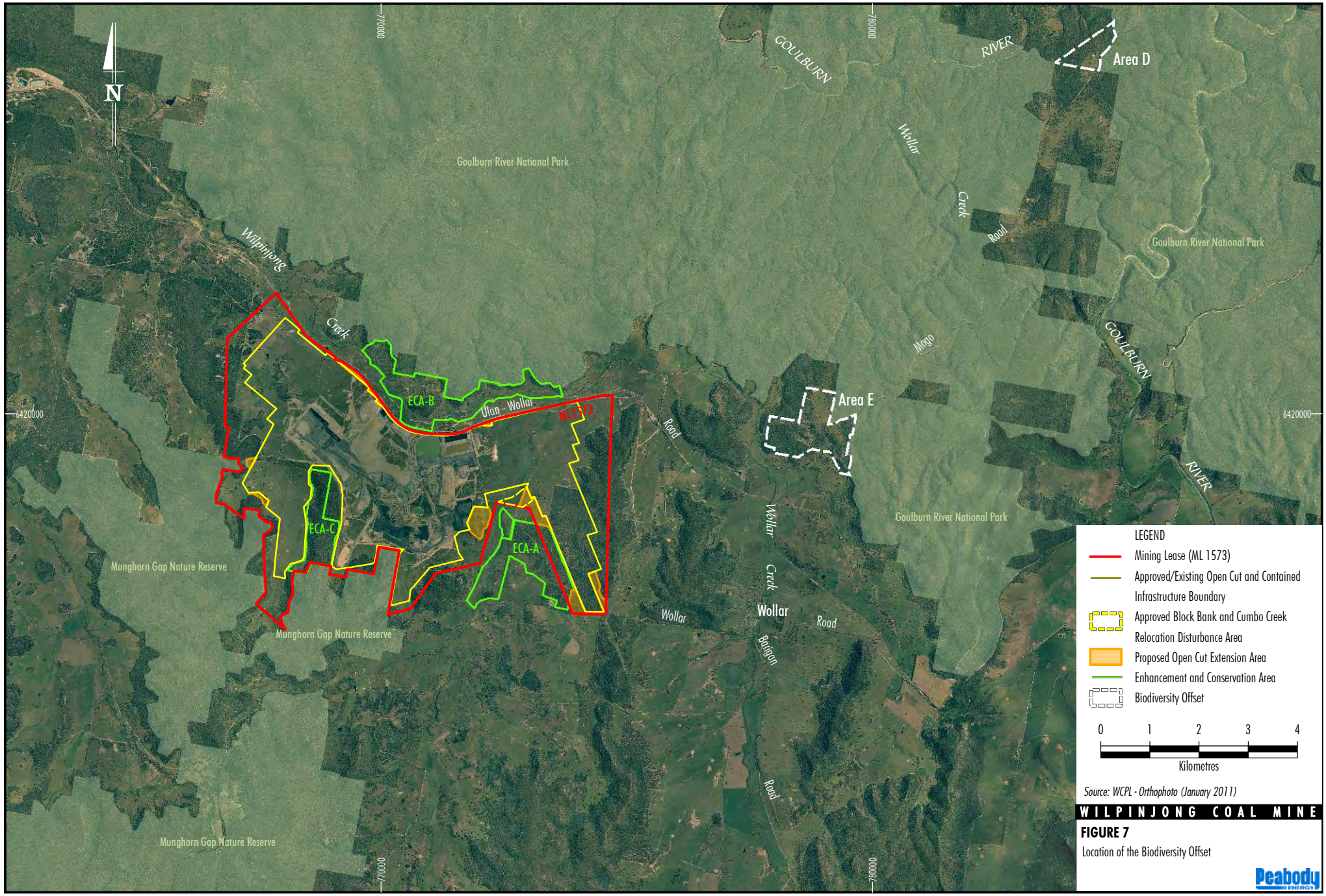
- Woodland: 192.8 ha;
- Shrubby Regeneration: 13.6 ha; and
- Derived Native Grassland: 4.4 ha.

