

APPENDIX E

COWAL GOLD MINE E42 MODIFICATION

FAUNA ASSESSMENT



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EXECUTIVE SUMMARY

Objectives

This vertebrate fauna survey and assessment was conducted for a proposed modification to the approved Cowal Gold Mine (CGM). Changes implemented to the approved CGM by the E42 Modification would result in the modified CGM.

The approved CGM is located approximately 38 kilometres (km) north-east of West Wyalong, New South Wales (NSW).

The objectives of the fauna survey and assessment were to:

- conduct a terrestrial vertebrate fauna survey in the study area utilising recognised fauna survey techniques;
- assess terrestrial vertebrate fauna species diversity (native and introduced) and their relative abundance;
- identify and describe the range of habitats utilised by terrestrial vertebrate fauna;
- compare the vertebrate diversity of the study area with those identified in nearby or regional faunal survey projects; and
- identify the potential impacts of the modified CGM on fauna including threatened fauna species.

Western Research Institute conducted the terrestrial vertebrate fauna survey in March 2008.

Findings

The vertebrate fauna species diversity in both the South Western Slopes Bioregion and regional area have been well described, as have the species of conservation concern.

All habitat types in the study area have been adversely impacted mainly due to past pastoral land management practices.

The Eucalypt Woodland and Mixed Woodland fauna habitats which occur within the E42 Modification area are relictual habitat patches in the landscape which have low to no connectivity with lands outside Mining Lease (ML) 1535.

Although the entry of stock is now controlled within ML 1535, the habitat within the E42 Modification area has a long history of grazing and as a result shows evidence of having lost a significant amount of topsoil, appears to be deficient in soil carbon, has discontinuous ground cover, little leaf litter, is tree hollow and ground log impoverished and demonstrates a lack of understorey and overstorey regeneration.

A number of threatened fauna species have the potential to utilise habitat within the study area. Only one threatened species was recorded during the survey, the Grey-crowned Babbler (*Pomatostomus temporalis temporalis*).

Conclusions

In summary the following conclusions were made:

- It is likely that the biodiversity values of the region would be maintained and possibly improved, considering the proposed measures to avoid, mitigate and/or offset potential impacts.

- The modified CGM is unlikely to reduce the long-term viability of any local population of vertebrate fauna species.
- The modified CGM is unlikely to lead to the extinction of any vertebrate species or population or place any at risk of extinction.
- The modified CGM is very unlikely to adversely affect critical habitat as no critical habitats are known to occur within the E42 Modification area.
- The modified CGM is very unlikely to adversely affect areas of high conservation value.
- Habitat that would be removed or changed by the modified CGM is not considered to adversely impact the long-term viability of any vertebrate species, population or ecological community.
- Matters of national environmental significance or other matters protected by the *Commonwealth Environment Protection and Biodiversity Conservation Act, 1999* are not likely to be significantly impacted by the modified CGM.

Given the above, from a regional perspective, biological diversity is likely to be maintained and adverse potential impacts from the modified CGM on vertebrate fauna are likely to be minimal.

E1 INTRODUCTION

Barrick Australia Limited (Barrick) is proposing to modify a number of components of the approved Cowal Gold Mine (CGM), located approximately 38 kilometres (km) north-east of West Wyalong, New South Wales (NSW) (Figure E-1). Changes implemented to the approved CGM by the E42 Modification would result in the modified CGM. The modified CGM is scheduled to commence in approximately Year 5 of CGM operations. The main changes to the approved CGM as a result of the E42 Modification would include those presented in Figure E-2, and described below:

- an increase to the operational mine life;
- an increase in the total production and maximum ore processing rate;
- an increase in gold production;
- an increase in the total surface area of the open pit;
- an increase in the total volume of waste rock;
- an increase in the height and surface area of the northern and southern waste emplacements;
- a reduction in the height of the perimeter waste emplacement in places;
- an increase in the total volume of tailings produced;
- an increase in the total surface area of low grade ore stockpiles;
- an increase in the height of the northern and southern tailings storage facilities;
- extraction of saline water from a saline groundwater supply borefield located within Mining Lease (ML) 1535; and
- other associated minor changes to infrastructure, plant, equipment and activities

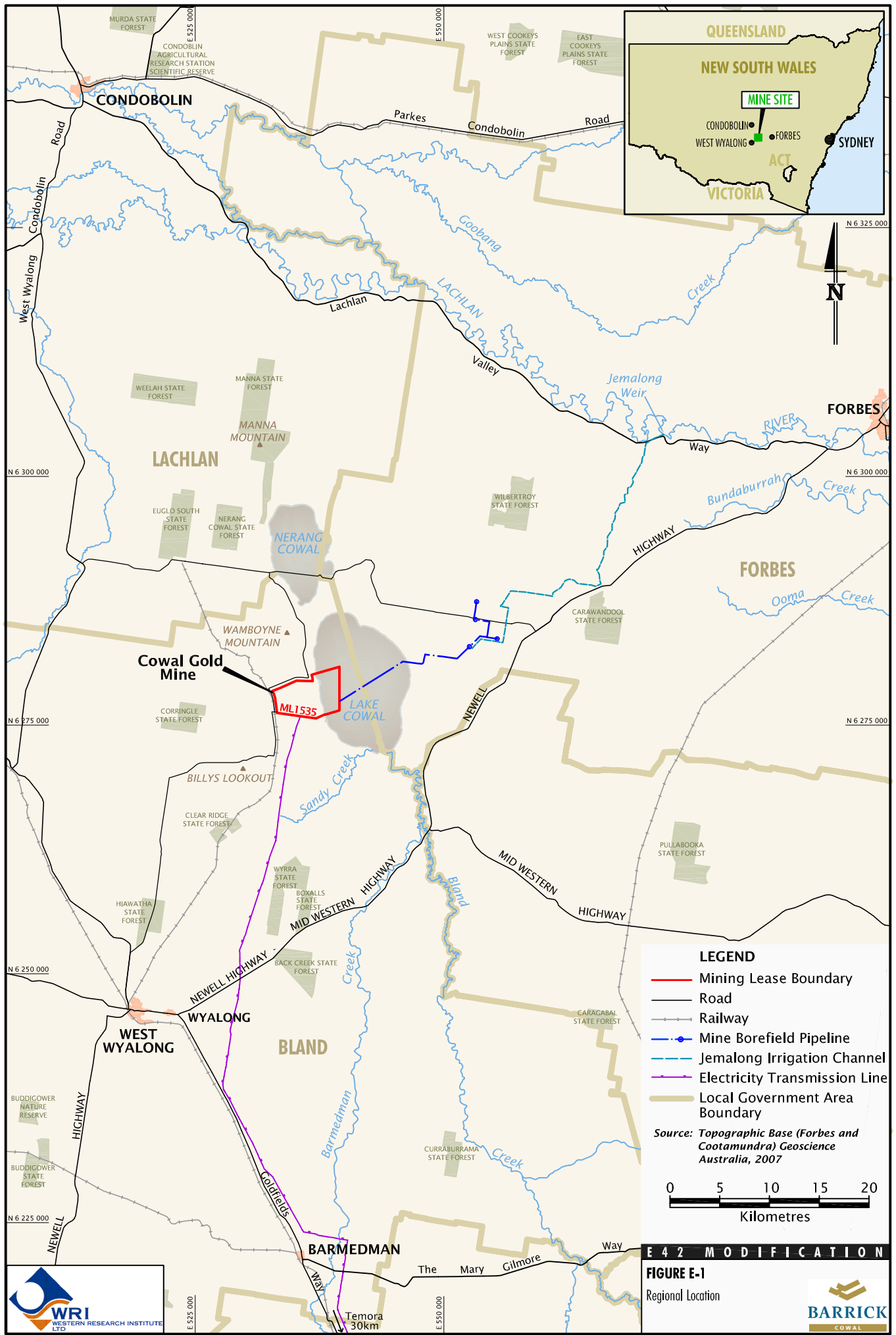
E1.1 SURVEY AND ASSESSMENT OBJECTIVES

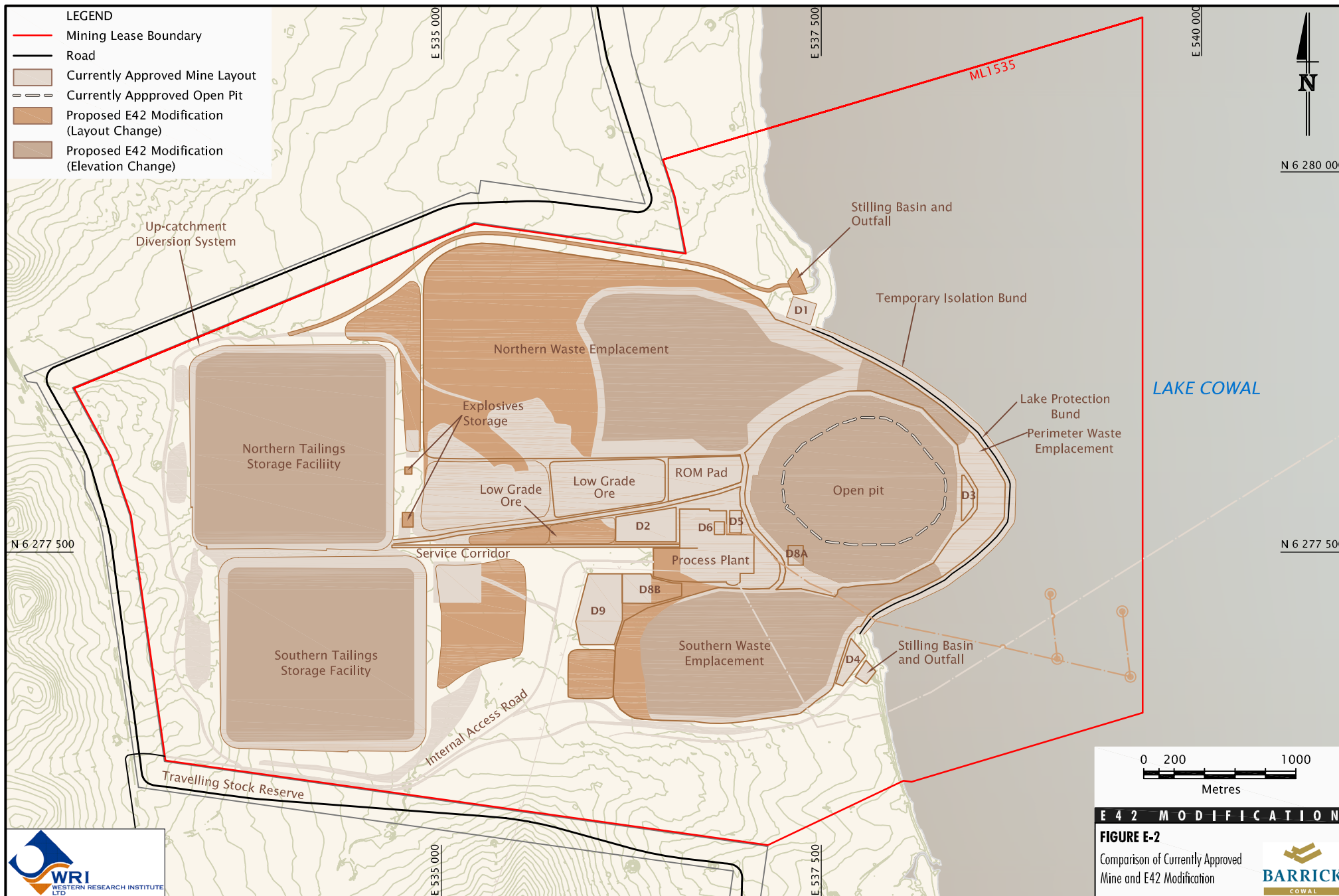
The objectives of the fauna survey and assessment were to:

- conduct a targeted threatened terrestrial vertebrate fauna survey in the study area, for those species considered possible occurrences utilising recognised fauna survey techniques;
- assess terrestrial vertebrate fauna species diversity (native and introduced) and their relative abundance;
- identify and describe the range of habitats utilised by terrestrial vertebrate fauna;
- compare the vertebrate diversity of the study area with those identified in nearby or regional faunal survey projects or analyses; and
- identify the potential impacts of the modified CGM on vertebrate fauna including threatened fauna species.

This Fauna Assessment was prepared in accordance with the *Draft Guidelines for Threatened Species Assessment* (NSW Department of Environment and Conservation [DEC] and Department of Primary Industries [DPI], 2005).

The study area covers the E42 Modification area shown on Figure E-2.





E1.2 PLANNING REGION

The Lachlan Catchment is centred on the Lachlan River and its tributaries, covering an area of 84,700 square kilometres (km²), and encompassing parts of the Central Tablelands, the Central Western Slopes and the Central Western Plains. The catchment covers a diversity of landforms, vegetation species and communities from semi-alpine to rangelands. The Lachlan River terminates in the Great Cumbungi Swamp and the lower catchment effluent creeks.

E1.3 BIOGEOGRAPHIC AND ZOOGEOGRAPHIC REGIONAL SETTING

Thackway and Cresswell (1995) describe a bioregion as a *complex land area composed of a cluster of interacting ecosystems that are repeated in similar form throughout*. Bioregional descriptions seek to describe the dominant landscape scale attributes of climate, lithology, geology, landform and vegetation. The *Interim Biogeographic Regionalisation for Australia* (IBRA) bioregion classifications by Thackway and Cresswell (1995; 2000) (and available on the Department of the Environment, Water, Heritage and Arts [DEWHA] internet site [2008a]) are similar to those previously proposed by Morgan and Terrey (1992).

Bioregions provide a way of viewing landscape and biotic patterns in ecological terms, since they represent major structural geologies and climatic differences, particularly where geomorphology is the major driver of soil and vegetation (Morgan, 2001; Smart, 2002). Thackway and Cresswell (1995) demonstrated that bioregions provide a relatively homogenous landscape with their associated biota, as well as linking ecosystems with relatively strong linkages compared with those found between bioregions.

The Lachlan Catchment does not fit neatly within any one of the range of bioregion models currently in use. These include the IBRA bioregions (Thackway and Cresswell, 1995), Anderson's climate-based botanical divisions and subdivisions of NSW (Anderson, 1961), and the zoogeographic regions of Spencer (1896), modified by Schodde (1994) as cited in Date *et al.* (2000). Furthermore it constitutes part of the administrative region known as the Central Western Region of NSW (Goldney and Bowie, 1987), important in the context of this study as a point of comparison, as the first vertebrate fauna analyses that assessed distribution, abundance and status in that region.

E1.3.1 South Western Slopes Bioregion

The approved CGM is located in the central north-west of the NSW South Western Slopes Bioregion. The South Western Slopes Bioregion is an extensive area of foothills and isolated ranges comprising the lower inland slopes of the Great Dividing Range. About 92% of the South Western Slopes Bioregion occurs in NSW and the remainder of the bioregion occurs in Victoria. It is bounded by six other bioregions: The Riverina and Cobar Peneplain bioregions to the west, Darling Riverine Plains and Brigalow Belt South Bioregions to the north, Sydney Basin to the north-east, and the South Eastern Highlands Bioregion running along much the eastern boundary (Sahukar *et al.*, 2003).

E1.3.2 Zoogeographic Region

The study area and surrounds are also located within the Eyrean zoogeographic region proposed by Spencer (1896) (and modified by Schodde [1994]) (cited in Date *et al.*, 2000). The Eyrean zoogeographic region (arid and semi arid zones) is a coarse but more useful predictor of faunal assemblages than the South Western Slopes Bioregion or the region commonly known as the Western Plains (Anderson, 1961). While IBRA bioregions have helped to rationalise our understanding of landscape patterns, fauna species tend to respond more to vegetation structure (i.e. grassland, woodland and forest) rather than to particular vegetation communities *per se*.

E1.4 PREVIOUS VERTEBRATE FAUNA SURVEYS

A significant number of vertebrate fauna surveys have been conducted in the broader Lake Cowal catchment which are applicable to the E42 Modification area and surrounds, including:

- historic surveys;
- fauna surveys and assessments conducted for the *Cowal Gold Project Environmental Impact Statement* (EIS) (North Limited, 1998) and the *Cowal Gold Project Species Impact Statement* (SIS) (Resources Strategies, *et. al.*, 1997);
- bird breeding monitoring;
- fauna surveys and assessments conducted for the *Implementation of the Threatened Species Management Protocol* (TSMP) (Barrick, 2003a);
- fauna species recorded within ML 1535 from January 2005 to February 2008; and
- a recent vertebrate fauna assessment of the Lachlan Catchment (Goldney *et al.*, 2008).

These fauna surveys and analyses are discussed below.

Historic Surveys

The first documented surveys (fish, amphibians, reptiles, birds and mammals) were by the CSIRO Scientist Vestjens (1977) who carried out surveys in the northern half of Lake Cowal from 1969 to 1976.

Other bird studies mainly focusing on wetlands species were conducted by Braithwaite *et al.* (1985a; 1985b; 1986a; 1986b) Kingsford *et al.* (1989; 1990; 1991) and Lawler (1989).

Goldney and Bowie (1987) consolidated existing data in their report to the Commonwealth Government, providing a status assessment of all vertebrate fauna in each map sheet of the administrative area known as the Central Western Region.

Fauna Surveys and Assessments Conducted for the EIS and SIS

Fauna surveys and assessments conducted for the EIS (North Limited, 1998) and SIS (Resources Strategies *et al.*, 1997) or utilised in its preparation included: Lane (1989; 1990; 1991a; 1991b; 1991c); Gunninah Consultants (1995); and Fisheries Research Institute (1997).

These surveys targeted fish, amphibians, reptiles, birds and mammals.

Greg Richards and Associates (1997a; 1997b) and Mount King Ecological Surveys (1997) conducted surveys and assessments of the proposed Temora to Cowal Electricity Transmission Line (ETL). This ETL traverses ML 1535.

Bird Breeding Monitoring

Bird breeding monitoring has been conducted at Lake Cowal since 1989. Studies associated with the monitoring of bird breeding on Lake Cowal include Lane (1989; 1990; 1991a; 1991b; 1991c), Crome (1995), Environmental and Educational Services (EES) (1992-1997; 1998-2000); Gell and Peake (2001); Gell (2002-2005; 2007; 2008), and Peake (2006). The monitoring programme has included examination of bird breeding activity and the assemblage of bird species over a whole filling and drying cycle of the lake from August 1989 to the end of 1997 (EES, 1999a; 1999b). The lake was dry between January and August 1998 and then partially refilled before drying out again by January 2002 (Gell, 2002-2005). Since January 2002 the lake has remained dry and little bird breeding activity has been observed (Gell, 2002-2005; 2007; 2008 and Peake, 2006).

Implementation of the Threatened Species Management Protocol

Targeted surveys for threatened fauna species (amphibians, reptiles, birds and mammals [including bats]) were conducted within ML 1535 in 2003 by Cenwest Environmental Services, Charles Sturt University and Greg Richards and Associates as part of the TSMP (Barrick, 2003a).

These surveys included sites within the E42 Modification area.

Additional targeted surveys for threatened species were also conducted for the approved CGM access road (Barrick, 2003b) and the Temora to Cowal ETL (Country Energy, 2004).

Fauna Species Recorded in ML 1535 from January 2005 to February 2008

Attachment EA contains a list of fauna species that have been recorded in ML 1535 from January 2005 to February 2008. These fauna species have been recorded during the following activities:

- monitoring of daily and seasonal fauna usage of the tailings dams within ML 1535 (Donato and Rowntree, 2006; Donato, 2007 and Donato and Smith, 2008);
- pre-clearance fauna surveys within ML 1535 (Barrick, 2005a-z, zi and zii; 2006a-c; 2007a-d; 2008a); and
- incidental observations of fauna within ML 1535 (Barrick, 2008b).

These observations have been made within and surrounding the E42 Modification area. The vertebrate fauna which may be recorded within the E42 Modification area are considered to be a subset of the vertebrate fauna species listed in Attachment EA.

Three threatened species have been recorded within ML 1535 since January 2005 (Attachment EA), namely the:

- Grey-crowned Babbler (*Pomatostomus temporalis temporalis*);
- Magpie Goose (*Anseranas semipalmata*); and
- Superb Parrot (*Polytelis swainsonii*).

The Grey-crowned Babbler has been recorded on many occasions between January 2005 and February 2008. The resident population has progressively moved outside ML 1535 as its habitat within ML 1535 has progressively been removed for approved developments.

The Magpie Goose was observed on two occasions during the pre-clearance surveys in 2005. The first observation was a pair of Magpie Geese observed flying overhead, the second observation was a Magpie Goose in a temporary inundated area created by ponded water from rainfall.

A group of Superb Parrots were observed flying overhead during the pre-clearance surveys in 2005 and again in 2008 foraging on mistletoe within ML 1535.

The potential impact of the modified CGM on these species is evaluated in Section E4.11.

Bat surveys using anabat detectors have been conducted during the pre-clearance surveys within ML 1535 since 2005. No threatened bat species have been recorded during pre-clearance surveys within ML 1535, despite many bat surveys undertaken (Barrick, 2005a-z, zi and zii; 2006 a-c; 2007a-d).

Regional Fauna Assessment

Goldney *et al.* (2008) have mapped the distribution and assessed the status of nearly 600 vertebrate species in the Lachlan Catchment based on a 1:100,000 mapsheet resolution. This includes the Wyalong map sheet and a listing of all native species (326) that have been recorded together with their current status.

E1.5 DESCRIPTION OF THE STUDY AREA

A description of the existing environment of the study area is provided below.

E1.5.1 General

The Lake Cowal area is characterised by flat to gently undulating land with scattered remnant vegetation. Much of the landscape in the area has been cleared for agriculture. The remaining vegetation is predominantly woodland with grassy understorey typically associated with rocky elevated areas, impeded drainage areas and road verges (Anne Clements and Associates, 1995).

