BIG ISLAND MINING PTY LTD

ABN 12 112 787 470

Dargues Reef Gold Project

ECOLOGY
Assessment

Prepared by

Gaia Research Pty Ltd

SEPTEMBER 2010

Specialist Consultant Studies Compendium

Volume 1, Part 2

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ABN 12 112 787 470

ECOLOGY
Assessment

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September 2010

CONTENTS

Page

CONTENTS

Page

APPENDICES

CONTENTS

Page

FIGURES

TABLES

CONTENTS

Page

PLATES (A colour copy of all plates is available on the Project CD)

EXECUTIVE SUMMARY

Fauna and flora surveys were conducted on the land described below, (the "Subject Site") in relation to a proposed extraction of mineral resources (gold). In this report Mining Lease (ML 103) is referred to as Dargues Reef. The southern section of the Project Site is referred to as the "recently acquired land".

- Lots 102 & 210/DP755934
- Lots 1, 2, 3, 4 & 5/DP986483
- Lot 104/DP1100849
- Lot 1021/DP1127185

The surveys used systematic and targeted methods in order to find species listed under the *Threatened Species Conservation Act 1995* (TSC Act) and the *Environmental Planning & Assessment Act 1979 (*EP&A Act). Two Threatened species, the Gang-gang Cockatoo *Callocephalon fimbriatum* and Flame Robin *Petroica phoenicea*, listed in Schedule 2 of the TSC Act was observed on site. The Glossy Black Cockatoo *Calyptorhynchus lathami*, which is also listed on Schedule 2 of the TSC Act was detected approximately four kilometres to the south of the Subject Site at Majors Creek cemetery. Previous surveys have detected the Little Eagle *Hieraaetus morphnoides* and Scarlet Robin *Petroica boodang* the Subject Area. No endangered ecological communities or threatened species of plant currently listed in the TSC Act were located. No viable ecological communities or species of plant currently listed in the EPBC Act were found within the Subject Site. Two species, the Black-faced Monarch *Monarcha melanopsis* and the White-throated Needletail *Hirundapus caudacutus*, listed as a migratory species under the EPBC Act (1999) were observed on the Subject Site.

The Proponent shall retain 35.1ha (99.4%) of Ribbon Gum - Snow Gum grassy open forest (referred to hereafter as Ribbon Gum Forest) within the Subject Site. This will conserve all hollow-bearing trees and regrowth vegetation and help protect the water quality of Spring Creek, a tributary of Majors Creek. The forest currently exists as fragmented or weakly connected areas of forest within the Subject Site. Approximately 0.2ha of native dominated grassland and 23.7ha of native-dominated pasture would be disturbed. The action would not have a significant impact on threatened species. The level of direct impact on native vegetation / habitat associated with this Project is minimal. Notwithstanding this, a number of measures shall be adopted to protect existing habitat and rehabilitate the Subject Site.

The Proponents have revegetated several areas between these blocks of bush with the intent of joining the vegetation to facilitate the movement of wildlife and provide stock shelter areas and screening. The Proponent has also removed much of the exotic weeds (Broom *Cytisus scoparius and* Blackberry *Rubus fruticosus*) from the northern section of Subject Site and fenced the Dargues Reef area from cattle.

Although only a small area of vegetation is proposed to be removed the proponent intends to implement ameliorative measures over the life of the Project so that the environment is rehabilitated to a state that is of a higher standard that that which currently exists. In addition, the Proponent proposes to prepare and implement a *Property Vegetation Plan* under the *Native Vegetation Act 2003* covering the northern section of the Subject Site. The proposed ameliorative and biodiversity strategies are described in detail in the *Environmental Assessment*.

Finally, the Ecology Assessment determined that the Project would not result in significant impacts on threatened species, populations or ecological communities and that a referral to the Commonwealth Minister for the Environment is not required.

DEFINITION OF TERMS

Within this report the following terms are defined.

- ***Dargues Reef*** land within Mining Lease 103.
- ***Direct impacts*** are those that directly affect habitat and individuals, usually within the footprint of disturbance. They include, but are not limited to, clearing and habitat removal.
- ***Exotic Species*** means species introduced from outside the area, that is from overseas or interstate.
- ***Grazing animals or stock*** means all livestock (including cattle, horses, sheep, goats and alpacas).
- ***Indirect Impacts*** occur when Project-related actions affect species, populations or ecological communities in a manner other than direct loss, usually beyond the footprint of disturbance. Indirect impacts can include loss of individuals through predation by domestic and/or feral animals, deleterious hydrological changes (including increased runoff and raising or lowering of the water table), erosion, weed invasion, pollution, trampling or other impacts due to increased human activity within or directly adjacent to sensitive habitat areas, altered fire regimes, habitat fragmentation and disruption of wildlife movement corridors.
- ***Landholder*** means Big Island Mining Pty Ltd or any subsequent owners if the title is sold or transferred.
- ***Life Cycle*** is the series or stages of reproduction, growth, development, aging and death of an organism.
- ***Local Occurrence*** means the ecological community that occurs within the study area. However the local occurrence may include adjacent areas if the ecological community on the study area forms part of a larger contiguous area of that ecological community and the movement of individuals and exchange of genetic material across the boundary of the study area can be clearly demonstrated.
- ***Local Population*** means the population that occurs in the study area. The assessment of the local population may be extended to include individuals beyond the study area if it can be clearly demonstrated that contiguous or interconnecting parts of the population continue beyond the study area.
- ***Locality*** is the area within a 5km radius of the Subject Site.
- ***Native Vegetation*** means indigenous vegetation as per the *Native Vegetation Act 2003.* This includes indigenous trees, shrubs, groundcover plants and aquatic plants.
- ***Noxious Weeds*** means any plant declared under the *Noxious Weeds Act 1993* within the local government area of *Palerang.*
- ***Proposal*** is the development, activity or action proposed
- ***Recently acquired land*** means the southern section of the Project Site, namely: Lots 1, 2, 3, 4 and 5/DP986483 and Lot104/DP1100849.

- ***Regeneration*** means reproduction from self-sown seeds or by vegetative recovery (sprouting from stumps, lignotubers, rhizomes or roots), which occurs naturally after disturbance.
- ***Risk of Extinction*** is the likelihood that the local population of the species or local occurrence of the endangered population or ecological community will become extinct either in the short, medium or long-term as a result of direct or indirect impacts on the viability of that population and includes changes to the ecological function of communities.
- ***Stock*** means all livestock (including cattle, horses, sheep, goats and alpacas).
- ***Subject area*** means the Subject Site and any additional area, which may be affected by the Project.
- ***Subject Site*** means the area directly affected by the Project. For the purposes of this assessment, this is defined as the Project Site (see Section 1.2)
- ***Subject Species, Populations or Ecological Communities*** means those threatened species, populations or ecological communities that are known or considered likely to occur in the study area. The EVALUATION OF IMPACTS is to explicitly consider the impacts of the Project on each of these entities.
  - The local population of a threatened plant species comprises those individuals occurring in the study area or the cluster of individuals that extend into habitat adjoining and contiguous with the study area that could reasonably be expected to be cross-pollinating with those in the study area.
  - The local population of migratory or nomadic fauna species comprises those individuals that are likely to occur in the study area from time to time.
  - The local population of resident fauna species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area.
- ***Viable*** means the capacity to successfully complete each stage of the life cycle under normal conditions.

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1. INTRODUCTION

1.1 BACKGROUND

This report was commissioned by Big Island Mining Pty Ltd ("the Proponent") to assess and document the impact of proposed development of the Dargues Reef Gold Mine ("the Project") on threatened species of fauna and flora or endangered ecological communities within the Subject Site (see Section 1.4) (**Figures 1** and **2**).

The report addresses the Director General's Requirements (DGRs) presented in **Appendix 1**. **Appendices 2, 3** and **4**, provided species lists of fauna and flora identified within the Subject Site during systematic surveys.

This report was prepared by Mr Garry Daly, with the assistance of the following individuals.

- Mr Greg Stone who undertook the vegetation survey for the Project.
- Mr B. Virtue who assisted with the diurnal bird surveys and other fauna surveys.
- Ms A. Rowell who assisted with the grassland components of the assessment, including field identification of these communities and
- Mr B. James who assisted with preparation of the bird species list for the Subject Site.

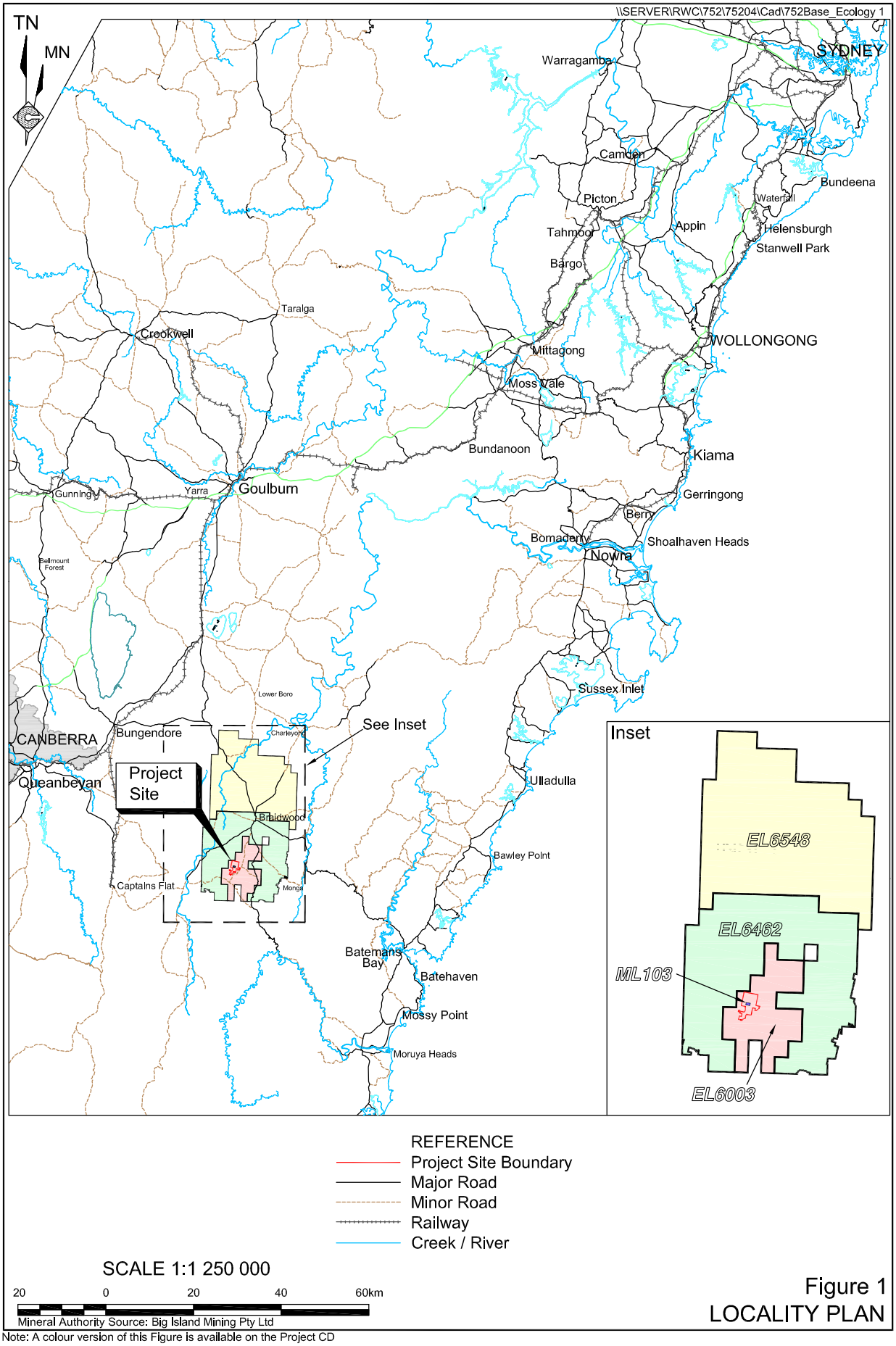
The curriculum vitas, including qualifications and licence numbers, of all individuals involved in the survey are presented in **Appendix 5**.

The following assessment forms a component of an *Environmental Assessment* prepared by R.W. Corkery & Co. Pty. Limited to support of an application for planning approval for the Project under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

1.2 PROJECT OVERVIEW AND PROPOSED SITE LAYOUT

The Project would include the following components (**Figure 2**).

- Extraction of waste rock and ore material from the Dargues Reef deposit using underground sublevel open stope mining methods with a suitable crown pillar to prevent surface subsidence.
- Construction and use of surface infrastructure required for the underground mine, including a box cut, portal and decline, magazines, fuel store, ventilation rise and power and water supply.
- Construction and use of a processing plant and office area which would include an integrated Run-of-Mine (ROM) pad/temporary waste rock emplacement, crushing and grinding, gravity separation and floatation circuits, Proponent and mining contractor site offices, workshop, laydown area, ablutions facilities, stores, car parking, and associated infrastructure.
- Construction and use of a tailings storage facility.



Note: A colour version of this Figure is available on the Project CD

Figure 1
LOCALITY PLAN

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TN
MN

See Detail Right

Site Access Road

Tailings Storage Facility

Tailings Storage Facility Access Road

Ventilation Rise

Spring Creek

Existing Site Access Track (to be decommissioned)

Majors Creek Road

Detail

Proponent & Mining Contractor Offices
Concentrate Storage
Gold Room
Floatation Tanks
Raw Water
Reagent & Other Storage
Concentrator
Crushing & Grinding Circuit
Processing Plant Office Area
+ 692
Water Supply Tanks
ROM Pad
+ 705
Sub-station
Settling Dam
Temporary Waste Rock Emplacement
Fuel Bay
Core Yard
Lay Down Yard
Workshop
Box Cut

SCALE 1:4 000

50 0 50 100 150 200 m

See Detail Left

REFERENCE

- Project Site Boundary
- Contour (m AHD)(Interval = 5m)
- Contour (m AHD)(Interval = 10m)
- + 692 Spot height (m AHD)
- Creek / Drainage Line
- Sealed Road
- Unsealed Road
- Existing Dam/Water Storage
- Proposed Settling Dam
- Proposed Harvestable Rights Dam (Indicative Location)
- Catchment Boundary
- Existing Transmission Line
- Proposed Transmission Line
- Proposed Pipeline (Indicative)
- Proposed Road/Track (Sealed/Unsealed)
- Fence (note: fences not co-incident with cadastral boundaries)

SCALE 1:8 000

100 0 100 200 300 400 m

Base Map Source: Geo-spectrum (Australia) Pty Ltd

Figure 2
SUBJECT SITE LAYOUT

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- Construction and use of a water management system, including construction and use of eight dams and associated water reticulation system, to enable the harvesting and supply of water for mining-related operations. It is noted that the proposed water harvesting operations would be consistent with the Proponent's harvestable right.
- Construction and use of a site access road and intersection to allow site access from Majors Creek Road.
- Transportation of sulphide concentrate from the Project Site to the Proponent's customers via public roads surrounding the Project Site using covered semi-trailers.
- Construction and use of ancillary infrastructure, including soil stockpiles, core yards, internal roads and tracks and surface water management structures.
- Construction and rehabilitation of a final landform that would be geotechnically stable and suitable for a final land use of nature conservation and/or agriculture.

It is noted that during the life of the Project the Proponent proposes to undertake additional exploration drilling to further define identified mineralisation and identify additional mineralisation. Extraction of those resources does not form a part of this application. As a result, a subsequent application for approval to extract any identified resources may be prepared once sufficient information is available to adequately identify the proposed activities.

1.3 STUDY OBJECTIVES

The objectives of the study were to:

- assess the Subject Site for threatened species and endangered ecological communities as listed under State and Commonwealth legislation;
- conduct systematic surveys for fauna, flora and ecological communities;
- assess the local and regional significance of all listed threatened species and communities that were either detected on or adjacent to the Subject Site or may utilise the Subject Site based on known habitat preference;
- identify fauna habitat of conservation significance;
- apply the seven part test in Section 5A of the EP&A Act, as amended by the TSC Act as part of the Part 3A assessment to determine whether there is likely to be a significant impact on threatened species or their habitat and endangered ecological communities;
- apply Part 9 of the EPBC Act to determine whether there is likely to be a significant impact on a matter of national significance; and
- provide data from the surveys in an excel spreadsheet to the New South Wales National Parks and Wildlife as per requirement under the scientific licence issued by the Department of Environment Climate Change and Water (DECCW).

1.4 DESCRIPTION OF SUBJECT SITE

1.4.1 Introduction

The Subject Site covers the following land titles and is shown in **Figure 3.** The total area of the Subject Site is approximately 403ha, all of which is owned by the Proponent.

- Lots 102 & 210/DP755934
- Lots 1, 2, 3, 4 & 5/DP986483
- Lot 104/DP1100849
- Lot 1021/DP1127185

The Subject Site is located immediately north of the village of Majors Creek and approximately 13km south-southwest of Braidwood within the Southern Tablelands of NSW. The Subject Site is within the Araluen and Shoalhaven Catchments, however, all significant ground disturbing activities would be undertaken within the Araluen Catchment. Elevations within the Subject Site range from approximately 600m AHD to 900m AHD.

1.4.2 Geology

The Subject Site is located in the eastern section of the Lachlan Fold Belt and is associated with the Devonian-aged Braidwood Granodiorite. The resulting soils have a high level of quartz as a result of the decomposed granite. Exposed outcrops of granite occur at the surface at several locations, especially on some of the hills.

1.4.2.1 Climate

Table 1 presents meteorological data from the Bureau of Meteorology-operated Braidwood (Wallace Street) meteorological station. January is the hottest month, with a maximum average temperature of 26.0°C. July is the coldest month with an average maximum temperature of 11.4°C and an average minimum temperature of minus 0.2°C.

Based on records from the Wallace Street Braidwood meteorological station, annual average rainfall is 718.8mm, with rainfall distributed reasonably evenly through the year, with between 47mm and 70mm falling on average each month. The driest year on record is 1982 when 340mm of rain was recorded. By contrast, the wettest year on record is 1974 when 1341mm was recorded.

Table 1
Monthly weather data from Braidwood

	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Temperature													
Mean maximum temperature (C°)	26.0	25.4	23.0	19.1	15.2	12.0	11.4	13.2	16.4	19.4	22.0	25.0	
Mean minimum temperature (C°)	10.9	11.1	9.3	5.9	2.6	0.7	-0.2	0.8	2.7	5.4	7.6	9.6	
Rainfall													
Mean rainfall (mm)	70.3	65.6	69	56.4	58	66.5	47.2	47.4	48.8	62.7	62.9	64	718.8
Highest rainfall (mm)	261.9	323.6	339.6	249.4	663.9	517.1	344.6	250.8	145.6	357.2	216.4	277.7	1341.7
Lowest rainfall (mm)	0.8	0	0.3	0	1.2	0.5	0	0.6	4.1	2	1.3	0	340
Highest daily rainfall (mm)	104.6	175	160.4	118	199.9	113.3	101.9	89.6	154.9	106.7	86.9	106.7	

Source: Bureau of Meteorology – Braidwood – Wallace Street (Station number: 069010).
Note temperature data collected at Braidwood – Wallace Street from 1907 to 1975. Data from 1985 to 2007 has been sourced from the Braidwood Racecourse Station and used to calculate a mean maximum and minimum temperatures for the period 1907 to 2007.

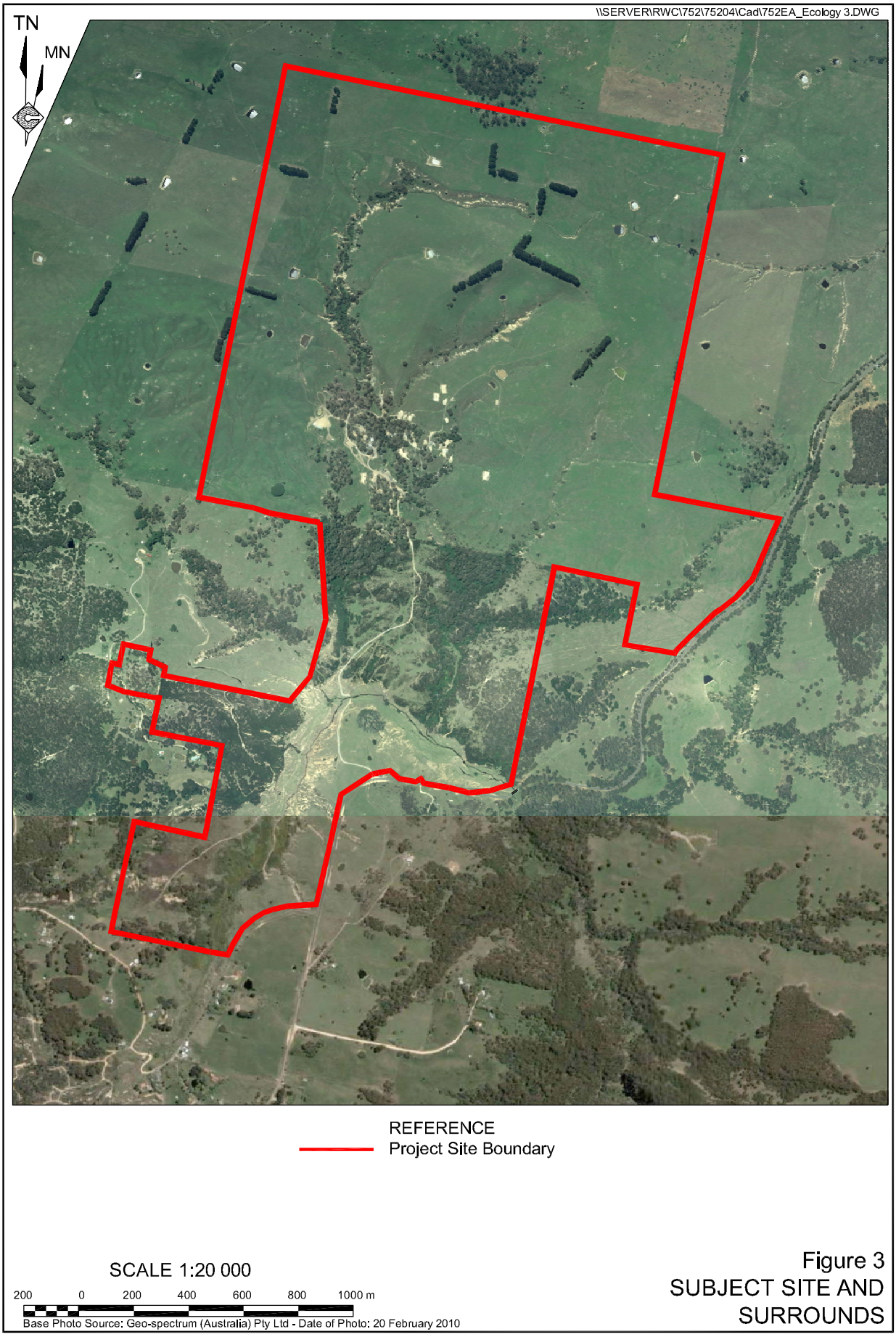


Figure 3
SUBJECT SITE AND SURROUNDS

2. LISTED FAUNA, FLORA AND ECOLOGICAL COMMUNITIES

The following databases were searched to identify species and ecological communities that may occur in the Locality (within 5km of the Subject Site). In addition, DECCW provided a list of species required to be assessed during this assessment. Finally, additional species with the potential to occur within the vicinity of the Subject Site were determined based on author's records and experience. The Australian Museum (AM) database is currently not available via the AM website and the BioNet website was not operating being 'temporarily unavailable'.

- NPWS Wildlife Atlas, accessed 30 April 2010;
- NPWS Flora Atlas, accessed 30 April 2010;
- DEWHA Protected Matters Search Tool, accessed 21 June 2010 and
- PlantNet/Flora Online, accessed 14 June 2010

Five threatened species of flora listed under the *Threatened Species Conservation Act 1995* and *Commonwealth Environment Protection and Biodiversity Act 1999* have been recorded within 5km of the Subject Site (**Table 2**). In addition, DECCW in their requirements for the Environmental Assessment identify a number of other threatened species which, in their opinion, require assessment. As a result, **Table 2** presents a list of species and ecological communities that may occur within or surrounding the Subject Site based on the above sources of information.

Table 2
Listed Species and Ecological Communities

Page 1 of 3

Threatened Species / Ecological Community	Scientific Name	TSC Act Schedule	EPBC Act	DECCW DGRs	Authors records
Fauna Species					
Koala	*Phascolarctos cinereus*	2		x	
Squirrel Glider	*Petaurus norfolcensis*	2		x	
Yellow-bellied Glider	*Petaurus australis*	2		x	
Spotted-tailed Quoll	*Dasyurus maculatus*	2		x	
White-footed Dunnart	*Sminthopsis leucopus*	2		x	
Eastern Pygmy Possum	*Cercartetus nanus*	2		x	
Grey-headed Flying Fox	*Pteropus poliocephalus*	2	V		
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	2		x	
Eastern Bentwing Bat	*Miniopterus schreibersii oceanensis*	2		x	
Greater Broad-nosed Bat	*Scoteanax rueppellii*	2		x	
Golden-tipped Bat	*Kerivoula papuensis*	2		x	
Large-footed Myotis	*Myotis macropus*	2		x	
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	2		x	
Smoky Mouse	*Pseudomys fumeus*	1	E		

Table 2 (Cont)
Listed Species and Ecological Communities

Threatened Species / Ecological Community	Scientific Name	TSC Act Schedule	EPBC Act	DECCW DGRs	Authors records
Fauna Species					
Australian Painted Snipe	*Rostratula australis*	1	V		
Little Eagle	*Hieraaetus morphnoides*	2		x	
Square-tailed Kite	*Lophoictina isura*	2		x	
Brown Treecreeper	*Climacteris picumnus victoriae*	2		x	
Regent Honeyeater	*Xanthomyza phrygia*	1	E		
Diamond Firetail	*Stagonopleura guttata*	2		x	
Hooded Robin	*Melanodryas cucullata cucullata*	2		x	
Scarlet Robin	*Petroica boodang*	2		x	
Flame Robin	*Petroica phoenicea*	2		x	
Pink Robin	*Petroica rodinogaster*	2		x	
Barking Owl	*Ninox connivens*	2		x	
Powerful Owl	*Ninox strenua*	2		x	
Gang-gang Cockatoo	*Callocephalon fimbriatum*	2		x	x
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	2		x	x
Swift Parrot	*Lathanus discolour*	1	E		
Striped Legless Lizard	*Delma impar*	2	V	x	
Broad-headed Snake	*Hoplocephalus bungaroides*	1	V		
Giant Burrowing Frog	*Heleioporus australiacus*	2	V	x	
Littlejohn's Tree Frog	*Litoria littlejohni*	2	V	x	
Southern Bell Frog	*Litoria raniformis*	1	V	x	
Macquarie Perch	*Macquaria australasica*		E		
Australian Graying	*Prototroctes maraena*		V		
Flora Species					
Small-leaved Gum	*Eucalyptus parvula*	1		x	
Araluen Gum	*Eucalyptus kartzoffiana*	1	V	x	
Mauve Burr Daisy	*Calotis glandulosa*	2			
Michelago Parrot-Pea	*Dillwynnia glaucula*	1		x	
Monaro Golden Daisy	*Rutidosis leiolepis*	2		x	
Austral Toadflax	*Thesium australe*		V	x	
Araluen Zieria	*Zieria adenophora*	1A		x	
Dense Cord-rush	*Baloskion longipes*	2		x	
Hoary Sunray	*Leucochrysum albicans var. tricolor*		E		
Tangled Bedstraw	*Gallium australe*	1		x	
Thick-lipped Spider-orchid	*Caladenia tessellata*		V		

Table 2 (Cont)
Listed Species and Ecological Communities

Threatened Species / Ecological Community	Scientific Name	TSC Act Schedule	EPBC Act	DECCW DGRs	Authors records
Endangered Ecological Community					
Majors Creek Leek Orchid	*Prasophyllum sp. Majors Creek*	1A		x	
Pale Golden Moths	*Diuris ochroma*	1			
Small Snake Orchid	*Diuris pedunculata*	1			
Natural Temperate Grasslands of the Southern Tablelands (NSW and ACT) (EPBC community)			E		
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland			CE		
Sources: DECCW Atlas of NSW Wildlife, NPWS Flora Atlas, DEWHA Protected Matters Search Tool, PlantNet/Flora Online and Daly unpub. data*.					

3. SURVEY METHODS

3.1 INTRODUCTION

The methods used by Gaia Research during the preparation of this report adhere to those defined under:

- the Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working draft), prepared by the Department of Environment and Conservation (2004); and
- the Draft Guidelines for Threatened Species Assessment prepared by the (then) Department of Environment and Conservation and Department of Primary Industries (2005).

The assessment for determining impact on threatened flora and fauna considered the recommendations detailed in Threatened Species Assessment Guidelines prepared by the Department of Environment and Climate Change (2007).

The dataset produced during this survey is compatible with those generated during the comprehensive regional assessment of forests undertaken by the Department of Environment, Climate Change and Water (previously the NPWS, DEC and DECC) as a prelude to the regional forestry agreement in NSW.

3.2 FLORA SURVEYS

3.2.1 Introduction

The flora surveys were conducted on 14 October 2009, 25 January 2010, 3 May 2010 and 4 and 9 June 2010. The initial survey was undertaken during the flowering period of Thick-lipped Spider-orchid *Caladenia tessellata* i.e. generally late September or early October in extant southern populations (DECCW, 2009a) and Major's Creek Leek Orchid *Prasophyllum sp*. Majors Creek i.e. October to December (DECCW 2009a). Potential habitat within the Subject Site for the latter species was not searched during the flowering period for this species.

3.2.2 Methods

A preliminary survey of the subject area was undertaken to ascertain the major vegetation types present and the distribution of each. Sites considered to be representative of these vegetation types were selected for further surveying. Wherever possible, survey sites were located in areas were disturbance was proposed e.g. Tailings Storage Facility, access road, magazine etc. Other sites were selected on the basis of potential conservation significance e.g. native grassland remnants.

The vegetation surveys consisted of 100m transects, random meanders and 20 x 20m quadrats. The location of the thirteen transects and four 20 x 20m quadrats undertaken are given in **Table 5** and **Figure 4**. The survey results are provided in **Appendix 2**. The locations of the survey sites were recorded by global positioning system in GDA Datum 94, UTM co-ordinates in Zone 55.

Plant identifications were made according to nomenclature used in Harden (1990, 1991, 1992 and 1993). Recent name changes outlined in issues of *Cunninghamia* and *Telopea* were used where applicable. The conservation significance of species was established with reference to Briggs and Leigh (1999) and the TSC Act.

The vegetation was searched using a general botanic survey method, as outlined by York, Binns and Shields (1991), in order to establish an inventory of the largest number of plant species occurring within the Subject Site and to determine the location and extent of vegetation types. Specific searches for plant species of conservation significance were then carried out in potential habitat using the "Random Meander Technique" (Cropper, 1993).

3.2.3 Grassland Classification

DECCW required that grasslands at the site be classified as either Native Grassland, Native-dominated Pasture or Exotic-dominated Pasture, however the criteria for the classifications was not prescribed.

For the purposes of this assessment, the DEWHA Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory website (DEWHA, 2010) was consulted to develop these classifications were based upon the following criteria:

Native Grassland - remnants of natural temperate grassland are considered part of the listed community (Environment ACT, 2005) if:

- they are dominated by native grasses and/or native forbs (more than 50% total vegetative cover, excluding exotic annuals), and
- a diversity of native forbs is present.

Native-dominated Pasture - >50% cover of native species, dominated by native grasses with very few native forbs and usually moderate cover of clovers and/or exotic pasture grasses

Exotic-dominated Pasture - community does not include grassland where 50% or more of the total plant cover is dominated by perennial exotic species and there is a low diversity of native forbs or the native forb component (including soil seed reserves) is not sufficient to re-establish the characteristic native groundcover (Environment ACT, 2005).