The woodland habitat present within the proposed Biodiversity Offset is in good condition. Some areas were regenerating from past clearance but demonstrated a high level of diversity. Weed species were not dominant at any location within the Biodiversity Offset. Similarly, the open grassland habitat demonstrated a good level of diversity, and low level of weeds.

Further description and assessment of the two areas that comprise the Biodiversity Offset, in terms of adequacy in compensating for fauna habitat loss, is given in the Fauna Assessment of Biodiversity Offset report (Attachment D). The locations of the two areas that make up the Biodiversity Offset for the Modification are shown in Figure 7. The vegetation mapping and locations of threatened fauna species is shown on Figures 8 and 9.

7.2.2 Strategic Benefit of the Biodiversity Offset

The Biodiversity Offset provides a representative sample of the land forms and habitats that are found in this part of the Brigalow belt South IBRA Region. Management of these habitats will provide a strategic benefit to the overall nature conservation in the region. Being located immediately adjacent to the Goulburn River National Park (a major conservation reserve) increases the values of the Biodiversity Offset.



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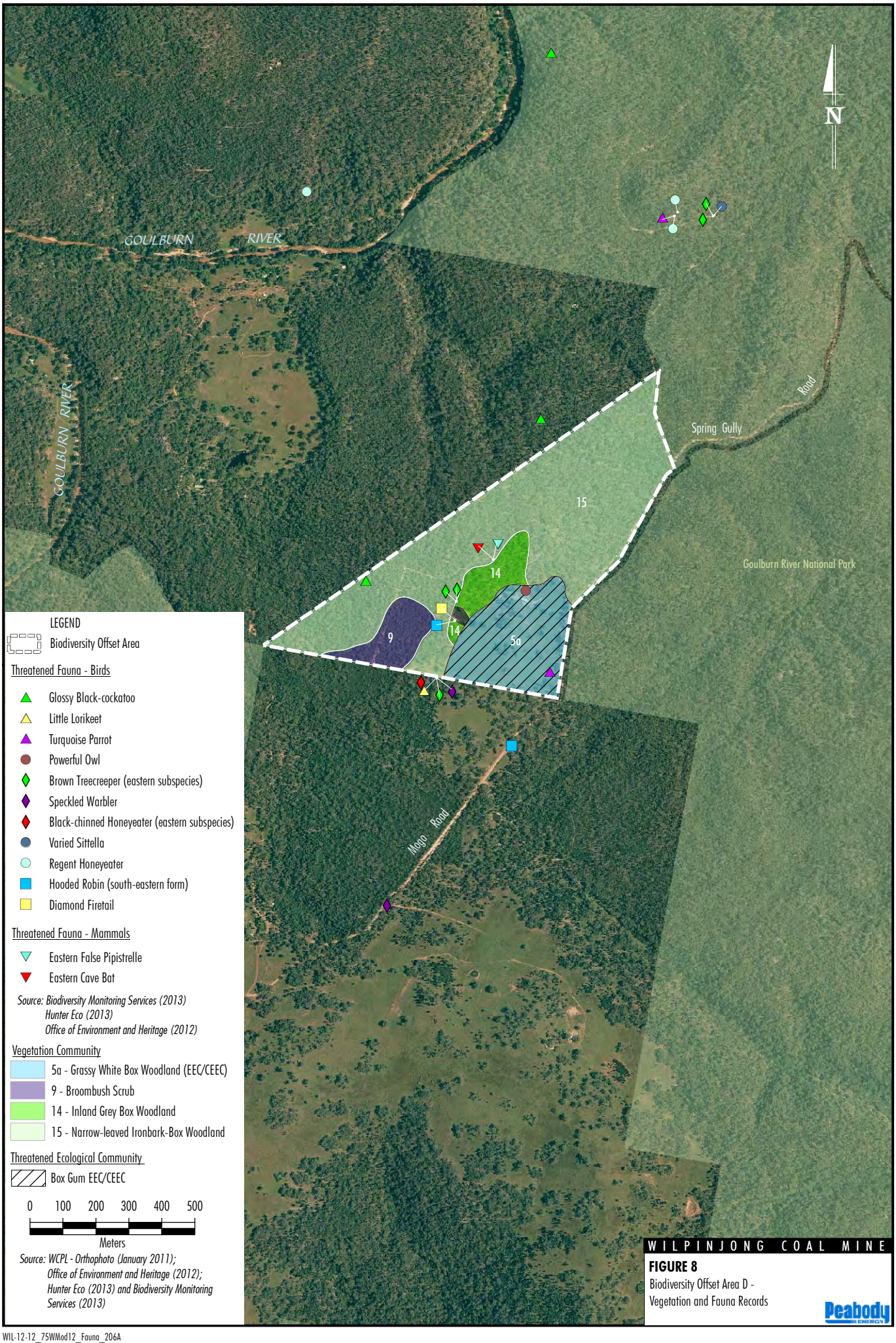