Lake Cowal is listed on the Register of National Estate (DEWHA, 2008b), due to its importance as a waterbird concentration area.

Major physical features in the surrounding landscape include Lake Cowal, Wamboyne Mountain (relative level [RL] 412 metres [m] Australian Height Datum [AHD], approximately 5 km north of ML 1535) and Billys Lookout (RL 368 m AHD, approximately 7 km south-west of ML 1535).

Prior to the development of the approved CGM, the vegetation within ML 1535 consisted of cleared agricultural lands with scattered native timber and a range of woodland and lake-bed vegetation communities. ML 1535 is now a developed mine site, dominated by mining infrastructure, tailings storage facilities, waste emplacements, open pit area, water storages, soil stockpiles and various bunds including the lake protection bund (Figure E-2). Hence within ML 1535, native vegetation has been progressively cleared to facilitate approved developments.

E1.5.2 Climate

The Cowal region is located on the boundaries of the south-eastern semi-arid and the south-eastern temperate regions of Australia (Austin and Nix, 1978). The warmest months within the region are November through to March, with cooler temperatures occurring from May to September. Average daily air temperatures range from a maximum of 31.3 degrees Celsius (°C) to a minimum of 5°C (North Limited, 1998).

Relative humidity is variable and temperature dependant, whilst the mean annual rainfall for Wyalong is 477 millimetres (mm) spread more-or-less evenly throughout the year (Bureau of Meteorology, 2008). Evaporation fluctuates between summer and winter and on average exceeds rainfall by more than four-fold.

Over the year, the area experiences winds from all directions but most commonly from the south-west. In summer and spring, the south-westerly winds prevail while in autumn and winter, the most common winds are from the south-south-east (Holmes Air Sciences, 2008).

E1.5.3 Soils

The NSW Department of Land and Water Conservation (DLWC) (1994) identified three major soil types within ML 1535. These are hard pedal red duplex soils; grey, brown and red cracking clays; and hill soils. All three soil types are present within the E42 Modification area.

E1.5.4 Hydrology and Topography

ML 1535, including the E42 Modification area, is located within the Bland Creek catchment which falls steadily from west to east and drains into Lake Cowal. Lake Cowal is generally substantially inundated seven years out of ten (North Limited, 1998), however substantial water has not been in Lake Cowal since 1995.

Within ML 1535 land elevation ranges from RL 205 m AHD to RL 223 m AHD with slopes of around 1% falling to the east. The highest area within the E42 Modification area is Cowal West Hill, and the lowest, the ephemeral drainage line immediately west of Cowal West Hill.

The topography surrounding the E42 Modification area has changed significantly due to the construction of approved developments. The latter can result in temporary shallow, inundated lands within approved disturbance areas (as was the case immediately south of Cowal West Hill for the duration of the fauna survey).

E1.5.5 Landuse

The landuse within ML 1535 is predominantly mining. A small area of Lake Cowal is within ML 1535 immediately east, north and south of the open pit and the temporary isolation bund. Lands surrounding ML 1535 are predominantly used for agriculture.

E1.5.6 Vegetation and Habitat Types

The EIS identified eight vegetation communities within ML 1535. Within the E42 Modification area the following vegetation communities have been identified by FloraSearch (2008):

- Dwyer's Mallee Gum/White Cypress Pine Woodland (*E. dwyeri*– *Callitris glaucophylla*);
- Myall/Belah Woodland (*Acacia pendula* – *Casuarina cristata*);
- Secondary Grassland; and
- Lakebed.

As fauna habitat types, these vegetation communities can be described as variable density woodlands grading into cleared agricultural lands with scattered native trees.

Additional micro-habitats include scattered windrows from previous clearings relocated in the cleared agricultural landscape west of Cowal West Hill, the ephemeral drainage line with dams, running through the cleared agricultural lands west of Cowal West Hill and scattered gilgai across the approved CGM. The habitat value of gilgai depressions for terrestrial vertebrate fauna is not well understood but it is known to act as temporary micro-wetlands within the landscape. However, there are no vertebrate species that solely rely on gilgai to carry out their life history strategies.

E1.6 THREATENED SPECIES

Database Records

Threatened species are considered likely to occur within the study area.

Table E-1 provides a list of threatened fauna species which are known or considered likely to occur within the wider region. The list was compiled based on searches of the following databases for a 400 km² search area surrounding the E42 Modification area:

- Birds Australia (2008) database;
- Australian Museum (2008) database;
- NSW Department of Environment and Climate Change (DECC) (2008a) Atlas of NSW Wildlife;
- BioNet (2008) database; and
- Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) Protected Matters Search (DEWHA, 2008c).

The search area used for these database searches was smaller than the search area used for the EIS (North Limited, 1998) and SIS (Resource Strategies *et al.*, 1997), as the EIS and SIS covered the Temora to Cowal ETL, approved CGM borefield buried pipeline and access road. The search area was refined as modifications are not proposed to these components of the approved CGM. There were a number of additional threatened fauna species discussed in the EIS and SIS and these species have also been considered in this report.

Table E-1 also provides an assessment of the likelihood of these species occurring within the study area during the survey. The full species list produced from the database search (with exception of DEWHA [2008c]) is provided in Attachment EB.

Table E-1
Threatened Fauna Species Recorded within the Wider Region

Scientific Name	Common Name	Conservation Status		Source of Record					Likelihood of Occurrence in the Study Area During the Survey	Comment
		TSC Act ¹	EPBC Act ²	Birds Australia ³	Australian Museum ⁴	DECC Atlas of NSW Wildlife ⁵	BioNet ⁶	EPBC Act Protected Matters Search ⁷		
Amphibians										
Crinia sloanei	Sloane's Froglet	V	-	-	-	✓	✓	-	Possible	Has been located at Lake Cowal.
Birds										
Leipoa ocellata	Malleefowl	E	V	-	-	✓*	✓	✓	Very unlikely	No suitable habitat in the study area.
Anseranas semipalmata	Magpie Goose	V	-	✓	-	✓	✓	-	Unlikely	Foraging habitat in the study area only under extended wet conditions. Has been located on Lake Cowal.
Oxyura australis	Blue-billed Duck	V	-	✓	✓	✓	✓	-	Unlikely	Foraging habitat in the study area only under extended wet conditions. Has been located on Lake Cowal.
Stictonetta naevosa	Freckled Duck	V	-	✓	-	✓	✓	-	Unlikely	Foraging habitat in the study area only under extended wet conditions. Has been located on Lake Cowal.
Botaurus poiciloptilus	Australasian Bittern	V	-	-	-	✓*	-	-	Unlikely	Foraging habitat in the study area only under extended wet conditions. Has been located on Lake Cowal.
Pandion haliaetus	Osprey	V	-	-	-	✓	✓	-	Very Unlikely	Foraging habitat only under extended wet conditions on Lake Cowal. Occasional visitor.
Lophoictinia isura	Square-tailed Kite	V	-	-	-	✓	✓	-	Unlikely	Limited habitat within ML 1535.
Hamirostra melanosternon	Black-breasted Buzzard	V	-	-	-	✓	✓	-	Unlikely	Limited habitat within ML 1535.
Falco hypoleucos	Grey Falcon	V	-	✓	-	✓*	✓	-	Unlikely	Limited foraging habitat available.

Table E-1 (Continued)
Threatened Fauna Species Recorded within the Wider Region

Scientific Name	Common Name	Conservation Status		Source of Record					Likelihood of Occurrence in the Study Area During the Survey	Comment
		TSC Act ¹	EPBC Act ²	Birds Australia ³	Australian Museum ⁴	DECC Atlas of NSW Wildlife ⁵	BioNet ⁶	EPBC Act Protected Matters Search ⁷		
Birds (Continued)										
<i>Grus rubicunda</i>	Brolga	V	-	✓	-	✓	✓	-	Unlikely	Foraging habitat in the study area only under extended wet conditions. Has been located on Lake Cowal.
<i>Ardeotis australis</i>	Australian Bustard	E	-	-	-	✓	-	-	Very Unlikely	At eastern extremity of range and limited habitat within ML 1535.
<i>Limosa limosa</i>	Black-tailed Godwit	V	-	-	-	✓	✓	-	Unlikely	Foraging habitat in the study area only under extended wet conditions. Has been located on Lake Cowal.
<i>Rostratula benghalensis australis</i>	Australian Painted Snipe	V	V	✓	-	✓*	✓	✓	Unlikely	Foraging habitat in the study area only under extended wet conditions. Has been located on Lake Cowal.
<i>Burhinus grallarius</i>	Bush Stone-curlew	E	-	-	-	✓*	✓	-	Unlikely	Limited habitat within ML 1535.
<i>Cacatua leadbeateri</i>	Major Mitchell's Cockatoo	V	-	✓	-	✓	-	-	Unlikely	Limited habitat and not recorded within ML 1535.
<i>Polytelis swainsonii</i>	Superb Parrot	V	V	✓	-	✓*	✓	✓	Unlikely	Limited habitat within ML 1535.
<i>Lathamus discolor</i>	Swift Parrot	E	E	-	-	✓*	✓	✓	Unlikely	Limited habitat and not recorded within ML 1535.
<i>Neophema pulchella</i>	Turquoise Parrot	V	-	-	-	✓*	✓	-	Unlikely	Limited habitat and not recorded within ML 1535.
<i>Ninox connivens</i>	Barking Owl	V	-	✓	-	✓*	-	-	Very Unlikely	Limited habitat and not recorded within ML 1535.
<i>Tyto novaehollandiae</i>	Masked Owl	V	-	-	-	✓*	-	-	Very Unlikely	Limited habitat within ML 1535.
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper	V	-	✓	-	✓	✓	-	Unlikely	Limited habitat and not recorded within ML 1535.

Table E-1 (Continued)
Threatened Fauna Species Recorded within the Wider Region

Scientific Name	Common Name	Conservation Status		Source of Record					Likelihood of Occurrence in the Study Area During the Survey	Comment
		TSC Act ¹	EPBC Act ²	Birds Australia ³	Australian Museum ⁴	DECC Atlas of NSW Wildlife ⁵	BioNet ⁶	EPBC Act Protected Matters Search ⁷		
Birds (Continued)										
<i>Hylacola cauta</i>	Shy Heathwren	V	-	-	-	✓*	✓	-	Very Unlikely	Limited habitat and not recorded within ML 1535.
<i>Pyrrholaemus sagittata</i>	Speckled Warbler	V	-	✓	✓	✓	✓	-	Unlikely	Limited habitat and not recorded within ML 1535.
<i>Xanthomyza phrygia</i>	Regent Honeyeater	E	E	-	-	✓*	✓	✓	Unlikely	Limited habitat and not recorded within ML 1535.
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater	V	-	-	-	✓*	✓	-	Very Unlikely	Limited habitat and not recorded within ML 1535.
<i>Grantiella picta</i>	Painted Honeyeater	V	-	✓	-	✓	✓	-	Very Unlikely	Limited habitat and not recorded within ML 1535.
<i>Melanodryas cucullata cucullata</i>	Hooded Robin	V	-	✓	✓	✓*	✓	-	Very Unlikely	Limited habitat and not recorded within ML 1535.
<i>Drymodes brunneopygia</i>	Southern Scrub-robin	V	-	-	-	✓*	✓	-	Very Unlikely	Limited habitat and not recorded within ML 1535.
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler	V	-	✓	-	✓	✓	-	Likely	Potential habitat is available in the study area. Located across ML 1535.
<i>Cinclosoma castanotus</i>	Chestnut Quail-thrush	V	-	-	-	✓*	✓	-	Very Unlikely	Limited habitat and not recorded within ML 1535.
<i>Stagonopleura guttata</i>	Diamond Firetail	V	-	✓	✓	✓	✓	-	Very Unlikely	Limited habitat and not recorded within ML 1535.
<i>Pachycephala inornata</i>	Gilbert's Whistler	V	-	-	-	✓	✓	-	Very Unlikely	Limited habitat and not recorded within ML 1535.

Table E-1 (Continued)
Threatened Fauna Species Recorded within the Wider Region

Scientific Name	Common Name	Conservation Status		Source of Record					Likelihood of Occurrence in the Study Area During the Survey	Comment
		TSC Act ¹	EPBC Act ²	Birds Australia ³	Australian Museum ⁴	DECC Atlas of NSW Wildlife ⁵	BioNet ⁶	EPBC Act Protected Matters Search ⁷		
Mammals										
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V	-	-	-	✓*	✓	-	Very unlikely	No suitable habitat within ML 1535. Believed to be extinct in the bioregion.
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-	-	-	✓*	✓	-	Very unlikely	Limited habitat within ML 1535.
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E	-	-	✓*	✓	-	Very unlikely	No suitable habitat within ML 1535. Believed to be extinct in the bioregion.
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat	V	-	-	-	✓*	✓	-	Possible	Potential but limited habitat available in the study area.
<i>Nyctophilus timoriensis</i>	Eastern Long-eared Bat (south-east form)	V	V	-	-	✓	✓	✓	Possible	Potential but limited habitat available in the study area.
<i>Chalinolobus picatus</i>	Little Pied Bat	V	-	-	-	✓*	✓	-	Possible	Potential but limited habitat available in the study area.
<i>Myotis adversus</i>	Large-footed Myotis	V	-	-	-	✓*	✓	-	Very unlikely	Limited habitat within ML 1535.

¹ Threatened Species Status under the NSW *Threatened Species Conservation Act, 1995* (TSC Act).

² Threatened Species Status under the EPBC Act.

³ Birds Australia (2008).

⁴ Australian Museum (2008).

⁵ DECC (2008a).

⁶ BioNet (2008).

⁷ DEWHA (2008c).

V Vulnerable

E Endangered

* The validity of the only DECC record of this species in the search area is questionable.

The DECC Atlas of NSW Wildlife (DECC, 2008a) contains a number of threatened species records (at -33.62 latitude and 147.45 longitude) for which the validity of the only record of the species in the DECC database search results is questionable (i.e. the Malleefowl, Australasian Bittern, Grey Falcon, Australian Painted Snipe, Bush-stone Curlew, Superb Parrot, Swift Parrot, Turquoise Parrot, Barking Owl, Masked Owl, Shy Heathwren, Regent Honeyeater, Black-chinned Honeyeater, Hooded Robin, Southern Scrub-robin, Chestnut Quail-thrush, Brush-tailed Phascogale, Squirrel Gilder, Spotted-tailed Quoll, Yellow-bellied Sheath-tailed Bat, Little Pied Bat and Large-footed Myotis). These questionable records are identified as such in Table E-1. The DECC record source is attributed to the EIS (DECC pers. comm., 2007), however, these species were not recorded in the EIS. Further, the questionable records have only been recently added to the DECC Atlas of NSW Wildlife database (DECC pers. comm., 2007). It is likely that the BioNet database records for the same species are also incorrect as they are based on the DECC records. The likelihood of the modified CGM affecting these species is discussed in Section E4.11.

For some of these species there are other records from other sources which occur within the search area. These species include the Australasian Bittern and Australian Painted Snipe reported towards the north of Lake Cowal by Vestjens (1977 in North Limited, 1998), the Superb Parrot recorded during pre-clearance fauna surveys (Section E1.4), the Yellow-bellied Sheath-tailed Bat recorded by Greg Richards and Associates (1997a) and the Little Pied Bat recorded by Gunninah Consultants (1995). These species are further discussed in Section E4.11.

Other Information Sources

In addition to the database results presented in Table E-1, a number of other sources were used to determine the likelihood of threatened species occurring in the E42 Modification area, including:

- the previous fauna surveys described in Section E1.4;
- the EIS (North Limited, 1998) and SIS (Resource Strategies *et al.*, 1997);
- the schedules of the TSC Act, EPBC Act and *Fisheries Management Act, 1994* (FM Act);
- Preliminary and Final Determinations of the NSW Scientific Committee (DECC, 2008b);
- distribution and habitat descriptions available on the DECC Threatened Species Internet Site (DECC, 2008b) and in references such as Strahan (1998); and
- the essential lifecycle components of candidate species (including breeding, foraging, roosting/nesting and movement/migration).

There are a number of species which could occur in the surrounds (based on distribution of the species) despite not having been previously recorded in the databases in Table E-1 (i.e. the Pink-tailed Legless Lizard [*Aprasia parapulchella*] and Glossy Black-cockatoo [*Calyptorhynchus lathamii*]). These species are further considered in Section E4.11.

The SIS (Resource Strategies *et al.*, 1997) assessed the potential impact of the approved CGM on the Black-necked Stork. However, it is considered that this species is unlikely to be impacted by the modified CGM as it has not been recorded at Lake Cowal or in the surrounding area despite extensive bird surveys (Section E1.4). Vagrant Black-necked Storks may visit Lake Cowal when the lake is full, although this is unlikely as the species primarily inhabits coastal habitats. As such, this species has not been considered further.

The Southern Bell Frog (*Litoria raniformis*) was identified in the EIS database search (North Limited, 1998). While Lake Cowal (when inundated) provides potential habitat for the Southern Bell Frog, this species is regarded as being extinct in the South Western Slopes Bioregion. Further, this species has not been recorded in either Lake Cowal, the E42 Modification area or within ML 1535. Considering this, it is very unlikely that the Southern Bell Frog would be impacted by the modified CGM. As such, this species has not been considered further.

Vestjens (1977) recorded *Tympanocryptis lineata* (presumed to be *T. lineata lineata*) in a 60 km² central area of Lake Cowal between 1969 and 1976. However, it is the subspecies/species *pinguicollis*¹ that is threatened under the TSC Act and EPBC Act and it has not been recorded in the E42 Modification area and/or immediate surrounds. *T. lineata pinguicollis* is found in the basalt plains of southern Victoria and the native grasslands of south-eastern NSW and the Australian Capital Territory (ACT) (Osborne and Kubolic, 1992; Robertson and Cooper, 2000). This species is considered unlikely to occur in the E42 Modification area and/or immediate surrounds given its known distribution is significantly further to the south-east, and at higher altitudes and in cooler climates, than those that characterise the Lake Cowal area. As such, this species has not been considered further.

E1.7 ENDANGERED ECOLOGICAL COMMUNITIES

The following endangered ecological communities (EECs) under the TSC Act may occur within the study area:

- Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes Bioregions EEC (Myall Woodland EEC); and
- Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Colbar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC (Inland Grey Box Woodland EEC).

In addition to the above, the Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Lachlan River Endangered Ecological Community (Lachlan River Catchment EEC) is listed under the FM Act and includes Lake Cowal in the listing (DPI Threatened Species Unit, 2006).

E1.8 ENDANGERED POPULATIONS

No endangered populations listed under the TSC Act occur within the study area.

E1.9 MIGRATORY SPECIES

Table E-2 presents the migratory species listed under the EPBC Act that have been recorded within the wider region by the sources listed in Section E1.6.

¹ The recently published Recovery Plan for *Tympanocryptis lineata pinguicollis* (Robertson and Cooper, 2000) accepts that *pinguicollis* is a species in its own right (as argued by Osborne and Kubolic, 1992) and that *lineata lineata* is an interior species (see also Shea, 2002 and Smith *et al.*, 1999). Cogger (2000) however continues to recognise *pinguicollis* as a subspecies of *lineata*.

Table E-2
Migratory Species Recorded within the Wider Region

Scientific Name	Common Name	Source of Record				
		Birds Australia ¹	Australian Museum ²	DECC Atlas of NSW Wildlife ³	BioNet ⁴	EPBC Act Protected Matters Search ⁵
<i>Acrocephalus australis</i>	Australian reed-warbler	-	-	✓	-	-
<i>Apus pacificus</i>	Fork-tailed Swift	✓	-	✓	✓	✓
<i>Ardea alba</i>	Great Egret	✓	-	✓	✓	✓
<i>Ardea ibis</i>	Cattle Egret	✓	-	✓	✓	✓
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	✓	-	✓	✓	✓
<i>Calidris ferruginea</i>	Curlew Sandpiper	✓	-	✓	✓	✓
<i>Calidris melanotos</i>	Pectoral Sandpiper	✓	-	✓	✓	✓
<i>Calidris ruficollis</i>	Red-necked Stint	✓	-	✓	✓	✓
<i>Falcunculus frontatus whitei</i>	Eastern Shrike-tit	-	-	✓	✓	✓
<i>Gallinago hardwickii</i>	Latham's Snipe	✓	-	✓	✓	✓
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	✓	-	✓	✓	✓
<i>Hirundapus caudacutus</i>	White-throated Needle-tail	-	-	-	-	✓
<i>Leipoa ocellata</i>	Malleefowl	-	-	✓	✓	✓
<i>Limosa limosa</i>	Black-tailed Godwit	-	-	✓	✓	✓
<i>Merops ornatus</i>	Rainbow Bee-eater	✓	-	✓	✓	✓
<i>Pandion haliaetus</i>	Osprey	-	-	✓	✓	✓
<i>Plegadis falcinellus</i>	Glossy Ibis	✓	-	✓	✓	✓
<i>Rhipidura rufifrons rufifrons</i>	Rufous Fantail	-	-	✓	✓	✓
<i>Rostratula benghalensis australis</i>	Australian Painted Snipe	✓	-	✓	✓	✓
<i>Tringa nebularia</i>	Common Greenshank	✓	-	✓	✓	✓
<i>Tringa stagnatilis</i>	Marsh Sandpiper	✓	-	✓	✓	✓
<i>Xanthomyza phrygia</i>	Regent Honeyeater	-	-	✓	✓	✓

¹ Birds Australia (2008)

² Australian Museum (2008)

³ DECC (2008a)

⁴ BioNet (2005)

⁵ DEWHA (2008c)

The Malleefowl (*Leipoa ocellata*) is listed as a migratory species under the EPBC Act. However, it cannot be considered to be a migratory species.