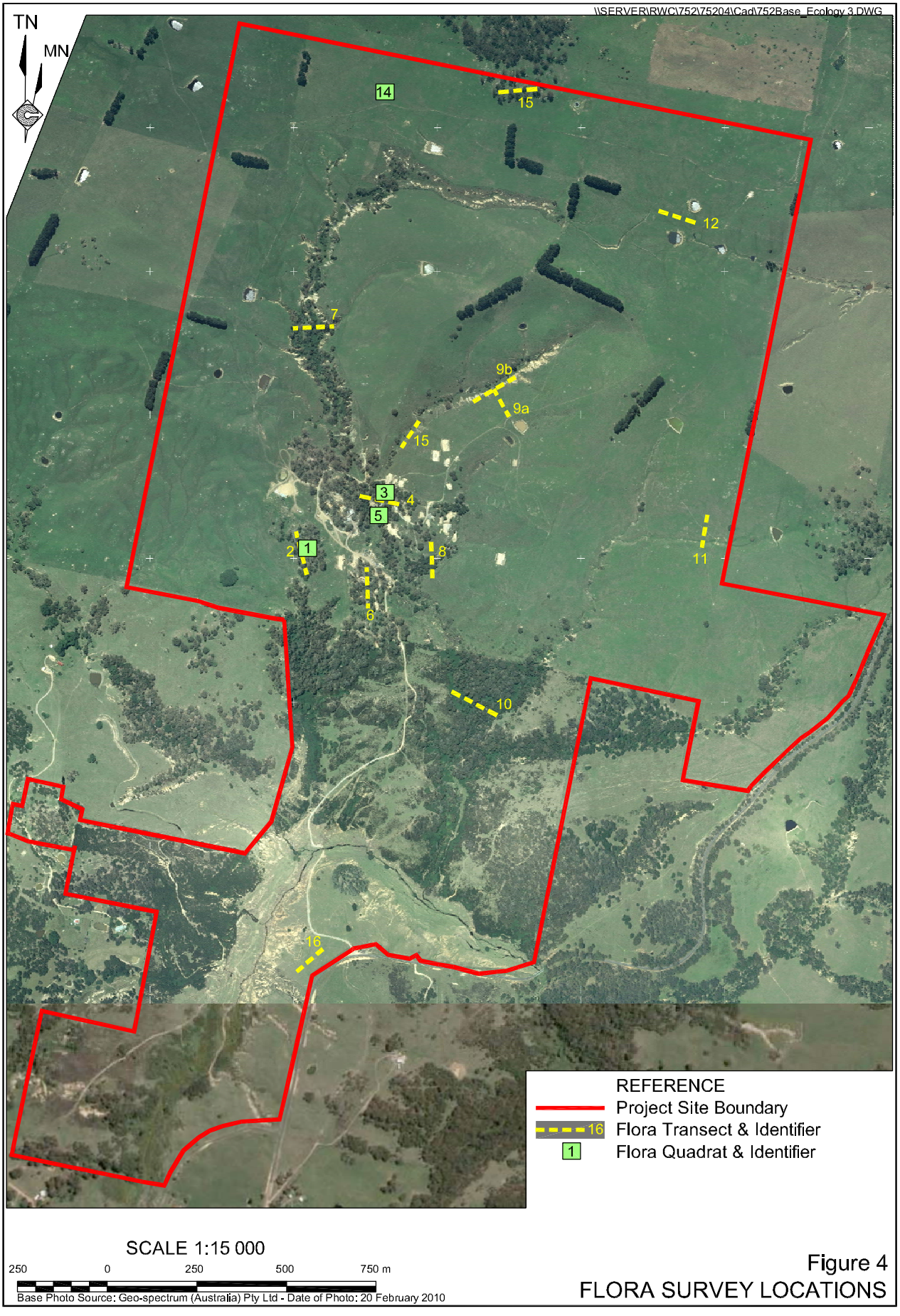


Figure 4
FLORA SURVEY LOCATIONS

3.3 FAUNA ASSESSMENT

3.3.1 Introduction

Surveys for fauna were conducted on the 19 November 2007, from 12 to 15 October 2009 and from 1 to 4 February 2010 (see Sections 3.1.2 to 3.1.9 and **Table 3**). The total list of species detected is provided in **Appendix 3**. The site-based and targeted survey methods and survey effort are summarised in **Tables 3** and **4** and the raw data in **Appendix 4**. Systematic surveys were based around a 2ha (100 x 200 m) site herein termed a transect. Two small mammal trapping transects were set within the Ribbon Gum – Snow Gum Open Forest (refered to hereafter as Ribbon Gum Forest) in spring 2009 and these were resurveyed in late summer 2010. Four harp traps were set at various locations in order to capture insectivorous bats (**Figure 5**). The location of each survey site was recorded by global positioning system in GDA Datum 94, UTM Australian Map Grid co-ordinates in Zone 55.

Figure 5 and **Table 5** presents the location of each of the fauna survey locations. The locations for Elliott traps, spotlight searches, bird surveys, reptiles searches and streamside search represent the start of the transect or search area.

Table 3
Details of Effort for Systematic Fauna Surveys

Page 1 of 2

Survey Method	Date and Time	Weather
Elliott and Cage Trapping	13 to 15 October 2009	Cloudy, windy and cold
	2 to 4 February 2010	Warm, humid with showers
Harp Trapping	13 to 15 October 2009	Cloudy, windy and cold
	2 to 4 February 2010	Warm, humid with showers
Diurnal Bird Surveys	7.48h to 8.08h and 8.10h to 8.30h on 13 October 2009	Cloudy, windy and cold
	7.07h to 7.27h and 7.36h to 7.56h on 14 October 2009,	Cloudy, windy and cold
	6.35h to 6.55h in 15 October 2009	Cloudy, windy and cold
	5.35h to 5.55h, 5.56h to 6.16h, 6.23h to 6.43h and 7.00h to 7.20h on 2 February 2010.	Warm, humid, still and overcast
Foot-based Spotlight Survey	19.53h to 20.33h on 12 October 2009, 19.04h to 19.44h on 13 October 2009, 10.05h to 10.25h on 14 October 2009	Cloudy, windy and cold
	20.01-20.21 on 1 February 2010, 21.00h to 21.30h on 2 February 2010	Warm, humid, still and part cloud cover
	19.04 to19.44h on 13 October 2009	Cloudy, windy and cold
Diurnal Herpetofauna Census	8.55h to 9.25h on 14 October 2009	Fine and cold
	12.27h to 2.57h on 3 February 2010 (two person survey)	Warm, humid, still and part cloud cover
Nocturnal Streamside Search	20.55h to 21.25h on 2 February 2010	Warm, humid, still and part cloud cover

Table 3 (Cont'd)
Details of Effort for Systematic Fauna Surveys

Survey Method	Date and Time	Weather
Call Playback	19.43h – 20.00h on 1 February 2010	
Dusk survey	18.40h – 19.43h on 1 February 2010	
Searches for incised Ribbon Gum	Undertaken during all survey periods	
Searches for Koala scats	Undertaken during diurnal searches	
Searches for Striped Legless Lizards	Undertaken during diurnal searches	
Searches for nesting cockatoo	Diurnal and dusk survey for birds entering hollows of trees	
Opportunistic surveys	Undertaken during all survey periods	

Table 4
Summary of Systematic and Targeted Fauna Survey Methods

Method	Standard effort	Total effort
Elliott (per transect)	Ten A size traps set on the ground at twenty metre intervals for 3 days baited with peanut butter/oats.	120 trap nights
Cage trapping (per transect)	Two cage traps baited with sardines/peanut butter/oats.	24 trap nights
Harp trapping	One harp trap set for three nights within 100 metres of each transect, plus additional harp traps was set across a potential flight path for two nights.	24 trap nights
Diurnal herpetofauna census	0.5 hectare (50 x 100 metre) searched by two people for one-person hour i.e. 60 minutes (min).	60 min plus 900 min over six days
Diurnal bird census	2 hectares (100 x 200 metre) searched for 20 minutes.	180 min plus 1000 min over six days
Foot based spotlighting	40 minute spotlight survey along roads or edge of bush.	200 min
Streamside search	30 minute search	30 +15 min
Targeted searches for trees incised by Yellow-bellied Glider	Searches of Ribbon Gum stems – particularly young trees.	Six days
Searches for Koala scats	Searches under Ribbon Gum (as per SEPP 44) for Koala scats	Six days
Searches for white-wash	Searches under large hollow-bearing trees for evidence of nesting large forest owls.	Six days
Targeted inspections of hollows	Surveys of hollows for nesting Gang-gang Cockatoo and or Glossy Black Cockatoo.	Six days

3.3.2 Elliott and Cage Trapping

Two lines each consisting of ten A size Elliott traps were set for three consecutive days on the ground at 20m intervals on two transects and baited with a mixture of peanut butter and rolled oats (**Figure 5**). The traps were placed under bushes or other vegetation so that they were protected from direct sunlight and were checked daily during the early morning to minimise stress to captured animals from heat or ants. Traps were set from 13 to 15 October 2009 and from 2 to 4 February 2010.

Two cage traps were set along each transect and baited with the above mentioned mixture and set for the same period. These larger traps (20 x 20 x 55cm) were set at one end and half way along each transect.

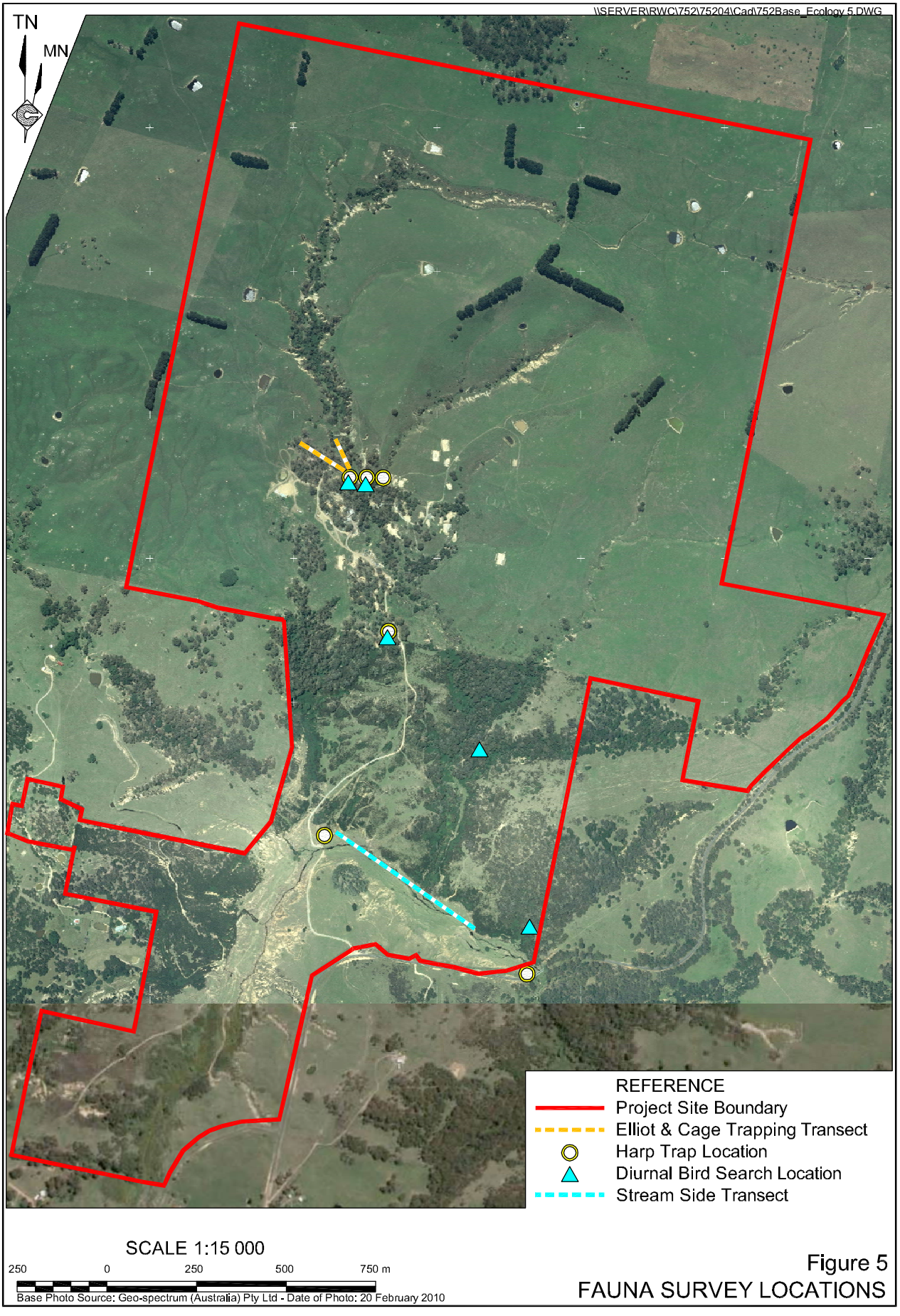


Figure 5
FAUNA SURVEY LOCATIONS

The location of the mammal trapping transects are given in **Table 5** and shown in **Figure 5.** One transect was positioned beside Spring Creek and the other approximately 50m to the southwest of the creek on the ridge. Both transects were located within a patch of remnant Ribbon Gum Forest.

3.3.3 Harp Trapping

Two harp traps (Harp 1 and Harp 2 sites – see **Figure 5**) were erected within 100m of the Elliott and cage trapping transects from 13 to 15 October 2009 and from 2 to 4 February 2010. Harp 1 was positioned over Spring Creek and Harp 2 approximately 50 m to the east of Spring Creek.

Table 5
Summary of survey site locations

Page 1 of 2

Location	Survey/Name	Location	
		Easting	Northing
Dargues Reef - ridge	Elliott & cage trapping site 1	748885[1] 749022[2]	6063069[1] 6062982[2]
Dargues Reef - beside Spring Creek	Elliott & cage trapping site 2	748992[1] 749092[2]	6062983[1] 6062842[2]
Dargues Reef - beside Spring Creek	Harp trap site 1	748994	6062980
Dargues Reef - upslope from Spring Creek	Harp trap site 2	749077	6062930
Dargues Reef - eroded gully upslope from Spring Ck	Harp trap site 3	749211	6062943
Recently acquired land - over Majors Creek at crossing	Harp trap site 4	748892	6061994
Recently acquired land - over Majors Creek under bridge	Harp trap site 5	749481	6061631
Recently acquired land - beside boundary fence	Harp trap site 6	748940	6062607
Dargues Reef – ridge plus Spring Creek	Spotlight site 1	748885[3]	6063069[3]
Recently acquired land - beside southern boundary fence	Spotlight site 2	748940[3]	6062607[3]
Recently acquired land beside Majors Creek	Spotlight site 3	749597[3]	6061743[3]
Dargues Reef - ridge plus Spring Creek	Spotlight site 1	748885[3]	6063069[3]
Dargues Reef - ridge	Call playback	748885	6063069
Dargues Reef – ridge	Diurnal bird site 1	748885[3]	6063069[3]
Dargues Reef - beside Spring Creek	Diurnal bird site 2	748992[3]	6062983[3]
Recently acquired land – deep eroded gully	Diurnal bird site 3	748910[3]	6062600[3]
Freehold land beside Majors Creek bridge	Diurnal bird site 4	749597[3]	6061743[3]
Recently acquired land - beside boundary fence	Diurnal bird site 5	748940[3]	6062607[3]
Dargues Reef - ridge	Diurnal reptile site 1	748885	6063069
Recently acquired land - Majors Ck from crossing downslope	Streamside search	748892[1] 749300[2]	6061994[1] 6061700[2]
Dargues Reef – Forest near current work site	1 flora plot	748855	6062879

Table 5 (Cont'd)
Summary of survey site locations

Location	Survey/Name	Location	
		Easting	Northing
Dargues Reef – Forest near current work site	2 flora transect	748855[4]	6062879[4]
Dargues Reef – Forest near current work site	3 flora plot	749061	6063002
Dargues Reef – Forest near current work site	4 flora transect	749061[4]	6063002[4]
Dargues Reef – Forest near current work site	5 flora plot	749042	6062932
Dargues Reef – Forest near current work site	6 flora transect	749042[4]	6062932[4]
Dargues Reef – Harvestable rights dam site in gully	7 flora transect	748845[4]	6063429[4]
Dargues Reef – Pipeline route in grassland	8 flora transect	749206[4]	6062806[4]
Dargues Reef – Tailings storage area in grassland	9a flora transect	749397[4]	6063276[4]
Dargues Reef – Tailings storage area in grassland	9b flora transect	749397[4]	6063276[4]
Dargues Reef – Broom infested area	10 flora transect	748832[4]	6062561[4]
Dargues Reef – Access road site in grassland	11 flora transect	749930[4]	6062936[4]
Dargues Reef – Access road site in grassland	12 flora transect	749788[4]	6063733[4]
Dargues Reef – Forest remnant	13 flora transect	749394[4]	6064104[4]
Dargues Reef – Magazine site	14 flora plot	748965	6064096
Dargues Reef – Tailings storage area in grassland	15 flora transect	749203[4]	6063204[4]
Dargues Reef – grassland near Major's Creek Road	16 flora transect	748897	6061708[4]

Note 1: Start point of transect.
Note 2: Finish point of transect.
Note 3: Indicative commencement point.
Note 4: Co-ordinates represent centre point of 100m transects

In addition, traps were erected at the following locations on the following dates.

- Harp 3 - in a deeply eroded gully with Black wattle regrowth, approximately 150m east of Spring Creek from 13 to 15 October 2009;
- Harp 4 - across Majors Creek, where the access road crosses the creek. This area is land largely disturbed by prior alluvial mining operations and the trap was set specifically for the Large-footed Myotis from 13 to15 October 2009;
- Harp 5 - across Majors Creek, under the bridge where Majors Creek Road crosses the creek. This trap was set specifically for the Large-footed Myotis from 2 to 4 February 2010.
- Harp 6 - approximately 100m to the west of the access road from 2 to 4 February 2010. This site is located within Ribbon Gum Forest.

The location of the harp traps are given in **Table 5** and shown on **Figure 5.** The traps were checked daily in the early morning.

Anabat was not used during this assessment as this system has several problems. Some recordings can give false positives, namely a threatened species may be detected by the Anabat as it flies over the site but the bat/s may not roost within the site. Alternatively, the call can be misidentified. The significance of detecting a bat as it forages above the canopy during a flight that may cover many square kilometres is a perennial question in relation to assessing the significance of the impact of a single development. The problem with call identification is another problem that relates to a series of issues in this developing science.

Bats adjust their search phase calls when flying in different environments, giving steeper shorter calls in cluttered areas and flatter longer lower calls in open areas, which may make their calls appear like those of other species (Reinhold *et al.* 2001). Bats alter their calls when feeding and sometimes drinking, producing a series of pulses increasing in slope, frequency and speed in what is known as "attack phase" culminating in a "feeding buzz". Pulses emitted by bats during the attack phase and feeding buzz often resemble calls of other species with steep calls such as *Myotis* or *Nyctophilus* (Reinhold *et al.* 2001). Doppler patterns cannot be assessed in calls consisting of a few pulses making them much more difficult to distinguish from species with overlapping frequency ranges (Pennay *et al.* 2004). Some bat species produce calls in a range of harmonics. The zero crossings method of analysis used by Anabat can only display the dominant harmonic at which the bat is calling. Occasionally bats shift their energy to a different harmonic, and the detector records the call at the higher or lower frequency. For example, *Saccolaimus flaviventris* is usually recorded calling around 20 kHz. However, when foraging low to the canopy, or beneath the canopy in open woodlands it is sometimes recorded at about 30kHz. This shift is usually temporary and in longer calls pulses in the 20kHz range are obvious. In calls consisting of only a few pulses these may be absent, which could lead to misidentification with *Mormopterus* species 2 or 3 (Pennay *et al.* 2004). The call of the Large Bentwing Bat can be confused (if incomplete) with the Large Forest Bat *Vespadelus darlingtoni* as the frequency overlaps between 44.5 and 46 kHz (Pennay *et al.* 2004). For these reasons results derived from Anabat recordings provide an indication of what species may be in an area but this should be confirmed by harp trapping.

Based on published data on habitat preference and the author's own experience there is a possibility that three threatened species of micro-bat may forage on site and be recorded via Anabat. There are the Large Bentwing Bat, False Pipistrelle and Yellow-bellied Sheathtail Bat. The Large Bentwing Bat is essentially cave roosting and is the most likely species to be recorded via Anabat as it is much more common that the other two species.

Data indicates that the Yellow-bellied Sheathtail Bat is a summer migrant to the south coast and tablelands of New South Wales. The Greater Broad-nosed Bat is very rare in the region with only a few records from either Anabat or harp trapping (Daly unpublished data). Given these facts Anabat was considered very unlikely to elucidate if threatened species of micro-bat use hollows on the Subject Site for roosting. In addition, Anabat surveys were not undertaken because the Project would not result in the disturbance of any hollow-bearing trees and seasonal breeding and temporal movements of relevant species of bat means that specific prescriptions can be adopted to reduce the potential impact on seasonally active animals (see Recommendations).

3.3.4 Diurnal Bird Census

Diurnal birds were surveyed for a period of 20 minutes within a 2ha area along each of the Elliott and cage trapping transects. In addition, similar bird surveys were undertaken at three other locations in order to sample the broader area. The locations of the survey sites are given in **Figure 5.** Animals were identified by their species-specific calls and by direct observation with the aid of binoculars. Birds detected outside the surveyed transects were also recorded.

Bird surveys were initially conducted in the morning between the 13 and 15 October 2009 at the following sites.

- Diurnal Bird Sites 1 and 2 – in the vicinity of the two Elliott trapping sites.
- Diurnal Bird Site 3 – adjacent to Spring Creek.
- Diurnal Bird Site 4 - near the bridge over Majors Creek.
- Diurnal Bird Site 5 - approximately 100m to the west of the access road.

Further surveys were undertaken on 2 February 2010 at Diurnal Bird Sites 1, 2, 4 and 5

3.3.5 Foot-based Spotlighting

Spotlighting was conducted for arboreal mammals for 40 minutes within the Ribbon Gum Forest. The survey area covered an area of approximate 2ha but trails and dirt roads were mostly traversed to reduce the noise generated by trampling over leaves and branches. Spotlighting was conducted with the aid of a 50 watt/12 volt lights and involved the identification of animals by direct observation and the recognition of species specific calls.

The sites surveyed included the Ribbon Gum Forest near the Elliott trapping transects (Spotlighting Site 1), a site approximately 100m to the west of the access road (Spotlighting Site 2) and the Wattle regrowth forest/regenerating Ribbon Gum Forest north of the bridge over Majors Creek (Spotlighting Site 3).

3.3.6 Nocturnal Call Playback

Nocturnal birds and mammals are often detected when they vocalise to proclaim their territory or during social interaction. This behaviour is exploited when surveying by broadcasting pre-recorded species-specific calls to elicit a response if that particular species is within the immediate area. The standard suite of calls used for the Southern Comprehensive Regional Assessment was broadcast. Although some of the species assessed by call playback are not listed, as occurring in the area by the various databases the use of these calls is consistent with previous work conducted by the author.

The calls were broadcast from the start of Elliott Transect 1 (Call Playback Site 1) through a car stereo system from 19.43h to 20.00hrs on 1 February 2010. This location was selected as it was on a ridge and within remnant mature forest. No spotlights were operated during the playback but the immediate area was spotlit after the cessation of the playback. Call playback was undertaken prior to spotlighting as owls may call some time (more than 10min after the cessation of the broadcast). Call playback was not used during the October survey, as the conditions were windy and unsuitable.

Call playback was given in the following order.

- Powerful Owl *Ninox strenua*.
- Barking Owl *N. connivens*.
- Masked Owl Tyto novaehollandiae.
- Sooty Owl Tyto taeniolatus.
- Squirrel Glider Petaurus norfolcensis.
- Yellow-Bellied Glider *Petaurus australis*.
- Koala Phascolarctos cinereus.
- Bush Stone Curlew *Burhinus grallarius*.

3.3.7 Diurnal Herpetofauna Census

The herpetofauna census involved two 60 minute searches along Elliot trapping lines. The searches were conducted on 14 October 2009 between 8.55h and 9.25h and repeated on 3 February 2010 between 12.27h and 12.57h. Two people conducted the reptile search on both occasions. During herpetofauna searches, active animals were observed as they basked or foraged. Searches also involved lifting fallen logs, corrugated iron, rubbish and searching leaf litter.

3.3.8 Nocturnal Streamside Search

Amphibian searches were conducted beside Majors Creek for 30 minutes duration with the aid of a 50 watt/12 volt spotlight from 20.55h to 21.25hrs on the 2 February 2010. The streamside searches were for a distance of approximately 250m as shown on **Figure 5**.

3.3.9 Targeted Surveys

Targeted surveys were conducted for the following species using the following methods.

- Yellow-bellied Gliders *Petaurus australis* - searching for incised trees. This glider incises certain species of 'gum' tree to procure sap, which forms parts of the species diet. In the Perlang Local Government Area (LGA), the Yellow-bellied Glider incise Ribbon Gum and Brown Barrel *E. fastigata* (Daly unpub. data). Searches for incised Ribbon Gum were made during rolling foot censuses.
- Large forest owls - searches were made for trees utilised by these species for nesting by searching the base of all hollow-bearing trees for ‘white-wash’. The spattered white exudate of owls is an indication that the tree is in use by nesting birds.

3.4 ADEQUACY OF THE SURVEY METHODOLOGY

Table 6
Summary of DECCW survey requirements and effort undertaken

SPECIES	DECCW SURVEY REQUIREMENTS	CURRENT SURVEY
Giant Burrowing Frog, Littlejohn's Tree Frog, Southern Bell Frog, Green and Golden Bell Frog	Surveys should be undertaken using those methods recommended within DECCW's Threatened species survey and assessment guidelines: field survey methods for fauna. Amphibians. See Section 8 in the link below: http://www.environment.nsw.gov.au/resources/threatenedspecies/09213amphibians.pdf A combination of call playback and diurnal and nocturnal searches in suitable habitat (i.e. flowing streams) and weather conditions should be undertaken between December and February. A minimum of one 200 metre transect per stream repeated on a minimum of two separate nights must be conducted. Diurnal searches of rocky streams can also detect this species, which have been found under rocks on the edges of streams.	Nocturnal streamside search conducted along c. 30 m of Spring Creek in October 2009 and c. 250 m along Majors Creek in February 2010. Diurnal searches conducted along both streams for basking Bell Frogs and tadpoles in February 2010. Comment Giant Burrowing Frog and Littlejohn's Tree Frog are species complexes but all genetic units are not known to respond to call playback. Both species are mainly detected by observation of tadpoles and calling animals during nocturnal streamside searches. Pit-fall trapping can be used for Giant Burrowing Frog. Both species not known from highly disturbed sites.

Table 6 (Cont'd)
Summary of DECCW survey requirements and effort undertaken

SPECIES	DECCW SURVEY REQUIREMENTS	CURRENT SURVEY
Striped Legless Lizard	Pitfall trapping for *Delma impar* should be undertaken for 6 weeks, starting in early to mid November and extending through to mid/late December. Pitfall traps or funnel traps should be placed in suitable habitat being natural temperate grassland or nearby secondary grassland, with a preference for denser Kangaroo grass *Themeda australis* or other grassland, including *Phalaris*. Traps should be positioned in cross-shaped arrays of 5 traps each, 10 metres apart, with a trap at the centre and drift fencing extending 5 metres past the outside traps. Traps must be checked daily. In addition, roof tiles should be placed within likely habitat for at least 4 months prior to checking. Checking of tiles should be undertaken at least fortnightly throughout spring and early summer.	Diurnal reptile researches undertaken at the one site with most intact vegetation in October 2009 and repeated in February 2010. Targeted searches conducted over other sections of the site. Comment No pitfall trapping undertaken as site outside known distribution of the Striped Legless Lizard. Prior to European invasion the Subject Site would have supported open forest, a habitat type not normally associated with this species. Diurnal searches for active animals and rock rolling is, in the author's opinion, more effective for detecting this species.
Koala	Random meander searches should be undertaken focusing on the identification of potential roost, shelter or refuge sites within the study area. These sites may include tree canopy, undershrubs or in hollow logs or mammal burrows.	Diurnal random meander searches undertaken in all forested areas for Koala scats at base of tall eucalypts and examination of trees for scratches.

Table 6 (Cont'd)
Summary of DECCW survey requirements and effort undertaken

SPECIES	DECCW SURVEY REQUIREMENTS	CURRENT SURVEY
Squirrel Glider	The consultant needs to determine the distribution and abundance of the species on the Subject Site. Squirrel Gliders may occur across a wide variety of forest and woodland vegetation types. Live-trapping in trees is the preferred survey method for detecting Squirrel Gliders. Traps should be either large Elliott box traps or wire mesh 'bandicoot' traps (200 mm wide x 170 mm tall x 500 mm long; **Figure 2**) (manufactured by R.E. Walters Pty. Ltd., Sunshine, VIC). Live-trapping is a preferred sampling technique as it allows for unequivocal identification of animals. This is particularly important as the Squirrel Glider is very similar in appearance to the smaller Sugar Glider, *P. breviceps*. If definite identification cannot be made then any captured animals should be photographed and measured. Subsequent identification of the animal in question can then be made by an appropriate expert. The number of traps set at a site will vary according to the extent of suitable habitat, the area over which possible den sites are present, and the scale of the proposed clearing or activity. Traps should ideally be positioned horizontally in low tree branches. Traps must be attached to trees and spaced approximately 50-100 m apart in a transect or grid layout, as the habitat allows. Traps must be set for a minimum period of 3-4 consecutive nights. On each day traps should be set at dusk and checked the following morning. Where possible, traps should not be left open during daylight hours, particularly during periods of hot weather. In situations where the same animals are being repeatedly trapped, individual trap stations may need to be closed. If the species is present, given the rarity of the species in the region, any proposed development must avoid direct impacts on the species in the first instance, minimise any unavoidable or indirect impacts, and then set up processes which establish long-term conservation of the species on-site.	Spotlight searches conducted in all forest blocks. Searches were specifically made of Black Wattles as this is a known food tree of Squirrel Gliders (G. Daly pers. obs.). Call playback of Squirrel Glider played. Comment Sugar Gliders positively identified by direct observation and call. Call playback for Squirrel Gliders is not an efficient survey technique.

Table 6 (Cont'd)
Summary of DECCW survey requirements and effort undertaken

SPECIES	DECCW SURVEY REQUIREMENTS	CURRENT SURVEY
Yellow-bellied Glider	Map the location of den sites and feed trees within the study area. All trees to be removed or isolated by the proposed development must be assessed to determine if they are being used as den or feed trees. Surveys must consist of stag watching, spotlighting, call playback and habitat assessment. Spotlighting and call playback surveys must be undertaken on foot. At each call playback site, the call of the Yellow-bellied Glider should be played through a megaphone for 5 minutes, followed by at least 10 minutes of listening.	Searches for incised feed trees conducted over site. Call playback for Yellow-bellied Glider undertaken. Call playback for Powerful Owl undertaken (Yellow-bellied Glider mobbing behaviour). Spotlight searches conducted in all forested bocks. Comment Site too small and fragmented to support Yellow-bellied Gliders. This is a highly vocal species.
Spotted-tailed Quoll	Live cage traps using platform cat traps 30 cm x 30 cm x 60 cm. Trapping should be undertaken from late March over a 10 day period. Drainage lines should be targeted for surveys. Cage traps should be place 50 m apart along the drainage lines within the study area. Random meander searches should also be undertaken focusing on the identification of potential den or latrine sites within the study area. Den sites may include hollow-bearing trees, fallen logs, small cave, rock crevices, boulder field and rocky cliff faces. Latrine sites often occur on flat rocks among boulder fields and rocky cliff faces.	Cage trapping undertaken for three consecutive days totalling 12 trap nights in October and another 12 trap nights in February. Cage traps placed 50 m apart along the drainage lines within the study area. Searches conducted for latrine sites along Majors Creek, especially on rock outcrops. Comment Spotted-tailed Quoll have been trapped in this sized (20 x 20 x 55cm) trap and bait. Trapped *Rattus rattus* euthanased and placed in one trap as additional bait. Spotted-tailed Quoll require large areas of intact bushland, a habitat not present on site.

Table 6 (Cont'd)
Summary of DECCW survey requirements and effort undertaken

SPECIES	DECCW SURVEY REQUIREMENTS	CURRENT SURVEY
White-footed Dunnart, Eastern Pygmy Possum	Surveys for these species may be conducted with pitfall traps. Alternatively Elliot traps placed within flowering Banksia trees could also be used for the Eastern Pygmy possum. Pitfall trapping must be conducted with two litre buckets (at least 40 cm deep) set in clusters of three with each pit/trap in a cluster being approximately 5 m apart. These trap clusters should be spaced at 50 m intervals along transects at least 200 m in length (i.e. 15 pitfalls per 200 m). Pitfall trapping must be conducted for a minimum of two (but preferably three) separate sessions of 5 consecutive nights. The status of the White-footed Dunnart and Eastern Pygmy Possum in the region is poorly known. If either of these species is found on the Subject Site, then additional surveys in the locality must be undertaken to determine the significance of the population on the Subject Site.	Two lines of ten Elliott traps placed on ground (no Banksia shrubs present) for three consecutive days. Trapping done at these sites in October and repeated on February. Comment Site lacked habitat complexity associated with sites that support White-footed Dunnart and or Eastern Pygmy Possum. Habitats normally associated with these species are floristically rich and have a dense shrublayer. Site lacked any species of Banksia.
Eastern False Pipistrelle, Eastern Bentwing Bat, Greater Broad-nosed Bat, Golden-tipped Bat, Large-footed Myotis, Yellow-bellied Sheathtail-bat	Surveys using anabat recorders and stag watching should aim to identify the number and location of roost sites for the subject bats and identify important foraging habitat in the study area and the locality. If required, the DECCW can provide further advice on bat survey techniques to acquire this information. Surveys of the Subject Site, study area and locality shall be undertaken for hollow-bearing trees. This shall involve intensive searches for hollow-bearing trees in the Subject Site and study area. Representative sampling of the locality for hollow-bearing trees shall involve the use of transects in selected locations and the gathering of data in conjunction with ground-truthing for endangered ecological communities. The number of hollow-bearing trees recorded shall be used to provide context to the potential breeding habitat affected by the action proposed.	Harp trapping undertaken in October and repeated on February. Four traps set for three consecutive days. Targeted trapping for Large-footed Myotis. Stag watching undertaken indicating small microbats utilise hollows on the site. Comment A number of common forest dwelling microbat trapped indicating harp traps set in appropriate locations. Habitat on Subject Site considered suitable for Eastern False Pipistrelle. No hollow trees would be removed for this development; hence impacts on tree roosting species of bat negligible.

