Appendix 4

Abel Underground Coal Mine Sub-tropical Rainforest Monitoring Plan: 2012 Monitoring*

(No. of pages including blank pages = 58)

Note*: A copy of this Appendix is only available on the Project CD

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WB13R_101-1150

Abel Underground Coalmine Sub-tropical Rainforest Monitoring Plan: 2012 Monitoring

Abel Underground Coalmine Beresfield, NSW

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Bright People. Right Solutions.

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Abel Underground Coalmine Sub-tropical Rainforest Monitoring Plan: 2012 Monitoring

Abel Underground Coalmine Beresfield, NSW

Kleinfelder Job No. 101-1150

Prepared by:

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EXECUTIVE SUMMARY

Donaldson Coal Pty Ltd commenced operations at Abel Underground Coalmine at Beresfield in the lower Hunter Valley, New South Wales, during 2008. To comply with part of the conditions of consent, a Flora and Fauna Management Plan (F&FMP) was prepared in late 2007 by ecobiological.

The F&FMP identified the need to establish a Sub-tropical Rainforest Monitoring Plan (SRMP) to monitor the sub-tropical rainforest areas of Long Gully Creek. While there are several areas of rainforest in the surface vegetation, the most extensive and best developed area lies in the Long Gully Creek system.

Rainforest monitoring has been conducted at Long Gully Creek for the past five years (2008, 2009, 2010, 2011 and 2012). This area has been identified as being susceptible to potential impacts through mine subsidence. The Sub-tropical Rainforest Monitoring Plan (SRMP) is directed at assessing the stability of the rainforest/dry forest interface as well as the floristic and faunal diversity within the rainforest proper. It has been estimated that it will take approximately 10 years before any impacts due to subsidence are detectable in the sub-tropical rainforest. The current study will gather information on the presence and status of threatened species present in this area and will allow best practice measures to be incorporated into the Subsidence Management Plan (SMP). The Sub-tropical Rainforest Monitoring Plan (SRMP) will continue until one year after mining has passed under the Long Gully and Blue Gum Creek catchments.

This report provides the fifth annual monitoring results since the completion of a baseline assessment by ecobiological in 2008 and details the occurrence of flora, fauna and threatened species against which any changes over time can be measured and evaluated.

The results of the 2012 flora survey were similar to those of the baseline survey, representing no substantial change in floral diversity. The transition between dry and moist forest has expanded slightly in 2012, a slight increase in the width of the rainforest within the gully. This is likely to be due to natural changes in species richness occurring within the subject site. A slight retraction of the shrub layer has also occurred, which can be explained by the dieback of Lantana camara. *Groundcover species appear to have decreased, which may be attributed to dry conditions during months leading up to the survey period. These changes are identified as minor and are consistent with what is typically expected to occur in a rainforest system.*

In total, 49 fauna species were recorded during the survey period, comprising four arboreal mammal species, three terrestrial mammal species, ten bat species, 30 bird species, one amphibian species and one reptile species. Five of these species are listed as threatened under the NSW Threatened Species Conservation Act 1995. *These include the Powerful Owl (Ninox strenua), the Sooty Owl (*Tyto tenebricosa*), the Little Bentwing-bat (*Miniopterus australis*), the Eastern Freetail-bat (*Mormopterus norfolkensis*) and the Grey-headed Flying-fox (*Pteropus poliocephalus*). Almost all arboreal and terrestrial fauna species recorded during baseline monitoring in 2008 were also recorded during the 2012 survey effort. Bird*

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species diversity showed signs of decreasing, however this is likely to be due to natural variation in bird numbers. A relatively high number of bat species were identified during the 2012 survey.

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ABBREVIATIONS

AHD	Australian Height Datum
DP	Deposited Plan
DSEWPaC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities
EEC	Endangered Ecological Community (category of Threatened Ecological Community)
EP&A Act	*Environmental Planning and Assessment Act* 1979
EPBC Act	*Environment Protection and Biodiversity Conservation Act* 1999
GIS	Geographic Information System
GPS	Global Positioning System
ha	hectares
KTP	Key Threatening Process
LEP	Local Environmental Plan
LGA	Local Government Area
MU	Map Unit

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DEFINITIONS

Abundance – a relative measure of how common or rare a species (or attribute) is in a given location.

Affected Species – any species likely to be impacted upon by a proposal.

Arboreal – living in a tree or trees. Contrasted with *terrestrial*, living on the ground; *aquatic*, living in water; *amphibious*, living on both land and water.

Aquatic – living in the water.

Amphibious – having two distinct life phases, one of which involves living on land and one of which involves living in water.

Conservation status – categories for describing the relative level of concern for a species, community or population's persistence in nature. Key factors taken into account include threats operating and representation in formal conservation reserves. It may not be limited to legal status alone.

Development – has the same meaning as in the EP&A Act, 1979.

Direct impacts – impacts that directly affect habitat and individuals and include but are not limited to death through predation, trampling, poisoning of the organism itself, and the removal of suitable habitat.

Distribution – the overall area or geographical range in which a species is known to occur. Relative abundance will vary at different points within its geographical range.

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1. INTRODUCTION

1.1 BACKGROUND

Donaldson Coal Pty Ltd (Donaldson) commenced mining during 2008 at a new underground mine (known as Abel Underground Coal Mine), located approximately 23 kilometres north-west of Newcastle. The mine will extract up to 4.5 million tonnes per year over 21 years using high productivity continuous miner based bord and pillar systems, and pillar extraction techniques. The seams to be mined are located under the Black Hill rural residential and adjoining forested areas. Mine access and associated surface infrastructure is located within the existing Donaldson Coal mine open cut void at Beresfield, with transfer of coal to the existing Bloomfield Coal Handling and Preparation Plant (CHPP) immediately to the north for coal washing and rail transport to the Port of Newcastle.

Underground coal mining is often associated with adverse environmental impacts due to subsidence (Bell et al. 2000, Sidle et al. 2000). Subsidence can cause loss of productive land, damage to underground pipelines and above-ground structures, decreased stability of slopes and escarpments, contamination of groundwater by acid drainage and dewatering of streams and groundwater supplies (Sidle et al. 2000). Of these, one of the major environmental concerns arising from the Abel mine is the effect of subsidence on local and regional hydrology. Surface and sub-surface cracking associated with mining subsidence can alter surface flow and create preferential flow paths, thus causing dewatering and rerouting of surface water and groundwater (Sidle et al. 2000). Alterations in channel and drainage morphology may also affect channel erosion, sediment delivery, and routing in streams and riparian habitat.

Associated with development approval for the Abel coal mine were a number of conditions of consent. These conditions included a requirement for the preparation of a Flora and Fauna Management Plan (F & FMP) which was prepared by ecobiological in 2007. The F&FMP, which forms part of a comprehensive Environmental Management System for the Abel mine, sets out a strategy to monitor the effectiveness of the conservation measures proposed in the Environmental Assessment (EA) Statement of Commitments for the overall operation of the mine. Part of this strategy was to establish a Surface Ecological Monitoring Plan (SEMP) to monitor the effectiveness of the conservation measures proposed in the EA to mitigate

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against subsidence impacts on three distinct habitat areas: farm dams that form a belt across the mine site; subtropical rainforest areas of Long Gully Creek; and Pambalong Nature Reserve.

The SEMP outlines a monitoring plan for each of these areas by which baseline and subsequent monitoring data are to be gathered to inform future management. This report forms the fifth annual monitoring report for the Sub-tropical Rainforest Monitoring and Management Plan (SRMP) since the completion of the baseline study in 2008, and forms part of the overall SEMP.

1.2 SUBTROPICAL RAINFOREST

Subtropical rainforests are characterised by a dense, multi-layered tree canopy approximately 20-40 m tall, and are generally comprised of large emergent trees and a sub-canopy of smaller trees (Keith 2004). Subtropical rainforests, along with tropical rainforests in Queensland, have the most diverse tree flora of any vegetation type in Australia (Floyd 2008). The understorey is typically open and consists of scattered saplings, shrubs and ferns. Vines and epiphytic orchids are also common. As subtropical rainforests have high plant species diversity, structural complexity and biomass, they subsequently support diverse assemblages of native fauna.

In NSW, subtropical rainforests are scattered across coastal lowlands and escarpment foothills north from the Illawarra region to the Queensland border. They typically occur on south and east aspects in valleys and foothill gullies on fertile soils such as basalt derived soils or alluvial soils, which are high in nutrients such as phosphorus and calcium. Rainforests can also occur in low nutrient sandstone such as at Long Gully, Newcastle (Floyd 1990). Subtropical rainforests are distributed in areas with warm temperatures and annual rainfall of 1300 mm or greater (Keith 2004; Floyd 2008).

The primary threats to subtropical rainforest are fire and weed invasion. Rainforests are not adapted to fire due to the relatively low frequency of fire events within these communities; as a result only a very low proportion of species present possess mechanisms for tolerating or recovering from fire. Therefore, fire can strongly influence rainforest boundaries as it promotes the establishment of fire-adapted species and encourages the replacement of rainforest with sclerophyll forest. Invasion of exotic species is also a significant threat to subtropical rainforests. There is potential for vigorous woody exotic weeds such as Camphor

Laurel (*Cinnamomum camphora*), Privet (*Ligustrum* sp.) and Lantana (*Lantana camara*) to become established in rainforest systems particularly where there is high disturbance and natural succession processes are affected (Floyd 2008; Peel 2010). Where disturbance is lower, these exotic species are generally restricted to the edges of subtropical rainforests as demonstrated at Long Gully Creek.