E2 SURVEY METHODS

The fauna survey was designed in consideration of the following:

- the large number of vertebrate fauna surveys that have been conducted for the approved CGM and the immediate surrounds as outlined in Section E1.4;
- most of the threatened species which occur in the region are unlikely to reside in the study area;
- the limited fauna habitat within the E42 Modification area (i.e. approximately 290 hectares [ha]); and
- the fauna habitat within the E42 Modification area is surrounded by currently approved disturbance areas.

It is expected that the vertebrate species that would be detected in the E42 Modification area would be a relatively small subset of species that once were located within ML 1535 prior to development, as well as a subset of those species located during pre-clearance surveys within ML 1535 between January 2005 and February 2008.

The robust quality of existing vertebrate survey data from nearby locations and within the region, means that cross-checking the outcomes of this survey could be readily undertaken.

E2.1 SURVEY TIMING AND CONDITIONS

The vertebrate fauna survey was conducted in autumn 2008 over a three-day period. The weather conditions during the survey are provided in Table E-3, together with sunrise and sunset times. Temperatures varied from mild to warm. No rain fell during the survey period. However, significant rain fell within ML 1535 in the month preceding the survey (approximately 37.8 mm) (Bureau of Meteorology, 2008). There was no moonlight during evening surveys. During the fauna survey, Lake Cowal was dry.

Table E-3
Temperature, Total Rainfall, Relative Humidity,
Sun and Moon Information for the Survey Period

Date	Temperature (°C) ¹		Rainfall (mm) ¹	Relative Humidity Range ¹	Sun		Moon	
	Max.	Min.			Sunrise	Sunset	Moon Rise	Moon Set
03/03/08	32.0	12.6	0	17-66.8	0701	0745	0155	1701
04/03/08	34.3	13.4	0	17.3-52.9	0702	0744	0257	1741
05/03/08	36.9	16.1	0	12.8-51.3	0703	0743	0401	1816

¹ Approved CGM meteorology data.

E2.2 FAUNA SAMPLE TRANSECTS AND SITES

The E42 Modification area was stratified into three habitat units for the purpose of the survey. These were:

- Eucalypt Woodland;
- Mixed Woodland; and
- Cleared Agricultural Land with Scattered Trees.

These habitats are fully described in Sections E3.1 and E3.2.

Since these areas are relatively small, each discrete habitat was regarded as a 'site' and the majority of survey effort was associated with sampling transects running through the longest axis of each site. In the case of the Eucalypt Woodland site (located on Cowal West Hill), three parallel transects were used running the complete north-south length of the remnant, two on either side of the ridge and the third along the hilltop. These transects were about 1 km in length. An additional spotlighting transect utilised the vehicle track separating the Eucalypt Woodland site and the Cleared Agricultural Land with Scattered Trees to the immediate west.

Similarly the Mixed Woodland habitat was surveyed using two parallel transects running along the longest axis of this habitat. These transects were approximately 0.5 km in length.

One continuous transect was utilised for the drainage line and Cleared Agricultural Land with Scattered Trees. This transect commenced from the northern end of Cowal West Hill crossing the drainage line and then continuing along the drainage line to south-west, and then through the scattered timber line before heading directly east to the southern edge of Cowal West Hill. This transect was approximately 1.5 km in length.

As discussed in Section E3.1, Lakebed habitat also occurs within the E42 Modification area. A sampling site was not established within the Lakebed habitat during this supplementary survey given the many fauna surveys which have been previously conducted in this habitat type (Section E1.4), during periods when the lake is both dry and wet, and also considering the relatively small scale of the proposed disturbance to this habitat type (Figure E-2). Section E4 provides an assessment of the potential impacts on the Lakebed habitat and associated fauna species.

E2.3 FAUNA SURVEY TECHNIQUES

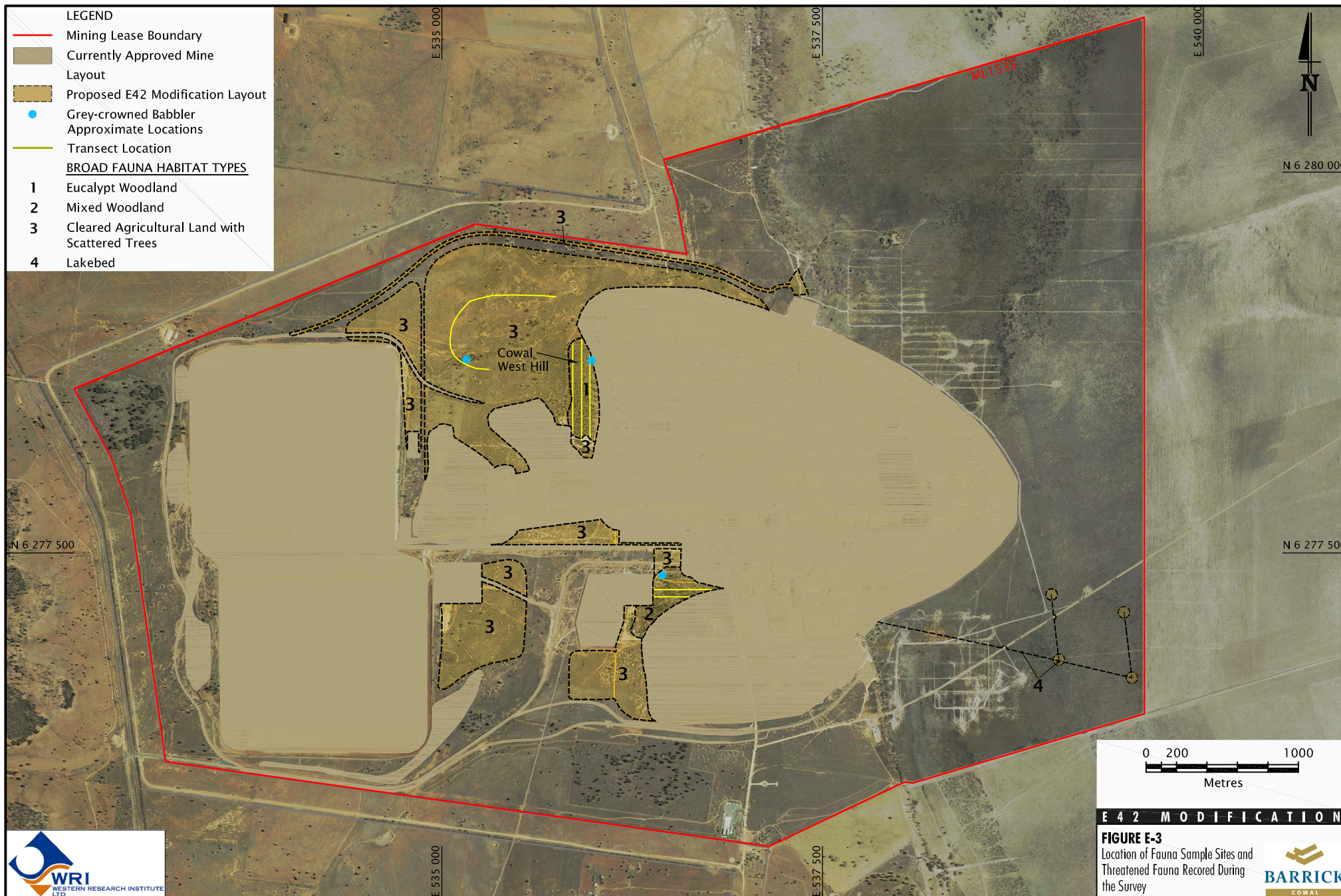
The survey techniques utilised were based on the DECC (DEC, 2004) and Bell and Hoyer's (2002) recommendations and are described below. The survey effort implemented at each survey site is summarised in Attachment EC.

Where necessary, species identifications were checked using the following references: Marchant and Higgins (1993); Pizzey and Knight (1997); Cogger (2000); Menkorst and Knight (2001); Barret *et al.* (2003); Morcombe (2004); Strahan (1998) and Swan *et al.* (2004). Playback calls were selected from Stewart (1997; 1999a; 1999b). Tracks and traces were identified where possible using Triggs (2004).

Spotlighting

The primary targets of this activity were arboreal and ground dwelling larger mammals, nocturnal birds, nocturnal amphibians and reptiles. Spotlighting activities involved:

- Spotlighting on foot: The Eucalypt Woodland on Cowal West Hill was surveyed by three persons who walked simultaneously along the three parallel transects from south to north for approximately 45 minutes, walking at around 1 km/hour, on one evening about an hour after sunset (Figure E-3). Similarly in the Mixed Woodland two parallel transects were simultaneously walked by two persons.
- Additional spotlighting was carried out using a vehicle travelling at around 5 km/hour, using the vehicle track between the Eucalypt Woodland on Cowal West Hill and the Cleared Agricultural Land with Scattered Trees (Figure E-3). This enabled both habitats to be surveyed along their longest axis on two occasions. This was the only spotlighting carried out in the Cleared Agricultural Land with Scattered Trees other than targeting the drainage line and dams for amphibians.



- During spotlighting forays on foot or by car, intentional listening time was dedicated to assessing the presence of amphibians, night birds and arboreal fauna by detecting signature calls.

Herpetological Searches

Systematic searches were conducted for reptiles and amphibians along the transect lines described above and shown in Figure E-3. Approximately 60 minute daytime searches were conducted on two separate days at each of three sites targeting reptiles and amphibians. Bark was prised from trees, ground litter was raked, logs were turned over and cavities examined, fallen branches were moved, rocks were turned and slow walking was used in an attempt to flush out any reptiles or amphibians present.

Bird Surveys

Two one-hour surveys were conducted on two separate days using the transects described above, one in the morning and one in the late afternoon. Birds were recognised by sight, calls and flight patterns. The observer walked slowly up and down each long axis transect (Figure E-3).

Call Playback

Standard call playback procedures were used to target two species, the Barking Owl and Squirrel Glider. Nocturnal playbacks were conducted jointly for the Eucalypt Woodland on Cowal West Hill and the Cleared Agricultural Land with Scattered Trees to the west, and separately in the Mixed Woodland, at appropriate locations. Each session commenced with a short listening period, followed by spotlighting of the surrounding vegetation. The call of the target species was played for three to five minutes separated by 30 seconds of listening. Following the completion of calls, a further spotlight scan was made of the surrounding vegetation under nocturnal conditions.

Opportunistic Observations

Any sightings of fauna were recorded whilst travelling throughout the study area.

Tracks and Traces

Searches for tracks and traces were combined with other activities, particularly herpetological searches. Searches were conducted for hair samples, skulls, animal droppings, diggings and scratch marks, etc. Some areas and track sections were particularly suited to identifying animal tracks. All scats that were located could be identified in the field.

Bat Surveys

Anabat detectors for bat fauna were not used during the survey given bats have been extensively surveyed within ML 1535 over the last three years (Section E1.4). The list of bat species located within ML 1535 between 2005 and 2008 is found in Attachment EA.

E2.4 RELATIVE ABUNDANCE

The relative abundance of each species recorded was estimated as follows:

- 1 One sighting of the species, or at least one trace found.
- U Uncommon, 2-5 observations of the species, as well as an assessment of how widespread and persistent the species was.
- MC Moderately Common, 6-25 observations of the species, as well as an assessment of how widespread and persistent the species was.
- C Common, 26-35 observations of the species, as well as an assessment of how widespread and persistent the species was.
- A Abundant, more than 35 observations of the species, as well as an assessment of how widespread and persistent the species was.
- ? Relative abundance cannot be estimated when a species presence is identified solely from tracks and traces.

Hence relative abundance was based on empirical data as well as being a value judgement made by an experienced surveyor.

E3 SURVEY RESULTS

E3.1 FAUNA HABITAT TYPES AND COMPLEXITY

The E42 Modification area is comprised of the following three broad habitat types:

- **Eucalypt Woodland**

The Eucalypt Woodland habitat occurs on Cowal West Hill and is dominated by *Eucalyptus dwyeri* and *Callitris glaucophylla*. This remnant woodland is elevated about 15 to 20 m above the surrounding landscape and is immediately adjacent to the currently approved northern waste emplacement to the east, ore and soil stockpiles to the south and predominantly cleared agricultural land to the north and west (Figure E-3).

There is no permanent water within this habitat type although at times the ephemeral drainage line to the north provides water for extant species, as does locally ponded water immediately south of the remnant.

This Eucalypt Woodland is now a relictual patch of habitat within the landscape which has low to no connectivity with lands outside ML 1535, depending on the inherent vagility of particular species. In habitat terms, whilst a distinct vegetation community and elevated, the Eucalypt Woodland was once likely part of a continuous woodland made up of a mosaic of the vegetation communities that have been previously identified within ML 1535.

Although the entry of stock is now controlled within ML 1535, the Eucalypt Woodland habitat on Cowal West Hill has a long history of grazing and as a result shows evidence of having lost a significant amount of topsoil, appears to be deficient in soil carbon, has discontinuous ground cover, little leaf litter, is tree hollow and ground log impoverished and demonstrates a lack of understorey and overstorey regeneration.

Small (~10 centimetres [cm] round) bushrocks were scattered across the Eucalypt Woodland habitat type. This particular micro-habitat is important for many invertebrate species and for a limited number of smaller reptiles.

Habitat Assessment

Overall habitat condition was assessed as being moderate. This assessment is based on: past clearing for agriculture, long-term grazing with evidence of over-grazing having occurred, poor dominant tree health due to the impacts of extended drought, a species impoverished mid storey, an understorey improving following the reduction of grazing with the commencement of mining, low weed invasion, the presence of fallen logs and the presence of micro and macro tree hollows in sufficient numbers to support a limited number of hollow dependent fauna. However, the extent of this moderate habitat and its relative isolation within the landscape, suggests that vertebrate species diversity is likely to be relatively low.

- **Mixed Woodland**

The Mixed Woodland habitat is dominated by Belah (*Casuarina cristata*) and Myall (*Acacia pendula*). This habitat type is listed as an EEC in NSW. This remnant woodland is surrounded by currently approved developments: the developing southern waste emplacement, process plant to the immediate west and north-east, and soil stockpiles to the south (Figure E-3). The Mixed Woodland is now a relictual patch of habitat within the landscape which has low to no connectivity with lands outside ML 1535, depending on the inherent vagility of particular species.

There is no permanent water within this habitat type but under wet conditions, water ponds in some components of the landscape and within scattered gilgai.

The area has a long history of over-grazing (although stock entry is now controlled within ML 1535) and as such, appears to be deficient in soil carbon, has discontinuous ground cover, little leaf litter, is hollow and ground log impoverished, but is demonstrating some understorey and overstorey regeneration.

Gilgai soils and associated depressions are scattered across this habitat type. The habitat value of gilgai depressions for terrestrial vertebrate fauna are not well understood but act as temporary micro-wetlands within the landscape. These assist amphibia to successfully breed. However, there are no vertebrate species that solely rely on gilgai to carry out their life history strategies.

Habitat Assessment

The overall value of this habitat was assessed as moderate. This assessment is based on the following: sparse over-storey with Myall often in over-mature and declining condition, lack of well formed age classes in dominant trees (Myall and Belah), sparse low shrub layer, relatively high ground cover diversity of grasses and shrubs, low level of weed invasion, some regeneration and native pant recovery following the cessation of grazing, the presence of fallen logs, and the presence of micro and macro tree hollows in sufficient numbers to support some hollow dependent fauna, However the extent of this moderate habitat, and its relative isolation within the landscape, suggests that vertebrate species diversity is likely to be relatively low.

- **Cleared Agricultural Land with Scattered Trees**

This is a human-made landscape created through extensive clearing and a range of agricultural practices (with grazing being the dominant practice).

An ephemeral drainage line with associated dams dissects the cleared agricultural land along a north-south axis. This drainage line once connected with Lake Cowal as part of a widespread minor drainage network. It is predominantly treeless. The main drainage line varies in width from 2 to 10 m, appears to have incised over the years, and is connected with a series of farm dams. Vegetation varies from grassland to a range of plants that respond to varying water gradients.

The dominant remaining tree species are Wilga (*Geijera pariflora*) with occasional Rosewood (*Alectryon oleifolius*) and a patch of Belah (*Casuarina cristata*) and Bimble Box (*E. populnea*).

Scattered windrows from previous vegetation clearings also occur within this broad habitat type. These windrows were placed in the landscape in an attempt to provide habitat for reptiles.

To a lesser extent than the Mixed Woodland habitat type, gilgai soils and associated depressions are scattered across the Cleared Agricultural Land with Scattered Trees.

Habitat Assessment

The overall value of this habitat was assessed as moderate. This assessment is based on the following: the area has been cleared for grazing but does not appear to have been cropped, native pasture is in relatively good condition, minimum weed invasion, low to absent mid storey, scattered and clumped mature trees, with little to no regeneration, ephemeral drainage line wetland, very limited amounts of fallen logs, and micro and macro tree hollows in sufficient numbers to support hollow dependent fauna. However, the extent of this moderate habitat, and its relative isolation within the landscape, suggests that vertebrate species diversity is likely to be relatively low in this habitat type.

- **Lakebed**

The vegetation on the lakebed of Lake Cowal is adapted to the irregular wetting and drying cycle. As the Lake was dry at the time of the survey, the fauna habitat was a temporary grassland of native and naturalised pasture grasses.

When the Lake is inundated with water, the wetland supports ephemeral aquatic plants which provide habitat for fauna such as aquatic invertebrates, fish and wetland birds.

Historically throughout its drying cycle the lakebed has been subject to livestock grazing and, in some areas, cropping.

Habitat Assessment

The Lakebed habitat is part of Lake Cowal and therefore contributes to the fauna values of the Lake. As the Lake was dry at the time of the survey, the overall habitat condition of the temporary grassland habitat which occurs within the E42 Modification area was assessed as being low to moderate. This assessment is based on: past disturbance from cropping and long-term grazing as well as the occurrence of widespread pasture grasses. It is recognised that when the Lake is inundated, the resultant wetland habitat would be utilised by a different range of fauna, thereby changing the condition of the fauna habitat. It is considered, however, that the dominant influence on the condition of the Lake habitat (in both its wetland and dry grassland states) is agricultural practices (e.g. cropping and grazing).

E3.2 FAUNA SPECIES DIVERSITY AND ABUNDANCE

A total of 39 native vertebrate species were located during the survey. Two introduced species were identified. Attachment ED provides a list of species which were recorded during the survey. In total three amphibian, three reptile, 30 bird and three native mammal species were identified.

E3.2.1 Comparison with Other Survey Data

Table E-4 provides a comparison of the results from the current survey with three other surveys/analyses at a range of scales within the Wyalong 1:100,000 mapsheet. The table also reports the vertebrate species diversity identified by Goldney *et al.* (2008) in their Central West study (Lachlan and central West Catchments) across 89 x 1:100,000 map sheets including Wyalong. These include species within the Wyalong mapsheet and within ML 1535 (either extinct or once present), and species present at Lake Cowal during the preparation of the EIS (240 species) (North Limited, 1998). The data includes the significant numbers of waterbirds and swamp birds associated with Lake Cowal in flood or very wet conditions.

Table E-4
A Comparison of Results from this Study with other Survey Results

Faunal Group	Wyalong 1:100,000 mapsheet ¹	EIS ² (data reported is from within ML 1535 and also Lake Cowal)		Fauna Species Recorded in ML 1535 from January 2005 to February 2008 ³	Current Survey (2008)
		Including Waterbirds	Not Including Waterbirds		
Native Amphibia	11	11	11	6	3
Native Reptiles	30 ⁴	31	31	16	3
Native Birds	255	177	109	70	30
Native Mammals	30	20	20	19	3
Introduced Species	10	10	10	8	2
Total Threatened Species	35	15	15	4	1
Total Native Species	326	240	171	111	39

¹ Goldney *et al.* (2008) based on a modified and supplemented NSW Wildlife Atlas.

² North Limited (1998).

³ Survey data associated with species recorded within ML 1535 (Appendix EA).

⁴ The discrepancy between the number of reptiles in 1 and 2 is likely explained by the Vestjens (1977) and some other survey data not having been entered into the NSW Wildlife Atlas.

During progressive clearing within ML 1535 from January 2005, 111 vertebrate species have been located. These data include only two waterbirds. In contrast, vertebrate species diversity in the current survey represents approximately 35% of the species located within ML 1535, approximately 15% of the species reported in the EIS with waterbirds included and approximately 25% with waterbirds excluded, and approximately 12% of the native vertebrate species diversity in the Wyalong 1:100,000 mapsheet with waterbirds included. These data indicate that the current survey located a relatively small subset of the potential species found in the Lake Cowal area.

E3.2.2 Species Diversity, Composition and Abundance

Thirty-nine native species were located during the survey (Tables E-4 and E-5, and Attachment ED). Three species were observed only once, 26 were assessed as Uncommon, 11 were assessed as Moderately Common and only one was assessed as being Common within the study area. Native species diversity varied between 26 to 30 per site. Introduced species were located at all sites and varied between 1 to 2 species. Both introduced species were assessed as being Uncommon within the study area.

The types of species recorded during the survey are consistent with the expected species diversity in a relic ecological-sink landscape, where local and regional extinctions are very likely occurring and where some species may be present but not actively breeding.

Table E-5
Distribution of Terrestrial Fauna Species across Survey Sites

	Number of Species per Sample Site				
	Eucalypt Woodland	Cleared Agricultural Land with Scattered Trees		Mixed Woodland	Total Number of Species Recorded
		Terrestrial Component	Emphemeral Drainage Line		
Native Amphibians	1	2	2	0	3
Native Reptiles	3	3	0	2	3
Native Birds	17	16	8	16	30
Native Mammals	3	1	0	2	3
Introduced Species	2	1	0	2	2
Total Native Species	26	23	10	22	39
Total Species					41

E3.2.3 Amphibians

Three amphibian species were located during the survey (Table E-4 and E-5, and Attachment ED). The number of species located at the sampling sites varied between zero to two species (Table E-5). Two species were assessed as being Moderately Common and one species was only seen once (Attachment ED).

