INTEGRA COAL

Integra Coal Operations Pty Ltd

ABN: 96 118 030 998

Glennies Creek Open Cut Coal Mine

Fauna Assessment

Prepared by

Countrywide Ecological Service

October 2007

Specialist Consultant Studies Compendium: Part 3

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Fauna Assessment

of the

Glennies Creek Open Cut Coal Mine

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Acknowledgments:

The field work for this report was conducted under *National Parks and Wildlife Act 1974* Section 132C License No S10393 and Animal Research Authority 01/1082 under the Animal Research Act 1985.

Gerry Swan undertook the sampling for amphibians and reptiles and Michiala Bowen analysed the hair samples. Anne Conway assisted in the field and in preparing this report.

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EXECUTIVE SUMMARY

This is a fauna survey report and an assessment of the likely impacts on the fauna community in the area of the proposed Glennies Creek Open Cut Coal Mine ("the Project") 12km north of Singleton in the Hunter Valley Coal District. The Proponent, Integra Coal Operations Pty Ltd, is seeking to establish an open cut coal mine with a maximum ROM coal production of 1.5Mtpa for a life of approximately 5 to 6 years. The Project Site covers an area of approximately 376ha, with an Open Cut Area of approximately 320ha with an open cut pit shell of 90ha and an out-of-pit overburden emplacement of approximately 43ha.

This report details the methods used and the results obtained from this study that include fauna surveys conducted between August 2004 and June 2006 within the nominated survey area that initially included the Open Cut Area and the Northern Biodiversity Offset Area (the Survey Area). The Survey Area, located in the Upper Hunter River Valley, is within the Sydney Bioregion (Thackway and Cresswell, 1995) but is in the Hunter Subregion (see Morgan, 2001). The fauna in the regional context, for the purpose of discussion and assessment, is defined by the Singleton LGA.

The following five fauna habitats based on structural characteristics are discernible in the Survey Area.

1. Open Pastures.
2. Open Woodland.
3. Woodland.
4. Riparian Oaks.
5. Wetland / Dams.

The balance of the Project Site consists of an area of land that is subject to existing mine disturbance.

The strong regrowth in parts of the rehabilitated areas has necessitated the reclassification of some of the area as Regenerating Woodland / Shrubland (see GCNRC 2007a).

A variety of methods were used to sample the fauna. Some of the methods used targeted more than one fauna group. Fauna surveys were carried out to record the fauna over the Survey Area between August 2004 and June 2006. The survey methods used and intensity of sampling is generally in accordance with NPWS (2004), modified in this instance to take account of the extensive areas of rehabilitated and cleared grazing land in the Survey Area.

The results of the surveys indicated the following.

- All of the nine species of frogs recorded in and around the Open Cut Area are common but protected native species.
- Other than the two exotic bird species and the listed vulnerable species, Grey-crowned Babbler, recorded during the surveys, the other 59 identified birds species are protected native species.
- Twenty-four mammal species were caught in the traps deployed, identified from body tissues (including hair samples) and/or bones, or observed in and around the Survey Area. These included the listed vulnerable Brush-tailed Phascogale, *Phascogale tapoatafa*.

- The microbat species were identified from their ultra-sonic calls during the spring survey. Two of the nine species of microbats that were recorded during the surveys, are listed as vulnerable. Of these, the record of the Eastern Little Mastiff-bat, *Mormopterus norfolkensis,* is unusual and is close to the western limit of its known distribution.
- The European Red Fox, Feral Cat and the European Rabbit recorded occurring on the Open Cut Area are listed as key threatening processes listed under the EPBC and TSC Acts.
- All 11 species of reptiles recorded during this survey are common protected native species.

Although the majority of the area subject to disturbance in this Project consists of cleared paddocks and recent post-mining rehabilitated and soil stockpile areas, some 76.7ha of Woodland and Open Woodland would be affected. The cumulative impact from this additional removal of native vegetation in the regional context is discussed in Section 6.4 and its likely impact on the relevant listed threatened species in Section 6.1.

Pursuant to Part 3A of the EP&A Act the following assessment were carried out on the listed threatened fauna as to –

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

The following species include those that were recorded in or, in the case of *Pteropus poliocephalus,* were likely to occur on the Open Cut Area.

- Grey-crowned Babbler, *Pomatostomus temporalis.*
- Eastern Bentwing-bat, *Miniopterus schreibersii oceanensis*.
- Eastern Freetail-bat, *Mormopterus norfolkensis.*
- Grey-headed Flying-fox, *Pteropus poliocephalus.*
- Brush-tailed Phascogale, *Phascogale tapoatafa.*

The likely impact on these and other, vagrant, transient and migratory species that may use the Project Site from time to time are also discussed.

No threatened fauna population or community has been listed under the TSC Act in the Glennies Creek Catchment or Singleton LGA.

As there is no critical fauna habitat listed in Singleton LGA, consideration with regards to "Whether or not the Project will adversely affect critical habitat" is irrelevant.

Considerations pursuant to the EPBC Act in relation to the fauna within the Study Area can be found in Section 6.3.

Considerations in relation to native vegetation conservation with reference to the connectivity and conductivity of habitat (or wildlife) corridors and Koala habitat management can be found in Section 6.4 and Section 6.5 respectively.
Seventeen safeguarding measures have been recommended in Section 7 to minimise and/or ameliorate any adverse impact on the local fauna in general and, in particular, on the listed threatened species that may occur within the Study Area and the adjoining fauna habitats.

Having given consideration to the proposed recommendations referred to above for minimising and ameliorating the impact from the proposed activity, the biodiversity offsets offered and the post-approval monitoring and pre-start survey proposed, we are of the opinion that:

1. in the context of the details of operation of the proposed Glennies Creek Open Cut Coal Mine, all practical measures have been considered and reasonable actions have been taken to prevent avoidable impacts on the fauna in the layout design of this proposed open cut coal mine;
2. adequate attempts have been made to maintain and improve the biodiversity values in the Open Cut Area and the biodiversity offset areas;
3. it has not been possible to preserve some of the areas of high conservation value on the Open Cut Area, namely the remnant Woodland and the Old Growth gallery along the old Crown road reserve (see **Plate 6**);
4. the proposed Project has no nexus to any critical fauna habitat listed under the TSC or EPBC Act;
5. the proposed Project is unlikely to cause the local extinction of any threatened species;
6. the proposed Project is unlikely to impact upon the long-term viability of local populations of any listed threatened species, population or ecological community;
7. the proposed Project is expected to have short-tem impacts on the Grey-crowned Babbler and the Brush-tailed Phascogale and alter the pattern of use of the Open Cut Area by these species and other potential transient listed threatened species;
8. the proposed Project is unlikely to affect fauna in any aspect of the environment that are matters of national environmental significance that would warrant a referral to the Commonwealth;
9. the Project is consistent with ecologically sustainable development principles with regards to the fauna and is unlikely to diminish the long-term local biodiversity (see Section 6.6); and
10. the safeguards, offsets and ameliorative actions considered and proposed to be implemented to minimise the impact upon fauna within and surrounding the Project Site and the local biodiversity are the greatest extent practicable.

Thus, the Project should not be considered to constitute a controlled action under the EPBC Act but would require further post-approval attention with regards to the management of the local biodiversity particularly in relation to the population of Grey-crowned Babbler and that of the Brush-tailed Phascogale.

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1 INTRODUCTION

This is a fauna survey report and an assessment of the likely impacts on the fauna community in the area of the proposed Glennies Creek Open Cut Coal Mine ("the Project") 12km north of Singleton in the Hunter Valley Coal District (see **Figure 1** Location Diagram of the Survey Area).

Integra Coal Operations Pty Ltd (ICO), ("the Proponent"), proposes to further develop the coal resources within and immediately adjacent to the Glennies Creek Colliery. The Project would target coal recoverable by open cut methods within an area adjacent to the northern boundary of the former Camberwell North Pit.

The Proponent is seeking to establish an open cut coal mine with a maximum ROM coal production of 1.5Mtpa for a life of approximately 5 to 6 years. The Project Site covers an area of approximately 376ha, with an Open Cut Area of approximately 320ha with an open cut pit shell of approximately 90ha and an out-of-pit overburden emplacement of approximately 43ha.

The proposed activities will involve the following (see **Figure 2** Project Site Layout).

- Construction of a site access road off Middle Falbrook Road.
- Construction of the open cut facilities area (including transportable offices, a bathhouse, a crib room, a report room, first aid facilities and stores; as well as a workshop, lay-down areas, parking facilities and associated infrastructure).
- Construction of two Dirty Water Containment Dams, namely the Northern and Southern Dirty Water Containment Dams.
- Coal mining by open cut methods within a pit shell covering approximately 90ha (7.7Mt reserve). Within this area, drilling has identified three principal coal seams amenable to mining by open cut methods, namely the:
  - Middle / Lower Liddell;
  - Barrett; and
  - Hebden seams.
- Transportation of run-of-mine (ROM) coal to the Camberwell Coal Handling and Preparation Plant (CHPP) via a combination of internal haul routes A to E (see **Figure 2**).
- When required, stockpiling of ROM coal at a temporary ROM coal stockpile area located at the top of the active open cut ramp (see Part B6.2) or at the existing RL100 Stockpile Area, with subsequent transportation to the Camberwell CHPP (see **Figure 2**).
- Highwall / auger mining. During the course of the open cut mining, there may be opportunities to undertake mining from the northern highwall using either highwall or auger mining methods to extract additional coal. These methods of mining would result in underground extraction for a maximum length of approximately 300m from the base of the highwall (see **Figure 2**). The final distance would depend on the type of mining undertaken. Highwall or auger mining would not occur outside the Project Site boundaries, nor would it result in subsidence of the ground surface. The coal that would be extracted by this method would be in addition to the 7.7Mt to be extracted by open cut mining methods.

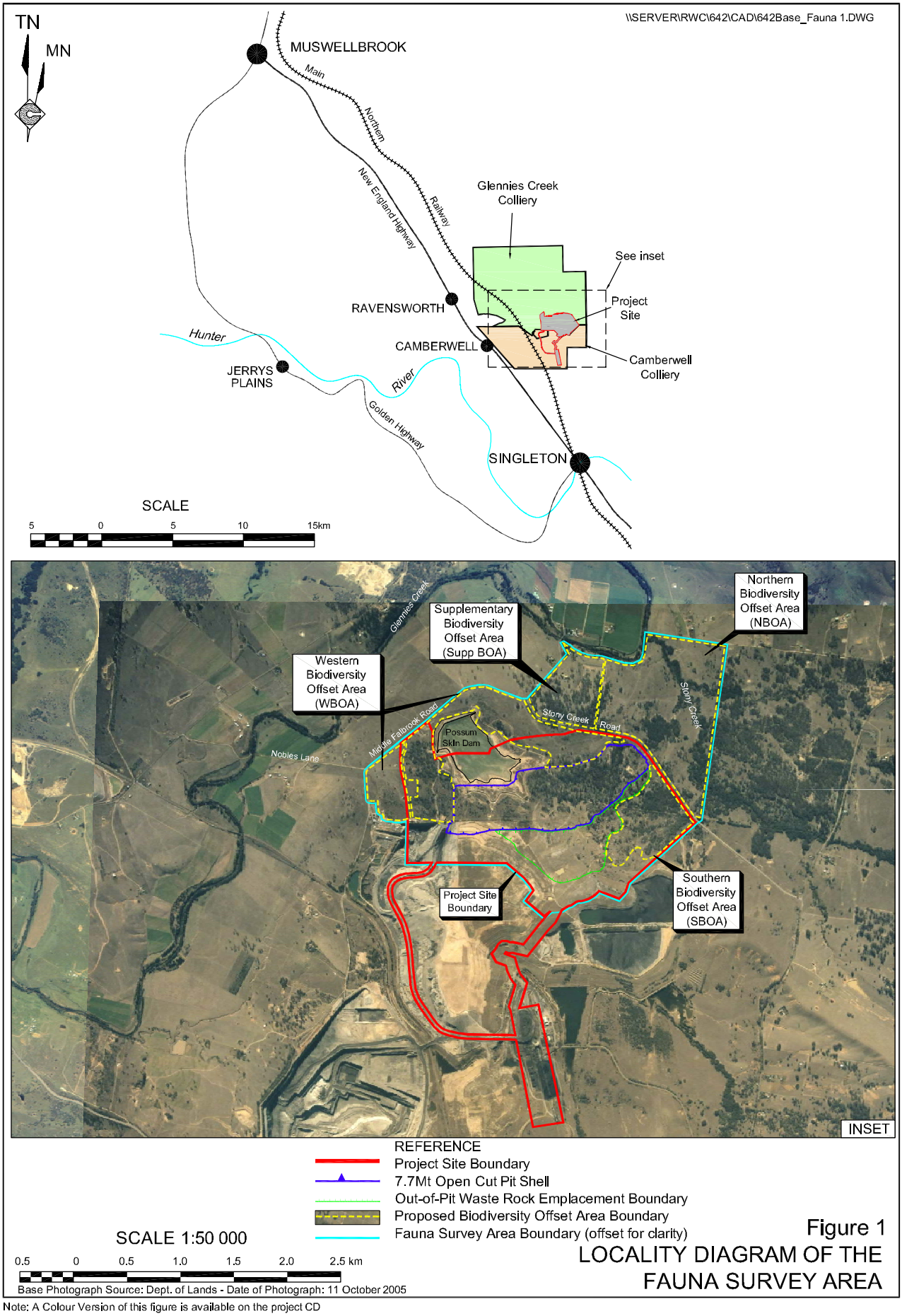
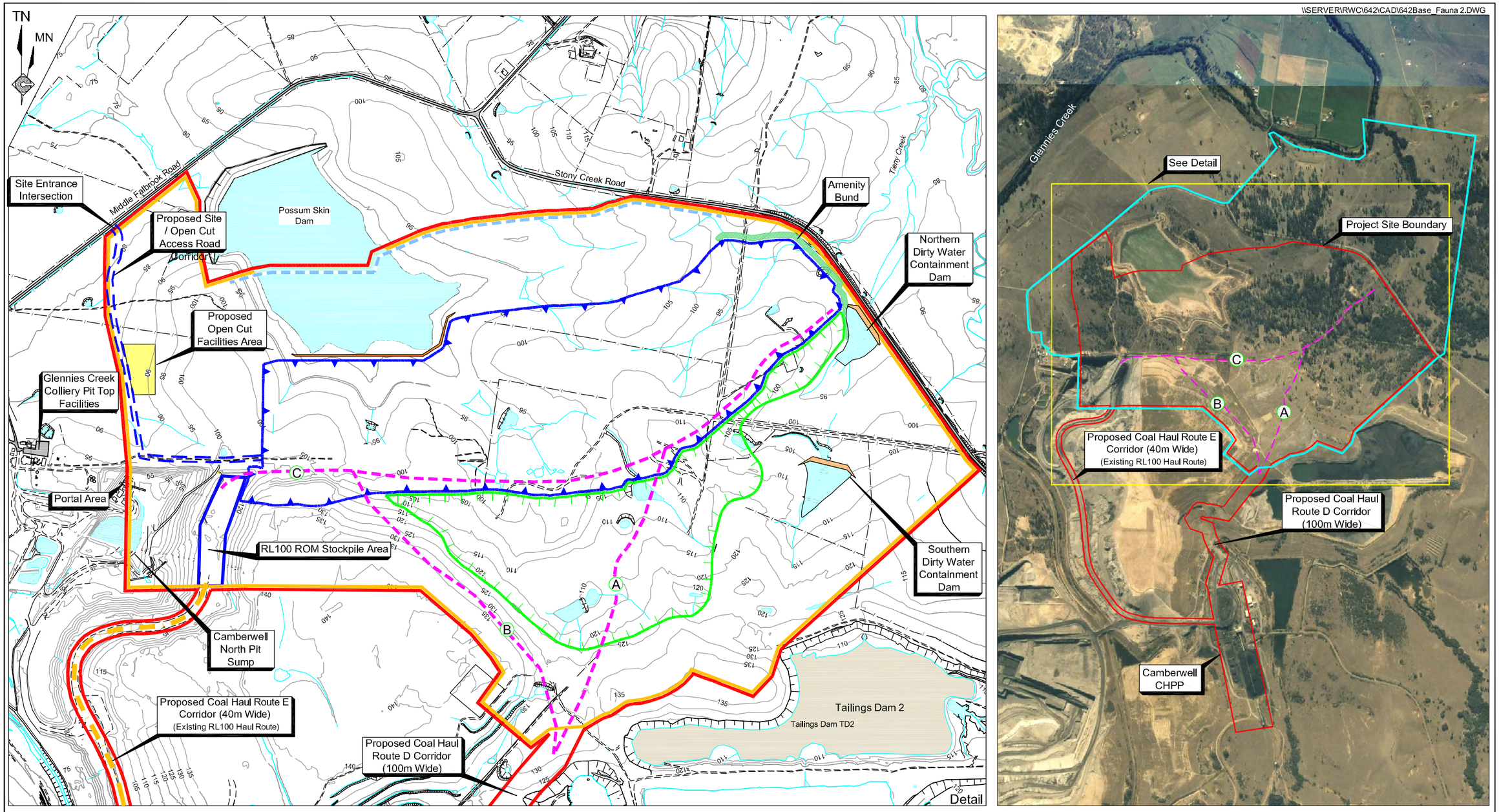


Figure 1
LOCALITY DIAGRAM OF THE FAUNA SURVEY AREA

Note: A Colour Version of this figure is available on the project CD

\\SERVER\RWC\642\CAD\642Base_Fauna 2.DWG



REFERENCE

- Project Site Boundary
- Open Cut Area Boundary
- Fauna Survey Area Boundary (offset for clarity)
- 7.7Mt Open Cut Pit Shell
- Out-of-Pit Waste Rock Emplacement Boundary
- Existing RL100 ROM Stockpile Area Boundary
- Lateral Extent of Highwall / Auger Mining
- Existing RL100 Haul Route (to Camberwell CHPP)
- Proposed Coal Haul Route (See Inset)
- Contour (m AHD)(Interval = 5m)
- Creek / Drainage Line
- Dam / Water Storage
- Sealed Road
- Unsealed Road / Track
- Fence
- Amenity Bund
- Proposed Site / Open Cut Access Road Corridor

SCALE 1:12 500

200 0 200 400 600 m

SCALE 1:25 000

250 0 250 500 750 1000 1250 m

Base Map Source: Geo-Spectrum (Australia) Pty Ltd - Date: December 2004

Figure 2
PROJECT SITE LAYOUT

- Programmed placement of waste rock materials from the open cut. Initially this would be to an out-of-pit emplacement, with subsequent placement out-of-pit as well as to in-pit in areas where mining has been completed. The proposed out-of-pit emplacement would have a disturbance footprint of approximately 43ha (see **Figure 2**).
- Storage and washing of ROM Coal and dispatch of product coal from the Camberwell CHPP.
- Progressive reshaping and rehabilitation of all areas of mining-related disturbance. Overall, the total disturbed area to be rehabilitated would be approximately 143ha as indicated in **Table 1**.
- Implementing and maintaining comprehensive systems to manage noise, vibration, air quality, visibility, surface water, groundwater, flora, fauna and Aboriginal heritage issues.

Table 1
Indicative Disturbance Areas

Disturbance	Indicative Area (ha)
Open Cut Pit Shell (7.7Mt)	90.0
Out-of-Pit Waste Rock Emplacement	43.0
Open Cut Facilities Area	1.5
Site Access Road	0.5
Haul Routes A* and B (C is within open cut footprint)	3.2
Stony Creek Road Amenity Bund	1.0
Clean Water Diversion Channels	0.2
Dirty Water Containment Dams	3.1
TOTAL	142.5
* Not including the section of this haul route within the out-of-pit waste rock emplacement footprint.	
Note: Soil stockpile footprints would be located within the areas of open cut and out-of-pit waste rock emplacement disturbance as much as possible.	

A related activity to the coal mining, transportation and washing would be the provision of various offsets in response to the clearing of approximately 75.1ha of native vegetation, and approximately 47.6haof previously rehabilitated areas. These offset strategies include the protection and enhancement of:

- approximately 122ha of land owned by the Glennies Creek joint venture to the north of Stony Creek Road (Northern Biodiversity Offset Area);
- approximately 39ha of land owned by the Glennies Creek joint venture to the south of Stony Creek Road and east of the out-of-pit waste rock emplacement (Southern Biodiversity Offset Area);
- approximately 94ha of land owned by the Glennies Creek joint venture to the south of Stony Creek and Middle Falbrook Roads and north and west of the areas of existing and proposed disturbance (Western Biodiversity Offset Area); and

- approximately 33ha of non-Project related land to the north of Stony Creek and west of the Northern Biodiversity Offset Area, subject to negotiation of a suitable arrangement with the landowners of this land (Supplementary Biodiversity Offset Area) (see Figure B3B1).

The Northern Dirty Water Containment Dam would contain approximately 10ML, and would occupy an area of approximately 1.4ha. The Southern Dirty Water Containment Dam would contain approximately 35ML, and would occupy an area of 1.65ha. During construction of the dams, only the area of the dam wall would be disturbed. The remaining footprint of the dam would not be disturbed. Clean water diversion channels would be constructed around the dirty water dams to divert clean water from upslope of the dam into the natural drainage line below the dam. These diversions would be located immediately adjacent to the high water line of the dam and would be between 2m and 4m wide.

Once operational, the dams would be maintained in an empty state. Following a rainfall event, the dams would collect surface water flowing from the unrehabilitated areas of the waste rock emplacement. This water would be pumped to Tailings Dam 2 as soon as possible after water has commenced flowing into the dam. Indicatively, the dams would be equipped with pumps with a float switch, such that the pump would start automatically when water within the dam reaches a certain level. Both dirty water dams have been designed to contain a 1 in 50 year rainfall event. That is, the dams would only overflow following a rainfall event of greater magnitude than a 1 in 50 year event. This would provide a 1 in 10 risk of release of dirty water, or completely filling the dirty water dams, during the life of the Project.

The Northern Dirty Water Dam would be equipped with a 21L/s pump. This would enable the dam to be completely emptied from full in 5½ days. The Southern Dirty Water Dam would be equipped with a 50L/s pump. This would enable this dam to be completely emptied from full in just under 8 days.

Whether the dams are removed completely once rehabilitation of the Waste Rock Emplacement is complete and the dams are no longer required would be a decision made towards the end of the life of the Project and would be made in consultation with an appropriately qualified and experienced ecological consultant.

The surface water assessment indicates that the catchment area of the natural catchment would not be significantly reduced during the operation of the dirty water dams. Once the dams have been removed, the catchment would be marginally larger than the existing catchment.

This report details the methods used and the results obtained from this study that include fauna surveys conducted between August 2004 and June 2006 within the nominated survey area that initially included the Open Cut Area[1] and the Northern Biodiversity Offset Area (the Survey Area) (see **Figure 1**).

[1] Chhp and hauls roads

The report discusses and assesses the likely impacts the proposed development may have on all protected fauna[2] and listed[3] key threatening processes, and in particular, on any listed threatened species, populations and communities that were recorded or that may occur in the area and immediate environs. It has been revised to provide information requested in the *Draft Guidelines for Threatened Species Assessment* issued by DEC and DPI in 2005 pursuant to Part 3A of the EP&A Act. It makes recommendations to ameliorate and minimise any adverse impact the proposed development may have on the fauna community. Pursuant to Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act), the report aims to provide relevant information with sufficient probative value on the fauna for the Minister for Planning to determine if this Project can be approved and under what conditions.

This report also assesses the need for a Koala Habitat Management Plan pursuant to *State Environmental Planning Policy No. 44, Koala Habitat Protection,* (SEPP 44). The Singleton Local Government Area (LGA) is listed in Schedule 1 of this planning instrument.

In addition, the report discusses the Project with regard to both the State and Commonwealth listed key threatening processes, Ecological Sustainable Development (ESD) Principles and the clearing of native vegetation under the *Native Vegetation Act 2003* (NV Act). The discussion in this fauna report in regards to the NV Act relates only to the loss and fragmentation of fauna habitat and wildlife corridors in the regional context.

This report also considers whether the Project could constitute a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999 (C'th)* (EPBC Act) with regards to any fauna matters[4].

For the purposes of this report, the following terminology is used.

1. The "Fauna Survey Area" of some 443ha for sampling of fauna for the proposed Glennies Creek Open Cut Coal Mine, is located 1km east of the existing Glennies Creek Underground Coal Mine portals (see **Figure 1**).
2. The "region" referred to covers the Singleton Local Government Area (LGA).

The Survey Area does not include areas of the Project Site outside the Open Cut Area, namely the Proposed Coal Haul Route Corridors D or E, or the Camberwell Coal Handling and Preparation Plant (CHPP). These areas, which were added as late amendments, are either areas of current mining activities (Proposed Coal Haul Route Corridor E and the Camberwell

CHPP) or areas of previous intense mining-related disturbance (Proposed Haul Route Corridor D). Consequently, the potential for fauna-related impacts in these areas related to the proposed open cut is expected to be negligible, No additional fauna consideration is deemed warranted notwithstanding that these areas have not been included in the current assessment.

[2] These are defined under the *National Parks and Wildlife Act 1974*
[3] These are defined under the *Threatened Species Conservation Act 1995* (TSC Act) and the *Fisheries Management Act 1994* (FM Act).
[4] See Guidelines: website *http://www.deh.gov.au/epbc/publications/nes-guidelines.html*

The field surveys were undertaken by Dr. Leong Lim, PhD (CEUS, Mac Uni), MSc (Hons) (Mac Uni), B.Sc (Sydney), B. Laws (UTS). An expert in threatened fauna, he is the senior author of the one of the earliest threatened species management plans for an Australian fauna (Lim *et al* 1978)[5] and first Recovery Plan for a threatened species for the Threatened Species Programme for ANCA (Lim 1981)[6]. Dr Lim undertook his elective in Environmental Law on the EPBC Act and until recently was a research fellow at the Quantitative Genetics Laboratory at Macquarie University. He is a member of three IUCN/SSC specialist teams and the Kowari and Bilby Recovery Teams[7]. He has extensive survey experience in coastal, tablelands and slopes environments as well as semi-arid and arid habitats. Mr Gerry Swan is a well known herpetologist who is a research associate at the Australian Museum and has written several field guides on reptiles as well as popular books on frogs and reptiles. Mr Swan has completed a Senior Biology Certificate Course in TAFE in which he now teaches from time to time between running workshops for public interest groups and utilities (like the Police and Fire Brigade) on the conservation and handling of reptiles. He edited "Herpetofauna", the official journal for the Australian Herpetologists Society, for many years. He is currently involved in research in Yathong Nature Reserve with the University of Wollongong and NPWS (NSW), has undertaken monitoring and survey work in Queensland and NSW and has been an active member of the Australian Museum specimen collection teams.

2 SURVEY AREA AND EXISTING HABITAT

The Survey Area is located in the Upper Hunter River Valley east of the Great Dividing Range. It is within the Sydney Bioregion (Thackway and Cresswell, 1995) but is in the Hunter Subregion (see Morgan, 2001). Its characteristics are as follows.

> "SB2: Hunter Undulating to low hilly on fine-grained Permian sediments, with ironbark forests in the east, and *E. albens* woodlands in the west".

Consequently, a number of the listed threatened species, populations and communities that are listed in the sandstone habitat in the "SB7: Pittwater Dissected plateaus and ridges on Triassic sandstones, with dry sclerophyll woodlands and open forests, and heaths. Some coastal sands" are not relevant to this subregion. Albeit, the southern boundary of Singleton LGA is within the "SB4: Wollemi High altitude dissected sandstone plateaus, with numerous basalt caps. Tall dry sclerophyll forests" the fauna of concern in this subregion are similarly not relevant in the Survey Area.

The Survey Area encompasses the Open Cut Area and most of the biodiversity offset areas (see **Figure 1**). There are five vegetation communities in the Open Cut Area. GCNRC (2007b) described them as follows.

- **Community 1** – Tussock Grassland
- **Community 2** – Regenerating Native Woodland / Shrubland

[5] The Ecology and Management of the Yellow-footed Rock Wallaby, *Petrogale xanthopus*, Gray. ANPWS, NSW, NPWS and SA, NPWS.
[6] Recovery Plan for the Kowari, *Dasyroides byrneii*. ANCA and Qld, NPWS.
[7] The threatened status of the Bilby, Kowari and Yellow-footed Rock Wallaby have all been downgraded since the actions to conserve and manage them have been effectively implemented.

- **Community 3** – Narrow-leaf Ironbark, *Eucalyptus crebra* Spotted Gum, *Corymbia maculata,* with some Forest Red Gum, *E. tereticornis* Community
- **Community 4** – Rehabilitated Disturbed Land
- **Community 5** – Bull Oak, *Allocasuarina luehmannii*
- **Community 6** – Disturbed Land

An additional two vegetation communities are present within the Northern Biodiversity Offset Area. GCNRC (2007b) describes them as follows.

Community 7 – *Casuarina glauca*, Swamp Oak **Community 8** – *Casuarina cunninghamiana*, River Oak

These communities have been classified according to the floristics (ie. the presence of plant species that make up the community), thus they also suggest the potential into which these communities may be able to regenerate.

The entire Survey Area has been subject to stock grazing from the time of early European settlement. At the time of the first sampling, with the exception of the areas where post-mining rehabilitation had taken place, horses and cattle were still being grazed.

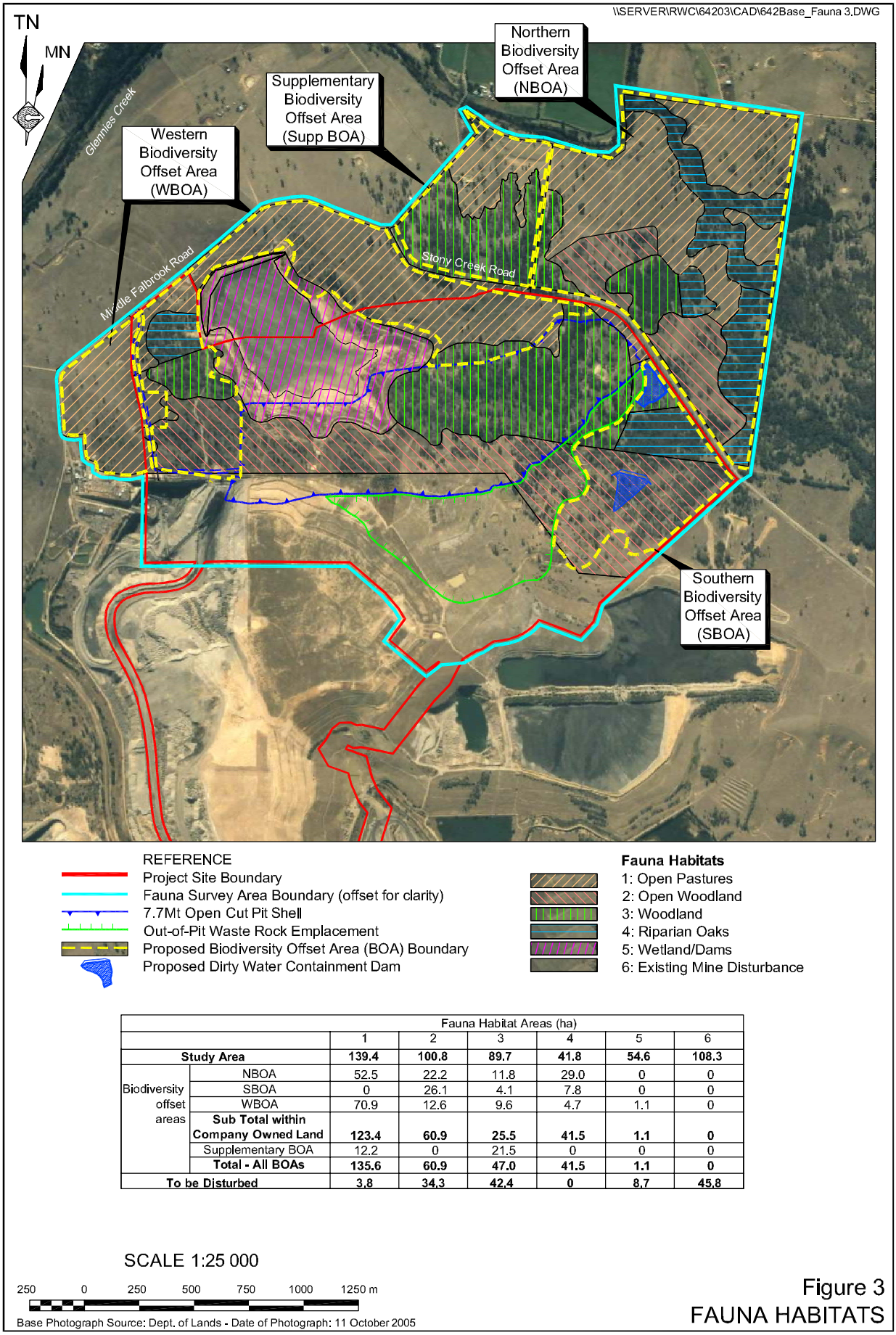
The Woodland vegetation is regrowth from previous land clearing with few hollow-bearing trees and little leaf litter. Except for the trees along an old road easement, the only scattered isolated mature trees with hollows occur in the proposed Open Cut Area.

There are remnants of rural settlement and road construction facilities in the Open Woodland areas including a roughly constructed stock yard made from local timber on the northern side at the eastern end of the east-west road reserve, and a small quarry (presumably to obtain road base material) and a blue metal dump with a small pile of this material piled up in one corner between the two road reserves. On the southern side at the northern end of the east-west road reserve there was an abandoned fibreglass speed boat and remnants of an old derelict caravan.

There was marked gully erosion in the riparian habitat between and around the clusters of oaks in parts of the Northern Biodiversity Offset Area.

The Open Cut Area is located just outside the area nominated in the Year 2020 Synoptic Plan (DMR1999) for integrated landscape mine site rehabilitation in Upper Hunter Valley although the Project Site is within the Glennies Creek Catchment (see HCMT 2003).

The following five fauna habitats and the existing mine disturbance are discernible in the Survey Area (see **Figure 3**). These are stratified according to the composition of the fauna habitat structure and the extent of each of the habitat types are summarized in **Table 2** below.