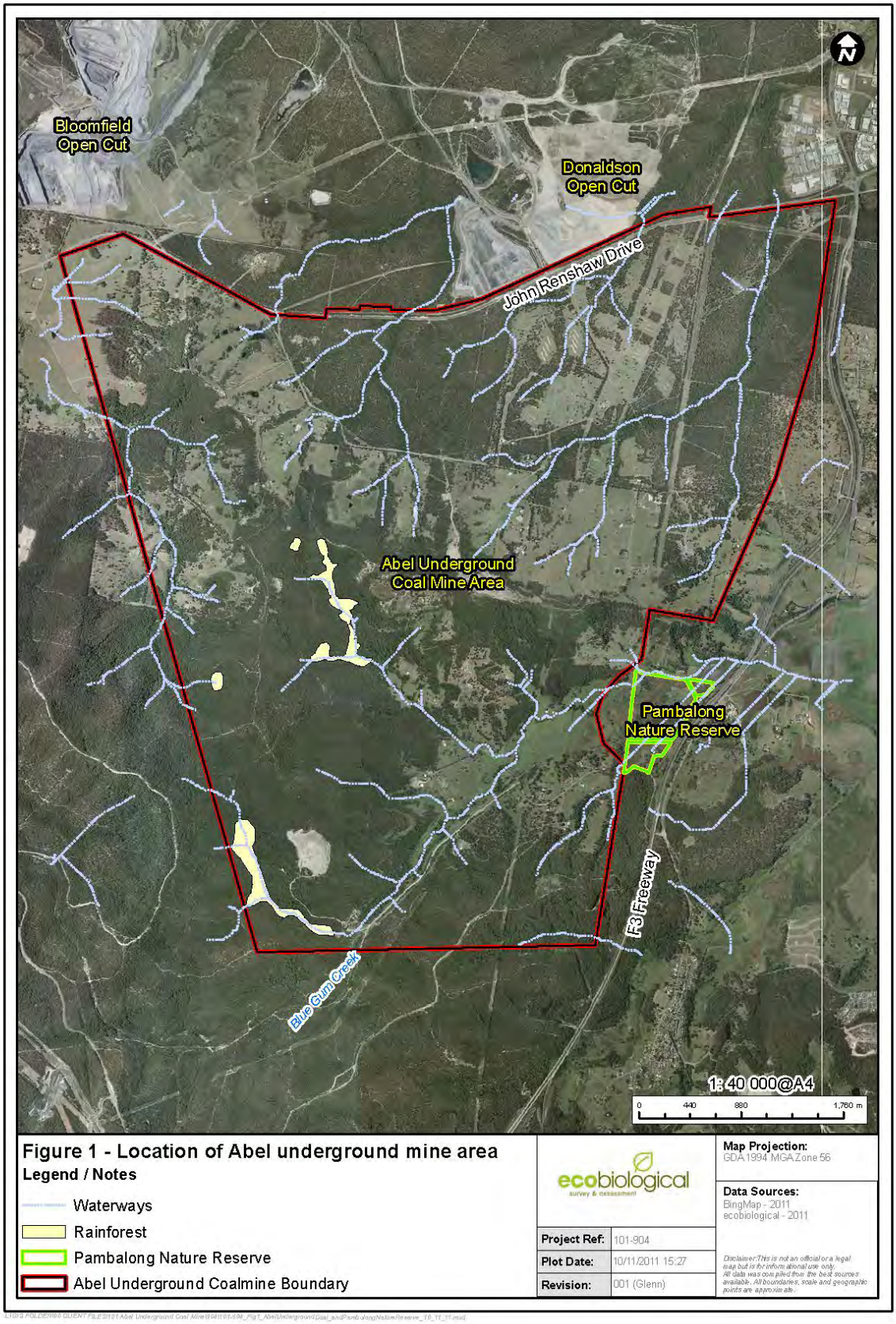
1.2.1 Location

The Abel Underground Mine is located within Newcastle, Cessnock and Maitland local government areas (LGAs). The majority of the underground mine and surface infrastructure area is within the Cessnock LGA.

The location of the underground mine area and surface facilities is shown in **Figure 1**. The underground mine area is bounded on the eastern side by the F3 Freeway; the western and southern sides by a tract of forest that extends south to the Central Coast and beyond to Hornsby and to the northern side by existing open cut coal mining activities within the Donaldson and Bloomfield mine leases.

The Abel underground mine area is approximately 2750 ha and consists of low undulating forested hills with patches of cleared land for 110 rural/residential properties. Large areas of land are owned by Donaldson, Coal and Allied and the Catholic Diocese of Maitland and Newcastle. Black Hill School, various local roads and other infrastructure are located in the area.

A ridgeline associated with Black Hill runs east-west through the proposed underground mine area. Tributaries of Buttai Creek, Viney Creek/Weakley's Flat Creek and Four Mile Creek drain northwards from this ridgeline. A wide catchment containing Long Gully and Blue Gum Creek drains from the ridgeline providing water to the wet swamp at Pambalong Nature Reserve. Some cliff-lines and steeper gullies are located along sections of the Black Hill ridge.


Bloomfield Open Cut
Donaldson Open Cut
John Renshaw Drive
Abel Underground Coal Mine Area
Pambalong Nature Reserve
F3 Freeway
Blue Gum Creek
N
1:40 000@A4
0
440
880
1,760 m
Figure 1 - Location of Abel underground mine area
Legend / Notes
Waterways
Rainforest
Pambalong Nature Reserve
Abel Underground Coalmine Boundary
ecobiological
survey & assessment
Project Ref: 101-904
Plot Date: 10/11/2011 15:27
Revision: 001 (Glenn)
Map Projection:
GDA 1994 MGA Zone 56
Data Sources:
BingMap - 2011
ecobiological - 2011
Disclaimer: This is not an official or a legal map but is for informational use only. All data was compiled from the best sources available. All boundaries, scale and geographic points are approximate.

2. METHODS

2.1 FLORA DIVERSITY

Monitoring of rainforest vegetation across Long Gully Creek was undertaken to indicate whether the rainforest community is stable, expanding or contracting. This was achieved using two transects extending across the width of the rainforest, starting and ending in the adjoining dry forest (**Figure 2**). The transect length across the rainforest gully for Transect 1 was 70 m and 50 m for Transect 2. Transects were divided into quadrats 5 m long by 1 m wide, end-to-end. The following was recorded for each quadrat:

- Total floristic content with the species being classified as a dry or moist forest species as well as whether the species belonged to the ground, shrub, midstorey or overstorey/emergent structural layers; and,
- An estimate of the foliage projective cover (FPC), as defined in Walker and Hopkins (1988), of vegetation in the ground, shrub, midstorey, overstorey and vine structural layers. The estimated FPC was recorded for each 5 m quadrat for each structural layer.

A second order polynomial trend line was used to determine the transitional zones between moist and dry forest types. R^2 values were also calculated to determine how well the fitted lines explained the data. The closer the R^2 value is to 1, the higher confidence that the trend line fits the data.

A sample was taken from any plants unable to be identified at the subject site for later identification. Floristic identification and nomenclature was based on Harden (1992, 1993, 2000, 2002) with subsequent revisions as published on PlantNet (http://plantnet.rbgsyd.nsw.gov.au). Plants listed under the ROTAP scheme (Briggs and Leigh 1996) were also considered in this assessment along with species and vegetation deemed to be of local conservation significance.

Flora surveys were conducted on 23 November 2012.

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2.2 FAUNA DIVERSITY

In order to determine the rainforest-dependent species, faunal diversity monitoring was centred on two transects approximately 200 m long, one situated in the rainforest and the second located in the surrounding dry forest. Fauna surveys were conducted from 29 October to 23 November 2012.

Both trapping transects consisted of an equal number of Elliott A traps, Elliott B traps on the ground and in trees, hair tubes and harp traps. Seven Elliott B tree traps were placed in the dry forest transect, as compared with three along the rainforest transect. The reduced number of tree traps along the rainforest transect was due to an inability to erect traps in some otherwise suitable trees due to hardness of tree trunks and presence of poisonous plant species surrounding these trees. The location of fauna survey activities is shown in **Figure 2**. **Table 1** provides the total trap night count.

Table 1: Trapping statistics for the subject site

Trap type	Traps	Nights	Trap nights
Elliott A	40	4	160
Elliott B Tree	10	4	40
Elliott B Ground	10	4	40
Harp Trap	2	4	8
Hair tubes (in trees)	16	4	64

2.2.1 Arboreal Mammals

Ten Elliott B traps and 16 hair tubes were placed in trees at heights of 3 m or more, along two transects and baited with a mixture of rolled oats, honey, peanut butter and treacle. The trunks of trees containing the traps were sprayed with a mixture of honey and water. These traps were check daily for arboreal species and wafers from the hair tubes were collected after a 4-night period and checked for the presence of hair samples. Hair identification methods followed those of Brunner et al. (2002). If any hair sample was thought to be from a threatened species, the sample was sent to Barbara Triggs, an expert in the field of hair identification for a second opinion.

Spotlighting was undertaken along each transect from dusk for a total of four person hours over two nights to identify the presence of any arboreal mammals. Trees were inspected

during daylight hours for the presence of habitat hollows and if present these were watched at dusk to see if any nocturnal birds or mammals emerged.

2.2.2 Terrestrial Mammals

Forty Elliott A and 10 Elliott B traps were placed along two transects at regular intervals to target terrestrial mammal species. The traps were baited with a mix of rolled oats, honey, peanut butter and treacle and set in position for four consecutive nights and checked each morning.

Spotlighting was undertaken along each transect from dusk for a total of four person hours over two nights to identify the presence of any terrestrial mammals. Careful daytime searches were conducted to detect the presence of fauna activity such as diggings, droppings or scratch marks.

2.2.3 Bats

A harp trap was erected along each transect in bat 'flyways' such as across a natural forest opening in the dry forest and across the rainforest gully to maximise the likelihood of captures. The harp traps were set in position for four consecutive nights and checked each morning. Bats captured were identified in the field and placed in specially designed 'soft release' boxes tethered to nearby trees which enable the bats to shelter during the day and exit the boxes on nightfall from narrow openings at the base of the box.

Anabat II and/or Anabat SD1 bat-call recorders (Titley Electronics, Ballina) were used to record the calls of any Microchiropteran bats feeding in the area. The units were set up at dusk and recording occurred for a total of four hours at four locations over two nights. Spotlighting searches of blossoming trees were also undertaken to identify any Megachiropteran bat species.

2.2.4 Birds

A 20 minute bird survey of both the rainforest and dry forest transect was undertaken by walking the length of each transect on 20 November 2012 and again on 23 November 2012. Birds were identified either visually, with the aid of binoculars, or by call interpretation. Surveys were conducted in the morning when bird activity is maximised (Bibby et al. 2000). Opportunistic sightings were also recorded and listed separately to actual survey results.