Table 6 (Cont'd)
Summary of DECCW survey requirements and effort undertaken

SPECIES	DECCW SURVEY REQUIREMENTS	CURRENT SURVEY
Little Eagle, Square-tailed Kite	Diurnal bird surveys across the subject area targeting woodland and forest for nesting sites. Opportunistic surveys should be conducted in the locality given the large home range of the species.	Nine 20 min. diurnal bird surveys across the subject area targeting woodland and forest for nesting sites. Opportunistic surveys conducted in the locality.
Woodland Birds including: Brown Treecreeper, Diamond Firetail, Hooded Robin, Scarlet Robin, Flame Robin	Diurnal bird census shall be undertaken in the early morning and/or late afternoon within the *Subject Site* on three occasions each separated by a period of one week. Each census shall comprise observations for birds, including call recognition, for a period of 45 minutes at a minimum of three locations spread across the Subject Site. Additional opportunistic bird census shall be employed across the *study area* and *locality* during the course of other surveys for the EA. Surveys can be undertaken at any time of the year, but shall avoid high-wind and/or rainy days.	Nine 20 min. diurnal bird surveys across the subject area targeting woodland and forest for nesting sites. Surveys conducted in October and February. Opportunistic surveys conducted in the locality.
Barking Owl, Powerful Owl	Nocturnal call playback (1 site per 100 ha) with an initial listening period of 10 min then play the call of each subject species separated by at least a 2 min listening period, then finish with a 10 minute listening period. Identify and map all hollow-bearing trees (potential nest trees) on the Subject Site and estimate the availability of hollow-bearing trees in the locality.	Nocturnal call playback was undertaken at 1 site with an initial listening period of 10 min then play the call of each subject species then finish with a 10 minute listening period. Total areas of disturbance would be 26.5ha Spotlight surveys conducted over entire site.
Gang-gang Cockatoo Glossy Black-Cockatoo	Undertake diurnal bird surveys across the study area and nesting assessments using a combination of stag watching and listening for calls of the birds returning to nests in the late afternoon during the known breeding season of the species, to ascertain the locations of any nest sites in the study area. These surveys should target hollow-bearing trees with hollows of suitable size (>10cm diameter) for the species that are to be removed for the Project or which lie within 50m of areas to be disturbed by the Project. Identify and map the availability, condition and security of potential breeding and foraging habitat for the species in the locality. Adequate protection measures should also be identified to protect known nest sites from the proposed activity.	Diurnal bird surveys undertaken across the study area and locality. Comment Pair of Gang-gang Cockatoo observed undertaken nesting behaviour. Signs of Glossy Black Cockatoo located at Majors Creek cemetery.

Table 6 (Cont'd)
Summary of DECCW survey requirements and effort undertaken

SPECIES	DECCW SURVEY REQUIREMENTS	CURRENT SURVEY
ENDANGERED ECOLOGICAL COMMUNITIES	**SURVEY REQUIREMENTS**	**CURRENT SURVEY**
Natural Temperate Grasslands	Surveys shall identify the extent and condition of existing vegetation communities (i.e. Snow Gum Woodlands), including any endangered ecological communities in the *Subject Site* and *study area*. This shall involve the use of vegetation surveys in the *Subject Site* and the *study area*. The use of existing datasets held by DECCW in combination with ground-truthing of selected sites within areas mapped by DECCW as the ecological community is recommended for surveys of the *locality*. The sites sampled shall be used to provide context to the communities affected by the action proposed. Surveys can be undertaken at any time of the year under varied seasonal conditions.	Comment The Natural Temperate Grassland remnant is restricted to an interrupted, narrow strip <5m width. Transects taken where possible.
FLORA	**SURVEY REQUIREMENTS**	
Threatened flora Araluen Gum Small-leaved Gum Hoary Sunray Araluen Zieria Austral toadflax Dense Cord-rush Mauve Burr Daisy Michelago Parrot-Pea Small-leaved Gum Tangled Bedstraw	Systematic surveys using evenly spaced transects located about 10 m apart in suitable habitat across the Subject Site. Random meander searches should be undertaken focusing on the identification of threatened flora species occurring within the study area. The occurrence of threatened species should be mapped. Surveys should be undertaken during appropriate times when the species are best detectable.	Random meander searches undertaken focusing on the identification of threatened flora species occurring within the study area. Comment No Threatened Species detected in transects or random meanders.
Majors Creek Leek Orchid	Systematic surveys using evenly spaced transects located about 10 m apart in suitable habitat across the Subject Site. Surveys should be undertaken between October and December.	Random meander undertaken in least disturbed forest and across large areas of disturbed forest in October 2009. Potential habitat within the Subject Site was not searched during the flowering period for this species.
Small Snake Orchid	Systematic surveys using evenly spaced transects located about 10 m apart in suitable habitat across the Subject Site. Surveys should be undertaken between August and October.	Random meander undertaken in least disturbed forest and across large areas of disturbed forest in October 2009.

- Koala - searches were made for Koala scats at the base of large gum trees. In additional scratches on Ribbon Gum were examined as Koala make many small scratch marks on the trees that they climb as opposed to large scratch marks made by the Common Brushtail Possum and or Lace Monitor.
- Striped Legless Lizard – diurnal searches over the Subject Site involving lifting of rocks and fallen logs. Searches for active animals were conducted during this time.
- Searches were made for Spotted-tailed Quoll latrine sites along Majors Creek at sites that had exposed rock outcrops.
- Searches were made of hollow trees for nesting Gang-gang Cockatoo

3.4.1 Incidental Observations

Further incidental observations of animals were made based on visual identification of animal, remains, or other features or call recognition. These are included in **Appendix 3**.

The survey methodology and effort was considered adequate to detect sedentary threatened species of fauna. Those species with large home ranges such as the Little Eagle and Scarlet Robin were not detected during our surveys but are known from the Subject Area. The use of harp traps was adequate to positively identify six species that would roost on the Subject Site. Harp trapping did not detect high flying species such as the White-striped Mastiff Bat that was heard ecolocating during spotlight searches. Threatened species of microbat may forage and den on the site. The impact of the proposed development on tree denning microbats, gliders, cockatoos and owls is considered negligible, as no hollow-bearing trees shall be removed for the proposed development. Hence, a detailed assessment of potential breeding and habitat (i.e. hollow-bearing trees) on the Subject Site was not undertaken.

4. RESULTS

4.1 INTRODUCTION

This section provides an overview of the species, populations and ecological communities identified within the Subject Site. It is noted that the following sub-sections focus primarily on species, populations and ecological communities identified under the TSC Act or the EPBC Act. However, **Appendices 2** to **4** present a complete list of species identified during the ecology survey.

4.2 PREVIOUS ASSESSMENTS CONDUCTED ON THE SITE

An investigation was undertaken by the authors as part of a Review of Environmental Factors prepared to support an application for approval of exploration activities under Part 5 of he EP&A Act within Exploration Licence 6003 (R. W. Corkery and Co., 2008) on 19 November 2007. At that time a pair of Gang-gang Cockatoo *Callocephalon fimbriatum* were observed nesting in a Ribbon Gum in the vicinity of the Dargues Reef deposit.

4.3 ECOLOGICAL SETTING AND HABITAT IDENTIFIED

The forest within the Subject Site primarily consisted of Ribbon Gum Forest, with a small area of River Peppermint Open Forest in the northernmost section of the Subject Site. The community had a variety of age classes. The majority of trees within the Ribbon Gum Forest were remnants being in the order of 120-200 years old (based on the presence of hollows, diameter at breast height, presence of hollows and soil type). Many trees were of sufficient age to contain hollows, which were of a dimension to cater for forest dependant fauna and many supported mistletoe. No assessment of the size and number of tree hollows was undertaken. The reason for not quantifying this habitat is that no hollow-bearing trees shall be removed as part of the Project. However, the site supports a relatively large number of hollow-bearing trees within all the remnant Ribbon Gum patches. Given the intensity of gold mining in the Majors Creek area the presence of so many mature trees was unexpected.

The Ribbon Gum forest had a sparse shrublayer and groundcover. There were small areas of Black Wattle *Acacia mearnsii* regrowth, a grove of Poplars *Populus nigra* and large areas of woody weeds and cleared pasture. The wattle regrowth had a grassy groundcover but lacked habitat complexity, such as fallen logs and hollows. The wood weeds formed dense stands that provided refuge for small passerine birds and Rabbits.

The Proponent has undertaken weed management on its original land for several years and Broom and Blackberry have been treated and largely removed by the application of herbicides. Cattle and other stock are excluded from the active exploration areas but occur on land in other areas. In contrast the newly purchased land (southern section of the Subject Site) is weed infested, highly eroded and degraded. The weeds present include Broom *Cytisus scoparius*, Blackberry *Rubus fruticosus,* Willows *Salax* species and Black Thistle *Cirsium vulgare.* The program of weed management will be extended to the newly purchased land.

The areas of cleared pasture provided little habitat for fauna. Within the Subject Site the breakdown in area of these communities is:

- Ribbon Gum Forest – 28.2ha;
- fragmented Ribbon Gum Forest - 7.1ha;
- Woody weeds shrubland - 30.1ha;
- Regenerating wattles - 18.5ha;
- Exotic vegetation – 5.6ha;
- Native grassland – 0.2ha;
- Native-dominated pasture – 280.1ha;
- exotic-dominated pasture – 2.5ha; and
- Largely disturbed land – 23.1ha
- River Peppermint Open Forest – 1.3ha;

Fallen logs were a common component on the forest floor in the Ribbon Gum Forest and there were a few rock outcrops that provided refuge habitat for saxicolous species of reptile, such as the Southern Cunningham Skink. The rock outcrops were located beside Majors Creek, beside Spring Creek near Elliott trapping transect 2 and on the hill some 500m east of this site. There was no evidence of recent fire, either as anecdotal evidence or by the presence of burnt timber.

Spring Creek is a non-perennial tributary of Majors Creek. Both creeks provide habitat for several species of fish, frog and semi-aquatic reptile. One dam on the Subject Site provides habitat for species of amphibian that breed in static bodies of water. Spring Creek and Majors Creek are highly degraded as a result of previous mining (Dunshea, 1997) and agriculture activities. As a result of previous gold mining there has been considerable erosion and sections within the bed and beside the creek have been eroded. In sections approximately six metres of soil and rock has been lost. The area and depth of erosion can been estimated by the height of the residual creek edges. Currently Majors Creek and much of its tributary areas within the Subject Site are either pasture or exotic weeds such as Willows. The riparian environment of this section of Majors Creek within the Subject Site is an artefact.

Majors Creek may provide habitat connectivity between the Subject Site and adjacent areas if sections are revegetated. The water quality of Majors Creek must be protected during the proposed mining so that the action does not have indirect impacts on the species and habitat surrounding the Subject Site.

4.4 FLORA SURVEY RESULTS

4.4.1 Introduction

Within the Subject Site, it is estimated that approximately 95% of the original native vegetation has been removed or significantly disturbed as a result of previous clearing and grazing. This sub-section describes the species, ecological communities and habitat identified during the survey.

4.4.2 Summary of Flora Survey Results

Transects 2, 4 and 6, plots 1, 3, 5 and random meanders were undertaken within remnant Ribbon Gum Forest. These remnants were found to have been disturbed by grazing and the introduction of exotic pasture species and weeds. Exotic understorey species such as Hawthorn *Crataegus monogyna* and Broom *Cytisus scoparius* were also present. Vehicular access and recent clearing activities have also had some impact at the edges of these remnants.

Transects 7 and 8 and random meanders were undertaken within Regenerating Wattles.

Transects 9a, 11, 12, 15 and 16, plot 14 and random meanders were undertaken in Native-dominated pasture, which covers the majority of the Subject Site. It is likely that these communities were derived from a mosaic of Natural Temperate Grassland and Grassy Woodlands. Clearing, grazing, cultivation and the introduction of exotic pasture species have altered the structure and floristics of these communities. Species resistant to grazing, such as Weeping Grass *Microlaena stipoides* and Snow Grass *Poa labilladieri* have persisted while sensitive grasses and herbs have disappeared. The site around transect 16 represents a community with a higher content of native species and further surveys in Spring are recommended.

Transect 9b and random meanders were undertaken within the small, isolated area identified as Native Grassland, which may have previously covered extensive areas of the site. This remnant is not considered viable due to its size (c. 500m2) and location between disturbed grassland and an eroding slope. Although the community represents Natural Temperate Grasslands Endangered Ecological Community. An Assessment of Significance was not considered necessary due to the non-viability of the community.

Transect 10 was undertaken within Woody Weeds Shrubland dominated by Broom *Cytisus scoparius* and Blackberry *Rubus fruticosus.* Such communities are common in the local area, having colonised land historically cleared and degraded by mining activities.

A small area of Exotic-dominated pasture is present on the north-western boundary of the Subject Site. No surveys were undertaken within this area.

Historic clearing and mining activities have produced patches of Disturbed Land, generally in the southern area of the site. Such disturbed land is common to the local area, and left unmanaged, these sites will either become infested with weeds such as Blackberry and Broom or by native Wattles. No surveys were undertaken within these areas.

Transect 13 and random meanders were undertaken within a remnant of River Peppermint Open Forest. The remnant is dominated by Weeping Grass, with weeds and exotic pasture species also present.

4.4.3 Species Identified

During the survey 100 species of native plant and 38 exotic species were located. The list of all species identified is presented in **Appendix 2.** No species listed under the TSC Act or EPBC Act were identified.

4.4.4 Ecological atioand Vegetn Communities Identified

The following ecological communities were identified within the Subject Site. **Figure 6** presents the distribution of each community within the Subject Site.

Community 1 - Ribbon Gum - Snow Gum Grassy Open Forest

The remnant vegetation within the Subject Site may be classified as Ribbon Gum - Snow Gum Grassy Open Forest on flats and undulating hills of the eastern tableland (referred to as Ribbon Gum Forest), South Eastern Highlands (GW p220 Tozer *et al.* 2006). This community is related to the Southern Tablelands Flats Forest (DIPNR, 2004). **Plate 1** presents a typical view of this community.

The overstorey is dominated by Ribbon Gum *Eucalyptus viminalis* and Narrow-leaved Peppermint *E. radiata* with occasional Snow Gum *E. pauciflora*. Many trees are mature and support hollows. The community is distributed over the site in small fragmented patches. Roads and land cleared as a result of previous mining and agricultural activities are the main actions that have caused the fragmentation. The sparse understorey includes small trees of Black Wattle *Acacia mearnsii* and Blackwood *A. melanoxylon* and the exotic Hawthorn *Crataegus sp*. Patches of Broom *Cytisus scoparius* are also present.

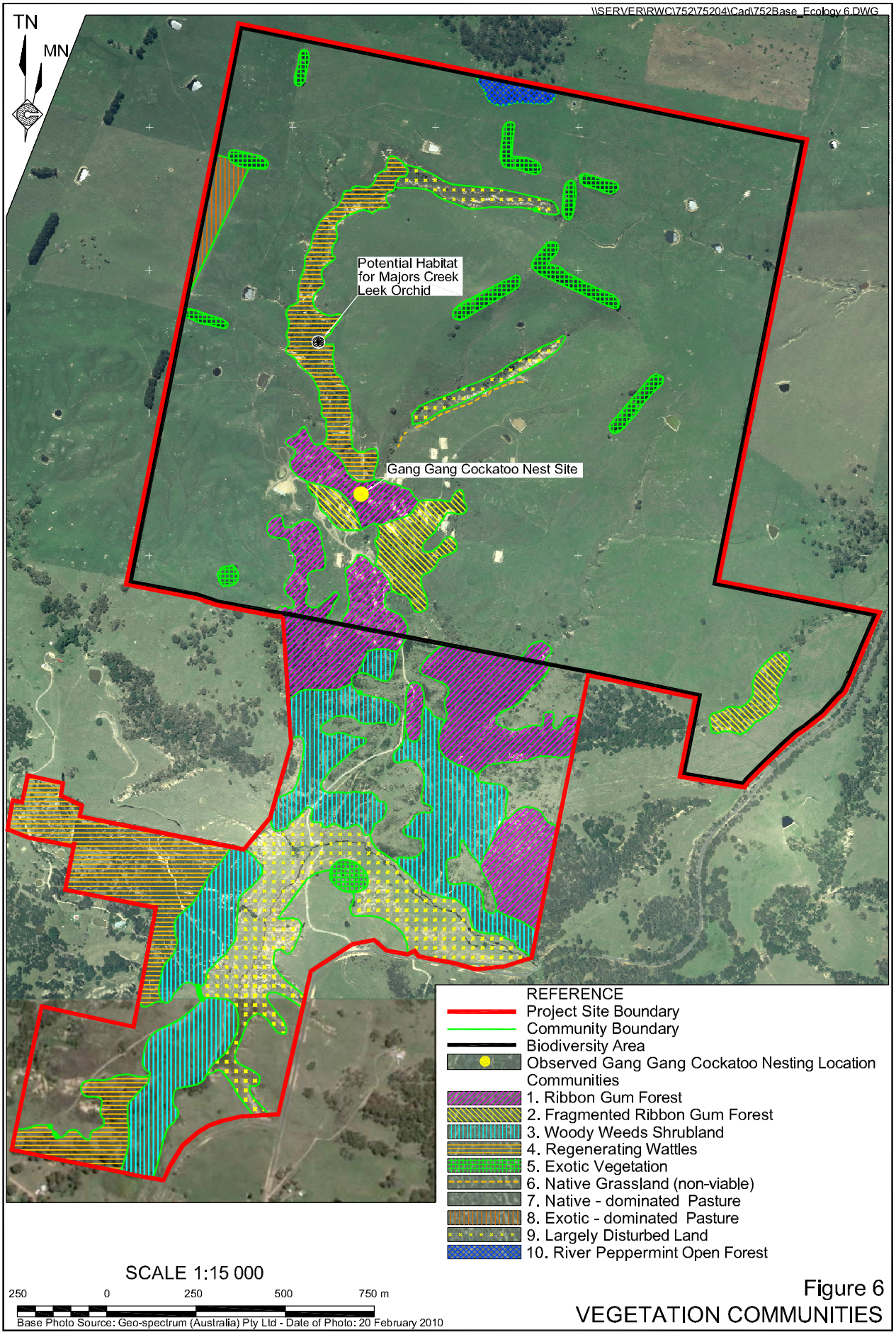


Figure 6
VEGETATION COMMUNITIES

The grassy groundcover includes native grasses and herbs such as Native Raspberry *Rubus parvifolius*, Kidney Weed *Dichondra spp.*, Twining Glycine *Glycine clandestina*, Slender Tick-trefoil *Desmodium varians*, Prickly Starwort *Stellaria pungens*, Native Geranium *Geranium solander var. solanderi*, Spiny-headed Mat Rush *Lomandra longifolia*, Weeping Grass *Microlaena stipoides*, Wallaby Grasses *Austrodanthonia spp.*, Kangaroo Grass *Themeda australis*, Bracken Fern *Pteridium esculentum*, Bidgee-Widgee *Acaena novae-zelandiae*, River Tussock *Poa labillardierei*, Common Raspwort *Gonocarpus tetragynus*, St. John's Wort *Hypericum gramineum* and Stinking Pennywort *Hydrocotyle laxiflora* and exotic species such as Sorrel *Acetosella vulgaris*, Yorkshire Fog *Holcus lanatus*, Indian Hedge Mustard *Sisymbrium orientale*, Rye Grass *Lolium perrene* and other common exotic pasture species.

Ribbon Gum - Snow Gum grassy open forest has affinity with the Tablelands Frost Hollow Grassy Woodlands in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South western Slopes Bioregions. The NSW Scientific Committee has made a Preliminary Determination to support a proposal to list this community as an Endangered Ecological Community in Part 3 of Schedule 1 of the Act. This preliminary determination was on public exhibition from 9th July until 3rd September 2010. No date has been set for the making of a Final Determination.

Until a Final Determination has been made the community has no legal conservation significance, and it will be sometime in the future before this occurs. In the meantime, we can only note that a Preliminary Determination has been made.

Plate 1
Typical view of Ribbon Gum Forest

Community 2 - Fragmented Ribbon Gum - Snow Gum Grassy Open Forest

This community represents a degraded and disjunct form of Ribbon Gum - Snow Gum Grassy Open Forest described above.

Community 3 - Woody Weeds Shrubland

This community consists largely of Broom *Cytisus scoparius* and Blackberry *Rubus fruticosus* and is common in the southern sections of the Subject Site on land newly acquired by the Proponent. This community consists of a dense shrub layer to 2m of Broom and / or Blackberry. This community occurs in highly disturbed areas but can also occur in untreated areas as the shrublayer in Ribbon Gum Forest and or Black wattle regrowth. **Plate 3** presents a typical view of this community.

Plate 2
Typical view of fragmented Ribbon Gum – Snow Gum Forest

Community 4 - Regenerating Wattles

Small patches of Black Wattle *Acacia mearnsii* and Blackwood *A. melanoxylon* occur along the gullies and on the edges of the Ribbon Gum Forest areas that are regenerating. This community provides an indication of previous disturbance. Vegetation within the Regenerating Wattles community is up to 5m high and often supports Broom and/or Blackberry in the shrublayer. The groundcover often consists of exotic grasses, such as Rye Grass. **Plate 4** presents a typical view of this community.

Plate 3
Typical view of Woody Weeds Shrubland dominated by Broom and Blackberry

Plate 4
Typical view of Regenerating Wattles in gully with Blackberry and exotic grasses.

Community 5 - Exotic Vegetation

This community consists of stands of poplars and pines planted as wind breaks. The groundcover consists of exotic grasses, such as Rye Grass. **Plate 5** presents a typical view of this community.

Plate 5
Typical view of Exotic Vegetation

Community 6 – Native Grassland

Native Grassland or Natural Temperate Grassland is present at one location within the Subject Site as an interrupted strip of <5m width present above an eroding gully and native pasture (**Plates 6** and **7**). The community is diverse and includes mostly grassland species such as Kangaroo Grass Themeda australis, Spear Grass Austrostipa bigeniculata suggesting that the community may have been within a woodland / grassland mosaic. The total area of the Native Grassland is small and not considered viable due to long borders, location between disturbed grassland and an eroding slope. This community has affinity with North-western & Eastern Wallaby Grass - Red-grass Tussock Grassland (Wallaby Grass - Red-grass - Tall Speargrass - Common Everlasting - Kangaroo Grass - Mat-rush tussock grassland) (DEWHA, 2010) although with a greater presence of Kangaroo Grass.

Plate 6
Typical view of Native Grassland as a narrow strip between Native-dominated pasture upslope and eroding gully downslope

Community 7 – Native-dominated Pasture

The majority of the site supports areas of Native-dominated pasture of low-diversity with species such as Weeping Grass *Microlaena stipoides* and Snow Grass *Poa labilladieri* in association with exotic pasture species. It is likely that areas of this community were derived from Rehwinkel's Wet Tussock Grassland (River Tussock - Rush - Kangaroo Grass - Wallaby Grass - Tall Sedge - Weeping Grass wet tussock grassland) (DEWHA 2010). The dominance of Snow Grass is likely to be an artefact of grazing, as is the dearth of Kangaroo Grass. The current dominance of Weeping Grass may be a temporary feature due to seasonal conditions.

The Subject Site also includes Native-dominated pasture with greater diversity and presence of native species constituting a degraded form of Native Grassland (**Plates 8, 9** and **10**). A small, isolated area is present on slopes at Transect 15.

Plate 7
Typical view of Native Grassland as a narrow strip between Native-dominated pasture upslope and eroding gully downslope.

Community 8 Exotic-dominated Pasture

Areas of exotic-dominated pasture include common pasture species such as Phalaris *Phalaris aquatica*, Clovers *Trifolium spp*. and Ryegrass Lolium *perrene* with a very low incidence of native species (**Plate 11**).

Plate 8
Typical view of Native-dominated Pasture

Plate 9
Typical view of Native-dominated Pasture with higher diversity of native species

Plate 10
Typical view of Native-dominated Pasture with higher diversity of native species

Plate 11
Typical view of Exotic-dominated Pasture

Community 9 – Largely Disturbed Land

Past mining activities and subsequent erosion have resulted in areas of disturbed land, generally associated with creeks and gullies. These areas are either devoid of vegetation or support a sparse vegetative cover (**Plate 12**).

Plate 12
Typical view of Largely Disturbed Land

Community 10 – River Peppermint Open Forest

A small remnant of Open Forest dominated by River Peppermint *Eucalyptus elata* occurs in the northern boundary of the Subject Site. The understorey is dominated by Weeping Grass *Microlaena* stipoides with weeds and exotic pasture species (**Plate 13**).

Plate 13
Typical view of River Peppermint Open Forest

4.4.5 Threatened Flora Species/Communities Identified

4.4.5.1 Ecological Communities

Other than the small, non-viable areas of Natural Temperate Grassland, No Endangered Ecological Communities or species listed under the TSC Act or EPBC Act were located within the Subject Site.

Ribbon Gum Forest has been extensively cleared and within the region remnants are exposed to grazing, small-scale clearing and weed invasion. Small areas are represented in Deua National Park.

Potential habitat for Major's Creek Leek Orchid *Prasophyllum sp. Majors Creek* is represented at the Subject Site by a small, restricted remnant of Swamp Gum *Eucalyptus ovata* with a grassy understorey of native and exotic species. The site is located above a severely eroded gully close to two proposed Harvestable Rights Dams and a Pipeline (Transect 7). This site was first identified in May 2010 and opportunity to inspect the area during the orchid's October to December flowering season has not been possible. Project Site Layout would suggest that the habitat would not be disturbed by the proposed development. See the recommendations in Section 5.

Recent communication (June 2010) with Rainer Rehwinkel of DECCW indicates that annual surveys within Major's Creek Cemetery over the past ten years have not recorded the emergence of this species. Given that the orchid is 'apparently highly susceptible to grazing, being retained only at a historically ungrazed site' (http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10668), it is unlikely that *Prasophyllum sp. Majors Creek* would be present within the Subject Site.

4.5 FAUNA SURVEY RESULTS

4.5.1 Introduction

The current survey detected 151 species of vertebrate including two fish, seven frog, seven reptile, 117 (63 during current survey) bird and 18 mammal species. Mr B. James has detected a total of 110 species of bird in the Subject Area and these are included in **Appendix 3** to provide a more comprehensive list of animals that occur on the Subject Site**.** A summary of the current survey results and those species detected by B. James are presented in **Table 7**, with a list of all fauna species identified presented in **Appendix 3**.

Table 7
Summary of Fauna Detected During the Survey

Vertebrate group	Species detected during survey
Fish	2
Frog	7
Reptile	7
Bird	117 (six exotic)
Mammal - non flying	11 (3 exotic)
Mamma - bats	7
Total	151

The Gang-gang Cockatoo was observed to nest within the Subject Site during a survey on 19 November 2007 and has been observed by employees of the Proponent in remanent vegetation at regular intervals since that date. The approximate location of the nest site is provided in **Figure 6**.

The Flame Robin was observed on site in degraded land beside Majors Creek on 14 October 2009. These species are listed under Schedule 2 of the TSC Act as threatened.

In addition, chewed cones of the Black She-oak *Allocasuarina littoralis* were identified in the Majors Creek cemetery, indicating a number of Glossy Black Cockatoo live in the vicinity of the Subject Site. This species is currently listed under Schedule 2 of the TSC Act as threatened.

4.5.2 Elliott and Cage Trapping

The following species were captured in Elliot or cage traps during the survey. There were no captures of animals on Elliott line 1 but the following animals were trapped beside Spring Creek on Elliott line 2:

- Three Black Rats *Rattus rattus*;
- One Agile Antechinus *Antechinus agilis*;
- Two Eastern Bluetongue Skink *Tiliqua scincoids;*
- One Little Raven *Corvus mellori* and
- One Grey Currawong *Strepera visicolor*.

The capture rate was low, reflecting the high degree of fragmentation of the bushland and the relatively small size of the forest on the Subject Site.

4.5.3 Harp Trapping

The following species were caught at Harp Trap Sites 1 and 2 during the survey. **Table 8** presents an overview of species caught and locations.

- Chocolate Wattled Bat *Chalinolobus morio.*
- Little Forest Bat Vespadelus darlingtoni,
- Southern Forest Bat *Vespadelus regulus,*
- Little Forest Bat Vespadelus vulturnus,
- Gould's Long-eared Bat *Nyctophilus gouldii*
- Lesser Long-eared Bat *Nyctophilus geoffroyi*.

The species caught are common in the southern region of NSW. The diversity of bats caught during the October 2009 survey was surprising given the low night temperatures (below 10^{o} C) and the strong winds that the area experienced during the time of that survey. Many more bats and two additional species were tapped during the February 2010 survey as it was mostly overcast during that time and the night temperature were about twenty degrees.

Table 8
Summary of bats trapped

Site	Cm	Ng	Ne	Vd	Vr	Vv
Harp Trap Site 1- October 2009 survey	3		1			
Harp Trap Site 2 - October 2009 survey						1
Harp Trap Site 1 - February 2010 survey		1		4	2	
Harp Trap Site 2 - February 2010 survey	1					8
Harp Trap Site 3 - October 2009 survey						
Harp Trap Site 4 - October 2009 survey						
Harp Trap Site 5 - February 2010 survey						
Harp Trap Site 6 - February 2010 survey		2	16			

Note 1: Cm = *Chalinolobus morio,* Ng = *Nyctophilus gouldii,* Ne = *Nyctophilus geoffroyi,* Vd = *Vespadelus darlingtoni,* Vr = *Vespadelus regulus,* Vv = *Vespadelus vulturnus.* Clear cells indicates no captures

No bats were caught at the sites where the traps were placed over Majors Creek or the site within wattle regrowth in a gully (Harp Trap Sites 3, 4 and 5). Traps at site 3 and 4 were blown over on the first trap-night due to strong winds during the October 2009 survey.

4.5.4 Diurnal Bird Census

Forty one species of bird were detected during the systematic diurnal surveys (**Table 9**). Incidental observations and indirect evidence made by Messer's Daly, James and Virtue revealed the presence of an additional seventy seven species within and adjacent to the Subject Site. This information is included in **Appendix 3**.

The bird survey sites in the remnant patches to the southeast of the proposed Processing Plant area did not support the Eastern Yellow Robin, whereas the species was detected in the large patches of bushland. The Eastern Yellow Robin can be considered an indicator species for remnant patch size.

The Gang-gang Cockatoo was initially detected displaying nesting behaviour on the Subject Site on 19 November 2007. At that time a pair of Gang-gang Cockatoo were observed exhibiting nesting behaviour in a Ribbon Gum in the vicinity of the Dargues Reef deposit. The birds did not appear to be impacted by the drilling noise. The Gang-gang Cockatoo was not detected during the surveys in October 2009 but approximately 20 birds were observed to the southeast of the proposed Processing plant area during the entire February 2010 survey. Birds were observed feeding on seed of Black wattle *Acacia mearnsii*. The site also supports a number of Hawthorn *Crataegus monogyna,* an exotic species that produces and abundance of red coloured fruit that the Gang-gang Cockatoo eat. The presence of large numbers of Gang-gang Cockatoo may be related to the abundant supply of Hawthorn berries that had dropped just prior to the February 2010 survey.

A number of seasonal breeding migratory birds were detected during the systematic surveys. These included the Rufous Whistler, Black-faced Monarch, Dollarbird and Sacred Kingfisher. In addition the White-throated Needletail was observed opportunistically.

The Subject Site has a relatively high species diversity of bird. The high diversity is partially a reflection of the year's observations made by Mr James while living at Majors Creek.

Table 9
Number of individual Birds Detected During the Systematic Surveys

Species	Diurnal Bird Site (see Figure 3)[2]								
	1a[1]	1b[1]	2a[1]	2b[1]	3	4a[1]	4b[1]	5a[1]	5b[1]
Red Wattlebird	2o	3o	4o	5o	4o		1W	4o	3o
Yellow-faced Honeyeater	3o	1o	1O	4o	3o	1W	1o	3o	
Striated Pardalote	2w							2w	
Black-faced Cuckoo Shrike	1o								
Sulfur-crested Cockatoo	1O				1O				
Crimson Rosella	5o	3o	2o	3o	4o	3o	2o	6o	3o
Galah	2o								
Common Starling	2o								
Grey Fantail	3o	2o	1o	2o	2o	2o	4o	7o	2o
White-throated Treecreeper	1w	1W	1w		1w		2w		2w
Grey Shrike-thrush	2o			1w	2o			2o	
Rufous Whistler	3w		1W		1w	1W	1o	1w	1w
White-browed Scrubwren	3o		2o	1o	2o	5o	1o	2o	
Little Raven	2o		2o		1o			1o	
Eastern Whipbird			1o		1o		1w	2o	
Australian Magpie		3o	1O	7o	1W	2o	1w	1W	6o
White-winged Chough			6O						
Jacky Winter			1o						
Spotted Pardalote			1w		1w			2o	
Grey Butcherbird			1W						1w
Black-faced Monarch			1o						
Superb Fairy-wren				3o	3o		1w		
New-holland Honeyeater					2o				
Eastern Yellow Robin					1o	1o			
Brown Thornbill					1o	2o			
Eastern Spinebill					4o	1o		3o	
Common Bronzewing						1o			
Pied Currawong		3o				1W	1W		1W
White-naped Honeyeater								2w	
Fan-tail Cuckoo								1W	
Magpie Lark								2o	
Gang-gang Cockatoo		2o		3o			2w		1w
Grey Currawong		1o		1W					
Australian Hobby		1o							
Sacred Kingfisher				1o					1w
Red-browed Finch				3o					
Silvereye				4o					
Dollarbird									1w
Brown-headed Honeyeater							2o		
Golden Whistler							1o		
Wonga Pigeon							1W		
Total species	14	10	15	13	18	11	15	16	11

Note 1: Suffix a = October 2009 survey. Suffix b = February 2010 survey
Note 2 o = observed within Subject Site, w = heard call within Subject Site, O = observed adjacent to Subject Site, W = heard call adjacent to Subject Site.

4.5.5 Foot-Based Spotlighting

Spotlighting revealed the presence of the following species.

- Common Brushtail Possum *Trichosurus vulpecula*.
- Common Ringtail Possum *Pseudocheirus peregrinus*.
- Sugar Glider Petaurus breviceps.
- Common Wombat Vombatus ursinus.

- Eastern Grey Kangaroo *Macropus giganteus*.
- Red Fox Vulpes vulpes.
- Rabbit Oryctolagus cuniculus.

The Sugar Glider was observed in Black Wattles *Acacia mearnsii* during the October 2009 survey and in a flowering Ribbon Gum during the February 2010 survey. The Sugar Glider was also observed to the east of the Subject Site, also in Black wattles.

4.5.6 Nocturnal Call Playback

No animals responded to the broadcast of the pre-recorded calls. No large owls were heard calling during the dusk survey or during spotlight surveys.