		Fauna Habitat Areas (ha)					
		1	2	3	4	5	6
Study Area		**139.4**	**100.8**	**89.7**	**41.8**	**54.6**	**108.3**
Biodiversity offset areas	NBOA	52.5	22.2	11.8	29.0	0	0
	SBOA	0	26.1	4.1	7.8	0	0
	WBOA	70.9	12.6	9.6	4.7	1.1	0
	Sub Total within Company Owned Land	**123.4**	**60.9**	**25.5**	**41.5**	**1.1**	**0**
	Supplementary BOA	12.2	0	21.5	0	0	0
	Total - All BOAs	**135.6**	**60.9**	**47.0**	**41.5**	**1.1**	**0**
To be Disturbed		**3.8**	**34.3**	**42.4**	**0**	**8.7**	**45.8**

SCALE 1:25 000

250 0 250 500 750 1000 1250 m

Base Photograph Source: Dept. of Lands - Date of Photograph: 11 October 2005

Figure 3
FAUNA HABITATS

Table 2
Fauna Habitats

		Fauna Habitat Areas (ha)					
		1	2	3	4	5	6
Fauna Study Area		**143.4**	**100.8**	**89.7**	**41.8**	**54.6**	**108.3**
Biodiversity Offset Areas	NBOA	52.5	22.2	11.8	29.0	0	0
	SBOA	0	26.1	4.0	7.8	0	0
	WBOA	67.4	12.6	9.6	4.7	1.1	0
	Sub Total within Project-related Land	**119.9**	**60.9**	**25.5**	**41.5**	**1.1**	**0**
	Supplementary BOA	12.2	0	21.5	0	0	0
	Total – All BOAs	**132.1**	**60.9**	**47.0**	**41.5**	**1.1**	**0**
To be Disturbed		**1.3**	**34.3**	**42.4**	**0**	**8.7**	**45.8**

Note 1: NBOA = Northern Biodiversity Offset Area
Note 2: SBOA = Southern Biodiversity Offset Area
Note 3: WBOA = Western Biodiversity Offset Area
Note 4: Supplementary BOA = Supplementary Biodiversity Offset Area

1. **Habitat 1 - Open Pastures** - **Plate 1**: This habitat generally corresponds to vegetation Community 1 in GCNRC (2007a).

> *"These areas are generally open grassland communities but there are areas where Eucalyptus crebra [Narrow-leaved Ironbark] or Eucalyptus moluccana [Grey Box] trees are scattered through the community. Other sections of this community support varying degrees of eucalypt regeneration with the main species regenerating being Allocasuarina luehmannii [Bull Oak], Grey Box, Narrow-leaf Ironbark and Eucalyptus fibrosa [Broad-leaved Ironbark].*
>
> *Shrubs are sometimes present as scattered individuals or small clumps and include Acacia pravifolia [Coil-pod Wattle] and Daviesia genistifolia [Broom Bitter-pea].*
>
> *Common ground layer species include Aristida sp. [Wiregrass], Anagallis arvensis* [Scarlet Pimpernell], Bothriochloa macra [Red Grass], Cheilanthes sieberi [Rock Fern], Cymbopogon refractus [Barbed Wire Grass], Dianella revoluta [Spreading Flax-lily], Digitaria brownii [Cotton Panic], Linum marginale [Native Flax], Romulea rosea* [Onion Grass] and Senecio madagascarensis* [Fireweed]." (GCNRC, 2007a).*

Although these areas adjoining Habitat 2 and 3 were not sampled with traps, they were sampled in other ways and targeted to establish the presence of the Speckled Warbler and listed threatened seedeaters like the Turquoise Parrot and Diamond Firetail, no attempt was made to deploy traps in these highly modified habitats (the Open Pasture and areas that are within the existing and adjoining mines, including the grass covered rehabilitated dumps). With its long history of agricultural land use, few native fauna are known to have been able to persist in such habitats with little or no vertical habitat component other than an exotic ground cover.

Plate 1 Open Pastures

Plate 2 Open Woodland

Note: Plates are presented in colour on the Project CD

2. Habitat 2 - Open Woodland - **Plate 2**: This habitat corresponds to Community 2 in GCNRC (2007a).

> *"There is also an area in the south eastern section of the Study Area where the landscape is covered with low mounds of stockpiled topsoil that have covered any native groundcover plants and low shrubs. Scattered through this area are Eucalyptus crebra [Narrow-leaved Ironbark] and Eucalyptus tereticornis [Forest Red Gum] trees and some regeneration of these species.*
>
> *Some occurrences of the shrubs Acacia falcata, Eremophila debile [Amulla], Daviesia ulicifolia [Broom Bitter-pea], Pultenaea sp. and Maireana microphylla [Eastern Cottonbush] are also present.*
>
> *Common ground layer species include Cirsium vulgare* [Spear Thistle], Conyza bonariensis* [Flax-leaf Fleabane], Galenia pubescens* [Galenia], Hypochaeris glabra* [Smooth Catsear], Hypochaeris radicata* [Flatweed], Medicago sativa* [Lucerne], Senecio madagascarensis* [Fireweed], Setaria sphacelata var. sericea* [Setaria cultivar Narok], Trifolium repens* [White Clover] and Trifolium subterraneum* [Subterranean Clover]."*

When it was sampled in 2004, this community, except for the stockpile areas and isolated patches of saplings with a few trees, was covered almost exclusively by exotic grasses with little or no vertical structural habitat component. These areas were overgrazed by sheep, cattle and horses as well as a large mob of Eastern Grey Kangaroos.

Subsequently, parts of Habitats 2 and 1 have been reclassified as Regenerating Native Woodland / Shrubland (GCNRC 2007b) following a recent period of strong growth of the shrub layer which includes many self-seeded local *Eucalyptus* spp. saplings. This has come about as a consequence of good rains since 2004 and the reduction in the stock grazing pressure from their partial or total exclusion from parts of the Project Site.

3. Habitat 3 - Woodland - **Plate 3**: This generally corresponds to Community 3 in GCNRC (2007a).

> *"The main tree species within this community are Eucalyptus crebra [Narrow-leaf Ironbark], Corymbia maculata [Spotted Gum], Eucalyptus moluccana [Grey Box] and Eucalyptus tereticornis [Forest Red Gum]. Other trees include Eucalyptus fibrosa [Broad-leaved Ironbark], Eucalyptus blakelyi [Blakely's Red Gum], Allocasuarina luehmannii [Bull Oak] and Angophora floribunda [Rough-barked Apple].*
>
> *Shrub species recorded include Pittosporum angustifolium [Butterbush], Acacia falcata, Pultenaea sp., Daviesia genistifolia [Broom Bitter-pea], Hardenbergia violacea [False Sarsaparilla], Lissanthe strigosa [Peach Heath], Daviesia ulicifolia [Gorse Bitter-pea], Acacia parvipinnula [Silver-stemmed Wattle], Eremophila debile [Amulla], Acacia pravifolia [Coil-pod Wattle], Lycium ferocissimum* [African Boxthorn], Notelaea microcarpa [Native Olive], Myoporum montanum [Western Boobialla], Cassinia arcuata [Chinese Shrub], Acacia decora [Western Golden Wattle] and Phyllanthus hirtellus [Thyme Spurge].*

Plate 3 Woodland

Plate 4 Riparian Oaks

Note: Plates are presented in colour on the Project CD

Common ground layer species include Aristida sp. [Wiregrass], Cheilanthes sieberi [Rock Fern], Chloris ventricosa [Tall Chloris], Chrysocephalum apiculatum [Yellow Buttons], Cymbopogon refractus [Barbed Wire Grass], Cirsium vulgare [Spear Thistle], Conyza bonariensis* [Flax-leaf Fleabane], Demodium varians [Slender Tick-trefoil], Dianella revoluta [Spreading Flax-lily], Dichondra repens [Kidney Weed], Fimbristylis sp. [Fringe Rush], Linum marginale [Native Flax], Modiola caroliniana* [Red-flowered Mallow], Lomandra sp. [Matrush], Senecio madagascarensis* [Fireweed], Pomax umbellata [Pomax], Sida rhombifolia* [Paddy's Lucerne], Opuntia stricta* [Prickly Pear], Themeda australis [Kangaroo Grass] and Xerochrysum bracteatum [Golden Everlastings]." (GCNRC, 2007a).*

The Open Woodland include clumps of scattered Community 3 trees which, while still classified floristically as vegetation Community 3 by GCNRC (2007a), structurally, they do not provide the same Woodland habitat patch quality for fauna. These areas include all the areas south of the east-west road reserve where the land surface is uneven from having been cleared and used for dumping of topsoil from the Camberwell Mine. Some large mature Ironbark and Box trees with large hollows have remained in this area with a few scatted stags and logs.

These areas also include the habitat south of Possum Skin Dam indicated as Community 3 which is structurally more characteristic of the Community 1 and/or Community 4.

The fauna sampling was concentrated on the 42ha Woodland area over and around the proposed Pit Area. This area included an Old Growth gallery along a road reserve running north-south meeting the east-west road reserve at its western end and forming a T-intersection with Stony Creek Road at the other. This gallery consists of essentially two rows of a single line of Spotted Gum and Ironbark trees on either side of an unsealed gravel road. Despite their mature age, few hollows are evident along this gallery.

The remainder of this Woodland consists of regrowth with an open understorey with little or no shrub layer in most places at the time of the 2004 sampling. There are a few large decaying logs and stumps in this area representing signs of distant past logging and recent timber cutting for firewood and fence posts. Old fire scars can also be seen in the few scattered large Box and Ironbark trees over 30m in height in this area of Woodland suggesting the existence of a previous Tall Forest.

There were signs of apparent past heavy stock grazing and at the time of sampling cattle and sheep were freely grazing the area.

Since the initial sampling in 2004, the shrub layer has been allowed to regenerate with the reduction and recent exclusion of stock grazing in those areas. No pre-European settlement trees have survived in this woodland remnant and none in the Open Cut Area, even as stags. As a consequence, there are little or no signs of tree hollows even in the largest trees over 20m high (see GCNRC 2007b). Ironbarks and Spotted Gums do not form many tree hollows until they are very old (probably around 100 years). The cohort in this woodland remnant is likely to be a post-WWII regeneration and the trees are unlikely to develop hollows for a few decades yet.

4. Habitat 4 - Riparian Oaks - Plate 4. This corresponds to Communities , 5, 6 and 7 in GCNRC (2007a).

> *"Allocasuarina luehmannii* [Bull Oak] is the dominant species within this community with mature trees and regeneration present - the latter particularly around the perimeter of the main occurrences. *Eucalyptus crebra* [Narrow-leaf Ironbark], *Angophora floribunda* [Rough-barked Apple] and *Eucalyptus moluccana* [Grey Box] trees are present in some sections to varying degrees. Shrub species recorded include *Acacia parvipinnula* [Silver-stemmed Wattle], *Acacia paradoxa* [Kangaroo Thorn], *Cassinia laevis* [Cough Bush], *Cassinia arcuata* [Chinese Shrub], *Acacia pravifolia* [Coil-pod Wattle] and *Myoporum montanum* [Western Boobialla].
>
> Ground layer species include *Aristida* sp. [Wiregrass], *Cheilanthes sieberi* [Rock Fern], *Chrysocephalum apiculatum* [Yellow Buttons], *Cymbopogon refractus* [Barbed Wire Grass], *Dianella revoluta* [Spreading Flax-lily] and *Eragrostis brownii* [Cotton Panic]." (GCNRC, 2007a).

These are areas along the First Order streams flowing northeast from the junction of the two road reserves down towards the Second Order streams into Stony and Tieny Creeks across Stony Creek Road.

The patch quality of this riparian habitat has remained relatively intact due to the poor grazing value of the understorey with is largely covered in pine needles or nearly bare of any other ground cover. However, serious structural damage to this riparian gallery is evident from past over stocking where improved pastures and/or cultivation are evident by the contouring of cleared areas in the Northern Biodiversity Offset Area.

At the edges of these galleries an ecotone of Woodland tree species forms a structurally and floristically rich band of transitional habitat. This ecotone is however mostly absent from most of this riparian gallery in the Northern Biodiversity Offset Area except in the proximity of Stony Creek Road.

All these riparian areas were excluded from the proposed mine layout design as a consequence of early advice from the current consultants. There are many mature trees in these remnants and the larger trees have peeling barks as they senesce.

5. Habitat 5 - Wetland / Dams - Farm dams and Possum Skin Dam - **Plate 5**

No vegetation description was given in GCNRC (2007a) other than "Rehabilitated Disturbed Land" but some of these dams have various extents of waterweeds in them. Species include Cumbungi, *Typha* sp., Spike Rush, *Eleocharis* sp. (and probably *Cyperus* sp), Red Azolla, *Azolla filiculoides var. rubra*, Swamp Lily, *Ottelia ovalifolia*, Water Primrose, *Ludwigia peploides ssp. montevidenesis*, (Cunningham, G. pers comm.).

The extent to which they cover the dams and their conditions are dependent on the amount of rainfall that is occurring locally and the seasonal evaporation rate. In the case of Possum Skin Dam, this is also affected by the water pumped out from the Glennies Creek Underground Mine. This water is getting increasing saline.

Plate 5 Wetland – Dam

Note: Plate is presented in colour on the Project CD

Several other smaller dams exist throughout the Project Site. At least seven are located in the Open Woodland but none in the Woodland over the proposed Pit Area. Four dams are located along the drainage lines in which the proposed Dirty Water Dams will be located.

There are also numerous waterholes along Tieny Creek but all were dry at the time of sampling except for some evidence of soaks on the sides of the deeper holes and erosion walls along the creek bed.

3 METHODS AND MATERIALS

A variety of methods were used to sample the fauna. Some of the methods used targeted more than one fauna group. Trap and recording sites are shown on **Figure 4**. Fauna surveys were carried out to record the fauna over the Survey Area between August 2004 and June 2006 (see **Appendix 3** for details). The survey methods used and intensity of sampling is generally in accordance with NPWS (2004)[8], modified in this instance to take into account the extensive areas of rehabilitated land in the early stages of revegetation and cleared grazing land in the Survey Area.

[8] It should be noted that nowhere has it been stated that NPWS (2004) document applies to Pt 3A of the EP& A Act. Cognisance should also be given to the fact that the original survey in October 2004 was conducted prior to the adoption of these guidelines in 2005 after public comments for the purpose of Part 4 and Part 5 of the EP & A Act. CES representing the Environment Institute of Australia and NZ was part of the Advisory Committee to NPWS which provided advice for the formulated these guidelines.

Information about the fauna community within the Survey Area was supplemented with a number of published and other unpublished sources[9]. See Barrett *et al* (2003), Blakers *et al* (1981), Churchill (1998), NPWS (2002), Strahan (1995), Ayers *et al* (1996-99), NPWS (1999) and Cogger (2000). Field identifications were done with Anstis (2002), Barker *et al* (1995), Triggs (1996), Slater *et al* (1994), Swan *et al* (2004) and Parnaby (1992). The bat calls were identified with the assistance of Reihold *et al* (2001) and Pennay *et al* (2004).

3.1 Amphibians

Systematic sampling of all water holes was conducted to identify the frog species in and around the around Study Area. See **Appendix 4** for more details.

Pitfall trap lines comprising 2 PVC pipes 150mm diameter x 600mm deep with a 30.0 cm high 10.0m drift fence extending 2.0 m each side of the pitfall traps were located in the various habitat types at sites P1-P4 (see **Figure 4**). Two tube traps[10] were also installed between the pitfall traps, one each side of the drift fence.

These traps were located in positions that will maximise the capture of reptiles associated with a particular habitat and according to their behaviour. They are usually deployed in adjoining areas of open habitat where they bask and hunt, and not in the midst of any stratified habitat type. Though designed to target reptiles, both the pitfall and tube traps also catch small mammals and amphibians.

This trap effort with four traps at each site over four nights is equivalent to 64 trap nights which is adequate for a 300ha site estimating from a basis of 24 trapnights of the first 50ha and a multiple of this for each subsequent 100ha area (see DEC 2004). This trap effort is sufficient for Habitat 2, 3 and 4 on the Project Site.

The Survey Area is subjected to cattle grazing and the locations of pitfall traplines were limited to areas away from the open paddocks. Searches for frogs were made during the early evenings along the drainage lines (natural and artificial) draining into Tieny Creek, and around all the dams within the Survey Area and in adjoining the areas that are within sight and hearing distance of the Survey Area. Tieny Creek is ephemeral at this location and has few, if any, permanent water holes within the Study Area.

Calls of *Litoria aurea* were broadcast during the day in the Spring 2004 survey at all the water holes that had water in them including the southeastern edges of Possum Skin Dam. Approximately 20 minutes were spent at each location. The timing of this survey was not considered optimal for amphibians (November to March is generally considered optimum times to sample frogs) it is, however, not expected to negate the effective sampling for Bell Frogs which are known to bask in the sun even in mid-Winter.

[9] These sources included a number of EISs for proposed mines in the Upper Hunter Valley but those that were before 1990 were of limited assistance providing any useful information on the local fauna.

[10] Called a pipe-trap in Lohoefener and Wolfe (1984)

Plate 6 Old Growth Gallery

Note: Plate is presented in colour on the Project CD

3.2 Birds

The birds within sight and sound distance around the Survey Area were identified from calls and direct observation each morning along the Elliott trap line (T1 to T4) and opportunistically throughout the day. Effectively each of these transects was approximately 300m in length. The bird census durations amounted to a total of 30 minutes along each transect although each trap line took up to 1hr to traverse depending on the capture rate in the traps.

Although the main census was in early spring (early October 2004), winter samples (late August) were supplemented by additional incidental observations during supplementary samplings in early September 2005 and in autumn (May and June 2004).

The calls of the relevant listed threatened owl species were broadcast from positions C1-C4 (**Figure 4**) and C5-C10 (**Figure 5**) to determine the presence of these species in the area. The 10 nights sampling bring it beyond the 90% probability of detection level for locating rare owls.

Special effort was made to locate Grey-crowned Babblers and their nests on and in the areas adjoining the Survey Area (see **Figure 7**). Subsequent targeted surveys covered all accessible areas within a 10km radius of the Open Cut Area (see **Figure 6**).

3.3 Mammals

A variety of methods were used to sample mammals as discussed below. **Figure 4** and **Figure 5** display trap deployment positions and spotlighting transects. Additionally, each day, ground searches for signs and body remains were carried out throughout the Survey Area. These include all identifiable items presented in Triggs (1996).

No large Elliott traps were used on the ground and no sand traps were deployed. Instead additional time was spent in habitat searches for signs of small and medium size mammals in areas were regular use are most likely, viz soft sandy areas adjacent to and between logs on the ground and animal tracks leading down to drainage lines and water holes. The lack of ground cover in the Survey Area suggests that medium size listed threatened species like Spotted-tail Quoll is unlikely to occur locally.

Targeted mammal sampling methods included the following.

3.3.1 Small Mammals

Elliott live mammal traps (Type A, Elliott Scientific Equipment, Upwey, Victoria) were set in spring, along 4 lines through the remnant vegetation and through open areas as indicated on **Figure 4**. At each site (identified as T1 to T4 on **Figure 4**), 50 traps were set for 4 nights. Each trap was placed about 10 m apart in a line and baited with a mix of rolled oats, peanut butter, dog food and sesame oil.

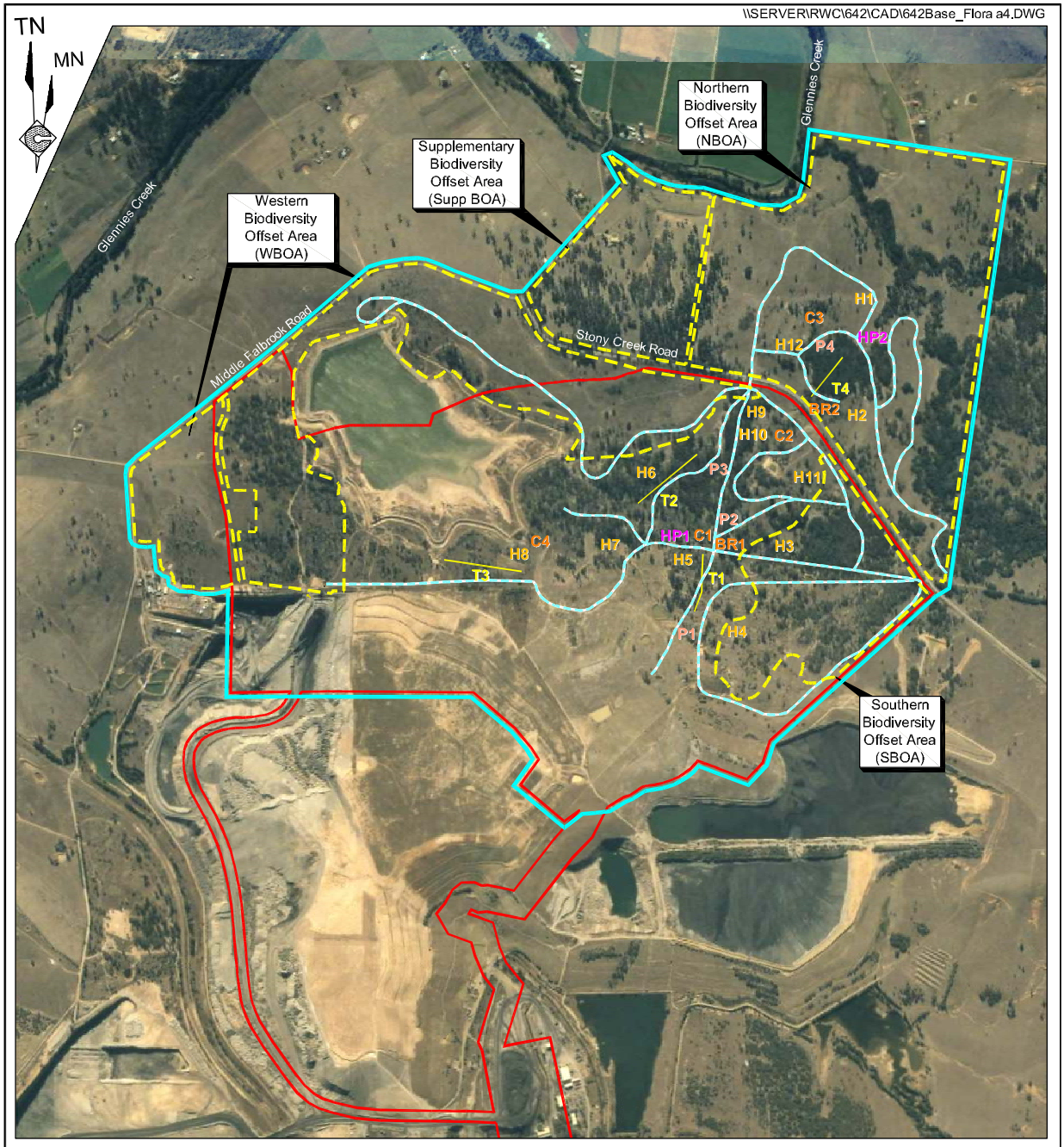


Figure 4
FAUNA SAMPLING - 2004 - 2005

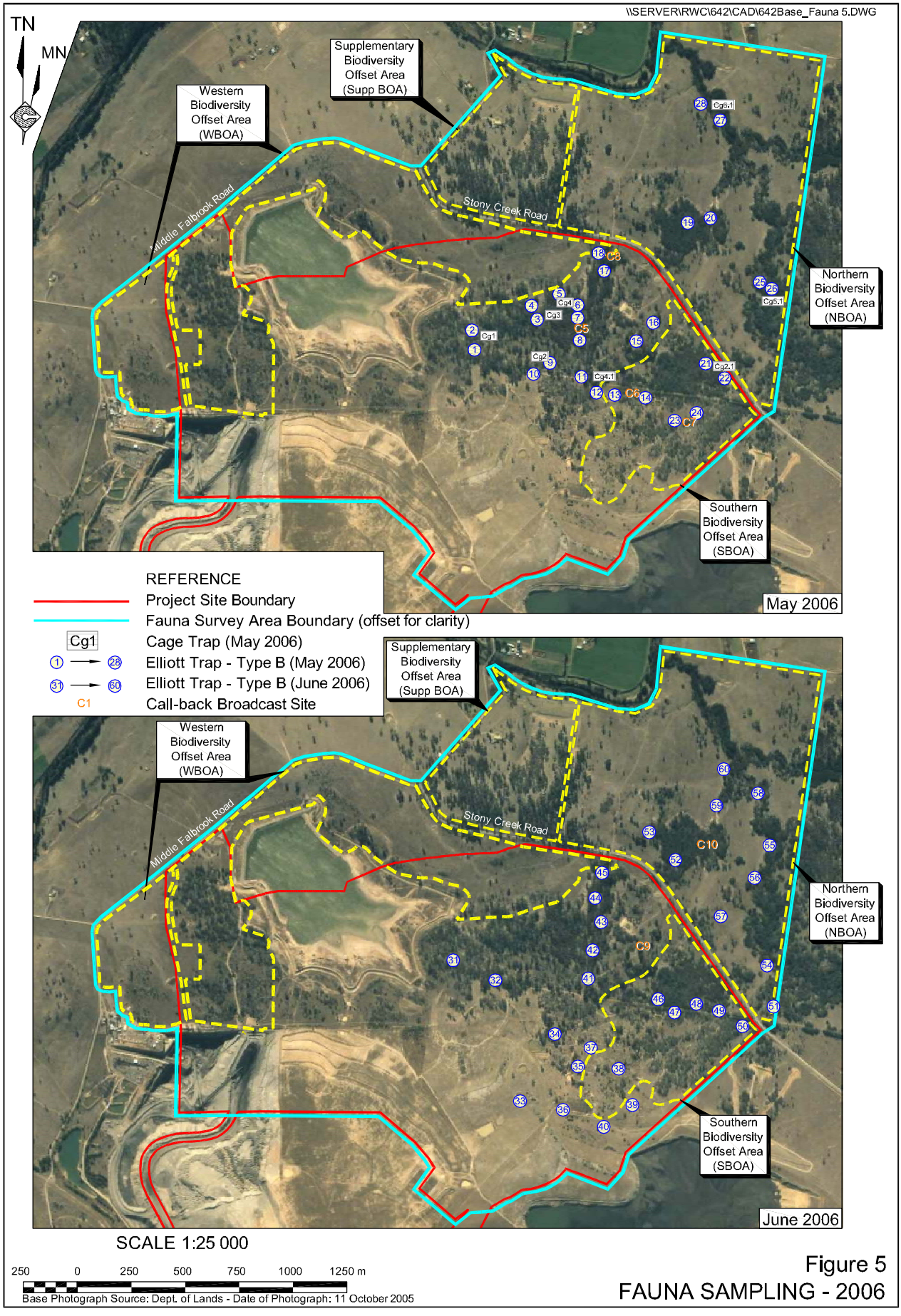


Figure 5
FAUNA SAMPLING - 2006

In the spring sampling the traps at T4 were closed a day early to avoid trap mortality from repeated entry by the same lactating individuals of *Antechinus*. The trap rate over the 3 day period was between 13% and 20%.

A total of 375 trapnights was achieved during the survey with less than 2% trap return in all except on T4. This trapping effort should be sufficient to cover an area up to 350ha (see DEC 2004). This trapping effort is considered sufficient for the survey area when Habitat 1 and the area occupied by current mining activities are excluded from the trap deployment design for this Project Site.

Twelve hair sampling tube sites (H1 to H12 – see **Figure 4**), were established and baited with the same bait as the Elliott traps. Two traps were deployed at each site, one on the ground and one in nearby trees at about 6m height. The tree trunks in the vicinity were sprayed with a honey solution to attract arboreal mammals. These traps were left for over 14 days. As well as small mammals, hair tubes also sample hairs of rare and trap-shy large and medium size mammals.

These traps are double ended consisting of a large end (measuring 100mm x70mm) and a small end (measuring 100mm x 35mm). Each trap site therefore represents effectively four hair sampling tubes. The 12 sites are thus the equivalent of 48 hair tubes. When exposed for 14, instead of the 4 days recommended, the sampling effort well exceeds both the hair tubes and arboreal hair tube requirements in NPWS (2004).

3.3.2 Microbats

Recordings of bat calls were made from mobile and stationary positions (BR) using Anabat-CF ultrasonic recorders between (Titley Electronics, Ballina, N.S.W.). Harp traps were deployed for two nights at location HP1 and two nights at HP2 during the spring survey (**Figure 4**).

The sampling efforts for microbats (see **Appendix 3**) which have included overnight recordings and continual mobile recordings over the spotlighting transects as well as targeting the Old Growth and Riparian galleries and the waterholes on the Project Site exceeded the 90% detection levels required as observed by Richards (2001) and Duffy *et al* (2000).

3.3.3 Nocturnal Species and Arboreal Mammals

Two 2-hour spotlight searches were conducted in the evenings during the spring and winter samples in the Survey Area using a 50-watt spotlight on each side of a slow moving vehicle. Each spotlight transect (**Figure 4**) was traversed at least once per night and the fauna observed noted.

Recorded calls of the listed threatened species in **Table 3** were played at points C1-C4 (**Figure 4**) and C5-C10 (**Figure 5**). The areas around these sites were searched with a spotlight for 10 minutes after an initially listening watch of approximately the same duration. Each five minute call sequence was followed by up to a five minute listening watch. At the completion of the call sequences a 10 minute search of the surrounding area and subsequent searches were conducted opportunistically while spotlighting over the Survey Area.

Table 3
List of Relevant Listed Threatened Species used in the Call Broadcasts

Scientific Name	Common Name
1. *Phascolarctos cinereus*	Koala
2. *Petaurus norfolcensis*	Squirrel Glider
3. Petaurus australis	Yellow-bellied Glider
4. *Ninox strenua*	Powerful Owl
5. *Ninox connivens*	Barking Owl
6. *Tyto novaehollandiae*	Masked Owl
7. *Burhinus grallarius*	Bush Stone-curlew

3.3.4 Supplementary Trapping

Ten baited cage traps were deployed on the ground in the Survey Area over 4 nights in May 2006 to sample medium size mammals (see **Figure 5**). At these locations, a couple of Elliott traps (Type B) were located on 2.0m high platforms on the side of the 2 nearest larger tree trunks around these cage traps. A generous helping of honey was used in the peanut butter-rolled oats-dog food mixture for the bait. Honey was also sprayed on the trunks of the trees on which these traps were located.

This represented a trapping effort of 80 trap nights for the arboreal traps and 40 trap nights for the cage traps which is considered adequate for an area up to 300ha which would cover the Woodland and the Open Woodland with scattered mature trees.

The cage trap and Elliott traps were relocated to another position when consecutive captures of the same species occurred over successive nights at a particular location.

A subsequent above-ground sampling regime in June 2006 was applied to target Phascogale using 30 Elliott Traps (Type B) over two nights out over the Study Area concentrating on the areas that were not fully covered in the earlier surveys. See **Figure 5** and **Appendix 3** for details. This represents a further 60 trap nights bringing the total to 140 trap nights. The three locations where Phascogales were caught are presented in **Figure 6**.

3.4 Reptiles

In addition to the pitfall traps (see Section 3.1), searches were made for reptiles in the leaf litter and along the riparian habitat, in the Bull Oak Community and the denser habitats along the low lying areas, as well as under rocks, bark and logs in the Survey Area.

No further duplication for pitfall traps was attempted due to the early October sample. Instead, additional effort was concentrated on habitat searches by a highly experienced herpetologist in Mr Swan. This was considered more productive in locating reptiles at this time of the year when the reptiles may not be very active.

From approximately 11.00am to 4.00pm, the whole Open Cut Area and the riparian habitat were systematically searched.

Particular attention was made to record turtles that may occur along the drainage and creek lines as well as in the dams.

3.5 Invertebrates

There are no invertebrates listed as threatened in this region. Consequently, no specific sampling was undertaken and no further attention to invertebrates is warranted in assessing this proposal.

3.6 Fish

The fish fauna was not targeted for sampling as no listed threatened fish species are likely to occur in the Survey Area where there are only 1st Order streams or likely to be adversely affected in or near the proposed mine. There will be no significant alterations to the runoff pattern and the existing natural flow of the drainage in the Survey Area into Tieny Creek and Stony Creek will not be further altered. As there will not be any water discharge from the proposed mine into any of the streams, no further attention to the fish fauna in the Glennies Creek catchment is warranted for this proposal. Notwithstanding the highly stressed state the creek is in, it still has most of its native fish fauna (see HCMT 2003).

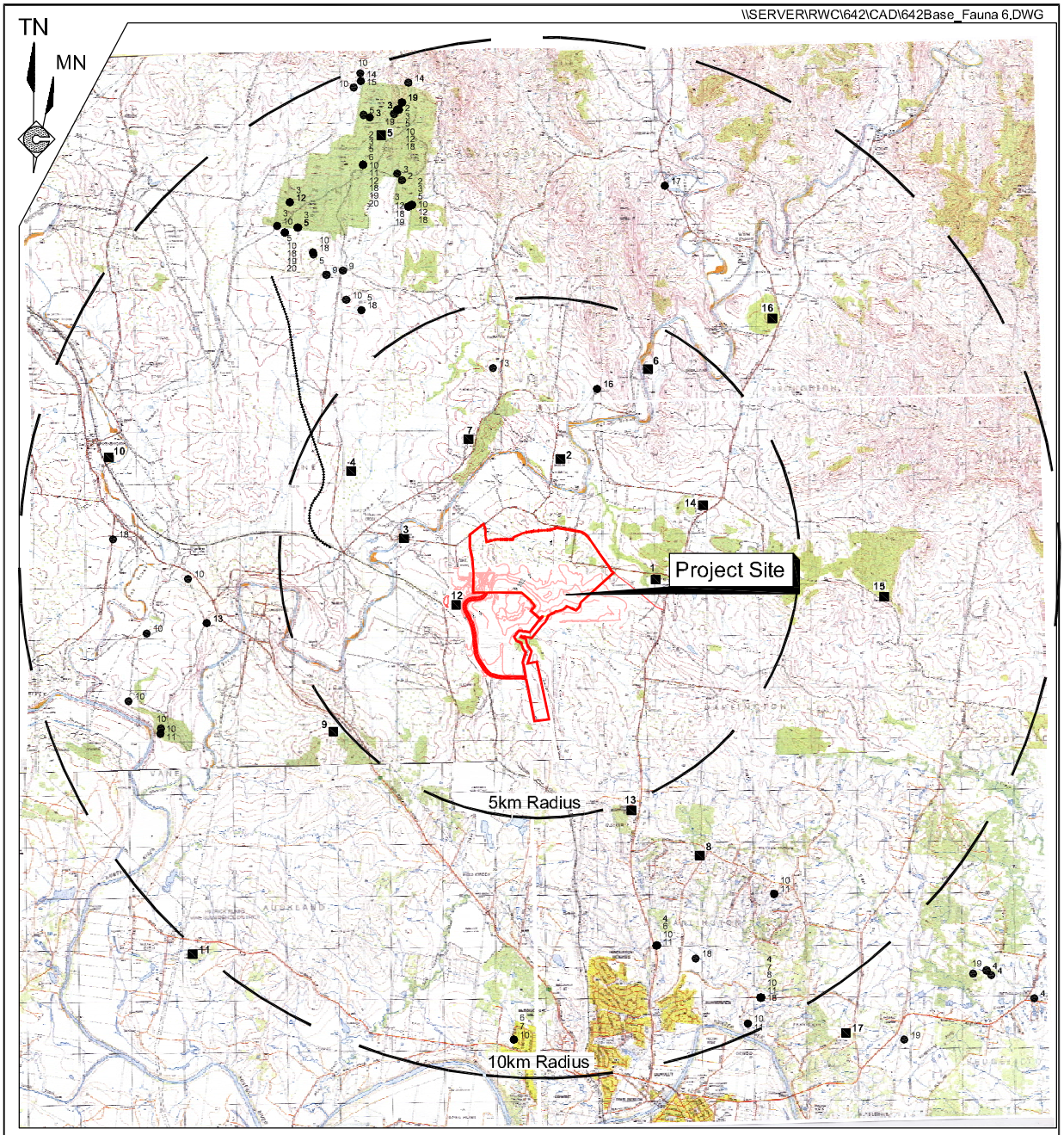
4 REGIONAL FAUNA

An initial checklist of the regional fauna was compiled from the NPWS *Atlas of NSW Wildlife* (Singleton LGA October 2004), Strahan (1995), Swan *et al* (2004), Barrett *et al* (2003), Parnaby (1992), Cogger (2000), Churchill (1998), Ayers *et al* (1996-99), NPWS (1999) and other published and unpublished sources.