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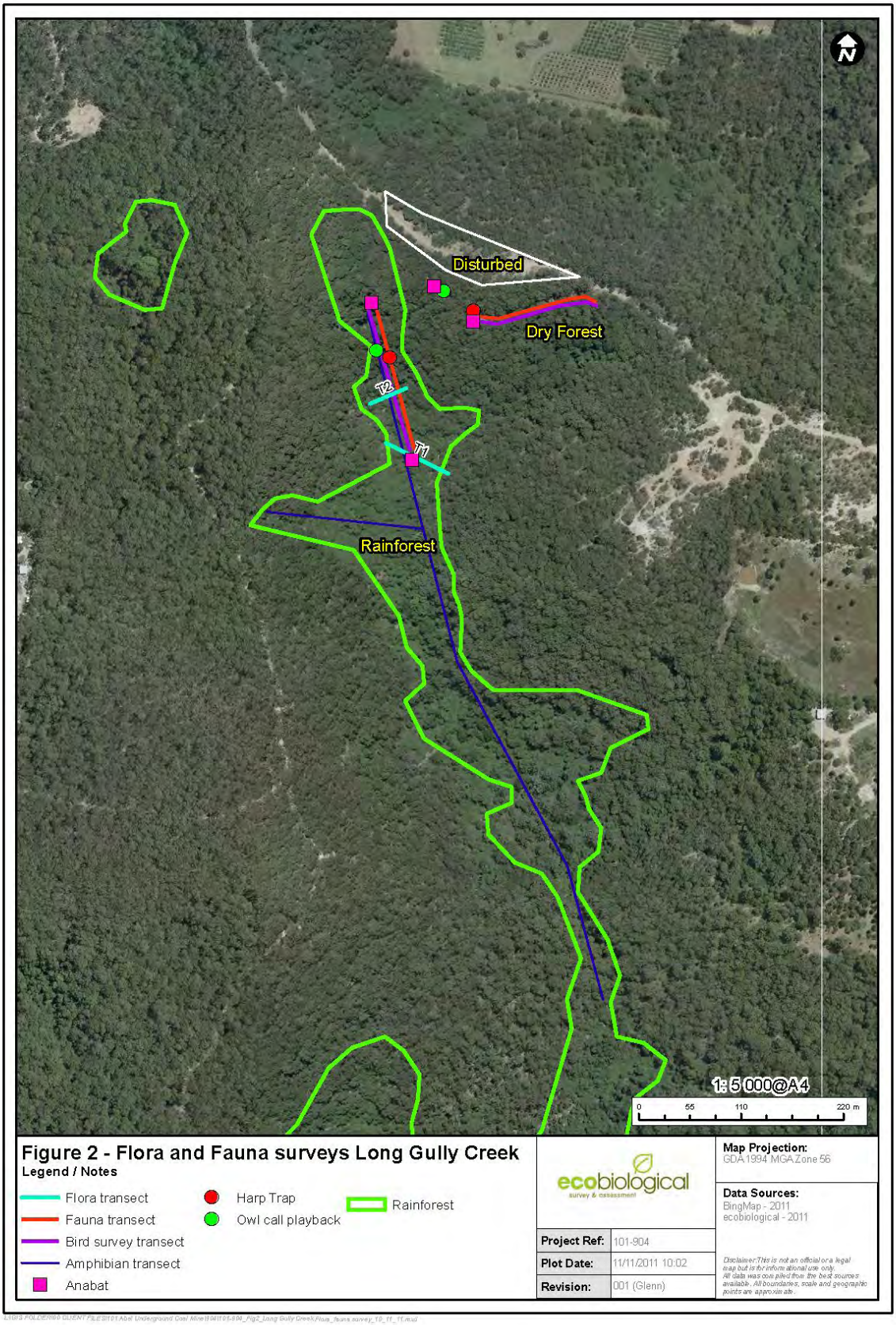
After dark, the calls of threatened owl species (Powerful Owl, Masked Owl, Sooty Owl and Barking Owl) were broadcast over a megaphone in an attempt to encourage a call back response. The subject site was also searched to locate any regurgitated owl pellets. The size, shape and content of any pellets found were analysed to determine the species of owl from which the pellet originated as well as the prey species the owl had been feeding on. Analysis methods followed those of Brunner et al. (2002) and Triggs (1996).

2.2.5 Amphibians

A survey for amphibians was conducted along a portion of the length of the Long Gully rainforest. This involved standardised survey techniques for amphibian species including diurnal habitat searches, nocturnal spotlight surveys and dip netting for tadpoles. Call playback was also conducted for two species of threatened Barred River Frogs (*Mixophyes balbus* and *M. iteratus*) due to habitat being present that could form potential habitat for these species.

During diurnal surveys, dip netting and visual searches were carried out to locate any tadpoles present in any water bodies. During nocturnal surveys, spotlight searches were carried out by walking lengths of suitable habitat and using head torches to search for frogs by eye shine or by physical sightings.

Adult frogs encountered were identified by visual confirmation or by their distinct advertisement calls. Tadpoles were keyed out using diagnostic features including mouthparts (tooth rows, jaw sheaths and papillae), pigmentation, body size, tail structure (musculature, fin depth, fin shape, tip shape), eye direction and spacing, pupil pigmentation, nare shape and spacing, spiracle height and direction, vent length and direction, and tadpole behaviour according to Anstis (2002).


Disturbed
Dry Forest
T2
T1
Rainforest
1:5 000@A4
0
55
110
220 m
Figure 2 - Flora and Fauna surveys Long Gully Creek
Legend / Notes
Flora transect
Fauna transect
Bird survey transect
Amphibian transect
Anabat
Harp Trap
Owl call playback
Rainforest
ecobiological
survey & assessment
Project Ref: 101-904
Plot Date: 11/11/2011 10:02
Revision: 001 (Glenn)
Map Projection:
GDA 1994 MGA Zone 56
Data Sources:
BingMap - 2011
ecobiological - 2011
Disclaimer: This is not an official or a legal map but is for information al use only.
All data was compiled from the best sources available. All boundaries, scale and geographic points are approximate.

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3. RESULTS

3.1 WEATHER CONDITIONS AND SURVEY ACTIVITY

The prevailing weather conditions throughout the trapping survey period at the subject site were warm and humid days, with light to overcast conditions, light to heavy rain, and light to moderate winds. The mean minimum temperature was 10° C and the mean maximum temperature was 30.0° C. Weather conditions during the survey period are provided in **Table 2**.

Table 2: Schedule of activities and weather conditions during the fauna survey period

Weather	Date	
	29/10/2012	1/11/2012
Temp	16°C	30°C
Humidity	29.4	28.7
Cloud cover	0	3
Rain	0	0
Barom	1012	1015.9
wind	20km	40km gusts
wind direction	northerly	north

3.2 FLORA DIVERSITY

A total of 52 and 45 flora species were identified on Transect 1 and Transect 2 in 2012, respectively (**Appendix 1**). This is comparable with species richness found during the baseline study in 2008, in which 54 and 51 flora species were detected on Transect 1 and Transect 2, respectively.

No flora species listed as threatened under the NSW *Threatened Species Conservation Act 1995* were recorded during surveys. One plant species *Eucalyptus fergusonii* subsp. *fergusonii* listed under ROTAP (Briggs and Leigh 1995) was recorded on Transect 2.

Flora species were assigned a preferred forest type or habitat, being either a dry forest or moist forest species (see **Appendix 1**). **Figure 3** and **Figure 5** show the relationship between dry forest species and moist forest species over the length of each transect for 2008. **Figure 4** and **Figure 6** show this relationship for 2012. The trend lines for Transect 1 have changed since the baseline survey; this shows that the transition between dry and moist forest has expanded slightly over the past 5 years. The transition from dry to moist forest commences at 0-5 m and from moist to dry forest at 65-70 m; this is an increase of approximately 10 m since the 2008 survey. The 2012 data is more variable than the baseline survey, as denoted by the lower R^2 values.

The trend lines for Transect 2 in 2012 remain similar to the baseline survey. The transition from dry forest to moist forest again commences at 5-10 m and from moist forest to dry forest at 40-45 m.

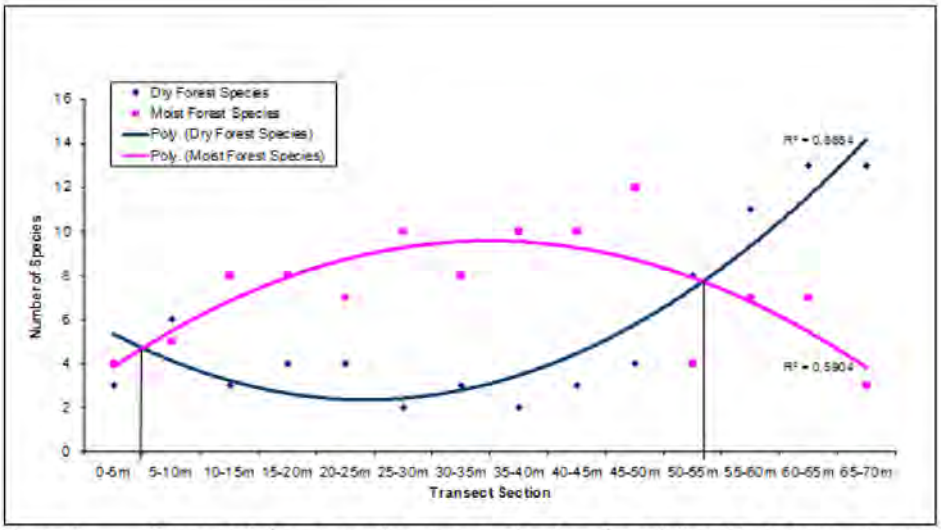

Figure 3 **Transect 1 forest species curves, showing the relationship between dry and moist forest species across the length of the transect in 2008. Black lines indicate the forest transition zones determined in 2008**