A total of six amphibian species have been located within ML 1535 since 2005 (Attachment EA). During pre-clearance surveys in late February 2008, the Desert Tree Frog was recorded within the E42 Modification area. The presence of the Desert Tree Frog represents the first record for this species in the Lake Cowal region, although it is well within the species' range.

No threatened amphibian species were located during the survey. The recently listed threatened species, the Sloane's Froglet (*Crinia sloanei*), was recorded in 1995 and 1997 from within the Lake Cowal area (DECC, 2008a).

E3.2.4 Reptiles

Reptile species diversity was very low across the survey site, with only three species located during the survey (Tables E-4 and E-5, and Attachment ED). The number of species located at all sampling sites varied between zero and three. The majority of species were located within the Eucalypt Woodland and in the adjacent Cleared Agricultural Land with Scattered Trees survey sites (Table E-5). All reptiles recorded were assessed as being Uncommon within the study area (Attachment ED).

The reptile species located represent less than 10% of species described in the EIS (North Limited, 1998). No threatened reptile species were located during the survey or have previously been recorded within the Lake Cowal area (e.g. Vestjens, 1977; Gunninah Consultants, 1995; Mount King Ecological Surveys, 1995; Barrick, 2003a; Barrick, 2005a-z, zi and zii; 2006a-c; 2007a-d; 2008a and b).

E3.2.5 Birds

Thirty bird species were located during the survey (Tables E-4 and E-5, and Attachment ED), representing less than 12% of the bird species located within the Wyalong 1:100,000 mapsheet and approximately 27% of the bird species (excluding waterbirds) reported in the EIS (North Limited, 1998) (Table E-4).

The number of bird species located at all sampling sites varied between eight and seventeen, with the majority of species located within the Eucalypt Woodland survey site (Table E-5). Eight species were assessed as being Moderately Common, one species was Common, twenty species were Uncommon and one species was only located once (Attachment ED).

One threatened bird species was recorded, namely, the Grey-crowned Babbler (*Pomatostomus temporalis temporalis*). The records of this species are further discussed in Section E3.2.8.

E3.2.6 Mammals

A total of three native mammals were located during the survey, namely the Short-beaked Echidna, Common Brushtail Possum and Eastern Grey Kangaroo (Tables E-4 and E-5, and Attachment ED). Bats and small mammals were not targeted in this survey due to the large amount of previous survey data on these groups.

The number of species located at all sampling sites varied between zero and three, with all species located within the Eucalypt Woodland survey site, and no mammal species located along the ephemeral drainage line within the Cleared Agricultural Land with Scattered Trees (Table E-5).

The Eastern Grey Kangaroo was assessed as Moderately Common, while the Short-beaked Echidna was Uncommon, and the Common Brushtail Possum was only located once (Attachment ED).

A total of 13 bat species have been recorded within ML 1535 from 2005 to 2008 as listed in Attachment EA. No threatened bat species were recorded during this period.

Other native mammal species that were not targeted during this survey included small mammals such as *Antechinus* spp. and *Sminthopsis* spp. No droppings of either genus were located during the survey. Little suitable habitat was available for either genus and in the unlikely event of either being present would likely be so in very low numbers with future local extinction almost inevitable. No small ground dwelling mammals belonging to these two genera and located during prior surveys in the Lake Cowal area, are threatened species.

E3.2.7 Introduced Fauna

Two introduced vertebrates were located during the survey and included the Red Fox and European Rabbit (Tables E-4 and E-5, and Attachment ED). The Red Fox and European Rabbit were both located within the Eucalypt Woodland and the Mixed Woodland habitats. Both species were assessed as being Uncommon in the study area.

The Feral Cat (*Felis catus*), Brown Hare (*Lepus capensis*), House Mouse (*Mus musculus*) and Sheep (*Ovis aries*) have been previously recorded within ML 1535 (Attachment EA).

E3.2.8 Threatened Fauna Species

Only one threatened species, the Grey-crowned Babbler (*Pomatostomus temporalis temporalis*), was located within the Eucalypt Woodland, Mixed Woodland and Cleared Agricultural Land with Scattered Trees. This species was assessed as Uncommon in the study area. The survey site, co-ordinates and number of individuals located are outlined in Table E-6.

Table E-6
Threatened Fauna Species Located During the Survey

Scientific Name	Common Name	Conservation Status		Survey Sites	Location of Record		Number of Individuals
		TSC Act ¹	EPBC Act ²		Easting	Northing	
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler	V	-	Eucalypt Woodland	535163	6 278769	1
				Cleared Agricultural Land with Scattered Trees	535984	6 278764	Calls heard.
				Mixed Woodland	536449	6 277353	Calls heard.

¹ Threatened species status under the NSW TSC Act (current as at April 2008).

² Threatened species status under the Commonwealth EPBC Act (current as at April 2008).

V Vulnerable

E3.2.9 Threatened Ecological Communities

The only threatened ecological communities found within the study area was the Myall Woodland EEC and Lachlan River Catchment EEC (FloraSearch, 2008).

E3.2.10 Migratory Species

One migratory species under the EPBC Act was recorded during the survey, the Cattle Egret (*Ardea ibis*). The Cattle Egret was located flying overhead in the Cleared Agricultural Land with Scattered Trees survey site. It was assessed as Uncommon during the survey.

The migratory species listed in Table E-2 are considered possible to occur within the study area.

E4 EVALUATION OF POTENTIAL IMPACTS

The EIS (North Limited, 1998) and SIS (Resource Strategies *et al.*, 1997) assessed the short-term and long-term potential impacts from the approved CGM on fauna. The type of potential impacts associated with the E42 Modification would be largely the same as those identified in the EIS (North Limited, 1998) and SIS (Resource Strategies *et al.*, 1997), the difference due to an increase in the area proposed to be cleared.

The following sections evaluate the potential impacts of the modified CGM on vertebrate fauna species, populations and their habitats in consideration of the *Draft Guidelines for Threatened Species Assessment* (DEC and DPI, 2005). The magnitude, extent and significance of these potential impacts are identified.

E4.1 HABITAT REMOVAL/MODIFICATION

Habitat removal and modification resulting from the modified CGM would involve the following key threatening processes listed under the TSC Act:

- Clearing of Native Vegetation;
- Removal of Dead Wood and Dead Trees;
- Bushrock Removal;
- Loss of Hollow-bearing Trees; and
- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.

Clearing of Native Vegetation

The E42 Modification disturbance area covers approximately 290 ha of land (Figure E-3). Broad fauna habitat types which would be cleared or modified include:

- approximately 15 ha of Eucalypt Woodland;
- approximately 15 ha of Mixed Woodland;
- approximately 10 ha of Lakebed; and
- approximately 250 ha of Cleared Agricultural Land with Scattered Trees.

The Eucalypt Woodland and Mixed Woodland fauna habitats which occur within the E42 Modification area are relictual habitat patches in the landscape which have low to no connectivity with lands outside ML 1535.

Although the entry of stock is now controlled within ML 1535, the habitat within the E42 Modification area has a long history of grazing and as a result shows evidence of having lost a significant amount of topsoil, appears to be deficient in soil carbon, has discontinuous ground cover, little leaf litter cover, is tree hollow and ground log impoverished and demonstrates a lack of understorey and overstorey regeneration. However, all three habitats were assessed as having a 'moderate' habitat value, taking into consideration the habitats inherent values (Section E3.1).

Removal of Dead Wood and Dead Trees

Scattered dead trees and logs occur within the 290 ha of land to be disturbed by the modified CGM. These include scattered timber piles relocated from previously cleared areas to increase reptile habitat within ML 1535. Although stag trees may be utilised by fauna (primarily birds and bats) the removal of these trees is unlikely to significantly impact any fauna species.

Bushrock Removal

Bushrocks were primarily recorded in the Eucalypt Woodland on Cowal West Hill. The removal of these are unlikely to significantly impact any fauna species as the bushrocks are predominantly small (~10 cm round) and were found to provide habitat mainly for invertebrate species. However, it is likely that they provide some habitat for cryptic small reptile species within the Eucalypt Woodland.

Loss of Hollow-bearing Trees

Hollow-bearing trees with small to large hollows were primarily found in the Dwyer's Red Gum (*Eucalyptus dwyeri*) in the Eucalypt Woodland on Cowal West Hill and scattered Bimble Box (*Eucalyptus populnea*) through the Cleared Agricultural Land with Scattered Trees habitat. However micro-hollows, suitable primarily for some bat species, were much more common in the landscape, and found in all tree species. The removal of these hollow-bearing trees is unlikely to significantly impact any fauna species, given the patches of habitat are relatively small and disjunct from other areas of habitat in the surrounds.

Alteration to the Natural Flow Regimes of Rivers and Streams and their Floodplains and Wetlands

An ephemeral drainage line was recorded within the Cleared Agricultural Land with Scattered Trees habitat in the north of the E42 Modification area. This ephemeral drainage line would be diverted as part of a modified up-catchment diversion system. The up-catchment diversion system is an existing concept of the approved CGM.

The diversion of this ephemeral drainage line is unlikely to significantly impact any fauna species given it is located within cleared agricultural land and more permanent habitat exists in the surrounding area (e.g. Bland Creek and within Lake Cowal when inundated).

The location of the pipeline and borefield within Lake Cowal is unlikely to alter the natural flow regime of Lake Cowal as it would extend only partially into the lake.

Conclusion

In consideration of the above, the removal or modification of fauna habitats within the E42 Modification area is unlikely to significantly impact any fauna species. Measures to avoid and mitigate fauna habitat removal/modification impacts are discussed in Section E5.

E4.2 VEHICULAR TRAFFIC MOVEMENTS

Vehicular traffic movements associated with the modified CGM have the potential to increase the incidence of fauna mortality caused by traffic. It is considered unlikely that the additional vehicular traffic movements required for the modified CGM would significantly impact fauna given the location of the proposed traffic movements and the measures to avoid and mitigate potential impacts described in Section E5 (e.g. speed limits).

E4.3 FAUNA AND NOISE

A number of recent literature reviews have been conducted on the effects of noise on wildlife (Radle, 2007; Kaseloo, 2005; Institute for Environmental Monitoring and Research, 2001).

Noise can potentially impact certain fauna species, although studies on the effect of noise on wildlife have shown potential impacts are varied. Many studies have shown that fauna are well adapted to human activities and noise, while other studies have shown that noise can cause masking of vocalisation, physiological stress and changes in movement/patterns of behaviour (Radle, 2007; Kaseloo, 2005; Institute for Environmental Monitoring and Research, 2001).

Given the proposed continuation of noise and bird behaviour monitoring in accordance with the *Cowal Gold Project Flora and Fauna Management Plan* (FFMP) (Barrick, 2003c) (Section E5), as well as the contingency measures in place in the event that assessment and monitoring results indicate that adverse impacts are occurring on fauna in accordance with the FFMP (Section E5), noise emissions from the modified CGM would be unlikely to significantly impact any fauna species.

E4.4 BLASTING

Blasting overpressure and vibration has the potential to disturb routine activities of vertebrate fauna, particularly birds. For example, disruptions to normal breeding and behaviour patterns may result from birds taking flight as a result of the blasting stimulus (i.e. blast noise and/or vibration).

Bird behaviour monitoring for the first blasts at the approved CGM was undertaken by Gell (2005) in accordance with the FFMP (Barrick, 2003c). The four fauna specialists who conducted the monitoring found that *there was no abrupt change in the behaviour of any bird species to any blast. In fact, there was no evidence that any bird perceived any blast* (Gell, 2005).

Given the proposed continuation of blast and bird behaviour monitoring in accordance with the FFMP (Barrick, 2003c) (Section E5), as well as the contingency measures in place in the event that assessment and monitoring results indicate that adverse impacts are occurring on fauna (Section E5), the modified CGM would be unlikely to significantly impact any fauna species.

E4.5 ARTIFICIAL LIGHTING

Artificial lighting has the potential to affect the behavioural patterns of some fauna species. Some bird and bat species, for example, are attracted to insects around lights. As a consequence of this, they could become prey for larger predators (e.g. owls) which may lead to changes in population structure and community composition.

Potential artificial lighting impacts from the approved CGM are unlikely to significantly increase as a result of the modified CGM. It is considered unlikely that artificial lighting required for the modified CGM would significantly impact fauna. Measures to avoid and mitigate for potential artificial lighting impacts on fauna are discussed in Section E5.

E4.6 INTERACTION OF FAUNA WITH THE TAILINGS STORAGE FACILITIES

There is potential for fauna to be impacted as a result of interaction with the modified CGM tailings storage facilities, due to increased exposure to cyanide in the tailings water. Cyanide in the tailings storage facilities could either be ingested through the drinking of water given the extension of the life of the mine, inhaled as hydrogen cyanide gas or absorbed through skin contact with water or tailings slurry.

Although the tailings storage facilities would increase in height as a result of the modified CGM the surface areas would remain largely unchanged and the management of the tailing storage facilities and the types of potential impacts would not change from those described in the EIS (North Limited, 1998) and SIS (Resource Strategies *et al.*, 1997).

In accordance with the *Cowal Gold Project Implementation Plan to Protect Fauna from Interactions with the Tailings Storage Facilities* (Barrick, 2005ziii), Donato and Rowntree (2006), Donato 2007 and Donato and Smith (2008) have conducted seasonal wildlife use patterns of the approved CGM tailings storage facilities since 2006. They found that:

- there has been no recorded fauna deaths attributable to cyanide or effects of cyanide on wildlife and the cyanide concentrations recorded were not considered to be a risk to wildlife;
- the 2 m high perimeter fence has been effective in preventing the entry of most terrestrial fauna; and
- wildlife most likely to interact with the tailings storage facilities are birds and bats.

As described in the EIS (North Limited, 1998) and SIS (Resource Strategies *et al.*, 1997), the management of the tailings storage facilities in accordance with the measures described in Section E5 would result in a low likelihood that fauna would be significantly impacted by the tailings storage facilities.

E4.7 MOVEMENT OF DUST TO LAKE COWAL

Atmospheric dust emissions produced near Lake Cowal have the potential to impact the lake.

The atmospheric dust emissions produced by the approved CGM would increase slightly as a result of the modified CGM. This increase is primarily associated with on-going construction activities, mining activities and waste rock handling and stockpiling activities.

The approved CGM currently operates with a dust monitoring programme and Lake Cowal monitoring programme. These programmes would continue for the modified CGM as further discussed in Section E5.

It is unlikely that any vertebrate species would be impacted either directly or indirectly by any dust increase generated as a result of the modified CGM.

E4.8 INTRODUCED FLORA SPECIES

Native vegetation disturbance can act as a catalyst for weed incursion and if management initiatives are not implemented, proliferation of weeds can occur.

With the measures to avoid and mitigate impacts from the introduced flora species (Section E5), it is unlikely that introduced flora would significantly impact native fauna.

E4.9 INTRODUCED FAUNA SPECIES

The European Rabbit (*Oryctolagus cuniculus*), European Red Fox (*Vulpes vulpes*) and Feral Cat (*Felis catus*) are introduced animal species which have been recorded within ML 1535 and wider region. Each of these species have a corresponding key threatening process listed under the TSC Act, viz.:

- competition and grazing by the Feral European Rabbit;
- predation by the European Red Fox; and
- predation by the Feral Cat.

There is potential for further colonisation of the study area by introduced animal species due to potentially increased refuge sites/scavenging areas. With the measures already in place to avoid and mitigate impacts from introduced fauna species (Section E5), it is unlikely that introduced fauna would significantly impact native fauna.

E4.10 FAUNA AND THE FINAL VOID

The approved CGM final void would become greater in depth and area as a result of the modified CGM. The final void is unlikely to significantly impact any fauna species given the proposed measures to avoid and mitigate for potential impacts discussed in Section E5.

E4.11 THREATENED FAUNA SPECIES

Table E-1 in Section E1.6 provides a list of threatened fauna species which have been recorded within the wider region. This list of threatened fauna species was refined to a list of threatened fauna species with records within or proximal to ML 1535 (Table E-7).

Table E-7
Threatened Fauna Species with Records within or Proximal to ML 1535

Scientific Name	Common Name	Conservation Status	
		TSC Act ¹	EPBC Act ²
Amphibians			
<i>Crinia sloanei</i>	Sloane's Froglet	V	-
Birds			
Woodland Birds			
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler	V	-
<i>Polytelis swainsonii</i>	Superb Parrot	V	V
Waterbirds			
<i>Anseranas semipalmata</i>	Magpie Goose	V	-
<i>Oxyura australis</i>	Blue-billed Duck	V	-
<i>Stictonetta naevosa</i>	Freckled Duck	V	-
<i>Botaurus poiciloptilus</i>	Australasian Bittern	V	-
<i>Grus rubicunda</i>	Brolga	V	-
<i>Limosa limosa</i>	Black-tailed Godwit	V	-
<i>Rostratula benghalensis australis</i>	Australian Painted Snipe	V	V
Mammals			
<i>Chalinolobus picatus</i>	Little Pied Bat	V	-
<i>Nyctophilus timoriensis</i>	Eastern Long-eared Bat (South-east form)	V	V
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V	-

1 Threatened Species Status under the NSW TSC Act.

2 Threatened Species Status under the Commonwealth EPBC Act.

V Vulnerable

Threatened fauna species which have questionable DECC records in the search area from co-ordinate -33.62 latitude and 147.45 longitude (Section E1.6), are not included in Table E-7. However, the likelihood for the modified CGM to affect these species is considered in the following sections.

In accordance with the *Draft Guidelines for Threatened Species Assessment* (DEC and DPI, 2005), the potential effect of the modified CGM on current disturbance regimes applicable to threatened species has been considered. However, the modified CGM is unlikely to adversely affect any current disturbance regimes applicable to the threatened fauna species in Table E-7, given the disturbance regimes in the study area are largely human-induced (e.g. grazing).

In accordance with the *Draft Guidelines for Threatened Species Assessment* (DEC and DPI, 2005), the potential effect of the modified CGM on connectivity of habitat for threatened species has been assessed. The modified CGM is unlikely to significantly reduce habitat connectivity for any threatened fauna species, and therefore unlikely to impact any threatened species' population viability.

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 DEWHA (DEWHA, 2008c), Register of Critical Habitat held by the Director-General of the DECC (DECC, 2008d), the Register of Critical Habitat held by the Director-General of the DPI-Fisheries (DPI-Fisheries, 2008) or identified within the Bland Local Environment Plan. Therefore, the modified CGM would not affect any critical habitat.

The potential impacts from the modified CGM on the species listed in Table E-7 and discussed in Section E1.6 are assessed in the following sections.

As explained in the sections below, it is unlikely that the modified CGM would significantly impact any threatened fauna species. The modified CGM is unlikely to have an adverse effect on the lifecycle of any threatened species such that a viable population would be at risk of extinction.

E4.11.1 Amphibians

The Sloane's Froglet is considered to be the only threatened and extant amphibian with potential habitat components likely to occur in the study area (Table E-7). However, it was not located in the E42 Modification area or the ML 1535. It should also be noted that *C. sloanei* can be confused with two common species present within ML 1535 and Lake Cowal when inundated, namely *C. parsignifera* and *C. signifera*.

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

The Sloane's Froglet was recorded within Lake Cowal by Gunninah Consultants (1995) and records are contained within the DECC Wildlife Atlas from 1995 and 1997. Despite many surveys (Section E1.4), this froglet has not been recorded within ML 1535.

The Sloane's Froglet is most common in woodlands, floodplains, grasslands, and open and disturbed areas. Within these habitats they shelter under logs and other debris, usually in moist depressions or near water. The Sloane's Froglet breeds from late winter to spring and small eggs are laid singly (DECC, 2008b).

Individual froglets may group together either seasonally, such as at breeding sites, or they may occupy discrete habitat patches within the broader landscape, such as discrete water bodies or drainage units (Frogs Australia Network, 2008).

It is possible that the modified CGM would remove and modify a portion of habitat resources which may be occasionally utilised by this species, given the occurrence of potential habitat for this species in low lying or gilgai areas within Mixed Woodland and Cleared Agricultural Land with Scattered Trees as well as within the ephemeral drainage line. However, the modified CGM is unlikely to significantly disrupt the breeding cycle, foraging behaviour or dispersal ability of a local population (if one existed) given the availability of ephemeral habitat within Lake Cowal and in similar agricultural lands in the immediate surrounds.

A number of measures are implemented at the approved CGM which would avoid and/or mitigate potential impacts on the Sloane's Froglet if it is present in the surrounds:

- Control of weeds to minimise the potential for weeds to degrade the species habitat.
- Pest control to minimise the potential for pests to impact this species and its habitat.
- Control of dust emissions to minimise the potential for dust to impact this species.
- Site water management to prevent the degradation of the quality of water in Lake Cowal.

These measures would be continued at the modified CGM as discussed further in Section E5.

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

The modified CGM would remove and modify a portion of habitat resources which may be occasionally utilised by the Sloane's Froglet, namely, ephemeral low lying and gilgai components of the Mixed Woodland and Cleared Agricultural Land with Scattered Trees, as well as the ephemeral drainage line.

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

In the Central West, the Sloane's Froglet has a discontinuous range with records west of Lake Cowal in the Lachlan Catchment at Lake Cargellico, approximately 120 km north-west (DECC, 2008b). The species known range occupies almost the whole of central NSW. If the species were to occur within the study area, it would not be at the limit of its known range.

E4.11.2 Reptiles

As discussed in Section E1.6, the Pink-tailed Legless Lizard (*Aprasia parapulchella*) is the only threatened reptile that is considered to potentially occur in the Lake Cowal area. However, it has not been found either within ML 1535 or in the immediate surrounds and is therefore not listed in Table E-1. The lizard typically resides under continuous areas of loose, medium-sized surface rocks in open areas with little or no woody vegetation, and within a predominantly native grass understorey, with well-drained soil with little to no leaf litter (Swan, 1990; Osborne *et al.*, 1991 in Ayers *et al.*, 1996). The rocky habitat on Cowal West Hill is quite dissimilar to this species' habitat requirements and unlikely to support a population of the Pink-tailed Legless Lizard. This species is considered unlikely to occur in the study area and therefore unlikely to be affected by the modified CGM.