The current fauna checklist for the Singleton LGA, showed that 36 species of frogs, some 240 birds, 79 mammals and 69 reptiles species have been recorded on the data base (NPWS 2006; see **Appendix 1**).

4.1 State Listed Threatened Terrestrial Vertebrates

The available data on the distribution and abundance of the threatened fauna (listed under the NSW *Threatened Species Conservation Act 1995*) in the Singleton LGA suggest the following (see **Figure 6** and **Appendix 2**).



REFERENCE
Project Site Boundary
Threatened Species Recorded Location
Grey-crowned Babbler (Regional Survey Location)

Reference	Common Name
1	Barking Owl
2	Black-chinned Honeyeater (eastern subspecies)
3	Brown Treecreeper
4	Brush-tailed Phascogale
5	Diamond Firetail
6	Eastern Bentwing-bat
7	Eastern Freetail-bat
8	Gang-gang Cockatoo
9	Green and Golden Bell Frog
10	Grey-Crowned Babbler (eastern subspecies)
11	Grey-headed Flying-fox
12	Hooded Robin
13	Koala
14	Masked Owl
15	Powerful Owl
16	Red Goshawk
17	Red-backed Button-quail
18	Speckled Warbler
19	Spotted-tailed Quoll
20	Squirrel Glider

SCALE 1:125 000

2 0 2 4 6km

Base Map Source: Camberwell (1977) & Singleton (2001) 1:25 000 Topographic Maps

Figure 6
REGIONAL FAUNA

Note: A colour version of this figure is available on the project CD

4.1.1 Amphibians

There are no less than 36 amphibian species that can be expected to occur in the region. Eight are listed as threatened, see (**Table 4)**.

Table 4
Listed Threatened Frogs

Scientific Name	Common Name	Status
1. *Litoria aurea*	Green and Golden Bell Frog	E1
2. *Litoria booroolongensis*	Booroolong Frog	E1
3. *Mixophyes balbus*	Stuttering Frog	E1
4. *Litoria daviesae*	Davies' Tree Frog	V
5. *Litoria littlejohni*	Littlejohn's Tree Frog	V
6. *Heleioporus australiacus*	Giant Burrowing Frog	V
7. *Philoria sphagnicolus*	Sphagnum Frog	V
8. *Pseudophryne australis*	Red-crowned Toadlet	V

None of these listed threatened species are relevant to the Open Cut Area, except the Green and Golden Bell Frog. This frog was not recorded on or near the Survey Area but is known to occur in the vicinity within 6km to the north in Bettys Creek and was recorded in Mt Owen EIS (HVCC 2003). Several of the farm dams that were holding water more regularly have waterweeds, viz *Typha* sp. and *Eleocharis* sp., which are characteristic of ponds favoured by *L. aurea*.

4.1.2 Birds

At least 240 species of birds could occur in the region, of which 21 are listed as threatened, see **Table 5**.

Table 5
Listed Threatened Birds

Scientific Name	Common Name	Status
1. *Xanthomyza phrygia*	Regent Honeyeater	E1
2. *Lathamus discolor*	Swift Parrot	E1
3. *Erythrotriorchis radiatus*	Red Goshawk*	E1
4. *Ephippiorhynchus asiaticus*	Black-necked Stork (W)	E1
5. *Hamirostra melanosternon*	Black-breasted Buzzard	V
6. *Ixobrychus flavicollis*	Black Bittern (W)	V
7. *Pyrrholaemus sagittatus*	Speckled Warbler*	V
8. *Climacteris picumnus*	Brown Treecreeper*	V
9. *Stagonopleura guttata*	Diamond Firetail*	V
10. *Grantiella picta*	Painted Honeyeater	V
11. *Melithreptus gularis*	Black-chinned Honeyeater*	V
12. *Pachycephala olivacea*	Olive Whistler	V
13. *Melanodryas cucullata*	Hooded Robin*	V
14. *Pomatostomus temporalis*	Grey-crowned Babbler**	V
15. *Neophema pulchella*	Turquoise Parrot*	V
16. *Ninox connivens*	Barking Owl*	V
17. *Ninox strenua*	Powerful Owl	V
18. *Tyto novaehollandiae*	Masked Owl	V
19. *Tyto tenebricosa*	Sooty Owl	V
20. *Callocephalon fimbriatum*	Gang-gang Cockatoo	V
21. *Calyptorhynchus lathami*	Glossy Black-Cockatoo	V

W denotes wetland species
* denotes species that has been recorded within 10km of the Open Cut Area.
** denotes recorded during this survey

There are at least seven exotic species known to occur in this region (see **Appendix 1**).

4.1.3 Mammals

At least 77 species of mammal, including 13 introduced species, may occur in the region. The mammal species that are listed as threatened including eight bats[11] are listed in **Table 6** and **Table 7**.

Table 6
Listed Threatened Non-flying Mammals

Scientific Name	Common Name	Status
1. Petrogale penicillata	Brush-tailed Rock-wallaby	E1
2. Pseudomys oralis	Hastings River Mouse	E1
3. Phascolarctos cinereus	Koala*	V
4. Cercartetus nanus	Eastern Pygmy-possum	V
5. Dasyurus maculatus	Spotted-tail Quoll	V
6. Phascogale tapoatafa	Brush-tailed Phascogale**	V
7. Macropus parma	Parma Wallaby	V
8. Thylogale stigmatica	Red-legged Pademelon	V
9. Petaurus australis	Yellow-bellied Glider	V
10. Petaurus norfolcensis	Squirrel Glider*	V
11. Aepyprymnus rufescens	Rufous Bettong	V
12. Potorous tridactylus	Long-nosed Potoroo	V

* denotes species that has been recorded within 10km of the Open Cut Area.
** denotes recorded during this study.

Table 7
Listed Threatened Bats

Scientific Name	Common Name	Status
1. Mormopterus norfolkensis	Eastern Freetail-bat**	V
2. Falsistrellus tasmaniensis	Eastern False Pipistrelle	V
3. Miniopterus schreibersii oceanensis	Eastern Bentwing-bat**	V
4. Miniopterus australis	Little Bentwing-bat	V
5. Myotis adversus	Large-footed Myotis	V
6. Chalinolobus dwyeri	Large-eared Pied Bat	V
7. Scoteanax rueppellii	Greater Broad-nosed Bat	V
8. Pteropus poliocephalus	Grey-headed Flying-fox*	V

* denotes species that has been recorded within 10km of the Open Cut Area.
** denotes recorded during this study.

The records of the *Petrogale penicillata* in the NPWS Wildlife Atlas database (see NPWS 2004) are confined to the Wattagan Mountains and are not of any relevance to the Open Cut Area. It is a species that requires topographically complex rocky habitat with rockpiles, scree slopes and steep cliffs with benches, none of these are evident in the survey area.

There are recent records of an isolated local *Phascogale tapoatafa* population occurring to the east of Singleton and isolated records in the Mount Royal National Park, 15km to the northeast of the Open Cut Area.

[11] A ninth species of microbat, the Eastern Long-eared Bat, *Nytophilus timoriensis*, often listed as occurring in the region is agruably out of its normal range of distribution.

4.1.4 Reptiles

At least 69 species of reptiles may occur in the region but there is only one record of a listed endangered species - the Broad-headed Snake, *Hoplocephalus bungaroides* in the Singleton LGA.

Hoplocephalus bungaroides was listed as endangered species and the removal of bushrocks was listed as a key threatening process in response to the destruction of its rocky habitat. This snake is not relevant to the Open Cut Area as the Project does not involve any rocky outcrop or escarpment environments that this snake inhabits.

4.2 Native Fish

The Open Cut Area is not within the distributional range of any fish listed as threatened under the F M Act. It is noteworthy that the Open Cut Area is in the catchment of the Hunter River while the western limits of the Singleton LGA lie in the Macquarie River Catchment. No sampling for this fauna group was attempted for this reason and further discussion can be found in Section 4.4 below.

4.3 Invertebrates

No invertebrate species has been listed as threatened in the region defined by Singleton LGA.

4.4 Environment Protection and Biodiversity Conservation Act

A search for Commonwealth listed threatened species under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), international agreement listed species, threatened populations and ecological communities and key threatening processes in the Department of Environment and Heritage on-line data base centered on the Singleton LGA in May 2005 revealed the following.

4.4.1 Threatened Communities

The only listed threatened ecological community that may occur in this area is the Grassy White Box Woodlands community. This community does not occur on the Open Cut Area (GCNRC, 2007a).

4.4.2 Threatened Species

The Department of Environment and Heritage database suggests the listed threatened fauna species in **Table 8** may occur in the Survey Area.

The listed fish only occur in the Macquarie River Catchment which forms part of the western limits of Singleton LGA and are not relevant to the Open Cut Area which is in the Hunter River Catchment. No further attention to this fauna group is warranted for any consideration regarding this Project.

The Broad-headed Snake is the only listed endangered reptile in the region. The removal of bushrocks was listed as a key threatening process in response to the perceived destruction of the habitat of this species around Sydney. This species is not relevant to the Open Cut Area as The Project does not involve any rocky outcrop or escarpment.

4.4.3 Migratory Species

Terrestrial and wetland species (JAMBA and CAMBA) covered by migratory provisions of the EPBC Act that may occur on and around the Open Cut Area are listed in **Table 9**.

Table 8
Listed Threatened Fauna Species under the EPBC Act

Scientific Name	Common Name	Status
Frogs		
1. Litoria aurea	Green and Golden Bell Frog	Vulnerable
2. Mixophyes balbus	Stuttering Frog	Vulnerable
3. Mixophyes iteratus	Giant Barred Frog	Endangered
Birds		
1. Lathamus discolor	Swift Parrot	Endangered
2. Rostratula benghalensis australis	Australian Painted Snipe	Vulnerable
3. Xanthomyza phrygia	Regent Honeyeater	Endangered
Mammals		
1. Chalinolobus dwyeri	Large-eared Pied Bat	Vulnerable
2. Dasyurus maculatus	Spotted-tailed Quoll	Endangered
3. Nyctophilus timoriensis	Eastern Long-eared Bat	Vulnerable
4. Petrogale penicillata	Brush-tailed Rock-wallaby	Vulnerable
5. Potorous tridactylus	Long-nosed Potoroo	Vulnerable
6. Pseudomys oralis	Hastings River Mouse	Endangered
7. Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable
Reptile		
1. Hoplocephalus bungaroides	Broad-headed Snake	Vulnerable
Fishes		
1. Maccullochella pallid	Murray Cod	Vulnerable
2. Macquaria australasica	Macquarie Perch	Endangered
Invertebrates		
Nil	_	_

Table 9
Listed Migratory Species

Scientific Name	Common Name
1. Haliaeetus leucogaster	White-bellied Sea-Eagle**
2. Monarcha melanopsis	Black-faced Monarch
3. Monarcha trivirgatus	Spectacled Monarch
4. Hirundapus caudacutus	White-throated Needletail
5. Myiagra cyanoleuca	Satin Flycatcher
6. Rhipidura ruffirons	Rufous Flycatcher
7. Xanthomyza phrygia	Regent Honeyeater
8. Gallinago hardwickii	Latham's Snipe
9. Rostratula benghalensis australis	Australian Painted Snipe
** denotes recorded during this study.	

See Section 6.3 for a discussion of these EPBC Act Listed migratory and marine species.

4.4.4 Listed Marine Species

Notwithstanding those that have already been listed as threatened or migratory species that are also marine species, the listed marine species in **Table 10** may also occur within the Open Cut Area.

Table 10
Listed Marine Species Not Included in Table 8

Scientific Name	Common Name
1. Apus pacificus	Fork-tailed Swift
2. Ardea alba	Great Egret
3. Ardea ibis	Cattle Egret
4. Merops ornatus	Rainbow Bee-eater

4.4.5 Listed Sites

There are no World Heritage Properties, National Heritage Places, Ramsar Sites or Critical Habitats within 10km of the Open Cut Area.

5 FAUNA IN THE SURVEY AREA

Other than some of the seasonal and procedural considerations discussed in Section 3, the results of this survey have to be viewed in perspective with the limitations from its relative small size, isolated, the modified and fragmented nature of this habitat remnant on a landscape scale. This is reflected in the lower species abundance as well as the deficiency from lack of intra-habitat species diversity (richness) when compared to the regional diversity in the Singleton LGA as well as the Upper Hunter Region[12].

[12] It is inappropriate to use species richness presdiction for the Hunter Catchment Management Authority area that includes species for the whole of the Hunter Valley, including the Lower Hunter Valley for this purpose.

Notwithstanding the unbalanced sampling effort both in the habitat stratification and from targeting of areas that will be subjected to more direct impact from the proposal, the sampling strategy while subject to inherent bias, is considered both desirable and appropriate for the purpose of assessing the likely impact on the fauna community of this Project.

The fauna recorded during the various surveys in the Glennies Creek Survey Area and the adjoining areas are as follows.

5.1 Amphibians

The sampling of amphibians included habitat searchers in refugias under leaf litter, rocks and logs in the adjoining the dry stream beds and dams. No further intra-habitat diversity is expected from any additional sampling effort. Calls recorded from subsequent sampling periods confirmed this assertion.

Table 11 lists the frog species that were recorded on or in areas adjoining the Survey Area during the spring survey.

Table 11
Frogs Recorded in the Glennies Creek Survey Area

Scientific Name	Common Name	Occurrence
1. *Litoria caerulea*	Green Tree Frog	D
2. *Litoria peronii*	Peron's Tree Frog	D
3. *Litoria latopalmata*	Broad-palmed Frog	D
4. *Litoria fallax*	Eastern Dwarf Tree Frog	D
5. *Uperoleia laevigata*	Smooth Toadlet	D
6. *Crinia signifera*	Common Eastern Froglet	D, C
7. *Limnodynastes tasmaniensis*	Spotted Marsh Frog	D, C
8. *Limnodynastes dumerilii*	Eastern Banjo Frog	D
9. *Limnodynastes fletcheri*	Fletcher's Frog	D, C
D – Dams	C – Ponds in Creek or other drainage lines	

All the nine species of frogs recorded in and around the Open Cut Area are common species.

5.2 Birds

The lack of independence arising from the close proximity of the bird transects and the large number of zero cells in the data set as well as large fluctuations in numbers recorded for some of the species, only presence/absent data is presented here to reflect the bird community in the Fauna Survey Area. Over half of the number of species recorded in this Fauna Survey Area was recorded from incidental sightings (including the Open Pastures) or from targeted searchers around the various dams, including Possum Skin Dam.

Other than resident territorial species such as the aggressive Noisy Minor which has a more uniform distribution in the Woodland, the density in this bird community varied with the local movements of the communal nesting species like the White-wing Chough, Apostlebird and Grey-crowned Babbler. These fluctuations in abundance were also affected by transit of flocks of Silvereyes and Common Starlings that were present only episodically in Study Area.

Other than the two exotic species and the listed vulnerable species – the Grey-crowned Babbler - all identified species are protected native species. **Table 12** lists the 61 bird species observed in or near the Survey Area during the two surveys.

The locations of the Grey-crowned Babbler sightings and nests are indicted in **Figure 7** where this species was only recorded at locations 2 and 4 of the 17 sites visited during that survey and its local occurrence within a 10km radius is presented in **Figure 6**.

Table 12
Birds Recorded in and Around the Glennies Creek Survey Area

Page 1 of 2

Scientific Name	Common Name	Early Spring	Late Winter
		Sept / Oct 04	Aug 04 and May/June 06
1. Cygnus atratus	Black Swan	*	*
2. Chenonetta jubata	Australian Wood Duck	*	*
3. Anas platyrhynchos #	Mallard	*	*
4. Anas gracilis	Grey Teal		*
5. Phalacrocorax varius	Pied Cormorant		*
6. Poliocephalus poliocephalus	Hoary-headed Grebe	*	*
7. Himantopus himantopus	Black-winged Stilt	*	
8. Anas superciliosa	Pacific Black Duck	*	
9. Tachybaptus novaehollandiae	Australasian Grebe	*	*
10. Anhinga melanogaster	Darter	*	
11. Egretta novaehollandiae	White-faced Heron	*	*
12. Ardea ibis	Cattle Egret[13]		*
13. Porphyrio porphyrio	Purple Swamphen	*	*
14. Phalacrocorax sulcirostris	Little Black Cormorant	*	
15. Theskiornis spinicollis	Straw-necked Ibis		*
16. Haliaeetus leucogaster	White-bellied Sea-Eagle[14]		*
17. Aquila audax	Wedge-tailed Eagle	*	*
18. Falco berigora	Brown Falcon		*
19. Falco cenchroides	Nankeen Kestrel	*	*
20. Elanus axillaris	Black-shouldered Kite	*	*
21. Vanellus miles	Masked Lapwing	*	*
22. Phaps chalcoptera	Common Bronzewing	*	*
23. Ocyphaps lophotes	Crested Pigeon	*	*
24. Cacatua roseicapillus	Galah	*	*
25. Cacatua galerita	Sulphur-crested Cockatoo	*	*
26. Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo		*
27. Platycercus elegans	Crimson Rosella		*
28. Platycercus eximius	Eastern Rosella	*	*
29. Ninox novaeseelandiae	Southern Boobook		*
30. Podargus strigoides	Tawny Frogmouth		*
31. Tyto alba	Barn Owl	*	

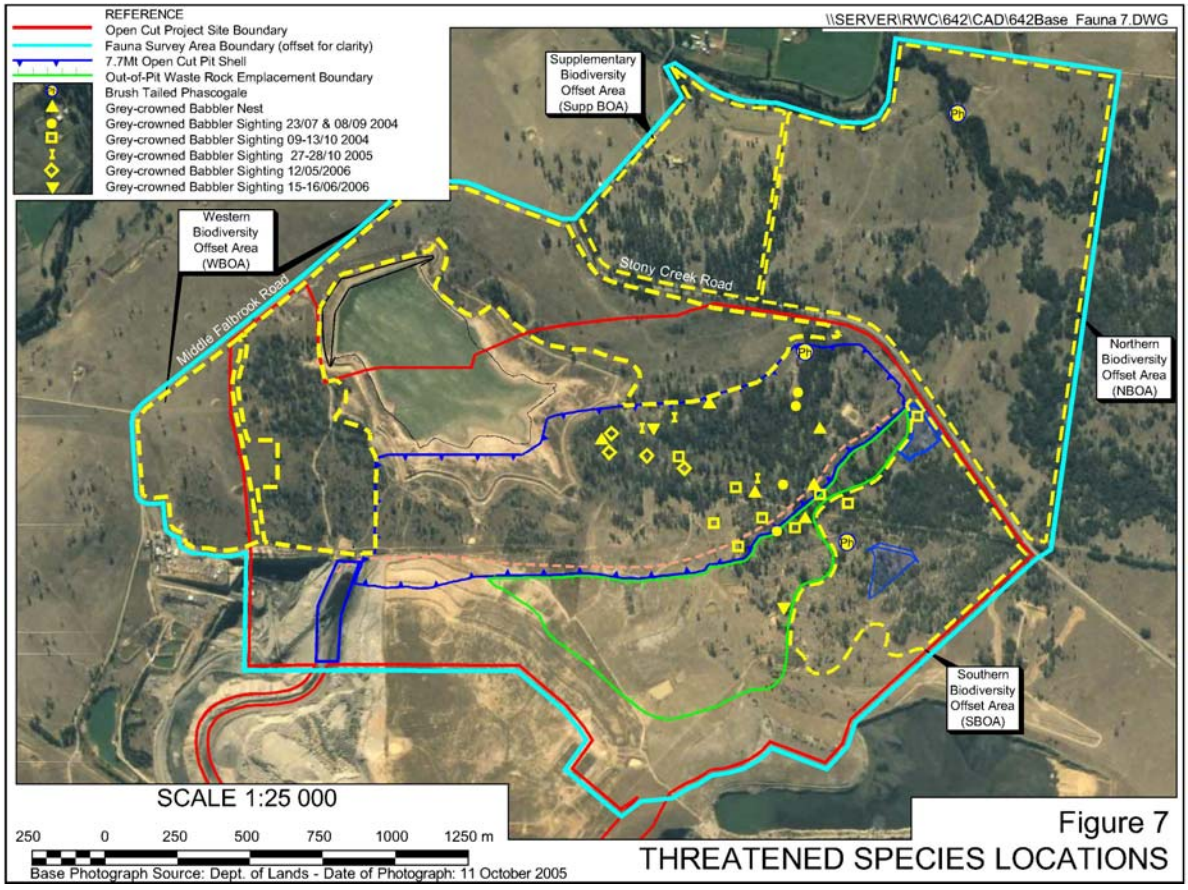
* - Recorded during this study # - Exotic species (V) - Listed vulnerable species.

[13] The Cattle Egret is an EPBC Act listed migratory species; see Section 6.2.3.
[14] The White–bellied Sea-Eagle is also an EPBC Act listed migratory species. This eagle started to move Inland in early 2006 in response to the filling of inland wetlands (eg Barren Box Swamp and Macquarie Marshes) after heavy rain. Individuals often follow major watercourses like the Hunter River.

Table 12 (Cont'd)
Birds Recorded in and Around the Glennies Creek Survey Area

Scientific Name	Common Name	Early Spring	Late Winter
		Sept / Oct 04	Aug 04 and May/June 06
32. Malurus cyaneus	Superb Fairy-wren		*
33. Pardalotus punctatus	Spotted Pardalote	*	
34. Cormobates leucophaeus	White-throated Treecreeper		*
35. Dacelo novaeguineae	Laughing Kookaburra	*	*
36. Acanthiza chrysorrhoa	Yellow-rumped Thornbill	*	*
37. Acanthiza lineata	Striated Thornbill		*
38. Zosterops lateralis	Silvereye	*	*
39. Manorina melanocephala	Noisy Miner	*	*
40. Pomatostomus superciliosus	White-browed Babbler	*	*
41. Pomatostomus temporalis (V)	Grey-crowned Babbler	*	*
42. Pachycephala pectoralis	Golden Whistler		*
43. Acanthiza chrysorrhoa	Eastern Spinebill		*
44. Pachycephala rufiventris	Rufous Whistler	*	*
45. Myiagra inquieta	Magpie-lark (Pee Wee)		*
46. Coracina novaehollandiae	Black-faced Cuckoo-shrike	*	*
47. Centropus phasianinus	Pheasant Coucal	*	
48. Hirundo neoxena	Welcome Swallow	*	*
49. Cheramoeca leucosternus	White-backed Swallow		*
50. Cracticus torquatus	Grey Butcherbird	*	*
51. Cracticus nigrogularis	Pied Butcherbird	*	*
52. Gymnorhina tibicen	Australian Magpie	*	*
53. Strepera graculina	Pied Currawong	*	*
54. Corvus coronoides	Australian Raven	*	*
55. Corvus bennetti	Little Crow		*
56. Corcorax melanorhamphos	White-winged Chough	*	*
57. Struthidea cinerea	Apostlebird	*	
58. Rhipidura albiscapa	Grey Fantail		*
59. Rhipidura leucophrys	Willie Wagtail	*	*
60. Megalurus gramineus	Little Grassbird	*	
61. Sturnus vulgaris#	Common Starling		*

* - Recorded during this study # - Exotic species (V) - Listed vulnerable species.



5.3 Mammals

Table 13 lists the 25 mammal species that were caught in the traps deployed, identified from body tissues (including hair samples) and bones, and/or observed in and around the Survey Area. The microbat species were identified from their ultra-sonic calls during the spring survey.

Table 13
Mammals Recorded in and Around the Glennies Creek Survey Area

Page 1 of 2

Scientific Name	Common Name	Methods
1. *Tachyglossus aculeatus*	Short-beaked Echidna	D, F
2. *Trichosurus vulpecula*	Common Brushtail Possum	W,F,H
3. *Antechinus flavipes*	Yellow-footed Antechinus	E1,E2,H
4. *Macropus giganteus*	Eastern Grey Kangaroo	O,S,H, F
5. *Macropus rufogriseus*	Red-necked Wallaby	O,S,H,F
6. *Wallabia bicolor*	Swamp Wallaby	O,F
7. *Mus domesticus*	House Mouse#	E1,H, P
8. *Rattus rattus*	Black Rat	E1,H
9. *Oryctolagus cuniculus*	European Rabbit #+	D,S,F
10. *Lepus capensis*	Brown Hare#	O,S
11. *Vulpes vulpes*	European Red Fox#+	O,S,H
12. *Canis lupus familiaris*	Farm Dog#	O
13. *Felis catus*	Feral Cat #+	O,S,H
14. *Nyctinomus (Tadarida) australis*	White-striped Mastiff-bat	C

Table 13 (Cont'd)
Mammals Recorded in and Around the Glennies Creek Survey Area

Scientific Name	Common Name	Methods
15. Mormopterus norfolkensis	Eastern Mastiff-bat (V)	C
16. Mormopterus planiceps	Little Mastiff-bat (sp2)	C
17. Miniopterus schreibersii oceanensis	Eastern Bentwing-bat (V)	C
18. Chalinolobus morio	Chocolate Wattled Bat	C
19. Nyctophilus geoffroyi	Lesser Long-eared Bat	C
20. Nyctophilus gouldi	Gould's Long-eared Bat	C
21. Chalinolobus gouldii	Gould's Wattled Bat	C
22. Vespadelus vulturnus	Little Forest Bat	C
23. Petaurus breviceps	Sugar Glider	S, E2
24. Phascogale tapoatafa	Brush-tailed Phascogale (V)	E2
25. Pteropus poliocephalus	Grey-headed Flying-fox (V)	-[15]

D – diggings W – Wire cage traps F – faecal Pallets
H – Hair Samples E1 – Elliott type 1 E2 – Elliott type 2
S – Spotlighting C – Ultrasonic calls O – Observed from sight and/or sound
– Exotic Species + Key threatening process under TSC and EPBC Acts

With the exception of the Brush-tailed Phascogale, all terrestrial and arboreal species caught or observed were either common native species or exotic species. All native species are protected. The exotic species recorded included the European Rabbit, European Red Fox and the Feral Cat which are listed a Key Threatening Processes (+) in the TSC Act (NSW) and the EPBC Act (C'th). The locations of the Brush-tailed Phascogale capture sites are indicated on **Figure 7**.

Out of the nine species of microbats that were identified or recorded during the surveys from the >800 usable zero-crossing calls sequences recorded during the survey, two were listed as vulnerable. No capture was recorded in the harp trap and all the microbats were identified from calls. The record of *Mormopterus norfolkensis* is unusual and is close to the western limit of its known distribution. This species with a characteristically flat and very distinctive alternating frequency call was recorded from only two analysable calls.

Although the Old Growth gallery on the north-south road reserve and the isolated large mature trees in the Survey Area were targeted with the mobile ultrasonic call recording unit no cluster or concentration of calls that might suggest the presence of a colonial roosting site were recorded.

5.4 Reptiles

Table 14 lists the reptiles that were caught in the traps and/or recorded during searches under rocks, logs, bark and leaf litter, as well as along low lying areas leading into Stony Creek and the edges of Possum Skin Dam and other dams in Survey Area.

[15] Not recorded during any of the surveys but the presence of a camp in a park in Singleton suggests that the Project Site is within foraging flight distance from this flying-fox colony.

Table 14
Reptiles recorded in the Survey Area

Scientific Name	Common Name	Status
1. *Chelodina* longicollis	Eastern Snake-necked Turtle	P
2. Pogona barbata	Eastern Bearded Dragon	P
3. Cryptoblepharus virgatus	Wall Lizard	P
4. Eulamprus quoyii	Eastern Water-skink	P
5. Egernia striolata	Tree-crevice Skink	P
6. Lampropholis delicata	Dark-flecked Garden Sunskink	P
7. Carlia foliorum	Tree-based Litter-skink	P
8. Ramphotyphlops wiedii	Brown-snouted Blind Snake	P
9. Varanus varius	Lace Monitor	P
10. Pseudechis porphyriacus	Red-bellied Black Snake	P
11. Demansia psammophis	Yellow-faced Whipsnake	P
P – Protected		

All 11 species of reptiles recorded during this survey are common protected native species.

6 DISCUSSION AND IMPACT ASSESSMENT

Notwithstanding the highly modified, degraded, fragmented and isolated nature of the environs in which the Project Site is located amidst other mines, agricultural land and rural-residential subdivisions, the wildlife value and potential significance of these habitat remnants to the biodiversity of the Upper Hunter Valley (and more proximally to the Glennies Creek Catchment) should not be overlooked (see Lindenmayer and Fischer 2006 and Johnson *et al* 2007).

It is also noteworthy that the Project Site is located on the landscape where only 1st Order streams exist. It has neither the habitat gradient diversity of Ravensworth State Forest and Mount Royal National Park to the East, Wollemi National Park to the West nor does it has habitat occurring on soils with high productivity on the floodplains around Singleton and along the Hunter River.

The Open Cut Area covers some 320ha with the likely area of disturbance of approximately 135ha - with 90ha for the pit shell and 43ha for the out-of-pit waste rock emplacement. Although the majority of the area subject to disturbance consists of cleared paddocks and recent post-mining rehabilitated and soil stockpile areas, some 76.7ha of vegetation remnant (consisting of 42.4ha of Woodland and 34.3ha of Open Woodland habitat) would be affected. The cumulative impact from this removal of native vegetation in the regional context is discussed in Section 6.4 and its likely impact on each of the relevant listed threatened species in Section 6.1.

The likely impact this loss of fauna habitat would have on the native fauna, in particular the listed threatened species should be considered with the following factors in mind.

- Firstly, this area of the State is still overcoming the adverse effect of the recent drought conditions on the local fauna community, notwithstanding some recent rain in the region.

- Secondly, if approval is granted for this proposed mine to proceed, the further clearing of Woodland habitat will have a cumulative impact in the Upper Hunter Valley. This, however, pales into insignificance when compared to the more recent widespread development from rural-residential subdivision (hobby farms), the establishment of wide acreage vineyards and the unfettered establishment of horse studs that have compounded the habitat destruction which had resulted from earlier settlement and agricultural activities in the Singleton LGA. It thus follows that it is at best problematic whether or not, given the relatively small, isolated and fragmented woodland habitat remnant of the Project Site (and the biodiversity offset areas), can on their own, significantly maintain or improve the longer term local biodiversity values in the Glennies Creek catchment. This would still be true after taking into account the actions proposed to avoid or mitigate the various impacts and compensate for the unavoidable impacts of the proposed activity. However, this should be viewed in the larger context that cumulatively with other biodiversity offset areas from future mines and other regionally base conservation programs (see DMR 1999 and HCMT 2003). They will become an important element in the conservation of biodiversity in the Upper Hunter Valley.
- Thirdly, it is likely that, because of the widespread nationwide drought condition, a number of species from further west, over the Great Dividing Range may have occurred locally in areas that would normally have been their marginal habitats.
- Fourthly, the woodland remnants on the Project Site and the biodiversity offset areas are already currently fragmented by roads and Open Pasture. They are also isolated from the large habitat remnant (of what remains) of Ravensworth State Forest as a consequence of the Mt Owen Mine and the rich flood plain country of the Hunter River near Singleton. There is no direct habitat corridor connection to Mount Royal National Park upstream from Lake St. Claire or Wollemi National Park on the southern side of the Hunter River and the New England Highway.
- Finally, surveys to determine the local dispersion of the Grey-crowned Babbler were constrained by the lack of access to private properties outside the control of the Proponent.

Early considerations were given to the sequencing of the open cut operation from least to most environmentally sensitive areas and the extent of the pit limit to avoid areas of high conservation value. These included any remnant woodland patches, especially those habitats with mature trees, regenerating native vegetation, natural wetlands and riparian habitats.

Due to the location of the coal bearing strata it was apparently neither operationally possible to leave the clearing of Woodland area and the tall mature tree gallery to a later stage of development, nor was it commercially viable to exclude the woodland area, including the Old Growth gallery along the north-south road reserve (see **Plate 6**) from the proposed activity.

The stand of Bull Oak (approximately 11.1ha), and the road reserve running east-west and the area of Camberwell topsoil storage area with scattered trees have been preserved. This was achieved by relocating the proposed out-of-pit emplacement in areas that have been subjected to previous mining activities instead of over this area (see **Figure 2**).