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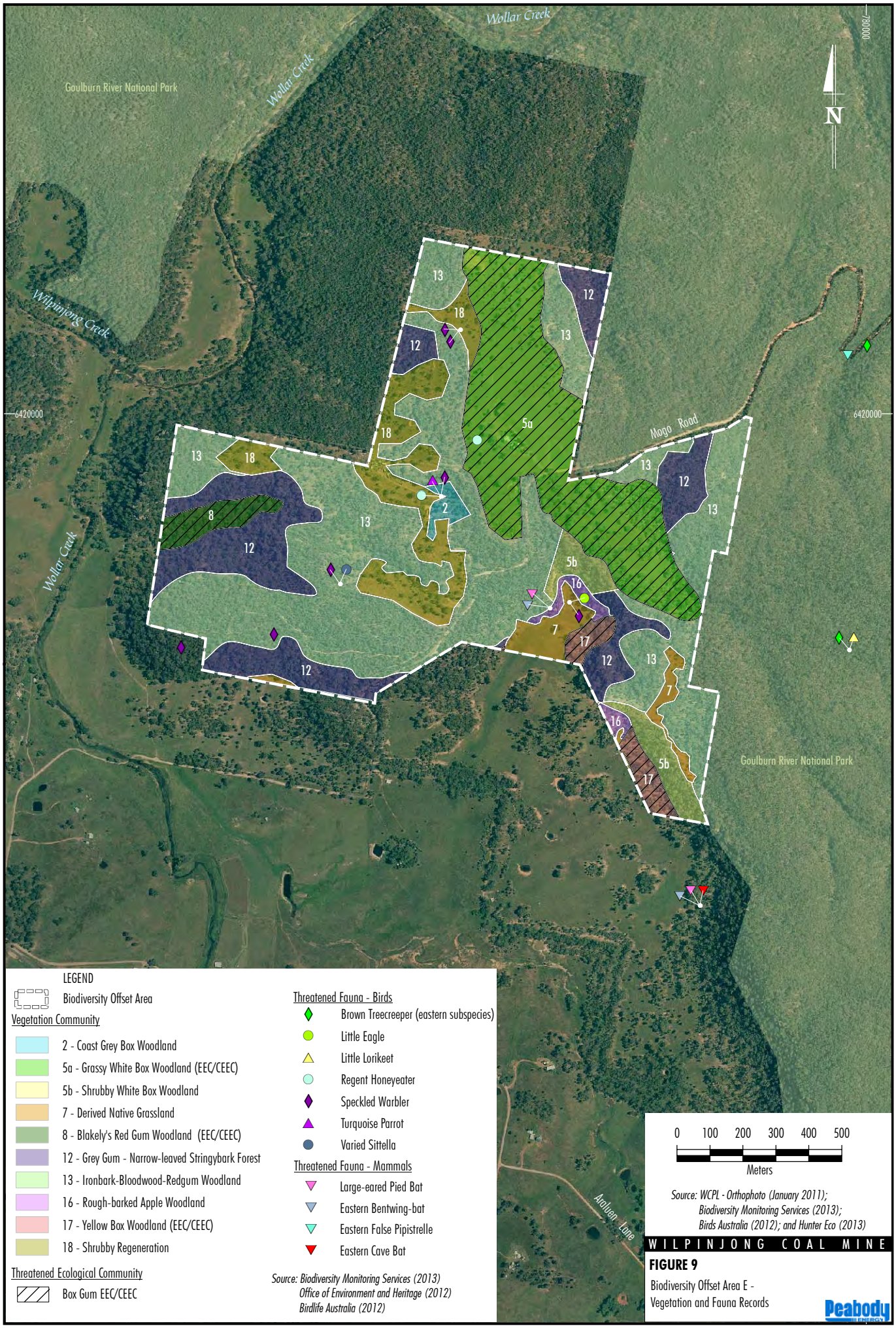