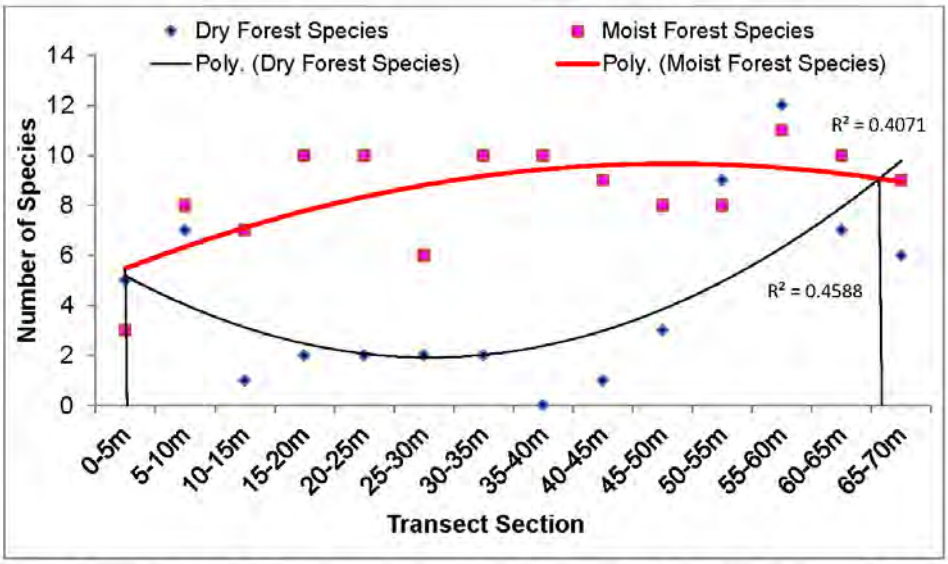

Figure 4 **Transect 1 forest species curves, showing the relationship between dry and moist forest species across the length of the transect in 2012. Black lines indicate the forest transition zones determined in 2012**

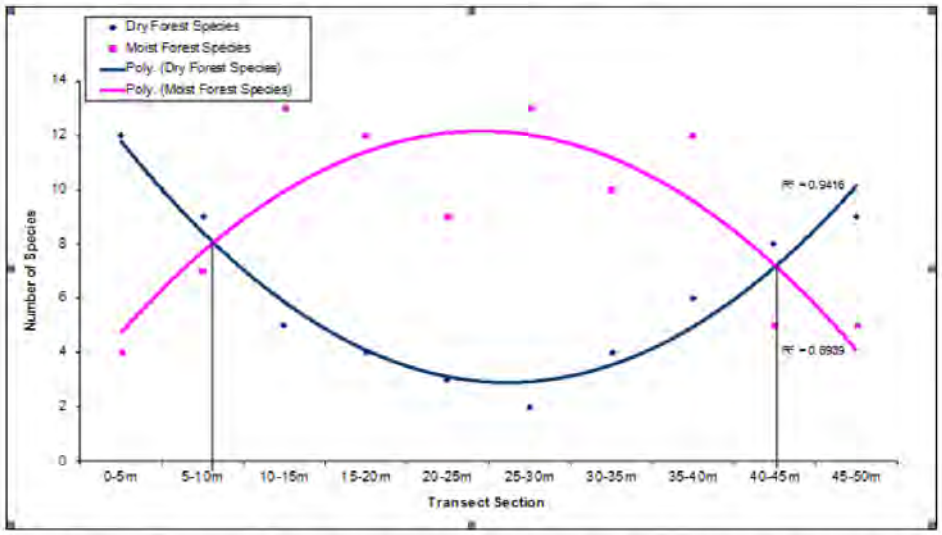

Figure 5 **Transect 2 forest species curves, showing the relationship between dry and moist forest species across the length of the transect in 2008. Black lines indicate the forest transition zones determined in 2008**

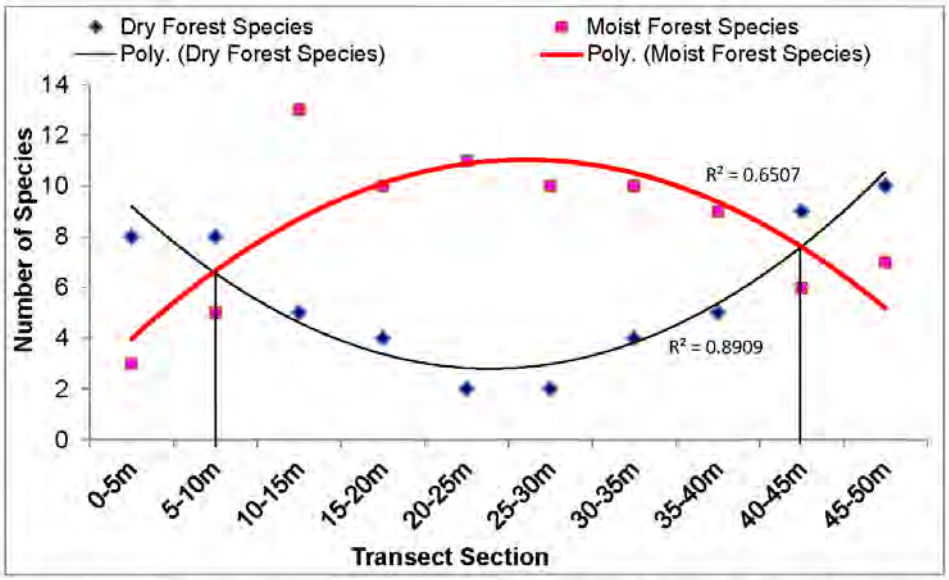

Figure 6 **Transect 2 forest species curves, showing the relationship between dry and moist forest species across the length of the transect in 2012. Black lines indicate the forest transition zones determined in 2012**

3.3 STRUCTURAL LAYER FPC ESTIMATES

The estimated foliage projective coverage (FPC) has been separated into structural layers, including ground, shrub, midstorey, overstorey and vine layers (**Figures 7 to 11**). It should be noted that there is an inherent variability in the estimation of FPC. The estimation of FPC is not sensitive enough to detect slight changes over a single year; it is rather an indication of major changes over several years.

The ground layer FPC has dropped slightly, by approximately 10%, since the baseline report at both Transect 1 and Transect 2 (**Figure 7**). The shrub layer FPC has dropped between intervals 5 m and 70 m on Transect 1 (**Figure 8**). This is mainly attributed to the dieback of the exotic species *Lantana camara*. At Transect 2, the shrub layer FPC has remained constant. There has also been a slight decrease in midstorey species at Transect 2 (**Figure 9**). The overstorey layer has changed at Transect 1 due to openings in the canopy at 30m and 55 m. It is important to note that these changes are more likely to be due to the loss of single trees rather than widespread tree decline. Canopy gaps are an expected occurrence in rainforest systems (**Figure 10**). The main change in the vine layer occurs between 30m

and 35m at Transect 1 (**Figure 11**). These changes are also likely to be due to natural dieback and regeneration of rainforest vine species.

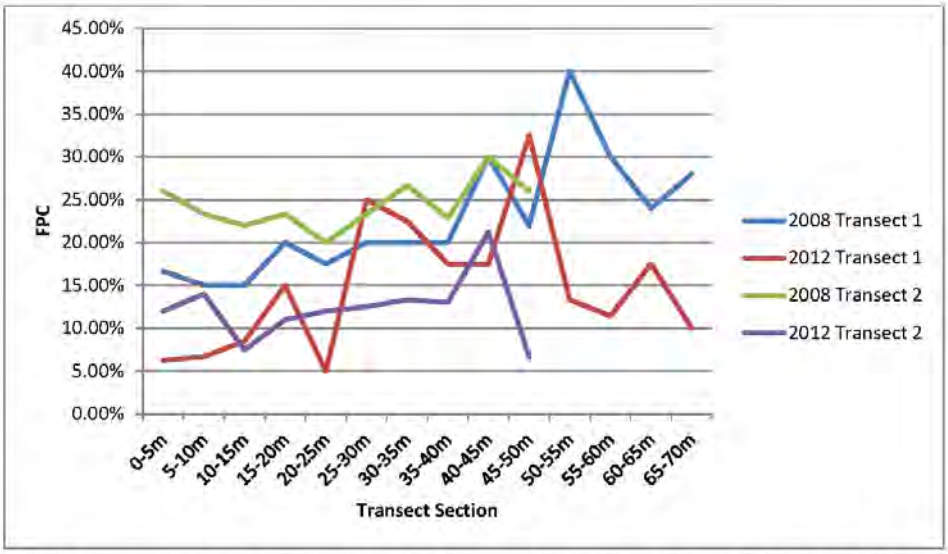

Figure 7 **Estimated ground layer FPC for Transect 1 and Transect 2 in 2008 and 2012.**

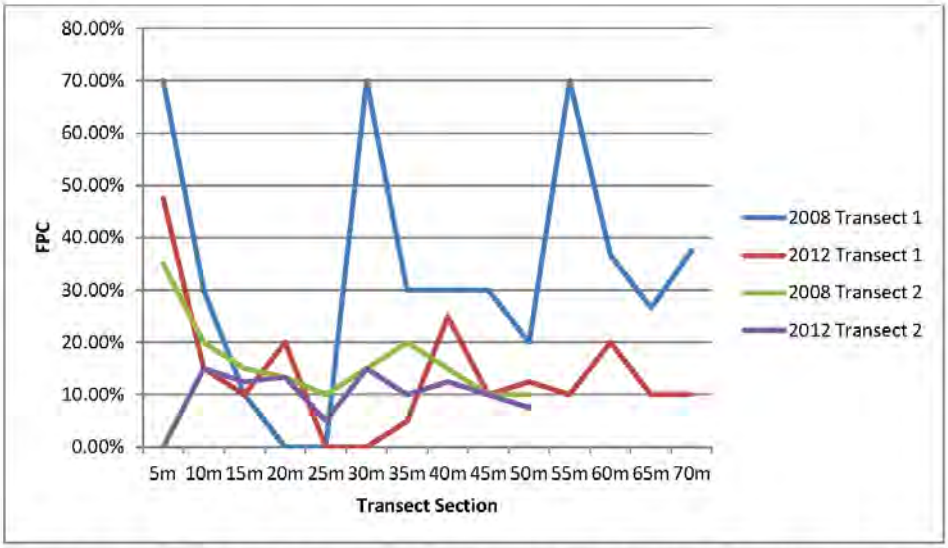

Figure 8 **Estimated shrub layer FPC for Transect 1 and Transect 2 in 2008 and 2012.**