E4.11.3 Woodland Birds

Introduction

There are a number of threatened woodland birds that may potentially occur within ML 1535 based on their known distribution (listed in Table E-1 and discussed in Section E1.6). However, the majority of woodland birds, listed in Table E-1 and discussed in Section E1.6, are not likely to occur in the E42 Modification area or close surrounds and are therefore are not listed in Table E-7.

The following woodland bird species listed in Table E-1 and discussed in Section E1.6, do not have credible records within the study area or close surrounds (Section E1.6), the Grey Falcon (*Falco hypoleucos*), Glossy Black-cockatoo (*Calyptorhynchus lathamii*), Bush Stone-curlew (*Burhinus grallarius*), Major Mitchell's Cockatoo (*Cacatua leadbeateri*), Swift Parrot (*Lathamus discolor*), Turquoise Parrot (*Neophema pulchella*), Barking Owl (*Ninox connivens*), Brown Treecreeper (*Climacteris picumnus victoriae*), Speckled Warbler (*Pyrrholaemus sagittata*), Black-chinned Honeyeater (*Melithreptus gularis gularis*), Painted Honeyeater (*Grantiella picta*), Hooded Robin (*Melanodryas cucullata*), Gilbert's Whistler (*Pachycephala inornata*), Diamond Firetail (*Stagonopleura guttata*), Malleefowl (*Leipoa ocellata*), Square-tailed Kite (*Lophoictinia isura*), Black-breasted Buzzard (*Hamirostra melanosternon*), Regent Honeyeater (*Xanthomyza phrygia*), Shy Heathwren (*Hylacola cauta*), Southern Scrub-robin (*Drymodes brunneopygia*) and Chestnut Quail-thrush (*Cinclosoma castanotus*). Furthermore, the likelihood of these species being found within ML 1535 has considerably decreased with on-going approved developments that have occurred including widespread clearing of potential habitats. Since these threatened woodland birds are unlikely to occur within ML 1535, they are also unlikely to be affected by the modified CGM. These species are not considered further.

Threatened Woodland Bird Species Likely to be Affected

Two threatened woodland birds which are likely to be affected by the modified CGM are the Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) and the Superb Parrot (*Polytelis swainsonii*) (Table E-7). The Grey-crowned Babbler has been recorded on many occasions within ML 1535 and in the immediate surrounds. The Superb Parrot has only been observed within ML 1535 in pre-clearance surveys on two occasions as an overhead group and during a group feeding activity.

The following section identifies potential impacts on these two woodland birds.

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

The various forms of woodland that occur within the study area provide habitat resources for a limited number of threatened woodland birds, including the two threatened woodland birds listed above. The potential effect of the modified CGM on the lifecycle of these birds is discussed below:

- The Grey-crowned Babbler (eastern sub-species) has been recorded within ML 1535 on many occasions between January 2005 and February 2008. The resident population appears to have diminished progressively within ML 1535 as habitat and multiple nest sites have been removed. During the current survey for the modified CGM the Grey-crowned Babbler was recorded utilising all broad habitat types (Section E3.2.8). Furthermore, nest sites from previous years and spring 2008 were located within the study area suggesting that recent breeding events are likely to have occurred.

Grey-crowned Babbler groups usually build a series of domed nests made of sticks usually about 4 m above the ground (NSW Scientific Committee, 2001). The nests are maintained throughout the year and old nests are often used to build new nests (NSW Scientific Committee, 2001).

The Grey-crowned Babbler lives in family groups which may include up to 15 individuals (DECC, 2008b), although within ML 1535 area these groups tend to be between 6 to 12 in number. These extended family parties are utilised for both the co-operative feeding of young and predator avoidance (King, 1980 in Garnett and Crowley, 2000). This species defends territories ranging between 1 ha and 50 ha all year round (DECC, 2008b).

The modified CGM would remove and modify habitat resources utilised by this species.

- A group of Superb Parrots were observed flying overhead during the pre-clearance surveys within ML 1535 in 2005 and again in 2008 foraging on mistletoe within ML1535.

No ideal breeding habitat for the Superb Parrot occurs within the E42 Modification area (e.g. River Red Gums and Eucalypt forest [Figure E-3]), however it is recognised that the Superb Parrot has been known to nest in hollows within open woodland or isolated paddock trees (after DECC, 2008b) which do occur within the study area. It is likely that the Superb Parrot previously recorded in ML 1535 were part of a non-breeding flock, as non-breeding flocks are nomadic and partly migratory (Ayers *et al.*, 1996), whereas breeding parrots exhibit high nest site fidelity (DECC, 2008b).

Given the occurrence of limited breeding and potential foraging habitat for the Superb Parrot within the study area the modified CGM will remove these habitat resources. However, the modified CGM is unlikely to significantly disrupt the breeding cycle or foraging and dispersal behaviour of a local population (were it to exist) given the availability of more suitable habitat in the surrounds (e.g. River Red Gums around Lake Cowal).

A number of measures have been developed in accordance with the TSMP (Barrick, 2003a) to avoid and mitigate potential impacts on these species as they occur in the surrounds:

- Mechanisms have been developed to keep birds from the tailings storage facilities, including deterrence measures.
- The cyanide destruction process has been designed to result in cyanide levels at which bird mortalities approach zero.
- Noise and blast management measures which aim to not create demonstrable disturbance to bird breeding at the northern end of the lake.
- Control of weeds to minimise their potential to degrade the species habitat.
- Pest control to minimise the potential for pests to impact this species and its habitat.
- Control of dust emissions to minimise the potential for dust to impact this species.
- Site water management to prevent the degradation of the quality of water in Lake Cowal and elsewhere on site.

These measures developed for the approved CGM will remain in place and benefit the modified CGM, as discussed further in Section E5.

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

The modified CGM would remove and modify potential/actual habitat resources utilised by both the Grey-crowned Babbler and the Superb Parrot. In the case of the latter species, these resources are limited and only occasionally utilised.

It is unlikely that the modified CGM will significantly affect, if at all, the above woodland birds.

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

Neither the Grey-crowned Babbler nor the Superb Parrot are at the limits of their ranges in the study area. In NSW, the Grey-crowned Babbler occurs on the western slopes and plains but is less common at higher altitudes of the tablelands (DECC, 2008b). Isolated populations exist in coastal woodlands on the North Coast, in the Hunter Valley, and from the South Coast near Nowra (Blakers *et al.*, 1984; Schodde and Mason, 1999 in NSW Scientific Committee, 2001). The Superb Parrot is more-or-less within the central core of its range within ML 1535 although it is an uncommon species on-site.

E4.11.4 Waterbirds

Introduction

The Osprey (*Pandion haliaetus*), a species utilising extended wet periods, and the Australian Bustard (*Ardeotis australis*), a plains dweller (Table E-1), may be potential visitors to the Lake Cowal region based on their known distribution. However, it is considered unlikely that they would occur within ML 1535 and less likely within the E42 Modification area, given the occurrence of only marginal habitat resources. On this basis, it is considered unlikely that these two species would be affected by the modified CGM. These species are not considered further.

Threatened Waterbird Species Likely to be Affected

The following section identifies potential impacts of the modified CGM on the following waterbirds which may potentially be affected by the modified CGM (Table E-7):

- Magpie Goose (*Anseranas semipalmata*);
- Blue-billed Duck (*Oxyura australis*);
- Freckled Duck (*Stictonetta naevosa*);
- Australasian Bittern (*Botaurus poiciloptilus*);
- Brolga (*Grus rubicunda*);
- Black-tailed Godwit (*Limosa limosa*); and
- Australian Painted Snipe (*Rostratula benghalensis australis*).

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

All of the threatened waterbird species listed above have been recorded at Lake Cowal (North Limited, 1998). However, only the Freckled Duck and Magpie Goose have been recorded within ML 1535 during previous fauna surveys (Section E1.4). The Freckled Duck record was reported in the SIS (Resource Strategies *et al.*, 1997), while the Magpie Goose was observed on two occasions during the pre-clearance surveys within ML 1535 in 2005 under very wet conditions. The first observation was a pair of Magpie Geese observed flying overhead and the second observation was a Magpie Goose in a temporary inundated area created by ponded water from rainfall.

Limited habitat for threatened waterbird species would be removed or changed by the modified CGM. The habitat resources are associated with temporary ponding of water, roosting habitats, feeding resources, and successional areas of shallow loving wetland plants. Waterbirds are unlikely to nest within the limited available habitat in the E42 Modification area unless on-going wet conditions are present.

Survey records (Section E1.4) indicate that the main waterbird breeding areas occur in wooded and vegetated parts in northern sections of the lake.

Waterbirds may be attracted to open water within the modified CGM tailings storage facilities. However, a number of measures have been developed in accordance with the TSMP (Barrick, 2003a) to avoid and mitigate potential impacts associated with the tailings storage facilities:

- Mechanisms have been developed to keep waterbirds from the tailings storage facilities, including deterrence measures.
- The cyanide destruction process has been designed to result in cyanide levels at which bird mortalities approach zero.

Additional measures have been developed in accordance with the TSMP (Barrick, 2003a) to avoid and mitigate other potential impacts on waterbirds:

- Noise and blast management measures which aim to not create demonstrable disturbance to waterbird breeding at the northern end of the lake.
- Control of weeds to minimise their potential to degrade the species habitat.
- Pest control to minimise the potential for pests to impact on these species and their habitats.
- Control of dust emissions to minimise the potential for dust to impact on these species.
- Site water management to prevent the degradation of the quality of water in Lake Cowal.

These continuing measures are likely to benefit all waterbird species within ML 1535.

It is unlikely that the modified CGM will significantly affect, if at all, the above wetland birds.

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

Limited habitat for threatened waterbird species would be removed or changed by the modified CGM. The habitat resources are primarily associated with roosting habitat in mature trees and temporary habitat along the ephemeral drainage line. Waterbirds are unlikely to nest within the current available habitats in the E42 Modification area.

It is unlikely that the modified CGM will affect the habitat of these wetlands birds and would only potentially affect the habitat in a very marginal manner.

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

No threatened waterbird species listed above are at the limits of their known distributions.

E4.11.5 Mammals

Introduction

This section assesses the potential impacts of the modified CGM on seven species, namely the Squirrel Glider (*Petaurus norfolcensis*), Brush-tailed Phascogale (*Phascogale tapoatafa*), Spotted-tailed Quoll (*Dasyurus maculatus*), Large-footed Myotis (*Myotis adversus*), Little Pied Bat (*Chalinolobus picatus*), Eastern Long-eared Bat (South-east form) (*Nyctophilus timoriensis*) and Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*) (Table E-1).

Typical habitat resources for the Squirrel Glider do not occur within the E42 Modification area, and only marginal potential habitat resources for this species occur within the surrounds. This species is considered unlikely to occur in the study area and unlikely to be affected by the modified CGM. This species is not considered further.

The Brush-tailed Phascogale and Spotted-tailed Quoll are also unlikely to be affected by the modified CGM as both species are believed to be extinct in the South Western Slopes Bioregion. These two species are not considered further.

The Large-footed Myotis (*Myotis adversus*) is also unlikely to be affected by the modified CGM as this species appears to be an obligate cave dweller (Greg Richards and Associates, 1997a) and has not been previously recorded within the Lake Cowal area assuming the record within the DECC and BioNet database (Section E1.6) is questionable. This species is not considered further.

Other Threatened Mammals Species

There are three threatened bats which may possibly occur in the immediate surrounds based on the occurrence of potential habitat, namely the Little Pied Bat, Eastern Long-eared Bat (South-east form) and Yellow-bellied Sheath-tail-bat (Table E-7). These bat species have been assessed below as if they were likely to be affected by the modified CGM. The following section identifies potential impacts on these bats.

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

The Yellow-bellied Sheath-tail-bat is the only threatened bat species to be recorded from within ML 1535 during previous fauna surveys described in Section E1.4 (North Limited, 1998). This species was recorded in River Red Gum Woodland fringing Lake Cowal (Greg Richards and Associates, 1997a). The River Red Gum Woodland would not be removed or modified as part of the modification.

Records of the Little Pied Bat and the Eastern Long-eared Bat were recorded within the databases or previous surveys (Section E1.4 and E1.6).

Gunninah Consultants (1995) tentatively recorded the Little Pied Bat at Wamboyne Mountain, however the record is considered to have a high probability of mis-identification.

Two records of the Eastern Long-eared Bat were identified from the database search (Section E1.6) (DECC, 2008b). However the records are from 1988/1989 and have an inaccuracy of 100 km and 10 km, respectively. Given the inaccuracy of the Eastern Long-eared Bat records it is questionable as to whether this species occurs in the surrounds.

No threatened bat species have been recorded within ML 1535 from January 2005 to February 2008, despite many bat surveys undertaken (Attachment EA).

Considering the above, the Yellow-bellied Sheathtail Bat, the Little Pied Bat and the Eastern Long-eared Bat are considered unlikely to occur within the E42 Modification area and are therefore unlikely to be affected.

While bats may be attracted to open water within the modified CGM tailings storage facilities, a number of measures have been developed in accordance with the TSMP (Barrick, 2003a) to avoid and mitigate potential impacts associated with the tailings storage facilities:

- Mechanisms have been developed to keep bats from the tailings storage facilities (e.g. minimising the area of open water and making the tailings storage facilities non-conductive to wildlife).
- The cyanide destruction process has been designed to result in cyanide levels at which bat mortalities approach zero.

These on-going measures will continue to benefit wildlife following the implementation of the modified CGM as discussed further in Section E5.

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

The habitat requirements for the threatened bat species are as follows:

- The Eastern Long-eared Bat inhabits dry open woodlands and around River Red Gums that line watercourses and lakes on the inland plains of the semi-arid zone (Parnaby, 1995 in Ayers *et al.*, 1996). The Eastern Long-eared Bat is quite flexible in its roost selection, but has a predilection for tree hollows, exfoliating bark or dense foliage (Lunney *et al.*, 1988 in North Limited, 1998).
- The Yellow-bellied Sheathtail-bat can be found in a wide range of habitats, including wet and dry sclerophyll forest, open woodland, Acacia shrubland, mallee, grasslands and desert (Churchill, 1998). The Yellow-bellied Sheathtail-bat roosts in tree hollows that are predicted to be large and situated such that there is enough clear space at the exit to allow an unencumbered drop until the bat attains normal flight speed (Greg Richards and Associates, 2000). The species has been found to utilise multiple roost sites (Greg Richards and Associates, 2000), and may roost singly or in groups of up to six (DECC, 2008b).
- The Little Pied Bat inhabits dry open forest, open woodland, Mulga woodlands, chenopod shrublands, *Callitris* forest and mallee (Churchill, 1998). The Little Pied Bat was thought to only roost in caves or their substitutes including buildings (Hall and Richards, 1979; Reardon and Flavel, 1987; Richards, 1995). However, roost site flexibility is known for this primarily subterranean species, and locations such as mud nests of Fairy Martins and disused buildings have been recorded (Richards, 1979).

The modified CGM is likely to remove a small portion of potential roosting and foraging habitat for the Eastern Long-eared Bat and Yellow-bellied Sheathtail-bat and some potential foraging habitat for the Little Pied Bat.

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

None of the threatened bat species listed above are at the limits of their known distributions.

E4.11.6 Fish

If threatened fish species (such as the Murray Cod) were to occur in Lake Cowal (when filling), they are unlikely to be affected by the modified CGM. No change to the lake protection bund is proposed for the modified CGM.

E4.12 THREATENED ECOLOGICAL COMMUNITIES

This section assesses the potential impacts of the modified CGM on EECs as they provide fauna habitat.

E4.12.1 Myall Woodland

Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes Bioregions is an EEC under the TSC Act. The Mixed Woodland fauna habitat is equivalent to the Myall Woodland EEC as described in Section E3.1. As stated in Section E4.1, the removal or modification of fauna habitat within the E42 Modification area is unlikely to significantly impact any fauna species. Measures to avoid and mitigate for fauna habitat removal/modification impacts are discussed in Section E5.

E4.12.2 Lachlan River Catchment

The Lachlan River Catchment EEC is listed under the FM Act and includes *all native fish and aquatic invertebrates within all natural rivers, creeks, streams and associated lagoons, billabongs, lakes, wetlands and paleo-channels, flood runners, floodplains and effluent streams of the Lachlan River* (DPI Threatened Species Unit, 2006). Lake Cowal is included in the listing of the Lachlan River Catchment EEC (DPI Threatened Species Unit, 2006).

The dynamics of the Lake Cowal system have been modified significantly by a number of factors including agricultural landuse within the catchment, clearing, levee construction and modifications to flood entry and exit points and the construction of the Jemalong-Wyldes Plains irrigation system, including the Jemalong Weir (Goldney *et al.*, 1997 in North Limited, 1998). European Carp (*Cyprinus carpio*), a recognised threat to the Lachlan River Catchment EEC, has also been historically recorded in Lake Cowal.

As previously described, an ephemeral drainage line was recorded within the Cleared Agricultural Land with Scattered Trees habitat in the north of the E42 Modification area. This ephemeral drainage line would be redirected as part of the Up-Catchment Diversion System as part of the modified CGM. The redirection of this ephemeral drainage line is unlikely to significantly impact the Lachlan River Catchment EEC.

The saline groundwater supply borefield is unlikely to significantly impact the Lachlan River Catchment EEC, given the small area of disturbance, the hydraulic relationship between Lake Cowal and the groundwater (Coffey Geotechnics Pty Ltd, 2008).

E4.13 MIGRATORY SPECIES

No migratory species are likely to be significantly impacted by the modified CGM (Table E-2).

E5 IMPACT AVOIDANCE AND MITIGATION MEASURES

A number of impact avoidance and mitigation measures applicable to fauna have been developed for the approved CGM as described below.

Fauna Management

The mitigation measures and management for flora and fauna (including threatened ecological communities, populations and species) at the approved CGM are presented in the FFMP (Barrick, 2003c). The objectives of the FFMP are to fulfil the relevant consent conditions by providing:

- methods for monitoring daily and seasonal fauna usage of the tailings storage facilities and whether deaths or other effects or incidents involving native fauna are occurring;
- a protocol for the reporting of any deaths or other incidents involving native fauna on the ML;
- fauna autopsy facilities to enable the cause of any wildlife deaths to be quickly determined;
- contingency measures for reducing cyanide levels in the tailings storage facilities in the event it is established that fauna deaths are occurring from cyanide in tailings storage facilities water;
- mechanisms to keep fauna and avifauna away from the tailings storage facilities;
- plans for the rescue and rehabilitation of wildlife that may become bogged/sick/trapped in the tailings storage facilities or elsewhere within ML 1535;
- methods to conserve and enhance wildlife values around Lake Cowal and within ML 1535;
- monitoring of fauna, fish and aquatic invertebrate within the Lake Cowal region as documented in the EIS (North Limited, 1998) and SIS (Resource Strategies *et al.*, 1997);
- for the investigation of fauna deaths off the mine site, if requested by the Director-General;
- details to relocate any threatened species and/or its habitat away from disturbed areas that are created by mine operations;
- details of monitoring the mine's impacts particularly on birdlife in bird breeding areas, threatened fauna and fish and aquatic invertebrates around Lake Cowal, and contingency measures should impacts be identified as occurring; and
- a threatened species management protocol, including provisions for targeted searches prior to construction and proposed mitigation measures where threatened fauna species are found.

The above objectives would continue for the modified CGM.

The FFMP would be revised to incorporate the E42 Modification.

Vegetation Clearance Protocol

In accordance with Consent Condition 3.10(B), which requires the minimisation of the removal of trees and other vegetation from the mine site, a Vegetation Clearance Protocol has been developed for the approved CGM (Barrick, 2003c). The Vegetation Clearance Protocol would also be applicable to the modified CGM.

Threatened Species Management Protocol

The TSMP was developed to minimise potential impacts of the approved CGM on threatened flora and fauna species known and/or considered possible occurrences in the disturbance areas and/or immediate surrounds (Barrick, 2003a).

The key components of the TSMP include: database interrogation, preliminary assessment, secondary assessment, threatened species management strategy and regulatory review. The TSMP includes provisions for targeted searches prior to construction and proposed mitigation measures where threatened flora or fauna species are found (Barrick, 2003a). These measures would also be applicable to the modified CGM.

Rehabilitation

The revegetation programme for the modified CGM would aim to revegetate new landforms with selected species of native and/or endemic vegetation that are both suitable to the physiographic and hydrological features of each landform, and which expand on the areas of remnant endemic vegetation that currently exist in the immediate region. This would include species characteristic of the Myall Woodland EEC (e.g. Myall [*Acacia pendula*] and Belah [*Casuarina cristata*]), as described in the existing TSMP (Barrick, 2003a).

Traffic

As discussed in Section E4.2, the movement of vehicles associated with the modified CGM has the potential to increase the incidence of fauna mortality via vehicular strike. To reduce this potential, speed limits would be imposed on vehicles using roads and tracks within ML 1535 (Barrick, 2003c). Signposting has been installed to remind personnel of the danger of vehicles to wildlife (Barrick, 2003c). These measures are also applicable to the modified CGM.

Noise Monitoring

A range of noise control measures are implemented at the approved CGM to minimise noise emissions. Examples include the restriction of truck movements, adjustment of reversing alarms, scheduling the use of noisy equipment, directing noise emissions away from any sensitive areas and keeping equipment well maintained (Barrick, 2003c). These measures would also be applicable to the modified CGM.