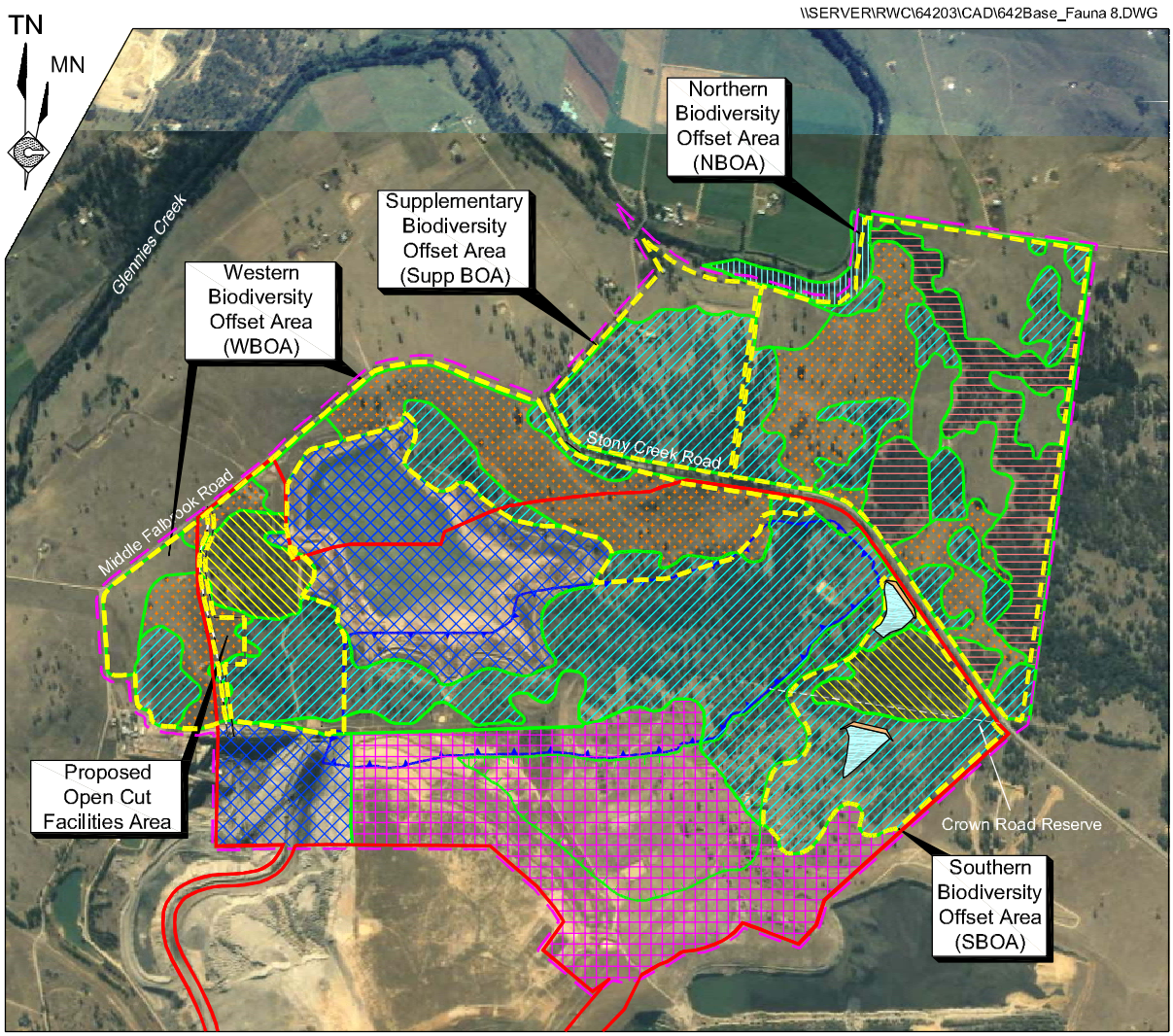
The Project offers further offsets including, 33ha in the Supplementary Biodiversity Offset Area to the north of Stony Creek Road which includes an area of approximately 21.5ha of Woodland with a commitment to an early commencement of revegetation of riparian corridors, progressive rehabilitation and screen planting within the proposed biodiversity offset areas and Open Cut Area to improve the habitat quality and connectivity of the remaining remnants to other habitat patches (see **Figure 8**). This will have positive impacts upon the local ecology and maintain the short term biodiversity. It would improve the conductivity and connectivity of the proposed habitat remnants and the wildlife corridor around the proposed mine to nearby creek lines and other nearby habitat remnants in the Glennies Creek Catchment. See **Appendix 5** for further discussion.

Impact from the Dirty Water Containment Dams has been limited to less than 2ha. These dams are expected only to accommodate sediment laden water run-off from the surface workings on the Open Cut Area. Both of these dams are expected to be empty most of the time with almost all of the existing trees remaining unaffected in their current position. As these dams have been designed with a capacity to accommodate run-off from a 1 to 50 year rainfall event, it is also not expected to impact upon the existing creek during the life of the proposed mine.

If project approval is granted for the proposed open cut mine to proceed, an initial pulse impact and a longer term press impact are expected to occur with the commencement of clearing of the Woodland area to construct the box cut. This initial impact will also include other mine-related activities such as the construction of mine infrastructure including bunds, tracks and the Dirty Water Containment Dams. The more sensitive areas that will be affected will include the Old Growth gallery along the north-south road reserve and parts of the old topsoil dump area south of the east-west road reserve. The initial dumping of overburden is expected to occur in the Open Pastures and unrehabilitated areas and is not expected to affect any natural fauna habitat.

Subsequent progression in the construction of the pit and out-of-pit waste rock emplacement will continue to exert a longer term press impact on the environment that will affect the habitats directly on the 135ha area over the 5 to 6-year life of the mine. The most significant of this impact will be over the 90ha within the pit shell affecting approximately 42.4ha of the Woodland and the 34.3ha of the Open Woodland when the out-of-pit emplacement is taken into account.

The loss of the Old Growth gallery in the Woodland and some other mature trees in the Open Woodland, is not expected to significantly affect the natural fauna habitat value of this highly fragmented habitat patch. Nevertheless, the proposed activity will increase edge effects in the smaller remaining patches south of Middle Falbrook Road and Stony Creek Road. These disturbances are expected to impact on the behaviour of the local fauna and their pattern of foraging and habitat use on the Project Site and the surrounding country. No regional study exists or has been attempted to establish in this highly modified and fragmented landscape any real stepping-stone effect this remnant habitat patch may have on any of the fauna recorded or likely to be found on the Project Site. Any attempt to discuss this theoretical ecological concept involving vagrant, incidental and migratory in relation to the Project Site would be at best speculative. See Section 6.4 for further discussion.



REFERENCE
- Project Site Boundary
- Flora 4b Study Area (offset for clarity)
- 7.7Mt Open Cut Pit Shell
- Out-of-Pit Waste Rock Emplacement
- Dirty Water Containment Dam
- Proposed Biodiversity Offset Area Boundary

VEGETATION COMMUNITIES
- 1: (Remainder) Tussock Grassland
- 2: Regenerating Native Woodland / Shrubland
- 3: Narrow-leaf Ironbark - Spotted Gum - Forest Red Gum
- 4: Rehabilitated Disturbed Land
- 5: Bull Oak
- 6: Disturbed Land
- 7: Swamp Oak
- 8: River Oak

		Vegetation Community Areas (ha)							
		1	2	3	4	5	6	7	8
Flora Study Area		**51.6**	**77.5**	**180.1**	**93.8**	**21.1**	**76.3**	**33.4**	**1.5**
Biodiversity Offset Areas	NBOA	28.4	30.9	26.9	0	0	0	33.4	1.5
	SBOA	0	0	27.8	0	11.1	0	0	0
	WBOA	10.2	43.1	30.8	0	9.8	0.4	0	0
	Sub Total within Project Related Land	**38.6**	**74.0**	**85.5**	**0**	**20.9**	**0**	**33.4**	**1.5**
	Supplementary BOA	5.8	0	27.6	0	0	0	0	0
	Total - (BOAs)	**44.4**	**74.0**	**113.1**	**0**	**20.9**	**0.4**	**33.4**	**1.5**
Area To be Disturbed		**6.1**	**0.7**	**68.3**	**47.6**	**0**	**12.3**	**0**	**0**

SCALE 1:25 000

250 0 250 500 750 1000 1250 m

Source: GCNRC (2007a & 2007b) - Figure 1

Figure 8
BIODIVERSITY OFFSET AREAS
AND VEGETATION COMMUNITIES

The clearing of the woodland and rehabilitated areas and the stockpiling of topsoil and fallen trees will be depriving the birds and arboreal mammals of nesting and foraging habitats. There is no way to compensate for this loss directly due to the age and size of the trees in the Woodland. It will, however, create habitat opportunities for open country birds, reptiles, amphibians and small mammals.

Apart from the clearing of those habitat areas, the Project will also affect the surrounding environment with dust, illumination during dark hours and noise, including intermittent blasting from the proposed mining activities. Except for the dust in very close proximity (say up to 100m) to the pit shell and haul road they are not expected have a significant impact upon the local fauna. These impacts will be minimized and regulated by mine operational plans (see Part D of the *Environmental Assessment*). From observations and experience in other open cut mines, barring the effect of any toxic discharge, the local fauna will generally habituate to these exogenous stimuli from mining activities, especially from such episodic events like blasting.

The effect of dust from the haul road is mitigated by its location being sited distally from the biodiversity offset areas, the preserved Riparian Habitat and the regenerating woodland on the old topsoil stockpile area south of the east-west road reserve. The local road traffic is not expected to increase by any significant level although an initial pulse impact can be expected of movement of fauna from the southern side of Stony Creek Road to the Northern and Supplementary Biodiversity Offset Areas during the establishment of the pit.

The loss of the Woodland will be mitigated by the regeneration from the destocking of the Regeneration Woodland/ Shrubland areas and the rehabilitation of the various habitat corridors to join the fragmented patches of native vegetation and riparian habitat in the Glennies Creek Catchment (see *Environmental Assessment* **Figure D20**).

6.1 Likely Impact on Listed Threatened Species

The above proposed ameliorative actions notwithstanding, the assessment of likely adverse impact on listed threatened species by this proposed open cut mine has been undertaken further as follows.

NPWS (2006) listed in the Singleton LGA checklist no less than 8 species of frogs, some 21 birds, 20 mammals and one reptile as threatened see **Appendix 1**. Although cognizance should be given to the fact that the locations of these listed species threatened provided by the NSW Wildlife Atlas is far from perfect (see **Figure 6**), it represents a cumulative picture of the distribution pattern of those species that is superior to data bases that rely only on voucher specimens such as those of the Australian Museum and CSIRO. Taking this accessible data and interpreting the information in conjunction with the regional landscape ecological factors is an effective means to assign what is proportionate to each species in the presentation of the likely probative value and relevance of the level of information that should be necessary in a planning and industry technical report when assessing the likely impact a proposal could have on each of them. This is particularly relevant for the Singleton LGA and Glennies Creek Catchment in the Upper Hunter Valley where the existing environments have been dictated by a long history of settlement and land use.

The likely significant impacts of this Project on listed threatened species recorded or likely to occur on the Open Cut Area and the proposed biodiversity offset areas are discussed below.

6.1.1 Amphibians

No listed threatened frogs are known in the habitat type in the Open Cut Area, except the Green and Golden Bell Frog, and none have been recorded from the vicinity of the Survey Area.

The Green and Golden Bell Frog, *Litoria aurea*, has been recorded from the Singleton LGA near Ravensworth to the northwest of the Open Cut Area (HVCC 2003). The dams on the site were all checked both during the day and at night. No *L. aurea* was seen or heard at any of the sites. Only two of the dams in the Survey Area had any emergent vegetation to provide suitable habitat for bell frogs, the remainder of the other dams were devoid of any such vegetation or any suitable cover such as rock piles etc at the edges. Nevertheless this is an opportunistic species that occurs in highly modified environments such as the Olympic Site former brick pit in Sydney.

This bell frog can also tolerate a high degree of salinity and occurs in brackish environments (Kooragang Island in Newcastle) and marine environments (eg. islands off Port Stephens near the inter-tidal zone). Having sampled the Open Cut Area on multiple occasions targeting this species, it is extremely unlikely that a viable population of this bell frog occurs on or near the Open Cut Area. Its absence notwithstanding, in future it may be possible that within its leasehold area, the Proponent can participate in a Glennies Creek Catchment regional reintroduction conservation program that might involve the Mt Owen bell frog population near Ravensworth.

The Open Cut Area is not associated with any population of this amphibian nor interferes with any recovery action for this species. The proposed activity is unlikely to diminish the population size or the distribution range of this frog and is unlikely to cause any impact on this species by facilitating, introducing or augmenting an invasive species into its population. No further consideration is warranted for this frog.
Considerations for the other listed threatened frogs in the Singleton LGA are as follows.

- The Booroolong Frog, *L. booroolongensis*, is confined to clear high mountain streams along the ranges from NSW to Victoria, generally above 200m. The absence of permanent running streams would preclude it from the site and it is thus not relevant to any consideration for this Project.
- Davies' Tree Frog, *L. daviesae*, is a newly described species that was recently distinguished from *L. subglandulosa.* It has been recorded from the Mount Royal State Forest to the north of the Open Cut Area. It is found only in permanent flowing streams in the northern Hunter River catchment above 400m and would not occur on this site. This frog is not relevant to the Open Cut Area.
- Littlejohn's Tree Frog, *L. littlejohni*, has only been recorded in the region from Wollemi National Park to the south. It is found on the slopes of the Great Dividing Range at altitudes over 280 metres, and prefers flowing streams associated with sandstone rock outcrops. Given the lack of suitable habitat it is most unlikely the species occurs on the site and is thus not relevant to the Open Cut Area.

- The Giant Burrowing Frog, *Heleioporus australiacus*, has only been recorded in the region except from Wollemi National Park. The species prefers relatively undisturbed permanent streams. The disturbed nature of the Open Cut Area suggests, this species is unlikely to occur on the site.
- A barred frog, the Stuttering Frog, *Mixophyes balbus*, has been recorded from the Singleton LGA in Mount Royal State Forest towards the Barrington Tops. This barred frog inhabits mainly cool rainforest and moist sclerophyll forest. No suitable habitat exits for this species on the Open Cut Area and environs and it is thus not relevant to the Open Cut Area. This barred frog is also an EPBC Act listed species and as the Open Cut Area is not associated with any important population of this amphibian and the proposed activity is unlikely to cause any impact on this frog by an introduction or encouragement of an invasive species or interfere with any recovery action for this species. No further consideration is warranted for this species.
- There is no record of the Southern or Giant Barred Frog, *M. iteratus,* another EPBC Act listed species in the Singleton LGA. This species inhabits coastal rainforests and wet sclerophyll forests. As the Open Cut Area is not associated with any population of this amphibian that may diminish its size or distribution and the proposed activity is unlikely to cause any impact on this species by an introduction or encouragement of an invasive species or interfere with any recovery action for this species. No further consideration is warranted for this frog.
- The Sphagnum Frog, *Philoria sphagnicolus*, has been recorded in the Mount Royal National Park area and is a high elevation frog found in moist sclerophyll forest, Antarctic Beech forest and sphagnum moss beds. These habitat types do not occur on the Open Cut Area thus this species is not relevant to this Project.
- The Red-crowned Toadlet, *Pseudophryne australis*, has been recorded in Yengo and Wollemi National Parks to the south. Given its association with sandstone escarpments in the Sydney Basin it would not occur on this site. This toadlet is not relevant to the Open Cut Area.

The proposed actions in the biodiversity offset areas are unlikely to affect any of these frogs. However, as these areas will be set aside permanently to conserve the local biodiversity, appropriately modified existing or newly purpose built dams in these offset areas, especially those north of Stony Creek Road, could be offered to be included in a future program for the reintroduction of the Green and Golden Bell Frog in the Upper Hunter Valley.

6.1.2 Birds

With regards to listed threatened birds, the Open Cut Area is unlikely to have much significance to two groups of birds - wetland birds and ground dwelling birds.

The Open Cut Area has neither been a permanent wetland nor has it been associated with any wetland system. Notwithstanding the existence of Possum Skin Dam (which will be partly affected by this Project), and other holding ponds and farm dams in the Survey Area, the Project is unlikely to significantly impact on any listed threatened wetland or wetland dependent species like the Black Bittern, *Ixobrychus flavicollis*. Little or no suitable nesting sites occur in or near these water bodies and the dependence on the current mining operation of most of them make these water bodies unreliable as a resource for wetland species. There is one record of the Black-necked Stork, *Ephippiorhynchus asiaticus*, in the region but this occurrence is out of its normal breeding range where it is nomadic (see Barrett *et al* 2003). It is possible that both this bittern and the stork may use any of the farm dams on the Project Site and including Possum Skin Dam - as they may also use any other mine or farm dam in the region. The likely impact from this proposal on these species is inconsequential. No habitat elements on the biodiversity offset areas are likely to benefit these species.

With regards to ground dwelling species like the Bush Stone-curlew, *Burhinus grallarius*, although no record of this species occurs in the region, it is known to have been distributed extensively in woodland habitat with sparse understorey (see Blakers *et al* 1984). It was not recorded during this survey and due to the presence of foxes and the degraded understorey in the habitat remnants between the extensive areas of cleared pastures on the Open Cut Area and surrounding areas, it is unlikely that any ground dwelling species can persist in the Survey Area with the high exotic predator pressure and the lack of food items at ground level. The expected increase in cover in the understorey layer from shrub rehabilitation in the biodiversity offset areas will not favour this species although the proposed vertebrate pest control program may reduce potential predation on this species, assuming that recolonisation is possible for this species in the Glennies Creek Catchment.

Apart from these species, a number of other listed threatened birds that were not recorded during the survey but are transient, migratory or species which are nomadic or with very large home ranges may from time to time use the Project Site including the Open Cut Area.

The Red Goshawk, *Erythrotriorchis radiatus,* Black-breasted Buzzard, *Hamirostra melanosternon*, Barking Owl, *Ninox connivens*; Powerful Owl, *Ninox strenua*; Masked Owl, *Tyto novaehollandiae*, and the Sooty Owl, *Tyto tenebricosa*, have been recorded in the region, and the Survey Area is within their distribution ranges. No listed threatened raptors or owls were recorded in or around the Open Cut Area during this survey. Attempts with callback broadcasts over a total of 10 nights had a better than 90% change of detecting these owls if they occur locally and the Project Site is part of their home range (see DEC 2004).

Hamirostra melanosternon is a rare but very widespread species found throughout the Australian Continent, except the southern and eastern coastal regions. There is only one record of this buzzard in the Singleton LGA. It is interesting to note that no report of this species was ever recorded in the Atlas of Australian Bird (Blakers *et al* 1984) or in the new atlas (Barrett, *et al* 2003). At best it should be considered an incidental vagrant to the Upper Hunter Valley, if not a mere misidentification of this large raptor.

Erythrotriorchis radiatus and *N. connivens* have been recorded within 10km of the Open Cut Area (see **Figure 6**). This goshawk usually occurs as sedentary individuals or as breeding pairs and it is unlikely to be missed if the Survey Area is part of its core home range with a nest nearby. Similarly, the owl usually readily responds to a broadcast of its own call if it is within hearing distance - in ideal conditions, over 800m from the broadcast source. Its lack of response suggests that it is absent in the vicinity. These considerations notwithstanding, from time to time, both these species may still forage through the remnant vegetation in or near the Open Cut Area.

All these raptors and owls keep relatively large home ranges and are dependent on habitats with large trees. In the Upper Hunter Valley these are now almost exclusively confined to the riparian zone along the larger rivers or uncleared gullies. In this landscape, it is these large trees that bear the large tree hollows or dense vegetation where they can find a roost. They can also only persist in areas where there are high densities of larger prey species - mainly birds in the case of the diurnal raptors and arboreal mammals in the case of the owls. The home range of the owls is expected to exceed 1000ha in this highly modified agricultural landscape. None of these larger predatory bird species are therefore likely to be significantly affected by the proposed mine where none of these important ecological factors occur in the Open Cut Area. It is unlikely that any of the offset and ameliorative measures proposed for this Project will benefit these species in the short term. In the longer term, however, the improvement in the habitat patch quality may bring about the occurrence of potentially higher prey densities thus hunting opportunities for these raptors and owls.

There are no less than 54 Glossy Black-Cockatoo, *Calyptorhynchus lathami*, location records in the region and it is a threatened species listed in the Upper Hunter Catchment Management sub-region (NPWS 2006a). This cockatoo was specially targeted during the survey due to the presence of the substantial stands of Riparian Oaks (Bull Oak, *Allocasuarina luehmannii,* Swamp Oak, *Casuarina glauca* and River Oak, *Casuarina cunninghamiana*) in the various parts of the Survey Area but it was not recorded during this study. An analysis of the regional distribution records suggests that they were confined mostly to the hill slopes along the river valleys where other species of *Allocasuarina* and *Casuarina* occur, in particular *C. torulosa*. This is consistent with what is known of its ecology. In the Central West of NSW around places like Dubbo, it is known to feed on *A. luehmannii,* which occurs along the creeklines on the Survey Area and environs. It has also been known to feed on seeds of *Angophora*. It is not expected to be affected by this proposed mine as almost all of the *A. luehmannii* stands on the Open Cut Area and the *Casuarina* spp. on the Northern Biodiversity Offset Area will be preserved and will remain unaffected. The actions proposed in the biodiversity offset areas are likely to benefit *C. lathami* as their potential foraging habitat in the riparian oaks will be preserved and enhanced.

There are no less than 116 records of Gang-gang Cockatoo, *Callocephalon fimbriatum,* in the region. All except one of these locations is in Wollemi National Park or on the hill slopes adjacent to Mount Royal National Park. There is a single record of this cockatoo along the Hunter River near Singleton, within 10km if the Open Cut Area. This species prefers to forage in extensive stands of large eucalypts on hill slopes and valleys. It nests in hollows in large trees near permanent water in sheltered gullies. It is a noisy bird with a very distinctive call. This species was not observed to occur on or near the Survey Area. The Project is unlikely to affect this species because of the location of the Open Cut Area that is positioned in relatively flat terrain on the landscape. It is doubtful if any of the actions proposed in the biodiversity offset areas, within the life of the proposed mine and in the foreseeable future, will benefit *C. fimbriatum.*

There are eight records of Turquoise Parrot, *Neophema pulchella*, in the region. None of these records are within 10km of the Open Cut Area. It is a small parrot that feeds on grass (including exotic grasses), herbaceous plants and seeds from shrubs. It is often recorded feeding in cleared paddocks near the remnants of mixed assemblage communities of native Eucalypts, especially Box Woodland. This bird usually nests within 2.0m from the ground and relies on a source of reliable drinkable water nearby. Notwithstanding the artificial dam in the Study Area, including Possum Skin Dam with its saline water, a reliable source of suitable water from runoffs is not always present and there are few potential nesting sites on the Project Site (see habitat description in Section 2). As it is partly nomadic, the relatively small area of the Open Cut Area in the landscape context of Glennies Creek Catchment makes it unlikely that the proposed mine could have a significant impact on this species. The exclusion of stock from the proposed biodiversity offset areas will now allow the grasses to seed and the woodland areas to regenerate. This regeneration and the revegetation program with this proposal are likely to benefit this grass parrot especially if native grass species are allowed to re-establish themselves in the biodiversity offset areas and post-mining attempts are made to re-establish native grass on the Open Cut Area.

The listed endangered Swift Parrot, *Lathamus discolor,* is also listed in the EPBC Act and is nomadic in this part of its range. It is a winter visitor to the Australian mainland where it opportunistically feeds on flowering Eucalypts in southeastern Australia up almost to Queensland. There are now up to five records of this parrot in the Singleton LGA. None of these are within 10km of the Open Cut Area. It is a regular visitor in the Lower Hunter region around Mount Tomalpin in varying numbers (from 20 to 200 birds) almost every other year, particularly when winter-flowering Eucalypts are flowering profusely. It has been recorded to forage on some of the tree species that occur on the Open Cut Area, namely the Forest Redgum, *E. tereticornis*, and Spotted Gum, *Corymbia maculata*. It also feeds on Narrow-leaf Ironbark, *E. crebra*, a species that also flowers in winter but only irregularly and which is more common on the Western Slopes. On the mainland, the Swift Parrots undertake their winter forages mainly on the Coastal Plains (where they frequent mostly Swamp Mahogany, *E. robusta*) and the Western Slopes, and they no doubt fly up the Hunter Valley in their winter movements on the mainland. It has not been recorded to frequent any site in the Upper Hunter Valley. The winter flowering trees in the Survey Area, *Eucalyptus blakelyi* (normally from August to December) and *Corymbia maculata* (irregularly from April to September) were not in flower until 2006. The Project Site located east of the Great Dividing Range in the Upper Hunter Valley is not associated with any important population of this parrot and the proposed activity is unlikely to cause any impact on this species by introducing an invasive species, or interfere with any recovery action for this species. No further consideration is warranted for this species. The offset and ameliorative measures for this project will preserve and enhance the feed trees for the Swift Parrot in the balance of the Project Site thus ensuring the existence of this habitat patch that is currently unprotected in a highly fragmented and modified landscape.

Although there are at least 24 records of the Regent Honeyeater, *Xanthomyza phrygia,* in the region (see NPWS 2004) it was not recorded during the surveys and none of these records are within 10km radius of the Open Cut Area (see NPWS 2006). It has been observed in the region although no breeding seemed to have been recorded in the Hunter Valley.

Apart from the Capertee Valley, the Northwestern slopes of NSW are arguably the western limits of this honeyeater's distribution with important breeding areas in the Warrumbungles National Park and Pilliga Nature Reserve to the west, and the Barraba District to the northwest (see Ayers et al., 1996-99 and see French *et al* 2003). The breeding birds start to arrive in these areas at the beginning of winter in the Box-Ironbark Woodland and they start breeding by spring. Individuals roam widely outside the breeding season mostly in White Box, Yellow Box Ironbark Woodland and are rarely seen outside their breeding areas. Once common, its numbers are still in decline and the clearing of their breeding habitat for agriculture and the disappearance and fragmentation of their foraging habitat outside their breeding season has been attributed to have caused its decline.

It is a very conspicuous species but this species was not recorded during any of the surveys. The proposed activity will affect approximately 76.7ha of vegetation remnants (approximately 42.4ha of this area is Woodland and 34.3ha of Open Woodland where except for the Old Growth gallery and the area south of the east-west road reserve, there are few mature trees (see **Plate 3** cf **Plate 2** and **Plate 6**). On a landscape scale it is thus unlikely to significantly affect this honeyeater due to its opportunistic feeding pattern and transient behaviour in this part of its nomadic range. It is expected to occur in the Survey Area only as a transient and not as a viable local population, thus, no population of this species is likely to be affected significantly by the Project.

Xanthomyza phrygia is also an EPBC Act listed species. The Open Cut Area is not associated with any important population of this bird nor would it interfere with any recovery action for this species. The proposed activity is unlikely to cause any significant impact on this species by introducing, facilitation the spread or augmenting the impact from an invasive species. No further consideration of the likely impact from the proposed activity on this species is warranted. The offset and ameliorative measures for this project will preserve and enhance the feed trees for *X. phrygia* in the balance of the Project Site thus ensuring the existence of this habitat patch that is currently unprotected in a highly fragmented and modified landscape.

Neither the Black-chinned Honeyeater, *Melithreptus gularis*, nor the Painted Honeyeater, *Grantiella picta*, was recorded during the surveys. The latter species is nomadic in NSW and is heavily dependent on mistletoe (see Oliver *et al* 2003), which is uncommon on the Open Cut Area, albeit there are some mistletoes in many of the stressed trees in the biodiversity offset areas (see GCNRC 2007b). With the reduced stress from destocking in the biodiversity offset areas the proliferation of mistletoes cannot be expected to continue or allowed to continue if some of the larger trees are to be prevented from suffering premature morbidity. The former species, *M. gularis* has been recorded in the region in Ravensworth State Forest less than 10km from the Project Site, although it is rarely recorded east of the Great Dividing Range, especially in woodland and forest habitat fragments less than 200ha, it does appear to be able to persist in small habitat fragments. It is principally associated more with predominantly Yellow and White Box-Ironbark Woodland on the western slopes (see Higgins *et al* 2001). Neither habitat characteristics are significant features in the Survey Area and environs. These species are thus unlikely to occur at or near the proposed mine site or be affected by the proposed activity. It is unlikely therefore that these birds will benefit from any of the ameliorative and offset proposals for this proposed Project.

The Hooded Robin, *Melanodryas cucullata*, has been recorded within 10km of the Open Cut Area. It is a widespread species that occurs in small family groups in Acacia shrubs, woodland and mallee where there is abundant dead timber (Blakers *et al* 1984). It forages in clearings and at the edge of stands of vegetation remnants where it darts from bare branches and tree stumps on the larger insects on the ground. It has been recorded to occupy a home range that varies from 9.0ha to 15ha increasing in winter reflecting the higher nutritional intake it requires during its breeding period. It can apparently only exist in relatively large vegetation remnants, presumably in response to predation pressure from other native birds (like Butcherbirds and Currawongs) in the more open country.

It builds its neat small cup-shape nest of soft dry grass, strips of bark and other dry vegetation held together by spiders' webs. Nests are located in the crevices of trees and stumps (Beruldsen 2003). It is a bird that is essentially sedentary or resident in its habit and makes only local movements between the hills in summer to the adjacent lowland in winter. No migratory or nomadic movements have been observed in this robin.

All the recordings of this bird have been in the proximity of Mount Royal National Park and Ravensworth State Forest where there is or has been substantial areas of woodland habitat. Notwithstanding the limited winter sampling effort to locate this species, it is unlikely that the Project Site which is an isolated, relatively small and fragmented habitat remnant will allow a viable population of this robin to persist. It is thus unlikely that this species will be affected by the Project. In the longer term the post-mining regeneration in the Northern and Supplementary Biodiversity Offset Areas may benefit this species when those habitat patches become less fragmented with the revegetation and regeneration of the native trees and shrubs.

The Brown Treecreeper, *Climacteris picumnus*, has also been recorded within 10km of the Open Cut Area again almost exclusively in Ravensworth State Forest[16]. It was not recorded during this study although there are some 34 records of it in the Singleton LGA. This species was especially targeted during all the surveys. It is an obvious bird to detect due to its nesting and foraging habits. It occurs in Eucalypt woodland with sparse understorey where it forms permanent territories and forages amongst fallen timber in cracks, crevices and under bark as well as on the ground for insects. It is a tree hollow nester and usually occurs in pairs or small groups foraging on tree trunks and on the ground amongst the leaf litter and on fallen logs for ants, beetles and insect larvae. The lack of fallen timber and poor leaf litter cover under the Woodland over most of the Open Cut Area (see Section 2) and surrounding areas precludes this bird foraging adequately to persist locally. It is thus not expected to be significantly affected by the proposed activity. Although the removal of native trees in the Open Cut Area will negatively impact upon any potential use of the area by this treecreeper, the stockpiling and ultimate spreading of the fallen timber over the Open Cut Area and the ameliorative actions on the biodiversity offset areas, including the installation of artificial nest boxes could improve the habitat patch quality to benefit this species.

[16] The contigous extent of this highly significant regional habitat remnant has in recent time been diminished by the existing Mt Owen Mine.

There has been no record of the Olive Whistler, *Pachycephala olivacea*, within 10km of the Open Cut Area although it known to occur in the Singleton LGA. It is a forest and woodland bird that inhabits areas of relatively thick understorey where it forages on the ground for the larger insects. An analysis of the distribution record suggests that it occurs mainly in the rainforest and Eucalypt forest above 500m and is not relevant to the Open Cut Area, much less the less vegetated area in the rest of the Project Site. Notwithstanding that with the destocking and revegetation of the biodiversity offset areas and the balance of the Project Site outside the Open Cut Area, the shrub layer will regenerate and the stockpiling of the fallen timber can attract and increase the density of ground insects, constrained by its habitat requirements it is unlikely to benefit from any of the offset and ameliorative actions proposed for this Project.

Two other listed vulnerable species, the Diamond Firetail, *Stagonopleura guttata*, and the Speckled Warbler, *Pyrrholaemus sagittatus,* that are known to occur in the region were not recorded during these surveys; although both have been recorded within 10km of the Open Cut Area.

Pyrrholaemus sagittatus is a widespread species inhabiting Eucalypt Woodland where it prefers foraging for insects in open grassy, leaf litter and shrub cover. This warbler usually occurs as resident pairs nesting on the ground with good grass cover, fallen leaves and fallen bark over a home range of only up to 12ha. However, it also appears to require contiguous large vegetation remnants of more than 100ha in which to survive. It is a ground nesting species that is prone to predation by introduced predators. Analysis of the regional records suggests that this warbler appears to be confined to larger areas of undisturbed open woodland (>100ha) and adjoining areas, like Ravensworth State Forest to the north of the Open Cut Area. The Woodland in the Open Cut Area and environs is thus unlikely to support a local viable population of this warbler. It is unlikely that this species would be significantly affected by the proposed activity. There is considerable uncertainty if any of the offset and ameliorative actions from this Project will ever benefit this species notwithstanding that the habitat patches in the Northern and Supplementary Biodiversity Offset Areas will regenerate to have habitat characteristics that are more conducive to this warbler.

By comparison with the former, *S. guttata,* is a seedeater that frequents woodland and forest with grassy understorey and a good shrub cover, especially near a water source. *Stagonopleura guttata* is a widespread species in eastern Australia, occurring predominantly west of the Great Dividing Range. It lives in small family groups and feeds on grass seeds, other plant material and insects on the ground. They appear to be unable to persist in habitat remnants less than 200ha. These habitat characteristics do not feature prominently on the Open Cut Area in its current condition with very sparse understorey and being highly fragmented (see habitat description in Section 2). It is unlikely that the Open Cut Area and environs can support a local viable population of this finch. This firetail can be expected to occur, albeit probably only as transients, in the Upper Hunter Valley beyond its normal distribution range during drought years where the dry conditions farther west forces these finches east. It has been recorded in what was Ravensworth State Forest less than 10km from the Project Site. From this perspective, the proposed activity is thus unlikely to significantly affect this species and although in the biodiversity offset areas and the Project Site outside the Open Cut Area, the habitat patch quality will most likely improve to favour the ecological requirements of this bird, it is doubtful if any of these offset and ameliorative actions will benefit this finch.