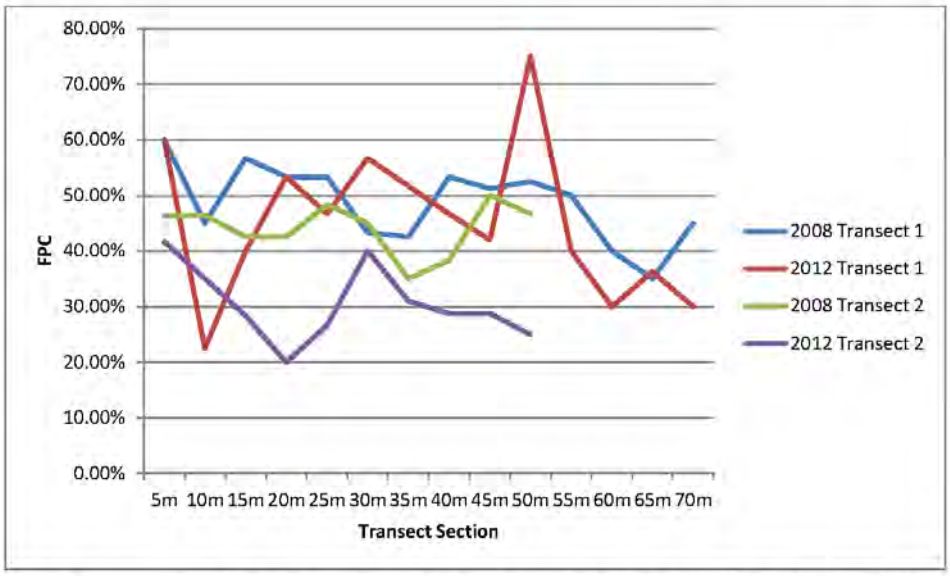

Figure 9 **Estimated midstorey layer FPC for Transect 1 and Transect 2 in 2008 and 2012.**

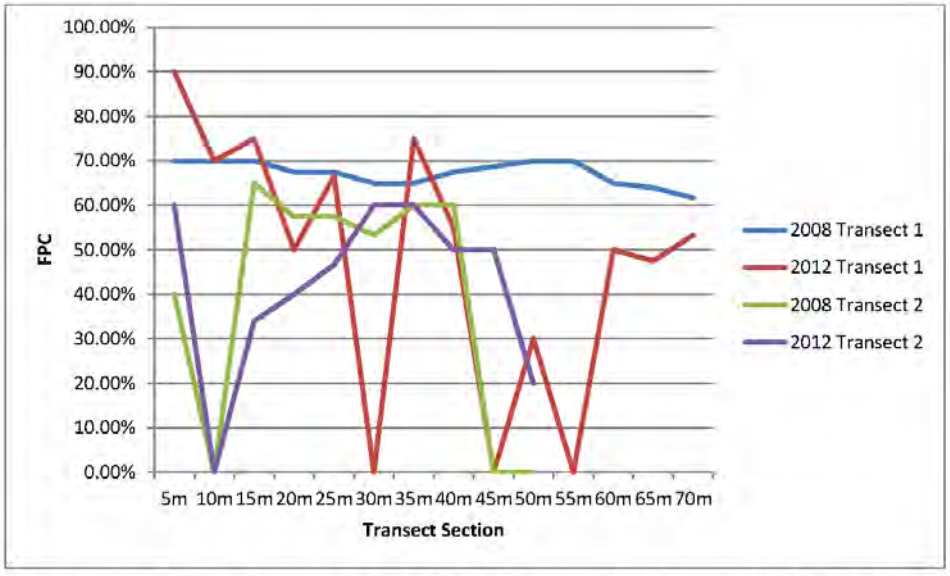

Figure 10 **Estimated overstorey layer FPC for Transect 1 and Transect 2 in 2008 and 2012.**

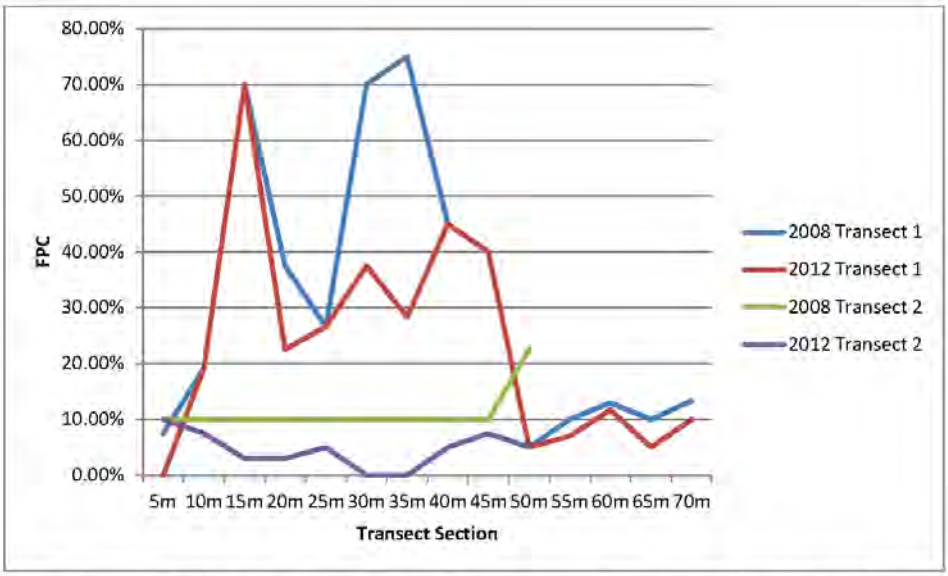

Figure 11 **Estimated vine layer FPC for Transect 1 and Transect 2 in 2008 and 2012.**

3.4 FAUNA SPECIES RICHNESS

In total, 51 fauna species were recorded during the 2012 survey period, comprising four arboreal mammal species, three terrestrial mammal species, ten bat species, 32 bird species, one amphibian species and one reptile species (**Appendix 2**). Five of these species are listed as threatened under the NSW Threatened Species Conservation Act 1995. These include the Powerful Owl (*Ninox* strenua), the Sooty Owl (*Tyto tenebricosa*), the Little Bentwing-bat (*Miniopterus australis*), the Eastern Freetail-bat (*Mormopterus norfolkensis*) and the Grey-headed Flying-fox (*Pteropus poliocephalus*). A total of 33 and 39 fauna species were recorded in the Dry Forest and Rainforest habitats respectively. Average numbers of species recorded across all years is 38 in the Dry Forest and 32 in the Rainforest (**Figure 12**).

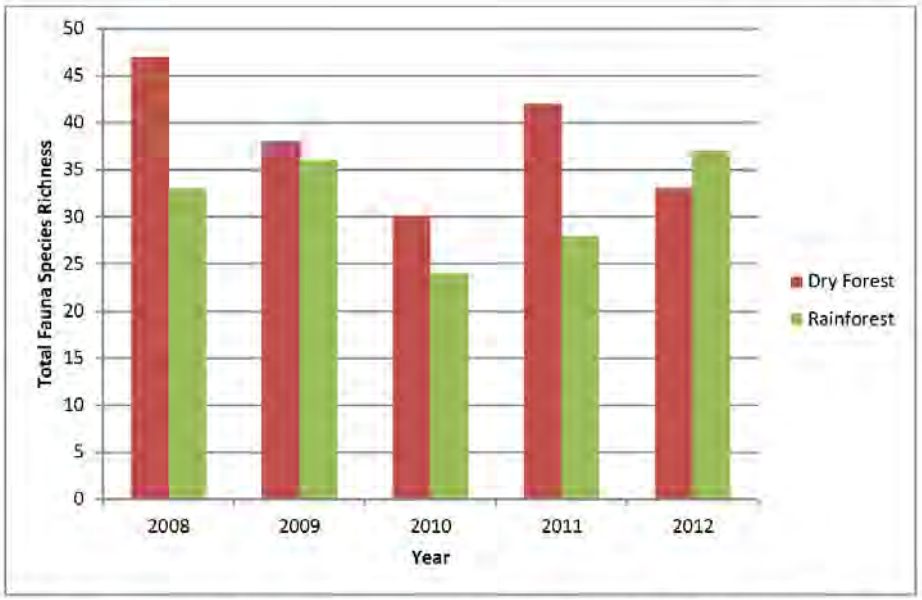

Figure 12 **Fauna Species Richness within the Dry Forest and Rainforest transects from 2008 to 2012.**

Each group is discussed in more detail below, with comparisons made between the current results and the data collated annually since the 2008 baseline study. Selected photographs of fauna species recorded during surveys of Long Gully Creek are also provided in **Appendix 3**.

3.4.1 Arboreal Mammals

Four arboreal mammal species were recorded during the survey period. These included the Sugar Glider (*Petaurus breviceps*), the Common Brushtail Possum (*Trichosurus vulpecular*), the Common Ringtail Possum (*Pseudocheirus peregrinus*) and the Greater Glider (*Petauroides volans*). Arboreal mammal diversity was similarly low in the rainforest transect to previous years, however, the greatest diversity of arboreal mammals on record were identified in the dry forest transect.

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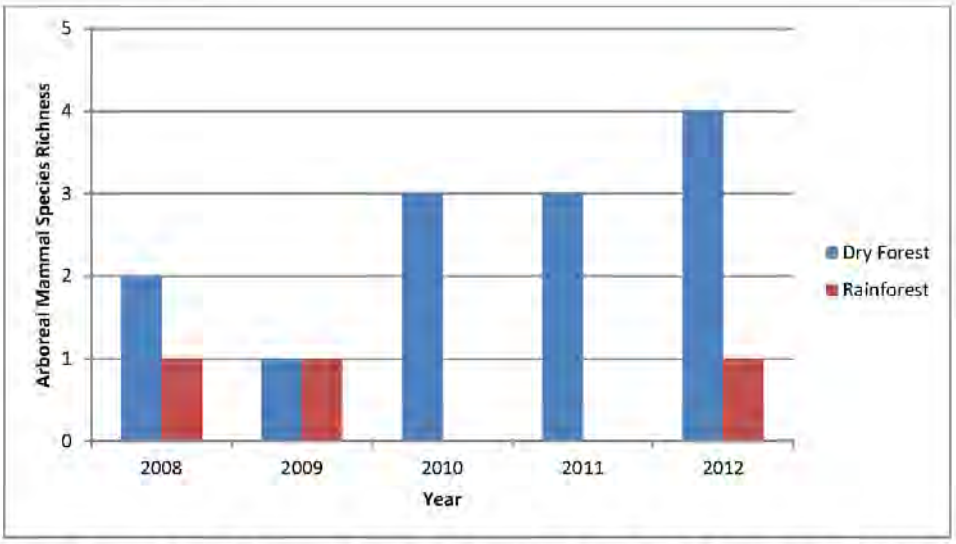

Figure 13 **Arboreal Mammal Species Richness within the Dry Forest and Rainforest transects from 2008 to 2012.**

3.4.2 Terrestrial Mammals

Three terrestrial mammal species were detected during the 2012 surveys. These were the Brown Antechinus (*Antechinus stuartii*), the Bush Rat (*Rattus fuscipes*) and the Black Rat (*Rattus Rattus*). Terrestrial mammal species richness was lower in the dry forest transect compared to previous years, but similar in the rainforest transect (**Figure 14**).