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Ecosystem Resilience

At present the ecosystem resilience in the Biodiversity Offset is not as strong as that expected to occur after the removal or reduction of domestic stock and the implementation of appropriate pest management. However, the diversity of bird and other fauna within the Biodiversity Offset is similar or better than that in the Modification open cut extension areas.

7.2.3 Proposed Management

It is recommended that management of the Biodiversity Offset be focussed on stock control, weed management and select plantings as necessary (following review of natural regeneration). Species used for plantings should be selected in consideration of threatened species habitat preferences with the aim of regenerating nesting, roosting and foraging habitat suitable for local threatened fauna species. Measures should be developed cognisant of the measures described in the *Goulburn River National Park and Munghorn Gap Nature Reserve Plan of Management* (National Parks and Wildlife Service 2003).

Existing infrastructure

The Biodiversity Offset contains a number of access tracks, dwellings and internal fencing, as well as some small tanks for stock watering. The continued use of this infrastructure versus their removal would be determined in consultation with DP&I and OEH depending on the protection mechanism used to secure the land for conservation, and possible beneficial uses of the infrastructure.

7.2.4 Reconciliation of the Proposed Biodiversity Offset Strategy against OEH Offset Principles

There are 13 OEH *Principles for the use of biodiversity offsets in NSW* (OEH, 2013d) that provide a framework for considering environmental impacts and developing offset proposals. A reconciliation of the proposed Biodiversity offset strategy against these principles is given in Table 13.

The main ecological gain of the proposed Biodiversity Offset is to provide a representative sample of land forms and habitats found in the general area and to counterbalance specific impacts of development on biodiversity. This results in the conservation of either known or suitable habitats for each threatened fauna species potentially impacted by the Modification. The relative size of the Biodiversity Offset in comparison to the development area is also a benefit. The Biodiversity Offset is more than four times the size of the Modification open cut extension areas (210.8 ha versus 51.7 ha). The proposed Biodiversity Offset will also ensure that regional biodiversity values will be improved by undertaking actions that increase the quantity, quality or likely persistence of these values.

7.2.5 Long-term Protection of the Proposed Offset

The Biodiversity Offset would be protected in perpetuity by any reasonable mechanism to the satisfaction of the Director-General of the DP&I. Such mechanisms may include incorporation into adjoining reserve, Biobanking Agreements, Voluntary Conservation Agreements, Voluntary Planning Agreements, Property Vegetation Plans etc. WCPL's preference is to reach an agreement with the OEH so that the proposed Biodiversity Offset can be added to the Goulburn River National Park estate.