Blasting Management

A number of measures to minimise the impact of blasting activities are implemented at the approved CGM. These may include eliminating secondary blasting, varying the direction of initiation, keeping face heights to a practical minimum, and exercising strict control over the burden, spacing and orientation of all blast drill holes (Barrick, 2003c). These measures would also be applicable to the modified CGM.

Dust Management

A number of air quality safeguards and control methods are implemented at the approved CGM to minimise dust emissions (Barrick, 2003d). These safeguards and control methods would also be applicable to the modified CGM.

Weed Management

Barrick currently manage weeds at the approved CGM in accordance with the Lands Management Plan (Barrick, 2003e). The aims of the Lands Management Plan are to minimise the possibility of new weed incursion and control the spread of any existing noxious weeds on Barrick-owned land. The weed management programme would also be applicable to the modified CGM.

Pest (Animal and Vermin) Control

Pest control activities are implemented at the approved CGM and include (Barrick, 2003c; 2003e):

- regular property inspections to assess the status of pest populations within Barrick-owned land;
- mandatory pest control for declared pests (i.e. rabbits, pigs and wild dogs) in accordance with Pest Control Orders under the *Rural Lands Protection Act, 1998*; and
- inspections to assess the effectiveness of control measures implemented and review of these measures if necessary.

These pest control activities would also be applicable to the modified CGM.

Monitoring of Fauna Usage of the Final Void

The current commitment to develop a monitoring programme will be developed to monitor fauna usage of the final void at the approved CGM would remain for the modified CGM (Barrick, 2003c). The monitoring programme will be developed as a component of the strategy to be developed for the long-term management and monitoring of the area. The strategy will be submitted by Year 7 of mining operations, or five years before mine closure, whichever is the earlier. The monitoring programme would also be applicable to the modified CGM.

Mechanisms to Keep Fauna Away from the Tailings Storage Facilities

Mechanisms have been developed to keep threatened waterbirds away from the approved CGM tailings storage facilities and include (Barrick, 2003c):

- Minimising the area of open water in the tailings storage facilities. To reduce the attractiveness of the tailings storage facilities to threatened waterbirds, the area of open water in the tailings storage facilities will be minimised by maximising the dry density of tailings and maximising the re-use of water from the tailings storage facilities in the process plant (North Limited, 1998).
- Making the area non-conducive to the establishment of wildlife habitats. Rehabilitation of the tailings storage facility area during operations will be such that minimal habitat opportunities will be created for threatened waterbirds. Rehabilitation of the tailings storage facility batters will achieve soil stabilisation yet will not create desirable habitat.

Avifauna deterrence mechanisms are also utilised at the tailings storage facilities (e.g. audio and visual stimuli to scare/repel birds). In accordance with the *Cowal Gold Project Implementation Plan to Protect Fauna from Interactions with the Tailings Storage Facilities* (Barrick, 2005ziii), Donato and Rowntree (2006), Donato 2007 and Donato and Smith (2008) have conducted surveys of seasonal wildlife use patterns of the approved CGM tailings storage facilities since 2006. They found that:

- there has been no recorded deaths or effects of cyanide on wildlife and the cyanide concentrations recorded were not considered to be a risk to wildlife;

- the 2 m high perimeter fence has been effective in preventing the entry of most terrestrial fauna; and
- wildlife most likely to interact with the tailings storage facilities are birds and bats.

The measures to keep threatened waterbirds away from the approved CGM tailings storage facilities would be continued for the modified CGM.

Cyanide Destruction Process

The cyanide destruction process at the approved CGM has been designed to result in cyanide levels in the tailings storage facilities of less than 20 milligrams per litre (mg/L) for 90% of the time and less than 30 mg/L for the remainder of the time (North Limited, 1998) (Barrick, 2003c). This level is in accordance with industry experience that indicates bird mortalities approach zero at levels of cyanide exposure below 50 mg/L weak acid dissociable cyanide (CN_{WAD}) (Donato, 1997 in Barrick, 2003c).

The CN_{WAD} levels of the aqueous component of the tailings slurry stream would continue to be maintained to the limits described above for the modified CGM.

Artificial Lighting

Lighting strategies/control measures to minimise potential artificial lighting impacts would include the use of unidirectional lighting fixtures.

Site Water Management

Measures have been developed for the approved CGM for the management and monitoring of surface water quality and quantity within and around the mine site (Barrick, 2003f). Management strategies to prevent the degradation of the quality of water in Lake Cowal during the mine's construction and operation phases include a variety of erosion, sediment and salinity control measures. These site water management and monitoring strategies would also be applicable to the modified CGM.

E6 OFFSET MEASURES

The Director General's requirements for modified CGM require a description of the measures that would be implemented to ensure there is no net loss of the biodiversity values of the region in the medium to long-term.

The following discussion describes how biodiversity values would be maintained or improved in accordance with the objectives of the *Draft Guidelines for Threatened Species Assessment* (DEC and DPI, 2005).

This section considers the faunal values of the modified CGM offset areas, which are located on Barrick-owned Land (Figure E-4). Barrick propose that significant areas of existing native vegetation would be enhanced (some 340 ha) and significant areas of cleared agricultural land would be revegetated (some 120 ha).

Fauna Characteristics

The southern offset area provides Eucalypt Woodland fauna habitat (i.e. Dwyers Mallee Red Gum Woodland on hill tops with ecotonal Grey Box and Ironbark Woodland) and Cleared Agricultural Land with Scattered Trees. Detailed vegetation mapping by FloraSearch (2008) is shown on Figure E-4. The inclusion of the Cleared Agricultural Land in the offset area provides the possibility of increasing the existing remnant patch area through revegetation. Furthermore there is the opportunity of significant regeneration of existing native vegetation within the remnant and around its perimeter.

The hill remnant vegetation in the southern offset area (Figure E-4), has relatively high conservation value in the context of the Lake Cowal landscape because of its relatively large area and the scarcity of other such remnants. However, given the current degraded condition of the remnant and the lack of connectivity with other areas of habitat it is very likely that this remnant has impoverished vertebrate species diversity. The effects of previous pastoral practices are evident including extensive grazing (now ceased) adversely impacting understorey diversity and quality, significant on going sheet erosion, partial clearing by logging, ringbarking, and past shooting.

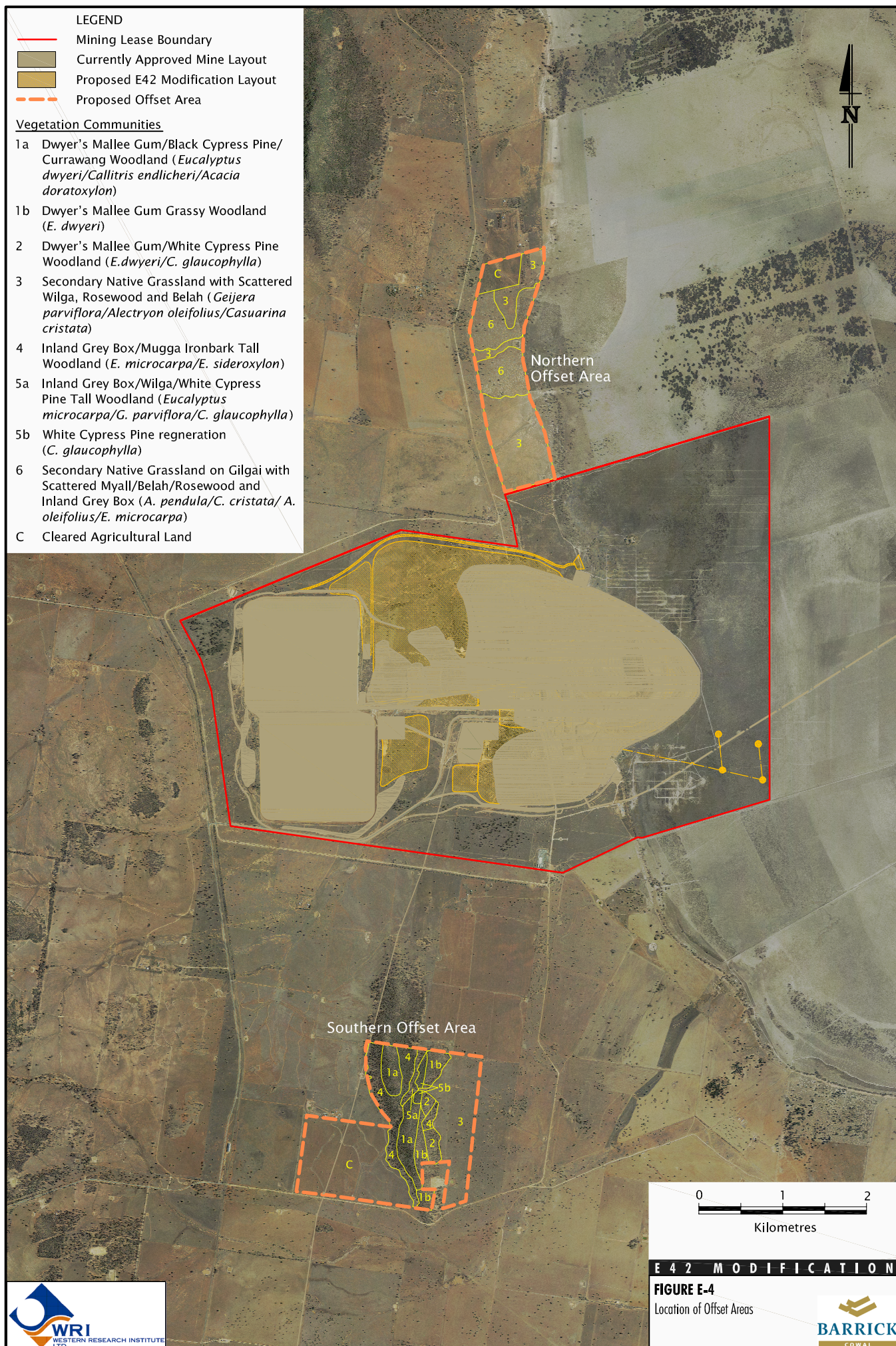
A dam is located at the edge of the hill remnant at the boundary of the remnant-farming land and is no doubt an important source of water for a range of vertebrate species. An opportunity exists to enhance habitat at the existing dam.

A Grey-crowned Babbler colony, a threatened species, was recorded within the southern offset area during a site evaluation in April 2008 and a targeted search in 2003. The offset area also contains potential habitat for other threatened fauna species recorded within the E42 Modification area (e.g. Superb Parrot).

The northern offset area (Figure E-4) provides the opportunity to increase the area of Myall Woodland in the landscape through natural regeneration and revegetation.

Management

The conservation of the offset areas would be secured through rezoning and/or re-conditioning of relevant landholdings to reflect conservation purposes. The rezoning and/or re-conditioning would be undertaken in consultation with the Bland Shire Council. The rezoning and/or re-conditioning of relevant landholdings would be undertaken within three years of the Development Consent being modified or a time period to the satisfaction of the Director-General of the Department of Planning.



In addition, a management plan would be prepared by suitably qualified person(s) to facilitate the revegetation and regeneration of native vegetation and habitats of the relevant lands. It is anticipated that the plan would detail measures including:

- Native revegetation plantings.
- Regeneration of existing native vegetation communities.
- Exclusion of grazing to facilitate the regeneration of native vegetation.
- Weed and pest management.
- Soil erosion remediation.
- Selective use of native plant fertilizer and mineral rock products to improve habitat health.
- A proposal (within the remnant) for ecological thinning of locked thicket regrowth to encourage plant succession and to create increased habitat heterogeneity.
- Fire management measures to include irregular mosaic burnings to maintain and/or increase habitat heterogeneity.
- Increasing nesting resources (nest boxes and logs available from vegetation clearance activities at the mine site).
- Habitat enhancement at the existing dam.
- Provision for consultation with DECC regarding the management of common invasive native birds (eg. Noisy Miners and Kurrawongs).
- Re-introduction of non-threatened species captured at the mine site (e.g. during vegetation clearance activities) within the southern offset area (e.g. frogs and smaller reptiles).
- Signage of the vegetation offset areas.
- Monitoring the performance of the offset by suitably qualified person(s).

It is likely that the offset, would constitute a suitable offset against potential residual impacts associated with the modified CGM (after the avoidance and mitigation measures provided in Section E5), given the anticipated improvement in the value fauna habitat of the land within the offset areas in the medium to long-term.

E7 KEY THRESHOLDS

Key thresholds are discussed below in relation to the modified CGM are in accordance with the Draft *Guidelines for Threatened Species Assessment* (DEC and DPI, 2005).

Whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts would maintain or improve biodiversity values.

It is likely that the biodiversity values of the region would be maintained or improved considering the modified CGM proposed measures to avoid and mitigate for potential impacts outlined in Section E5 and offset measures outlined in Section E6.

Whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or ecological community.

The modified CGM is unlikely to reduce the long-term viability of a local population of any fauna species or population as the fauna habitat components which occur within the study area are widespread within the region.

Whether or not the proposal is likely to accelerate the extinction of a species, population or ecological community or place it at risk of extinction.

The modified CGM is unlikely to accelerate the extinction of any fauna species or population or place it at risk of extinction as the fauna habitat components which occur within the study area are widespread within the region.

Whether or not the proposal would adversely 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 DEWHA (DEWHA, 2008d), Register of Critical Habitat held by the Director-General of the DECC (DECC, 2008c), the Register of Critical Habitat held by the Director-General of the DPI-Fisheries (DPI Fisheries, 2008) or identified within the Bland Local Environment Plan. Therefore, the modified CGM would not affect any critical habitat.

E8 SUMMARY AND CONCLUSION

In summary the following conclusions have been made:

- It is likely that the vertebrate fauna values of the region would be maintained and possibly improved, considering the proposed measures to avoid, mitigate and/or offset potential impacts.
- The modified CGM is unlikely to reduce the long-term viability of any local population of vertebrate fauna species.
- The modified CGM is unlikely to lead to the extinction of any vertebrate species or population or place any at risk of extinction.
- The modified CGM would not adversely affect critical habitat as no critical habitats are known to occur within the E42 Modification area.
- The modified CGM is very unlikely to adversely affect areas of high conservation value.
- Habitat that would be removed or modified by the modified CGM is not considered to adversely affect the long-term viability of any vertebrate species, population or ecological community.
- Matters of national environmental significance, or other matters protected under the EPBC Act, are not likely to be significantly affected by the modified CGM.
- Given the above, from a regional perspective, biological diversity is likely to be maintained and potential adverse effects from the modified CGM on vertebrate fauna are likely to be minimal.

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ATTACHMENT EA

FAUNA SPECIES RECORDED IN ML 1535
FROM JANUARY 2005 TO FEBRUARY 2008

Table EA1
Fauna Species Recorded in ML 1535 from January 2005 to February 2008

Scientific Name	Common Name	Conservation Status	
		TSC Act ¹	EPBC Act ²
Amphibians			
<i>Crinia parassignifera</i>	Eastern Sign-bearing Froglet	P	-
<i>Crinia signifera</i>	Common Eastern Froglet	P	-
<i>Limnodynastes dumerilii</i>	Eastern Banjo Frog	P	-
<i>Limnodynastes tasmaniensis</i>	Spotted Grass Frog	P	-
<i>Littoria peronii</i>	Peron's Tree Frog	P	-
<i>Littoria rubella</i>	Desert Tree Frog	P	-
Reptiles			
<i>Acanthophis antarcticus</i>	Common Death Adder	P	-
<i>Chelodina longicollis</i>	Snake-necked Turtle	P	-
<i>Cryptoblepharus carnabyi</i>	Spiny-palmed Shinning-skink	P	-
<i>Demansia psammophis</i>	Yellow-faced Whipsnake	P	-
<i>Gehyra variegata</i>	Tree Dtella	P	-
<i>Lerista muelleri</i>	Wood Mulch-slider	P	-
<i>Morelia spilota</i>	Carpet Python	P	-
<i>Morethia boulengeri</i>	South-eastern Morethia Skink	P	-
<i>Pogona barbata</i>	Bearded Dragon	P	-
<i>Pogona vitticeps</i>	Central Bearded Dragon	P	-
<i>Pogona barbata</i>	Bearded Dragon	P	-
<i>Pseudonaja textilis</i>	Eastern Brown Snake	P	-
<i>Ramphotyphlops bituberculatus</i>	Prong-snouted Blind Snake	P	-
<i>Notechis scutatus</i>	Tiger Snake	P	-
<i>Tiliqua scincoides</i>	Eastern Blue-tongued Lizard	P	-
<i>Varanus varius</i>	Lace Monitor	P	-
Birds			
<i>Ardea alba</i>	Great Egret	P	-
<i>Egretta garzetta</i>	Little Egret	P	-
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	P	-
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	P	-
<i>Anas gracilis</i>	Australian Grey Teal	P	-
<i>Anas</i> sp.	Unidentified Teal	P	-
<i>Anas superciliosa</i>	Pacific Black Duck	P	-
<i>Anseranus semipalmate</i>	Magpie Goose	V	-
<i>Anthus novaeseelandiae</i>	Richard's Pipit	P	-
<i>Aquila audax</i>	Wedge-tailed Eagle	P	-
<i>Ardea novaehollandiae</i>	White-faced Heron	P	-
<i>Artamus cyanopterus</i>	Dusky Woodswallow	P	-
<i>Barnardius barnardi</i>	Eastern Ringneck	P	-
<i>Barnardius zonarius</i>	Australian Ringneck	P	-
<i>Cacatua pastinator</i>	Little Corella	P	-
<i>Cacatua roseicapilla</i>	Galah	P	-
<i>Chenonetta jubata</i>	Australian Wood Duck	P	-

Table EA1 (Continued)
Fauna Species Recorded in ML 1535 from January 2005 to February 2008

Scientific Name	Common Name	Conservation Status	
		TSC Act ¹	EPBC Act ²
<i>Cheramoeca leucosternus</i>	White-backed Swallow	P	-
<i>Chrysococcyx basalus</i>	Horsefield's Bronze-Cuckoo	P	-
<i>Cincloramphus cruralis</i>	Brown Songlark	P	-
<i>Cincloramphus mathewsi</i>	Rufous Songlark	P	-
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	P	-
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	P	-
<i>Corcorax melanorhamphos</i>	White-winged Cough	P	-
<i>Cormobates leucophaeus</i>	White-throated Treecreeper	P	-
<i>Cormobates mellori</i>	Little Raven	P	-
<i>Corvus coronoides</i>	Australian Raven	P	-
<i>Cracticus nigrogularis</i>	Pied Butcherbird	P	-
<i>Craticus torquatus</i>	Grey Butcherbird	P	-
<i>Ctenotus robustus</i>	Robust Ctenotus	P	-
<i>Cygnus atratus</i>	Black Swan	P	-
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	P	-
<i>Dendrocygna eytoni</i>	Plumed Whistling-Duck	P	-
<i>Dromaius novaehollandiae</i>	Emu	P	-
<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater	P	-
<i>Falco berigora</i>	Brown Falcon	P	-
<i>Falco cenchroides</i>	Australian Kestrel	P	-
<i>Falco peregrinus</i>	Peregrine Falcon	P	-
<i>Fulica atra</i>	Eurasian Coot	P	-
<i>Grallina cyanoleuca</i>	Magpie-lark	P	-
<i>Gymnorhina tibicen</i>	Australian Magpie	P	-
<i>Hieraaetus morphnoides</i>	Little Eagle	P	-
<i>Hirundo neoxena</i>	Welcome Swallow	P	-
<i>Lichenostomus pencilatus</i>	White-Plumed Honeyeater	P	-
<i>Manorina melanoccephala</i>	Noisy Miner	P	-
<i>Northiella haematogaster</i>	Blue Bonnet	P	-
<i>Nymphicus hollandicus</i>	Cockatiel	P	-
<i>Ocyphaps lophotes</i>	Crested Pigeon	P	-
<i>Pardalotus striatus</i>	Striated Pardalote	P	-
<i>Phaps chalcoptera</i>	Common Bronzewing	P	-
<i>Philemon corniculatus</i>	Noisy Friarbird	P	-
<i>Platycercus eximius</i>	Eastern Rosella	P	-
<i>Podargus strigoides</i>	Tawny Frogmouth	P	-
<i>Polytelis swainsonii</i>	Superb Parrot	V	V
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler	V	-
<i>Psephotus haematonotus</i>	Red-rumped Parrot	P	-
<i>Rhipidura fuliginosa</i>	Grey Fantail	P	-
<i>Rhipidura leucophrys</i>	Willie Wagtail	P	-

Table EA1 (Continued)
Fauna Species Recorded in ML 1535 from January 2005 to February 2008

Scientific Name	Common Name	Conservation Status	
		TSC Act ¹	EPBC Act ²
<i>Struthidea cinerea</i>	Apostlebird	P	-
<i>Sturnus vulgaris</i>	Common Starling	P	-
<i>Tadorna tadornoides</i>	Australian Shelduck	P	-
<i>Threskiornis spinicollis</i>	Straw-necked Ibis	P	-
<i>Tyto alba</i>	Barn Owl	P	-
<i>Vanellus tricolor</i>	Banded Lapwing	P	-
<i>Vanellus miles</i>	Masked Lapwing	P	-
<i>Vanellus miles</i>	Spur-winged Plover	P	-
<i>Elanus axillaris</i>	Black Shouldered Kite	P	-
<i>Haliastur sphenurus</i>	Whistling Kite	P	-
<i>Platalea regia</i>	Royal Spoonbill	P	-
Mammals			
<i>Macropus fuliginosus</i>	Western Grey Kangaroo	P	-
<i>Macropus giganteus</i>	Eastern Grey Kangaroo	P	-
<i>Macropus rufus</i>	Red Kangaroo	P	-
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna	P	-
<i>Chalinolobus gouldii</i>	Gould's Wattle Bat	P	-
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	P	-
<i>Mormopterus</i> sp.	Southern Freetail Bat	P	-
<i>Nyctophilus</i> sp.	Long-eared Bat	P	-
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat	P	-
<i>Scotorepens greyii</i>	Little Broad-nosed Bat	P	-
<i>Scotorepens orions</i>	Eastern Broad-nosed Bat	P	-
<i>Tadarida australis</i>	White-striped Freetail Bat	P	-
<i>Trichosurus vulpecula</i>	Common Brushtail Possum	P	-
<i>Vespadelus</i> sp.	Forest Bat	P	-
<i>Vespadelus baverstocki</i>	Inland Forest Bat	P	-
<i>Vespadelus darlingtoni</i>	Large Forest Bat	P	-
<i>Vespadelus regulus</i>	Southern Forest Bat	P	-
<i>Vespadelus vulturnus</i>	Little Forest Bat	P	-
<i>Wallabia bicolor</i>	Swamp Wallaby	P	-
<i>Felis catus</i>	Feral Cat	P	-
<i>Lepus capensis</i>	Brown Hare	P	-
<i>Mus musculus</i>	House Mouse	P	-
Possibly <i>Sminthopsis</i> sp.	Unidentified Mouse	P	-
<i>Orytolagus cuniculus</i>	Rabbit	P	-
<i>Antechinus</i> sp.	Mouse	P	-
<i>Ovis aries</i>	Sheep	P	-
<i>Vulpes vulpes</i>	Red Fox	P	-

¹ Threatened Species Status under the NSW *Threatened Species Conservation Act, 1995*.