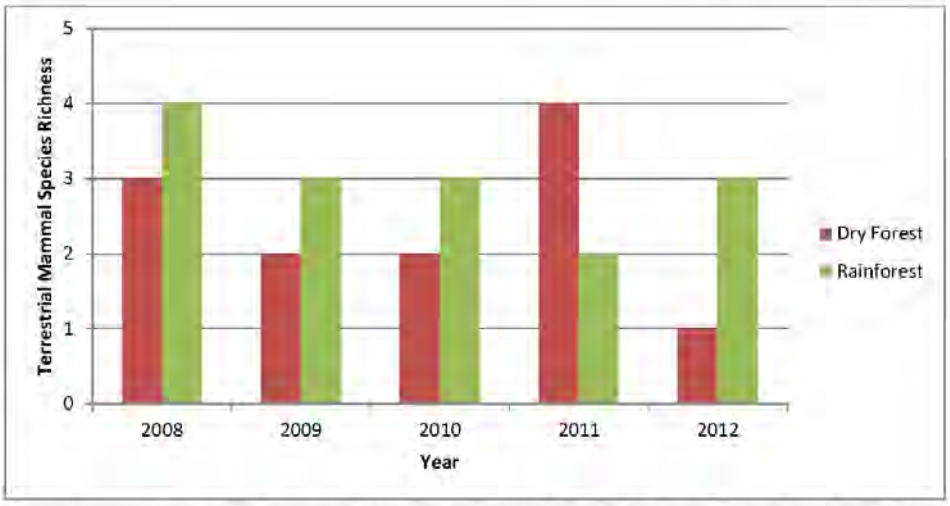

Figure 14 **Terrestrial Mammal Species Richness within the Dry Forest and Rainforest transects from 2008 to 2012**

3.4.3 Bats

Nine species of insectivorous bat could be confirmed as occurring on the subject site during the 2012 survey, compared with six species recorded in 2008, eight species in 2009, three in 2010 and three in 2011 (**Figure 15**). Most of these species were detected via Anabat recorders. The Little Bentwing-bat (*Miniopterus australis*), the Eastern Freetail-bat (*Mormopterus norfolkensis*) and the Grey-headed Flying-fox (*Pteropus poliocephalus*) are listed as vulnerable under the NSW TSC Act 1995.

Four new bat species were detected in 2012: White-striped Free-tailed Bat (*Tadarida australis*), Eastern Horseshoe Bat (*Rhinolophus megaphyllus*), Greater Broad-nosed Bat (*Scoteanax rueppellii*), and Eastern Cave Bat (*Vespadelus troughtoni*).

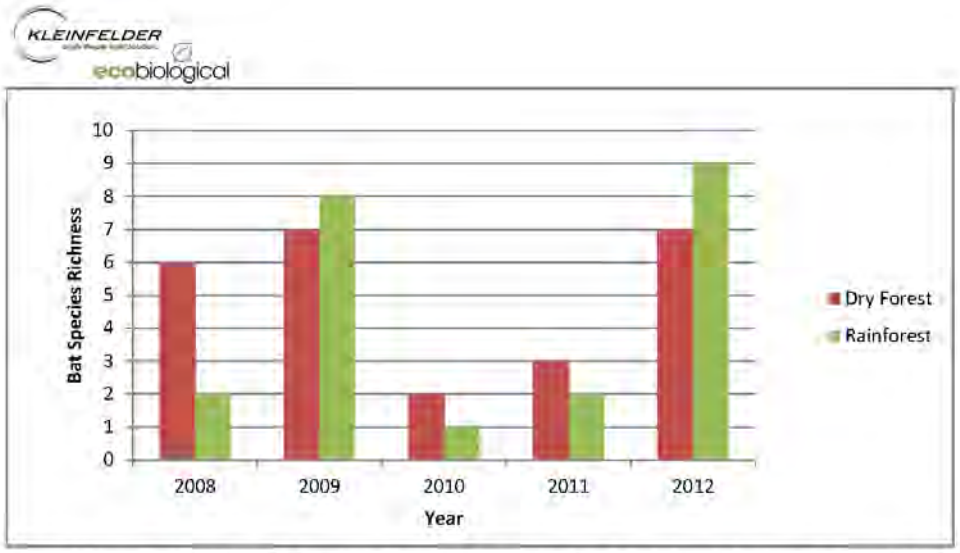

Figure 15 **Bat Species Richness within the Dry Forest and Rainforest transects from 2008 to 2012.**

3.4.4 Birds

Bird species richness was slightly lower in 2012 compared to previous surveys. This is mainly due to less species being recorded in the dry forest transect (**Figure 16**). A similar number of species were recorded in the rainforest transect compared to previous years. A total of 30 species were detected in 2012, compared to 34 in 2011, 30 in 2010, 35 in 2009 and 36 in 2008. The threatened Powerful Owl *(Ninox strenua)* and the Sooty Owl (*Tyto tenebricosa*) previously recorded in 2008 and 2010 were also recorded in 2012. Three new bird species were detected in 2012; Superb Lyrebird (*Menura novaehollandiae*), Spectacled Monarch (*Symposiachrus trivirgatus*), and Olive-backed Oriole (*Oriolus sagittatus*).

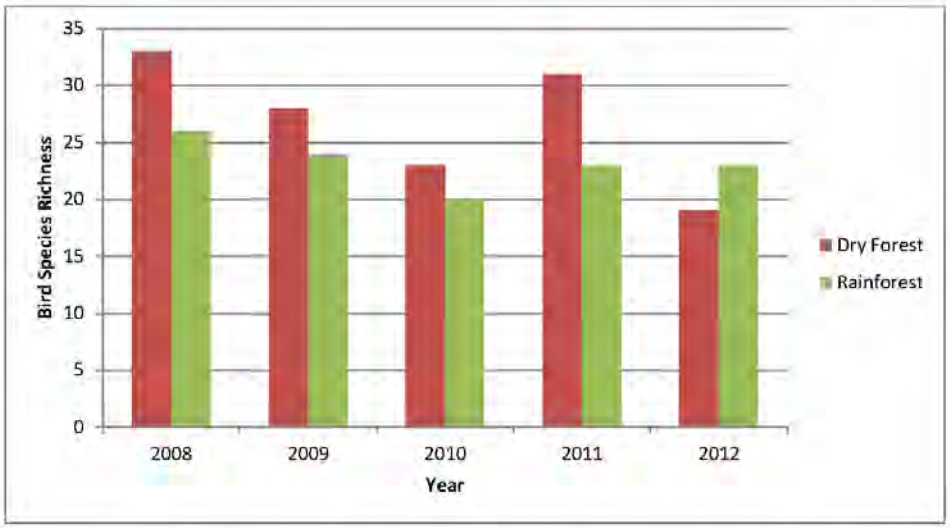

Figure 16 **Bird Species Richness within the Dry Forest and Rainforest transects from 2008 to 2012.**

3.4.5 Amphibians

Only one amphibian species, the Eastern Dwarf Tree Frog (*Litoria fallax*) was detected during the 2012 surveys. Amphibian species richness has also been low in previous years of the survey (**Figure 17**).

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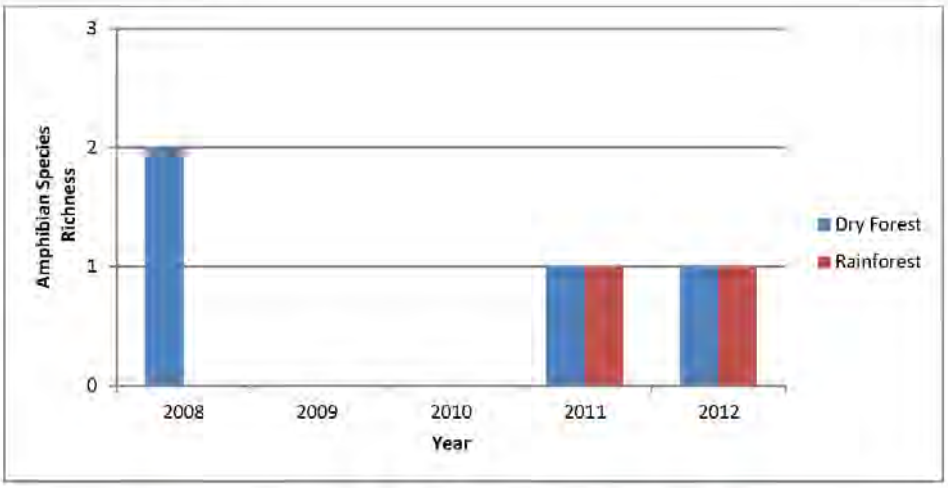

Figure 17 **Amphibian Species Richness within the Dry Forest and Rainforest transects from 2008 to 2012.**

3.4.6 Reptiles

Reptiles are not specifically targeted as part of the fauna monitoring program, however, all opportunistic sightings were noted.

One reptile species, the Lace Monitor (*Varanus varius*) was detected in the 2012 survey within the dry forest transect.

4. CONCLUSION

Monitoring of the Sub-tropical Rainforest area within Long Gully Creek has been undertaken in 2012 in accordance with the F& FMP for Abel Underground Coalmine (ecobiological 2007). The results of this fifth annual monitoring report documents the current extent of the Sub-tropical Rainforest area and the species richness of flora and fauna inhabiting it. Future annual surveys will provide ongoing data, which will be evaluated and any significant changes identified.

A total of 52 and 45 flora species were recorded along Transect 1 and Transect 2, respectively. This is similar to the results of the baseline survey, representing no substantial change in floral species richness. The transition between dry and moist forest has expanded slightly in 2012 at Transect 1, with the width of the moist forest increasing. However, this is likely to be due to variability in species richness within each quadrat along this transect, as represented by the low R^2 value, and does not represent any substantial change in rainforest width. The forest transitional zones for Transect 2 occur in a similar location to that identified in the baseline study. The FPC along Transect 1 and Transect 2 showed little variation between survey events. The only major change occurred in the shrub layer of Transect 1, which can be explained by the dieback of the exotic species *Lantana camara*. Overall, no major changes in the rainforest width or species richness were detected during the 2011 monitoring.