There is one record of the Red-backed Spotted Button-quail, *Turnix maculosa*, in the region (NPWS 2006 and see **Appendix 2**) and this is within 10km of the Project Site (see **Figure 6**). This has always been a very rare and mostly coastal bird that is associated with moist grassland - "overgrown swamps, watermeadows and dense wet grassland" (Beruldsen 2003). It leaves a distinctive cleared saucer-like area in the leaf litter around its nest. The habitat type that this species requires is not present in the Project Site or the biodiversity offset areas. It is therefore unlikely that this species will be affect by this Project and any ameliorative and offset measures that have been proposed are unlikely to benefit this species in the Upper Hunter Valley.

Other than the Grey-crowned Babbler, *Pomatostomus temporalis*[17], which is discussed in detail in Section 6.2.1 of this report, no other listed threatened bird was recorded during the various surveys for this Project. The record of the occurrence of the White-breasted Sea Eagle, *Haliaeetus leucogaster*, an EPBC Act listed species over Possum Skin Dam is discussed in Section 6.3.2.

Other species like the Blue-billed Duck, *Oxyura australis*, and the Freckled Duck, *Stictonetta naevosa*, have not been recorded in the Singleton LGA (see NPWS 2006) although apparently known to occur in the Hunter Valley (DECC 2007a). These are both rare ducks that have very widespread distributions. The Freckled Duck breeds in inland lakes and only occur east of the Great Dividing Range as occasional transients or vagrants while the nomadic Blue-billed Duck usually occurs around permanent deep water swamps. They are, however, very mobile species and thus from time to time, as transients or vagrants, can be expected to use the various dams, including Possum Skin Dam. There is no critical shortage of similar dams as those found in the Open Cut Area in the Upper Hunter Valley such that the destruction of the dams for the proposed activity will affect these ducks in any significant way other than having to seek alternative resting sites nearby. No further consideration is warranted for these ducks.

6.1.3 Mammals

Notwithstanding that parts of up to 89.7ha of the Survey Area has Woodland habitat, most of which south of Stony Creek Road will be cleared if this Project proceeds, the likely impact from the Project on the terrestrial fauna has to be reviewed in the perspective of this highly modified landscape near Singleton in the Upper Hunter Valley which has had a long history of European settlement. The agricultural and pastoral land use practices that preceded mining in this area have reduced the native mammal community in the area immediately around the Open Cut Area to the “non-critical weight” species that are known to be less susceptible to extinction (see Burbidge and McKenzie 1989 and Recher and Lim 1989). Thus given the long settlement history of the Singleton LGA, it is unlikely that any of the listed presumed extinct species would still be found in or near the Survey Area.

[17] In NSW it is *Pomatostomus temporalis temporalis,* the eastern sub-species, that has been listed as vulnerable.

The Survey Area is not within habitat range of the Brush-tailed Rock-wallaby which is confined to rocky outcrops and ledges or steep hill slopes. Although it is known to occur in the Singleton LGA (see **Appendix 2**) the nearest record was in Wollemi National Park. It is unlikely to be affected by the Project as this habitat type does not occur in or around the Open Cut Area. This species is not expected to be found on the Open Cut Area and is not relevant to this Project.

This rock-wallaby is also an EPBC Act listed species and as the Open Cut Area is not associated with any important population of this macropod, and the proposed activity is unlikely to cause any impact on this species by an introduction or encouragement of an invasive species or interfere with any recovery action for this species, no further consideration is warranted.

Of the listed vulnerable arboreal mammals, the Koala is subject to SEPP 44 and is dealt with in detail in Section 6.4 of this report. The other four species are discussed below.

There are at least 20 Squirrel Glider, *Petaurus norfolcensis*, records in the Singleton LGA, one of these is in Ravensworth State Forest, within 10km of the Open Cut Area. An analysis of the distribution of these records suggest that they occurred where there were substantial areas of relatively intact forest/woodland habitat which are still contiguous, like in Ravensworth State Forest and in dedicated conservation areas in the LGA. This glider was not recorded during this study and no viable population is expected to be found in this isolated, regenerating and regrowth open woodland remnant on and around the Open Cut Area. *Petaurus norfolcensis* can often be found in habitat where there are large mature Eucalypt with hollows and when there is a dense Acacia shrub understorey. It can persist even in narrow road reserves when these habitat conditions exist. This glider is not expected to be affected by this proposed activity although the removal of the Open Woodland and Woodland habitats in the Open Cut Area will diminish the likelihood of the use of this area by this glider into the foreseeable future. The actions proposed in the biodiversity offset areas, especially the installation of nest boxes and the destocking of those areas will have a positive effect on this species by providing nesting opportunities and the regenerating shrubland could increase the density of Acacias that might enable this glider to recolonise the biodiversity offset areas.

The Yellow-bellied Glider, *Petaurus australis*, is a large glider that requires extensive areas of tall forest or woodland with large mature mixed Eucalypt trees with overlapping flowering periods throughout the seasons to survive. Some 40 records of this glider exist in this LGA but none within 10km of the Open Cut Area. They are all in the area around Mount Royal National Park. There are no extensive stands of tall trees[18] on or near the Open Cut Area, and no viable local population of this glider is likely to be affected by this Project. Although this glider is known to be able to survive in habitat fragments of around 20ha in North Queensland Mahogany Forest, this species is unlikely to persist in these small and fragmented Woodland habitat remnants (even if all the area in the biodiversity offset areas and the Project Site was covered in tall mature trees) in this part of the Upper Hunter Valley. Any biodiversity offset and ameliorative measure proposed for this project is thus of limited benefit to this species.

[18] Notwithstanding the description of parts of the area as "Tall Forest" by GCNRC (2007b) using McDonald *et al* (1990) instead of Specht (1970) classification as "Woodland" and "Open Forest" - the cutpoint in the latter authority is 30m height instead of the 24m in the former.

There are only three records of the Eastern Pygmy-possum, *Cercartetus nanus*, in this LGA; none within 10km of the Open Cut Area. This little possum spends much of its time near the ground and is associated with a thick understorey of *Banksia* and *Leptospermum* spp. for cover and food. These resources do not exist on the Open Cut Area. It is therefore unlikely that a viable local population of this possum exists on the Open Cut Area and immediate surrounding areas. It is therefore unlikely that the proposed coal mine would affect this little possum. However, this possum is known to persist in Ironbark Forest with thick Acacia and Leptospermum shrub layer in Pilliga Nature Reserve so any biodiversity offset and ameliorative measures proposed for this that will increase the shrub density may benefit this species if it can persist in this part of the Upper Hunter Valley.

There was no record of Brush-tailed Phascogale, *Phascogale tapoatafa*, within 10km of the Open Cut Area although no less than 16 are known in the LGA. Recent records (c 2004) of this agile arboreal dasyurid occur to the east of Singleton where they appear to be confined to a valley between Glendon Brook and Elderslie. The lack of nesting hollows over most the Open Cut Area and surrounding areas suggests that it is unlikely that a viable local population of this species could have survived in the Open Cut Area and its immediate surrounding areas. However, three captures representing at least one female on the Open Cut Area, and a male in the Northern Biodiversity Offset Area suggest that one or more pairs of this species have been frequenting the habitats in the Open Cut Area and environs. It is noteworthy that no Phascogale capture was recorded in Habitat 3 Woodland other than along the Old Growth gallery where the mature trees are located. The other captures were in Habitat 2, the Open Woodland with isolated mature trees and Habitat 4 the Riparian Oaks. Further discussion of this species can be found in Section 6.2.5.

Small macropods like the Parma Wallaby, *Macropus parma* and the Red-legged Pademelon, *Thylogale stigmatica,* would be unlikely to have survived previos land use practices in the Open Cut Area and environs. It is a relatively isolated and highly fragmented woodland remnant. The six records of this wallaby and 11 records of the pademelon are confined to Mount Royal and Wollemi National Parks, none within 10km of the Open Cut Area, including Ravensworth State Forest. It is thus unlikely that this Project is likely to affect either of these small macropods. It follows that any of the ameliorative actions, including destocking and having a programme to control vertebrate pests as well as the biodiversity offset measures, which will increase the shrub layer and could theoretically favour these species in the longer term, are unlikely to benefit them.

The Long-nosed Potoroo, *Potorous tridactylus*, and the Rufous Bettong, *Aepyprymnus rufescens*, are typical of the critical weight marsupials that have disappeared from most settled areas all over the Australian Continent. Although there are four records of this potoroo and 13 records of this bettong in this LGA, they are all confined to the Mount. Royal State Forest some distance from the site of this proposed activity. These species are unlikely to be found in and around the Open Cut Area and there has been no record of these species within 10km of the Survey Area, including in Ravensworth State Forest. It is thus also unlikely that this Project is likely to affect either of these small marsupials. It follows that any of the ameliorative actions, including destocking and having a programme to control vertebrate pests as well as the biodiversity offset measures, which will increase the shrub layer and could theoretically favour these species in the longer term, are unlikely to benefit them.

This potoroo is also an EPBC Act listed species and as the Open Cut Area is not a habitat occupied by a local population of this marsupial and the proposed activity is unlikely to cause any impact on this species by an introduction or encouragement of an invasive species or interfere with any recovery action for this species no further consideration is warranted for this species.

The Hastings River Mouse, *Pseudomys oralis*, is a native rodent that requires thick ground cover often associated with ferns and grasses (Meek *et al* 2006). Although much is still to be learned about this mouse's habitat requirements (see Pyke and Read 2003), no extant population of this mouse has been recorded in any location below 500m AHD. There are at least 14 records of this rodent in the Singleton LGA but none within 10km of the Open Cut Area. All known records are located in Mount Royal National Park. It is unlikely that this rodent would be found in this part of the Hunter Valley in this vicinity, inclusive of the Open Cut Area. It is thus unlikely that it would be affected by or relevant to this Project.

This native rodent is also an EPBC Act listed species and as the Open Cut Area is not associated with any important population of this mouse and the proposed activity is unlikely to cause any impact on this species by an introduction or encouragement of an invasive species or interfere with any recovery action for this species no further consideration is warranted for this species.

The Large-footed Myotis, *Myotis adversus*, is confined to riparian corridors where it forages over the water by scooping its prey from the surface of the water. It is found in 2nd Order and higher order waterways (see Anderson, *et al* 2006). The creeks on the Open Cut Area and the immediate adjacent areas are 1st Order waterways. It is thus unlikely that this bat with a highly specialised foraging behaviour would be affected by this Project. Nevertheless, this fishing bat may still be found along Glennies Creek and maybe Reedy Creek outside the Open Cut Area where biodiversity offset corridors have been proposed. This creek is outside the Survey Area and was not sampled during this study. The improvement in the habitat quality in the proposed biodiversity offset areas adjoining this creek can only benefit this species by restoring its natural habitat in the riparian zone.

Two hollow roosting microbats, the Eastern False Pipistrelle, *Falsistrellus tasmaniensis,* and the Greater Broad-nosed Bat, *Scoteanax rueppellii,* that are listed as vulnerable have also been recorded in this the Singleton LGA. Although there are at least 10 records of the former and 6 of the latter species in this LGA, neither of these insectivorous bats are known to occur with 10km of the Open Cut Area and neither were recorded during this study. Again, as the high intensity of call sampling suggests these species either do not occur locally or their densities are so low that their detection will always be problematic. The night time lows in the ambient temperature did not drop below 10ºC a critical level at which severe limitations have to be recognised for detecting bats out of season.

Both these bats are below canopy foragers and they are species that prefer moister tall forest habitats that are not present on and around the Open Cut Area in this part of the Upper Hunter Valley. Records of these species are located in Wollemi National Park or in areas close to Mount Royal National Park. They are thus unlikely to be affected by the proposed mine and their relevance to the assessment of this Project is at best marginal.

Assuming that these species use the Open Cut Area from time to time, the negative impact and the benefit of the proposed ameliorative and offsets measures are likely to be similar to those described below for microbats, generally.

There are no less than 17 records of the Eastern Bentwing-bat[19], *Miniopterus schreibersii*, a cave dwelling species in the Singleton LGA and it was also recorded over the Open Cut Area during the spring survey. A detailed assessment of the likely impact this Project may have on this microbat is in Section 6.2.2.

The assessment and conclusion reached in Section 6.2.2 for larger *M. schreibersii* are also applicable to two other cave dwelling species, the Large-eared Pied Bat, *Chalinolobus dwyeri,* and the smaller Little Bentwing-bat, *Miniopterus australis,* known to occur in the Singleton LGA. Notwithstanding that there are 6 records of the *C. dwyeri* and 3 of this smaller species of bentwing-bat in the LGA, neither are known occur with 10km of the Open Cut Area and only *M. schreibersii* was recorded during this study. Presumably, these other species would use the Project Site although the intense call recordings suggest that it would be a rare event due to the absence or low density of these species locally.

The Eastern Freetail-bat[20], *Mormopterus norfolkensis*, was recorded during the survey. There are no less than 17 other records of this microbat in the Singleton LGA and it is known to occur within 10km of the Open Cut Area (NPWS 2004). Further consideration of the likely significant impact on this microbat can be found in Section 6.2.3.

All these insectivorous microbats are likely to benefit from the actions proposed in the biodiversity offset areas from the increase in foraging opportunities as the destocking allows regeneration of the shrub layer and the various stands of trees representing different cohorts are allow to grow and mature under less stressful conditions. These bats including all the cave dwelling species are known to use tree hollows outside their breeding season and can be expected to use the nest boxes in the biodiversity offset areas. The development of a richer habitat structural diversity from the destocking would result in a denser if not also more diverse (species rich) insect community. Thus, both in the short-term and in the longer term, the ameliorative and offset actions proposed for this Project will benefit these bats and arguably sufficiently to balance what negative effects the clearing of 76.7ha remnant of the native vegetation on the Open Cut Area would have on the species' foraging opportunities.

The listed vulnerable Spotted-tailed Quoll, *Dasyurus maculatus*, has been identified as occurring in the Singleton LGA from some 29 records. There is no record of this species with 10km of the Open Cut Area (NPWS 2006). This species, although robust in its ability to use a variety of habitats, requires a reasonably dense ground level cover (other than perennial grasses) and is not expected to occur in the Survey Area due to a lack of suitable habitat. It is thus not expected to be affected by this mining Project. In the short-term, it is also unlikely to benefit from the ameliorative and offset measures proposed for this Project although in the longer term the improvement in the habitat quality and structure in the biodiversity offset areas, especially along the riparian zone might benefit any local population of this species in the Stony Creek Catchment and would assist its long-term recolonization of the biodiversity offset areas from the adjoining Stony Creek riparian habitat.

[19] Often called the Common or Large Bentwing-bat the listed threatened sub-species is the southern stock, *Miniopterus schreibersii oceanesis*.
[20] Also called the Eastern Little Mastiff-bat (Parnaby 1992) or the East-coast Freetail bat (Churchill 1998)

This quoll is also an EPBC Act listed species and as the Open Cut Area is not area associated a local population of this marsupial and the proposed activity is unlikely to cause any impact on the species by an introduction or encouragement of an invasive species or interfere with any recovery action for this species no further consideration is warranted for this species.

The Grey-headed Flying-fox, *Pteropus poliocephalus,* has been recorded within 10km of the Open Cut Area. Although no less than 28 records of this fruit bat exist in the Singleton LGA, it was not recorded on or near the Open Cut Area during this study. Nevertheless it can be assumed from the existence of a camp of this megachiroptera in a park in Singleton that it would forage over much of the LGA including the Open Cut Area when the Myrtaceaes are flowering. A detailed assessment of the likely impact this proposed mine can have on this flying-fox is in Section 6.2.5.

6.1.4 Reptiles

With regard to reptiles, the Broad-headed Snake, *Hoplocephalus bungaroides*, has been recorded in the Singleton LGA. The two records are from Wollemi National Park at the southern extremity of the Singleton LGA where there are sandstone escarpments. It has not been recorded within the Hunter Valley and no suitable habitat occurs on the Open Cut Area or surrounding areas. There is no record of this species within 10km of the Open Cut Area and it is unlikely that the proposed mine would affect this snake.

This snake is also an EPBC Act listed species and as the Open Cut Area is not associated with any important population of this reptile and the proposed activity is unlikely to cause any impact on this species by an introduction or encouragement of an invasive species or interfere with any recovery action for this species no further consideration is warranted for this species.

Although the Pale-headed Snake, *Hoplocephalus bitorquatus*, is known from scattered localities in the Hunter Valley, none have however been recorded from the immediate area inclusive of the Open Cut Area or elsewhere in the Singleton LGA. As it primarily eats frogs, it tends to favour tree lined free-flowing watercourses. Given the lack of suitable habitat on the Open Cut Area it is unlikely to occur here and thus is unlikely to be affected by this Project.

6.2 Threatened Species, Populations and Communities

The threatened species recorded, or likely to be found, on the Open Cut Area are discussed in Section 6.2.1 to Section 6.2.5; listed threatened populations and communities in Section 6.2.6 and critical habitats in Section 6.2.7.

For each of the species discussed in Sections 6.2.1 to 6.2.5, the impact of the Project has been assessed against each of the key thresholds listed in the *Draft Guidelines for Threatened Species Assessment* published by the Department of Environment and Conservation and Department of Primary Industries in July 2005. Two of the key thresholds are discussed explicitly for each species. These thresholds are listed below.

- Whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or ecological community.
- Whether or not the proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction.

The remaining key thresholds listed below are discussed within Sections 6.2.1 to 6.2.5 and Section 6.2.7.

- Whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts will maintain or improve biodiversity values.
- Whether or not the proposal will adversely affect critical habitat.

6.2.1 Grey-crowned Babbler, *Pomatostomus temporalis*

A family of *P. temporalis* was recorded on the Open Cut Area during this study (see **Figure 7**). This babbler has also been recorded elsewhere in the Singleton LGA and there are at least 11 previous records of this bird within 10km of the Open Cut Area (NPWS 2006a).

> *"Grey-crowned Babblers occupy open woodland dominated by mature eucalypts, with tall shrubs, and intact ground cover of grass and forbes…. "*
> (Scientific Committee Final Determination 26 October 2001).

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

In order to assess potential impacts on the life cycle of the *P. temporalis*, it is necessary to address the primary components of its ecology, such as breeding, foraging, nesting and movement accordingly.

Breeding

Pomatostomus temporalis breeds co-operatively, once or twice a year from June to December. Breeding occurs as sedentary family groups of 2-13 birds.

Foraging

Pomatostomus temporalis is insectivorous and forages in leaf litter and on the bark of trees in Eucalypt woodlands. Home ranges vary from less than 2 ha in high rainfall areas to over 50 ha in semi-arid woodland habitats.

Nesting

*Pomatostomus temporalis builds conspicuous nests "in the shape of a rounded bottle on its side with a spout-like entrance near the top and sloping slightly downwards…. Nests are placed either in an upright fork of a sapling (see **Figure 4**) or horizontal fork at the extremities of a limb of a substantial tree,…from a few metres to fifteen metres above ground, but usually less than ten"* (Beruldsen 2003).

Movements

No seasonal movement is apparent in *P. temporalis* and family groups seem to permanently occupy an area.

The threats to this species have been identified as "habitat degeneration due to weed invasion" and "grazing by stock and clearance and fragmentation of habitat, including removal of dead timber" (NPWS 2001). These threats have lead to a reduction in family group size and increasing isolation of populations (with the consequential adverse effects of genetic isolation and inbreeding).

This Project would involve the removal or modification of some 76.7ha of Woodland and surrounding Open Woodland with isolated trees representing a significant area of known habitat of a family of this babbler. As a result it is likely that the Project would affect this local family significantly as there are probably insufficient Open Woodland and Woodland habitats in the surrounding remnants to support this locally displaced babbler family and sustain its current numbers. Notwithstanding that the areas of *Casuarina* would be preserved, an area representing about 45% of the vegetation remnants would be removed early during the proposed life of the Project as an initial pulse impact (see EA Section B4). The family group would have to move to the remaining surrounding habitat. Although this would be ameliorated by the improvement in the habitat patch quality in the surrounding remaining Woodland from destocking and ameliorative planting (see **Figure 8**).

- *Whether or not the Project is likely to accelerate the extinction of the species, population or ecological community*

The proposed activity is unlikely to isolate any local population of this babbler from any currently interconnecting or proximate areas of habitat of this species because of its mobility through its ability to fly between patches of habitat. Field observations (records of disused nests and sightings of foraging groups) in October 2005 suggest that this family is has been reduced to 3-5 birds which are no longer in resident on the Open Cut Area. They are however, still foraging through the Woodland areas on the Open Cut Area regularly.

Pomatostomus temporalis is poorly represented in conservation reserves as it occurs in the woodland habitat on richer soils on plains and undulating terrain that are favoured for agriculture. It also used to occur in Ravensworth State Forest which has now been largely consumed by the Mt Owen Open Cut Coal Mine.

It is however noteworthy that in the nearby Mt Owen Mine, the post-development monitoring program has recorded this babbler persisting around the mine site and it is apparently using areas of rehabilitation that are over 5 years old (see HVCC 2003). Thus the biodiversity offsets proposed for this Project should have a beneficial effect on this species if the shrub layer is allowed to establish and regenerate, and the regrowth from saplings encouraged in the biodiversity offset areas. These outcomes from destocking and/or supplementing planting can eventuate in the short term and within the anticipated life of this proposed mine.

The Survey Area in the Hunter Sub-region of the Sydney Basin Bioregion is not at the distributional limit of this listed vulnerable babbler species which is known to occur in suitable habitat over most of eastern half of NSW.

In summary, the babbler family occupying the Open Cut Area would be affected by the proposed open cut coal mine and thus there is likely to be a significant impact on the generational viability of this local population of *P. temporalis*. How this population would respond to this proposed activity would depend much on effective ameliorative and biodiversity offset measures are adopted. See Recommendation in Section 7.0.

6.2.2 Eastern Bentwing-bat, Miniopterus schreibersii

There are a number of records of this bentwing-bat in the Singleton LGA and several known records are within 10km of the Project Site. *Miniopterus schreibersii* is normally a cave dweller that forages over large areas, including over Woodland such as those present in the Open Cut Area and environs.

In order to assess potential impacts on the life cycle of the *M. schreibersii*, it is necessary to address the primary components of its ecology, such as breeding, foraging, roosting and movement/migration accordingly.

Breeding

Miniopterus schreibersii (and the smaller *M. australis* with only three records in the region, none within 10km of the Project Site) are colonial breeding bats that annually congregate in maternal caves to breed over the winter months. They were listed as a vulnerable species because of its special breeding behaviour. Its congregation makes it susceptible to disturbance in and around its maternal caves in the cold winter months.

Foraging

This bentwing-bat forages for a variety of insects in tree canopies and regularly forages over several kilometres from its roosting site over a large range of habitats, including open pastures with isolated trees.

Roosting

Outside the winter breeding season, this bentwing-bat has been found in disused silos, mine shafts, drainage culverts and occasionally in tree hollows although is a known cave dweller.

Movement

Sub-populations are thought to have high maternal site fidelity and seldom intermix with other breeding stocks but will foray several 100km from their birth sites between breeding seasons. Although a widespread and cosmopolitan species no seasonal migratory movements have been recorded in this species.

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

No maternal cave is known to exist within 20km of Open Cut Area in this part of the Upper Hunter Valley and the proposed activity is unlikely to significantly affect the availability of foraging habitat for or the long-term viability of this bat in the area.

- *Whether or not the Project is likely to accelerate the extinction of the species, population or ecological community.*

This microbat is a common cave dependent bat. It was listed as vulnerable because of its communal breeding habits. The proposed activities do not involve impacting directly or indirectly upon any cave or mine shaft. It is thus unlikely to impact upon any viable local population of this bentwing-bat.

The habitat on the Open Cut Area represents foraging habitats for this microbat. Given the mobility of this bat, the disturbance clearing of 135ha including 42.4ha Woodland and 34.3ha of Open Woodland would not represent a significant reduction of foraging area for this bat. This notwithstanding, this microbat would continue foraging over the areas affected by the proposed mine, albeit probably in a different pattern.

The location area occupied by the proposed coal mine does not constitute a significant wildlife corridor for the surrounding habitats adjoining the Open Cut Area (see **Figure 2**), the Project is unlikely to affect the conductivity and connectivity of woodland around the Open Cut Area.

On a State-wide basis, the roost and maternal sites of this bentwing-bat are well conserved as the more rugged and inaccessible areas of the landscape have been dedicated for reserves.

The Glennies Creek Catchment is not the known limit of this microbat. *Miniopterus schreibersii* ranges into Victoria, Queensland and South Australia as well as NSW.

In summary, the proposed coal mine is unlikely to adversely significantly affect this microbat so that it would have an impact on its long-term viability. The proposed activity over the Open Cut Area will alter the foraging pattern of this microbat during the life if the mine and during early post-mining rehabilitation. This conclusion also applies to the other cave dwelling microbat species, viz. the Large-eared Pied Bat, *Chalinolobus dwyeri,* and the Little Bentwing-bat, *Miniopterus australis,* known to occur in the Singleton LGA (albeit *C. dwyeri* is not a communal cave breeding species).

Chalinolobus dwyeri is also an EPBC Act listed species. It is unlikely that the Open Cut Area is habitat for an important population of this cave dwelling bat and the proposed activity is unlikely to result in any impact from an invasive species on this bat or interfere with any recovery action for this species. No further consideration of any likely impact on this species is warranted.

The proposed offset and ameliorative measures will allow the habitat patch quality to improve over time. Notwithstanding the pulse impact from the initial clearing of parts of this highly fragmented and isolated vegetation remnant the remaining areas, especially the proposed biodiversity offset areas will most likely have an increased insect diversity and density. This will provide better foraging opportunity for these bats and the opportunity for the remaining mature trees to senesce and form hollows will provide longer term roosting opportunities. In the short term, the installation of nest boxes[21] for microbats could provide immediate roosting opportunities for these species.

[21] The provision of say, 100 bat roosting boxes scattered in appropriate locations over the biodiversity offset areas would ameliorate the loss of roosting sites from the clearing of trees in the Open Woodland and Woodland areas in the Open Cut Area.

6.2.3 Eastern Freetail-bat, Mormopterus norfolkensis

Mormopterus norfolkensis was recorded foraging over the Open Cut Area from its characteristic alternating flat zero-crossing call pattern. This freetail-bat was recorded from only a few isolated calls. It normally roosts in tree hollows and forages in the tree canopy. It forages over wide areas flying several kilometres each night. This bat would no doubt continue to use the Open Cut Area over the life of the proposed mine. There are no less than 17 other known locations in the Singleton LGA where this bat has been recorded, one within 10km of the Open Cut Area.

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

In order to assess potential impacts on the life cycle of this little known freetail-bat it is necessary to address the primary components of its ecology, such as breeding, foraging, roosting and movement accordingly.

Breeding

Virtually nothing is known of the breeding biology of *M. norfolkensis*. There are however some suggestions of male exclusive maternal groups forming during breeding (Allison and Hoye 1995).

Foraging

Most records of *Mormopterus norfolkensis* are in dry eucalypt forest and woodland but records exist of this bat foraging low over a rocky river in rainforest and wet sclerophyll forest. Other than that this freetail bat is insectivorous, little is known of its prey preference or foraging behaviour. It has however been recorded gleaning flying insects around light poles in a suburban park and at a mine facility.

Roosting

Mormopterus norfolkensis normally roosts in tree-hollows but have also been found under bark, metal caps of telegraph posts and in the roofs of huts (Churchill 1998).

Movement

No seasonal movement or any other movement pattern has been recorded for this bat. Presumably it forages over a large area as is the case with other *Mormopterus* spp, and is limited only in its mobility by the performance inherent in its wing design.

- *Whether or not the Project is likely to accelerate the extinction of the species, population or ecological community.*

The Project will involve the removal of 76.7ha of vegetation remnant representing 40% of the vegetation remnant. Taking its mobility and its ability to access foraging habitats to the north of Stony Creek Road, it is unlikely that the proposed mine would significantly adversely affect this local population of *M. norfolkensis.* There are proposed safeguards, including pre-start surveys (see Section 7.0), biodiversity offsets that would be adopted in the mine layout design, including the destocking of the balance of the lease areas and the areas to the north of Stony Creek Road (see **Figure 6**), and early commencement of rehabilitation. Only the foraging behaviour and roosting pattern of this rare bat would be modified over the Open Cut Area.
It is, however, unlikely that this local population of *M. norfolkensis* would be put at risk of extinction by this Project. Taken on a landscape scale, the 76.7ha of vegetation remnant does not constitute a significant area of habitat for *M. norfolkensis.*

The area of proposed mine does not constitute a significant wildlife corridor for the habitats in the locality (see **Figure 1**). The proposed mine is unlikely to affect the conductivity and connectivity between any habitat remnants although at this stage it is part of the Synoptic Plan for the year 2020 integrated landscapes for mine site rehabilitation for the Hunter Valley (see DMR 1999).

Mormopterus norfolkensis can be found along the greater part of east coast of the Australian mainland so the Open Cut Area of this proposed mine is not the limit of its known distribution.

In summary, the proposed open cut mine is unlikely to accelerate the extinction or affect the long-term viability of *M. norfolkensis.* The effect of the proposed ameliorative and offset measures on this species will be the same as those detailed above for the other threatened listed microbats.

6.2.4 Grey-headed Flying-fox, *Pteropus poliocephalus*

Pteropus poliocephalus was not recorded on the Open Cut Area or immediate adjoining area during this study. It was however observed roosting in the park in Singleton. No less than 28 location records of this species are known In the Singleton LGA, including a couple within 10km of the Open Cut Area. They are undoubtedly individuals from the Singleton colony that is in the park in town next to the New England Highway.

This fruit bat can be expected to occur on the Open Cut Area in the Woodland when the native trees are flowering. It is noteworthy that the tree species on the Project Site are known to have blossom at different times; see **Table 15** below.

Table 15
Flowering Times of Trees in the Survey Area

Myrtaceae Species	Season/ Months
Eucalyptus tereticornis	Spring
Eucalyptus fibrosa	Summer
Eucalyptus blakelyi	August - December
Eucalyptus crebra	October - November, irregular
Eucalyptus molluccana	Summer and Autumn
Corymbia maculate	April - September, irregular
Angophora floribunda	December - March

Only *C. maculate* was observed flowering in mid-June 2006, albeit rather poorly.

This fruit bat was listed as a vulnerable species because of its roosting habits at communal camps. It was also targeted for destruction by fruit growers for its ability to opportunistically exploit fruit crops as a suitable food resource to substitute for the diminishing natural fruit, blossom and nectar on which it normally relies.

In order to assess potential impacts on the life cycle of this otherwise common fruit bat, it is necessary to address the primary components of its ecology, such as breeding, foraging, roosting and movement accordingly.

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

Breeding

Pteropus poliocephalus breeds in traditional camps where they congregate and start mating by mid-summer but conceptions appear to occur only by around April. Most births of a single young occur around October each year but have been recorded to occur throughout the summer. The young are carried around with the mothers while they forage for up to a month. They are then left in camp until they can fly with their mothers after about three months. They are weaned by the time they are six months old and congregate in winter camps.

Foraging

They normally forage within 15km of their camps but individuals have been known to fly up to 50km to seek out a particular food source. This flying fox prefers native blossoms and fruits but the increasing fragmentation and cumulative clearing of native bushland has seen this species increasingly raiding commercial fruit orchards.

Roosting

They congregate in communal traditional roosts called camps. These are located in gullies or other suitably sheltered locations like in the park in Singleton and the Botanic Gardens in Sydney.

Movement

This is a very mobile species and a portion of the adults in every camp disperse from the camp over winter. This seasonal movement appears to be related to the abundance of food resources.

Considering the mobility of this flying-fox along the East Coast of parts of Victoria, NSW and Southern Queensland, and its semi-nomadic habits, it is unlikely that the 190ha of Woodland and Open Woodland habitats in the Survey Area which represents only a small part of its foraging habitat would significantly impact upon this species' life cycle or the viability of the Singleton *P. poliocephalus* population.

Due to its aerial mobility and semi-nomadic movement patterns, this fruit bat is unlikely to become isolated from any habitat remnants in the Singleton LGA as a consequence of the removal of 76.7ha of this vegetation remnant should this proposed mine proceed. The area of proposed mine does not contain any significant area of natural habitat for *Pteropus poliocephalus* by way of a collective roosting site, often referred to as a camp. Although the clearing of most of the woodland area and the mature trees in the other areas in the Open Cut Area will represent an initial pulse impact loss on the foraging resources for this flying fox and this resource cannot be offset in the short or longer term within the operational life of the proposed mine, the offset and ameliorative measures proposed for this project will ensure that the remaining areas of this highly fragmented and isolated habitat patch will be preserved and the saplings and smaller trees can mature to provide blossoms for this flying fox.

- *Whether or not the Project is likely to accelerate the extinction of the species, population or ecological community.*

Woodland remnants in the Open Cut Area habitat type that used to occur over the entire Hunter Valley are now poorly conserved (see **Figure 1**). This is largely due to the long history of land use that has dated back to early European settlement of this country. This conservation short-fall notwithstanding, it is unlikely that the Project would accelerate the extinction of this flying-fox due to its mobility and opportunistic habits.

The Project Site is not at the limit of the known distribution of *P. poliocephalus* which extends throughout the eastern half of NSW and into Eastern Victoria and SE Queensland.

This flying fox is also an EPBC Act listed species and as the Open Cut Area is not area used as a camp for this megachiroptera and the proposed activity is unlikely to cause any impact on the species by an introduction or encouragement of an invasive species or interfere with any recovery action for this species no further consideration is warranted for this species.

In summary, although it is unlikely that the proposed mine would significantly adversely impact upon this flying-fox to reduce it long-term viability, the initial clearing of the Woodland and Open Woodland habitat in the Open Cut Area will amount to a pulse impact from a reduction of foraging habitat and the loss of this spasmodic food resource within flight distance from Singleton. This impact will continue as a press impact until saplings can reach an age when they can flower as small trees. This is not expected to happen within the operational life of the mine that is currently being proposed. Nevertheless, the ameliorative and offset measures proposed will ensure that the maximum number of potential food trees can regenerate to improve the foraging habitat quality for this flying fox in the longer term.

6.2.5 Brush-tailed Phascogale, *Phascogale tapoatafa*

There has been no previous record of *P. tapoatafa* within 10km of the Open Cut Area. There were no records of *P. tapoatafa* in the Singleton LGA other than the population around Singleton and another population in Wollemi NP approximately 15km to northeast of the Open Cut Area. In hindsight, its known distribution in the Singleton LGA is almost certainly the result of poor sampling, notwithstanding the fact that this species has only ever been found in low densities in this part of its range in the Hunter Valley.