4.5.7 Diurnal Herpetofauna Census

One Three Toed Skink *Hemiergis decresiensis* was found under a fallen log during the quantitative reptile search at Reptile Site 1 in October 2009 and one Weasel Skink *Saproscincus mustelina* in the February 2010 survey.

Searches in the broader area of the Subject Site and Majors Creek revealed the presence of the following species.

- Eastern Bluetongue Skink *Tiliqua scincoides.*
- Southern Cunningham's Skink *Egernia cunninghamiana.*
- Gippsland Water Dragon *Physignathus lesueurii howitti* (observed beside Majors Creek).
- Southern Water Skink *Eulamprus heatwolei* (observed beside Majors Creek).
- Red-bellied Black Snake *Pseudechis porphyriacus* (sloth at reptile search site 1).

4.5.8 Nocturnal Streamside Search

Spotlighting beside Majors Creek revealed the presence of the following species.

- Lesueur's Tree Frog *Litoria lesueurii* (N=6).
- Common Eastern Froglet *Crinia signifera* (N=1).
- Striped Marsh Frog *Limnodynastes peroni* (N=4).
- Southern Green Stream Tree Frog *Litoria nudidigata* (observed during spotlight searches beside Spring Creek in October 2009).
- Gippsland Water Dragon Physignathus lesueurii howitti.
- Eels Anguilla australis.
- Mountain Galaxias *Galaxias olidus*.

4.5.9 Amphibian surveys

The following species of amphibian were identified during the surveys.

- Verreaux's Tree Frog *L. verreauxii.*
- Bleating Tree Frog *Litoria dentata.*
- Spotted Grass Frog Limnodynastes tasmaniensis.
- Peron's Tree Frog *Litoria peroni* (observed opportunistically)

No Green and Golden Bell Frogs *Litoria aurea* or Growling Grass Frog *Litoria raniformis* were detected during diurnal searches along Majors Creek or dams on the Subject Site. No Heath Frog *Litoria littlejohni* tadpoles of calling frogs were detected in Spring Creek or Majors Creek.

4.5.10 Targeted Surveys

Dusk surveys of potential den sites

No Yellow-bellied Gliders, large forest owls, Bush Stone Curlew, or Glossy Black Cockatoo were observed or heard call during the dusk surveys. Approximately twenty Gang-gang Cockatoo were observed during the dusk survey conducted in February 2010.

Searches for incised trees

No trees located on or adjacent to the Subject Site had been incised by the Yellow-bellied Glider.

Searches for cracked Casuarina cones

No Black She Oak *Allocasuarina littoralis* were located on the Subject Site. Broader searches within the Locality revealed the species feeds on Black She Oak in the Majors Creek cemetery.

Searches for white-wash

No white-wash was located at the base of hollow trees.

4.5.11 Incidental Observations

Species observed or heard opportunistically were recorded. The species observed and type of observation is detailed in **Appendix 3**.

4.5.12 Listed Fauna Species Identified

Table 10 identifies the species listed under the TSC Act or the EPBC Act observed within or adjacent to the Subject Site.

Table 10
Listed Species Observed within the Subject Site

Common Name	Scientific Name	Source
Little Eagle	*Hieraaetus morphnoides*	B. James
Gang-gang Cockatoo	*Callocephalon fimbriatum*	B. James, G. Daly
Scarlet Robin	*Petroica boodang*	B. James
Flame Robin	*Petroica phoenicea*	B. James, G. Daly

5. RECOMMENDATIONS AND AMELIORATION MEASURES

5.1 INTRODUCTION

The following recommendations and amelioration measures are provided to assist the Proponent minimise potential impact on listed species, populations and ecological communities within and surrounding the Subject Site. It has been assumed in determining the likely impacts of the Project that these recommendations would be fully implemented. Section 5 of the Environmental Assessment provides a detailed list of commitments made by the Proponent. In addition, it is recognised that a Biodiversity Strategy would be required. The proposed strategy is summarised in Section 2.15 of the *Environmental Assessment* and its adequacy is assessed in Section 7.2 of this document. The proposed Biodiversity Strategy has not been taken into account when assessing potential Project-related impacts.

The riparian areas of Spring Creek and Majors Creek require special attention as they are used by a range of aquatic fauna and constitute the most logical area to form the basis of a habitat corridor to link the Subject Site to areas to the east and the remnant forest to the north.

5.2 SHORT-TERM MANAGEMENT STRATEGIES

The following short-term management strategies are recommended.

- Avoid the use of phosphates in pasture areas to encourage the proliferation of native grasses.
- Maintain stocking rates at a level to sustain and facilitate the spread of native pasture species.
- Strip topsoil to a depth of 100mm prior to the construction of any site infrastructure. This topsoil should be used to cover areas undergoing rehabilitation so that seed and propagules of native grassland species are conserved.
- Fence all areas of Ribbon Gum Forest and Fragmented Ribbon Gum Forest and limit mining-related activities within those areas.
- Continue the existing weed control program, with particular focus on managing Broom and Blackberry within the southern section of the Subject Site.
- Erosion control measures must ensure that the water quality of Spring and Majors Creeks are protected.

- Fallen and dead standing timber should not to be removed from the Subject Site as this represents habitat for fauna.
- Ensure that areas of habitat suitable for the Majors Creek Leek Orchid are appropriately identified and fenced and access restricted. Ensure no disturbance occurs within the fenced areas.

5.3 LONG TERM MANAGEMENT STRATEGIES

A common theme in draft or approved recovery plans, threat abatement plans is the loss of habitat. Clearing of native vegetation is listed as a key threatening process under the TSC Act (1995). Hence, the long term management of the Subject Site should be to protect areas of native vegetation, manage grazing operations, eradicate weeds and develop a revegetation plan that involves the local community so that in the long term natural ecosystems are restored and indigenous species of plant and animal recolonise the site.

To ensure that these objectives are achieved, it is recommended that a Biodiversity Management Plan (BMP) shall be prepared and implemented within a reasonable time of receipt of Project approval. This plan should specify actions to be undertaken during the life of the Project and for several years after the site has been decommissioned and may also describe management of the proposed biodiversity offset area (see Section 7). This plan should describe the composition and condition of the remnant vegetation and address the issues in the areas not directly disturbed by mining-related activities. The plan should include the following components.

- An ongoing weed control program.
- Fencing to appropriately manage grazing.
- A land preparation program, including procedures for clearing vegetation, stripping, stockpiling and spreading soil and managing erosion and sedimentation.
- A revegetation and amelioration program, including appropriate revegetation of areas of prior disturbance with endemic species. The program should take into account the proposed Biodiversity Strategy and preservation and amelioration of the Native Grassland Community. The program should also promote the use of the site by Glossy Black Cockatoo through planting with She Oaks *Allocasuarina littoralis.* The program should include a detailed list of endemic lower, mid and upper storey species.
- A rehabilitation program, including detailed procedures for the shaping, covering, revegetation and management of areas disturbed by Project-related activities.

The BMP should be prepared in consultation with the relevant government agencies and surrounding community. Where possible, local Landcare or similar groups should be engaged to help develop and implement the plan.

5.4 ONGOING MONITORING

On-going monitoring of the effectiveness of the mitigation measures shall be undertaken. The following monitoring program would be implemented within the Project Site. The results of the monitoring program would be reported in each Annual Environmental Management Report (AEMR) prepared for the Project.

- Ensure that searches for Major's Creek Leek Orchid are undertaken during the flowering period for the orchid, both within suitable habitat areas within the Project Site and within the Majors Creek Cemetery.
- Areas undergoing rehabilitation will be monitored on a 6 monthly basis to determine the success or otherwise of the management, mitigation and ameliorative measures and the rehabilitation programs.
- A set of photographic reference points will be established and photographs taken at six monthly intervals to document activities within the Subject Site, including weed control and revegetation actions.

6. ASSESSMENT OF IMPACTS

6.1 INTRODUCTION

Table 11 presents those species, populations and ecological communities listed under the TSC Act and EPBC Act that were either observed within the Subject Site, have been observed previously within 5km of the Subject Site or are considered by the author or DECCW or DEWHA as having the potential to occur within the Subject Site.

The assessment of impacts on species, populations and ecological communities identified in **Table 11** has been divided into two components. An initial habitat assessment is presented in Section 6.2 to identify those species for which suitable habitat does not exist within the Subject Site and for which no further assessment is warranted. For those species, populations and ecological communities for which suitable habitat exists within the Subject Site, a detailed impact assessment has been provided. Separate assessments have been provided for those species, populations and ecological communities listed under the TSC Act and the EPBC Act.

No groundwater dependent ecosystems were located within the Subject Site or immediately downstream as Spring and Major's Creek have been significantly disturbed as a consequence of historic mining activities.

6.2 TSC ACT PRELIMINARY IMPACT ASSESSMENT

Table 12 presents the habitat preference for all species, populations and ecological communities identified in **Table 11**. An assessment of whether suitable habitat occurs within the Subject Site is given and based on habitat preference, suitability of the site (area, degree of fragmentation) and survey results a subset of species are selected for further assessment.

Table 11
Listed Species, Populations or Ecological Communities

Threatened Species / Ecological Community	TSC Act Schedule	EPBC Act Classification	Information source
Fauna			
Koala	2		DECCW
Squirrel Glider	2		DECCW
Yellow-bellied Glider	2		DECCW
Spotted-tailed Quoll	2		DECCW
White-footed Dunnart	2		DECCW
Eastern Pygmy Possum	2		DECCW
Grey-headed Flying Fox	2	Vulnerable	DEWHA
Eastern False Pipistrelle	2		DECCW
Eastern Bentwing Bat	2		DECCW
Greater Broad-nosed Bat	2		DECCW
Golden-tipped Bat	2		DECCW
Large-footed Myotis	2		DECCW
Yellow-bellied Sheathtail-bat	2		DECCW
Smoky Mouse	1	Endangered	DEWHA
Australian Painted Snipe	1	Vulnerable	DEWHA
Little Eagle	2		DECCW, author, observed
Square-tailed Kite	2		DECCW
Swift Parrot	1	Endangered	DEWHA
Brown Treecreeper	2		DECCW
Regent Honeyeater	1	Endangered	DECCW
Diamond Firetail	2		DECCW
Hooded Robin	2		DECCW
Scarlet Robin	2		DECCW, author, observed
Flame Robin	2		DECCW, author, observed
Pink Robin	2		DECCW
Barking Owl	2		DECCW
Powerful Owl	2		DECCW
Gang-gang Cockatoo	2		DECCW, author, observed
Glossy Black-Cockatoo	2		DECCW, author
Striped Legless Lizard	2	Vulnerable	DECCW
Broad-headed Snake	1	Endangered	DEWHA
Giant Burrowing Frog	2	Vulnerable	DECCW
Littlejohn's Tree Frog	2	Vulnerable	DECCW
Southern Bell Frog	1	Vulnerable	DECCW

Table 11 (Cont'd)
Listed Species, Populations or Ecological Communities

Threatened Species / Ecological Community	TSC Act Schedule	EPBC Act Classification	Information source
Flora			
Araluen Gum	1	Vulnerable	DECCW
Araluen Zieria	1A		DECCW
Austral Toadflax		Vulnerable	DECCW
Horay Sunray		Endangered	DEWHA
Dense Cord-rush	2		DECCW
Mauve Burr Daisy	2		DECCW
Michelago Parrot-Pea	1		DECCW
Monaro Golden Daisy	2		DECCW
Small-leaved Gum	1		DECCW
Tangled Bedstraw	1		DECCW
Thick-lipped Spider-orchid		Vulnerable	DECCW
Majors Creek Leek Orchid	1A		DECCW, author
Pale Golden Moths	1		DECCW
Small Snake Orchid	1		DECCW
Endangered Ecological Community			
Natural Temperate Grasslands of the Southern Tablelands (NSW and ACT) (EPBC community)		Endangered	DECCW
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC community)		Critically Endangered	DEWHA

Table 12
Preferred Habitat of Listed Species and Ecological Communities

Threatened Species / Ecological Community	Habitat Preference in region	Habitat Assessment Survey results
Koala	Ribbon Gum Forest.	Habitat present within Subject Site. Species not detected. No further assessment required.
Squirrel Glider	Found in a variety of forests but in this region associated with woodlands, especially those with Black wattle	Habitat present within Subject Site. Species not detected. No further assessment required.
Yellow-bellied Glider	Found in a variety of forests but in this region associated with Brown Barrel tall open forests and Ribbon Gum Forest	Habitat present within Subject Site but site isolated and of insufficient size to support a troupe. No further assessment required.
Spotted-tailed Quoll	The Spotted-tailed Quoll has been found in a variety of habitat types which range from closed forest to heathland	Habitat not present within Subject Site. No further assessment required
White-footed Dunnart	Found in a variety of habitat types including open forests, woodlands and heathlands with dense shrublayer	Habitat not present within Subject Site. No further assessment required.
Eastern Pygmy Possum	Woodland/Heathlands with dense shrublayer plus tall open forest	Habitat not present within Subject Site. No further assessment required.

Table 12 (Cont'd)
Preferred Habitat of Listed Species and Ecological Communities

Threatened Species / Ecological Community	Habitat Preference in region	Habitat Assessment Survey results
Grey-headed Flying Fox	Found in a variety of habitat types including open forests, woodlands, tall open forest and closed forest, usually below 200 m asl in temperate Australia.	Not expected to occur at this altitude. No further assessment required.
Eastern False Pipistrelle	Highly associated with mature tall open forest at altitude above 100m. Roosts in tree hollows.	Habitat present within Subject Site but no forest to be removed. **Further assessment required**
Eastern Bentwing Bat	In winter roosts in select caves but during spring/summer forages over a range of forest types.	Habitat present within Subject Site but no forest to be removed. **Further assessment required**
Greater Broad-nosed Bat	Found in a variety of forests. Often coastal at higher latitudes and forages beside creeks. Roosts in tree hollows.	Habitat present within Subject Site but no forest to be removed. **Further assessment required**
Golden-tipped Bat	Closed riparian forests usually with Yellow-throated Scrubwren as they roost in unused nests.	Habitat not present within Subject Site. No further assessment required
Large-footed Myotis	Riparian habitats with hollow trees, bridges or caves.	Habitat present within Subject Site but no forest to be removed. **Further assessment required**
Yellow-bellied Sheathtail-bat	Seasonal migrant found in a wide range of forest types	Habitat present within Subject Site but no forest to be removed. **Further assessment required**
Smoky Mouse	Heath on ridge tops and slopes in sclerophyll forest, heathland and open-forest from the coast (in Victoria) to sub-alpine regions of up to 1800 metres.	Habitat not present within Subject Site. No further assessment required
Australian Painted Snipe	Inhabits inland and coastal temporary or infrequently filled freshwater wetlands, particularly where there is grass.	Habitat not present within Subject Site. No further assessment required
Swift Parrot	Over-wintering habitat on the mainland is the box-ironbark forests and woodlands inland of the Great Dividing Range in Victoria and New South Wales.	Habitat not present within Subject Site. No further assessment required
Little Eagle	The Little Eagle occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used.	Habitat present within Subject Site. **Further assessment required**
Square-tailed Kite	Seasonal summer breeding migrant that inhabits coastal and subcoastal forests, particularly those on fertile soils and with an abundance of passerines	Habitat present within Subject Site but no forest to be removed. No further assessment required.
Brown Treecreeper	A medium-sized insectivorous bird that occupies eucalypt woodlands, particularly open woodland lacking a dense understorey. It is sedentary and nests in tree hollows within permanent territories.	Habitat present within Subject Site but no forest to be removed. No further assessment required.
Regent Honeyeater	Occurs in temperate *Eucalyptus* woodlands and open forest.	Habitat present within Subject Site but no forest to be removed. No further assessment required.
Diamond Firetail	Occupies eucalypt woodlands, forests and mallee where there is a grassy understorey.	Habitat present within Subject Site but no forest to be removed. No further assessment required.
Hooded Robin	Prefers woodlands with a variety of shrub species.	Habitat present within Subject Site but no forest to be removed. No further assessment required.

Table 12 (Cont'd)
Preferred Habitat of Listed Species and Ecological Communities

Threatened Species / Ecological Community	Habitat Preference in region	Habitat Assessment Survey results
Scarlet Robin	The Scarlet Robin breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses and sometimes in open areas.	Habitat present within Subject Site. Previously detected. **Further assessment required**
Flame Robin	In NSW it breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. It migrates in winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains	Habitat present within Subject Site. Previously detected. Further **assessment required**
Pink Robin	Occurs in tall open eucalypt forests and closed forests	Habitat present within Subject Site but no forest to be removed. No further assessment required.
Barking Owl	Occurs in eucalypt woodland, open forest, swamp woodlands and riverine timber. In region detected in tall open forest	Habitat present within Subject Site but no forest to be removed. No further assessment required.
Powerful Owl	In region detected in tall open forests (Brown Barrel) with an abundance of arboreal mammals.	Habitat present within Subject Site but no forest to be removed. No further assessment required.
Gang-gang Cockatoo	Prefers various mature eucalypt forests.	Habitat present within Subject Site. Species detected. **Further assessment required.**
Glossy Black-Cockatoo	Prefers woodland and open forest with an abundance of Black Oak.	Habitat not present within Subject Site and no forest to be removed. No further assessment required.
Striped Legless Lizard	Occurs in temperate grasslands.	Habitat very marginal within Subject Site and outside known range. No further assessment required.
Broad-headed Snake	Sandstone outcrops in woodland within 200km of Sydney	Habitat not present within Subject Site. No further assessment required.
Giant Burrowing Frog	Occurs in heathland and woodland particularly beside non-perennial creeks	Habitat not present within Subject Site. No further assessment required.
Littlejohn's Tree Frog	Species complex but occurs in woodland and heathland and occasionally in open forest	Habitat not present within Subject Site. No further assessment required.
Southern Bell Frog	Occurs beside creeks with secondary billabongs that have Cumbungi and little canopy species	Habitat not present within Subject Site and no forest to be removed. No further assessment required.
Araluen Gum	Grows near rivers, in grassy or shrubby woodland or in wet sclerophyll forest on moderately fertile sandy soil on granite.	Not located on site. No further assessment required.
Small-leaved Gum	Grows mainly in grassy woodlands around the edges of broad, flat headwater valleys at altitudes of 800 – 1200 m asl on poorly drained humic soils derived from granite or granodiorite.	Not located on site. No further assessment required.
Araluen Zieria	Araluen Zieria grows in shrubland on a rocky granite hillside at a single site near Araluen south of Braidwood.	Not located on site. No further assessment required.
Austral Toadflax	Found in damp sites in association with Kangaroo Grass in grassland or grassy woodland.	Not located on site. No further assessment required.

Table 12 (Cont'd)
Preferred Habitat of Listed Species and Ecological Communities

Threatened Species / Ecological Community	Habitat Preference in region	Habitat Assessment Survey results
Dense Cord-rush	Commonly found in swamps or depressions in sandy alluvium, sometimes growing with sphagnum moss.	Not located on site. No further assessment required.
Mauve Burr Daisy	Found in montane or natural temperate grassland (dominated by *Themeda australis*) and Snow Gum (*Eucalyptus pauciflora*) Woodlands on the Monaro and Shoalhaven area.	Not located on site. No further assessment required.
Michelago Parrot-Pea	Occurs on exposed patches of clay or on rocky outcrops in eucalypt woodland often dominated by Scribbly Gum (*Eucalyptus rossii*), Snow Gum (*E. pauciflora*), Broad-leafed Peppermint (*E. dives*) and Red Stringybark (*E. macrorhyncha*)	Not located on site. No further assessment required.
Monaro Golden Daisy	Grows on basalt, granite and sedimentary substrates usually in natural Temperate Grassland.	Not located on site. No further assessment required.
Horay Sunray	Cabbage Gum *Eucalyptus pauciflora* woodland.	Not located on site. No further assessment required.
Tangled Bedstraw	In NSW Tangled Bedstraw has been found in moist gullies of tall forest, *Eucalyptus tereticornis* forest, coastal Banksia shrubland, and *Allocasuarina nana* heathland.	Not located on site. No further assessment required.
Thick-lipped Spider-orchid	Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil.	Not located on site. No further assessment required.
Majors Creek Leek Orchid	Currently only known from one site (cemetery) at Majors Creek	Not located on site. **Further assessment required.**
Pale Golden Moths	Grown in open grassy woodland of *Eucalyptus viminalis* / *E. pauciflora* or *E. pauciflora* / *E. parvula*	Not located on site. No further assessment required.
Small Snake Orchid	Often on peaty soils in moist areas on grassy slopes or flats on shale, fine granite or among boulders.	Not located on site. No further assessment required.
Natural Temperate Grasslands of the Southern Tablelands (NSW and ACT) (EPBC community)	Natural temperate grassland is grassy vegetation dominated by moderately tall (25–50 cm) to tall (50–100 cm), dense to open tussock grasses in the genera *Austrodanthonia, Austrostipa*, *Bothriochloa*, *Poa* and *Themeda*. Up to 70% of all plant species may be forbs.	Narrow, restricted area located but considered to be non-viable. No further assessment required.
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC community)		Not located on site. No further assessment required.

6.3 TSC ACT DETAILED IMPACT ASSESSMENT

This section provides a detailed assessment of the anticipated Project-related impacts on species and ecological communities listed under the TSC Act, taking into account the recommendations presented in Section 5. Section 5A of the EP&A Act, as amended by the TSC Act, sets out the factors to be considered in deciding whether there is likely to be a significant effect on threatened species, populations or communities and or their habitat as a result of a proposed development. The Project would disturb a total of 28.4ha of which 27.4ha is pasture.

The preliminary impact assessment presented in Section 6.2 indicates that the following TSC Act-listed species have the potential to occur within the Subject Site.

- Eastern Bent-wing Bat.
- Eastern False Pipistrelle.
- Greater Broad-nosed Bat.
- Yellow-bellied Sheathtail Bat.
- Large-footed Myotis.
- Gang-gang Cockatoo.
- Little Eagle.
- Square-tailed Kite.
- Brown Treecreeper.
- Regent Honeyeater.
- Diamond Firetail.
- Hooded Robin.
- Scarlet Robin.
- Flame Robin.
- Pink Robin.
- Barking Owl.
- Powerful Owl.
- Majors Creek Leek Orchid

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

Eastern Bentwing Bat

The Eastern Bent-wing Bat occurs along the east coast from Queensland through New South Wales and Victoria. There are other subspecies/populations in north-west West Australia and the Northern Territory and one in the west of Victoria and South Australia (Van Dyck and Strahan 2008). Each population is centred on one or two maternity colonies, and the population range is often determined by watersheds (Dwyer 1966 and 1969). Dwyer (1969) indicates that the Common Bent-wing Bat in the Shoalhaven belong to two populations which have nursery sites at Church Cave, Wee Jasper and The Drum, Bungonia.

The Eastern Bentwing Bat species is essentially a cave-roosting species, but is also known to use man-made habitats such as road culverts, storm-water tunnels and other man-made structures. During spring, pregnant females, with some non-pregnant females and juvenile males, congregate at maternity roosts. The females stay in these roosts during summer and depart in February and juveniles depart a month later and both may travel considerable distances to their over wintering roosts (Van Dyck and Strahan 2008). Roost sites outside the breeding period depend on the sex and age of the individuals.

The Eastern Bentwing Bat is known from a variety of habitats along the east coast including rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grasslands (Churchill 1998). In forested areas, it flies above the canopy to hunt, while in riparian rainforest it may fly within a few metres from the ground (G. Daly pers. obs.).

In the region this species has been mostly caught in tall open forests along the escarpment. There shall be no direct impacts on this species as no hollow-bearing trees are to be removed and the foraging and potential roost sites are distant from the area proposed to be disturbed. The indirect impacts on this species include an altered noise regime from truck movements and machinery and areas being illuminated at night. The lights at night attract insects and subsequently microbats feed at these sites.

Eastern False Pipistrelle

The Eastern False Pipistrelle occurs along the east coast from southern Queensland through New South Wales, Victoria, Tasmania and the south-eastern tip of South Australia. In southern Australia the species hibernates during winter and roosts in the hollows of living eucalypts. Females fall pregnant during late spring and early summer lactating from December to mid-January. This species often forages below or near the canopy and has a preference for tall open forests at high altitude (Van Dyck and Strahan 2008). Given the relatively large size of this bat it is expected to have a large home range and has been recorded forging over 12 kilometres from it's roost.

In the region this species has been detected via Anabat in the Tallaganda Badja area (QEM 1994) and trapped in Wadbilliga NP by the author on 6 and 7 February 1997 (Bumberry Ck Firetail).

There shall be no direct impacts on this species as no hollow-bearing trees are to be removed and the foraging and potential roost sites are distant from the area proposed to be disturbed. The indirect impacts on this species include an altered noise regime from truck movements and machinery and areas being illuminated at night. The lights at night attract insects and subsequently microbats feed at these sites.

Greater Broad-nosed Bat

The Greater Broad-nosed Bat occurs from north Queensland along the east coast to the New South Wales Victorian border. Although inhabiting a variety of habitats from woodland through moist and dry eucalypt forest to rainforest it generally not occur at altitudes above 500 m, except perhaps in the very north of its range (Van Dyck and Strahan 2008). Creeks and small rivers in open forest and favoured corridors where it hawks backwards and forwards for its prey of slow flying insects and smaller microbats.

The Greater Broad-nosed Bat roosts in tree hollows and a single young is born in January. Prior to birth several females will congregate at maternity sites, which are hollow-bearing trees. This species usually forages above the canopy at a height of thirty metres. Subsequently it is rarely caught in harp traps and most records on the wildlife atlas are from Anabat recordings of calls.

In the broader region a specimen was trapped by the author on Misty Mt Rd west of Batemans Bay on 12 March 1997. This area at that time was within Buckenbowra State Forest but as a result of the Regional Forest Agreement is now National Park.

There shall be no direct impacts on this species as no hollow-bearing trees are to be removed and the foraging and potential roost sites are distant from the area proposed to be disturbed. The indirect impacts on this species include an altered noise regime from truck movements and machinery and areas being illuminated at night. The lights at night attract insects and subsequently microbats feed at these sites.

Yellow-bellied Sheathtail Bat

The Yellow-bellied Sheathtail Bat has a wide distribution that covers all states and territories with the exception of Tasmania. The species has been found in a wide range of habitat types from desert to tall open forests. Evidence indicates this species is a spring migrant to the Shoalhaven, with records from southern Australia only taken between January and June (Churchill 1998). The species roosts in tree hollows and tend to be solitary for most of the year but may form small groups of 2-6 in late winter and spring. Most records are from echolocation calls as the species usually forages above the canopy (Van Dyck and Strahan 2008). This is a rare seasonal migrant on the south coast and highlands of NSW. Trapping by the author over ten years in the broader region has failed to capture any individuals.

There shall be no direct impacts on this species as no hollow-bearing trees are to be removed and the foraging and potential roost sites are distant from the area proposed to be disturbed. The indirect impacts on this species include an altered noise regime from truck movements and machinery and areas being illuminated at night. The lights at night attract insects and subsequently microbats feed at these sites.

Large-footed Myotis

The Large-footed Myotis occurs along the coast and ranges from Victoria to north-eastern Western Australia and the Murray River to eastern South Australia (Van Dyck and Strahan 2008). The Large-footed Myotis forages over fresh and semi-saline water often along creeks for insects and occasionally fish (Robson 1984). They rake the surface of the water with their sharp, curved claws of their feet to capture food. They have been found roosting in caves, mines or tunnels under buildings and bridges, in dense foliage (Dwyer 1970a) and tree hollows adjacent to water. Males tend to be solitary and are strongly attached to a particular site (roost) and defend a territory, excluding other males from his harem of females during the breeding season (Dwyer 1970b). Within the range from central NSW to south-eastern Queensland females give birth to two young each year, one in early October and the other in late January (Van Dyck and Strahan 2008).

Targeted harp trapping totalling six trap nights was conducted for this species at Majors Creek. No Large-footed Myotis were caught suggesting the species does not occur in this portion of the catchment. There shall be no direct impacts on this species as no hollow-bearing trees are to be removed and the foraging and potential roost sites are distant from the area proposed to be disturbed. The indirect impacts on this species include an altered noise regime from truck movements and machinery and areas being illuminated at night. The lights at night attract insects and subsequently microbats feed at these sites.

Gang-gang Cockatoo

The Gang-gang Cockatoo is distributed from southern Victoria through south- and central-eastern New South Wales (Shields and Crome 1992). In summer, the Gang-gang Cockatoo occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, the Gang-gang Cockatoo occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas (Shields and Crome 1992). The species undertake nomadic as well as seasonal movements and may occur at apparently random points within their range.

The Gang-gang Cockatoo requires hollows in the trunks or large limbs of large trees in which to breed (Gibbons 1999, Gibbons and Lindenmayer 2000). Breeding usually occurs in tall mature sclerophyll forests that have a dense understorey, and occasionally in coastal forests. Nests are most commonly recorded in eucalypt hollows in live trees close to water (Beruldsen 1980). Breeding usually occurs between October and January (Chambers 1995).

The Ribbon Gum Forest within the Subject Site provides foraging and nesting habitat for the Gang-gang Cockatoo, although the species has not been recorded nesting on the site since 2007 (B. James pers. comm.). The loss of approximately approximately 0.2ha of this forest is not considered 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. Being volar and highly nomadic (or large seasonal movements) this population has a large home range covering several thousand hectares. No hollow-bearing trees shall be removed so potential nesting sites will be retained.

The indirect impacts on this species include an altered noise regime from truck movements and machinery and areas being illuminated at night. It is noteworthy that the nesting birds were approximately 50m from drilling operations and did not appear to be perturbed. In the February 2010 survey approximately 20 birds were observed on the site over three days, indicating that at time the species is locally abundant. The birds were foraging within 50m of drilling operations and truck movements and the drilling areas were illuminated at night. These observations indicate that loud even noise and localised night-time illumination is tolerated by this species.

Little Eagle

The Little Eagle has recently been added to the TSC Act (1995) by the Scientific Committee. The determination is dated February 2010 (NSW Scientific Committee 2010).The Little Eagle occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used (Marchant and Higgins 1993; Aumann 2001a). For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring. Young fledge in early summer. Generation length has been estimated as 10 years (Debus and Soderquist 2008). It eats birds, reptiles and mammals, occasionally adding large insects and carrion (Marchant and Higgins 1993; Aumann 2001b; Debus et al. 2007). It was formerly heavily dependent on rabbits, but following the spread of rabbit calicivirus disease, and consequent decline in rabbit numbers by 65-85% in the arid and semi-arid zones (Sharp et al. 2002), the Little Eagle is increasingly dependent on native prey. Most of its former native mammalian prey species in inland NSW are extinct (terrestrial mammals of rabbit size or smaller, e.g. large rodents, bandicoots, bettongs, juvenile hare-wallabies and wallabies: Van Dyck and Strahan 2008).

In the 1990s, the Little Eagle was estimated globally as numbering tens of thousands to as many as 100 000 birds (Ferguson-Lees and Christie 2001). Given the low reproductive rate of 0.5-1.0 young per pair per year, maturity at two or three years, and a floating population of juvenile and immature eagles (Marchant and Higgins 1993), mature individuals probably comprise less than three-quarters of the population. Following the calicivirus induced reduction of rabbit prey, the species is thought to have declined greatly but accurate figures are not available. There has been a long-term decline in reporting rate of *c.* 50% in south-eastern NSW since the 1970s, with an accelerating trend since the 1990s (Bounds 2008).

The main threats to the Little Eagle are inferred to be clearing and degradation of its foraging and breeding habitat. Over 50% of forest and woodland has been cleared in NSW (Lunney 2004; Olsen *et al.* 2005). Loss of breeding sites may bring the Little Eagle into increasing interspecific with the larger, dominant Wedge-tailed Eagle *Aquila audax* (Olsen and Fuentes 2005; Olsen and Osgood 2006; Olsen *et al.* 2008; Debus *et al.* 2007). Secondary poisoning from pindone used to control rabbits is listed as a possible threat.

The indirect impacts on this species include an altered noise regime from truck movements and machinery. Little Eagles may use the Subject Site for nesting as there are mature living trees. The impact of noise and illumination on nesting birds is unknown.

The loss of approximately approximately 0.2ha of this Ribbon Gum Forest is not considered 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. Being volar and foraging over very large home ranges the loss of approximately 0.2ha to the local population is small. No Little Eagles were observed during the current survey but have been recorded from the area by B. James.

Square-tailed Kite

The Square-tailed Kite is endemic to Australia and is sparsely distributed throughout the mainland (Marchant and Higgins 1993). The species occurs in coastal and sub-coastal forests, particularly those on fertile soils and with an abundance of passerines (Marchant and Higgins 1993). The Square-tailed Kite is a spring/summer breeding migrant to southern NSW. They feed mostly on small birds and foliage insects but occasionally take small mammals and lizards (Marchant and Higgins 1993).

Square-tailed Kite nest in mature live trees, often near water. The nest is placed in a fork of a large limb, which is usually horizontal (Marchant and Higgins 1993). Breeding in New South Wales occurs from August to early November (Marchant and Higgins 1993). The Square-tailed Kite is threatened by habitat loss through clearing.

The indirect impacts on this species include an altered noise regime from truck movements and machinery. Square-tailed Kite may use the Subject Site for nesting as there are mature living trees. These birds are sensitive to disturbance at the nest (G. Daly pers. obs.).

The loss of approximately 0.2ha of this Ribbon Gum Forest is not considered 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.

Brown Treecreeper

The Brown Treecreeper is a medium-sized insectivorous bird that occupies eucalypt woodlands; particularly open woodland lacking a dense understorey. It is sedentary and nests in tree hollows within permanent territories, breeding in pairs or communally in small groups (Noske 1991). Birds forage on tree trunks and on the ground amongst leaf litter and on fallen logs for ants, beetles and larvae (Noske 1979).