In total, 51 fauna species were recorded during the survey period, comprising four arboreal mammal species, three terrestrial mammal species, ten bat species, 32 bird species, one amphibian species and one reptile species. Five of these species are listed as threatened under the NSW Threatened Species Conservation Act 1995. These include the Powerful Owl (*Ninox* strenua), the Sooty Owl (*Tyto tenebricosa*), the Little Bentwing-bat (*Miniopterus australis*), the Eastern Freetail-bat (*Mormopterus norfolkensis*) and the Grey-headed Flying-fox (*Pteropus poliocephalus*).

Almost all arboreal and terrestrial fauna species recorded during baseline monitoring in 2008 were also recorded during the 2012 survey effort. Bird species diversity showed signs of decreasing, however this is likely to be due to natural variation. A relatively high number of bat species were identified (nine species in 2012 compared to four species in 2011, three species in 2010, six species in 2008 and eight species in 2009). This is most likely attributed

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to canopy disturbance within the rainforest transect. Over the past few survey events, the density of canopy cover has slowly increased, thus potentially restricting the movement of microchiropteran bat species into the lower areas of the rainforest gully. In 2011, a large mature tree fell during storms and opened a large gap in the canopy. In 2012, the Anabat detector was placed adjacent to this canopy gap to determine if bats were entering the lower stratum. This resulted in the highest number of bat species recorded to date within the rainforest transect . The ideal conditions for fauna on the 29/10/2012 survey night may also attribute to the high numbers of bats in both transects.

Continued annual monitoring prior to mining activities passing under the rainforest at Long Gully Creek will enable further determination of the natural variation in the diversity of species. Statistical analysis of this pre-mining data will be undertaken at an appropriate time (e.g. 12 months prior to mining passing under the rainforest gully) and for subsequent years (post-mining) to determine whether any trends are apparent in the data.

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APPENDIX 1: FLORA SPECIES RECORDED: 2008, 2009, 2010, 2011 & 2012

Family	Scientific Name	Common Name	Forest Type	Stratum	Transect 1					Transect 2				
					2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower	Dry	Ground	x	x	x	x	x	x	x	x	x	x
Adiantaceae	*Adiantum formosum*	Giant Maidenhair Fern	Moist	Ground	x	x	x	x	x	x	x	x	x	x
Adiantaceae	*Adiantum hispidulum*	Rough Maidenhair Fern	Moist	Ground	x	x	x	x	x	x	x	x		
Adiantaceae	*Pellaea falcata*	Sickle Fern	Dry	Ground	x	x	x	x	x	x	x	x	x	x
Aphanopetalaceae	*Aphanopetalum resinosum*	Gum Vine	Dry	Vine	x	x	x	x	x					
Apocynaceae	*Marsdenia rostrata*	Common Milk Vine	Dry	Vine	x	x	x	x	x				x	x
Apocynaceae	*Parsonsia straminea*	Monkey Rope	Dry	Vine	x			x	x					
Araceae	*Gymnostachys anceps*	Settlers Flax	Moist	Ground	x	x	x	x	x	x	x	x	x	x

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Family	Scientific Name	Common Name	Forest Type	Stratum	Transect 1					Transect 2				
					2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
Bignoniaceae	*Pandorea pandorana subsp. pandorana*	Wonga Wonga Vine	Dry	Vine	x	x	x	x	x	x	x	x	x	x
Blechnaceae	*Blechnum patersonii subsp. patersonii*	Strap Water Fern	Moist	Ground						x	x			
Blechnaceae	*Doodia aspera*	Rasp Fern	Dry	Ground	x	x	x	x	x	x	x	x	x	x
Boraginaceae	*Ehretia acuminata*	Koda	Moist	Overstorey						x	x	x	x	x
Capparaceae	*Capparis arborea*	Native Pomegranate	Moist	Shrub	x	x	x	x	x	x	x	x	x	x
Commelinaceae	*Aneilema acuminatum*		Moist	Ground				x	x	x	x	x	x	x
Convolvulaceae	*Dichondra repens*	Kidney weed	Dry	Ground						x	x	x	x	x
Cornaceae	*Alangium villosum subsp. polyosmoides*	Muskwood	Moist	Overstorey	x	x	x	x	x					
Cunoniaceae	*Schizomeria ovata*	Crab Apple	Moist	Overstorey			x	x	x					

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Family	Scientific Name	Common Name	Forest Type	Stratum	Transect 1					Transect 2				
					2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
Cyperaceae	*Carex sp.*		Moist	Ground				x	x	x	x	x	x	
Cyperaceae	*Gahnia aspera*		Dry	Ground						x	x			
Davalliaceae	*Arthropteris tenella*		Moist	Ground	x	x	x	x	x	x	x	x	x	x
Dicksoniaceae	*Calochlaena dubia*	Rainbow Fern	Moist	Ground	x	x	x	x	x	x	x	x	x	x
Dioscoreaceae	*Dioscorea transversa*	Native Yam	Dry	Vine	x	x	x	x	x	x	x	x	x	x
Ebenaceae	*Diospyros australis*	Black Plum	Moist	Overstorey	x	x	x	x	x	x	x			
Elaeocarpaceae	*Elaeocarpus obovalus*	Blueberry Ash	Moist	Overstorey						x	x	x	x	x
Euphorbiaceae	*Alchornea ilicifolia*	Dovewood	Moist	Midstorey	x	x	x	x	x	x	x	x	x	x
Euphorbiaceae	*Baloghia inophylla*	Brush Bloodwood	Moist	Midstorey	x	x	x	x	x	x	x	x	x	x
Euphorbiaceae	*Croton verreauxii*	Green Native Cascarilla	Dry	Midstorey	x	x	x	x	x	x	x	x	x	x
Fabaceae (Mimosoideae)	*Acacia longissima*	Long-leaf Wattle	Dry	Shrub						x	x	x	x	x

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Family	Scientific Name	Common Name	Forest Type	Stratum	Transect 1					Transect 2				
					2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
Fabaceae (Mimosoideae)	*Pararchidendron pruinosum var. pruinosum*	Snow Wood	Moist	Midstorey	x	x	x	x	x					
Flacourtiaceae	*Scolopia braunii*	Flintwood	Moist							x	x	x	x	x
Lamiaceae	*Clerodendrum tomentosum*	Hairy Clerodendrum	Moist	Midstorey	x									
Lamiaceae	*Plectranthus parviflorus*		Dry	Ground	x	x	x	x	x					
Lauraceae	*Cryptocarya microneura*	Murrogun	Moist	Overstorey	x	x	x	x	x					
Lauraceae	*Neolitsea australiensis*	Green Bolly Gum	Moist	Midstorey	x	x	x	x	x	x	x	x	x	x
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry	Dry	Vine	x	x	x	x	x					
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily	Dry	Vine	x	x	x	x	x	x	x	x	x	x
Malvaceae	*Hibiscus heterophyllus*	Native Rosella	Dry	Midstorey	x	x	x	x	x	x	x	x	x	x

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Family	Scientific Name	Common Name	Forest Type	Stratum	Transect 1					Transect 2				
					2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
Meliaceae	*Synoum glandulosum subsp. glandulosum*	Scentless Rosewood	Dry	Shrub	x	x	x	x	x					
Meliaceae	*Toona ciliata*	Red Cedar	Moist	Overstorey						x	x	x	x	x
Menispermaceae	*Legnephora moorei*	Round-leaf Vine	Moist	Vine						x	x			
Menispermaceae	*Sarcopetalum harveyanum*	Pearl Vine	Moist	Vine		x	x	x	x					
Menispermaceae	*Stephania japonica var discolor*	Snake vine	Moist	Vine	x									
Monimiaceae	*Doryphora sassafras*	Sassafras	Moist	Midstorey						x	x		x	x
Monimiaceae	*Wilkiea huegeliana*	Veiny Wilkiea	Moist	Shrub						x	x	x	x	x
Monimiaceae	*Wilkiea macrophylla*	Large-leaved Wilkiea	Moist	Midstorey						x	X	x	x	x
Moraceae	*Ficus fraseri*	Sandpaper Fig	Moist	Midstorey	x									
Moraceae	*Ficus sp.*		Dry	Overstorey	x									

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Family	Scientific Name	Common Name	Forest Type	Stratum	Transect 1					Transect 2				
					2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
Moraceae	*Streblus brunonianus*	Whalebone Tree	Moist	Midstorey	x	x	x	x	x	x	x	x	x	x
Moraceae	*Trophis scandens*	Burny Vine	Moist	Vine						x	x		x	x
Myrtaceae	*Backhousia myrtifolia*	Grey Myrtle	Moist	Overstorey	x	x	x	x	x					
Myrtaceae	*Eucalyptus acmenoides*	White mahogany	Dry	Overstorey						x	x	x	x	x
Myrtaceae	*Eucalyptus fergusonii subsp. fergusonii*	Grey Ironbark	Dry	Overstorey						x	x	x	x	x
Myrtaceae	*Melaleuca styphelioides*		Dry	Overstorey	x	x	x	x	x					
Myrtaceae	*Rhodamnia rubescens*	Scrub Turpentine	Dry	Midstorey	x									
Myrtaceae	*Syncarpia glomulifera*	Turpentine	Dry	Overstorey	x	x	x	x	x					
Oleaceae	*Notelaea longifolia*	Large Mock-olive	Dry	Shrub	x	x				x	x	x	x	x
Oleaceae	*Olea paniculata*	Native Olive	Moist	Overstorey						x	x	x	x	x
Orchidaceae	*Dendrobium sp.*		Dry	-	x	x	x	x	x					

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Family	Scientific Name	Common Name	Forest Type	Stratum	Transect 1					Transect 2				
					2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
Orchidaceae	*Sarcochilus falcatus*	Orange-blossom Orchid	Moist	-						x	x	x		
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush	Moist	Shrub	x	x	x	x	x					
Pittosporaceae	*Pittosporum multiflorum*	Orange Thorn	Moist	Shrub	x	x	x	x	x	x	x	x	x	x
Poaceae	*Oplismenus aemulus*	Basket Grass	Dry	Ground	x	x	x	x	x	x	x	x	x	x
Podocarpaceae	*Podocarpus elatus*	Plum Pine	Moist	Overstorey								x	x	x
Polypodiaceae	*Pyrrosia confluens var. confluens*	Horse-shoe Felt Fern	Moist	-	x	x	x	x	x	x	x	x	x	x
Rhamnaceae	*Alphitonia excelsa*	Red Ash	Moist	Overstorey	x	x	x	x	x			x	x	x
Ripogonaceae	*Ripogonum album*	White Supplejack	Moist	Vine	x									
Rubiaceae	*Morinda jasminoides*	Sweet Morinda	Moist	Vine	x	x		x	x	x	x		x	