Phascogale tapoatafa was recorded at three locations on four different occasions that included an adult female[22] on Narrow-leaf Ironbark in the Camberwell topsoil dump near location C6 in May 2006 (see **Figure 7**). Another full grown female capture[23] was recorded along the old road reserve on a senesced Forest Red Gum in June 2006. A non-sexually active adult male was also recorded in May 2006 on a River Oak on the creek bank in the proposed biodiversity offset area. All were yearlings.

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

Breeding

Phascogale tapoatafa breeds once a year and have a highly synchronized breeding pattern. Mating in hollows occur around June and is followed by male die-off. Females can live up to three years. The gestation period is approximately 30 days after which up to eight neonatal attach to the teats in the rudimentary pouch of enlarged lateral ventral abdominal skin folds on the mother. Like other dasyurids, *P. tapoatafa* produces supernumerary young.

Young are left in the maternal nest after about 7 weeks when they are still hairless.

Young are independent of their mother after approximately 20 weeks, ie. at the beginning of spring and start to disperse during mid-summer.

Foraging

Between dusk and dawn, *Phascogale tapoatafa* forages in leaf litter, tree hollows, hollow logs and under bark for small vertebrates, insects and other invertebrates. This carnivorous marsupial is an efficient predator and has also been known to consume bird eggs. Nectar forms part of its diet and it has been known to feed for prolonged period in a heavy flowering Eucalypt (Sonderquist 1995).

Lactating mothers return to their young in the maternal nest during the night at regular frequencies. This nest attendance frequency decreases until the young are fully weaned around 20 weeks when she would only return to the nest after dawn. The young learn to hunt alone.

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[22] The female caught in the same trap on a subsequent night was almost certainly the same female from the previous night. As a precaution, this trap was moved to another location on subsequent nights.

[23] This was probably the same female caught in May 2006 as adult females keep exclusive home ranges.

Nesting

Phascogale tapoatafa nests in tree hollows, stags, stumps and hollow logs. Females have exclusive home ranges with other females. Home ranges of females vary between 20ha and 70ha - except they may sometimes overlap with their mother. Males have exclusive home ranges about twice the size of female and overlap with females, except during the mating period.

Females prefer large tree cavities with small secure entrances in which they build large nests. Individuals use up to 20 nests over the year and often make large nests of bark strips, fur and feathers.

Movements

Phascogales are solitary for most of their life-cycle. Young remain within their mothers near their maternal nests until dispersal. Independent females remain close to their maternal home range after dispersal while males have larger home ranges and move long distances between habitat remnants during the mating period.

- *Whether or not the Project is likely to accelerate the extinction of the species, population or ecological community.*

The proposed activity would remove some of the exclusive home range of, probably, only one female and it's young. The extent of this impact on those individuals with the Open Cut Area would depend on the timing of the clearing of the Open Woodland and Woodland habitats and the effectiveness of the ameliorative and offset actions proposed. It would also affect the establishment of the young of this mother in the surrounding area.

Notwithstanding the 20m buffer to the nearest capture location in the Open Woodland from the out-of-pit emplacement that has been adopted and the minimal impact from the Dirty Water Containment Dams, particular precautions are considered necessary in order to ensure that if these dams fill or partly fill with water during the onset of the breeding season and early nesting (between July and August) there is an escape route for the breeding female Phascogale from any nesting tree that is isolated by rising water. If a nesting female is located, there will be a need to make sure that she has free access to her nest hollow until November when the young are fully independent and start dispersing. Currently any method of mechanically bridging an isolated nest tree, by ropes or otherwise, can only be considered experimental.

While it is unlikely that the adverse impact on this female that had its home range in the Open Cut Area, the viability of the local population of this Phascogale in the around Singleton and Wollemi NP is unknown. While the Wollemi population is in a nature conservation area no other information regarding its status is known at this stage.

It is therefore important that the impact on the local Phascogale population and the effectiveness of the proposed ameliorative and offset measures are monitored adequately. Whether the proposed activity would accelerate the extinction of a local population of this species is unknown at this stage. The provision of nest boxes to offset the loss of tree hollows from the clearing of mature trees from the Open Woodland and Woodland areas in the Open Cut Area would be an appropriate ameliorative action to adopt.

6.2.6 Threatened Fauna Population and Community

No threatened fauna population or ecological community has been listed under the TSC Act in the Glennies Creek Catchment, the Singleton LGA or the Upper Hunter Valley.

6.2.7 Critical Habitat

No critical fauna habitat has been listed in Glennies Creek Catchment, Singleton LGA or the Upper Hunter Valley.

6.2.8 Summary for the Seven Part Test

Further to the above, in pursuant to Part 3A of the EP&A Act, the assessments of the likely significant effect on threatened species, populations or ecological communities, or their habitats were conducted for the abovementioned species recorded or likely to be found in the Open Cut Area and immediate environs in accordance to the current guidelines (DEC, 2004), in particular Section 5A of the EP& A Act. This is summarised below as follows.

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

See Section 6.2.1 to 6.2.5 and Section 6.5.

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

See Section 6.2.6.

[c] in the case of an endangered ecological community or critically endangered ecological community , whether the action proposed:

[i] is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

[ii] is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

See Section 6.2.6.

[d] in relation to the habitat of a threatened species, population or ecological community:

[i] the extent to which the habitat is likely to be removed or modified as a result of the action proposed, and

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

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

See Section 6.1, Section 6.2.1 to Section 6.2.6 and Section 6.5.

[e] whether the action proposed is likely to have an effect on critical habitat [either directly or indirectly].

See Section 6.2.7.

[f] whether the action proposed is consistent with the objectives or actions of a species recovery plan or threat abatement plan.

See Section 6.1 and Section 6.2.1 to Section 6.2.5.

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

See Section 6.3.3, Section 6.4 and Section 6.6.

6.3 EPBC Act

Under the EPBC Act considerations of Commonwealth listed threatened species apply to all land. Thus, these matters are considered below as to whether the proposed activity would constitute a controlled action.

6.3.1 EPBC Act Listed Threatened Species

Considerations of EPBC Act listed species have been included in the relevant parts of Section 6.1 and bear no need for repetition here except for the following.

(i) It is noteworthy that the Eastern Long-eared Bat, *Nyctophilus timoriensis,* that is listed to occur in the DEH data base, is most likely to have resulted from a misidentification. This species is unlikely to be found east of the Great Dividing Range and is likely to have been confused with a specimen from a montane population of *N. gouldi* (see Parnaby 1992).

(ii) *Pteropus poliocephalus* is also an EPBC Act listed species. However, the Singleton fruit bat population is not a major roosting site and the proposed activity is unlikely to result in any invasive species becoming established in this species' habitat or interfere with the recovery of this fruit bat.

6.3.2 International Agreement Listings

The migratory species listed under CAMBA and JAMBA as well as the marine species listed under the EPBC Act that can be affected by contaminated water, they are unlikely to be significantly adversely affected by this proposed mining activity for the following reasons.

- The relatively small size of the proposed mine on a landscape scale, no tailings or discharge dam that can be potentially hazardous to waterbirds would be constructed.
- The water management regime from this operation would be contained wholly within the Open Cut Area.

Other EPBC Act listed species that are within the distribution range of the Open Cut Area are:

The White-bellied Sea-Eagle, *Haliaeetus leucogaster*, is predominantly a coastal and estuarine species but also occurs in inland waterways where there are sufficient fish in the lakes and rivers for it to persist. Although there are at least 4 records of it in the Singleton LGA, this eagle was recorded on one occasion during this study and there is no other record of this eagle within 10km of the Open Cut Area, although there is a record of it on the Hunter River near Singleton. The proposed coal mine does not involve or have any direct or indirect impact on any natural wetland or waterway thus it would have no impact on the White-bellied Sea-Eagle.

There are at least 15 records of the White-throated Needletail, *Hirundapus caudacutus*, in the Singleton LGA. It is a migratory species that spends almost all of its time in the air over the Australian Continent. Although it was not recorded during this study, there is at least one record of it within 10km of the Open Cut Area. However, it opportunistically roosts in taller trees from time to time. The removal of 76.7ha of Woodland and Open Woodland is unlikely to have any direct or indirect impact on this mostly aerial species.

The Satin Flycatcher, *Myiagra cyanoleuca*, is a species that inhabits Eucalypt Woodland and migrates north in winter. It breeds in the wetter areas with dense vegetation and moves to drier habitats once the young are out of the nest. This species was not observed on the Open Cut Area during this study. Although it is known to occur in the Singleton LGA from at least eight records, it has not been recorded within 10km of the Open Cut Area. Any likely adverse impact on this species can be minimised, if the removal of Woodland remnants can be kept to a minimum. In this part of its range where it is nomadic, the removal of 76.7ha of Woodland and Open Woodland is unlikely to cause a significant impact on *M. cyanoleuca*.

The Painted Snipe, *Rostratula benghalensis,* and its congeneric, the listed Vulnerable Australian Painted Snipe, *R. benghalensis australis*, are species that forage in mudflats and nest among the vegetation in shallow water. This type of wetland habitat does not occur on or near the Open Cut Area. This snipe was not recorded during this study and there is no record of this species in the Singleton LGA. The Project is thus unlikely to affect this species.

Latham's Snipe, *Gallinago hardwickii*, is a species that usually forages in muddy edges of natural freshwater swamps and pools, and occupies the surrounding wet grass and heath. This species was not recorded during this study and there is also no record of this species in the Singleton LGA. This species is unlikely to have any reliance on the Open Cut Area where the dams at best represent only poor quality habitat. The proposed activity is thus unlikely to affect this snipe.

The Rufous Fantail, *Rhipidura rufifrons*, is a summer migrant in Southeastern Australia. Although it is found in the Sydney Basin Bioregion it is only occasionally found further west, in this subregion. It is associated with structurally diverse eucalypt forests in the Central Tablelands and Central Coast. Although this fantail has been recorded in the in the Singleton LGA there is no record of it with 10km of the Open Cut Area. The Survey Area is in the drier Upper Hunter, is marginal non-breeding habitat for this fantail as it does not have the structural diversity of some habitat patches in some of the gullies in the region to the north and south. This Project is thus unlikely to significantly impact upon this species.

The Black-faced Monarch, *Monarcha melanopsis*, has been recorded in the Singleton LGA in no less than 15 locations. This species was not recorded during this study and there is no record of this species within 10km of the Open Cut Area. From its breeding grounds on the east coast of Australia below 26°S along the eastern slopes and plains and extending past the Victorian border it migrates north to winter beyond Rockhampton in N. Queensland. It inhabits rainforest and eucalypt forest where it forages in the tangled understorey for insects and their larvae along branches and crevices. There is very little understorey cover on the Open Cut Area, the Project is thus unlikely to significantly impact upon this species.

There is only one record of the Spectacled Monarch, *Monarcha trivirgatus*, in the Singleton LGA. It is essentially a rainforest bird although it is also associated with mangroves and is known to occur in Eucalypt forests close to rainforests. This monarch usually feeds within 6.0m from the ground among the understorey for insects and other invertebrates often taking them in flight. This bird was not recorded during this study and it has not been recorded in any location within 10km of the Open Cut Area. There is no rainforest near the Open Cut Area, thus the Project is unlikely to significant impact upon this species.

There is no record of the Fork-tailed Swift, *Apus pacificus*, in the Singleton LGA. This species was not recorded during this study. It is a migratory species that breeds in Asia and is nomadic in this part of its wet season distribution range in Australia. It may not roost at all most of the time over this part of its range where it is in constant flight but is known to occasionally settle over night to roost in reeds, cliffs and large trees. It is unlikely that given the relatively small size of this Project on a landscape scale, and the limited number of what can be considered large trees (trunk diameter at SBH >> 0.75m), that the proposed activity would have a significant impact upon this swift.

There are at least three records of the Great or White Egret, *Ardea alba*, in the Singleton LGA. Although there is a record of this egret within 10km of the Open Cut Area, this species was not recorded during this study. This cosmopolitan egret is widespread in the coastal areas as well as in inland Australia. It often feeds communally with other wetland birds mainly on fish, invertebrates and frogs in shallow swamps and flooded fields and along the edges of ditches and streams. The water discharge into storage dams from this proposed activity may create temporary opportunities for this bird but the Project is unlikely to have significant adverse impact on this species.

There are at least four records of the Cattle Egret, *A. ibis*, in the Singleton LGA. This species was not recorded on the Open Cut Area during this study and there is no record of this species within 10km of the Open Cut Area. The Hunter Valley is probably just beyond its non-breeding range although its breeding range has been expanding south. This egret breeds in colonies and congregates in flocks. It feeds on insects and other invertebrates disturbed by cattle and sometimes take ectoparasites from them. It also feeds in shallows of wetlands and drains, and is known to take small skinks. For similar reasons to *A. alba,* this Project is unlikely to significant impact this egret.

There is no record of the Rainbow Bee-eater, *Merops ornatus*, in the Singleton LGA and it was not recorded during this study. Although the bee-eater would live almost anywhere it can hawk for insects in sufficient quantities, the Open Cut Area does not offer the habitat characteristics to sustain high insect density. The Project is thus unlikely to significant impact this bee-eater.

The Upper Hunter Valley is not located en route to any known or established transcontinental jetstream related or coastal migratory pattern of any of this listed species. No further consideration of any of the international agreement listed species is thus warranted for this proposed mine.

6.3.3 Listed Key Threatening Processes

The European Red Fox, Feral Cat and the European Rabbit are listed as key threatening processes listed under the EPBC and TSC Acts.

The proposed activity is likely to have an adverse impact on the Feral Cat, European Red Fox and European Rabbit populations in the area by denying them the free foraging range of the existing altered landscape on the Open Cut Area. This can potentially assist in reversing some of the effects of the adverse impact these exotic species have on local native fauna if an appropriate pest (and weed) management plan is implemented.

The implications of other Key Threatening Processes that are listed under the TSC Act and EPBC Act are addressed in Section 6.4 and Section 6.6.

6.3.4 Summary

From the considerations above, the Project is unlikely to have any significant impact on matters that would constitute, or could be construed to be a controlled action under the EPBC Act.

6.4 Native Vegetation Conservation

No definitive systematic study on cumulative loss of fauna habitat in the Upper Hunter is currently available. The long history of settlement in the Hunter Valley and more recent development in agricultural activities (especially breeding of horses), mining, wine production as well as industrial, residential and rural residential sprawl has resulted in diminishing area of the valley remaining in remnant native vegetation. This has caused an increasing isolation and loss of habitat patches in the more productive parts of the valley. A more recent example of this process is the opening of the Mt Owen Mine that resulted in a significant loss of one of the larger regionally significant native vegetation patches in the valley which until then had been preserved in a State Forest area. An attempt to address some of these adverse impacts is detailed in DMR (1999).

The data regarding the cumulative loss of native vegetation, in particular the Woodland habitats around the Project Site from the operations of the adjoining existing Camberwell Open Cut Coal and Glennies Creek Underground Coal Mine as well as the Open Cut Ashton Coal Mine nearby, is unavailable from details provided in the studies associated with those respective proposals. However, a cursory inspection of historical aerial photographs will show that these project sites have been located largely on cleared agricultural land and their approvals to proceed have resulted in little additional fragmentation of native vegetation from the highly modified habitat already existed at that time; a landscape that has resulted from over 150 years of farming settlement in the Singleton district.

Some 76.7ha of vegetation remnant including 42.4ha of the Woodland habitat would be cleared for this proposed open cut mine, including an area of habitat with a gallery of large mature trees with Old Growth characteristics (with tree hollows, fallen branches, logs and stags; see **Plate 6**). This represents a significant area of the Ironbark – Spotted Gum Woodland habitat which has Old Growth characteristics in the Glennies Creek Catchment.

This Woodland remnant to be removed however does not have any apparent connection to any substantial adjacent native vegetation remnants such that the removal of this vegetation remnant would isolate any of the other habitat patches. Its role in the "Stepping Stone" theory in the Upper Hunter Valley landscape is thus unclear, if any. Nevertheless, recent studies have highlighted the contribution even the smallest habitat remnants can make at preserving the local biodiversity of a highly modified and almost totally cleared landscape (see Johnson *et al* 2007 and Lindenmayer and Fisher 2006). However, the appropriate considerations and the biodiversity conservation objectives of a potential mine site at this location should never be confused with the objectives of dedicated nature conservation areas, such as national parks and nature reserves.

The above comments notwithstanding the connectivity and conductivity of the remaining fauna habitats in the immediate area surrounding the Open Cut Area can be enhanced by:

(i) screen planting a 20m strip along the Stony Creek Road boundary of the Open Cut Area which would join the isolated roadside tree stands along this road to the remnant riparian vegetation;

(ii) continued destocking (including removing the horses from) the balance of the Open Cut Area which would allow natural regeneration that would improve the fauna habitat patch quality under and amongst the scattered trees; and

(iii) destocking and enhancement supplementary planting within the biodiversity offset areas, including along the riparian strips, to improve the habitat quality of the biodiversity offset area and these wildlife corridors to the riparian habitat along Reedy Creek.

6.5 SEPP 44 Koala Habitat Protection

Singleton LGA is listed under Schedule 1 of SEPP 44 and requires that any development application include an investigation to determine the presence of core and potential Koala habitat within the areas of proposed disturbance. One of the vegetation communities in the Survey Area contains one feed tree species, the Forest Red Gum, *E. tereticornis*, that is listed in Schedule 2. This comprises no more than 15% cover (see GCNRC 2007a). Neither Koala nor sign of Koala was encountered during the current surveys although there are some 43 records of Koalas in this LGA. There is one Koala record within 5km and another within 10km of the Open Cut Area (see **Figure 6**).

No Koala was found nor were there any signs of the species on the Project Site. All scratch marks evident on the smooth bark Eucalypts were attributed to the Brush-tailed Possums that are common in the region. Koalas usually frequent feed trees in areas of richer soils. In this largely agricultural landscape, they mostly occur near the riparian zone and floodplains. Koalas are, however, known to traverse considerable distance over cleared land in their dispersal between habitat remnants and have been recorded in low densities, for example in Ironbark forest in winter in most of Queensland. It is therefore possible that Koalas will use the timbered area of the Open Cut Area from time to time in their dispersal forays. Some might even take up short-term temporary residence in this remnant habitat patch from time to time.

Although the Koala may suffer the loss of the timbered area that will be cleared for the proposed pit, the preservation of the Bull Oak area will preserve the habitat connectivity of the riparian corridor on the southern side of Stony Creek Road to the rest of the Glennies Creek Catchment.

Given the above and the proposed planting to be carried out within the biodiversity offset areas and possibly in the Supplementary Biodiversity Offset Area as well as the rehabilitation of the Open Cut Area to native vegetation (see **Figure 8**), no significant area of potential (or core) Koala habitat will be lost in the long term as a result of this proposed development. Hence, no further consideration of a Koala habitat management plan pursuant to SEPP 44 is warranted.

Notwithstanding the net loss of the mature trees from the short-term pulse impact and the medium term press impact from the clearing of the native vegetation from the Open Cut Area, the medium to long-term post-mining cumulative loss of fauna habitat should be minimal with the safeguards and offsets proposed.

The clearing of native vegetation in the Open Cut Area will be confined to the southern side of Stony Creek Road (see **Figure 2**). As this area is isolated by agricultural land, existing mines and roads the Project will not be causing any further fragmentation of any contiguous habitat remnant or increase any edge effect on other native vegetation habitat patches.

This Project is unlikely to reduce the long-term viability of a local population of the species, accelerate the extinction of this species and it is not inconsistent with any recovery plan for the Koala.

6.6 ESD Principles

From the analysis in the preceding sections, it would appear unlikely that the proposed activity would adversely affect the biodiversity locally in the long to medium term, if the recommendations for biodiversity offsets and amelioration are adopted and carried out. Therefore no issue of either intergenerational equity or value-added consideration relating to fauna or their habitats arises. The proposed development is thus consistent with ESD principles with respect to these matters.

The precautionary principle dictates that we should not ignore any factors that are well established and accepted in general principles, for lack of adequate data in a particular instance, and should act upon them.

The proposed open cut mine would necessitate some clearing of some native vegetation and it would have some short term cumulative effect on the diminishing habitat remnants that form a network of habitat patches in the 2020 Synoptic Plan for the Hunter Valley of NSW (see DMR 1999) and in the Glennies Creek Catchment in particular (see HCMT 2003).

The issue of whether the proposed activity, the extraction of coal, would contribute to CO_2 emission as a major cause of global warming has been a subject of a Federal Court matter. It has accepted the fact that it was impossible to measure the increase from any single mine or to attribute any single mine to be responsible for any particular increase in global CO_2 emission.

In accordance with precautionary principles the adverse impact from this proposed open cut mine on the clearing of native vegetation and any increase in CO_2 emission would be minimised by compensatory and ameliorative measures on the native vegetation and fauna habitat which are detailed in the Section 7.0 below and are shown in **Figure 7**.

7 RECOMMENDED SAFEGUARDS

A number of safeguards can be put in place to minimise and/or ameliorate any adverse impact on the fauna in general and, in particular, on the listed threatened species that may occur in the Open Cut Area and the adjoining fauna habitats. These are as follows.

1. A Species Management Plan should be prepared for the Grey-crowned Babbler and Brush-tailed Phascogale to adaptively manage these species in the area of the lease area not directly affected by the proposed operational mining activities. These should include the following.
    - 1.1 The extent, pattern of deployment and timing of the deployment of nest boxes in the biodiversity offset areas.
    - 1.2 Post-approval monitoring of these species to enable any adaptive management to optimise the survival chances and increase the generational viability[24] of the local populations of these listed vulnerable species.
    - 1.3 The extent and location of felled and fallen timber in the biodiversity offset areas to create refuge and foraging opportunities by enhancing the habitat patch quality and structural diversity of the understorey.
2. Removal of native vegetation, including any regeneration should be kept to a minimum.
3. The existing remnant stands of Bull Oak, *Allocasuarina luehmannii,* and other vegetation remnants in the biodiversity offset area should be preserved and fenced off to allow those patches to regenerate to make up part of the biodiversity offsets that also include the biodiversity offset areas on northern side of Stony Creek Road.

[24] The courts have abandoned the established scientific definitions of population viability and case laws have now defined viability to mean generational viability of local population units.

4. The entire Open Cut Area should be permanently destocked to allow the grassy understorey to regenerate to improve the habitat patch quality for Grey-crowned Babblers in the remainder of the Open Cut Area that is indirectly affected by the proposed mining activity.

5. Mining should progress, where practicable, from the least sensitive to the more sensitive areas where native vegetation and/or where listed species have been recorded.

6. Where possible, tree removal, especially the larger mature trees, should be carried out in late spring and early autumn to avoid spring nesting birds and over-wintering bats.

7. Where mature trees with hollows are to be removed, pre-start inspections of those trees should be conducted for arboreal mammals, nesting birds and roosting bats, especially targeting the identified threatened species[25].

8. When located, nesting and roosting hollows, as well as nests, used by listed threatened species, should be relocated to appropriate locations nearby, where possible.

9. Microbat roost tubes (made from 150mm long 90mm diameter PVC tubes) should be provided to offset the loss of roosting resources that will be lost from the removal of tree hollows in the Open Woodland and Woodland habitats in Open Cut Area.

10. Other than commercial sawlogs, where possible, live and dead felled and fallen timber should be relocated and left on the ground as fauna habitat and not removed for use as firewood; a proportion of these should be located in the biodiversity offset areas.

11. Other that those sawlogs, no felled or fallen live or dead timber or vegetation debris of native vegetation should be buried or burned on site as a means of disposal.

12. Areas identified for biodiversity offsets should be effectively fenced off and destocked as soon as practicable to allow the local native vegetation community including the understorey to regenerate free of stock grazing pressure.

13. Rehabilitation, including fencing off of the areas between Stony Creek Road and Possum Skin Dam, and an ameliorative revegetation of a 20m wide corridor along the Stony Creek Road should commence as soon as practicable to enhance the connectivity along this roadside corridor and the creek line in the biodiversity offset areas, especially to the north of the confluence of Tieny Creek and Reedy Creek.

[25] An independent reviewer has suggested for inclusion in the recommendations "that when hollow-bearing trees are to be removed a wildlife carer and fauna ecologist be on site to inspect the tree for fauna, if fauna are present they should be cared for until appropriate time for release or placed in the care of a vet". The presence of amateur wildlife carers during clearing operations in mine sites can be problematic. They can be emotive, unrealistic and ill-equipped to deal with handling displaced native wildlife in field conditions during such operations. It is also often difficult to find (little to engage) a vet with more than mere academic Wildlife 101 knowledge of handling native wildlife and who will not delegate the tasks of caring and / or arranging for the release of displaced wildlife in their charge to poorly trained vetinary nurses.

14. The Open Cut Area should be rehabilitated to a native vegetation community that is consistent with the local landscape and this should commence progressively as soon as possible to minimise further habitat fragmentation in the Glennies Creek Catchment.

15. The Mining Operations Plan should include a vertebrate pest control program encompassing the Open Cut Area and all the biodiversity offset areas targeting rabbits, foxes, feral dogs and feral cats that have been declared to be Key Threatening Processes. This action should be implemented in co-operation with adjoining landholders and the local Rural Lands Protection Board.

16. Augmentation of the habitat to increase the habitat patch quality for other tree hollow nesters can be achieved in the biodiversity offset areas (other than those mentioned in Recommendations 1.1 and 9 above) this should be done in the short-term by installation of nest boxes strategically placed at an appropriate density determined in the Mining Operations Plan .

17. When the Southern Dirty Containment Water Dam is full or partly full of water during July and August, adequate and appropriate pre-emptive actions should be taken to ensure that no Phascogale nesting tree is isolated by the raising water and actions to provided free access to any active nesting tree should continue until the end of November.

8 SUMMARY OF DIRECTOR-GENERAL'S REQUIREMENTS

Table 16
Coverage of Environmental Assessment Requirements and Environmental Issues in the Fauna Report

ENVIRONMENTAL REQUIREMENTS RAISED BY THE DIRECTOR-GENERAL RELATING TO FAUNA (27.04.06)	
	Relevant Section(s)
Key Assessment Requirements, namely:	
• *Fauna* - Determine impacts on:	
– critical habitats,	6.2.7
– threatened species, population,	6.1, 6.2, 6.3
– ecological communities,	2
– groundwater dependent ecosystems, and	None Present
– native vegetation.	2, 6.4
• Include a comprehensive offset strategy as part of the mitigation measures for the project to ensure that there is no net loss of flora and fauna values in the area in the medium to long term.	Appendix 5
References	
• *Guidelines for Assessment of Aquatic Ecology in EIA* (DoP).	Not Relevant
• *Policy and Guidelines Aquatic Habitat Management and Fish Conservation* (DPI).	Not Relevant
• *Policy and Guidelines for Fish Friendly Waterway Crossings* (DPI).	Not Relevant
• Draft *Guidelines for Threatened Species Assessment* (DEC).	6
• *Threatened Biodiversity Survey and Assessment: Guidelines for Development and Activities* (DEC).	3
• *Guidelines for Developments Adjoining Department of Environment and Conservation Land* (DEC).	Not Relevant
• *NSW Wetlands Management Policy 1996* (DNR).	Not Relevant
• *NSW Groundwater Dependent Ecosystem Policy* (DNR).	Not Relevant
• *Principles for the Use of Biodiversity Offsets in NSW* - In *Guidelines for Biodiversity Certification of Environmental Planning Instruments* (DECC 2007b)	6, Appendix 5

Table 16 (Cont'd)
Coverage of Environmental Assessment Requirements and Environmental Issues in the Fauna Report

ENVIRONMENTAL REQUIREMENTS RAISED BY GOVERNMENT AGENCIES RELATING TO FAUNA (27.04.06)		
Government Agency	**Paraphrased Requirement**	**Relevant Section(s)**
Department of Environment and Conservation (22/12/04)	Provide a plan showing the distribution of any threatened fauna species on the Project Site.	Figure 7
	Where threatened species, populations or their habitats or communities exist and the effect of the development should be determined pursuant to Section 5A of the *Environmental Planning and Assessment Act 1979*.	6.1 and 6.2
	Describe the measures proposed to mitigate and/or ameliorate the impact from the development on threatened species.	7
	Provide a detailed assessment of threatened fauna species and their conservation significance including: • listings under the *Commonwealth Environment Protection and Biodiversity Conservation Act*; • listings under the *NSW Threatened Species Conservation Act* (including preliminary listings and/or determinations); • those recorded on the site or in the vicinity of the site; • those with the potential to occur; • an assessment of how identified species utilise the habitat on or in the vicinity of the development site; • consideration of listed Key Threatening Processes including clearing of native vegetation and bushrock removal.	 6.3 6.2 6.1, 6.2 6.1, 6.2 5 6.3.3
	Undertake a fauna survey to identify the distribution and abundance of fauna species known that are likely to use the Project Site. Include a description of available fauna habitats and assessment of conservation status of each.	2, 5
	Provide a plan showing results of fauna study at a project scale.	Figures 4, 5 and 7
	Describe the measures proposed to mitigate and/or ameliorate the impact from the development on fauna.	7
	Fauna surveys are to be undertaken by suitably qualified persons and qualifications and experience provided. Dates and times, site locations, survey design and methodology, analysis techniques and weather conditions at the time of the assessments and surveys must be provided.	1, 3 Appendices 3 and 4

Completed by R.W. Corkery & Co. (on behalf of Countrywide Ecological Service)

9 CONCLUSION

Having given consideration to the proposed recommendations listed above for minimising and ameliorating the impact from the proposed activity, the biodiversity offsets offered and the post-approval monitoring and pre-start survey proposed, it is concluded that:

1. in the context of the details of operation of the proposed Glennies Creek Open Cut Coal Mine, all practical measures have been considered and reasonable actions have been taken to prevent avoidable impacts on the fauna in the layout design of this proposed open cut coal mine;
2. adequate attempts have been made to maintain and improve the biodiversity values in the Open Cut Area and the biodiversity offset areas;
3. it has not been possible to preserve some of the areas of high conservation value on the Open Cut Area, namely the remnant Woodland and the Old Growth gallery along the old Crown road reserve (see **Plate 6**);
4. the proposed Project has no nexus to any critical fauna habitat listed under the TSC or EPBC Act;
5. the proposed Project is unlikely to cause the local extinction of any threatened species;
6. the proposed Project is unlikely to impact upon the long-term viability of local populations of any listed threatened species, population or ecological community;
7. the proposed Project is expected to have short-tem impacts on the Grey-crowned Babbler and the Brush-tailed Phascogale and alter the pattern of use of the Open Cut Area by these species and other potential transient listed threatened species;
8. the proposed Project is unlikely to affect fauna in any aspect of the environment that are matters of national environmental significance that would warrant a referral to the Commonwealth;
9. the Project is consistent with ecologically sustainable development principles with regards to the fauna and is unlikely to diminish the long-term local biodiversity (see Section 6.6); and
10. the safeguards, offsets and ameliorative actions considered and proposed to be implemented to minimise the impact upon fauna within and surrounding the Project Site and the local biodiversity are the greatest extent practicable.

Thus, the Project should not be considered to constitute a controlled action under the EPBC Act but would require further post-approval attention with regards to the management of the local biodiversity particularly in relation to the population of Grey-crowned Babbler and that of Brush-tailed Phascogale.