Brown Treecreepers are threatened by clearance and the fragmentation of the woodland habitat including removal of dead timber. This species appears unable to maintain viable populations in remnants less then 200ha and its abundance decreases as remnant size decreases (Barrett *et al.* 1994). Fragmentation also leads to a skewed sex ratio in Brown Treecreeper populations because female birds are unable to disperse to isolated remnants, increasing the chance of local extinctions (Walters *et al.* 1999).

Habitat degradation, including loss of hollow bearing trees, threatens Brown Treecreeper populations. Grazing by stock in woodland areas leads to a decrease the diversity of ground-dwelling invertebrates (Bromham *et al.* 1999) decreasing the availability of food for the birds. In addition, Brown Treecreepers are likely to be threatened by such factors as increased competition with aggressive honeyeater species and increased levels of nest predation that are a consequence of fragmentation of habitat (Major *et al.* 1998).

The indirect impacts on this species include an altered noise regime from truck movements and machinery. Brown Treecreepers are not expected to occur on site as the habitat is small and fragmented. The loss of approximately 0.2ha of this Ribbon Gum Forest is not considered to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Regent Honeyeater

The Regent Honeyeater is a medium-sized honeyeater drier open-forests and woodlands in south-eastern Australia. Regent Honeyeaters occur mainly in box-ironbark open-forests and riparian stands of Casuarina on the inland slopes of the Great Dividing Range. Although patterns of seasonal movement are poorly understood, there is a degree of regularity at some sites where Regent Honeyeaters are well-known to occur.

The total population may be close to or greater than the upper limit of 1500 (Menkhorst et al. 1999). They mainly feed on the nectar of flowering eucalypts, mistletoe (on River She-oak), insects including lerps.

The annual cycle of the Regent Honeyeater at the three main areas of occurrence (Bundarra-Barraba and Capertee Valley in NSW and the Chiltern and Lurg districts in Victoria) includes some common elements: arrival in the area in autumn or early winter and occurrence in loose flocks, often including communal roosting (Oliver 1998); subsequent breeding through spring and early summer, often as aggregations of pairs; and disappearance in mid- to late-summer after young have fledged.

In the Bundarra district of NSW breeding occurs between mid August and January (Ley and Williams 1994) and in the Capertee Valley, NSW, egg laying has been recorded in September and October (Geering and French 1998). Nests are constructed from strips of eucalypt bark, often from stringybark species, dry Casuarina branchlets, dry grass, twigs and spider web. They are placed in an upright fork between 3 and 30 m above ground and 2-3 eggs are laid.

The oldest retraps of banded Regent Honeyeaters indicate a longevity of at least six years seven months and a breeding life of at least 4 years (Menkhorst unpublished data). The main threats to the Regent Honeyeater is significant loss of habitat both in area and quality which has led to a marked population decline.

The indirect impacts on this species include an altered noise regime from truck movements and machinery. Regent Honeyeater are not expected to occur on site as the habitat is small and fragmented. The loss of approximately 0.2ha of this Ribbon Gum Forest is not considered 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.

Diamond Firetail

In New South Wales, the Diamond Firetail occurs predominantly west of the Great Dividing Range, although populations are known from drier coastal areas (Blakers *et al.* 1984, Schodde and Mason 1999, Daly unpub. data).

The Diamond Firetail is a brightly coloured finch that occupies eucalypt woodlands, forests and mallee where there is a grassy understorey. They forage on the ground, largely for grass seeds and other plant material, but also for insects (Blakers *et al.* 1984, Read 1994).

The Diamond Firetail is threatened by clearance and fragmentation of habitat. Isolation and reductions in remnant area inhibit dispersal and increase their vulnerability to local extinction via stochastic events (fires and droughts etc). Small, isolated populations also lose their long term genetic viability (Barrett *et al.* 1994). Further, Diamond Firetail populations appear unable to persist in areas, which lack remnants of native vegetation larger than 200ha (in Scientific Committee determination).

Habitat degradation, particularly overgrazing of the grass understorey, threatens the granivorous Diamond Firetail. In addition, an increased abundance of predators such as Pied Currawongs and Australian Ravens may increase nest predation in fragmented woodland remnants (Major *et al.* 1996).

The indirect impacts on this species include an altered noise regime from truck movements and machinery. Diamond Firetail are expected to occur on site. The loss of approximately 0.2ha of this Ribbon Gum Forest is not considered to have an adverse effect on the life cycle of this species such that a viable local population of the species is likely to be placed at risk of extinction.

Hooded Robin

The south-eastern form of the Hooded Robin *Melanodryas cucullata cucullata*, is distributed throughout south-eastern Australia, from Central Queensland, to Spencer Gulf, South Australia. They occupy a wide range of Eucalypt woodlands, Acacia shrublands and open forests (Blakers et al. 1984). In temperate woodlands, the species favours open areas adjoining large woodland blocks, with areas of dead timber and sparse shrub cover (Fitri and Ford 1997).

Hooded Robins live in small family groups of pairs or trios, and build cup-shaped nests. Home ranges are relatively large, and averaged 18ha for birds from the New England Tableland (Fitri and Ford 1997). The species feeds on the ground by pouncing on insects, and forages in areas with a mix of bare ground, ground cover and litter (Blakers et al. 1984)

The Hooded Robin is threatened by clearance and fragmentation of habitat including removal of dead timber. The species appears unable to survive in remnants smaller than 100-200ha (Egan et al. 1997).

The indirect impacts on this species include an altered noise regime from truck movements and machinery. Hooded Robin are not expected to occur on site as the forest is small and fragmented. The loss of approximately 0.2ha of this Ribbon Gum Forest is not considered to have an adverse effect on the life cycle of this species such that a viable local population of the species is likely to be placed at risk of extinction.

Scarlet Robin

The Scarlet Robin has recently been added to the TSC Act (1995) by the Scientific Committee. The determination is dated February 2010 (NSW Scientific Committee 2010). The Scarlet Robin is found in south-eastern Australia (extreme south-east Queensland to Tasmania, western Victoria and south-east South Australia) and south-west Western Australia. In NSW it occupies open forests and woodlands from the coast to the inland slopes (Higgins and Peter 2002). Some dispersing birds may appear in autumn or winter on the eastern fringe of the inland plains. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. During this period it is frequently detected along the northern Shoalhaven escarpment (G. Daly pers. obs.).

The Scarlet Robin breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses and sometimes in open areas. Abundant logs and coarse woody debris are important structural components of its habitat. It forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris. The Scarlet Robin builds an open cup nest of plant fibres and cobwebs, sited in the fork of tree (often a dead branch in a live tree, or in a dead tree or shrub), which is usually more than 2 m above the ground (Higgins and Peter 2002; Debus 2006a,b).

The Scarlet Robin is sensitive to habitat degradation (Watson *et al.* 2001, 2003; Radford *et al.* 2005; Radford and Bennett 2007), and overgrazing (Olsen *et al.* 2005). For instance, its occurrence (presence/absence) is positively associated with patch size and components of habitat complexity including increasing tree canopy cover, shrub cover, ground cover, logs, fallen branches and litter (Watson *et al.* 2003).

Nest sites, food sources and foraging substrates, such as standing dead timber, logs and coarse woody debris, are susceptible to depletion by grazing, firewood collection and ‘tidying up’ of rough pasture (Recher *et al.* 2002).

The indirect impacts on this species include an altered noise regime from truck movements and machinery. Scarlet Robin may use the Subject Site for nesting as there are remnant blocks of mature forest and riparian areas. The impact of noise and illumination on birds is unknown.

The loss of approximately approximately 0.2ha of this Ribbon Gum Forest is not considered 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. Being volar and foraging over very large home ranges the loss of approximately 0.2ha to the local population is small. No Scarlet Robin were observed during the current survey but have been recorded from the area by B. James. It is expected that on occasion birds would pass through the area as they migrate.

Flame Robin

The Flame Robin has recently been added to the TSC Act (1995) by the Scientific Committee. The determination is dated February 2010 (NSW Scientific Committee 2010).In NSW it breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. It migrates in winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains (Higgins and Peter 2002). Generation length has been estimated as 5 years (Garnett and Crowley 2000).

The Flame Robin's index of abundance (reporting rate) is positively associated with native vegetation cover (Barrett *et al.* 2007). Clearing and degradation of breeding habitat, and degradation of wintering habitat are key threats to the species. For instance, habitat in the sheep-wheat belt is subject to degradation by overgrazing and simplification by the removal of standing dead timber, logs and coarse woody debris. The species suffers a high rate of nest predation by native and exotic predators, including artificially large populations of Pied Currawong *Strepera graculina* in some areas (Higgins and Peter 2002).

The indirect impacts on this species include an altered noise regime from truck movements and machinery. The impact of noise and illumination on birds is unknown.

The loss of approximately 0.2ha of this Ribbon Gum Forest is not considered to have an adverse effect on the life cycle of the Flame Robin such that a viable local population of the species is likely to be placed at risk of extinction. Being volar and foraging over very large home ranges the loss of approximately 0.2ha to the local population is small. One Flame Robin was observed during the current survey and has been previously recorded from the area by Mr B. James. It is expected that on occasion birds would pass through the area as they migrate. One week after the assessment on the Subject Site Mr B. Virtue drove from Badja trig to Moruya and observed several Flame Robins beside the fire trail. The species is regionally abundant at select sites at times.

Pink Robin

The Pink Robin occurs in south-eastern Australia, from Tasmania to Victoria and southern New South Wales. In NSW, most birds are seen during autumn and winter. The Pink Robin occurs in tall open eucalypt forests and closed forests (Boles 1988). In NSW it has been recorded from the far south coast and ranges, usually in tall open forest at elevation. The species is largely sedentary, or locally dispersive into more open habitats during winter (Boles 1988).

The Pink Robin breeds during October to January and can produce two clutches per season (Boles 1988). The nest is a cup of moss and plant fibre placed in a horizontal fork up to 15m but usually less than 5m from the ground (Boles 1988).

Clearing and degradation of breeding habitat, and degradation of wintering habitat are key threats to the species. Like other small passerines, the species may suffer a high rate of nest predation by native and exotic predators, including artificially large populations of Pied Currawong.

The indirect impacts on this species include an altered noise regime from truck movements and machinery. The impact of noise and illumination on birds is unknown. The loss of approximately 0.2ha of this Ribbon Gum Forest is not considered to have an adverse effect on the life cycle of the Pink Robin such that a viable local population of the species is likely to be placed at risk of extinction.

Barking Owl

The distribution of the Barking Owl is described in detail in Higgins (1999). It occurs in Australia, East Indonesia and New Guinea. In Australia, the Barking Owl is found in northern, eastern and south- western Australia from the Pilbara and Kimberley, across the Top End and down through Queensland and the eastern Lake Eyre Basin to southern Victoria, with an isolated population in the south-west corner of WA. In NSW, it is widespread on the coastal plain and foothills and the inland slopes and plains.

The Barking Owl lives in forests and woodlands of tropical, temperate and semi-arid zones. Its habitat is summarised below from Kavanagh *et al.* (1995), Debus (1997) and Higgins (1999). The habitat is typically dominated by eucalypts, often red gum species and, in the tropics, paperbarks *Melaleuca* species. It usually roosts in or under dense foliage in large trees including rainforest species of streamside gallery forests, River She-oak *Casuarina cunninghamiana*, other *Casuarina* and *Allocasuarina* species, eucalypts, *Angophora* or *Acacia* species.

The Barking Owl hunts opportunistically for terrestrial, arboreal and aerial prey between dusk and dawn and occasionally in daylight (Higgins 1999). The diet is summarised from Kavanagh *et al.* (1995a), Debus (1997), Debus *et al.* (1998, 1999) and Higgins (1999). It eats a variety of birds, mammals and large insects.

They are strictly seasonal breeders, laying a single small clutch of 1 to 3 (usually 2) eggs in late winter or spring. The nest site is a large open hollow, often vertical or sloping, in the trunk or sometimes a spout of a eucalypt or *Melaleuca*, usually a live tree though occasionally a dead tree. Nest-hollow entrances are 2-35 m above the ground with a diameter of 20-46 cm and depth of 20-300 cm. In NSW, laying takes place in August-October or in November for replacement clutches if the first clutch fails. The incubation period lasts 36-37 days and the nestling period is 35-36 days.

Habitat loss and degradation is the major threatening process for the Barking Owl (Garnett and Crowley 2000). The relevant, key threatening processes are clearing of native vegetation, continued net loss of native hollow bearing trees and coarse woody debris due to firewood harvesting practices, removal of dead wood, dead trees and logs and competition for hollows from feral honeybees.

The indirect impacts on this species include an altered noise regime from truck movements and machinery. The impact of noise and illumination on birds is unknown. The loss of approximately 0.2ha of this Ribbon Gum Forest is not considered to have an adverse effect on the life cycle of the Barking Owl such that a viable local population of the species is likely to be placed at risk of extinction.

Powerful Owl

The Powerful Owl lives in forests and woodlands occurring in the coastal, escarpment, tablelands and western slopes regions of NSW. The Powerful Owl lives as monogamous, life-long pairs sedentary in large permanent home ranges. Home range has been estimated as 300-1500 ha according to habitat productivity; measured as 800 ha for one non-breeding individual and 350 ha for one breeding female closely associated with the nest tree and new fledgling (Kavanagh 1997).

Habitat for this species is widespread and primarily tall, moist productive eucalypt forests of the eastern tableland edge and the mosaic of wet and dry sclerophyll forests occurring on undulating, gentle terrain nearer the coast. Optimal habitat includes a tall, shrub layer and abundant hollows supporting high densities of arboreal marsupials.

Tree hollows used by owl prey species form in trees greater than 120 years old; those of a size used by owls for nesting and roosting form in trees greater than 165 and probably greater than 250 years old (Mackowski 1984, Lindenmayer *et al.* 1991, Milledge *et al.* 1991). Nesting occurs in old hollow eucalypts in unlogged, unburnt gullies and lower slopes within 100 m of streams or minor drainage lines, with hollows greater than 45 cm wide and greater than 100 cm deep; surrounded by canopy trees and subcanopy or understorey trees or tall shrubs.

Most (84%) pairs nest each year and most of those nesting (93%) produce at least one young (Kavanagh 1997). Laying is strictly seasonal, occurring mainly in June (mid-May to mid-July). The clutch is 1 to 2 eggs; a single clutch is laid per year although, rarely, a replacement clutch may be laid if the first attempt fails early in the egg stage. The incubation period is 5 weeks.

The Powerful Owl is a specialist predator of arboreal marsupials, particularly the Common Ringtail Possum in the lowlands and the Greater Glider in the highlands. These two mammals comprise more than 80% of the diet for this owl in most territories in NSW.

Forest clearing and fragmentation for agriculture and urban developments permanently removes foraging and breeding habitat affecting all age classes of owls. Intensive logging of wood-production forests has the potential for removing nest sites and roost sites for the owls, and den sites for prey species, unless these trees can be identified and protected.

The indirect impacts on this species include an altered noise regime from truck movements and machinery. The impact of noise and illumination on birds is unknown. The loss of approximately 0.2ha of this Ribbon Gum Forest is not considered to have an adverse effect on the life cycle of the Barking Owl such that a viable local population of the species is likely to be placed at risk of extinction.

Majors Creek Leek Orchid

Majors Creek Leek Orchid *Prasophyllum sp. Majors Creek* is currently only known from one site at Majors Creek where it grows in the ground layer of grassy woodland dominated by Swamp Gum *Eucalyptus ovata.* The groundcover includes Kangaroo Grass *Themeda australis* and Poa tussocks (*Poa* spp.). The Orchid is apparently highly susceptible to grazing, being retained only at a historically ungrazed site. Majors Creek Leek Orchid flowers from October to December and retreat into subterranean tubers after fruiting, so the species is not visible above-ground.Annual surveys at the only known site of Majors Creek Leek Orchid i.e. Major's Creek Cemetry over the past ten years have not recorded the emergence of the species (Rehwinkel, pers comm 2010).

Potential habitat for Majors Creek Leek Orchid is represented at the subject site by a small, restricted remnant of Swamp Gum *Eucalyptus ovata* with a grassy understorey of native and exotic species. Given that the species is 'apparently highly susceptible to grazing', it is unlikely that Majors Creek Leek Orchid would be present within the subject site. The Proponent has agreed that the area of potential habitat will be fenced and protected from grazing and further disturbance. As a result, the Project would not result in impacts that would place a viable local population of the species at risk of extinction.

Summary

The Ribbon Gum forest represents habitat for the Gang-gang Cockatoo, Little Eagle, Scarlet Robin and Flame Robin. The Ribbon Gum forest represents potential habitat for the False Pipistrelle, Yellow-bellied Sheath-tail Bat, Eastern Bent-wing Bat, Square-tailed Kite, Barking Owl, Powerful Owl, Pink Robin, Hooded Robin, Brown Treecreeper, Regent Honeyeater and Diamond Firetail. Majors Creek represents potential habitat for the Large-footed Myotis.

Since 0.2 ha of Ribbon Gum Forest shall be removed, the Project will not have an adverse impact on the life cycle of these species such that the local populations are at risk of extinction. There shall be no direct impacts on these species as no hollow-bearing trees are to be removed and the foraging and potential roost sites are distant from the area proposed to be disturbed.

The indirect impacts on these species include an altered noise regime from truck movements and machinery and areas being illuminated at night. The lights at night attract insects and subsequently microbats feed and others at these sites.

Finally, while it is unlikely that a population of Majors Creek Leek Orchid would occur within the Project Site, the management measures identified by the Proponent would result in protection of the species if it did occur.

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

No endangered populations listed in Part 2 of Schedule 1 of the TSC Act or Part 2 of Schedule 4 of the FM Act, were found on site.

(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,

No endangered ecological communities listed under Part 3 of Schedule 1 of the TSC Act or Part 3 of Schedule 4 of the FM Act, and no critically endangered ecological communities listed under Part 2 of Schedule 1A of the TSC Act or Part 2 of Schedule 4A of the FM Act were found on site.

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

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, 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,

i) The extent of habitat alteration associated with the Project is the loss of approximately 0.2ha of Ribbon Gum Forest/fragmented Ribbon Gum. This is not considered to be significant.

ii) The proposed action will not further fragment existing forest habitat.

iii) The existing bushland within the Subject Site is not critically important to the long-term survival of threatened species in the locality.

For forest dependant birds such as the Gang-gang Cockatoo, Little Eagle, Scarlet Robin and Flame Robin the loss of approximately 0.2ha of Ribbon Gum forest is not critically important as the loss will be within fragmented forest and not involve the loss of hollow-bearing trees that may be used by the Gang-gang Cockatoo for nesting. These species have large home ranges and the loss of this area is small in comparison to those ranges.

For microbats such as the Eastern Bent-wing Bat, Eastern False Pipistrelle, Greater Broad-nosed Bat, Yellow-bellied Sheathtail Bat and Large-footed Myotis the loss of approximately 0.2ha of Ribbon Gum forest is not critically important as the loss will be within fragmented forest and not involve the loss of hollow-bearing trees that may be used as roost sites. These species have large home ranges and the loss of this area of potential foraging habitat is small in comparison to those ranges.

Potential habitat for Majors Creek Leek Orchid at the subject site will be fenced and protected from grazing and further disturbance. Potential habitat for the species will therefore not be removed, modified, fragmented or isolated.

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

The DECCW website was searched for critical habitat listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Climate Change. Currently (last updated March 2008) critical habitat has been declared for Little Penguin population at Sydney's North Harbour, Mitchell's rainforest snail in Scotts Island Nature Reserve, Wollemi Pine and Gould's Petrel. There are two recommendations for critical habitat one for the Eastern suburbs Banksia scrub endangered ecological community and the Bomaderry Zieria within the Bomaderry Creek bushland.

The Project shall not have an adverse effect on critical habitat.

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

A recovery plan has not been prepared for the Gang-gang Cockatoo, Little Eagle, Scarlet Robin, Flame Robin or any species of microbat. However, any action to remove potential, foraging or dispersal habitat would not be consistent with the objectives or actions within any recovery plan, should one be developed. The action to remove Ribbon Gum Forest and native dominated pasture is inconsistent with recovery of threatened species. Actions that promote the recovery of a species by the conservation of existing habitat and revegetation works to repair damaged landscapes is considered applicable to objectives or actions in recovery plans. The loss of any habitat is not consistent with the objectives of recovery plans but the proposed amelioration measures are consistent with recovery plans.

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

The removal of native vegetation is considered a key threatening process under Part 4 of the TSC Act. The proposed action will require the removal of a non-viable strip of Natural Temperate Grassland and disturbed native dominated pasture.

Conclusion

Based on the above impact assessment, the Project will not have a significant impact on listed threatened species such that viable local populations of species are likely to be placed at risk of extinction.

6.4 EPBC ACT IMPACT ASSESSMENT

Under Part 9 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), any action that has, or is likely to have, a significant impact on a matter of National Environmental Significance (NES), is subject to a referral and assessment process and may progress only with the approval of the Commonwealth Minister for Environment. An action is defined as a Project, development, undertaking, activity (or series of activities), or alterations to any of these. The EPBC Act currently identifies seven matters of national environmental significance.

- World Heritage properties.
- National Heritage places.
- Ramsar wetlands of international importance.
- Listed threatened species and ecological communities.
- Listed migratory species.
- Commonwealth marine areas.
- Nuclear actions.

This section provides a detailed assessment of the anticipated Project-related impacts on species and ecological communities listed under the EPBC Act, taking into account the recommendations presented in Section 5.

There are two matters of national environmental significant that warrant consideration, namely threatened and migratory species. The Ribbon Gum Forest recorded within the Subject Site is not listed by the EPBC Act an endangered ecological community. Natural Temperate Grassland is present at one location within the site as an interrupted strip of <5m width present above an eroding gully and native pasture. The total area of the Native Grassland is small and not considered viable due to long borders location between disturbed grassland and an eroding slope.

The EPBC Act listed species that may occur within the Subject Site are provided in **Table 13.** The habitat used by those species is detailed in **Table 14.** This information is provided to allow an assessment of the likelihood of these species occurring within the Subject Site or being impacted by the proposed actions.

Table 13
Listed Species with the Potential to Occur Within the Subject Site

Scientific Name	Common Name	Migratory	Vulnerable or endangered
Haliaeetus leucogaster	White-bellied Sea Eagle	Listed	
Merops ornatus	Rainbow Bee-eater	Listed	
Acrocephalus stentoreus	Clamorous Reed-Warbler	Listed	
Hirundapus caudacutus	White-throated Needletail	Listed	
Danaus plexippus	Wanderer Butterfly	Listed	
Ardea alba	Great Egret, White Egret	Listed	
Ardea ibis	Cattle Egret	Listed	
Gallinago hardwickii	Latham's Snipe	Listed	
Rostratula benghalensis	Painted Snipe	Listed	
Monarcha melanopsis	Black-faced Monarch	Listed	
Myiagra cyanoleuca	Satin Flycatcher	Listed	
Rhipidura rufifrons	Rufous Fantail	Listed	
Xanthomyza phrygia	Regent Honeyeater	Listed	Endangered
Apus pacificus	Fork-tailed Swift	Listed	
Pteropus poliocephalus	Grey-headed Flying Fox		Vulnerable
Pseudomys fumeus	Smoky Mouse		Endangered
Lathanus discolour	Swift Parrot		Endangered
Delma impar	Striped Legless Lizard		Vulnerable
Hoplocephalus bungaroides	Broad-headed Snake		Vulnerable
Heleioporus australiacus	Giant Burrowing Frog		Vulnerable
Litoria littlejohni	Littlejohn's Tree Frog		Vulnerable
Litoria raniformis	Southern Bell Frog		Vulnerable
Eucalyptus kartzoffiana	Araluen Gum		Vulnerable
Macquaria australasica	Macquarie Perch		Endangered
Prototroctes maraena	Australian Grayling		Vulnerable
Leucochrysum albicans var. tricolor	Horay Sunray		Endangered
Thesium australe	Austral Toadflax		Vulnerable
Caladenia tessellata	Thick-lipped Spider-orchid		Vulnerable
Natural Temperate Grasslands of the Southern Tablelands (NSW and ACT) (EPBC community)			Endangered
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland			Critically Endangered

Table 14
Habitat Preferences of EPBC Act Species and Applicability to the Subject Site

Common Name	Habitat Preference	Habitat available within Subject Site?
White-bellied Sea Eagle	Coastal fringes and large rivers	No
Rainbow Bee-eater	Large rivers with sandy banks	No
Clamorous Reed-Warbler	Dense reed beds beside rivers and wetlands	No
White-throated Needletail	Aerial – follows summer storm fronts but on occasion may land on trees	Yes
Wanderer Butterfly	Woodlands and disturbed areas	Yes
Great Egret	Dams, billabongs and rivers	Yes
Cattle Egret	Open paddocks with cattle	Yes
Latham's Snipe	Dams, wetlands and mud flats	No
Painted Snipe	Temporary or infrequently filled wetlands	No
Black-faced Monarch	Tall open forest and closed forest	Yes
Satin Flycatcher	Woodlands and open forest	Yes
Rufous Fantail	Tall open forest and closed forest	Yes
Regent Honeyeater	Box woodlands	Yes
Fork-tailed Swift	Arial, over a variety of habitats	Yes
Grey-headed Flying Fox	Range of native vegetation at low altitude	No
Smoky Mouse	Heath on ridge tops and slopes in sclerophyll forest, heathland and open-forest	No
Swift Parrot	Over-wintering habitat on the mainland is the box-ironbark forests and woodlands.	Yes
Striped Legless Lizard	Native temperate grasslands	Yes
Broad-headed Snake	Sandstone escarpments within 200km of Sydney	No
Giant Burrowing Frog	Heath and woodland on sandstone	No
Littlejohn's Tree Frog	Heath and woodland over 10m asl	No
Southern Bell Frog	Creeks with secondary billabongs that have Cumbungi	Yes
Macquarie Perch	Clear creeks at low altitude	No
Australian Grayling	Clear creeks running through native vegetation	No
Araluen Gum	Grows near rivers, in grassy or shrubby woodland or in wet sclerophyll forest on moderately fertile sandy soil on granite.	No
Austral Toadflax	Damp sites in association with Kangaroo Grass in grassland or grassy woodland.	No
Thick-lipped Spider-orchid	Grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil.	No

There are ten species that may use the site on occasion. These species of bird are breeding spring migrants in the Perlang Local Government Area with nesting occurring primarily beside creeks in rainforest gullies. The Black-faced Monarch was detected on the site and the White-throated Needletail was observed flying over the site. The direct impacts on listed threatened species and migratory species is considered to be unlikely. Consequently, a referral to DEWHA under the EPBC Act is not warranted. By applying the Commonwealth's criteria for significance the proposed development does not need to be referred to the Commonwealth Minister for the Environment.

Table 15
EPA Impact assessment

Natural heritage element	Potential impact			Proposed safeguards or mitigation measures
	Yes or No	Likely impact:	Reasoning	
Fauna	Yes	Negligible	The Gang-gang Cockatoo, Flame Robin and Monarch Flycatcher were observed on the site. The site supports habitat for the White-throated Needletail, Wanderer Butterfly, Great Egret, Cattle Egret, Fork-tailed Swift, Satin Flycatcher, Rufous Fantail, Regent Honeyeater, Swift Parrot, Black_faced Monarch, Striped Legless Lizard and Southern Bell Frog. An assessment of the impact of the threatened species using the EPBC guidelines indicates that the proposed development will not lead to a long-term decrease in the size of a population and /or potentially disrupt the breeding cycle of a population, and would reduce the area of occupancy of the species, or modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, and interfere with the recovery of the species.	The retention of native vegetation including modified grasslands
Flora	No	Not significant under current listings	No species listed on the EPBC Act located.	See amelioration proposals
	Yes	Negligible	Natural Temperate Grasslands of the Southern Tablelands exists as a small fragmented strip beside an eroding creek edge.	The retention of modified grasslands and no phosphate based fertilisers to be applied to pasture

6.4.1 SEPP 44 Assessment

The Koala has lost such a significant amount of its habitat in NSW that in 1995 State Environmental Planning Policy No 44—Koala Habitat Protection (SEPP 44) was introduced to aid the conservation of the species. The aim of this policy is for Local Government to identify "Core Koala Habitat" and to encourage these areas to be included in environment protection zones (Department Of Planning Circular No. B35). Palerang Local Government Area (LGA) has only recently been formed by the augmentation of several other local government areas and consequently is not listed on Schedule 1 of SEPP 44 to which this SEPP applies. However, prior to the amalgamation Tallaganda was listed on Schedule 1 of SEPP 44 and so by default SEPP 44 applies to the Subject Site.

Palerang Council has not produced a Plan of Management for Koala. The Survey Area contains Ribbon Gum, which is a nominated 'feed tree species' in Schedule 2 of SEPP 44. The proportion of Ribbon Gum within the Subject site at the Dargues Reef area constitute more than 15% of the total number of trees in the upper strata in portions of the land. As a result, vegetated sections of the Subject Site may be classified as "Potential Koala Habitat"

No Koala scats or scratches were located within the Subject Site and as a consequence of previous clearing of forest in the Locality Koala are unlikely to use the Subject Site. Based on these facts SEPP 44 does apply to the Subject Site.

7. BIODIVERSITY STRATEGY

7.1 OVERVIEW OF THE BIODIVERSITY STRATEGY

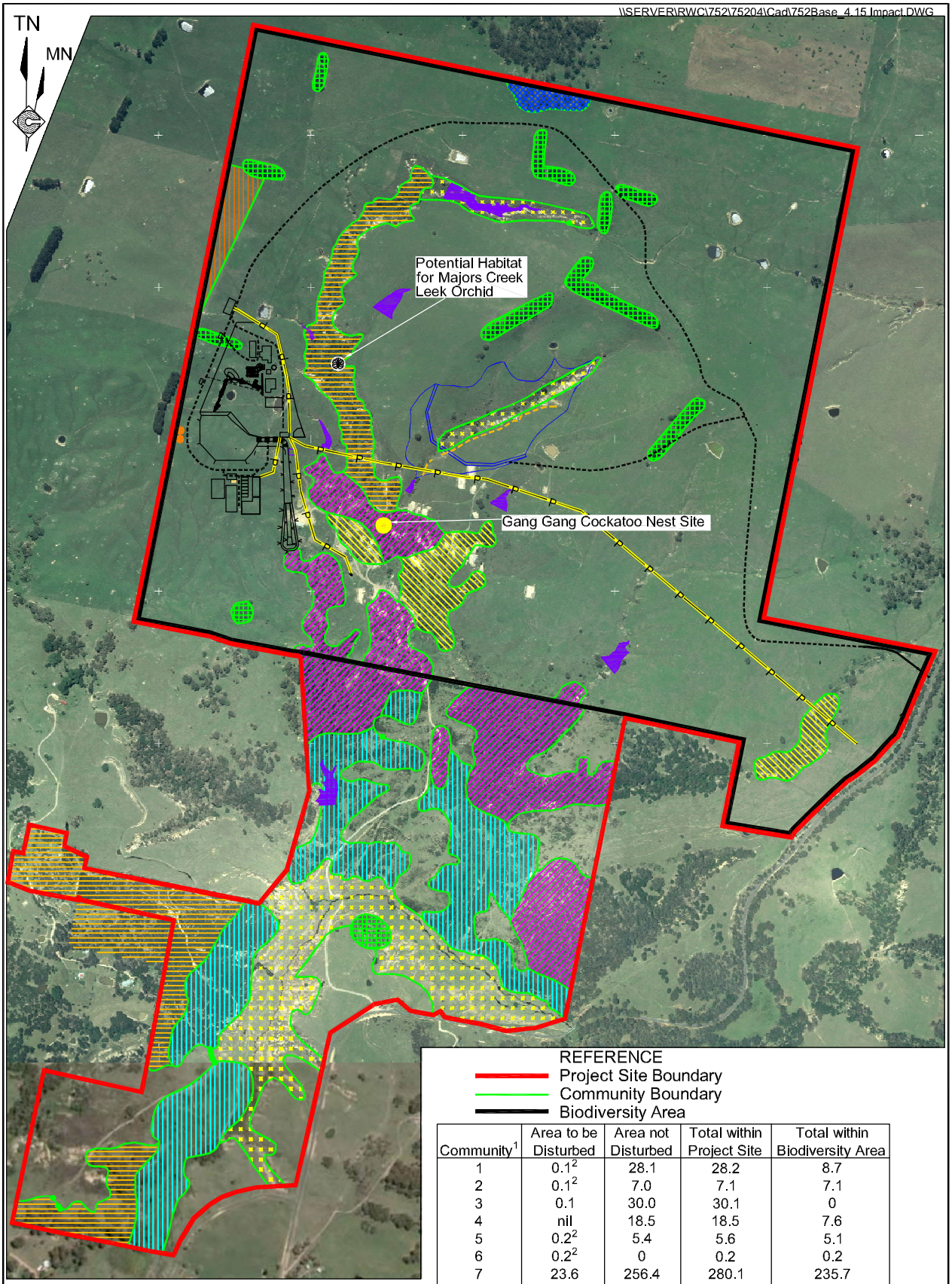
The Biodiversity Offset Strategy is presented in detail in Section 2.15 of the Environmental Assessment. The advice of DECCW has been sought during preparation of the strategy and it is anticipated that the Department of Planning would seek the concurrence of DECCW when determining the adequacy of the strategy. In accordance with the document Draft Guidelines for Threatened Species Assessment: Guidelines for developments and activities published by the then Departments of Environment and Climate Change and Primary industries in 2005, the Project has, to the greatest extent possible, sought to avoid and then mitigate adverse, Project-related impacts on the biodiversity values of the Project Site.

In summary, the Proponent would protect and manage the northern section of the Project Site (see **Figure 7**) for the purposes of biodiversity. The strategy would involve the following.