Table 13: Reconciliation of Biodiversity Offset Strategy against OEH Principles

Principles	Reconciliation
Impacts must be avoided first by using prevention and mitigation measures.	The disturbance area has been defined by topographical and geological constraints. The disturbance areas are extensions to the existing disturbance footprint rather than new isolated areas.
All regulatory requirements must be met.	The proposed Biodiversity Offset has been provided to satisfy the biodiversity assessment requirements of the EP&A Act. Impacts would not occur without regulatory approval.
Offsets must never reward ongoing poor performance.	The proposed Biodiversity Offset has been developed to address residual impacts of the Modification only.
Offsets will complement other government programs.	The proposed Biodiversity Offset strategy compliments the current reserve system in NSW by providing long-term security and management of a substantial area of vegetation/habitat adjoining Goulburn River National Park. WCPL intends to reach an agreement with the NSW Government so that the Biodiversity Offset can be added to the adjoining Goulburn River National Park.
Offsets must be underpinned by sound ecological principles.	The Biodiversity Offset would maintain and improve biodiversity values in the region in the medium to long-term. The Biodiversity Offset is underpinned by sound ecological principles such as: • consideration of structure, function and compositional elements of biodiversity including threatened species and their habitats; • consideration of the conservation status of ecological communities (e.g. through inclusion of large areas of higher quality Box-gum woodland EEC/CEEC) compared to the areas to be disturbed; and • measures to protect the long-term viability and functionality of biodiversity (e.g. securing and managing the land for conservation purposes).
Offsets should aim to result in a net improvement in biodiversity over time.	The Biodiversity Offset would result in the conservation and enhancement of existing remnant vegetation and the regeneration of previously cleared land. Management and mitigation measures proposed for the Biodiversity Offset would result in net improvement in biodiversity over time. Management measures may include fencing to manage stock, weed and feral animal control, revegetation and habitat supplementation. An assessment of the vegetation in the Biodiversity Offset is provided in Appendix E of the EA.
Offsets must be enduring - they must offset the impact of the development for the period that the impact occurs.	The Biodiversity Offset would be secured in perpetuity, and WCPL intends to reach an agreement with the NSW Government so that the Biodiversity Offset could be transferred to the National Parks estate, or other mechanisms acceptable to the NSW Minister for Planning and Infrastructure.
Offsets should be agreed prior to the impact occurring.	The Biodiversity Offset strategy is proposed as part of the Modification. The implementation of the Biodiversity Offset is likely to be a condition of Project Approval.

Table 13: Reconciliation of Biodiversity Offset Strategy against OEH Principles (Continued)

Principles	Reconciliation
Offsets must be quantifiable - the impacts and benefits must be reliably estimated.	Flora and fauna surveys have been conducted in both the disturbance and the Biodiversity Offset areas. The assessment of impacts from the Modification meet guidelines as required for assessments in NSW, both in survey effort/assessment and the targeting of the offset area. The fauna assessment of Biodiversity Offset (Attachment D) was also conducted to these standards. The area of the Biodiversity Offset is specified in Section 7.2.1 and a detailed assessment of the flora of the Biodiversity Offset is provided in Appendix E of the EA (Hunter Eco, 2013). The Biodiversity Offset strategy has been prepared based on the following: • characteristics of the habitat to be cleared and the flora and fauna (including threatened species and communities) likely to be impacted; • characteristics and condition of the vegetation/habitat as well as the species present in the Biodiversity Offset and current threats requiring management; • proposed management measures to avoid and mitigate impacts from the Modification; • the level of security on the Biodiversity Offset (e.g. extension to the Goulburn River National Park or other conservation agreement).
Offsets must be targeted.	As detailed in the principle above, quantification and assessment of impacts of the Modification and benefits of the Biodiversity Offset has been conducted. The Biodiversity Offset was specifically targeted to address the residual impacts associated with the Modification. It includes consideration of: • the conservation status of the ecological community present within the Modification area (e.g. the Biodiversity Offset includes relatively larger areas of Box-Gum Woodland EEC/CEEC); • the presence of threatened fauna species or their habitats (Appendix E); • connectivity (e.g. the Biodiversity Offset is adjacent to Goulburn River National Park); • long-term viability (i.e. the Biodiversity Offset is surrounded by dense vegetation and is located immediately adjacent to the Goulburn River National Park); and • the potential to enhance condition by management actions and the removal or management of threats (i.e. clearing, weeds, pests and grazing).
Offsets must be targeted.	It is demonstrated that there would be a like-for-like or better conservation outcome for biodiversity. Attachment D and the Flora Assessment (Hunter Eco, 2013 – Appendix E of the EA) provide a comparison of the quantities of the probable impact at the Modification and the benefits of the Biodiversity Offset.