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APPENDICES

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Appendix 1

Fauna Regional Checklist

(ie. Singleton Local Government Area: see NPWS 2004; revised with NPWS 2006)

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Fauna Regional Checklist

Scientific Name	Common Name	Legal Status	Count
Amphibia Hylidae			
Litoria aurea	Green and Golden Bell Frog	E1	5
Litoria booroolongensis	Booroolong Frog	E1	1
Litoria caerulea	Green Tree Frog	P	23
Litoria chloris	Red-eyed Tree Frog	P	6
Litoria citropa	Blue Mountains Tree Frog	P	1
Litoria daviesae	Davies' Tree Frog	V	1
Litoria dentata	Keferstein's Tree Frog	P	17
Litoria fallax	Eastern Dwarf Tree Frog	P	63
Litoria jervisiensis	Jervis Bay Tree Frog	P	1
Litoria latopalmata	Broad-palmed Frog	P	59
Litoria lesueuri	Lesueur's Frog	P	48
Litoria littlejohni	Littlejohn's Tree Frog	V	1
Litoria pearsoniana	Pearson's Green Tree Frog	P	1
Litoria pearsoniana/phyllochroa	Leaf Green Tree Frog species complex	P	2
Litoria peronii	Peron's Tree Frog	P	70
Litoria phyllochroa	Green Stream Frog	P	24
Litoria subglandulosa	Glandular Frog	V	4
Litoria tyleri	Tyler's Tree Frog	P	3
Litoria verreauxii	Verreaux's Tree Frog	P	21
Myobatrachidae			
Crinia signifera	Common Eastern Froglet	P	200
Heleioporus australiacus	Giant Burrowing Frog	V	10
Lechriodus fletcheri	Fletcher's Frog	P	12
Limnodynastes dumerilii	Bullfrog	P	50
Limnodynastes fletcheri	Long-thumbed Frog	P	2
Limnodynastes ornatus	Ornate Burrowing Frog	P	28
Limnodynastes peronii	Striped Marsh Frog	P	17
Limnodynastes tasmaniensis	Spotted Marsh Frog	P	212
Mixophyes balbus	Stuttering Frog	E1	2
Mixophyes fasciolatus	Great Barred Frog	P	1
Neobatrachus sudelli	Painted Burrowing Frog	P	4
Philoria sphagnicolus	Sphagnum Frog	V	1
Pseudophryne australis	Red-crowned Toadlet	V	24
Pseudophryne bibronii	Bibron's Toadlet	P	15
Pseudophryne coriacea	Red-backed Toadlet	P	2
Pseudophryne sp.	Unidentified toadlet sp.	P	6
Uperoleia fusca	Dusky Toadlet	P	20
Uperoleia laevigata	Smooth Toadlet	P	47
Uperoleia rugosa	Wrinkled Toadlet	P	1
Uperoleia sp.	Unidentified toadlet sp.	P	4
Uperoleia tyleri	Tyler's Toadlet	P	2

Fauna Regional Checklist

Scientific Name	Common Name	Legal Status	Count
Aves			
Acanthizidae			
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	P	69
Acanthiza lineata	Striated Thornbill	P	144
Acanthiza nana	Yellow Thornbill	P	74
Acanthiza pusilla	Brown Thornbill	P	215
Acanthiza reguloides	Buff-rumped Thornbill	P	67
Aphelocephala leucopsis	Southern Whiteface	P	1
Calamanthus pyrrhopygius	Chestnut-rumped Heathwren	P	19
Gerygone fusca	Western Gerygone	P	9
Gerygone mouki	Brown Gerygone	P	93
Gerygone olivacea	White-throated Gerygone	P	31
Origma solitaria	Rockwarbler	P	99
Pycnoptilus floccosus	Pilotbird	P	40
Pyrrholaemus sagittatus	Speckled Warbler	V	70
Sericornis citreogularis	Yellow-throated Scrubwren	P	51
Sericornis frontalis	White-browed Scrubwren	P	169
Sericornis magnirostris	Large-billed Scrubwren	P	26
Smicrornis brevirostris	Weebill	P	52
Accipitridae			
Accipiter cirrocephalus	Collared Sparrowhawk	P	10
Accipiter fasciatus	Brown Goshawk	P	26
Accipiter novaehollandiae	Grey Goshawk	P	7
Aquila audax	Wedge-tailed Eagle	P	70
Aviceda subcristata	Pacific Baza	P	5
Circus approximans	Swamp Harrier	P	3
Circus assimilis	Spotted Harrier	P	5
Elanus axillaris	Black-shouldered Kite	P	30
Erythrotriorchis radiatus	Red Goshawk	E1	3
Haliaeetus leucogaster	White-bellied Sea-Eagle	P	8
Haliastur sphenurus	Whistling Kite	P	15
Hamirostra melanosternon	Black-breasted Buzzard	V	1
Hieraaetus morphnoides	Little Eagle	P	10
Milvus migrans	Black Kite	P	3
Aegothelidae			
Aegotheles cristatus	Australian Owlet-nightjar	P	137
Alcedinidae			
Alcedo azurea	Azure Kingfisher	P	11
Anatidae			
Anas castanea	Chestnut Teal	P	9
Anas gracilis	Grey Teal	P	33
Anas platyrhynchos	Mallard	U	1
Anas rhynchotis	Australasian Shoveler	P	4

Fauna Regional Checklist

Scientific Name	**Common Name**	**Legal Status**	**Count**
Anas superciliosa	Pacific Black Duck	P	62
Aythya australis	Hardhead	P	24
Biziura lobata	Musk Duck	P	10
Chenonetta jubata	Australian Wood Duck	P	59
Cygnus atratus	Black Swan	P	15
Dendrocygna eytoni	Plumed Whistling-Duck	P	7
Tadorna tadornoides	Australian Shelduck	P	1
Anhingidae			
Anhinga melanogaster	Darter	P	6
Apodidae			
Hirundapus caudacutus	White-throated Needletail	P	23
Ardeidae			
Ardea alba	Great Egret	P	7
Ardea ibis	Cattle Egret	P	5
Ardea intermedia	Intermediate Egret	P	5
Ardea pacifica	White-necked Heron	P	18
Egretta garzetta	Little Egret	P	2
Egretta novaehollandiae	White-faced Heron	P	42
Ixobrychus flavicollis	Black Bittern	V	2
Ixobrychus minutus	Little Bittern	P	1
Nycticorax caledonicus	Nankeen Night Heron		3
Artamidae			
Artamus cyanopterus	Dusky Woodswallow	P	47
Artamus personatus	Masked Woodswallow	P	3
Artamus superciliosus	White-browed Woodswallow	P	4
Cracticus nigrogularis	Pied Butcherbird	P	80
Cracticus torquatus	Grey Butcherbird	P	118
Gymnorhina tibicen	Australian Magpie	P	169
Strepera graculina	Pied Currawong	P	253
Strepera versicolor	Grey Currawong	P	5
Cacatuidae			
Cacatua galerita	Sulphur-crested Cockatoo	P	122
Cacatua sanguinea	Little Corella	P	2
Callocephalon fimbriatum	Gang-gang Cockatoo	V	116
Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo	P	66
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	102
Eolophus roseicapillus	Galah	P	80
Nymphicus hollandicus	Cockatiel	P	3
Campephagidae			
Coracina maxima	Ground Cuckoo-shrike	P	1
Coracina novaehollandiae	Black-faced Cuckoo-shrike	P	127
Coracina papuensis	White-bellied Cuckoo-shrike	P	14
Coracina tenuirostris	Cicadabird	P	85
Lalage leucomela	Varied Triller	P	1

Fauna Regional Checklist

Scientific Name	Common Name	Legal Status	Count
Lalage tricolor	White-winged Triller	P	13
Caprimulgidae			
Eurostopodus mystacalis	White-throated Nightjar	P	21
Centropodidae			
Centropus phasianinus	Pheasant Coucal	P	3
Charadriidae			
Charadrius ruficapillus	Red-capped Plover	P	3
Elseyornis melanops	Black-fronted Dotterel	P	12
Erythrogonys cinctus	Red-kneed Dotterel	P	1
Vanellus miles	Masked Lapwing	P	66
Vanellus tricolor	Banded Lapwing	P	3
Ciconiidae			
Ephippiorhynchus asiaticus	Black-necked Stork	E1	1
Climacteridae			
Climacteris erythrops	Red-browed Treecreeper	P	62
Climacteris picumnus	Brown Treecreeper	V	44
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	7
Cormobates leucophaeus	White-throated Treecreeper	P	321
Columbidae			
Chalcophaps indica	Emerald Dove	P	1
Columba leucomela	White-headed Pigeon	P	6
Columba livia	Rock Dove	U	3
Geopelia cuneata	Diamond Dove	P	1
Geopelia humeralis	Bar-shouldered Dove	P	14
Geopelia placida	Peaceful Dove	P	16
Leucosarcia melanoleuca	Wonga Pigeon	P	102
Lopholaimus antarcticus	Topknot Pigeon	P	7
Macropygia amboinensis	Brown Cuckoo-Dove	P	23
Ocyphaps lophotes	Crested Pigeon	P	72
Phaps chalcoptera	Common Bronzewing	P	53
Phaps elegans	Brush Bronzewing	P	3
Streptopelia chinensis	Spotted Turtle-Dove	U	7
Coraciidae			
Eurystomus orientalis	Dollarbird	P	38
Corcoracidae			
Corcorax melanorhamphos	White-winged Chough	P	106
Corvidae			
Corvus coronoides	Australian Raven	P	133
Corvus mellori	Little Raven	P	3
Corvus orru	Torresian Crow	P	2
Cuculidae			
Cacomantis flabelliformis	Fan-tailed Cuckoo	P	81
Cacomantis variolosus	Brush Cuckoo	P	19

Fauna Regional Checklist

Scientific Name	**Common Name**	**Legal Status**	**Count**
Chalcites basalis	Horsfield's Bronze-Cuckoo	P	19
Chalcites lucidus	Shining Bronze-Cuckoo	P	36
Chalcites osculans	Black-eared Cuckoo	P	1
Cuculus pallidus	Pallid Cuckoo	P	14
Cuculus saturatus	Oriental Cuckoo	P	1
Eudynamys orientalis	Pacific Koel	P	24
Scythrops novaehollandiae	Channel-billed Cuckoo	P	37
Dicaeidae			
Dicaeum hirundinaceum	Mistletoebird	P	136
Dicruridae			
Grallina cyanoleuca	Magpie-lark	P	80
Monarcha melanopsis	Black-faced Monarch	P	82
Monarcha trivirgatus	Spectacled Monarch	P	1
Myiagra cyanoleuca	Satin Flycatcher	P	9
Myiagra inquieta	Restless Flycatcher	P	26
Myiagra rubecula	Leaden Flycatcher	P	75
Rhipidura albiscapa	Grey Fantail	P	264
Rhipidura leucophrys	Willie Wagtail	P	130
Rhipidura rufifrons	Rufous Fantail	P	75
Estrildidae			
Neochmia modesta	Plum-headed Finch	P	1
Neochmia temporalis	Red-browed Finch	P	150
Stagonopleura guttata	Diamond Firetail	V	27
Taeniopygia bichenovii	Double-barred Finch	P	73
Taeniopygia guttata	Zebra Finch	P	22
Eupetidae			
Cinclosoma punctatum	Spotted Quail-thrush	P	56
Psophodes olivaceus	Eastern Whipbird	P	200
Falconidae			
Falco berigora	Brown Falcon	P	27
Falco cenchroides	Nankeen Kestrel	P	66
Falco longipennis	Australian Hobby	P	16
Falco peregrinus	Peregrine Falcon	P	12
Fringillidae			
Carduelis carduelis	European Goldfinch	U	1
Halcyonidae			
Dacelo novaeguineae	Laughing Kookaburra	P	165
Todiramphus macleayii	Forest Kingfisher	P	1
Todiramphus sanctus	Sacred Kingfisher	P	43
Hirundinidae			
Cheramoeca leucosternus	White-backed Swallow	P	13
Hirundo neoxena	Welcome Swallow	P	90
Petrochelidon ariel	Fairy Martin	P	17
Petrochelidon nigricans	Tree Martin	P	15

Fauna Regional Checklist

Scientific Name	Common Name	Legal Status	Count
Laridae			
Chlidonias hybridus	Whiskered Tern	P	2
Larus novaehollandiae	Silver Gull	P	1
Sterna bergii	Crested Tern	P	2
Maluridae			
Malurus cyaneus	Superb Fairy-wren	P	121
Malurus lamberti	Variegated Fairy-wren	P	84
Megapodiidae			
Alectura lathami	Australian Brush-turkey	P	42
Meliphagidae			
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	P	1
Acanthorhynchus tenuirostris	Eastern Spinebill	P	240
Anthochaera carunculata	Red Wattlebird	P	43
Anthochaera chrysoptera	Little Wattlebird	P	7
Entomyzon cyanotis	Blue-faced Honeyeater	P	19
Epthianura tricolor	Crimson Chat	P	1
Grantiella picta	Painted Honeyeater	V	10
Lichenostomus chrysops	Yellow-faced Honeyeater	P	333
Lichenostomus fuscus	Fuscous Honeyeater	P	16
Lichenostomus leucotis	White-eared Honeyeater	P	138
Lichenostomus melanops	Yellow-tufted Honeyeater	P	105
Lichenostomus penicillatus	White-plumed Honeyeater	P	75
Lichmera indistincta	Brown Honeyeater	P	2
Manorina melanocephala	Noisy Miner	P	143
Manorina melanophrys	Bell Miner	P	114
Meliphaga lewinii	Lewin's Honeyeater	P	174
Melithreptus brevirostris	Brown-headed Honeyeater	P	31
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	11
Melithreptus lunatus	White-naped Honeyeater	P	138
Myzomela sanguinolenta	Scarlet Honeyeater	P	85
Philemon citreogularis	Little Friarbird	P	17
Philemon corniculatus	Noisy Friarbird	P	292
Phylidonyris nigra	White-cheeked Honeyeater	P	20
Phylidonyris novaehollandiae	New Holland Honeyeater	P	19
Phylidonyris pyrrhoptera	Crescent Honeyeater	P	33
Plectorhyncha lanceolata	Striped Honeyeater	P	54
Xanthomyza phrygia	Regent Honeyeater	E1	27
Menuridae			
Menura novaehollandiae	Superb Lyrebird	P	251
Meropidae			
Merops ornatus	Rainbow Bee-eater	P	74
Motacillidae			
Anthus australis	Australian Pipit	P	47

Fauna Regional Checklist

Scientific Name	**Common Name**	**Legal Status**	**Count**
Muscicapidae			
Zoothera lunulata	Bassian Thrush	P	20
Zoothera sp.	unidentified ground thrush	P	5
Neosittidae			
Daphoenositta chrysoptera	Varied Sittella	P	54
Oriolidae			
Oriolus sagittatus	Olive-backed Oriole	P	88
Sphecotheres vieilloti	Australasian Figbird	P	1
Orthonychidae			
Orthonyx temminckii	Logrunner	P	4
Pachycephalidae			
Colluricincla harmonica	Grey Shrike-thrush	P	255
Falcunculus frontatus	Eastern Shrike-tit	P	60
Oreoica gutturalis	Crested Bellbird	P	1
Pachycephala olivacea	Olive Whistler	V	3
Pachycephala pectoralis	Golden Whistler	P	230
Pachycephala rufiventris	Rufous Whistler	P	229
Paradisaeidae			
Ptiloris paradiseus	Paradise Riflebird	P	2
Pardalotidae			
Pardalotus punctatus	Spotted Pardalote	P	323
Pardalotus sp.	Unidentified Pardalote	P	1
Pardalotus striatus	Striated Pardalote	P	71
Passeridae			
Passer domesticus	House Sparrow	U	4
Pelecanidae			
Pelecanus conspicillatus	Australian Pelican	P	9
Petroicidae			
Eopsaltria australis	Eastern Yellow Robin	P	228
Melanodryas cucullata	Hooded Robin	V	18
Microeca fascinans	Jacky Winter	P	55
Petroica boodang	Scarlet Robin	P	28
Petroica goodenovii	Red-capped Robin	P	18
Petroica phoenicea	Flame Robin	P	7
Petroica rosea	Rose Robin	P	52
Tregellasia capito	Pale-yellow Robin	P	1
Phalacrocoracidae			
Phalacrocorax carbo	Great Cormorant	P	7
Phalacrocorax melanoleucos	Little Pied Cormorant	P	17
Phalacrocorax sulcirostris	Little Black Cormorant	P	12
Phalacrocorax varius	Pied Cormorant	P	3
Phasianidae			
Coturnix chinensis	King Quail	P	1
Coturnix pectoralis	Stubble Quail	P	10

Fauna Regional Checklist

Scientific Name	**Common Name**	**Legal Status**	**Count**
Coturnix ypsilophora	Brown Quail	P	22
Pittidae			
Pitta versicolor	Noisy Pitta	P	3
Podargidae			
Podargus strigoides	Tawny Frogmouth	P	124
Podicipedidae			
Podiceps cristatus	Great Crested Grebe	P	6
Poliocephalus poliocephalus	Hoary-headed Grebe	P	7
Tachybaptus novaehollandiae	Australasian Grebe	P	31
Pomatostomidae			
Pomatostomus superciliosus	White-browed Babbler	P	1
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	103
Psittacidae			
Alisterus scapularis	Australian King-Parrot	P	140
Glossopsitta concinna	Musk Lorikeet	P	7
Glossopsitta pusilla	Little Lorikeet	P	67
Lathamus discolor	Swift Parrot	E1	3
Neophema pulchella	Turquoise Parrot	V	10
Platycercus adscitus eximius	Eastern Rosella	P	135
Platycercus elegans	Crimson Rosella	P	140
Psephotus haematonotus	Red-rumped Parrot	P	32
Trichoglossus haematodus	Rainbow Lorikeet	P	5
Ptilonorhynchidae			
Ailuroedus crassirostris	Green Catbird	P	6
Ptilonorhynchus violaceus	Satin Bowerbird	P	90
Sericulus chrysocephalus	Regent Bowerbird	P	2
Rallidae			
Fulica atra	Eurasian Coot	P	17
Gallinula tenebrosa	Dusky Moorhen	P	16
Porphyrio porphyrio	Purple Swamphen	P	19
Rallus pectoralis	Lewin's Rail	P	1
Recurvirostridae			
Himantopus himantopus	Black-winged Stilt	P	10
Scolopacidae			
Calidris ruficollis	Red-necked Stint	P	1
Strigidae			
Ninox boobook	Southern Boobook	P	179
Ninox connivens	Barking Owl	V	7
Ninox strenua	Powerful Owl	V	28
Sturnidae			
Acridotheres tristis	Common Myna	U	29
Sturnus vulgaris	Common Starling	U	40

Fauna Regional Checklist

Scientific Name	**Common Name**	**Legal Status**	**Count**
Sylviidae			
Acrocephalus australis	Australian Reed-Warbler	P	10
Cincloramphus mathewsi	Rufous Songlark	P	5
Cisticola exilis	Golden-headed Cisticola	P	17
Megalurus gramineus	Little Grassbird	P	1
Megalurus timoriensis	Tawny Grassbird	P	6
Threskiornithidae			
Platalea flavipes	Yellow-billed Spoonbill	P	10
Platalea regia	Royal Spoonbill	P	3
Threskiornis molucca	Australian White Ibis	P	2
Threskiornis spinicollis	Straw-necked Ibis	P	37
Turnicidae			
Turnix maculosa	Red-backed Button-quail	V	1
Turnix varia	Painted Button-quail	P	37
Turnix velox	Little Button-quail	P	1
Tytonidae			
Tyto alba	Barn Owl	P	7
Tyto novaehollandiae	Masked Owl	V	17
Tyto tenebricosa	Sooty Owl	V	9
Zosteropidae			
Zosterops lateralis	Silvereye	P	155
Mammalia			
Acrobatidae			
Acrobates pygmaeus	Feathertail Glider	P	12
Bovidae			
Bos taurus	European cattle	U	46
Capra hircus	Goat	U	3
Burramyidae			
Cercartetus nanus	Eastern Pygmy-possum	V	3
Canidae			
Canis lupus	Wild Dog	U	169
Vulpes vulpes	European Red Fox	U	99
Dasyuridae			
Antechinus flavipes	Yellow-footed Antechinus	P	115
Antechinus sp.	Unidentified Antechinus	P	13
Antechinus stuartii	Brown Antechinus	P	99
Antechinus swainsonii	Dusky Antechinus	P	3
Dasyurus maculatus	Spotted-tailed Quoll	V	38
Phascogale tapoatafa	Brush-tailed Phascogale	V	14
Planigale tenuirostris	Narrow-nosed Planigale	P	1
Sminthopsis murina	Common Dunnart	P	129

Fauna Regional Checklist

Scientific Name	Common Name	Legal Status	Count
Equidae			
Equus caballus	Horse	U	8
Felidae			
Felis catus	Feral Cat	U	18
Leporidae			
Lepus capensis	Brown Hare	U	37
Oryctolagus cuniculus	European Rabbit	U	88
Macropodidae			
Macropus giganteus	Eastern Grey Kangaroo	P	93
Macropus parma	Parma Wallaby	V	4
Macropus robustus	Common Wallaroo	P	59
Macropus rufogriseus	Red-necked Wallaby	P	138
Petrogale penicillata	Brush-tailed Rock-wallaby	E1	41
Thylogale sp.	Unidentified Pademelon	P	12
Thylogale stigmatica	Red-legged Pademelon	V	17
Thylogale thetis	Red-necked Pademelon	P	37
Wallabia bicolor	Swamp Wallaby	P	185
Molossidae			
Mormopterus norfolkensis	Eastern Freetail-bat	V	20
Mormopterus planiceps	Little Mastiff-bat	P	5
Mormopterus sp. 1	undescribed mastiff-bat	P	8
Mormopterus sp.	Unidentified mastiff-bat	P	3
Mormopterus sp.	Little Mastiff-bat (big penis)	P	1
Nyctinomus australis	White-striped Freetail-bat	P	145
Muridae			
Hydromys chrysogaster	Water-rat	P	3
Melomys cervinipes	Fawn-footed Melomys	P	5
Mus dometicus (musculus)	House Mouse	U	203
Pseudomys novaehollandiae	New Holland Mouse	P	14
Pseudomys oralis	Hastings River Mouse	E1	13
Rattus fuscipes	Bush Rat	P	77
Rattus lutreolus	Swamp Rat	P	19
Rattus rattus	Black Rat	U	17
Rattus sp.	Native rat	P	19
Ornithorhynchidae			
Ornithorhynchus anatinus	Platypus	P	4
Peramelidae			
Isoodon macrourus	Northern Brown Bandicoot	P	6
Perameles nasuta	Long-nosed Bandicoot	P	14
Petauridae			
Petaurus australis	Yellow-bellied Glider	V	91
Petaurus breviceps	Sugar Glider	P	135
Petaurus norfolcensis	Squirrel Glider	V	25

Fauna Regional Checklist

Scientific Name	Common Name	Legal Status	Count
Phalangeridae			
Trichosurus caninus	Mountain Brushtail Possum	P	79
Trichosurus vulpecula	Common Brushtail Possum	P	228
Phascolarctidae			
Phascolarctos cinereus	Koala	V	49
Potoroidae			
Aepyprymnus rufescens	Rufous Bettong	V	14
Potorous tridactylus	Long-nosed Potoroo	V	4
Pseudocheiridae			
Petauroides volans	Greater Glider	P	162
Pseudocheirus peregrinus	Common Ringtail Possum	P	53
Pteropodidae			
Pteropus poliocephalus	Grey-headed Flying-fox	V	58
Rhinolophidae			
Rhinolophus megaphyllus	Eastern Horseshoe-bat	P	40
Suidae			
Sus scrofa	Feral Pig	U	8
Tachyglossidae			
Tachyglossus aculeatus	Short-beaked Echidna	P	63
Vespertilionidae			
Chalinolobus dwyeri	Large-eared Pied Bat	V	41
Chalinolobus gouldii	Gould's Wattled Bat	P	89
Chalinolobus morio	Chocolate Wattled Bat	P	183
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	10
Miniopterus australis	Little Bentwing-bat	V	3
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	32
Myotis adversus	Large-footed Myotis	V	4
Nyctophilus geoffroyi	Lesser Long-eared Bat	P	45
Nyctophilus gouldi	Gould's Long-eared Bat	P	123
Nyctophilus sp.	Unidentified Long-eared bat	P	14
Scoteanax rueppellii	Greater Broad-nosed Bat	V	6
Scotorepens balstoni	Inland Broad-nosed Bat	P	2
Scotorepens orion	Eastern Broad-nosed Bat	P	39
Vespadelus darlingtoni	Large Forest Bat	P	192
Vespadelus pumilus	Eastern Forest Bat	P	2
Vespadelus regulus	Southern Forest Bat	P	27
Vespadelus sp.	Unidentified Eptesicus	P	7
Vespadelus vulturnus	Little Forest Bat	P	392
Vombatidae			
Vombatus ursinus	Common Wombat	P	235

Fauna Regional Checklist

Scientific Name	Common Name	Legal Status	Count
Reptilia			
Agamidae			
Amphibolurus muricatus	Jacky Lashtail	P	43
Amphibolurus nobbi	Nobbi Lashtail	P	1
Hypsilurus spinipes	Southern Forest Dragon	P	1
Physignathus lesueurii	Eastern Water Dragon	P	41
Pogona barbata	Eastern Bearded Dragon	P	39
Rankinia (Tympanocryptis) diemensis	Mountain Heath Dragon	P	62
Boidae			
Morelia spilota	Carpet /Diamond Python	P	12
Chelidae			
Chelodina longicollis	Eastern Snake-necked Turtle	P	39
Colubridae			
Boiga irregularis	Eastern Brown Tree Snake	P	3
Dendrelaphis punctulatus	Green Tree Snake	P	2
Elapidae			
Acanthophis antarcticus	Southern Death Adder	P	3
Cacophis squamulosus	Golden Crowned Snake	P	2
Demansia psammophis	Yellow-faced Whipsnake	P	8
Drysdalia rhodogaster	Mustard-bellied Snake	P	1
Furina diadema	Red-naped Snake	P	13
Hemiaspis signata	Marsh Snake	P	4
Hoplocephalus bungaroides	Broad-headed Snake	E1	2
Notechis scutatus	Mainland Tiger Snake	P	6
Pseudechis guttatus	Spotted Black Snake	P	1
Pseudechis porphyriacus	Red-bellied Black Snake	P	42
Pseudonaja textilis	Eastern Brown Snake	P	15
Rhinoplocephalus nigrescens	Small-eyed Snake	P	9
Parasuta dwyeri	Variable Black-naped Snake	P	1
Vermicella annulata	Eastern Bandy-bandy	P	8
Gekkonidae			
Diplodactylus vittatus	Eastern Stone Gecko	P	23
Oedura lesueurii	Lesueur's Velvet Gecko	P	111
Oedura robusta	Robust Velvet Gecko	P	5
Phyllurus platurus	Broad-tailed Gecko	P	70
Underwoodisaurus milii	Thick-tailed Gecko	P	35
Pygopodidae			
Delma plebeia	Leaden Delma	P	3
Lialis burtonis	Burton's Snake-lizard	P	4
Pygopus lepidopodus	Southern Scaly-foot	P	1

Fauna Regional Checklist

Scientific Name	Common Name	Legal Status	Count
Scincidae			
Acritoscincus platynota	Red-throated Cool-skink	P	28
Anomalopus swansoni	Punctate Worm-skink	P	26
Calyptotis ruficauda	Red-tailed Calyptotis	P	1
Carlia (Lygisaurus) foliorum	Tree-base Litter-skink	P	44
Carlia tetradactyla	Southern Rainbow-skink	P	52
Carlia vivax	Tussock Rainbow-skink	P	3
Cryptoblepharus virgatus	Cream-striped Shinning-skink	P	19
Ctenotus robustus	Robust Ctenotus	P	47
Ctenotus taeniolatus	Copper-tailed Ctenotus	P	122
Cyclodomorphus michaeli	Native skink – no common name	P	1
Cyclodomorphus (Hemisphaeriodon) gerrardii	Pink-tongued Skink	P	2
Egernia cunninghami	Cunningham's Spiny-tailed Skink	P	10
Egernia major	Land Mullet	P	5
Egernia modesta	Eastern Ranges Rock-skink	P	6
Egernia striolata	Tree-crevice Skink	P	69
Egernia whitii	White's Rock-skink	P	89
Eulamprus heatwolei	Warm-temperate Water-skink	P	17
Eulamprus quoyii	Eastern Water-skink	P	115
Eulamprus tenuis	Bar-sided Forest-skink	P	34
Eulamprus tympanum	Cool-temperate Water-skink	P	3
Lampropholis amicula	Friendly Sunskink	P	1
Lampropholis delicata	Dark-flecked Garden Sunskink	P	153
Lampropholis guichenoti	Pale-flecked Garden Sunskink	P	75
Lampropholis sp.	unidentified grass skink	P	9
Lerista bougainvillii	South-eastern Slider	P	12
Morethia boulengeri	South-eastern Morethia Skink	P	11
Pseudemoia spenceri	Trunk-climbing Cool-skink	P	1
Saiphos equalis	Yellow-bellied Three-toed Skink	P	31
Saproscincus challengeri	Orange-tailed Shadeskink	P	2
Saproscincus mustelinia	Weasel Shadeskink	P	34
Saproscincus rosei	Orange-tailed Shadeskink	P	1
Tiliqua scincoides	Common Bluetongue	P	10
Typhlopidae			
Ramphotyphlops nigrescens	Blackish Blind Snake	P	3
Ramphotyphlops proximus	Proximus Blind Snake	P	1
Ramphotyphlops sp.	blind snake	P	1
Ramphotyphlops wiedii	Brown-snouted Blind Snake	P	10
Varanidae			
Varanus sp.	Unidentified Goanna	P	2
Varanus varius	Lace Monitor	P	80

Search Results LGA - SINGLETON returned a total of 20023 records of 459 species.
Report generated on 29/06/2006 – 21:50 (Data valid to 26/06/2006)

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Appendix 2

Listed Threatened Species

(within the Singleton Local Government Area)

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Listed Threatened Species – Within Singleton LGA

Scientific Name	Common Name	Status	Count	Habitat Present
Amphibia				
Hylidae				
Litoria aurea	Green and Golden Bell Frog	E1	5	Y
Litoria booroolongensis	Booroolong Frog	E1	1	N
Litoria daviesae	Davies' Tree Frog	V	1	N
Litoria littlejohni	Littlejohn's Tree Frog	V	1	N
Litoria subglandulosa	Glandular Frog	V	4	N
Myobatrachidae				
Heleioporus australiacus	Giant Burrowing Frog	V	10	N
Mixophyes balbus	Stuttering Frog	E1	2	N
Philoria sphagnicolus	Sphagnum Frog	V	1	N
Pseudophryne australis	Red-crowned Toadlet	V	24	N
Aves				
Acanthizidae				
Pyrrholaemus sagittatus	Speckled Warbler	V	70	Y
Accipitridae				
Erythrotriorchis radiatus	Red Goshawk	E1	3	Y
Hamirostra melanosternon	Black-breasted Buzzard	V	1	Y
Ardeidae				
Ixobrychus flavicollis	Black Bittern	V	2	N
Cacatuidae				
Callocephalon fimbriatum	Gang-gang Cockatoo	V	116	F
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	102	F
Ciconiidae				
Ephippiorhynchus asiaticus	Black-necked Stork	E1	1	F
Climacteridae				
Climacteris picumnus	Brown Treecreeper	V	51	Y
Estrildidae				
Stagonopleura guttata	Diamond Firetail	V	27	Y
Meliphagidae				
Grantiella picta	Painted Honeyeater	V	10	Y
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	11	
Xanthomyza phrygia	Regent Honeyeater	E1	27	Y
Pachycephalidae				
Pachycephala olivacea	Olive Whistler	V	3	Y
Petroicidae				
Melanodryas cucullata	Hooded Robin	V	18	Y
Pomatostomidae				
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	103	Y
Psittacidae				
Lathamus discolor	Swift Parrot	E1	3	F
Neophema pulchella	Turquoise Parrot	V	10	F

Listed Threatened Species – Within Singleton LGA

Scientific Name	Common Name	Status	Count	Habitat Present
Strigidae				
Ninox connivens	Barking Owl	V	7	Y
Ninox strenua	Powerful Owl	V	28	Y
Turnicidae				
Turnix maculosa	Red-backed Button-quail	V	1	N
Tytonidae				
Tyto novaehollandiae	Masked Owl	V	17	Y
Tyto tenebricosa	Sooty Owl	V	9	Y
Mammalia				
Burramyidae				
Cercartetus nanus	Eastern Pygmy-possum	V	3	Y
Dasyuridae				
Dasyurus maculatus	Spotted-tailed Quoll	V	38	Y
Phascogale tapoatafa	Brush-tailed Phascogale	V	14	Y
Macropodidae				
Macropus parma	Parma Wallaby	V	4	N
Petrogale penicillata	Brush-tailed Rock-wallaby	E1	41	N
Thylogale stigmatica	Red-legged Pademelon	V	17	N
Molossidae				
Mormopterus norfolkensis	Eastern Freetail-bat	V	20	Y
Muridae				
Pseudomys oralis	Hastings River Mouse	E1	13	N
Petauridae				
Petaurus australis	Yellow-bellied Glider	V	91	Y
Petaurus norfolcensis	Squirrel Glider	V	25	Y
Phascolarctidae				
Phascolarctos cinereus	Koala	V	49	Y
Potoroidae				
Aepyprymnus rufescens	Rufous Bettong	V	14	Y
Potorous tridactylus	Long-nosed Potoroo	V	4	
Pteropodidae				
Pteropus poliocephalus	Grey-headed Flying-fox	V	58	F
Vespertilionidae				
Chalinolobus dwyeri	Large-eared Pied Bat	V	41	F
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	10	F
Miniopterus australis	Little Bentwing-bat	V	3	F
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	32	F
Myotis adversus	Large-footed Myotis	V	4	N
Scoteanax rueppellii	Greater Broad-nosed Bat	V	6	F
Reptilia				
Elapidae				
Hoplocephalus bungaroides	Broad-headed Snake	E1	2	N

Species marked N are species with specialist habitat that are not found in the on the Open Cut Area. F – foraging habitat over Open Cut Area. Y – Breeding habitat present.

LGA - SINGLETON returned a total of 1158 records of 52 species. Wildlife Atlas

Report generated on 29/06/106 - 21:26 (Data valid to 26/06/2006).

Appendix 3

Sampling Details – Dates and Weather Conditions

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Sampling Details – Dates and Weather Conditions

	Temp max	Temp min	Conditions	Comments
Winter Sampling				Targeting Winter birds
23 August 2004	18ºC	6ºC	Clear and still night	Observed severe drought conditions; little ground cover
24 August 2004	19ºC	-	Windy and Clear	Stock in Project Site; deployment of Hair Sampling Tubes
Spring Sampling				Optimum sampling period
8 Sept 2004	20ºC	14ºC	Clear dry conditions	Pick up hair traps; cattle and horses in survey area
9 October 2004	24ºC	12ºC	Clear with light easterly winds	Drought conditions prevailing; dry and dusty
10 October 2004	26ºC	16ºC	Some clouds and some variable light winds	Mild evening temperatures until about 2300hrs
11 October 2004	28ºC	15ºC	Clear and settled conditions	Close traps frequented by breeding Antechinus
12 October 2004	25ºC	14ºC	Increasing clouds, light winds veering south	Little signs of native ground mammals other than macropods
13 October 2004	26ºC	-	Clear windy conditions	Pick up traps
Grey-crowned Babbler Supplementary				Targeting Grey-crowned Babbler
26 October 2005	22ºC	12ºC	Heavy cloud cover; windy southerly	Breeding season survey of Open Cut Area
27 October 2005	23ºC	-	Clear with light winds	Included off-site searches in vegetation remnants within 10km radius of Open Cut Area
Autumn Supplementary				Cage and tree trapping with Elliott trap Type B
9 May 2006	19ºC	8ºC	Clear and settled conditions	Grass seeded; some Acacia and Ironbark flowering
10 May 2006	20ºC	9ºC	Clear and settled conditions	Capture of Phascogale and Sugar Gliders
11 May 2006	21ºC	10ºC	Clear and settled conditions	Cattle moved into Biodiversity Offset Area
12 May 2006	22ºC	9ºC	Clear and light westerly winds veering south	Cattle moved into Project Site
13 May 2006	20ºC	-	Increasing clouds	Grey-crowned Babbler turned up but transit site
Phascogale Supplementary				Targeting Phascogale and Grey-crowned Babblers
15 June 2006	16ºC	2ºC	Clear and still in the evening	Deployment of 30 Elliott type B and spotlight along road reserve and riparian galleries.
16 June 2006	18ºC	6ºC	Light winds	Grey-crowned Babbler searches.
17 June 2006	18ºC	-	Cloudy with 10-15 knots wind	Light rain during night with a southerly change. Pick up traps.