- Identification and fencing, where required, of areas of Ribbon Gum Forest, including areas of fragmented Ribbon Gum Forest, creek bank stabilisation, active mining and ongoing rehabilitation.
- Ameliorative planting of indigenous tree and shrub species within areas of Ribbon Gum Forest to provide further habitat for threatened and other native species.
- Continued soil stabilisation works, including planting of suitable species, adjacent to existing drainage lines to limit further gully development and stabilise those drainage lines in the long term.
- Continued grazing of areas of grassland / pasture in a manner that would ensure that the biodiversity value of those grasslands / pastures is improved over time. This may involve limiting the times of year in which grazing is permitted and ensuring that an appropriate biomass (stocking rates) levels are maintained.
- Ensure that all other agricultural activities are consistent with increased biodiversity value of the grassland / pasture areas, including refraining from the use of inappropriate fertilisers or tilling the ground.
- Collect and spread the seed of suitable native grass species within grassland areas.
- Manage weeds and feral animals within the Biodiversity Area and elsewhere within the Project Site through annual weed and pest inspection and eradication programs.

The strategy would indicatively be incorporated into a *Property Vegetation Plan* prepared in consultation with DECCW and the Southern Rivers Catchment Management Authority and would be secured in perpetuity.

Figure 7 presents the areas of vegetation within the Project Site that would be disturbed and the areas that would be preserved within the Biodiversity Area.



Community[1]	Area to be Disturbed	Area not Disturbed	Total within Project Site	Total within Biodiversity Area
1	0.1[2]	28.1	28.2	8.7
2	0.1[2]	7.0	7.1	7.1
3	0.1	30.0	30.1	0
4	nil	18.5	18.5	7.6
5	0.2[2]	5.4	5.6	5.1
6	0.2[2]	0	0.2	0.2
7	23.6	256.4	280.1	235.7
8	nil	2.5	2.5	2.5
9	2.2	20.9	23.1	3.9
10	nil	1.3	1.3	1.3
Total	**26.5**	**370.1**	**396.6**	**272.1**

Note [1]: See Figure 4.14
Note [2]: Area nominal only

SCALE 1:15 000

250 0 250 500 750 m

Base Photo Source: Geo-spectrum (Australia) Pty Ltd - Date of Photo: 20 February 2010

Figure 7
VEGETATION COMMUNITY AREAS

7.2 ASSESSMENT OF THE BIODIVERSITY OFFSET STRATEGY

DECCW has established thirteen principles that are used as a guide to ascertain if proposed biodiversity offsets will achieve the desired conservation outcomes. These principals are presented in Appendix 2 of the document *Guidelines for Biodiversity Certification of Environmental Planning Instruments* published by the then Department of Environment and Climate Change. Each of these principles are addressed below.

1. **Impacts must be avoided first by using prevention and mitigation measures.**

   The Project has been designed to ensure that the minimum area is disturbed. Measures that have been implements include the following.

   - Designing the proposed mining operations as an underground mine rather than an open cut to minimise the area.
   - Redesigning and relocating the box cut and other infrastructure in the vicinity of the Project Site to ensure that no hollow-bearing trees would be disturbed.
   - Locating the Tailings Storage Facility at the top of an ephemeral drainage line to ensure that the facility occupies the minimum area possible.

2. **All regulatory requirements must be met.**

   The Proponent states that all regulatory requirements for the Project would be complied with.

3. **Offsets must never reward ongoing poor performance.**

   The Proponent contends that it's existing environmental record is of a high standard. Examples of appropriate environmental management include the following.

   - Management of weeds within the northern section of the Project Site. It is noted that the southern section of the Project Site was purchased by the Proponent in 2010 and ongoing weed management programs will be extended to those lands.
   - Management of exploration operations in a manner that ensure that the resident population of Gang-gang Cockatoo have remained within the Project Site.

4. **Offsets will complement other government programs.**

   The Biodiversity Strategy would complement existing NSW Government conservation objectives as the biodiversity area would preserve an area of native-dominated pasture which would be managed in a manner that would ensure the re-establishment of native grasses.

   Majors Creek Landcare has conducted revegetation and fenced off one eroded gully in the recently acquired land. The proposed actions would also complement this program.

5. Offsets must be underpinned by sound ecological principles.

The proposed Biodiversity Strategy:

- reflects the requirement to re-establish areas of native grasslands within the area surrounding the Project Site;
- would permit the ongoing beneficial use of the Biodiversity Area, ensuring that resources remain available to manage the land in an appropriate manner; and
- would protect those sections of the Biodiversity Area that are currently forested and would, through the exclusion of stock, ensure that the understory and shrub layers within those section are permitted to regenerate.

6. Offsets should aim to result in a net improvement in biodiversity over time.

The Biodiversity Strategy would, through appropriate land management, encourage the re-emergence of native grassland within cleared sections of the Project Site while facilitating the re-establishment of groundcover and shrub layers within areas of Ribbon Gum Forest. This would result in net improvement in biodiversity over time. In addition, continued land stabilisation works would result in the stabilisation of areas of active erosion within the subject site.

7. Offsets must be enduring and they must offset the impact of the development for the period that the impact occurs.

The Proponent proposes to secure the Biodiversity Offset in perpetuity.

8. Offsets should be agreed prior to the impact occurring.

The Proponent proposes to prepare a *Property Vegetation Plan* in consultation with DECCW and the Southern Rivers Catchment Management Authority within 12 months of the receipt of project approval, should it be granted.

9. Offsets must be quantifiable and the impacts and benefits must be reliably estimated.

Figure 7 presents the areas that would be disturbed by the Project and those that would be preserved within the Biodiversity Area. The quantification of offsets shall include areas (hectares) of land fenced from grazing animals, number and species of trees planted, cost of trees and materials associated with revegetation, area treated with herbicides and monitoring. The monitoring shall include photo-point records of revegetation and weed infested areas, monitoring the vegetation at quadrats and avifauna at sites.

10. Offsets must be targeted.

The Biodiversity Strategy would preserve and protect similar habitat to the habitat that would be disturbed

11. Offsets must be located appropriately.

The Biodiversity Area is entirely within the Project Site and surrounds the areas of proposed disturbance.

12. Offsets must be supplementary.

The biodiversity offset areas are not protected by existing covenants or other measures and not funded by other schemes. With the exception of limited funds provided to assist with creek bank stabilisation, there have been no incentive funds provided under previous management.

13. Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.

The Proponent anticipates that the project approval, should it be granted, would include a requirement to implement the proposed Biodiversity Strategy, including securing the biodiversity area to the satisfaction of the DECCW. In addition, the Proponent would undertake internal audits and monitoring of the biodiversity offset strategy and areas to determine that the proposed actions are leading to positive biodiversity outcomes.

In the event that the Proponent sells the land within the biodiversity area, subsequent purchasers would be bound by the *Property Vegetation Plan* that the Proponent would prepare.

8. CONCLUSIONS

One species, the Agile Antechinus, of native small ground dwelling mammal and three common species of arboreal mammal and seven common species of bat were identified within the Subject Site. The medium to large ground dwelling mammals observed within the Subject Site included the Swamp Wallaby, Eastern Grey Kangaroo, Wombat, Rabbit and Red Fox. The Echidna was observed close to the site and has been seen by other parties on the Subject Site. All these species are common within New South Wales or are exotic. Seven species of reptile and seven species of frog were detected on the site. All species of herpetofauna detected are common within the local area. Two species of fish observed in Majors Creek are considered common.

Two threatened species of fauna, the Gang-gang Cockatoo and Flame Robin were detected during the survey. A pair of Gang-gang Cockatoo was observed nesting on the Subject site in 2007 and twenty animals were observed in February 2010. The Flame Robin was observed in degraded land beside Majors Creek. These species have large home ranges and is highly seasonal in its occurrence in the area. No threatened species of flora was located within the Subject Site. The development of the mine is not considered to be a significant impact but part of the cumulative loss of habitat.

In line with the findings of the Part 3A assessment under the EP&A Act, it is considered that the Project would be unlikely to have a significant impact on any threatened species or endangered ecological communities currently listed under the TSC Act. Application of the EPBC Act also found that the Project would be unlikely to have a significant impact on any threatened species or EEC's. Therefore, a Species Impact Statement or Referral to the Department of Environment and Heritage (DEH) is not required.

Acknowledgements

We thank the Proponent for **Figure 1, 2** and **3**. R.W. Corkery & Co. Pty. Limited provided the Figures. Brian James provided the comprehensive bird list for the Subject Area.

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Appendices

(No. of pages excluding this page = 71)

Appendix 1 **Director-General's Requirements**

Appendix 2 **Fauna detected within the Subject Site**

Appendix 3 **Native flora located within the Subject Site**

Appendix 4 **Native flora located within quadrats and along transects**

Appendix 5 **Curriculum vitae of participating consultants**

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Appendix 1

Director-General's Requirements

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Table A1.16
Director-General's Requirements
(Department of Planning – 23 April 2010)

Paraphrased Requirement	Relevant EA Section(s)
BIODIVERSITY	
Including: • accurate estimates of any vegetation disturbance associated with the Project; • impacts on threatened species, populations or ecological communities; critical habitats; and native vegetation generally; • a detailed description of the measures that would be implemented to maintain or improve the regional biodiversity values in the medium to long term;	Figure 7 7 6

Table A1.17
Coverage of Environmental Issues

Page 1 of 7

Government Agency	Paraphrased Requirement	Relevant EA Section(s)
	FLORA AND FAUNA	
Department of Environment, Climate Change & Water (01/04/10)	A number of threatened entities are known to occur or have potential to occur in the Majors Creek area. A complete fauna and flora survey should be conducted and documented in accordance with the draft "Guideline for Threatened Species Assessment" (DEC and DPI, 2005) as it provides the assessment framework for threatened species issues associated with the site. All survey work should be undertaken at the appropriate time of year for each species to maximise the survey results.	3
	Of particular concern to DECCW is the potential for the Majors Creek Leek Orchid on site. This critically endangered species has only been identified on a site near the Project site, and any occurrence of this species must be recorded for further investigation by DECCW.	3.2
	The Project site may also support Endangered Ecological Communities (EEC). The EA must describe actions proposed to avoid or mitigate impacts caused by the Project for all threatened species found or likely to be found at the site. Threatened species that could potentially occur onsite and should be considered are listed in Table 1 below.	6
	The locations of the *subject species*, *populations* or *ecological communities* recorded in any survey conducted for the purposes of the EA shall be represented on a map of the *study area* that shows the Project (preferred scale 1:4,000 or finer).	Figures

Table 1
Coverage of Environmental Issues (cont'd)

<table>
<tr><th>Government Agency</th><th>Paraphrased Requirement</th><th>Relevant EA Section(s)</th></tr>
<tr><td colspan="3">FLORA AND FAUNA (cont'd)</td></tr>
<tr><td rowspan="3">Department of Environment, Climate Change & Water (01/04/10)</td><td>Likely impacts on regionally significant, protected, and threatened species and their habitats need to be assessed, evaluated and reported. The assessment should specifically report on the considerations listed in Step 3 of the Draft Threatened Species Assessment Guidelines (DECC and DPI, 2005) as stated below:

Step 3, Involves identifying not only the magnitude and extent of impacts but also the significance of the impacts as related to the conservation importance of the habitat, individuals and population likely to be affected.

The EA should clearly state whether it meets each of the key thresholds set out in Step 5 of the draft guidelines and describe the actions that will be taken to avoid or mitigate impacts or compensate to prevent unavoidable impacts of the Project on threatened species, populations, ecological communities, or their habitats. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after the measures are implemented.</td><td></td></tr>
<tr><td>For the purposes of this Evaluation of Impacts (EI), the species listed below are to be addressed as subject species:

<table>
<tr><td>FAUNA</td><td>Hooded Robin</td></tr>
<tr><td>Giant Burrowing Frog</td><td>Scarlet Robin</td></tr>
<tr><td>Littlejohn's Tree Frog</td><td>Flame Robin</td></tr>
<tr><td>Southern Bell Frog</td><td>Pink Robin</td></tr>
<tr><td>Striped Legless Lizard</td><td>Barking Owl</td></tr>
<tr><td>Koala</td><td>Powerful Owl</td></tr>
<tr><td>Squirrel Glider</td><td>Gang-gang Cockatoo</td></tr>
<tr><td>Yellow-bellied Glider</td><td>Glossy Black-Cockatoo</td></tr>
<tr><td>Spotted-tailed Quoll</td><td>FLORA</td></tr>
<tr><td>White-footed Dunnart</td><td>Araluen Gum</td></tr>
<tr><td>Eastern Pygmy Possum</td><td>Araluen Zieria</td></tr>
<tr><td>Eastern False Pipistrelle</td><td>Austral toadflax</td></tr>
<tr><td>Eastern Bentwing Bat</td><td>Dense Cord-rush</td></tr>
<tr><td>Greater Broad-nosed Bat</td><td>Majors Creek Leek Orchid</td></tr>
<tr><td>Golden-tipped Bat</td><td>Mauve Burr Daisy</td></tr>
<tr><td>Large-footed Myotis</td><td>Michelago Parrot-Pea</td></tr>
<tr><td>Yellow-bellied Sheathtail-bat</td><td>Pale Golden Moths</td></tr>
<tr><td>Little Eagle</td><td>Small Snake Orchid</td></tr>
<tr><td>Square-tailed Kite</td><td>Small-leaved Gum</td></tr>
<tr><td>Brown Treecreeper</td><td>Tangled Bedstraw</td></tr>
<tr><td>Diamond Firetail</td><td></td></tr>
</table>
</td><td>2 (Table 2)

3.4

6</td></tr>
<tr><td>In determining whether other entities should also be addressed as subject species, populations and ecological communities, consideration shall be given to the habitat types present within the study area, recent records of threatened species, populations or ecological communities in the locality and the known distributions of threatened species, populations and ecological communities. This analysis and its conclusion are to be documented in the Evaluation of Impacts.</td><td>6.2</td></tr>
</table>

Table 1
Coverage of Environmental Issues (cont'd)

Government Agency	Paraphrased Requirement	Relevant EA Section(s)
FLORA AND FAUNA (cont'd)		
Department of Environment, Climate Change & Water (01/04/10)	Databases such as the DECCW Atlas of NSW Wildlife and BioNet, as well as databases held by the Australian Museum and Royal Botanic Gardens, should be consulted to assist in compiling the list of possible entities to be analysed.	**2**
	A description of habitats including such components as the frequency of tree hollows, the presence of wetlands, the density of understorey vegetation, the composition of the ground cover, the soil type and the presence of heath and permanent or ephemeral swamps shall be given. The condition of these habitats within the study area shall be discussed, including the prevalence of introduced species. A description of the habitat requirements of threatened species, populations or ecological communities likely to occur in the study area shall be provided.	4.2.1 4.3.3
	Any areas which may provide habitat connectivity between the study area and adjacent areas of likely habitat for subject species, populations or ecological communities shall be identified and described.	5.1
	In defining the study area, consideration shall be given to possible indirect impacts of the proposed action on species/habitats in and surrounding the Subject Site. These could include impacts arising from altered fire and hydrology regimes, soil erosion or pollution, fencing, habitat fragmentation and disruption of wildlife movement corridors, edge effects, altered light and noise regimes, disturbance of roosting areas or other impacts due to increased use of the area by humans, and the impacts of increased levels of domestic and feral predators.	6.3
	Survey technique(s) shall be described and a reference given, where available, outlining the survey technique employed.	3
	Survey site(s) shall be identified on a map with a clear legend. The size, orientation and dimensions of quadrant or length of transect shall be clearly noted for each type of survey technique undertaken. Full AMG grid references for the survey site(s) shall be provided.	Figure 3 3.2
	DECCW survey proformas are to be used by field staff when applying a range of standard fauna survey techniques. Copies of standard proformas are included in Appendix 2 to these DGEARs. Digital copies of these proformas can be requested from the nominated DECCW contact officer. These proformas shall be used by field staff when undertaking fauna surveys and completed data sheets are to be included as an appendix to the Evaluation of Impacts.	Appendix 4
	The time invested in each survey technique shall be summarised in the Evaluation of Impacts, based on completed proformas, e.g. number of person hours / transect, duration of call playback, number of nights that traps are set.	Table 4

Table 1
Coverage of Environmental Issues (cont'd)

Government Agency	Paraphrased Requirement	Relevant EA Section(s)
	FLORA AND FAUNA (cont'd)	
Department of Environment, Climate Change & Water (01/04/10)	Personnel details including name of surveyor(s), contact phone number, qualifications and experience must be included. The person who identified records (e.g. Anabat, hair tubes, scat analysis) shall also be identified in this manner.	Appendix 5
	Environmental conditions during the survey shall be noted from the commencement of each survey technique until its completion. These conditions must be documented in the Evaluation of Impacts.	Appendix 4
	An assessment of the efficacy of each survey regime in detecting each species under the intensity utilised by the study is to be provided.	4.3 and 4.4
	A full list of all flora and fauna species recorded during the course of surveys shall be included (such information is indicative of the habitat quality of the site).	Appendix 2 3
	Appendix 1 of Attachment B of the DECCW letter details the specific survey requirements for the subject species, populations or ecological communities identified in Table 1 of these DGEARs. The flora and fauna survey of the study area must include the use of these survey methods.	3.4
	The remaining requirements need only be addressed for those threatened species or populations that are likely to be affected by the Project. • Discussion of local and regional abundance o Discussion of other known local populations o Discussion of habitat utilisation o Description of vegetation o Discussion of corridors • Assessment of Habitat o Description of Habitat Values o Distribution and condition of Regional Habitats • Discussion of Conservation Status	6.3
	In accordance with the Draft Guidelines for Threatened Species Assessment policy of Improve or Maintain, the ameliorative measures described for this development should meet the improve or maintain test for biodiversity values.	5
	Consideration shall be given to the information contained in approved and draft recovery plans or threat abatement plans for existing taxa, known or likely to occur in the study area, and whether any recommendation is applicable to the Project.	6.3
	The development of long-term management strategies shall be considered to protect areas within the study area which are of particular importance for the subject species, populations or ecological communities likely to be affected by the Project.	5
	i.	

Table 1
Coverage of Environmental Issues (cont'd)

Government Agency	Paraphrased Requirement	Relevant EA Section(s)
	FLORA AND FAUNA (cont'd)	
Department of Environment, Climate Change & Water (01/04/10)	For all subject species, populations and ecological communities, the Evaluation of Impacts shall describe the following: a. the location, nature and extent of habitat removal or modification which will result from the action proposed; b. the likely and potential impact of the removal of habitat. Particular attention shall be given to the loss of: ii. Natural temperate grasslands, iii. Grassland habitat for Striped Legless Lizard, iv. Hollow-bearing trees, foraging habitat and termite mounds utilised for breeding, roosting or denning by threatened fauna such as micro-chiropteran bats, small woodland birds and Rosenberg's Goanna respectively, v. Native grassland habitat for the Majors Creek Leek Orchid or Small Snake Orchid, and vi. Loss of food resources and the impact this may have on the subject species, populations or ecological communities.	6
	c. Any direct and indirect impacts of the Project including: i. the fragmentation or isolation of local populations and/or local occurrences, and the increased distance required for the movement of individuals/genetic material between habitat patches, ii. change in vegetation floristics and structure resulting from edge effects, iii. altered hydrology regimes (including increased runoff, raising or lowering of the water table, decrease in habitat due to damming), iv. soil erosion and pollution, particularly associated with changes to nutrient loads and water flow, and the long term impacts on the viability of the EEC's occurring onsite, v. disturbance to feeding or nesting/breeding of species, vi. trampling or other impacts including increase in weeds and compactions of soil due to increased use of the area by humans on the native grassland habitats, vii. habitat fragmentation and disruption of wildlife movement corridors and pollination mechanisms, viii. altered light and noise regimes, ix. the likely contribution of the action proposed to the threatening processes already acting on populations of those subject species or populations and occurrences of subject ecological communities in the locality.	6

Table 1
Coverage of Environmental Issues (cont'd)

Government Agency	Paraphrased Requirement	Relevant EA Section(s)
FLORA AND FAUNA (cont'd)		
Department of Environment, Climate Change & Water (01/04/10)	Any measures proposed to mitigate the effect of the Project on local populations of threatened species and populations and/or local occurrences of ecological communities shall be described. The potential effectiveness of any such amelioration in maintaining a viable local population and/or local occurrence in the short, medium and long term shall be discussed (e.g. fauna underpasses, vegetation management).	5
	The areas proposed to be used for compensatory strategies must be described in full including a detailed description of their biodiversity. These areas should be assessed in accordance with the Principles for the use of biodiversity offsets in NSW.	*Environmental Assessment* 7
	Any proposed pre-construction monitoring plans or on-going monitoring of the effectiveness of the mitigation measures shall be outlined in detail.	5.4
	An evaluation of Impacts must include details of the qualifications and experience in threatened species conservation of the person preparing the statement and of any other person who has conducted research or investigations relied on in preparing the statement.	Appendix 5
	Persons conducting flora and fauna surveys must have appropriate licences or approvals under relevant legislation.	Appendix 6
Council (06/04/10)	A full flora and fauna study should be undertaken using the DECCW guidelines.	3
	There is a significant weed infestation on the subject land, particular on the block adjoining Majors Creek Road. Rehabilitation and mitigation measures should be included in the EIS.	5
NSW Industry and Investment (21/04/10)	The proposed mining development should include consideration of the following issues:	
	• Description of any aquatic environments (watercourses, wetlands) located on the site or adjacent to the site and their regional significance.	4.2
	• Predictions of any impacts of the development upon aquatic environments both on the site and downstream (both temporary and permanent).	Groundwater Assessment
	• Safeguards to mitigate any impacts upon aquatic environments and riparian habitats (e.9. full details of proposed riparian buffer zones and riparian rehabilitation and revegetation plans).	Groundwater Assessment 5
	• Predictions of any impacts upon water quality and any aquatic threatened species, populations and ecological communities listed under the *Fisheries Management Act 1994* (both temporary and permanent).	Groundwater and Surface Water Assessment

Table 1
Coverage of Environmental Issues (cont'd)

Government Agency	Paraphrased Requirement	Relevant EA Section(s)
FLORA AND FAUNA (cont'd)		
NSW Industry and Investment (21/04/10)	• Safeguards to mitigate any impacts upon water quality, including impacts downstream into Majors Creek (e.g. details of proposed mine dewatering management, site stormwater management, and surface and groundwater quality monitoring downstream of the site).	Surface Water Assessment
	• Details of any proposed waterway crossings or possible obstruction of fish passage (e.g. access roads and water supply pipeline crossings).	NA
	• Full details of the proposed tailings storage facility (e.9. dimensions, capacity, construction methods and materials, proposed management and monitoring of any leachate during operation, proposed future removal and rehabilitation of drainage line etc.)	*Environmental Assessment*
	• Full details of proposed management of transport of sulphide concentrate both on site and on public roads, including management of potential spills from pipelines and truck movements.	*Environmental Assessment*
	I&I NSW recommends the inclusion of riparian corridors where possible to provide a buffer between the development areas and adjacent waterways or natural drainage lines to provide protection to riparian and aquatic habitats. Retention and replanting of native riparian vegetation will help to protect receiving waters from erosion and runoff. Where the riparian zone has become degraded or disturbed due to past use, rehabilitation of the zone is recommended including planting of endemic riparian vegetation.	*Environmental Assessment*
	The design and construction of any new or upgraded crossings of Majors Creek should be undertaken in accordance with the Department's *Policy and Guidelines for Fish Friendly Waterway Crossings (2004)* and *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (2004)*. These documents are available on our website www.industry.nsw.gov.au, under 'Aquatic Habitats' and 'Publications'.	NA
VEGETATION		
Department of Environment, Climate Change & Water (01/04/10)	The EA should clearly outline the extent to which the Project footprint will impact on areas of native vegetation.	EA
	Offsetting biodiversity and habitat loss would be required as identified in the threatened species guidelines.	EA

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Appendix 2

Fauna detected within the Subject Site

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Key

Abundance	F	frequent
	C	common
	O	occasional
	R	rare
	C/P	clumps/patches
Survey	P	Quadrats (plots) 1-4
	T	Transects

Family	Scientific Name	1 (P)	2 (T)	3 (P)	4(T)	5 (P)	6 (T)	7(T)	8 (T)	9a (T)	9b (T)	10 (T)	11 (T)	12 (T)	13 (T)	14 (P)	15 (T)	16 (T)
Native species																		
FERNS																		
Adiantaceae	*Cheilanthes sp.*										O							
Aspleniaceae	*Asplenium flabellifolium*							R	O									
Blechnaceae	*Blechnum cartilagineum*							O	O									
	Blechnum nudum								O									
Dennstaedtiaceae	*Pteridium esculentum*		R				O	O					O					
Dicksoniaceae	*Dicksonia antarctica*																	
Osmundaceae	*Todea barbara*							R										
DICOTYLEDONS																		
Apiaceae	*Hydrocotyle laxiflora*	R	O		C	R	O								C	O		
Asteraceae	*Brachycome rigidula*				O													
	Cassinia laevis				R													
	Cassinia trinerva								F									
	Cassinia aculeata		R				R											
	Chrysocephalum apiculatum				O			O		O	C						F	C
	Chrysocephalum semipappposum				R													
	Cymbonotus lawsonianus				R				R									
	Euchiton sp.							C	R	O	O						O	
	Helichrysum scorpioides							C			O		R	R		R		O
	Leptorhynchus squamatus							O										
	Ozothamnus diosmifolius								R									
	Senecio lautus								R									
	Senecio quadridentatus				R			R										
	Solenogyne gunnii							O										O
	Solenogyne sp.																O	
	Vittadinia cuneata							R		O	O						O	
	Vittadinia gracilis							R										
	Vittadinia muelleri										O							
Boraginaceae	*Cynoglossum australe*				R													
Campanulaceae	*Wahlenbergia communis*				O			O			O						O	O
Caryophyllaceae	*Scleranthus biflorus*				O						O						O	O
	Stellaria pungens	R	R	R		R	R											

Chenopodiaceae	*Einadia nutans*	O	O	C	C	O	O		O	O	O			O				O
Clusiaceae	*Hypericum gramineum*	R	R	R			R	R										
Convolvulaceae	*Dichondra repens*				R								R	O				O
	Dichondra spp		O				O											
Crassulaceae	*Crassula sieberiana*				R													
Dilleniaceae	*Hibbertia obtusifolia*				R													
Ericaceae	*Astroloma humifusum*							R			O							
Fabaceae	*Acacia mearnsii*		R		R		R	C	F									
	Acacia implexa										O							
	Acacia melanoxylon		O	R	R		R	C										
	Acacia ulicifolia			R			R											
	Bossiaea buxifolia				R													
	Glycine clandestina		R		O	R	R				O						O	
	Hardenbergia violacea				O						O							
	Desmodium varians	O	O		O	R												
Geraniaceae	*Geranium solanderi var solanderi*		R						C	O	O	O	O		O			
Goodeniaceae	*Goodenia hederacea*	O	O				R											
Haloragaceae	*Gonocarpus tetragynus*		R		C		R	C			O							
Lamiaceae	*Ajuga australis*				R													
Loranthaceae	*Amyema sp.*		R		R		O											
Myrtaceae	*Eucalyptus elata*														C			
	Eucalyptus ovata								O									
	Eucalyptus pauciflora		R						C									
	Eucalyptus radiata				F					O								
	Eucalyptus viminalis	C	O	R	C	C	C		O									
	Kunzea parvifolia		R															
	Leptospermum spp		R					R										
Oxalidaceae	*Oxalis perennans*				O	R												
	Ozothamnus argophyllus									R								
Pittosporaceae	*Bursaria spinosa*		O				O											
Plantaginaceae	*Plantago varia*				C				O									O
	Veronica plebeia				C													
Polygonaceae	*Rumex brownii*								O		O	O		O	C	O	R	
Ranunculaceae	*Ranunculus lappaceus*								O									

Rosaceae	*Acaena novae-zelandiae*	R	O				O							O						
	Acaena ovina			R	O			C	O		O						O			O
	Rubus parvifolius		R	R		R	R	O	C											
Rubiaceae	*Asperula conferta*							R	R		O				O	O	O			
Stylidiaceae	*Stylidium graminifolium*		R																	
Thymelaeaceae	*Pimelea curviflora*							O			O									
MONOCOTYLEDON																				
Cyperaceae	*Carex inversa*							O		O				O	O		O	O		O
Juncaceae	*Juncus australis*							O		O				O	R					
	Juncus sp.																			O
Lomandraceae	*Lomandra filiformis subsp. filiformis*			R	R		O				O									
	Lomandra longifolia		O		O	R	R													
	Lomandra multiflora		O																	
Phormiaceae	*Dianella sp.*										O									
Poaceae	*Aristida ramosa*																			O
	Austrodanthonia eriantha							C							F	O				
	Austrodanthonia fulva													O						
	Austrodanthonia laevis																			O
	Austrodanthonia sp.		O	O	C		O			O	O							O		O
	Austrostipa bigeniculata				O			R		O					C					
	Austrostipa spp.					R														
	Bothriochloa macra																			O
	Chloris truncata										O									
	Dichelachne sp.																	R		
	Elymus scaber														O					
	Eragrostis benthamii																			O
	Eragrostis leptostachya									O				R				O		O
	Hemarthria uncinata								R											
	Lachnagrostis filiformis														O		R			
	Joycea pallida													R						
	Microlaena stipoides	C	C	C	F	R	C		F	F				F	F	F	F			O
	Panicum effusum										O			O				O		O
	Poa labillardierei	O	R	O		O	R			C				F	O	O	O			

	Poa sieberiana																					O	
	Sorghum leiocladum				R						O												
	Sporobolus elongatus												F										
	Themeda australis	R	R		O			R	F													F	C
Exotic species																							
DICOTYLEDONS																							
Asteraceae	*Arctotheca calendula*														O								O
	Cirsium vulgare				R					O							O		O				
	Conyza sp.				O			R	O	O								O					
	Hypochoeris radicata	R	O		C	O	C	C	C	O					C		C	C	C				
	Lactuca serriola								R														
	Onopordum acanthium																	O					
	Taraxacum officinale				O												R		R				
Brassicaceae	*Lepidium ?africanum*										O				R			O					
	Sisymbrium orientale	O	R			R																	
Caryophyllaceae	*Paronychia brasiliensis*				O												O					O	
	Stellaria media																	O					
Chenopodiaceae	*Chenopodium ?detestans*																	O					
Fabaceae	*Cytisus scoparius*		R	R	R	R	R	O	O				F									O	
	Trifolium spp.				O			C		C									O				
	Trifolium repens														F	F	O		O				
	Trifolium ?subterraneum														O	O							
Malvaceae	*Malva parviflora*																		R				
	Modolia caroliniana																	O					
Myrsinaceae	*Anagallis arvensis*							R		O													
Phytolaccaceae	*Phytolacca octandra*																	C					
Plantaginaceae	*Plantago lanceolata*				C			C	C	O					C	C	C	O	O			O	
Polygonaceae	*Acetosella vulgaris*	O	C		C	R	C	C	C	C					C	C	C	O				O	
	Polygonum aviculare																						
	Rumex crispus							C										O					
Solanaceae	*Solanum nigrum*				C				O									O					
Gentianaceae	*Centaurium erythraea*							C															
	Erodium ?moschatum														O	O	O						

Malaceae	*Crataegus monogyna*	R	O		O	R		O	R												
Rosaceae	*Rubus fruticosus*				O			F	C												
MONOCOTYLEDONS																					
Poaceae	*Bromus catharticus*				O			C							O	O					
	Cynodon dactylon											C				C					
	Dactylis glomerata												C								
	Eleusine tristachya															O					
	Festuca sp.															C					
	Holcus lanatus		R	R					R	O					C						
	Lolium perrene											C	C	C	C	C					
	Paspalum dilatatum							O				O	O	C			O				
	Phalaris aquatica									O		O	O	C	O						

(P) 20 X 20M PLOT (T) 100m transect or random meander

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Appendix 2

Native flora within the Subject Site

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Fauna Detected on the Site

Nomenclature is based on Cogger (2000), Van Dyke and Strahan, R. (2008) and Christides and Boles (1994).

Key

Record	W	heard call
	O	observed during survey
	S	scats
	T	trapped
	P	previously detected in 2007
	M	miscellaneous – slothed skin
	*	introduced species

All records were made by either G. Daly or B. Virtue (Gaia Research) except the bird list provided by B. James.