² Threatened Species Status under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*.

V = Vulnerable

P = Protected

ATTACHMENT EB
DATABASE RESULTS

Table EB-1
Database Results

Scientific Name	Common Name	Conservation Status		Source of Record			
		TSC Act ¹	EPBC Act ²	Birds Australia ³	Australian Museum ⁴	DECC Atlas of NSW Wildlife ⁵	BioNet ⁶
Amphibians							
<i>Crinia parinsignifera</i>	Eastern Sign-bearing Froglet	P	-	-	-	✓	✓
<i>Crinia sloanei</i>	Sloane's Froglet	V	-	-	-	✓	✓
<i>Limnodynastes fletcheri</i>	Long-thumbed Frog	P	-	-	-	✓	✓
<i>Limnodynastes interioris</i>	Giant Banjo Frog	P	-	-	-	✓	✓
<i>Limnodynastes salmini</i>	Salmon Striped Frog	P	-	-	-	✓	✓
<i>Limnodynastes tasmaniensis</i>	Spotted Grass Frog	P	-	-	-	✓	✓
<i>Neobatrachus sudelli</i>	Sudell's Frog	P	-	-	-	✓	✓
<i>Notaden bennettii</i>	Crucifix Frog	P	-	-	-	✓	✓
<i>Uperoleia rugosa</i>	Wrinkled Toadlet	P	-	-	-	✓	✓
<i>Litoria caerulea</i>	Green Tree Frog	P	-	-	-	✓	✓
<i>Litoria peronii</i>	Peron's Tree Frog	P	-	-	-	✓	✓
Reptiles							
<i>Chelodina longicollis</i>	Eastern Snake-necked Turtle	P	-	-	-	✓	✓
<i>Gehyra variegata</i>	Tree Dtella	P	-	-	-	✓	✓
<i>Strophurus intermedius</i>	Southern Spiny-tailed Gecko	P	-	-	-	✓	✓
<i>Underwoodisaurus milii</i>	Thick-tailed Gecko	P	-	-	-	✓	✓
<i>Delma inornata</i>	Patternless Delma	P	-	-	-	✓	✓
<i>Pogona barbata</i>	Bearded Dragon	P	-	-	-	✓	✓
<i>Varanus gouldii</i>	Gould's Goanna	P	-	-	-	✓	✓
<i>Varanus varius</i>	Lace Monitor	P	-	-	-	✓	✓
<i>Cryptoblepharus carnabyi</i>	Spiny-palmed Shinning-skink	P	-	-	-	✓	✓
<i>Ctenotus allotropis</i>	Brown-blazed Wedgesnout Ctenotus	P	-	-	-	✓	✓
<i>Ctenotus robustus</i>	Robust Ctenotus	P	-	-	-	✓	✓

Table EB-1 (Continued)
Database Results

Scientific Name	Common Name	Conservation Status		Source of Record			
		TSC Act ¹	EPBC Act ²	Birds Australia ³	Australian Museum ⁴	DECC Atlas of NSW Wildlife ⁵	BioNet ⁶
<i>Lerista muelleri</i>	Wood Mulch-slider	P	-	-	-	✓	✓
<i>Lerista punctatovittata</i>	Eastern Robust Slider	P	-	-	-	✓	✓
<i>Menetia greyii</i>	Common Dwarf Skink	P	-	-	-	✓	✓
<i>Morethia boulengeri</i>	South-eastern Morethia Skink	P	-	-	-	✓	✓
<i>Tiliqua rugosa</i>	Shingle-back	P	-	-	-	✓	✓
<i>Tiliqua scincoides</i>	Eastern Blue-tongue	P	-	-	-	✓	✓
<i>Ramphotyphlops bituberculatus</i>	Prong-snouted Blind Snake	P	-	-	-	✓	✓
<i>Morelia spilota</i>	Carpet & Diamond Pythons	P	-	-	-	✓	✓
<i>Notechis scutatus</i>	Tiger Snake	P	-	-	-	✓	✓
<i>Parasuta spectabilis</i>	Mallee Black-headed Snake	P	-	-	-	✓	✓
<i>Pseudonaja textilis</i>	Eastern Brown Snake	P	-	-	-	✓	✓
<i>Suta suta</i>	Curl Snake	P	-	-	-	✓	✓
Birds							
<i>Struthidea cinerea</i>	Apostlebird	P	-	✓	✓	✓	-
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe	P	-	✓	-	✓	-
<i>Botaurus poiciloptilus</i>	Australasian Bittern	V	-	-	-	✓	-
<i>Anas rhynchos</i>	Australasian Shoveler	P	-	✓	-	✓	✓
<i>Ardeotis australis</i>	Australian Bustard	E	-	-	-	✓	-
<i>Falco longipennis</i>	Australian Hobby	P	-	✓	-	✓	✓
<i>Gymnorhina tibicen</i>	Australian Magpie	P	-	✓	✓	✓	✓
<i>Aegotheles cristatus</i>	Australian Owllet-nightjar	P	-	✓		✓	✓
<i>Pelecanus conspicillatus</i>	Australian Pelican	P	-	✓		✓	-
<i>Anthus australis</i>	Australian Pipit	P	-	-	-	✓	✓
<i>Stiltia isabellae</i>	Australian Pratincole	P	-	✓	-	✓	✓

Table EB-1 (Continued)
Database Results

Scientific Name	Common Name	Conservation Status		Source of Record			
		TSC Act ¹	EPBC Act ²	Birds Australia ³	Australian Museum ⁴	DECC Atlas of NSW Wildlife ⁵	BioNet ⁶
<i>Corvus coronoides</i>	Australian Raven	P	-	✓	-	✓	✓
<i>Acrocephalus australis</i>	Australian Reed-Warbler	P	M	-	-	✓	-
<i>Barnardius zonarius</i>	Australian Ringneck	P	-	✓	-	✓	-
<i>Barnardius zonarius barnardi</i>	Mallee Ringneck	P	-		-	✓	-
<i>Tadorna tadornoides</i>	Australian Shelduck	P	-	✓	-	✓	✓
<i>Porzana fluminea</i>	Australian Spotted Crake	P	-	✓	-	✓	✓
<i>Threskiornis molucca</i>	Australian White Ibis	P	-	✓	-	✓	-
<i>Chenonetta jubata</i>	Australian Wood Duck	P	-	✓	-	✓	✓
<i>Porzana pusilla</i>	Baillon's Crake	P	-	✓	-	✓	✓
<i>Vanellus tricolor</i>	Banded Lapwing	P	-	✓	-	✓	✓
<i>Ninox connivens</i>	Barking Owl	V	-	✓	-	✓	-
<i>Tyto alba</i>	Barn Owl	P	-	✓	-	✓	-
<i>Geopelia humeralis</i>	Bar-shouldered Dove	P	-	✓	-	✓	✓
<i>Falco subniger</i>	Black Falcon	P	-	✓	-	✓	✓
<i>Certhionyx niger</i>	Black Honeyeater	P	-	-	-	✓	✓
<i>Milvus migrans</i>	Black Kite	P	-	✓	-	✓	✓
<i>Cygnus atratus</i>	Black Swan	P	-	✓	-	✓	✓
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard	V	-	-	-	✓	✓
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater	V	-	-	-	✓	✓
<i>Chrysococcyx osculans</i>	Black-eared Cuckoo	P	-	✓	-	✓	✓
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-Shrike	P	-	✓	-	✓	✓
<i>Artamus cinereus</i>	Black-faced Woodswallow	P	-	✓	-	✓	✓
<i>Elseya melanops</i>	Black-fronted Dotterel	P	-	✓	-	✓	✓
<i>Elanus notatus</i>	Black-shouldered Kite	P	-	✓	-	✓	✓

Table EB-1 (Continued)
Database Results

Scientific Name	Common Name	Conservation Status		Source of Record			
		TSC Act ¹	EPBC Act ²	Birds Australia ³	Australian Museum ⁴	DECC Atlas of NSW Wildlife ⁵	BioNet ⁶
<i>Limosa limosa</i>	Black-tailed Godwit	V	M	-	-	✓	✓
<i>Gallinula ventralis</i>	Black-tailed Native-hen	P	-	✓	-	✓	✓
<i>Himantopus himantopus</i>	Black-winged Stilt	P	-	✓	-	✓	✓
<i>Northiella haematogaster</i>	Blue Bonnet	P	-	✓	-	✓	✓
<i>Oxyura australis</i>	Blue-billed Duck	V	-	✓	✓	✓	✓
<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater	P	-	✓	-	✓	✓
<i>Grus rubicunda</i>	Brolga	V	-	✓	-	✓	✓
<i>Falco berigora</i>	Brown Falcon	P	-	✓	-	✓	✓
<i>Accipiter fasciatus</i>	Brown Goshawk	P	-	✓	-	✓	✓
<i>Coturnix ypsilophora</i>	Brown Quail	P	-	✓	-	✓	✓
<i>Cinchoramphus cruralis</i>	Brown Songlark	P	-	✓	-	✓	✓
<i>Acanthiza pusilla</i>	Brown Thornbill	P	-	-	-	✓	✓
<i>Climacteris picumnus</i>	Brown Treecreeper	V	-	✓	-	✓	✓
<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater	P	-	✓	✓	✓	✓
<i>Melopsittacus undulatus</i>	Budgerigar	P	-	✓	-	✓	✓
<i>Gallirallus philippensis</i>	Buff-banded Rail	P	-	-	-	✓	✓
<i>Acanthiza reguloides</i>	Buff-rumped Thornbill	P	-	✓	-	✓	✓
<i>Burhinus grallarius</i>	Bush Stone-curlew	E	-	-	-	✓	✓
<i>Burhinus magnirostris</i>	Beach Stone-curlew	P	-	✓	-	-	-
<i>Ardea ibis</i>	Cattle Egret	P	M	✓	-	✓	✓
<i>Cinclosoma castanotus</i>	Chestnut Quail-thrush	V	-	-	-	✓	✓
<i>Anas castanea</i>	Chestnut Teal	P	-	✓	-	✓	✓
<i>Hylacola pyrrhopygia</i>	Chestnut-rumped Heathwren	P	-	✓	-	✓	✓
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill	P	-	✓	-	✓	✓

Table EB-1 (Continued)
Database Results

Scientific Name	Common Name	Conservation Status		Source of Record			
		TSC Act ¹	EPBC Act ²	Birds Australia ³	Australian Museum ⁴	DECC Atlas of NSW Wildlife ⁵	BioNet ⁶
<i>Coracina tenuirostris</i>	Cicadabird	P	-	✓	-	-	-
<i>Acrocephalus stentoreus</i>	Clamorous Reed-Warbler	P	-	✓	-	-	-
<i>Nymphicus hollandicus</i>	Cockatiel	P	-	✓	-	✓	✓
<i>Accipiter cirrhocephalus</i>	Collared Sparrowhawk	P	-	✓	-	✓	✓
<i>Phaps chalcoptera</i>	Common Bronzewing	P	-	✓	-	✓	✓
<i>Tringa nebularia</i>	Common Greenshank	P	M	✓	-	✓	✓
<i>Sturnus vulgaris</i>	Common Starling	P	-	✓	-	✓	✓
<i>Oreocia gutturalis</i>	Crested Bellbird	P	-	✓	-	✓	✓
<i>Ocyphaps lophotes</i>	Crested Pigeon	P	-	✓	-	✓	✓
<i>Corvus sp.</i>	Crow and Raven spp.	P	-	✓	-	-	-
<i>Calidris ferruginea</i>	Curlew Sandpiper	P	M	✓	-	✓	✓
<i>Anhinga melanogaster</i>	Darter	P	-	✓	-	✓	✓
<i>Geopelia cuneata</i>	Diamond Dove	P	-	✓	-	✓	✓
<i>Stagonopleura guttata</i>	Diamond Firetail	V	-	✓	✓	✓	✓
<i>Eurystomus orientalis</i>	Dollarbird	P	-	✓	-	✓	✓
<i>Taeniopygia bichenovii</i>	Double-barred Finch	P	-	✓	-	✓	✓
<i>Gallinula tenebrosa</i>	Dusky Moorhen	P	-	✓	-	✓	✓
<i>Artamus cyanopterus</i>	Dusky Woodswallow	P	-	✓	-	✓	✓
<i>Platycercus eximius</i>	Eastern Rosella	P	-	✓	-	✓	✓
<i>Falcunculus frontatus</i>	Eastern Shrike-tit	P	M	-	-	✓	✓
<i>Eopsaltria australis</i>	Eastern Yellow Robin	P	-	✓	✓	✓	✓
<i>Dromaius novaehollandiae</i>	Emu	P	-	✓	✓	✓	✓
<i>Turdus merula</i>	Eurasian Blackbird	P	-	-	-	✓	✓
<i>Fulica atra</i>	Eurasian Coot	P	-	✓	✓	✓	-

Table EB-1 (Continued)
Database Results

Scientific Name	Common Name	Conservation Status		Source of Record			
		TSC Act ¹	EPBC Act ²	Birds Australia ³	Australian Museum ⁴	DECC Atlas of NSW Wildlife ⁵	BioNet ⁶
<i>Carduelis carduelis</i>	European Goldfinch	P	-	-	-	✓	✓
<i>Hirundo ariel</i>	Fairy Martin	P	-	✓	-	✓	✓
<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo	P	-	✓	-	✓	✓
<i>Sminthopsis crassicaudata</i>	Fan-tailed Dunnart	P	-	-	-	✓	✓
<i>Petroica phoenicea</i>	Flame Robin	P	-	-	-	✓	✓
<i>Apus pacificus</i>	Fork-tailed Swift	P	M	✓	-	✓	✓
<i>Larus pipixcan</i>	Franklin's Gull	P	-	-	-	✓	✓
<i>Stictonetta naevosa</i>	Freckled Duck	V	-	✓	-	✓	✓
<i>Cacatua roseicapilla</i>	Galah	P	-	✓	✓	✓	✓
<i>Pachycephala inornata</i>	Gilbert's Whistler	V	-	-	-	✓	✓
<i>Plegadis falcinellus</i>	Glossy Ibis	P	M	✓	-	✓	✓
<i>Pachycephala pectoralis</i>	Golden Whistler	P	-	✓	-	✓	✓
<i>Cisticola exilis</i>	Golden-headed Cisticola	P	-	✓	-	✓	✓
<i>Phalacrocorax carbo</i>	Great Cormorant	P	-	✓	✓	✓	✓
<i>Podiceps cristatus</i>	Great Crested Grebe	P	-	✓	-	✓	✓
<i>Ardea alba</i>	Great Egret	P	M	✓	-	✓	✓
<i>Cracticus torquatus</i>	Grey Butcherbird	P	-	✓	-	✓	✓
<i>Falco hypoleucos</i>	Grey Falcon	V	-	✓	-	✓	✓
<i>Rhipidura fuliginosa</i>	Grey Fantail	P	-	✓	✓	✓	✓
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	P	-	✓	-	✓	✓
<i>Anas gracilis</i>	Grey Teal	P	-	✓	-	✓	✓
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler	V	-	✓	-	✓	✓
<i>Coracina maxima</i>	Ground Cuckoo-Shrike	P	-	✓	-	✓	✓
<i>Sterna nilotica</i>	Gull-billed Tern	P	-	✓	-	✓	✓

Table EB-1 (Continued)
Database Results

Scientific Name	Common Name	Conservation Status		Source of Record			
		TSC Act ¹	EPBC Act ²	Birds Australia ³	Australian Museum ⁴	DECC Atlas of NSW Wildlife ⁵	BioNet ⁶
<i>Aythya australis</i>	Hardhead	P	-	✓	-	✓	✓
<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe	P	-	✓	-	✓	✓
<i>Melanodryas cucullata cucullata</i>	Hooded Robin	V	-	✓	✓	✓	✓
<i>Chrysococcyx basalis</i>	Horsfield's Bronze-Cuckoo	P	-	✓	-	✓	✓
<i>Mirafrja javanica</i>	Horsfield's Bushlark	P	-	-	-	✓	✓
<i>Passer domesticus</i>	House Sparrow	P	-	✓	-	✓	✓
<i>Acanthiza apicalis</i>	Inland Thornbill	P	-	✓	-	✓	✓
<i>Ardea intermedia</i>	Intermediate Egret	P	-	✓	-	✓	✓
<i>Microeca leucophaea</i>	Jacky Winter	P	-	✓	✓	✓	✓
<i>Gallinago hardwickii</i>	Latham's Snipe	P	M	✓	-	✓	✓
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	P	-	✓	-	✓	✓
<i>Myiagra rubecula</i>	Leaden Flycatcher	P	-	-	-	✓	✓
<i>Elanus scriptus</i>	Letter-winged Kite	P	-	✓	-	✓	✓
<i>Ixobrychus minutus</i>	Little Bittern	P	-	✓	-	✓	✓
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant	P	-	✓	-	✓	✓
<i>Turnix velox</i>	Little Button-quail	P	-	-	-	✓	✓
<i>Cacatua sanguinea</i>	Little Corella	P	-	✓	-	-	-
<i>Corvus bennetti</i>	Little Crow	P	-	-	-	✓	✓
<i>Hieraaetus morphnoides</i>	Little Eagle	P	-	✓	-	✓	✓
<i>Egretta garzetta</i>	Little Egret	P	-	✓	-	✓	✓
<i>Philemon citreogularis</i>	Little Friarbird	P	-	✓	-	✓	✓
<i>Megalurus gramineus</i>	Little Grassbird	P	-	✓	-	✓	-
<i>Phalacrocorax melanoleucos</i>	Little Pied Cormorant	P	-	✓	-	✓	✓
<i>Corvus mellori</i>	Little Raven	P	-	✓	-	✓	✓
<i>Anseranas semipalmata</i>	Maggie Goose	V	-	✓	-	✓	✓

Table EB-1 (Continued)
Database Results

Scientific Name	Common Name	Conservation Status		Source of Record			
		TSC Act ¹	EPBC Act ²	Birds Australia ³	Australian Museum ⁴	DECC Atlas of NSW Wildlife ⁵	BioNet ⁶
<i>Grallina cyanoleuca</i>	Magpie-lark	P	-	✓	-	✓	✓
<i>Cacatua leadbeateri</i>	Major Mitchell's Cockatoo	V	-	✓	-	✓	-
<i>Anas platyrhynchos</i>	Mallard	P	-	-	-	✓	✓
<i>Leipoa ocellata</i>	Malleefowl	E	V/M	-	-	✓	✓
<i>Tringa stagnatilis</i>	Marsh Sandpiper	P	M	✓	-	✓	✓
<i>Vanellus miles</i>	Masked Lapwing	P	-	✓	-	✓	-
<i>Tyto novaehollandiae</i>	Masked Owl	V	-	-	-	✓	-
<i>Artamus personatus</i>	Masked Woodswallow	P	-	✓	✓	✓	✓
<i>Dicaeum hirundinaceum</i>	Mistletoebird	P	-	✓	-	✓	✓
<i>Psephotus varius</i>	Mulga Parrot	P	-	-	-	✓	-
<i>Biziura lobata</i>	Musk Duck	P	-	✓	-	✓	✓
<i>Falco cenchroides</i>	Nankeen Kestrel	P	-	✓	-	✓	✓
<i>Nycticorax caledonicus</i>	Nankeen Night Heron	P	-	✓	-	✓	✓
<i>Philemon corniculatus</i>	Noisy Friarbird	P	-	✓	-	✓	✓
<i>Manorina melanocephala</i>	Noisy Miner	P	-	✓	-	✓	✓
<i>Oriolus sagittatus</i>	Olive-backed Oriole	P	-	✓	-	✓	✓
<i>Ephthianura aurifrons</i>	Orange Chat	P	-	✓	-	✓	✓
<i>Pandion haliaetus</i>	Osprey	V	M	-	-	✓	✓
<i>Anas superciliosa</i>	Pacific Black Duck	P	-	✓	-	✓	✓
<i>Turnix varia</i>	Painted Button-quail	P	-	-	-	✓	✓
<i>Grantiella picta</i>	Painted Honeyeater	V	-	✓	-	✓	✓
<i>Rostratula benghalensis australis</i>	Australian Painted Snipe	V	V/M	✓	-	✓	✓
<i>Cuculus pallidus</i>	Pallid Cuckoo	P	-	✓	-	✓	✓
<i>Geopelia striata</i>	Peaceful Dove	P	-	✓	-	✓	✓