Table 13: Reconciliation of Biodiversity Offset Strategy against OEH Principles (Continued)

Principles	Reconciliation
Offsets must be located appropriately.	Both the Biodiversity Offset and the Modification are located in the Hunter-Central Rivers Catchment Management Area (CMA) (Hunter sub-catchment) and within the South Brigalow IBRA region. The Biodiversity Offset is also strategically located to complement existing reserves and therefore has the capacity to benefit biodiversity values in the same region as the Modification. The Biodiversity Offset has similar ecological characteristics to the Modification and would maintain or improve biodiversity values of the region in the medium to long-term. Vegetation communities (Appendix E of the EA - Hunter Eco, 2013) and habitat types present are considered to be an acceptable match for those disturbed by the Modification.
Offsets must be supplementary.	The Biodiversity Offset currently has various degrees of grazing and is not currently subject to management or funding for conservation. The Biodiversity Offset is considered to be beyond existing requirements and supplementary to existing requirements. This is because the Biodiversity Offset is not subject to an existing conservation agreement and prior to acquisition was subject to active clearing and grazing.
Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.	Measures to manage and independently audit the Biodiversity Offset would be developed in consultation with DP&I and OEH. It is expected that the implementation of the Biodiversity Offset would be a condition of Project Approval.

7.3 SUMMARY OF ECOLOGICAL GAINS OF THE PROPOSED BIODIVERSITY OFFSET

In summary, the proposed Biodiversity Offset has the following values relating to fauna:

- Located within the same CMA sub-region and IBRA region as the Modification open cut extension areas and would provide an opportunity to increase biodiversity values in the region.
- Located adjacent to the Goulburn River National Park and compliments the existing reserve system.
- All fauna habitat types present within the Modification open cut extension areas are represented in the Biodiversity Offset.
- The Biodiversity Offset has the ability to improve through management measures.
- All threatened species recorded within or near the Modification open cut extension areas are either known to occur or have the potential to occur within the Biodiversity Offset.
- A substantial area of higher quality Box-gum woodland EEC occurs within the Biodiversity Offset (approximately 47.8 ha).

8.0 CONCLUSION

The land to be used for the Modification is a mix of cleared pasture and woodland. The woodland habitat has been disturbed over the years from logging, clearing, stock grazing and rubbish dumping. A number of bird species (85) were located within the Modification open cut extension areas, as well as a representative sample of native mammals (20 species), reptiles (6 species) and amphibians (6 species). Such a faunal assemblage is similar to that recorded during the previous surveys for Wilpinjong Coal Mine.

The Modification would result in the loss of approximately 51.7 ha of native habitats, the extent of which would not significantly impact upon any native fauna population. Nine threatened species were recorded by Modification surveys within or near the Modification open cut extension areas. The main component of this suite of species were birds associated with the woodland habitats, and a number of bat species. The extent of loss of habitats and the application of management actions to reduce any impacts upon these species should result in no significant impacts upon these species. A suite of mitigation and management measures are proposed to reduce potential impacts. In addition, about 210.8 ha are proposed to be set aside as a Biodiversity Offset to compensate for any residual loss within the Modification open cut extension areas following implementation of mitigation and management measures.

An assessment of impacts on all species listed as threatened under the NSW TSC Act known or considered potential occurrences within the Modification open cut extension areas and surrounds. No significant impact was determined. The Federally listed species were assessed in accordance with the EPBC Act and no significant impact was determined.

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