MAMMALS

Family	Species	Common Name	Records
Tachyglossidae	*Tachyglossus aculeatus*	Echidna	O
Dasyuridae	*Antechinus agilis*	Agile Antechinus	T
Vombatidae	*Vombatus ursinus*	Common Wombat	O
Pseudocheiridae	*Pseudocheirus peregrinus*	Common Ringtail Possum	O
Phalangeridae	Trichosurus vulpecula	Common Brushtail Possum	O
Petauridae	*Petaurus breviceps*	Sugar Glider	O
Macropodidae	*Macropus giganteus*	Eastern Grey Kangaroo	O
	Wallabia bicolor	Swamp Wallaby	O
Molossidae	*Tararida australis*	White-striped Mastiff Bat	W
Vespertilionidae	*Chalinolobus morio*	Chocolate Wattle Bat	T
	Vespadelus darlingtoni	Large Forest Bat	T
	Vespadelus regulus	Southern Forest Bat	T
	Vespadelus vulturnus	Little Forest Bat	T
	Nyctophilus geoffroyi	Lesser Long-eared Bat	T
	Nyctophilus gouldii	Gould's Long-eared Bat	T
Muridae	*Rattus rattus*	Black Rat*	T
Leporidae	*Oryctolagus cuniculus*	Rabbit*	O
Canidae	*Vulpes vulpes*	Red Fox*	O

BIRDS

Family	Species	Common Name	James	Gaia
Phasianidae	*Coturnix ypsilophora*	Brown Quail	O	
Anatidae	*Cygnus atratus*	Black Swan	O	
	Tadorna variegata	Australian Shelduck	O	
	Chenonetta jubata	Australian Wood Duck	O	O
	Anus superciliosa	Black Duck	O	O
	Anus rhynchotis	Australasian Shoveler	O	
	Anus gracilis	Grey Teal	O	
	Anus castanea	Chestnut Teal	O	
	Aythya australis	Hardhead	O	
Podicipedidae	*Tachybaptus novaehollandiae*	Australasian Grebe	O	
	Tachybaptus poliocephalus	Hoary-headed Grebe	O	
Phalacrocoracidae	*Phalacrocorax melanoleucos*	Little Pied Cormorant	O	
	Phalacrocorax sulcirostris	Little Black Cormorant	O	
Pelicanidae	*Pelecanus conspicillatus*	Australian Pelican	O	
Ardeidae	*Egretta novaehollandiae*	White Faced Heron	O	
	Egretta garzetta	Little Egret	O	
	Ardea pacifica	Pacific Heron	O	
Threskiornithidae	*Threskiornis molucca*	Australian White Ibis	O	
	Threskiornis spinicollis	Straw-necked Ibis	O	
	Platalea flavipes	Yellow-billed Spoonbill	O	
Accipitridae	*Elanus axillaris*	Black-shouldered Kite	O	
	Accipiter fasciatus	Brown Goshawk	O	
	Aquila audax	Wedge-tailed Eagle	O	O
	Hieraaetus morphnoides	Little Eagle	O	
Falconidae	*Falco berigora*	Brown Falcon	O	
	Falco longipennis	Australian Hobby	O	O
	Falco subniger	Black Falcon	O	
	Falco peregrinus	Peregrine Falcon	O	O
	Falco cenchroides	Nankeen Kestrel	O	O
Rallidae	*Gallinula tenebrosa*	Dusky Moorhen	O	
	Fulica atra	Eurasian Coot	O	
Scolopacidae	*Actitis hypoleucos*	Common Sandpiper	O	
Charadriidae	*Elseyornis melanops*	Black-fronted Dotterel	O	
	Vanellus miles	Masked Lapwing	O	
Columbidae	*Streptopelia chinensis*	Spotted Turtle-dove *	O	
	Macropygia amboinensis	Brown Cuckoo-dove	O	
	Phaps chalcoptera	Common Bronzewing	O	O
	Ocyphaps lophotes	Crested Pigeon	O	
	Leucosarica melanoleuca	Wonga Pigeon		W
Cacatuidae	*Calyptorhynchus funereus*	Yellow-tailed Black-cockatoo	O	O
	Callocephalon fimbriatum	Gang-gang Cockatoo	O	O
	Cacatua roseicapilla	Galah	O	O
	Cacatua sanguinea	Little Corella	O	
	Cacatua galerita	Sulfur-crested Cockatoo	O	O
Psittacidae	*Alisterus scapulasis*	Australian King Parrot	O	
	Platycercus elegans	Crimson Rosella	O	O
	Platycercus eximius	Eastern Rosella	O	O
	Cacatua roseicapilla	Galah	O	O
	Cacatua galerita	Sulfur-crested Cockatoo	O	O
Cuculidae	*Cuculus pallidus*	Pallid Cuckoo	O	
	Cacomantis pyrrhophanus	Fan-tailed Cuckoo	O	O
	Cacomantis variolosus	Brush Cuckoo	W	

BIRDS (cont'd)

Family	Species	Common Name	James	Gaia
Strigidae	*Ninox novaeseelandiae*	Southern Boobook	O	
Podargidae	*Podargus strigoides*	Tawny Frogmouth	O	
Apodidae	*Hirundapus caudacutus*	White-throated Needletail	O	O
	Apus pacificicus	Fork-tailed Swift	O	
Halcyonidae	*Dacelo novaeguineae*	Laughing Kookaburra	O	O
	Todiramphus sancta	Sacred Kingfisher	O	O
Coraciidae	Eurystomus orientalis	Dollarbird	O	W
Climacteridae	*Climacteris leucophaea*	White-throated Treecreeper	O	O
Maluridae	*Malurus cyaneus*	Superb Fairy-wren	O	O
Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote	O	O
	Pardalotus striatus	Striated Pardalote	O	W
	Sericornis frontalis	White-browed Scrubwren	O	O
	Gerygone olivacea	White-throated Gerygone	W	
	Acanthiza reguloides	Buff-rumped Thornbill	O	
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	O	O
	Acanthiza pusilla	Brown Thornbill	O	O
	Acanthiza nana	Yellow Thornbill	O	
	Acanthiza lineata	Striated Thornbill	O	
	Smicrornis brevirostris	Weebill	O	
Meliphagidae	*Anthochaera carunculata*	Red Wattlebird	O	O
	Anthochaera chrysoptera	Little Wattlebird	O	
	Philemon corniculatus	Noisy Friarbird	O	
	Manorina melanocephala	Noisy Miner	O	
	Meliphaga lewinii	Lewin's Honeyeater	O	
	Melithreptus lunatus	White-naped Honeyeater		O
	Lichenostomus chrysops	Yellow-faced Honeyeater	O	O
	Lichenostomus leucotis	White-eared Honeyeater	O	W
	Melithreptus brevirostris	Brown-headed Honeyeater		O
	Phylidonyris novaehollandiae	New Holland Honeyeater		O
	Acanthorhynchus tenuirostris	Eastern Spinebill	O	O
Petroicidae	*Microeca leucophaea*	Jacky Winter	O	O
	Eopsaltria australis	Eastern Yellow Robin		O
	Petroica boodang	Scarlet Robin	O	
	Petroica phoenicea	Flame Robin	O	O
Cinclosomatidae	*Psophodes olivaceus*	Eastern Whipbird	O	O
	Cinclosoma punctatum	Spotted Quail-thrush	O	
Pachycephalidae	*Pachycephala pectoralis*	Golden Whistler	O	W
	Pachycephala rufiventris	Rufous Whistler	O	O
	Colluricincla harmonica	Grey Shrike-thrush		O
Dicruridae	*Rhipidura fuliginosa*	Grey Fantail	O	O
	Rhipidura leucophrys	Willie Wagtail	O	O
	Grallina cyanoleuca	Magpie Lark	O	O
	Monarcha melanopsis	Black-faced Monarch		O
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	O	O
	Lalage sueurii	White-winged Triller	O	O
Artamidae	*Artamus cyanopterus*	Dusky Woodswallow	O	O
	Cracticus torquatus	Grey Butcherbird	O	O
	Gymnorhina tibicen	Australian Magpie	O	O
	Strepera graculina	Pied Currawong	O	O
	Strepera visicolor	Grey Currawong	O	O

BIRDS (cont'd)

Family	Species	Common Name	James	Gaia
Corvidae	*Corvus coronoides*	Australian Raven	O	
	Corvus mellori	Little Raven	O	O
Corcoracidae	*Corcorax melanorhamphos*	White-winged Chough	O	O
Ptilonorhynchidae	*Ptilonorhynchus violaceus*	Satin Bowerbird	O	O
Alaudiea	*Alauda arvensis*	Skylark*	O	
Motacillidae	*Anthus novaeseelandiae*	Richard's Pipit	O	O
Passeridae	*Neochmia temporalis*	Red-browed Firetail	O	O
	Stagonopleura guttata	Diamond Firetail	O	
Fringillidae	*Carduelis carduelis*	European Goldfinch*	O	O
Hirundinidae	*Hirundo neoxena*	Welcome Swallow	O	O
	Hirundo nigricans	Tree Martin	O	
Sylviidae	*Cincloramphus cruralis*	Brown Songlark	O	O
Zosteropidae	*Zosterops lateralis*	Silvereye	O	O
Muscicapidae	*Turdus merula*	Common Blackbird*	O	
	Sturnus vulgaris	Common Starling*	O	O

REPTILES

Family	Species	Common Name	Observation
Agamidae	*Physignathus lesueurii howitti*	Gippsland Water Dragon	O
Scincidae	*Egernia cunninghamiana*	Southern Cunningham's Skink	O
	Eulamprus heatwolei	Southern Water Skink	O
	Hemiergis decresiensis	Three-toed Skink	O
	Saproscincus mustelina	Weasel Skink	O
	Tiliqua scincoides	Eastern Bluetongue Skink	O
Elapidae	*Pseudechis porphyriacus*	Red-bellied Black Snake	M

AMPHIBIANS

Family	Species	Common Name	Observation
Hylidae	*Litoria dentata*	Bleating Tree Frog	W
	Litoria nudidigitus	Southern Green Stream Frog	O
	Litoria lesueurii	Lesueur's Frog	O
	Litoria peroni	Peron's Tree Frog	W
	Litoria verreauxii	Verreaux's Tree Frog	O
Myobatrachidae	*Crinia signifera*	Common Eastern Froglet	W
	Limnodynastes peroni	Striped Marsh Frog	W
	Limnodynastes tasmaniensis	Spotted Grass Frog	W

FISH

Family	Species	Common Name	Observation
Anguillidae	*Anguilla australis*	Eel	O
Galaxiidae	*Galaxias olidus*	Mountain Galaxias	O

Appendix 3

Native flora located within quatrats along transects

(No. of pages excluding this page = 31)

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2010 Elliott and Cage Trapping

Complete one sheet for each site. Ten A size Elliott traps set on ground at 20 m intervals and two cage traps (sardines/oats/p butter) set at a 50 m interval for 3 consecutive nights.

Key: Gx=Ground Elliott No. x, GX=Ground B size Elliott No X (1 or 2), CH=Cage trap

Include all dates (when traps checked), write no captures if nil result.

Region: Palerang LGA – Majors Ck	**Site Name/No:** Ridge beside Spring Ck transect 1
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Daly, G.	**GDA:** 748885 6063069 Alt:
Date: 2-4/2/10	Altitude: 676
Cloud: 8/8	Moon:
Wind Speed: 0	Wind Direction: none
Rain: 0 -1	Temp.: circa 18 ^{0}C

Capt. Date	Species Name	No. Ind.	Sex	Elliott/ Cage	Notes/ Voucher No. Tissues/ Weather/Breeding type
2/2/10	No captures				
3/2/10	No captures				
4/2/10	No captures				

2009 Elliott and Cage Trapping

Complete one sheet for each site. Ten A size Elliott traps set on ground at 20 m intervals and two cage traps (sardines/oats/p butter) set at a 50 m interval for 3 consecutive nights.

Key: Gx=Ground Elliott No. x, GX=Ground B size Elliott No X (1 or 2), CH=Cage trap

Include all dates (when traps checked), write no captures if nil result.

Region: Palerang LGA – Majors Ck	**Site Name/No:** Ridge transect 1
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Daly, G.	**GDA:** 748885 6063069 Alt:
Date: 13-15/10/09	Altitude: 676
Cloud: 8/8	Moon:
Wind Speed: 0	Wind Direction: none
Rain: 0 -1	Temp.: circa 18 ^{0}C

Capt. Date	Species Name	No. Ind.	Sex	Elliott/ Cage	Notes/ Voucher No. Tissues/ Weather/Breeding type
13/10/09	No captures				
14/10/09	No captures				
15/10/09	No captures				

2010 Elliott and Cage Trapping

Complete one sheet for each site. Ten A size Elliott traps set on ground at 20 m intervals and two cage traps (sardines/oats/p butter) set at a 50 m interval for 3 consecutive nights.

Key: Gx=Ground Elliott No. x, GX=Ground B size Elliott No X (1 or 2), CH=Cage trap

4Include all dates (when traps checked), write no captures if nil result.

Region: Palerang LGA – Majors Ck	**Site Name/No:** Beside Spring Ck transect 2
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Daly, G.	**GDA:** 748990 6062980 Alt:
Date: 2-4/2/10	Altitude: 676
Cloud: 8/8	Moon:
Wind Speed: 0	Wind Direction: none
Rain: 0 -1	Temp.: circa 18 ^{0}C

Capt. Date	Species Name	No. Ind.	Sex	Elliott/ Cage	Notes/ Voucher No. Tissues/ Weather/Breeding type
2/2/10					Rat had escaped from cage trap
3/2/10	*Rattus rattus*	1		C1	Euthanased by concussion
3/2/10	*Tiliqua scincoides*	1		E4	
4/2/10	*Rattus rattus*	1		C1	Euthanased by concussion
4/2/10	*Antechinus agilus*	1	F	E6	

2009 Elliott and Cage Trapping

Complete one sheet for each site. Ten A size Elliott traps set on ground at 20 m intervals and two cage traps (sardines/oats/p butter) set at a 50 m interval for 3 consecutive nights.

Key: Gx=Ground Elliott No. x, GX=Ground B size Elliott No X (1 or 2), CH=Cage trap

Include all dates (when traps checked), write no captures if nil result.

Region: Palerang LGA – Majors Ck	**Site Name/No:** Beside Spring Ck transect 2
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Daly, G.	**GDA:** 748990 6062980 Alt:
Date: 2-4/2/10	Altitude: 676
Cloud: 8/8	Moon:
Wind Speed: 0	Wind Direction: none
Rain: 0 -1	Temp.: circa 18 ^{0}C

Capt. Date	Species Name	No. Ind.	Sex	Elliott/ Cage	Notes/ Voucher No. Tissues/ Weather/Breeding type
13/10/09	*Rattus rattus*	1		C1	Euthanased by concussion
14/10/09	*Tiliqua scincoides*	1		C2	
15/10/09	Little Raven	1		C1	
15/10/09	Grey Currawong	1		C2	

2009 Harp Trapping

Region: Palerang LGA – Majors Ck	**Site Name/No:** Spring Creek, harp trap site 1
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Daly, G.	**GDA:** 748994 6062980
Date: 13-15/10/09	Altitude: 676
Cloud: 0	Moon:
Wind Speed: 1-3	Wind Direction: S
Rain: 0	Temp.: circa 8 ^{0}C

Date	Sp Code	Species Name	Sex	F. arm (mm)	Wght (g)	Notes/ Voucher No.
13/10/09		*Chalinolobus morio*	M	40	8.9	
13/10/09		*Chalinolobus morio*	M	39	9.0	
14/10/09		*Chalinolobus morio*	M	39	8.0	
15/10/09		*Nyctophilus geoffroyi*	M			

2010 Harp Trapping

Region: Palerang LGA – Majors Ck	**Site Name/No:** Spring Creek, harp trap 1
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Daly, G.	**GDA:** 748994 6062980
Date: 2-4/2/10	Altitude: 676
Cloud: 8/8	Moon:
Wind Speed: 0	Wind Direction: none
Rain: 0 -1	Temp.: circa 18 ^{0}C

Date	Sp Code	Species Name	Sex	F. arm (mm)	Wght (g)	Notes/ Voucher No.
2/2/10		*Nyctophilus gouldi*	F	41	10.1	
3/2/10		No captures				
4/2/10		*Vespadelus regulus*	M	31	5.3	
4/2/10		*Vespadelus regulus*	F	32	5.8	
4/2/10		*Vespadelus darlingtoni*	F	35	7.4	
4/2/10		*Vespadelus darlingtoni*	F	36	7.3	
4/2/10		*Vespadelus darlingtoni*	M	36	6.9	
4/2/10		*Vespadelus darlingtoni*	M	34	7.0	

2009 Harp Trapping

Region: Palerang LGA – Majors Ck	**Site Name/No:** Uphill from Spring Creek, Harp Trap site 2
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Daly, G.	**GDA:** 749077 6062930
Date: 13-15/ 10/09	Altitude: 682
Cloud: 0	Moon:
Wind Speed: 1-3	Wind Direction: S
Rain: 0	Temp.: circa 8 ^{0}C

Date	Sp Code	Species Name	Sex	F. arm (mm)	Wght (g)	Notes/ Voucher No.
13/10/09		*Vespadelus vulturnus*	M	28	3.5	
14/10/09		No captures				
15/10/09		No captures				

2010 Harp Trapping

Region: Palerang LGA – Majors Ck	**Site Name/No:** Uphill from Spring Creek, Harp trap site 2
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Daly, G.	**GDA:** 749077 6062930
Date: 2-4/2/10	Altitude: 682
Cloud: 8/8	Moon:
Wind Speed: 0	Wind Direction: none
Rain: 0 -1	Temp.: circa 18 ^{0}C

Date	Sp Code	Species Name	Sex	F. arm (mm)	Wght (g)	Notes/ Voucher No.
2/2/10		*Vespadelus vulturnus*	F	29	4.2	
2/2/10		*Vespadelus vulturnus*	M	29	4.4	
2/2/10		*Vespadelus vulturnus*	M	28	3.9	
2/2/10		*Vespadelus vulturnus*	M	28	4.0	
2/2/10		*Vespadelus vulturnus*	M	28	3.6	
2/2/10		*Chalinolobus morio*	F	41	8.6	
3/2/10		*Vespadelus vulturnus*	F	28	3.9	
3/2/10		*Vespadelus vulturnus*	F	28	3.9	
3/2/10		*Vespadelus vulturnus*	M	28	4.0	
4/2/10		No captures				

2009 Harp Trapping

Region: Palerang LGA – Majors Ck	**Site Name/No:** Eroded Gully Uphill from Spring Creek, Harp trap site 3
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Daly, G.	**GDA:** 749211 6062943
Date: 13-15/10/09	Altitude: 700
Cloud: 0	Moon:
Wind Speed: 1-3	Wind Direction: S
Rain: 0	Temp.: circa 8 ^{0}C

Date	Sp Code	Species Name	Sex	F. arm (mm)	Wght (g)	Notes/ Voucher No.
13/10/09		No captures				Trap blown over
14/10/09		No captures				
15/10/09		No captures				

Harp Trapping

Region: Palerang LGA – Majors Ck	**Site Name/No:** Majors Creek, Harp trap site 4
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Daly, G.	**GDA:** 748892 6061994
Date: 13-15/10/09	Altitude: 700
Cloud: 0	Moon:
Wind Speed: 1-3	Wind Direction: S
Rain: 0	Temp.: circa 8 ^{0}C

Date	Sp Code	Species Name	Sex	F. arm (mm)	Wght (g)	Notes/ Voucher No.
13/10/09		No captures				Trap blown over
14/10/09		No captures				
15/10/09		No captures				

2010 Harp Trapping

Region: Palerang LGA – Majors Ck	**Site Name/No:** Majors Ck – under bridge, Harp trap site 5
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Daly, G.	**GDA:** 749481 6061631
Date: 2-4/2/10	Altitude: 634
Cloud: 8/8	Moon:
Wind Speed: 0	Wind Direction: none
Rain: 0 -1	Temp.: circa 18 ^{0}C

Date	Sp Code	Species Name	Sex	F. arm (mm)	Wght (g)	Notes/ Voucher No.
2/2/10		No captures				
3/2/10		No captures				
4/2/10		No captures				

2010 Harp Trapping

Region: Palerang LGA – Majors Ck	**Site Name/No:** Boundary fence, harp trap site 6
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Daly, G.	**GDA:** 748940 6062607
Date: 2-4/2/10	Altitude: 654
Cloud: 8/8	Moon:
Wind Speed: 0	Wind Direction: none
Rain: 0 -1	Temp.: circa 18 ^{0}C

Date	Sp Code	Species Name	Sex	F. arm (mm)	Wght (g)	Notes/ Voucher No.
2/2/10		No captures				
3/2/10		*Nyctophilus geoffroyi*	F	38	7.2	
3/2/10		*Nyctophilus geoffroyi*	F	38		
3/2/10		*Nyctophilus geoffroyi*	F	37	8.7	
3/2/10		*Nyctophilus geoffroyi*	M	35		
3/2/10		*Nyctophilus geoffroyi*	M	36	8.4	
4/2/10		*Vespadelus vulturnus*	F	29	4.3	
4/2/10		*Vespadelus vulturnus*	F	29	4.8	
4/2/10		*Nyctophilus geoffroyi*	F	39	8.8	
4/2/10		*Nyctophilus geoffroyi*	F	35	9.1	
4/2/10		*Nyctophilus geoffroyi*	F	37	10.2	
4/2/10		*Nyctophilus geoffroyi*	F	36	9.1	
4/2/10		*Nyctophilus geoffroyi*	F	39	9.9	
4/2/10		*Nyctophilus geoffroyi*	F	38	8.8	
4/2/10		*Nyctophilus geoffroyi*	M	37	7.5	
4/2/10		*Nyctophilus geoffroyi*	F	39	9.8	
4/2/10		*Nyctophilus geoffroyi*	F	39	9.6	
4/2/10		*Nyctophilus geoffroyi*	F	38	9.4	
4/2/10		*Nyctophilus geoffroyi*	M	38	8.6	
4/2/10		*Nyctophilus gouldi*	M	43	11.2	
4/2/10		*Nyctophilus gouldi*	M	41	10.4	

2009 Spotlighting and or Call Playback

Complete one sheet for each site even if no sightings or calls were recorded. Record all species.

Spotlight (by foot) for 40 min (one person) along transect and within 100m on either side of transect along the road. Conduct before call playback on the same night. All sightings/calls outside 50 m from transect must also be noted.

Key: O = observed, H = heard, I = incisions, IT = In tree, OG = On ground, DA = Dam, EW = Edge water

Call Playback: Listen for10 min. then play tape and then listen for additional 10 min. All sightings/calls outside 50 m from transect must also be noted.

Key: Detection Time: 1 = initial 10 min, 2 = during last 10 min, 3 = during call playback

Region: Palerang LGA – Majors Ck	**Site Name/No:** Ridge & along Spring Ck, Spotlight site 1
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Daly, G.	**GDA:** 748885 6063069 Alt:
Date: 12/10/09	Altitude: 676
Cloud: 0	Start- Finish (EST): 19.53-20.33
Wind Speed: 0 - 3	Wind Direction: S-W
Rain: 0	Temp.: circa 8 ^{0} C

Spotlighting Species Name	No. Ind.	Ob type	Notes/ distance from transect (m)
Common Brushtail Possum	3	O	
Red Fox	2	W	
White-striped mastiff Bat	1	W	
Crinia signifera	7	W	
Limnodynastes peroni	3	W	
Limnodynastes tasmaniensis	5	W	
Litoria verreauxii	3	W	
Call Playback Species Name	No. Ind.	Ob type	Notes/ distance from transect (m) Detection Time i.e. before, during of after broadcast
			Not conducted as very windy

2009 Spotlighting and or Call Playback

Complete one sheet for each site even if no sightings or calls were recorded. Record all species.

Spotlight (by foot) for 40 min (one person) along transect and within 100m on either side of transect along the road. Conduct before call playback on the same night. All sightings/calls outside 50 m from transect must also be noted.

Key: O = observed, H = heard, I = incisions, IT = In tree, OG = On ground, DA = Dam, EW = Edge water

Call Playback: Listen for10 min. then play tape and then listen for additional 10 min. All sightings/calls outside 50 m from transect must also be noted.

Key: Detection Time: 1 = initial 10 min, 2 = during last 10 min, 3 = during call playback

Region: Palerang LGA – Majors Ck	**Site Name/No:** Ridge Spring Ck & along Spring Ck, Spotlight site 1
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Daly, G.	**GDA:** 748885 6063069 Alt:
Date: 13/10/09	Altitude: 676
Cloud: 0	Start- Finish (EST): 19.04 – 19.44
Wind Speed: 0 - 3	Wind Direction: S-W
Rain: 0	Temp.: circa 8 ^{0} C

Spotlighting Species Name	No. Ind.	Ob type	Notes/ distance from transect (m)
Common Brushtail Possum	3	O	
Common Ringtail Possum	1	O	
Eastern Grey Kangaroo	6	O	
Wombat	1	O	
Call Playback Species Name	No. Ind.	Ob type	Notes/ distance from transect (m) Detection Time i.e. before, during of after broadcast

2010 Spotlighting and or Call Playback

Complete one sheet for each site even if no sightings or calls were recorded. Record all species.

Spotlight (by foot) for 40 min (one person) along transect and within 100m on either side of transect along the road. Conduct before call playback on the same night. All sightings/calls outside 50 m from transect must also be noted.

Key: O = observed, H = heard, I = incisions, IT = In tree, OG = On ground, DA = Dam, EW = Edge water

Call Playback: Listen for10 min. then play tape and then listen for additional 10 min. All sightings/calls outside 50 m from transect must also be noted.

Key: Detection Time: 1 = initial 10 min, 2 = during last 10 min, 3 = during call playback

Region: Palerang LGA – Majors Ck	**Site Name/No:** Ridge & along Spring Ck, Spotlight site 1
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Daly, G. and Virtue, B.	**GDA:** 748885 6063069 Alt:
Date: 1/2/10	Altitude: 676
Cloud: 8/8	Start- Finish (EST): 20.01 – 20.21 (Spotlight) = 40 min total
Wind Speed: 0	Start- Finish (EST): 19.43 – 20.00 (Call Playback)
Rain: 0	Temp.: circa 18 ^{0}C

Spotlighting Species Name	No. Ind.	Ob type	Notes/ distance from transect (m)
Common Brushtail Possum	4	O	Spotlight conducted by two persons
Sugar Glider	3	O	
Call Playback Species Name	No. Ind.	Ob type	Notes/ distance from transect (m) Detection Time i.e. before, during of after broadcast
Suite of southern CRA species			No response

2010 Spotlighting and or Call Playback

Complete one sheet for each site even if no sightings or calls were recorded. Record all species.

Spotlight (by foot) for 40 min (one person) along transect and within 100m on either side of transect along the road. Conduct before call playback on the same night. All sightings/calls outside 50 m from transect must also be noted.

Key: O = observed, H = heard, I = incisions, IT = In tree, OG = On ground, DA = Dam, EW = Edge water

Call Playback: Listen for10 min. then play tape and then listen for additional 10 min. All sightings/calls outside 50 m from transect must also be noted.

Key: Detection Time: 1 = initial 10 min, 2 = during last 10 min, 3 = during call playback

Region: Palerang LGA – Majors Ck	**Site Name/No:** Ridge beside Spring Ck & along Spring Ck Spotlight site 1
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Virtue, B.	**GDA:** 748885 6063069 Alt:
Date: 2/2/10	Altitude: 676
Cloud: 8/8	Start- Finish (EST): 21.00 – 21.30 (Spotlight) Total 30 min.
Wind Speed: 0	Start- Finish (EST):
Rain: 0	Temp.: circa 18 ^{0}C

Spotlighting Species Name	No. Ind.	Ob type	Notes/ distance from transect (m)
Common Brushtail Possum	3	O	
Call Playback Species Name	**No. Ind.**	**Ob type**	**Notes/ distance from transect (m) Detection Time i.e. before, during of after broadcast**
			Not undertaken

2009 Spotlighting and or Call Playback

Complete one sheet for each site even if no sightings or calls were recorded. Record all species.

Spotlight (by foot) for 40 min (one person) along transect and within 100m on either side of transect along the road. Conduct before call playback on the same night. All sightings/calls outside 50 m from transect must also be noted.

Key: O = observed, H = heard, I = incisions, IT = In tree, OG = On ground, DA = Dam, EW = Edge water

Call Playback: Listen for10 min. then play tape and then listen for additional 10 min. All sightings/calls outside 50 m from transect must also be noted.

Key: Detection Time: 1 = initial 10 min, 2 = during last 10 min, 3 = during call playback

Region: Palerang LGA – Majors Ck	**Site Name/No:** Boundary fence, spotlight site 2
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Daly, G. and Virtue, B.	**GDA:** 748940 6062607 Alt:
Date: 14/10/09	Altitude: 676
Cloud: 0	Start- Finish (EST): 19.05 – 19.25
Wind Speed: 0 - 1	Wind Direction: S-W
Rain: 0	Temp.: circa 8 ^{0}C

Spotlighting Species Name	No. Ind.	Ob type	Notes/ distance from transect (m)
Sugar Glider	2	O	
Rabbit	1	O	
Call Playback Species Name	No. Ind.	Ob type	Notes/ distance from transect (m) Detection Time i.e. before, during of after broadcast
			Not undertaken

2010 Spotlighting and or Call Playback

Complete one sheet for each site even if no sightings or calls were recorded. Record all species.

Spotlight (by foot) for 40 min (one person) along transect and within 100m on either side of transect along the road. Conduct before call playback on the same night. All sightings/calls outside 50 m from transect must also be noted.

Key: O = observed, H = heard, I = incisions, IT = In tree, OG = On ground, DA = Dam, EW = Edge water

Call Playback: Listen for10 min. then play tape and then listen for additional 10 min. All sightings/calls outside 50 m from transect must also be noted.

Key: Detection Time: 1 = initial 10 min, 2 = during last 10 min, 3 = during call playback

Region: Palerang LGA – Majors Ck	**Site Name/No:** Boundary fence towards shed, Spotlight site 3
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Virtue, B.	**GDA:** 749040 6062807 Alt:
Date: 2/2/10	Altitude: 676
Cloud: 8/8	Start- Finish (EST): 21.00 – 21.30
Wind Speed: 0	Wind Direction: N/A
Rain: 0	Temp.: circa 18 ^{0} C

Spotlighting Species Name	No. Ind.	Ob type	Notes/ distance from transect (m)
Common Brushtail Possum	3	O	
Call Playback Species Name	No. Ind.	Ob type	Notes/ distance from transect (m) Detection Time i.e. before, during of after broadcast
			Not undertaken

2009 Diurnal Birds - Site Based

Complete one sheet for each site even if no sightings or calls were recorded. Record all species.

One recorder per 20 min: 2 ha standard survey site.

Key: O = observed, W = heard, IT = In tree, OG = On ground, AC = flying above canopy, EW = Edge water

Region: Palerang LGA – Majors Ck	**Site Name/No:** Diurnal birds site 1
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Virtue, B.	**GDA:** 748885 6063069 Alt:
Date: 13/10/09	Start-Finish (EST): 7.48 – 8.08
Cloud: 0	Rain: 0
Wind Speed: 1	Wind Direction: S

WITHIN SITE			**OUTSIDE SITE**		
Species Name	No. Ind	Ob type	Species Name	No. Ind	Ob type
Red Wattlebird	2	O	Sulphur-crested Cockatoo	1	O
Yellow-faced Honeyeater	3	O			
Striated Pardalote	2	W			
Black-faced Cuckoo Shrike	1	O			
Crimson Rosella	5	O			
Galah	2	O			
Common Starling	2	O			
Grey Fantail	3	O			
White-throated Treecreeper	1	W			
Grey Shrike-thrush	2	O			
Rufous Whistler	3	W			
White-browed Scrubwren	3	O			
Little Raven	2	O			

2009 Diurnal Birds - Site Based

Complete one sheet for each site even if no sightings or calls were recorded. Record all species.

One recorder per 20 min: 2 ha standard survey site.

Key: O = observed, W = heard, IT = In tree, OG = On ground, AC = flying above canopy, EW = Edge water

Region: Palerang LGA – Majors Ck	**Site Name/No:** Beside Spring Ck, Diurnal bird survey 2
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Virtue, B.	**GDA:** 748990 6062980 Alt:
Date: 13/10/09	Start-Finish (EST): 8.10 – 8.30
Cloud: 0	Rain: 0
Wind Speed: 1	Wind Direction: S

WITHIN SITE			**OUTSIDE SITE**		
Species Name	No. Ind	Ob type	Species Name	No. Ind	Ob type
Eastern Whipbird	1	O	Yellow-faced Honeyeater	1	W
White-browed Scrubwren	2	O	Australian Magpie	1	W
White-throated Treecreeper	1	W	Rufous Whistler	1	W
Little Raven	2	O			
White-winged Chough	6	O			
Red Wattlebird	4	O			
Jacky Winter	1	O			
Spotted Pardalote	1	W			
Grey Fantail	1	O			
Silvereye	1	O			
Crimson Rosella	2	O			
Grey Butcherbird	1	W			
Black-faced Monarch	1	O			

2009 Diurnal Birds - Site Based

Complete one sheet for each site even if no sightings or calls were recorded. Record all species.

One recorder per 20 min: 2 ha standard survey site.

Key: O = observed, W = heard, IT = In tree, OG = On ground, AC = flying above canopy, EW = Edge water

Region: Palerang LGA – Majors Ck	**Site Name/No:** Boundary fence, Diurnal bird survey_5
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Virtue, B	**GDA:** 748940 6062607
Date: 15/10/09	Start-Finish (EST): 6.35-6.55
Cloud: 0	Rain: 0
Wind Speed: 1	Wind Direction: S

WITHIN SITE			**OUTSIDE SITE**		
Species Name	No. Ind	Ob type	Species Name	No. Ind	Ob type
Grey Fantail	7	O	Fan-tailed Cuckoo	1	W
Red Wattlebird	4	O	Australian Magpie	1	W
White-naped Honeyeater	2	W	Rufous Whistler	1	W
Little Raven	1	O			
Spotted Pardalote	2	O			
Striated Pardalote	2	W			
Eastern Spinebill	3	O			
Crimson Rosella	6	O			
Eastern Whipbird	2	O			
Yellow-faced Honeyeater	1	W			
Magpie Lark	2	O			
Grey-shrike Thrush	2	O			
White-browed Scrubwren	2	O			

2009 Diurnal Birds - Site Based

Complete one sheet for each site even if no sightings or calls were recorded. Record all species.

One recorder per 20 min: 2 ha standard survey site.

Key: O = observed, W = heard, IT = In tree, OG = On ground, AC = flying above canopy, EW = Edge water

Region: Palerang LGA – Majors Ck	**Site Name/No:** Beside Majors Ck, Bird survey site_4
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Virtue, B	**GDA:** 749597 6061743
Date: 14/10/09	Start-Finish (EST): 7.07 – 7.27
Cloud: 0	Rain: 0
Wind Speed: 1	Wind Direction: S

WITHIN SITE			**OUTSIDE SITE**		
Species Name	No. Ind	Ob type	Species Name	No. Ind	Ob type
Grey-shrike Thrush	2	O	Sulfur-crested Cockatoo	1	W
Crimson Rosella	4	O	Australian Magpie	1	W
White-throated Treecreeper	1	W			
Red Wattlebird	4	O			
Rufous Whistler	1	W			
Superb-fairy Wren	3	O			
Grey Fantail	2	O			
Eastern Whipbird	1	O			
New-holland Honeyeater	2	O			
Eastern Yellow Robin	1	O			
Brown Thornbill	1	O			
Yellow-faced Honeyeater	3	O			
Eastern Spinebill	4	O			
Little Raven	1	O			
White-browed Scrubwren	2	O			
Spotted Pardalote	1	W			

2009 Diurnal Birds - Site Based

Complete one sheet for each site even if no sightings or calls were recorded. Record all species.