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Appendix 4

Sampling Details – Deployment Effort

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Sampling Details – Deployment Effort

Habitat Description	Amphibians	Birds	Mammals	Reptiles
Habitat Type 1 Open Pasture	1 line x 4 days pitfall traps Incidental records	Opportunistic searches for Speckled Warbler Incidental records	2 times x 2 hr Spotlight and incidental records	1 line x 4 days pitfall traps Once 2 hr ground search and incidental records
Habitat Type 2 Open Woodland	1 line x 4 days pitfall traps Incidental records	2 lines x 4 days x 1hr early morning sampling 2 times x 1 hr call playbacks for owls (in conjunction with habitat 3) Opportunistic searches for Speckled Warbler and Brown Treecreeper Incidental records	2 lines x 4 days x 25 Elliott traps 2 times x 2 hr Spotlight searches 8 Hair Sampling tubes for 14 days Predator faecal pellet collection for analysis 2 times x 1 hr call playbacks for mammals (in conjunction with habitat 3) Incidental records	1 line x 4 days pitfall traps Once 2 hr ground search and incidental records
Habitat Type 3 Woodland	1 line x 4 days pitfall traps Incidental records	1 line x 4 days x 1hr early morning sampling Opportunistic searches for Speckled Warbler and Brown Treecreeper 2 times x 1 hr call playbacks for owls Predator pellet collection for analysis Incidental records	2 times x 2hr Spotlight searches 1 line x 4days x 25 Elliott traps 10 Hair Sampling tubes for 14 days 2 times x 1 hr call playbacks for mammals Predator faecal collection for analysis 2 times x 0.5 hr Bat call recording plus overnight recording 2 x 2 days Harp trap sampling for bats	1 line x 4 days pitfall traps 2 times x 1hr hand searches Incidental records

Sampling Details – Deployment Effort

Habitat Description	Amphibians	Birds	Mammals	Reptiles
Habitat Type 4 Riparian Oaks	1 line x 4 days pitfall traps 2 times x 1 hr hand catching plus call recording identification Incidental records	4 times x 1hr early morning sampling 2 times x. 1 hr call playback for owls Incidental records	2 times x 2hr Spotlight searches 1 line x 3 days x 25 Elliott traps 6 Hair Sampling tubes for 14 days Predator faecal pellet collection for analysis 2 times x. 1 hr call playback for mammals 2 times x 0.5 hr Bat call recording plus overnight recording 2 x 2 days Harp trap sampling for bats Incidental records	1 line x 4 days pitfall traps 2 x 1 hr hand searches Incidental records
Habitat Type 5 Wetland - Dams	2x20 minute nocturnal searched and call recording at each dam Searches along edges at each dam Spot checks at 6 accessible spot sites at Possum Creek Dam Diurnal visits to record turtle and targeting Bell Frogs.	2x10-30 minute census at each dam Incidental records	Searches along edges at each dam Spot checks at 6 accessible spot sites at Possum Creek Dam	Searches along edges at each dam Spot checks at 6 accessible spot sites at Possum Creek Dam

Sampling Details – Deployment Effort

Habitat Description	Amphibians	Birds	Mammals	Reptiles
Notes		Grey-crowned Babbler supplementary surveys see **Appendix 3** and **Figure 7** Repeated 2 times x 1 hr call playback for Owls in Habitat types 2,3 and 4	Brush-tailed Phascogale supplementary survey see **Appendix 3** and **Figure 7** Repeated 2 times x 1 hr call playback for Mammals in Habitat types 2,3 and 4	

Note that this sampling regime was designed to provide information on the likely impact from the proposed activity on the local fauna community. By its intent, it cannot be a balanced design and the sampling intensity is bias on the native habitats that are likely to be most affected.

Total Sampling Effort (not including opportunistic observations):

Elliott Traps Type A = 375 trapnights

Elliott Traps Type B = 120 trapnights

Hair Sampling tubes = 24 traps over 14 days

Cage Traps = 40 trapnights

Bat recordings = approximately 2 hrs mobile and 18+ hrs at 2 sites overnight

Harp traps = 4 trapnights

Pitfall Traps = 14 trapnights

Bird Census = 8hrs

Call Backs = 10 nights

Spotlighting = 20 hours

Ground Searches = 16 hours

Dam and Drainage Searches = 4+ hours plus diurnal visits.

Grey-crowned Babbler Searches = 3 field day equivalents; 17 sites within 10km of Study Area.

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Appendix 5

Biodiversity Offset Assessment

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A5.1 Introduction

This assessment should be read in conjunction with GCNRC (2007a) and GCNRC (2007b) assessment of the proposed biodiversity offset areas where the floristics and the structural characteristics of the habitat values of the vegetation community are presented and thus bear no need for duplication here.

The proposed rehabilitation of the riparian corridor along Glennies Creek to the north of Middle Falbrook Road and the Supplementary Biodiversity Offset Area remains an integral part of this assessment even though it was not sampled during the various surveys as it was considered to be isolated and remote from the Open Cut Area and the former area has limited wildlife conservation value in its current poor condition.

A5.2 Comparative Assessment

The comparison of the fauna community within the Open Cut Area and the Northern Biodiversity Offset Area on the northern side of Stony Creek Road is constrained by the following factors.

(i) Most of the habitat types, except for the Open Pastures, are not exactly structurally (and floristically) similar in both areas.

(ii) The area occupied by the various habitat structural types are different in size and are located topographically at different elevations within the landscape.

(iii) Sampling efforts for the various fauna groups have been concentrated on the area likely to be most affected, the Open Cut Area and is therefore unbalanced.

(iv) Because of the proximity of the two areas and the mobility of most of the fauna species, any comparison between the results obtained in either area cannot assume independence.

(v) All the drainage lines within the Open Cut Area have intermittent flows but the Northern and Supplementary Biodiversity Offset Areas include a riparian corridor along Glennies Creek, which has a permanent flow.

(vi) As a direct consequence of all the above, no statistical analysis could be conducted to present the similarities and differences in the faunal biodiversity between the two areas.

These constraints notwithstanding, a comparison of the fauna species recorded during the various surveys between August 2004 and June 2006 suggest that the fauna communities are similar in the two areas with the following characteristics (see **Table A5.1**).

Table A5.1
Fauna Species Found or Likely to be Found in the Open Cut Area and the Proposed Northern Biodiversity Offset Area (NBOA).

Scientific Name	Common Name	Open Cut Area^	NBOA
Amphibians			
1. Litoria caerulea	Green Tree Frog	*	*
2. Litoria peronii	Peron's Tree Frog	*	*
3. Litoria latopalmata	Broad-palmed Frog	*	*
4. Litoria fallax	Eastern Dwarf Tree Frog	*	*
5. Uperoleia laevigata	Smooth Toadlet	*	*
6. Crinia signifera	Common Eastern Froglet	*	*
7. Limnodynastes tasmaniensis	Spotted Marsh Frog	*	*
8. Limnodynastes dumerilii	Eastern Banjo Frog	*	*
9. Limnodynastes fletcheri	Fletcher's Frog	*	*
Birds			
1. Cygnus atratus	Black Swan	*	
2. Chenonetta jubata	Australian Wood Duck	*	*
3. Anas platyrhynchos #	Mallard	*	*
4. Anas gracilis	Grey Teal	*	
5. Phalacrocarax varius	Pied Cormorant	*	
6. Poliocephalus poliocephalus	Hoary-headed Grebe	*	
7. Himantopus himantopus	Black-winged Stilt	*	
8. Anas superciliosa	Pacific Black Duck	*	*
9. Tachybaptus novaehollandiae	Australasian Grebe	*	
10. Anhinga melanogaster	Darter	*	
11. Egretta novaehollandiae	White-faced Heron	*	
12. Ardea ibis	Cattle Egret	*	*
13. Porphyrio porphyrio	Purple Swamphen	*	
14. Phalacrocorax sulcirostris	Little Black Cormorant	*	
15. Theskiornis spinicollis	Straw-necked Ibis	*	*
16. Haliaeetus leucogaster	White-bellied Sea-Eagle	*	*
17. Aquila audax	Wedge-tailed Eagle	*	*
18. Falco berigora	Brown Falcon	*	*
19. Falco cenchroides	Nankeen Kestrel	*	*
20. Elanus axillaris	Black-shouldered Kite	*	*
21. Vanellus miles	Masked Lapwing	*	*
22. Phaps chalcoptera	Common Bronzewing	*	*
23. Ocyphaps lophotes	Crested Pigeon	*	*
24. Eolophus roseicapilla	Galah	*	*
25. Cacatua galerita	Sulphur-crested Cockatoo	*	*
26. Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo	*	*
27. Platycercus elegans	Crimson Rosella	*	*
28. Platycercus adscitus eximius	Eastern Rosella	*	*
29. Ninox boobook	Southern Boobook Owl	*	*

# denotes exotic species ^ denotes species listed as key threatening process.
* indicates species found or likely to be found in respective areas. V denotes listed vulnerable species
^ Open Cut Area includes the Western and Southern Biodiversity Offset Areas, the open cut pit shell and the oou-of-pit waste rock emplacement

Table A5.1
Fauna Species Found or Likely to be Found in the Open Cut Area and the Proposed Northern Biodiversity Offset Area (NBOA).

Scientific Name	Common Name	Open Cut Area^	NBOA
Birds Cont'd			
30. Podargus strigoides	Tawny Frogmouth	*	*
31. Tyto alba	Barn Owl	*	*
32. Malurus cyaneus	Superb Fairy-wren	*	*
33. Pardalotus punctatus	Spotted Pardalote	*	*
34. Cormobates leucophaeus	White-throated Treecreeper		*
35. Dacelo novaeguineae	Laughing Kookaburra	*	*
36. Acanthiza chrysorrhoa	Yellow-rumped Thornbill	*	*
37. Acanthiza lineata	Striated Thornbill	*	*
38. Zosterops lateralis	Silvereye	*	*
39. Manorina melanocephala	Noisy Miner	*	*
40. Pomatostomus superciliosus	White-browed Babbler	*	
41. Pomatostomus temporalis (V)	Grey-crowned Babbler	*	
42. Pachycephala pectoralis	Golden Whistler	*	*
43. Acanthiza chrysorrhoa	Eastern Spinebill	*	*
44. Pachycephala rufiventris	Rufous Whistler	*	*
45. Myiagra inquieta	Magpie-lark (Pee Wee)	*	*
46. Coracina novaehollandiae	Black-faced Cuckoo-shrike	*	*
47. Centropus phasianinus	Pheasant Coucal	*	*
48. Hirundo neoxena	Welcome Swallow	*	*
49. Cheramoeca leucosternus	White-backed Swallow	*	*
50. Cracticus torquatus	Grey Butcherbird	*	*
51. Cracticus nigrogulsris	Pied Butcherbird	*	*
52. Gymnorhina tibicen	Australian Magpie	*	*
53. Strepera graculina	Pied Currawong	*	*
54. Corvus coronoides	Australian Raven	*	*
55. Corvus bennetti	Little Crow	*	*
56. Corcorax melanorhamphos	White-winged Chough	*	*
57. Struthidea cinerea	Apostlebird	*	*
58. Rhipidura albiscapa	Grey Fantail	*	*
59. Rhipidura leucophrys	Willie Wagtail	*	*
60. Megalurus gramineus	Little Grassbird	*	*
61. Sturnus vulgaris#	Common Starling	*	*
Mammals			
1. Tachyglossus aculeatus	Short-beaked Echidna	*	*
2. Trichosurus vulpecula	Brush-tailed Possum	*	*
3. Antechinus flavipes	Yellow-footed Antechinus	*	*
4. Macropus giganteus	Eastern Grey Kangaroo	*	*
5. Wallabia bicolor	Swamp Wallaby	*[26]	*
6. Macropus rufogriseus	Red-necked Wallaby	*	*
7. Mus musculus#	House Mouse	*	*

# denotes exotic species ^ denotes species listed as key threatening process.
* indicates species found or likely to be found in respective areas. V denotes listed vulnerable species
^ Open Cut Area includes the Western and Southern Biodiversity Offset Areas, the open cut pit shell and the oou-of-pit waste rock emplacement

[26] Only in the thick Bull-oak community that will unaffected by the proposal.

Table A5.1
Fauna Species Found or Likely to be Found in the Open Cut Area and the Proposed Northern Biodiversity Offset Area (NBOA).

Scientific Name	Common Name	Open Cut Area^	NBOA
Mammals Cont'd			
8. Rattus rattus#	Black Rat	*	*
*9. Oryctolagus cuniculus#^*	European Rabbit	*	*
10. Lepus capensis#	Brown Hare	*	*
11. Vulpes vulpes# ^	European Red Fox	*	*
12. Canis lupus familiaris	Farm Dog	*	*
*13. Felis cattus#^*	Feral Cat	*	*
14. Nyctinomus (Tadarida) australis	White-striped Mastiff-bat	*	*
15. Mormopterus norfolkensis	Eastern Mastiff-bat (V)	*	*
16. Mormopterus planiceps	Little Mastiff-bat	*	*
17. Miniopterus schreibersii	Eastern Bentwing-bat (V)	*	*
18. Chalinolobus morio	Chocolate Wattled Bat	*	*
19. Nyctophilus geoffroyi	Lesser Long-eared Bat	*	*
20. Nyctophilus gouldii	Gould's Long-eared Bat	*	*
21. Chalinolobus gouldii	Gould's Wattled Bat	*	*
22. Vespadelus vulturnus	Little Forest Bat	*	*
23. Petaurus breviceps	Sugar Glider	*	
24. Phascogale tapoatafa	Brush-tailed Phascogale (V)	*	*
25. Pteropus poliocephalus	Grey-headed Flying-fox (V)	*	*
Reptiles			
1. Chelodina longicollis	Eastern Snake-necked Turtle	*	
2. Pogona barbata	Eastern Bearded Dragon	*	*
3. Cryptoblepharus virgatus	Cream-striped Shinning-skink	*	*
4. Eulamprus quoyii	Eastern Water-skink	*	*
5. Egernia striolata	Tree-crevice Skink	*	*
6. Lampropholis delicata	Dark-flecked Garden Sunskink	*	*
7. Carlia foliorum	Tree-based Litter-skink	*	*
8. Ramphotyphlops wiedii	Brown Snouted Blind Snake	*	*
9. Varanus varius	Lace Monitor	*	*
10. Pseudechis porphyriacus	Red-bellied Blacksnake		*
11. Demansia psammophis	Yellow-faced Whipsnake		*

# denotes exotic species^ denotes species listed as key threatening process.* indicates species found or likely to be f in respective areas.
^ Open Cut Area includes the Western and Southern Biodiversity Offset Areas, the open cut pit shell and the oou-of-pit waste rock emplacement

A5.3 Local Fauna Biodiversity Improvements

Notwithstanding the doubt expressed in Section 6 of this report of the likely contribution from the Project Site to the long-term local biodiversity from any measure adopted for this Project, the biodiversity offset areas can predictably increase the fauna diversity and density if not its richness based on the existing fauna community within a 10km radius of the Project Site.

Amphibians

(i) All the frog species recorded during these surveys are common and relatively opportunistic species and the differences in the abundance of the various species is directly related to the availability of standing water created by the artificial dams in and around the Open Cut Area from the current mining operation and past settlement. No frog species has become locally extinct, thus the biodiversity offset areas are unlikely to add to the species richness of the regional or local frog community.

Birds

(i) A combination of structural and floristic diversity as a consequence of the land-use history means that notwithstanding the more extensive canopy cover in the Open Cut Area, the Northern Biodiversity Offset Area has more small insectivorous birds.

(ii) The Open Cut Area is dominated by aggressive birds in the Woodland and Grassland, such as Noisy Miners, Butcherbirds, Australian Magpies and Australian Ravens.

(iii) The Grey-crowned Babbler has been recorded frequenting the Eucalypt Open Woodland within the Open Cut Area although it is likely to transit the Northern Biodiversity and the Supplementary Offset Areas as well as the other biodiversity offset areas during its local nomadic movements.

(iv) Blossom feeding birds occur in higher abundance in the Open Cut Area because of the more extensive Eucalypt canopy cover as compared to the biodiversity offset areas.

(v) Other than the grassland birds, such as the Spur-winged Plover, the more robust bird species such as the Eastern Rosella that feeds on both seeds and nectar is commonly found in both areas.

(vi) Waterbirds were recorded more commonly in the Open Cut Area as a consequence of the abundance of standing water in the various dams in the immediate environs.

(vii) The White Throated Treecreeper is the only bird that appears to be found only in the Northern Biodiversity Offset Area due to the more diverse habitat structure along the riparian habitat.

Mammals

(i) All the mammals recorded in the Open Cut Area were also recorded, or expected to occur, in the Northern Biodiversity Offset Area.

(ii) The Sugar Gliders were recorded in habitats with *Acacia* understorey within the proposed pit limits and the adjoining overburden emplacement in the Open Cut Area as well as the Bull Oak stand that would form the part of the biodiversity offset area south of Stony Creek Road.

(iii) An exotic Black Rat, *Rattus rattus*, was recorded in the Open Cut Area but was not recorded in the biodiversity offset area but this is only an artefact of sampling - it is a species that can be expected to be present in a landscape dominated by farmland and hobby farms.

(iv) There was an abundance of Yellow-footed Antechinus *Antechinus flavipes* in the Northern Biodiversity Offset Area where higher understorey structural cover exists along the creeklines compared with the Open Cut Area.

Reptiles

(i) Reptile species such as small skinks (Scincidae), gekkoes (Gekkonidae) snakes (Elapidae), dragons (Agamidae) and other reptiles are more likely to occur in higher abundance in areas of higher moisture content along the drainage lines in the Northern Biodiversity Offset Area.

With the addition of the Western Biodiversity Offset Area (WBOA) and Southern Biodiversity Offset Area (SBOA) with the various farm dams, all the wetland-related species that were recorded only in the Open Cut Area and previously predicted as not likely to occur in the NBOA are now likely to be found in the biodiversity offset areas.

A5.4 Likely Benefits to Listed Threatened Species

The following summary of the analysis of the likely benefits the dedication of the biodiversity offset areas are likely to have in the short term (within the operational life of the mine) and the longer term period (during and beyond post-mining rehabilitation). This is notwithstanding that the western part of WBOA and the Supplementary Biodiversity Offset Area have not been sampled for fauna. The assumption adopted here is that the fauna likely to be found in these areas will be similar to those recorded in the Open Cut Area and the NBOA. For more detailed discussion, see Section 6 of this report.

Table A5.2
Summary of Likely Benefit for Listed Threatened Species and Other Listed Species

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Scientific Name	Common Name	Status	Short Term	Longer Term
Threatened Amphibians				
Litoria aurea	Green and Golden Bell Frog	E1	-	+?
Litoria booroolongensis	Booroolong Frog	E1	NR	NR
Mixophyes balbus	Stuttering Frog	E1	NR	NR
Litoria daviesae	Davies' Tree Frog	V	NR	NR
Litoria littlejohni	Littlejohn's Tree Frog	V	NR	NR
Heleioporus australiacus	Giant Burrowing Frog	V	NR	NR
Philoria sphagnicolus	Sphagnum Frog	V	NR	NR
Pseudophryne australis	Red-crowned Toadlet	V	NR	NR

* denotes species that has been recorded within 10km of the Open Cut Area — W denotes wetland species
** denotes recorded during this survey — NR denotes not relevant
- denotes no benefit — + denotes benefit — ? denotes doubtful benefit

Table A5.2 (Cont'd)
Summary of Likely Benefit for Listed Threatened Species and Other Listed Species

Scientific Name	Common Name	Status	Short Term	Longer Term
Threatened Birds				
Xanthomyza phrygia	Regent Honeyeater	E1	-	+
Lathamus discolor	Swift Parrot	E1	-	+
Erythrotriorchis radiatus	Red Goshawk*	E1	?	NR
Ephippiorhynchus asiaticus	Black-necked Stork (W)	E1	NR	
Hamirostra melanosternon	Black-breasted Buzzard	V	?	?
Ixobrychus flavicollis	Black Bittern (W)	V	-	-
Pyrrholaemus sagittatus	Speckled Warbler*	V	+	+
Climacteris picumnus	Brown Treecreeper*	V	+	+
Stagonopleura guttata	Diamond Firetail*	V	+	?
Grantiella picta	Painted Honeyeater	V	+	+
Melithreptus gularis	Black-chinned Honeyeater*	V	+	+
Pachycephala olivacea	Olive Whistler	V	+	+
Melanodryas cucullata	Hooded Robin*	V	+	+
Pomatostomus temporalis	Grey-crowned Babbler**	V	+	+
Neophema pulchella	Turquoise Parrot*	V	+	+
Ninox connivens	Barking Owl*	V	-	+
Ninox strenua	Powerful Owl	V	-	+
Tyto novaehollandiae	Masked Owl	V	-	+
Tyto tenebricosa	Sooty Owl	V	-	+
Callocephalon fimbriatum	Gang-gang Cockatoo	V	+	+
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	+	+
Burhinus grallarius	Bush Thick-knee (Curlew)	E1	+	+
Oxyura australis,	Blue-billed Duck	V	NR	NR
Stictonetta naevosa	Freckled Duck	V	NR	NR
Turnix maculosa	Red-backed Button-quail	V	NR	NR
Threatened Mammals				
Petrogale penicillata	Brush-tailed Rock-wallaby	E1	NR	NR
Pseudomys oralis	Hastings River Mouse	E1	NR	NR
Phascolarctos cinereus	Koala*	V	-	+
Cercartetus nanus	Eastern Pygmy-possum	V	-	+
Dasyurus maculatus	Spotted-tail Quoll	V	-	+
Phascogale tapoatafa	Brush-tailed Phascogale*	V	-	+
Macropus parma	Parma Wallaby	V	-	+?
Thylogale stigmatica	Red-legged Pademelon	V	-	+
Petaurus australis	Yellow-bellied Glider	V	-	+
Petaurus norfolcensis	Squirrel Glider*	V	-	+
Aepyprymnus rufescens	Rufous Bettong	V	-	+
Potorous tridactylus	Long-nosed Potoroo	V	-	+
Mormopterus norfolkensis	Eastern Freetail-bat**	V	+	+
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	+	+
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat**	V		
Miniopterus australis	Little Bentwing-bat	V	+	+

* denotes species that has been recorded within 10km of the Open Cut Area — W denotes wetland species
** denotes recorded during this survey — NR denotes not relevant
- denotes no benefit — + denotes benefit — ? denotes doubtful benefit

Table A5.2 (Cont'd)
Summary of Likely Benefit for Listed Threatened Species and Other Listed Species

Scientific Name	Common Name	Status	Short Term	Longer Term
Threatened Mammals (Cont'd)				
Myotis adversus	Large-footed Myotis	V	-	+
Chalinolobus dwyeri	Large-eared Pied Bat	V	+	+
Scoteanax rueppellii	Greater Broad-nosed Bat	V	+	+
Pteropus poliocephalus	Grey-headed Flying-fox*	V	-	+

* denotes species that has been recorded within 10km of the Open Cut Area W denotes wetland species
** denotes recorded during this survey NR denotes not relevant
- denotes no benefit + denotes benefit ? denotes doubtful benefit

Table A5.3
Listed Migratory and Marine Species (not listed above)

Scientific Name	Common Name	Short Term	Longer Term
Haliaeetus leucogaster	White-bellied Sea-Eagle**	NR	NR
Monarcha melanopsis	Black-faced Monarch	-	+
Monarcha trivirgatus	Spectacled Monarch	-	+
Hirundapus caudacutus	White-throated Needletail	NR	?
Myiagra cyanoleuca	Satin Flycatcher	-	+
Rhipidura ruffirons	Rufous Flycatcher	-	+
Gallinago hardwickii	Latham's Snipe	-	-
Rostratula benghalensis australis	Australian Painted Snipe	-	-
Apus pacificus	Fork-tailed Swift	NR	?
Ardea alba	Great Egret	-	+
Ardea ibis	Cattle Egret	-	-
Merops ornatus	Rainbow Bee-eater	NR	NR

** denotes recorded during this survey NR denotes not relevant
- denotes no benefit + denotes benefit ? denotes doubtful benefit

Summary

Notwithstanding the loss of the Open Woodland, Woodland and the Old Growth tree gallery over the proposed open cut mine area on the old north-south road reserve, the biodiversity offset areas, in particular the Northern Biodiversity Offset Area and Supplementary Biodiversity Offset Area, present an opportunity to secure elements of the habitats of the local fauna community that would otherwise remain unprotected.

If the recommended safeguards in Section 7 of this report are adopted, the rehabilitation and regeneration on the Northern Biodiversity Offset Area (plus the Supplementary Biodiversity Offset Area) and the riparian corridor along Glennies Creek as fauna habitat would be consistent with and will contribute to the biodiversity values of the Glennies Creek Catchment Management Strategy (HCMT 2003) and Synoptic Plan for the Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley (DMR 1999).

This proposed offset is proportionate to the scale of development where 42.4ha of Woodland, including an Old Growth gallery, and 34.3ha of Open Woodland, areas that will be affected.

A5.5 DECC Biodiversity Guidelines

DECC (2007b) sets out the principles for the assessment of biodiversity offsets in New South Wales. Thirteen principles are identified including procedural and planning ones. Six of these are scientific principles - Principles 5, 6, 7, 9, 10 and 11.

- **Principle 1: Impacts must be avoided first by using prevention and mitigation measures**

  See Part D6.4 of the *Environmental Assessment* and Section 6 of this report.

- **Principle 2: All regulatory requirements must be met.**

  See Part D6.4 of the *Environmental Assessment* and Section 1 of this report.

- **Principle 3: Offsets must never reward ongoing poor performance.**

  See Part D6.4 of the *Environmental Assessment* and Section 6 of this report.

- **Principle 4: Offsets will complement other government programs.**

  See Part D6.4 of the *Environmental Assessment* and Section 6.6 of this report.

- **Principle 5: Offsets must be underpinned by sound ecological principles**

  See GCNRC (2007b), Section 6.1 to Section 6.6 and Section 7 of this report.

- **Principle 6: Offsets should aim to result in a net improvement in biodiversity over time**

  The proposed biodiversity offset areas will provide a diversity of habitat for flora and fauna. As the communities mature, there will be further development of a variety of habitat niches for use by fauna species. The current more mature remnants will age and develop a wider range of hollows and other habitat features as well as providing food for fauna. The Regenerating Native Woodlands / Shrublands Community will provide a different set of habitat features more suited to smaller birds that nest closer to the ground and cover for smaller fauna species.

  Because of the habitat changes that would result from the conservation of these proposed biodiversity offset areas, there would be a net improvement in biodiversity over time.

  See Section 6.1 to Section 6.6 for discussions of the offset value on the various listed and listed threatened species. These are summarized in **Table A5.1** and **Table A5.2**.

- **Principle 7: Offsets must be enduring – they must offset the impact of development for the period that that impact occurs**

  The Proponent has indicated that it would be prepared to enter into an appropriate conservation agreement with DECC to ensure the conservation of the lands contained within the boundaries of the proposed biodiversity offset areas in perpetuity.

  As a consequence, the flora communities within the biodiversity offset areas would be protected well beyond the period of impact of the disturbance associated with the proposed development.

  The biodiversity values of these biodiversity offset areas will also be enhanced by the additional plantings of native trees and shrubs on the post-mining landscape to provide additional corridors of native vegetation in the region in keeping with the aims of the *'Synoptic Plan: Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley of NSW'*. (DMR 1999) and the '*Glennies Creek Catchment Total Catchment Study*' objectives (HCMT 2003).

- **Principal 8: Offsets should be agreed (upon) prior to the impact occurring.**

  This is a procedural matter between the proponent and the consent authority.

- **Principle 9: Offsets must be Quantifiable – the impacts and benefits must be reliably estimated.**

  See GCNRC (2007b) and Section 5 and Section 6.6 inclusive.

- **Principle 10: Offsets must be targeted**

  This principle addresses the issue of offsets achieving a like-for-like or better conservation outcome. In the DECC publication, it is noted that *'Only ecological communities that are equal or greater in conservation status to the type of ecological community lost can be used as offsets'*. The proposed Biodiversity Offset Strategy involves (After GCNRC 2007b);

  a) the disturbance of:

  - **6.1ha of Community 1** – Open Tussock Grassland;
  - **0.7ha of Community 2** – Regenerating Native Woodlands / Grasslands;
  - **68.3ha of Community 3** – Narrow-leaf Ironbark – Spotted Gum – Grey Box which equates with the Central Hunter Ironbark – Spotted Gum – Grey Box Forest community [MU 27] of Peake [2006];
  - **59.9ha of previously disturbed land [Communities 4 and 6]** – land that, in its present state, is either largely bare or has been planted to exotic grasses with few native species evident; and

b) the conservation of:

- **44.4ha of Community 1** – Open Tussock Grassland. While this community has not been described by Peake [2006] it has considerable value as a food and shelter source for small mammals and reptiles and as a foraging area for many birds including parrots and other seed eating species as well insectivorous / invertebrate eating species - Crested Pigeons, Magpies, Peewees and White-faced Herons etc were noted during the field inspection. These grasslands were also observed to be used as food sources by a number of 'patrolling' raptor species.
- **74.0ha of Community 2** – Regenerating Woodland / Shrubland – which will in time form a mix of Narrow-leaf Ironbark – Spotted Gum – Grey Box Woodland community and Bull Oak Forest; and in time much of it will provide the same significant values as the areas of Narrow-leaf Ironbark – Spotted Gum – Grey Box community conserved within the proposed biodiversity offset areas. The area of this community between the proposed open cut limits and Stony Creek Road will, in time, enhance the linkages between the biodiversity offset areas to the north and south of the road as well as with Glennies Creek.
- **113.1ha of Community 3** – Narrow-leaf Ironbark – Spotted Gum – Grey Box community which equates with the Central Hunter Ironbark – Spotted Gum – Grey Box Forest community [MU 27] of Peake [2006]. Peake ascribes a significant value to this community, presumably because of it poor degree of reservation since he notes that it is widespread over the Hunter Valley floor. The conservation of 106ha of this community in the proposed biodiversity offset areas in a **ratio of 1.52: 1** [*in relation to the area proposed to be disturbed*] is a significant achievement for biodiversity conservation especially when it is conserved with a range of other habitats of significance.
- **20.9ha of Community 4** – Bull Oak Forest which equates with the Central Hunter Bull Oak Forest Regeneration community [MU32] of Peake [2006]. Peake notes that this community is not of regional significance. However, it should be noted that as an *Allocasuarina* species it provides a significant feed source for Cockatoos including the rarer and threatened species.

In addition to:

- **33.4ha of Community 6** - Swamp Oak Community which equates to the Central Hunter Swamp Oak Forest community [MU 28] of Peake [2006]. Peake describes this community as having a high significance because it is restricted in distribution, very highly cleared, highly threatened and extremely poorly reserved. The inclusion of this community within the biodiversity offset areas provides a significant enhancement to the value of these Areas
- **1.5ha of Community 7** – River Oak Community which equates with the Hunter Valley River Oak Forest [MU 30] of Peake [2006]. Peake describes this community as having a high significance because it is restricted in distribution, highly cleared, threatened and extremely poorly reserved. The inclusion of this community, even though it is small in size, within the biodiversity offset areas provides a significant enhancement to the overall value of these Areas

Although it is impossible within our lifetime to replace the older mature trees that will be lost in the Woodland and Open Woodland Habitat Areas on the Open Cut Area if the Project proceeds, the preservation of the remainder of the habitat remnants in the Biodiversity Offset Areas will ensure that at least some of the trees in this modified and fragmented habitat remnant can now develop into mature trees and grow old and senesce in time. With the ameliorative and enhancement actions proposed, in the absence of stock grazing pressures in the Offset Areas, the progression of the succession in the vegetation communities will bring improvements in habitat patch qualities for a wide range of fauna, including listed threatened species as summarised in Table A5.2. This biodiversity offset proposal is therefore adequate to preserve (if not enhance) the local biodiversity in Stony Creek Catchment in this part of the Upper Hunter Valley and is thus appropriate in scale and design to satisfy Principle 10 for this Project.

- **Principle 11: Offsets must be located appropriately.**

  The development proposal involves the clearing of a total of 75.1ha of native vegetation, comprising approximately:

  - 6.1 ha of Tussock Grassland;
  - 0.7ha of Regenerating Native Woodlands / Shrublands; and
  - 68.3ha of the *Eucalyptus crebra* [Narrow-leaf Ironbark] – *Corymbia maculata* [Spotted Gum] – *Eucalyptus tereticornis* [Forest Red Gum] Community;

  The biodiversity offset proposal is built around conserving a total of 287.3ha of native vegetation within the various biodiversity offset areas, including:

  - conserving 44.4ha of Tussock Grassland;
  - conserving 74.0ha of Regenerating Native Woodlands / Shrublands;
  - conserving 113.1ha of the *Eucalyptus crebra [*Narrow-leaf Ironbark*]* – *Corymbia maculata* [Spotted Gum] – *Eucalyptus tereticornis* [Forest Red Gum] Community;
  - conserving 20.9ha of the *Allocasuarina luehmannii* [Bull Oak] Community;
  - conserving 33.4ha of *Casuarina glauca* [Swamp Oak Community];
  - conserving 1.5ha of *Casuarina cunninghamiana* [River Oak Community]; and
  - re-establishing 10ha of the *Eucalyptus crebra* [Narrow-leaf Ironbark] – *Corymbia maculata* [Spotted Gum] – *Eucalyptus tereticornis* [Forest Red Gum] Community within the Northern and Supplementary Biodiversity Offset Areas to further enhance the value of the conserved lands.

  This offset strategy when combined with the re-establishment of the *Eucalyptus crebra* [Narrow-leaf Ironbark] – *Corymbia maculata* [Spotted Gum] – *Eucalyptus tereticornis* [Forest Red Gum] Community on the post mining landscape within the Project Site would result in a total area of some 550ha being conserved in perpetuity as habitat for native fauna.

The proposed biodiversity offset areas are strategically located to conserve and enhance the riparian habitat along Tieny Creek, Reedy Creek and Glennies Creek. Setting aside the biodiversity offset areas will allow the preservation of the remaining Woodland habitat and allow most of the other parts of the area to develop towards an Open Woodland habitat in the longer term, say in 5 years or more.

In the long term, the habitat structural quality in the biodiversity offset areas will improve and may approach the level of that expected of a conservation reserve in this part of the Upper Hunter Valley. Whether it can or is desirable to reach the mature Open Woodland or Tall Open Woodland habitat in which much of the Australian landscape appeared to have existed, at the time of European Settlement is uncertain (see Berry and Roderick 2006).

- **Principle 12: Offsets must be supplementary.**

  See GCNRC (2007b) and as detailed under Principle 10 and Principle 11 above.

- **Principle 13: Offsets and their Actions must be enforceable through development consent conditions, licence conditions, conservation agreement or a contract.**

  These procedural matters for the Consent Authority to pursue with the Proponent.

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