Table EB-1 (Continued)
Database Results

Scientific Name	Common Name	Conservation Status		Source of Record			
		TSC Act ¹	EPBC Act ²	Birds Australia ³	Australian Museum ⁴	DECC Atlas of NSW Wildlife ⁵	BioNet ⁶
<i>Calidris melanotos</i>	Pectoral Sandpiper	P	M	✓	-	✓	✓
<i>Falco peregrinus</i>	Peregrine Falcon	P	-	✓	-	✓	✓
<i>Cracticus nigrogularis</i>	Pied Butcherbird	P	-	✓	-	✓	✓
<i>Phalacrocorax varius</i>	Pied Cormorant	P	-	✓	-	✓	✓
<i>Strepera graculina</i>	Pied Currawong	P	-	✓	-	✓	✓
<i>Malacorhynchus membranaceus</i>	Pink-eared Duck	P	-	✓	✓	✓	✓
<i>Dendrocygna eytoni</i>	Plumed Whistling-Duck	P	-	✓	-	✓	✓
<i>Porphyrio porphyrio</i>	Purple Swamphen	P	-	✓	-	✓	✓
<i>Merops ornatus</i>	Rainbow Bee-eater	P	M	✓	-	✓	✓
<i>Anthochaera carunculata</i>	Red Wattlebird	P	-	✓	-	✓	✓
<i>Todiramphus pyrrhopygia</i>	Red-backed Kingfisher	P	-	-	-	✓	✓
<i>Charadrius ruficapillus</i>	Red-capped Plover	P	-	✓	-	✓	✓
<i>Petroica goodenovii</i>	Red-capped Robin	P	-	✓	-	✓	✓
<i>Turnix pyrrhotorax</i>	Red-chested Button-quail	P	-	-	-	✓	✓
<i>Erythronyx cinctus</i>	Red-kneed Dotterel	P	-	✓	-	✓	✓
<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet	P	-	✓	-	✓	✓
<i>Calidris ruficollis</i>	Red-necked Stint	P	M	✓	-	✓	✓
<i>Psephotus haematonotus</i>	Red-rumped Parrot	P	-	✓	-	✓	✓
<i>Xanthomyza phrygia</i>	Regent Honeyeater	E	E/M	-	-	✓	✓
<i>Myiagra inquieta</i>	Restless Flycatcher	P	-	✓	✓	✓	✓
<i>Anthus novaeseelandiae</i>	Richard's Pipit	P	-	✓	-	✓	✓
<i>Columba livia</i>	Rock Dove	P	-	✓	-	✓	✓
<i>Platelea regia</i>	Royal Spoonbill	P	-	✓	✓	✓	✓
<i>Rhipidura rufifrons</i>	Rufous Fantail	P	M	-	-	✓	✓
<i>Cincloramphus mathewsi</i>	Rufous Songlark	P	-	✓	✓	✓	✓

Table EB-1 (Continued)
Database Results

Scientific Name	Common Name	Conservation Status		Source of Record			
		TSC Act ¹	EPBC Act ²	Birds Australia ³	Australian Museum ⁴	DECC Atlas of NSW Wildlife ⁵	BioNet ⁶
<i>Pachycephala rufiventris</i>	Rufous Whistler	P	-	✓	✓	✓	✓
<i>Todiramphus sanctus</i>	Sacred Kingfisher	P	-	✓	-	✓	✓
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	P	M	✓	-	✓	✓
<i>Chrysococcyx lucidus</i>	Shining Bronze-Cuckoo	P	-	✓	-	✓	✓
<i>Hylacola cauta</i>	Shy Heathwren	V	-	-	-	✓	✓
<i>Larus novaehollandiae</i>	Silver Gull	P	-	✓	✓	✓	✓
<i>Zosterops lateralis</i>	Silvereye	P	-	✓	-	✓	✓
<i>Mirafra javanica</i>	Singing Bushlark	P	-	✓	-	-	-
<i>Lichenostomus virescens</i>	Singing Honeyeater	P	-	✓	-	✓	✓
<i>Ninox novaeseelandiae</i>	Southern Boobook	P	-	✓	-	✓	✓
<i>Drymodes brunneopygia</i>	Southern Scrub-robin	V	-	-	-	✓	✓
<i>Aphelocephala leucopsis</i>	Southern Whiteface	P	-	✓	✓	✓	✓
<i>Chthonicola sagittata</i>	Speckled Warbler	V	-	✓	✓	✓	✓
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater	P	-	✓	-	✓	✓
<i>Malurus splendens</i>	Splendid Fairy-wren	P	-	✓	-	-	-
<i>Porzana tabuensis</i>	Spotless Crake	P	-	✓	-	✓	✓
<i>Circus assimilis</i>	Spotted Harrier	P	-	✓	-	✓	✓
<i>Eurostopodus argus</i>	Spotted Nightjar	P	-	✓	-	✓	✓
<i>Pardalotus punctatus</i>	Spotted Pardalote	P	-	✓	-	✓	✓
<i>Lophoictinia isura</i>	Square-tailed Kite	V	-	-	-	✓	✓
<i>Threskiornis spinicollis</i>	Straw-necked Ibis	P	-	✓	-	✓	✓
<i>Pardalotus striatus</i>	Striated Pardalote	P	-	✓	-	✓	✓
<i>Plectorhyncha lanceolata</i>	Striped Honeyeater	P	-	✓	✓	✓	✓
<i>Coturnix pectoralis</i>	Stubble Quail	P	-	✓	-	✓	✓
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	P	-	✓	-	✓	✓

Table EB-1 (Continued)
Database Results

Scientific Name	Common Name	Conservation Status		Source of Record			
		TSC Act ¹	EPBC Act ²	Birds Australia ³	Australian Museum ⁴	DECC Atlas of NSW Wildlife ⁵	BioNet ⁶
<i>Malurus cyaneus</i>	Superb-Fairy-wren	P	-	-	-	✓	✓
<i>Polytelis swainsonii</i>	Superb Parrot	V	V	✓	-	✓	✓
<i>Circus approximans</i>	Swamp Harrier	P	-	✓	-	✓	✓
<i>Lathamus discolor</i>	Swift Parrot	E	E	-	-	✓	✓
<i>Podargus strigoides</i>	Tawny Frogmouth	P	-	✓	-	✓	✓
<i>Hirundo nigricans</i>	Tree Martin	P	-	✓	-	✓	✓
<i>Neophema pulchella</i>	Turquoise Parrot	V	-	-	-	✓	✓
<i>Daphoenositta chrysoptera</i>	Varied Sittella	P	-	✓	-	✓	✓
<i>Malurus lamberti</i>	Variegated Fairy-wren	P	-	✓	-	✓	✓
<i>Dendrocygna arcuata</i>	Wandering Whistling-Duck	P	-	-	-	✓	✓
<i>Aquila audax</i>	Wedge-tailed Eagle	P	-	✓	-	✓	✓
<i>Smicronis brevirostris</i>	Weebill	P	-	✓	-	✓	✓
<i>Hirundo neoxena</i>	Welcome Swallow	P	-	✓	-	✓	✓
<i>Gerygone fusca</i>	Western Gerygone	P	-	✓	✓	✓	✓
<i>Chlidonias hybridus</i>	Whiskered Tern	P	-	✓	-	✓	✓
<i>Haliastur sphenurus</i>	Whistling Kite	P	-	✓	-	✓	✓
<i>Cheramoeca leucosternum</i>	White-backed Swallow	P	-	✓	-	✓	✓
<i>Coracina papuensis</i>	White-bellied Cuckoo-Shrike	P	-	✓	-	✓	✓
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	P	M	✓	-	✓	✓
<i>Artamus leucorhynchus</i>	White-breasted Woodswallow	P	-	✓	-	✓	✓
<i>Pomatostomus superciliosus</i>	White-browed Babbler	P	-	✓	✓	✓	✓
<i>Artamus superciliosus</i>	White-browed Woodswallow	P	-	✓	✓	✓	✓
<i>Lichenostomus leucotis</i>	White-eared Honeyeater	P	-	✓	✓	✓	✓
<i>Egretta novaehollandiae</i>	White-faced Heron	P	-	✓	-	✓	✓
<i>Ephthianura albiglans</i>	White-fronted Chat	P	-	✓	-	✓	✓

Table EB-1 (Continued)
Database Results

Scientific Name	Common Name	Conservation Status		Source of Record			
		TSC Act ¹	EPBC Act ²	Birds Australia ³	Australian Museum ⁴	DECC Atlas of NSW Wildlife ⁵	BioNet ⁶
<i>Ardea pacifica</i>	White-necked Heron	P	-	✓	-	✓	✓
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater	P	-	✓	-	✓	✓
<i>Gerygone olivacea</i>	White-throated Gerygone	P	-	✓	-	✓	✓
<i>Corombates leucophaeus</i>	White-throated Treecreeper	P	-	✓	✓	✓	✓
<i>Chlidonias leucopterus</i>	White-winged Black Tern	P	-	✓	-	✓	✓
<i>Corcorax melanorhamphos</i>	White-winged Cough	P	-	✓	✓	✓	✓
<i>Malurus leucopterus</i>	White-winged Fairy-wren	P	-	✓	-	✓	✓
<i>Lalage sueurii</i>	White-winged Triller	P	-	✓	✓	✓	✓
<i>Rhipidura leucophrys</i>	Willie Wagtail	P	-	✓	-	✓	✓
<i>Acanthiza nana</i>	Yellow Thornbill	P	-	✓	✓	✓	✓
<i>Platelea flavipes</i>	Yellow-billed Spoonbill	P	-	✓	-	✓	✓
<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater	P	-		-	✓	✓
<i>Lichenostomus ornatus</i>	Yellow-plumed Honeyeater	P	-	✓	-	✓	✓
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	P	-	✓	-	✓	✓
<i>Manorina flavigula</i>	Yellow-throated Miner	P	-	✓	-	✓	✓
<i>Lichenostomus melanops</i>	Yellow-tufted Honeyeater	P	-	✓	-	✓	✓
<i>Taeniopygia guttata</i>	Zebra Finch	P	-	✓	-	✓	✓
Mammals							
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	P	-	-	-	✓	✓
<i>Nyctophilus timoriensis</i>	Eastern Long-eared Bat	V	V	-	-	✓	✓
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	P	-	-	-	✓	✓
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat	P	-	-	-	✓	✓
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat	P	-	-	-	✓	✓
<i>Scotorepens greyii</i>	Little Broad-nosed Bat	P	-	-	-	✓	✓
<i>Vespadelus vulturnus</i>	Little Forest Bat	P	-	-	-	✓	✓

Table EB-1 (Continued)
Database Results

Scientific Name	Common Name	Conservation Status		Source of Record			
		TSC Act ¹	EPBC Act ²	Birds Australia ³	Australian Museum ⁴	DECC Atlas of NSW Wildlife ⁵	BioNet ⁶
<i>Mormopterus planiceps</i>	Little Mastiff-bat	P	-	-	-	✓	✓
<i>Chalinolobus picatus</i>	Little Pied Bat	V	-	-	-	✓	✓
<i>Vespadelus regulus</i>	Southern Forest Bat	P	-	-	-	✓	✓
<i>Tadarida australis</i>	White-striped Freetail-bat	P	-	-	-	✓	✓
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V	-	-	-	✓	✓
<i>Trichosurus</i> sp.	Brush-tail Possum	P	-	-	-	✓	✓
<i>Trichosurus vulpecula</i>	Common Brush-tail Possum	P	-	-	-	✓	✓
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-	-	-	✓	✓
<i>Petaurus breviceps</i>	Sugar Glider	P	-	-	-	✓	✓
<i>Sminthopsis murina</i>	Common Dunnart	P	-	-	-	✓	✓
<i>Macropus robustus</i>	Common Wallaroo	P	-	-	-	✓	✓
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V	-	-	-	✓	✓
<i>Macropus giganteus</i>	Eastern Grey Kangaroo	P	-	-	-	✓	✓
<i>Macropus rufus</i>	Red Kangaroo	P	-	-	-	✓	✓
<i>Wallabia bicolor</i>	Swamp Wallaby	P	-	-	-	✓	✓
<i>Antechinus flavipes</i>	Yellow-footed Antechinus	P	-	-	-	✓	✓
<i>Myotis adversus</i>	Large-footed Myotis	V	-	-	-	✓	✓
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna	P	-	-	-	✓	✓
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E	-	-	✓	✓
<i>Rattus rattus</i>	Black Rat	U	-	-	-	✓	✓
<i>Hydromys chrysogaster</i>	Water-rat	P	-	-	-	✓	✓
<i>Lepus capensis</i>	Brown Hare	U	-	-	-	✓	✓
<i>Felis catus</i>	Cat	U	-	-	-	✓	✓
<i>Bos taurus</i>	European cattle	U	-	-	-	✓	✓
<i>Vulpes vulpes</i>	Fox	U	-	-	-	✓	✓

Table EB-1 (Continued)
Database Results

Scientific Name	Common Name	Conservation Status		Source of Record			
		TSC Act ¹	EPBC Act ²	Birds Australia ³	Australian Museum ⁴	DECC Atlas of NSW Wildlife ⁵	BioNet ⁶
<i>Capra hircus</i>	Goat	U	-	-	-	✓	✓
<i>Mus musculus</i>	House Mouse	U	-	-	-	✓	✓
<i>Sus scrofa</i>	Pig	U	-	-	-	✓	✓
<i>Oryctolagus cuniculus</i>	Rabbit	U	-	-	-	✓	✓
<i>Ovis aries</i>	Sheep (feral)	U	-	-	-	✓	✓

¹ Threatened Species Status under the NSW *Threatened Species Conservation Act, 1995*.

² Threatened Species Status under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*.

V = Vulnerable

E = Endangered

M = Migratory species

PE = Presumed Extinct P = Protected

U=Introduced

³ Birds Australia (2008) database records for the search area: (-33.45 - 147.17, -33.45 - 147.60, -33.81 - 147.61, -33.82 - 147.17). Data received March 2008.

⁴ Australian Museum (2008) database records for the search area: (-33.45 - 147.17, -33.45 - 147.60, -33.81 - 147.61, -33.82 - 147.17). Data received April 2008.

⁵ DECC (2008) Atlas of NSW Wildlife database records for the search area: (-33.45 - 147.17, -33.45 - 147.60, -33.81 - 147.61, -33.82 - 147.17). Data received April 2008.

⁶ Bionet (2008) NSW Government BioNet system database records within the following search area: -33.45 - 147.17, -33.45 - 147.60, -33.81 - 147.61, -33.82 - 147.17. Data received April 2008.

ATTACHMENT EC
SURVEY EFFORT

Table EC-1
Survey Effort

Method	Site location (Eucalypt Woodland, Cleared Agricultural Land with Scattered Trees, Mixed Woodland)
Spotlighting on Foot	3 person hours for Eucalypt Woodland and 2 person hours the Cleared Agricultural Land with Scattered Trees as well as the Mixed Woodland.
Spotlighting along Tracks	2 person hours for the Cleared Agricultural Land with Scattered Trees and Cowal West Hill (western aspect only).
Herpetological Searches	1 hr /transect for each site on two separate days. Total 6 hours.
Bird Surveys	1 hr for each transect, one morning and one afternoon for each site. 12 hrs total.
Nocturnal or Diurnal Call Playback	1 x 30 mins at all three sites. Total 3 hours.
Opportunistic Observations, Surveys and Searches	<i>Ad lib</i> across the survey sites particularly when moving between sites.
Tracks and Traces	<i>Ad lib</i> or when engaged in other activities above.

ATTACHMENT ED

FAUNA SPECIES RECORDED DURING THE
SURVEY OF THE E42 MODIFICATION AREA

Table ED-1
Fauna Species Recorded During the Survey of the E42 Modification Area

Scientific name	Common Name	Status		Detailed Results of the Fauna Survey Conducted for the Cowal E42 Modification by Western Research Institute in 2008				
				Site				Relative Abundance Across Sites
		TSC Act ¹	EPBC Act ²	Eucalypt Woodland	Cleared Agricultural Land with Scattered Trees		Mixed Woodland	
					Terrestrial Component	Ephemeral Drainage Line		
Amphibians								
Myobatrachidae								
Crinea signifera	Common Eastern Froglet	P	-		✓	✓		MC
Limnodynastes tasmaniensis	Spotted Grass Frog	P	-		✓	✓		MC
Hylidae								
Litoria peronii	Peron's Tree Frog	P	-	✓				1
Reptiles								
Gekkonidae								
Gehyra variegata	Tree Dtella	P	-	✓	✓			U
Scincidae								
Cryptoblepharus carnabyi	Shiny-palmed Shinning-Skink	P	-	✓	✓		✓	U
Morethia boulengeri	South-eastern Morethia Skink	P	-	✓	✓		✓	U
Birds								
Dromaiidae								
Dromaius novaehollandiae	Emu	P	-	✓	✓		✓	U
Anatidae								
Chenonetta jubata	Australian Wood Duck	P	-			✓		MC
Anas superciliosa	Pacific Black Duck	P	-			✓		MC
Anas gracilis	Grey Teal	P	-			✓		U
Podicipedidae								
Tachybaptus novaehollandiae	Australasian Grebe	P	-			✓		U
Threskiornithidae								
Threskiornis spinicollis	Straw-necked Ibis	P	-			✓		MC
Platalea flavipes	Yellow-billed Spoonbill	P	--			✓		U

Table ED-1 (Continued)
Fauna Species Recorded During the Survey of the E42 Modification Area

Scientific name	Common Name	Status		Detailed Results of the Fauna Survey Conducted for the Cowal E42 Modification by Western Research Institute in 2008				
				Site				
		TSC Act ¹	EPBC Act ²	Eucalypt Woodland	Cleared Agricultural Land with Scattered Trees		Mixed Woodland	Relative Abundance Across Sites
Terrestrial Component	Ephemeral Drainage Line							
Falconidae								
<i>Falco berigora</i>	Brown Falcon	P	-	✓	✓			U
Ardeidae								
<i>Ardea ibis</i>	Cattle Egret	P	M		✓			U
<i>Egretta novaehollandiae</i>	White-faced Heron	P	-		✓	✓		U
Charadriidae								
<i>Vanellus miles</i>	Masked Lapwing	P	-			✓		U
Columbidae								
<i>Ocyphaps lophotes</i>	Crested Pigeon	P	-	✓	✓		✓	U
Psittacidae								
<i>Eolophus roseicapilla</i>	Galah	P	-	✓	✓		✓	C
<i>Nymphicus hollandicus</i>	Cockatiel	P	-				✓	U
<i>Barnardius zonarius barnardi</i>	Eastern Ringneck	P	-				✓	U
<i>Northiella haematogaster</i>	Blue Bonnet	P	-	✓	✓		✓	MC
<i>Psephotus haematonotus</i>	Red-rumped Parrot	P	-	✓	✓		✓	U
Caprimulgidae								
<i>Eurostopodus argus</i>	Spotted Nightjar	P	-	✓				1
Meliphagidae								
<i>Manorina melanocephala</i>	Noisy Miner	P	-	✓	✓		✓	MC
<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater	P	-	✓				U
<i>Philemon corniculatus</i>	Noisy Friarbird	P	-	✓				U
Pomatostostomidae								
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler	V	-	✓	✓		✓	U

Table ED-1 (Continued)
Fauna Species Recorded During the Survey of the E42 Modification Area

Scientific name	Common Name	Status		Detailed Results of the Fauna Survey Conducted for the Cowal E42 Modification by Western Research Institute in 2008				
				Site				
		TSC Act ¹	EPBC Act ²	Eucalypt Woodland	Cleared Agricultural Land with Scattered Trees		Mixed Woodland	Relative Abundance Across Sites
					Terrestrial Component	Ephemeral Drainage Line		
Pachycephalidae								
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	P	-	✓	✓			U
Dicruridae								
<i>Grallina cyanoleuca</i>	Magpie-lark	P	-	✓	✓		✓	U
Artamidae								
<i>Cracticus torquatus</i>	Grey Butcherbird	P	-				✓	U
<i>Cracticus nigrogularis</i>	Pied Butcherbird	P	-	✓	✓		✓	U
<i>Gymnorhina tibicen</i>	Australian Magpie	P	-	✓	✓		✓	MC
Corvidae								
<i>Corvus coronoides</i>	Australian Raven	P	-	✓	✓		✓	MC
Corcoracidae								
<i>Corcorax melanorhamphos</i>	White-winged Chough	P	-				✓	U
<i>Struthidea cinerea</i>	Apostle Bird	P	-	✓	✓		✓	MC
Mammals								
Tachyglossidae								
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna	P	-	✓			✓	U
Phalangeridae								
<i>Trichosurus vulpecula</i>	Common Brushtail Possum	P	-	✓				1
Macropodidae								
<i>Macropus giganteus</i>	Eastern Grey Kangaroo	P	-	✓	✓		✓	MC

Table ED-1 (Continued)
Fauna Species Recorded During the Survey of the E42 Modification Area

Scientific name	Common Name	Status		Detailed Results of the Fauna Survey Conducted for the Cowal E42 Modification by Western Research Institute in 2008				
				Site				
		TSC Act ¹	EPBC Act ²	Eucalypt Woodland	Cleared Agricultural Land with Scattered Trees		Mixed Woodland	Relative Abundance Across Sites
					Terrestrial Component	Ephemeral Drainage Line		
Introduced Mammal Species								
<i>Vulpes vulpes</i>	Fox*			✓			✓	U
<i>Oryctolagus cuniculus</i>	Rabbit*			✓	✓		✓	U

Nomenclature for Family, Genus and Species and Common Names in accordance with CSIRO (2006) *CSIRO List of Australian Vertebrates – A Reference with Conservation Status*.

Legend:

* Introduced Species

¹ Status of threatened species under the NSW *Threatened Species Conservation Act, 1995* (current as at 7/04/2008).

² Status of threatened species under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (current as at 7/04/2008).

E Endangered V Vulnerable P Protected

U = Uncommon MC = Moderately Common C = Common

¹ One sighting of the species