One recorder per 20 min: 2 ha standard survey site.

Key: O = observed, W = heard, IT = In tree, OG = On ground, AC = flying above canopy, EW = Edge water

Region: Palerang LGA – Majors Ck	**Site Name/No:** Beside Spring Ck near Majors Ck, Diurnal bird survey_3
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Virtue, B.	**GDA:** 748910 6062600 Alt:
Date: 14/10/09	Start-Finish (EST): 7.36 – 7.56
Cloud: 0	Rain: 0
Wind Speed: 1	Wind Direction: S

WITHIN SITE			**OUTSIDE SITE**		
Species Name	No. Ind	Ob type	Species Name	No. Ind	Ob type
Eastern Yellow Robin	1	O	Yellow-faced Honeyeater	1	W
Common Bronzewing	1	O	Rufous Whistler	1	W
Australian Magpie	2	O	Pied Currawong	1	W
Grey Fantail	2	O			
Crimson Rosella	3	O			
White-browed Scrubwren	5	O			
Brown Thornbill	2	O			
Eastern Spinebill	1	O			

2010 Diurnal Birds - Site Based

Complete one sheet for each site even if no sightings or calls were recorded. Record all species.

One recorder per 20 min: 2 ha standard survey site.

Key: O = observed, W = heard, IT = In tree, OG = On ground, AC = flying above canopy, EW = Edge water

Region: Palerang LGA – Majors Ck	**Site Name/No:** Ridge beside Spring Ck, Diurnal bird survey_1
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Virtue, B.	**GDA:** 748885 6063069 Alt:
Date: 2/2/10	Start-Finish (EST): 5.35 – 5.55
Cloud 8/8:	Rain: none but overcast
Wind Speed: 0	Wind Direction:

WITHIN SITE			**OUTSIDE SITE**		
Species Name	No. Ind	Ob type	Species Name	No. Ind	Ob type
Australian Magpie	3	O	White-throated Treecreeper	1	O
Gang-gang Cockatoo	2	O			
Red Wattlebird	3	O			
Crimson Rosella	3	O			
Grey Fantail	2	O			
Pied Currawong	3	O			
Grey Currawong	1	O			
Australian Hobby	1	O			
Yellow-faced Honeyeater	1	O			

2010 Diurnal Birds - Site Based

Complete one sheet for each site even if no sightings or calls were recorded. Record all species.

One recorder per 20 min: 2 ha standard survey site.

Key: O = observed, W = heard, IT = In tree, OG = On ground, AC = flying above canopy, EW = Edge water

Region: Palerang LGA – Majors Ck	**Site Name/No:** Beside Spring Ck, Diurnal bird survey_ 2
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Virtue, B.	**GDA:** 748992 6062983 Alt:
Date: 2/2/10	Start-Finish (EST): 5.56 – 6.16
Cloud 8/8:	Rain: none but overcast
Wind Speed: 0	Wind Direction: N/A

WITHIN SITE			**OUTSIDE SITE**		
Species Name	No. Ind	Ob type	Species Name	No. Ind	Ob type
Gang-gang Cockatoo	3	O	Pied Currawong	1	W
Red Wattlebird	5	O			
Yellow-faced Honeyeater	4	O			
Grey Fantail	2	O			
Superb Fairy-wren	3	O			
Crimson Rosella	3	O			
Sacred Kingfisher	1	O			
Red-browed Finch	3	O			
Grey Shrike-thrush	1	W			
Australian Magpie	7	O			
White-browed Scrubwren	1	O			
Silvereye	4	O			

2010 Diurnal Birds - Site Based

Complete one sheet for each site even if no sightings or calls were recorded. Record all species.

One recorder per 20 min: 2 ha standard survey site.

Key: O = observed, W = heard, IT = In tree, OG = On ground, AC = flying above canopy, EW = Edge water

Region: Palerang LGA – Majors Ck	**Site Name/No:** Ridge beside Spring Ck, Diurnal bird survey_1
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Virtue, B.	**GDA:** 748885 6063069 Alt:
Date: 2/2/10	Start-Finish (EST): 5.35 – 5.55
Cloud 8/8:	Rain: none but overcast
Wind Speed: 0	Wind Direction:

WITHIN SITE			**OUTSIDE SITE**		
Species Name	No. Ind	Ob type	Species Name	No. Ind	Ob type
Australian Magpie	3	O	White-throated Treecreeper	1	O
Gang-gang Cockatoo	2	O			
Red Wattlebird	3	O			
Crimson Rosella	3	O			
Grey Fantail	2	O			
Pied Currawong	3	O			
Grey Currawong	1	O			
Australian Hobby	1	O			
Yellow-faced Honeyeater	1	O			

2010 Diurnal Birds - Site Based

Complete one sheet for each site even if no sightings or calls were recorded. Record all species.

One recorder per 20 min: 2 ha standard survey site.

Key: O = observed, W = heard, IT = In tree, OG = On ground, AC = flying above canopy, EW = Edge water

Region: Palerang LGA – Majors Ck	**Site Name/No:** Near Majors Creek bridge,
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Virtue, B.	**GDA:** 749470 6061670 Alt:
Date: 2/2/10	Start-Finish (EST): 7.00 – 7.20
Cloud 8/8:	Rain: 0-1
Wind Speed: 0	Wind Direction: N/A

WITHIN SITE			**OUTSIDE SITE**		
Species Name	No. Ind	Ob type	Species Name	No. Ind	Ob type
White-browed Scrubwren	1	O	Pied Currawong	1	W
Superb Fairy-wren	1	W	Wonga Pigeon	1	W
Grey Fantail	4	O	Australian Magpie	1	W
White-throated Treecreeper	2	W	Red Wattlebird	1	W
Yellow-faced Honeyeater	1	O			
Brown-headed Honeyeater	2	O			
Golden Whistler	1	O			
Crimson Rosella	2	O			
Rufous Whistler	1	O			
Gang-gang Cockatoo	2	W			
Eastern Whipbird	1	W			

2010 Nocturnal Streamside Search

Complete one sheet for each site even if no sightings or calls were recorded.

Record all species of fish, frog, reptile, bird and mammal. Presence of tadpoles, spawn or dead spawn.

Spotlight (by foot) for 30 min (one person) along circa 200m transect.

Key: O = observed, W = heard, T = tadpole, IT = In tree, OG = On ground, EW = Edge water,

UL = under litter

Region: Palerang LGA – Majors Ck	**Site Name/No:** Majors Ck
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyor: Daly, G.	**GDA:** 748890 6062000 Alt:
Date: 2/2/10	Altitude: 643
Cloud: 8/8	Start- Finish (EST): 20.55 – 21.25
Wind Speed: 0	Wind Direction: N/A
Rain: 0	Temp.: circa 18 ^{0} C

Sp Code	Species Name	No. Ind.	Ob type	MH type	Notes/ Voucher No. etc
	Limnodynastes peroni	3	W	IW	Also observed one total = 4
	Litoria lesueurii	6	O	EW	Checked groin for ID
	Crinia signifera	1	W		

Additional comments / observations (fish, yabbies etc).
Observed two Gippsland Water Dragons, eels, and *Galaxias olidus.* Heard White-striped Mastiff Bat call. Surveyed from creek crossing downstream towards bridge.

2009 Diurnal Reptile Search

Complete one sheet for each site even if no reptiles detected. Survey effort one person hr/0.5 ha. unless stated otherwise (i.e. 2 surveyors for 30 minutes)

0 = observed, w = heard, m = slough, s = scratches

egion: Palerang LGA – Majors Ck	**Site Name/No:** Ridge beside Spring Ck transect 1
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyors: Daly, G. and Virtue, B.	**GDA:** 748885 6063069
Date: 14/10/09	Altitude: 676
Cloud: 0/8	Start – Finish (EST): 8.55 – 9.25
Wind Speed: 0 - 1	Search effort = 60 minutes
Rain: 0	Temp.: circa 12 ^{0} C

Capt. Date	Species Name	No. Ind.	Ob type	MH Type	Notes/ Voucher No. Tissues/ Weather/Breeding type
14/10/09	*Hemiergis decresiensis*	1	O	UL	Under log
	Opportunistic Sightings				After time
	Tiliqua scincoides	1	O	UL	

2009 Diurnal Reptile Search

Complete one sheet for each site even if no reptiles detected. Survey effort one person hr/0.5 ha. unless stated otherwise (i.e. 2 surveyors for 30 minutes)

0 = observed, w = heard, m = slough, s = scratches

Region: Palerang LGA – Majors Ck	**Site Name/No:** Ridge beside Spring Ck Site 1
Team: Gaia Research	**Topographic Map:** Bendoura
Surveyors: Daly, G. and Virtue, B.	**GDA:** 748885 6063069
Date: 3/2/10	Altitude: 676
Cloud: 4/8	Start – Finish (EST): 12.27 – 12.57
Wind Speed: 0	Search effort = 60 minutes
Rain: 0	Temp.: 23.4 ^{0} C

Capt. Date	Species Name	No. Ind.	Ob type	MH Type	Notes/ Voucher No. Tissues/ Weather/Breeding type
3/2/10	*Saproscincus mustelina*	1	O	UL	Under log
	Opportunistic Sightings				After time
3/2/10	*Amphibolurus muricatus*	1	O		
3/2/10	*Litoria dentata*	2	W	IT	Calling from trees

NON-SYSTEMATIC / INCIDENTAL RECORDS

For species detected when not conducting systematic surveys.

O = observed, w= heard, s = scat, I = incisions, m = miscellaneous

ew = edge water, ul = under log, er = under rock, ut = under tin, ub = under bark, ac= flying, it = in tree,

og = on ground, or = on rock, ol = on log, iw = in water, da = dam, ig = in grass

1:25000 Topographic Map:	Recorder: Daly, G. and Virtue G.

Date	Easting	Northing	Location	Species Name	No	Obs type	MH type	Notes
13/10/09	748892	6061994	Majors Ck	Australian Wood Duck	6	O	EW	
13/10/09	748892	6061994	Majors Ck	Black Duck	4	O	EW	
13/10/09	748892	6061994	Majors Ck	Nankeen Kestrel	1	O	AC	
13/10/09	748892	6061994	Majors Ck	Wedge-tailed Eagle	2	O	AC	
13/10/09	748885	6063069	Ridge	Laughing Kookaburra	1	O	IT	
13/10/09	748885	6063069	Ridge	Yellow-rumped Thornbill	2	O		
14/10/09	748885	6063069	Ridge	Fan-tailed Cuckoo	1	W	IT	
14/10/09	748885	6063069	Ridge	Eastern Rosella	4	O		
14/10/09	748885	6063069	Ridge	White-naped Honeyeater	3	O		
14/10/09	748892	6061994	Majors Ck	Flame Robin	1	O		
14/10/09	748892	6061994	Majors Ck	Willie Wagtail	1	O	OG	
14/10/09	748885	6063069	Ridge	White-winged Triller	2	O	AC	
14/10/09	748885	6063069	Ridge	Dusky Woodswallow	4	O	AC	
14/10/09	748885	6063069	Ridge	Satin Bowerbird	1	O	AC	
14/10/09	748892	6061994	Majors Ck	Richard's Pipit	1	O	OG	
14/10/09	748885	6063069	Ridge	Welcome Swallow	1	O	AC	

Appendix 4

Curriculum vitae of participating consultants

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Curriculum Vitae of Surveyors/Authors

NAME **Garry John DALY**

DIRECTOR Gaia Research Pty. Ltd. ABN 21 073 711 421

D.O.B. 19 August 1957

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QUALIFICATIONS

1980	B.Sc. majoring in zoology. The University of New South Wales.
1982	Graduate Diploma of Education, University of Wollongong.

SOCIETY MEMBERSHIP

1990-present	Society for Growing Australian Native Plants. Rainforest Study Group.
1992-present	Australasian Affiliation of Herpetological Societies.
1996-present	Royal Zoological Society of New South Wales.

EMPLOYMENT

1983-5	Science Teacher at Leumeah High School, Sydney.
1985-9	Casual teaching.
1991-2	Casual teaching, freelance fauna surveys.
1992-present	Fauna and flora surveys/assessments/impact statements/review of environmental factors.
1995-present	Director Gaia Research Pty Ltd.

COMMITTEES

1993-98	Lower Shoalhaven Catchment Management Committee
1993-2002	Bundanon Trust Community Advisory and Environment Committee
1997-present	Green and Golden Bell Frog Recovery Team (DECCW)
2006-present	Giant Burrowing Frog Advisory committee / Recovery Team (DECCW SF NSW)
2006-present	Broad-headed Snake Advisory committee / Recovery Team (DECCW)
2006-present	NSW Threatened frog working committee (DECCW)

LICENCES AND APPROVALS

Scientific Investigation Licence No. S10470.
Animal Research Authority Issued by the Director General of NSW Agriculture No. 05/2371 to conduct fauna surveys utilising a variety of techniques.

SUCCESSFUL NOMINATIONS TO TSC ACT (1995)

The listing of Stuttering Frog *Mixophyes balbus* from Vulnerable to Endangered (Schedule 1).
The listing of Heath Frog *Litoria littlejohni* as Vulnerable (Schedule2).
Brush-tailed Rock Wallaby *Petrogale penicillata* part evidence taken to list species as Endangered (Schedule 1).
Advice to species associations and distribution of Swamp sclerophyll forest on Coastal Floodplain of the NSW North Coast.
Listing of Coastal Forest Red Gum/Grass Forest as Endangered Ecological Community within the Eurobodalla local government area.
Listing of Great Glider *Petauroides volans* as endangered population on Schedule 1, Part 2.
Joint application with other members of the Declining Frog Working Group to list the Green Tree Frog *Litoria caerulea* within the Sydney Basin as an Endangered Population.

SCIENTIFIC PUBLICATIONS

Daly, G. (1992). Aggressive territorial behaviour of free range water dragons *(Physignathus lesueurii lesueurii) Herpetofauna.* **22 (1)**: 37.
Daly, G. (1993). Reproductive biology of the scaly foot *(Pygopus lepidopodus). Herpetofauna*. **22(2):** 40-42.
Daly, G. (1993). Prey items of the red-bellied black snake *(Pseudechis porphyriacus). Herpetofauna.* **22 (2)**: 48.
Daly, G. (1993). Unusual behaviour of grass skinks *(Lampropholis delicata). Herpetofauna.* **23(2):** 41.
Daly, G. (1995). Observations on the green and golden bell frog *Litoria aurea* (Anuran: Hylidae). *Herpetofauna* **25 (1):** 2-9.
Daly, G. (1995). Observations on the tusked frog *Adelotus brevis* (Anuran: Myobatrachidae). *Herpetofauna.* **25 (2)**: 32-35.
Daly, G. (1996). Some problems in the management of the green and golden bell frog *Litoria aurea* (Anura: Hylidae) at Coomonderry Swamp on the south coast of New South Wales. In *The Green and Golden Bell Frog* Litoria aurea *Biology and Conservation* (Editors G. H. Pyke and W. S. Osborne). *Aust. Zool.* **30 (2):** 233-36.
Daly, G. (1996). Observations on the eastern owl frog *Heleioporus australiacus* (Anuran: Myobatrachidae) in south eastern New South Wales. *Herpetofauna* **26(1):** 33-42.
Daly, G. (1997). Behaviour of the bearded dragon lizards *Pogona barbata* and *P. vittaceps* in captivity. *Herpetofauna.* **27(2):** 28-33.
Daly, G. (1998). Review of the status and assessment of the habitat of the stuttering frog *Mixophyes balbus* (Anuran: Myobatrachidae) on the south coast of New South Wales. *Herpetofauna* **28(1):** 2-11.
Daly, G. (2000). Island populations: Survey of the reptiles and amphibians of the Jervis Bay region on the south coast of NSW. *Herpetofauna* **30(1):** 11-17.
Daly, G. (2000). Fauna of the Jervis Bay region: corridors, dead ends and isolated populations. Pp 177-88. In *Conservation through Cooperation: integrated management for the Jervis Bay region.* Janet Mackay and Associates (Ed). Proceedings from Integrated management conference NSW NPWS.
Daly, G. (2004). Surveys of reptiles and amphibians on the south-west slopes of NSW. *Herpetofauna.* **34(1):** 2-16.
Daly, G. (2006). Mapping glider songlines: development of a landscape management policy for the yellow-bellied glider *Petaurus australis* (Shaw 1791) in the Eurobodalla Shire on the south coast of New South Wales. *Australian Zoologist* **33(2):** 180-187.
Daly, G. (2006). Reptiles and frogs in the region of Morton National Park on the south coast of NSW. *Herpetofauna.* **36(1):** 5-24.

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Daly, G. and Evison, S. (1996). Observations of the Square-tailed Kite *(Lophoictinia isura)* at Nowra on the south coast of New South Wales. *Australian Birds* ***29*****(3):** 42-43.

Daly, G, Pennay, P. and Gosper, C. (2001). Reptiles and amphibians at Razorback Nature Reserve, Keverstone State Forest and the Abercrombie Caves region of New South Wales. *Herpetofauna.***31 (2):** 82-92.

Daly, G, Pennay, P. and Coombes, D. (2002). Surveys for the stuttering frog *Mixophyes balbus* on the south coast of New South Wales. *Herpetofauna.***32 (2):** 110-130.

Daly, G. and Senior, C. (2003). Surveys for and habitat assessment of the Green and Golden Bell Frog *Litoria aurea* on the far south coast of New South Wales. *Herpetofauna***33 (2):** 86-102.

Daly, G. and Coombes, D. (2005). *Limnodynastes tasmaniensis,* an addition to the herpetofauna of the Jervis Bay region of south-eastern NSW. *Herpetofauna***35 (2):** 85-6.

Daly, G. and Craven, P. (2007). Monitoring populations of Heath Frog *Litoria littlejohni* in the Shoalhaven region on the south coast of NSW. *Australian Zoologist* **34(2):** 165-172.

Daly, G. Virtue, B. and Stone, G. (2008). Results of a survey for the striped legless lizard *Delma impar* near Goulburn, New South Wales. *Herpetofauna* **38(1):** 51-58.

Daly, G. Johnson, P.; Malolakis, G.; Hyatt, A. and Peitsch, R. (2008). Reintroduction of Green and Golden Bell Frog Litoria aurea to Pambula on the south coast of New South Wales. *Australian Zoologist* **34(3):** 261-270.

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Daly, G. and Craven, P. (in review). Conservation actions taken for the Stuttering Frog *Mixophyes balbus* at Macquarie Pass National Park on the south coast of New South Wales. *Australian Zoologist.*

Evison, S. and Daly, G. (1995). Do White-throated Nightjars *(Eurostopodus mystacalis)* (Caprimulgidae) Make Scrapes for their Egg Sites? *Australian Birds*.

Goldingay, R. Daly, G & Lemckert, F. (1996). Assessing the impacts of logging on reptile and frogs in the montane forests of southern NSW. *Wild. Res.* **23:** 495-510.

Goldingay, R. and Daly, G. (1997). Surveys of arboreal mammals in the montane forests of Queanbeyan, New South Wales. *Aust. Mamm*. **20:** 9-19.

Murphy, M. and Daly, G. (1997) Records of the marsh snake *Hemiaspis signata* near Nowra, NSW: A southern range extension for the species. *Herpetofauna* **27(2):** 33-34.

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Coughran, J., McCormack, R. B and Daly, G. (2009). Translocation of the yabbie *Cherax destructor* into eastern drainages of New South Wales. *Australian Zoologist* **35(1):** 100-104.

BOOK

Daly, G.; Dawson, J. Schwarz, E.; Pietsch, R.; Saxson, M.; Claridge, A. and Oliver, L. (2000). *Threatened Fauna of the Shoalhaven.* Shoalhaven Catchment Management Committee and NSW National Parks and Wildlife Service, Queanbeyan.

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QUALIFICATIONS

B. App. Sc Parks, Recreation and Heritage (Charles Sturt University)
Adv. Dip. Land Management (University of Sydney),
Ass. Dip. Land Management (University of New England).

Woodlands Environmental Management consultancy has included:

- Preparation of environmental assessments undertaken for development applications, rehabilitation Projects and conservation agreements
- Preparation of environmental assessments undertaken in accordance with *Native Vegetation Act 2003, Threatened Species Conservation Act 1995, Threatened Species Conservation Amendment Act 2002,* the *Environmental Planning and Assessment Act 1979* and the *Commonwealth Environment Protection and Biodiversity Act 1999*
- Preparation of Assessments of Significance (Seven Part Tests) for Threatened Species and Endangered Ecological Communities.
- Preparation of Habitat Management Plans for the purpose of protecting Threatened Species of flora, fauna and Endangered Ecological Communities and their habitats.
- Vegetation surveying and mapping undertaken within conservation areas and bushland reserves on the Southern Tablelands
- Preparation and monitoring of Vegetation Management Plans in accordance with Department on Infrastructure, Planning and Natural Resources' General Terms of Approval for the granting of Part 3A Permit for work undertaken within riparian zones.
- Preparation of management plans for natural areas incorporating fire, weed and water management and rehabilitation work.
- Delivery of lectures, training, workshops and field days conducted for NSW National Parks and Wildlife Service, Hawkesbury - Nepean Catchment Management Authority, Wingecarribee Shire Council, Department of Agriculture, Landcare NSW, Bushcare, TAFE NSW, Department Infrastructure, Planning and Natural Resources and community groups

All work has been undertaken in accordance with the guidelines and requirements of, and in consultation with Department of Environment , Climate Change and Water, Catchment Management Authorities, Department of Water and Energy, National Parks and Wildlife Service, Sydney Water and Local Government Authorities etc.

Environmental consultancy has been undertaken within the Southern Highlands and Southern Tablelands of NSW within an area bound by Williamsdale, Collector, Braidwood, Araluen, Windellama, Robertson, Helensburgh, Pheasants Nest, Taralga and Gunning and within Wingecarribee, Wollondilly, Goulburn Mulwaree, Upper Lachlan and Palerang LGAs and the NSW South Coast from Helensburgh to Termeil within Wollongong and Eurobodalla LGAs.

Examples of recent Projects:

2006 Environmental Assessment (Flora and Fauna) for the Southern Distribution Business Park, Goulburn, NSW
Prepared with G. Daly, Gaia Research Pty Ltd for Mariner Land, Sydney

Environmental Assessment (Flora) for a Proposed Subdivision at 'Bangadilly', Parishes of Nundialla and Bangadilly, Canyonleigh, NSW Prepared for CPC Land Development Consultants Pty Ltd, Goulburn

Eucalyptus Identification Workshop – One-day workshop conducted for Wingecarribee Shire Council, Moss Vale

Targeted Survey for Threatened Species Austral Toadflax *Thesium australe* at Bungonia. Prepared for CPC Land Development Consultants Pty Ltd, Goulburn

2007 Environmental Assessment (Flora and Fauna) for a Proposed Subdivision at 'Springfield', Parishes of Mangamore and Terranna, Tirrannaville, NSW
Prepared for Mr. R. Maple-Brown, 'Springfield', Braidwood Rd. Goulburn

Vegetation Management Plan for Part 3A Permit at ''Narranbulla'', Hume Highway, Marulan, NSW. Prepared for Newball Pty Ltd, Sutton Forest

Environmental Assessment (Flora) for a Proposed Subdivision at 'Parkwood Estate', Oallen, NSW. Prepared for Mr. George Ioannidis, Fairfield

Property Planning and Biodiversity – Two-day workshop conducted for Wingecarribee Shire Council, Moss Vale

2008 Review of Environmental Factors for Mineral Exploration Activities at Majors Creek. Prepared for RW Corkery & Co. Pty Ltd, Orange

Environmental Assessment (Flora and Fauna) for a Proposed

Development at 'Merigan', Parish of Merigan, Merigan, NSW
Prepared for Merigan Pastoral Partnership, Merigan, Via Tarago

Planning for Biodiversity Management – Two-day workshop conducted for Wingecarribee Shire Council, Moss Vale

The Native Vegetation Act 2003 and Property Vegetation Plans seminars conducted at Moss Vale, Richmond and Lithgow for Department of Primary Industry and Quality Rural Solutions, Sutton

Assessment of Significance for White Box-Yellow Box-Blakely's Red Gum Woodland (Box-Gum Woodland) at Lots 2 & 4 DP 1082075, South Goulburn, NSW. Prepared for John W Craig Pty Ltd Goulburn

2009 Habitat Management Plan for 'Comfort Hill', Sutton Forest, NSW Prepared for R.G. Properties P/L, 'Comfort Hill', Sutton Forest NSW 2577

***Native Vegetation Act 2003* and Property Vegetation Plans**

From August 2007 until the present the principal of Woodlands Environmental Management, Mr Greg Stone, has worked under contract with Hawkesbury-Nepean Catchment Management Authority as a Catchment Officer with responsibility for administering the *Native Vegetation Act 2003,* undertaking assessments for Property Vegetation Plans and Native Habitat management.

DECCW Conservation Partners

From December 2008 until the present the principal of Woodlands Environmental Management, Mr Greg Stone, has worked under contract with Department Environment, Climate Change and Water preparing Conservation Agreements with private landholders on properties of high conservation value.

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QUALIFICATIONS
Bachelor of Science (Honours I), Australian National University, 1971-74, majoring in Botany and Zoology.

SOCIETY MEMBERSHIP
Member Canberra Ornithologists Group
Associate, Centre for Plant Biodiversity Research, CSIRO Division of Plant Industry
Member Friends of Grasslands
Member EIANZ

Employment/experience:
1992-2010: Biologist and Environmental Consultant, self-employed.
1982-91: Laboratory Scientist in the Bird Hazard Investigation Unit, Civil Aviation Authority. Studies of bird diet and behaviour at airports, advice on bird and habitat management to reduce birdstrike risk.
1979-81: Australian National Herbarium, CSIRO Division of Plant Industry. Taxonomic work on native plants.
1976-78: Department of Population Biology, Research School of Biological Sciences, ANU. Population genetics of wild rabbit populations in southern and western NSW.

Alison Rowell is a self-employed consultant, with 27 years' experience in surveys and studies of flora and fauna, specialising in survey, mapping, monitoring and management of threatened native species and communities. Most of her recent work has been in woodlands and grasslands in south-eastern NSW and the ACT.

Selected reports and publications:
Crawford, I., Howard, T. and Rowell, A. M. 1995. Indicative List of Rare or Threatened Flora and Fauna of the ACT Region. Report to the ACT Flora and Fauna Committee, ACT Parks and Conservation Service.
Crawford, I. and Rowell, A.M. 1996. Survey for uncommon or declining plants of lowland native grasslands of the ACT. Report to Wildlife Research Unit, ACT Parks and Conservation Service.
Cunningham, R. and Rowell, A.M. 2006. A statistical analysis of trends in detection rates of woodland birds in the ACT, 1998 to 2004. Report prepared for Canberra Ornithologists Group (COG) and Environment ACT.
Rowell, A.M. 1996a. A Study of the Native Grasslands of the Monaro District. Report to the NSW National Parks and Wildlife Service and the Department of Environment, Land and Planning. 104 pp.
Rowell, A.M. 1999. Majura Valley Transport Corridor. PALM Planning Study. Ecological Issues. Report to Gutteridge Haskins and Davey for ACT Department of Planning and Land Management. 24pp.

Rowell, A.M. 2001. Transport Infrastructure Requirements in the Majura Valley: Ecological Issues. Report to Maunsell McIntyre Pty Ltd, June 2001.
Rowell, A.M. 2001. Lawson Residential Estate Study: Ecological Issues. Report to Maunsell McIntyre Pty Ltd, August 2001.
Rowell, A.M. 2002. Horse Park Drive – Gundaroo Drive to Federal Highway: Ecological Issues. Report to Maunsell McIntyre, February 2002.
Rowell, A.M. 2003. Beatty Hill, Yarrowlumla Shire, NSW. Targeted flora and fauna surveys of site proposed for subdivision. Report to Northrop Consulting Engineers for Kenoss Pty Ltd.
Rowell, A.M. 2004. Potential impact on bird populations of proposed Woodlawn Wind Farm. Report prepared for URS Australia Pty Ltd.
Rowell, A.M. 2004. Potential impact on bird populations of proposed Crookwell II wind farm. Report prepared for URS Australia Pty Ltd
Rowell, A. M. 2005. Species Impact Statement For Proposed 9 Lot Rural Subdivision. Lots 4 & 5 Dp830430, Micalago Road, Cooma Monaro Shire, Parish Of Michelago, County Of Beresford. Report to Horseshoe Pty Ltd.
Rowell, A.M. 2005. Turallo Nature Reserve fauna survey: January 2004 to May 2005. Unpublished report to NPWS South West Slopes Region, Queanbeyan Area, June 2005.
Rowell, A. M. 2005. Macgregor West: Vegetation Mapping and Assessment of Golden Sun Moth Habitat. Report to Purdon and Associates Canberra, for ACT Planning and Land Authority.
Rowell, A. M. 2005. Potential Impact on Bird Populations of Proposed Mt Spring Wind Farm. Report prepared for URS Australia Pty Ltd.
Rowell, A. M. 2006. Stage 2 assessment of ecological values in Section 67 and Section 80 Deakin, and Section 66 Yarralumla. Report prepared for National Capital Authority.
Rowell, A .M. 2006. Monitoring and mapping of threatened fauna at HMAS Harman, 2004-2006. Report prepared for GHD Pty Ltd, for Resolve FM and Department of Defence
Rowell, A. M. 2007. Forde Development: Ecological values of Horse Park Drive wetland, floodplain and floodway. Prepared for Forde Development Pty Ltd.
Rowell, A. M. 2007. Maintenance Plan: Natural Temperate Grassland and Golden Sun Moth habitat at Blocks 3 & 7, Section 22, Barton. Prepared for Parsons Brinckerhoff Australia and Department of Finance, November 2007.
Rowell, A. M. 2007. Survey for Spider Orchids *Arachnorchis actensis* and *A. armata* at Majura Training Area, October 2007. Report to HLA Envirosciences and Department of Defence.
Rowell, A. M. 2009. Majura Parkway: surveys for Golden Sun Moth, Perunga Grasshopper, Canberra Raspy Cricket and their habitats. December 2008. Prepared for SMEC Australia, March 2009.
Rowell, A. M. 2009. Majura Parkway: survey for the endangered Grassland Earless Dragon *Tympanocryptis pinguicolla*, February to March 2009. Prepared for SMEC Australia, March 2009.
Rowell, A. M. 2009. Grassland Earless Dragon Monitoring, Canberra International Airport, February to March 2009. Report to Capital Airport Group, June 2009.
Rowell, A. M. 2009. Turallo Nature Reserve: Monitoring program for Little Whip Snake and Canberra Raspy Cricket, 2009. Report to NPWS Queanbeyan Area, Department of Environment and Climate Change NSW. August 2009.
Rowell, A. M. 2010. Survey for Golden Sun Moth at East Bonner, December 2009. Report to David Hogg Pty Ltd and ACT Land Development Agency.
Rowell, A.M. and Crawford, I. 1996. Review of Environmental Factors for Stage 10A of the Proposed Subdivision of Fairlane Estate, Queanbeyan. Report prepared for Fairlane Canberra Pty Ltd. 37pp.
Rowell, A.M. and Crawford, I. 1997b. Queanbeyan River Corridor Study: Flora, Fauna and Environmental Degradation. Report to National Environmental Consulting Services, for Queanbeyan City Council, April 1997.

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EDUCATION and TRAINING

2009 - present	Certificate in Ornithology, Charles Sturt University
2002	Environment and Land Management Certificate OTEN
1999	Diploma in Horticulture OTEN
1985	Diploma of Special Education, Alexandra Mackie
1961	Batchelor of Arts, Sydney University
1958	Primary Education Certificate Diploma Special Education, Balmain Teachers College

SOCIETY MEMBERSHIP

Birds Australia,
Illawarra Bird Observers Club,
Wilderness Society.

RECENT FAUNA SURVEYS

March 2010	Survey of birds at Bees Nest NR. Surveys conducted for Gaia Research P/L.
February 2010	Survey of birds at Cortona, part Lot102 DP755934 and Lot 101 DP755934 Majors Creek. Surveys conducted for Gaia Research P/L.
December 2009	Survey of birds at Jerrawangala NP. Surveys conducted for Gaia Research P/L.
October 2009	Survey of birds at Cortona, part Lot102 DP755934 and Lot 101 DP755934 Majors Creek. Surveys conducted for Gaia Research P/L.
February 2009	Survey of birds at Saltwater Swamp NR and Worrigee NP. Surveys conducted for Gaia Research P/L.
January 2008	Survey of birds at Comfort Hill, Moss Vale. Surveys conducted for Gaia Research P/L.
November 2007	Survey of birds at Gowan Brae, Mittagong. Surveys conducted for Gaia Research P/L.

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EDUCATION and TRAINING

Diploma of Teaching (Technical)
Bachelor of Education (Technical)

SOCIETY MEMBERSHIP

Illawarra Bird Observers Club (lapsed)
Southern Ocean Seabird Study Association (lapsed)
Contributor to first edition 'Atlas of Australian Birds'

EMPLOYMENT:

1972 – 1980 Fitter and Machinist
1980 – 1995 Teacher and Assistant to Head of Studies TAFE NSW
1995 – 2008 Self Employed in building industry
2008 – 2009 Field Assistant, Cortona Resources Ltd
2009 – Present Field Supervisor, Cortona Resources Ltd