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Family	Scientific Name	Common Name	Forest Type	Stratum	Transect 1					Transect 2				
					2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
Rutaceae	*Geijera salicifolia var. latifolia*		Moist	Midstorey						x	x			
Sapindaceae	*Alectryon subcinereus*	Native Quince	Moist	Midstorey	x	x	x	x	x	x	x	x	x	x
Sapindaceae	*Guioa semiglauca*		Moist	Midstorey	x	x	x	x	x	x	x			
Sapotaceae	*Planchonella australis*	Black Apple	Moist	Overstorey	x	x	x	x	x	x	x	x	x	x
Solanaceae	*Solanum prinophyllum*	Forest Nightshade	Moist	Shrub								x	x	x
Solanaceae	*Solanum stelligerum*	Devil's Needles	Moist					x	x					
Urticaceae	*Dendrocnide excelsa*	Giant Stinging Tree	Moist	Overstorey	x	x	x	x	x	x	x	x	x	x
Urticaceae	*Dendrocnide photinophylla*	Shiny-leaved Stinging Tree	Moist	Overstorey	x	x	x	x	x				x	x
Verbenaceae	**Lantana camara*	Lantana	Dry	Shrub	x	x	x	x	x	x	x	x	x	x
Vitaceae	*Cayratia clematidea*	Native Grape	Dry	Vine	x	x	x	x	x	x	x	x		

Family	Scientific Name	Common Name	Forest Type	Stratum	Transect 1					Transect 2				
					2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
Vitaceae	*Cissus antarctica*	Water Vine	Moist	Vine	x	x	x	x	x	x	x			
Vitaceae	*Tetrastigma nitens*		Moist	Vine	x	x	x	x	x			x	x	x
				Total	**54**	**48**	**47**	**52**	**52**	**51**	**51**	**45**	**47**	**45**

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APPENDIX 2: FAUNA SPECIES RECORDED 2008, 2009, 2010, 2011 & 2012

Order	Family	Scientific Name	Common Name	Legal Status	Method	Location									
						Dry forest					Rainforest				
						08	09	10	11	12	08	09	10	11	12
Amphibians															
Anura	Hylidae	*Litoria fallax*	Eastern Dwarf Tree Frog	P	Opportunistic record	x				x				x	x
		Litoria peronii	Peron's Tree Frog	P	Opportunistic record	x			x						
					Total	**2**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**1**	**1**
Reptiles															
Squamata	Scincidae	*Cyclodomorphus gerrardii*	Pink-tongued Skink	P										x	
	Varanidae	*Varanus varius*	Lace Monitor	P	Opportunistic sighting	x				x					
					Total	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**
Birds															
Caprimulgiformes	Aegothelidae	*Aegotheles cristatus*	Australian Owlet-nightjar	P	Spotlighting	x	x				x				
Columbiformes	Columbidae	*Leucosarcia picata*	Wonga Pigeon	P	Bird survey	x	x		x				x	x	
		Lopholaimus antarcticus	Topknot Pigeon	P	Bird survey								x		
		Macropygia amboinensis	Brown Cuckoo-dove	P	Bird survey	x	x		x		x	x	x	x	x
Coraciiformes	Alcedinidae	*Dacelo novaeguineae*	Laughing Kookaburra	P	Bird survey		x		x						x
		Todiramphus sanctus	Sacred Kingfisher	P	Bird survey	x	x	x	x	x	x				
Cuculiformes	Centropodidae	*Centropus phasianinus*	Pheasant Coucal	P	Opportunistic record	x									
	Cuculidae	*Cacomantis flabelliformis*	Fan-tailed Cuckoo	P	Bird survey	x		x						x	
		Cacomantis variolosus	Brush Cuckoo	P	Opportunistic record	x			x						
		Chalcites lucidus	Shining Bronze-Cuckoo	P	Bird survey		x				x				
		Scythrops novaehollandiae	Channel-billed Cuckoo	P	Bird survey				x	x					x

Order	Family	Scientific Name	Common Name	Legal Status	Method	Location									
						Dry forest					Rainforest				
						08	09	10	11	12	08	09	10	11	12
Galliformes	Megapodiidae	*Alectura lathami*	Australian Brush-turkey	P	Opportunistic record						x				
Passeriformes	Acanthizidae	*Acanthiza lineata*	Striated Thornbill	P	Bird survey	x		x	x					x	
		Acanthiza pusilla	Brown Thornbill	P	Bird survey	x		x	x	x	x	x		x	
		Gerygone mouki	Brown Gerygone	P	Bird survey	x	x	x	x		x	x	x	x	x
		Sericornis citreogularis	Yellow-throated Scrubwren	P	Bird survey						x	x	x	x	x
		Sericornis frontalis	White-browed Scrubwren	P	Bird survey	x	x		x		x	x			
	Artamidae	*Cracticus nigrogularis*	Pied Butcherbird	P	Bird survey				x						
		Cracticus tibicen	Australian Magpie	P	Bird survey			x							
		Strepera graculina	Pied Currawong	P	Bird survey	x	x								
	Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	P	Bird survey		x								
		Coracina tenuirostris	Cicadabird	P	Opportunistic record	x				x					
	Climacteridae	*Cormobates leucophaea*	White-throated Treecreeper	P	Bird survey	x	x	x	x	x	x	x	x		x
	Corvidae	*Corvus coronoides*	Australian Raven	P	Opportunistic record	x		x	x	x					
	Estrildidae	*Neochmia temporalis*	Red-browed Finch	P	Bird survey		x								
	Maluridae	*Malurus cyaneus*	Superb Fairy-wren	P	Bird survey		x					x		x	x
		Malurus lamberti	Variegated Fairy-wren	P	Bird survey					x		x			
	Meliphagidae	*Acanthorhynchus tenuirostris*	Eastern Spinebill	P	Bird survey	x	x	x	x	x	x	x	x	x	x
		Lichenostomus chrysops	Yellow-faced Honeyeater	P	Bird survey	x	x	x	x	x				x	
		Manorina melanophrys	Bell Miner	P	Bird survey	x			x						
		Meliphaga lewinii	Lewin's Honeyeater	P	Bird survey	x	x	x	x	x	x	x	x	x	x

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Order	Family	Scientific Name	Common Name	Legal Status	Method	Location									
						Dry forest					Rainforest				
						08	09	10	11	12	08	09	10	11	12
		Melithreptus lunatus	White-naped Honeyeater	P	Bird survey	x									x
		Myzomela sanguinolenta	Scarlet Honeyeater	P	Bird survey	x	x	x	x		x	x	x	x	
		Philemon corniculatus	Noisy Friarbird	P	Bird survey				x						
	Menuridae	*Menura novaehollandiae*	Superb Lyrebird	P	Bird survey										x
	Monarchidae	*Monarcha melanopsis*	Black-faced Monarch	P	Bird survey	x	x	x	x		x	x	x	x	x
		Symposiachrus trivirgatus	Spectacled Monarch	P	Opportunistic record										x
		Myiagra rubecula	Leaden Flycatcher	P	Bird survey	x	x		x		x				
	Oriolidae	*Oriolus sagittatus*	Olive-backed Oriole	P	Bird survey										x
	Pachycephalidae	*Colluricincla harmonica*	Grey Shrike-thrush	P	Bird survey	x				x	x		x	x	x
		Pachycephala pectoralis	Golden Whistler	P	Bird survey	x	x	x	x		x	x	x	x	x
		Pachycephala rufiventris	Rufous Whistler	P	Bird survey	x		x	x		x	x	x	x	
	Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote	P	Bird survey	x	x	x	x	x	x	x		x	x
	Petroicidae	*Eopsaltria australis*	Eastern Yellow Robin	P	Bird survey	x	x	x	x		x	x	x	x	x
	Pittidae	*Pitta versicolor*	Noisy Pitta	P	Bird survey					x		x	x		x
	Psophodidae	*Cinclosoma punctatum*	Spotted Quail-thrush	P	Bird survey	x	x					x			
		Psophodes olivaceus	Eastern Whipbird	P	Bird survey	x	x	x	x	x	x	x	x	x	x
	Ptilonorhynchidae	*Ailuroedus crassirostris*	Green Catbird	P	Bird survey					x		x		x	x
		Ptilonorhynchus violaceus	Satin Bowerbird	P	Bird survey								x		
	Rhipiduridae	*Rhipidura fuliginosa*	Grey Fantail	P	Bird survey	x	x	x	x	x	x	x	x	x	x
		Rhipidura rufifrons	Rufous Fantail	P	Bird survey			x		x	x				
	Timaliidae	*Zosterops lateralis*	Silvereye	P	Bird survey	x	x	x	x	x	x	x	x	x	x
Psittaciformes	Psittacidae	*Alisterus scapularis*	Australian King-Parrot	P	Bird survey		x		x		x				
		Platycercus eximius	Eastern Rosella	P	Bird survey		x		x			x			
		Trichoglossus haematodus	Rainbow Lorikeet	P	Opportunistic record	x									

Order	Family	Scientific Name	Common Name	Legal Status	Method	Location									
						Dry forest					Rainforest				
						08	09	10	11	12	08	09	10	11	12
Strigiformes	Strigidae	*Ninox strenua*	Powerful Owl	V	Opportunistic record				x		x		x	x	x
		Ninox novaeseelandiae	Southern Boobook	P	Spotlighting			x				x			
	Tytonidae	*Tyto tenebricosa*	Sooty Owl	V	Spotlighting			x		x					x
					Total	**33**	**28**	**23**	**31**	**19**	**26**	**24**	**20**	**23**	**25**
		Arboreal Mammals													
Diprotodonta	Acrobatidae	*Acrobates pygmaeus*	Feathertail Glider	P	Spotlighting	x		x	x						
	Petauridae	*Petaurus breviceps*	Sugar Glider	P	Spotlighting	x	x	x	x	x					
	Phalangeridae	*Trichosurus vulpecula*	Common Brushtail Possum	P	Spotlighting			x	x	x		x			x
	Pseudocheiridae	*Petauroides volans*	Greater Glider	P	Spotlighting					x	x				
		Pseudocheirus peregrinus	Common Ringtail Possum	P	Spotlighting					x					
					Total	**2**	**1**	**3**	**3**	**4**	**1**	**1**	**0**	**0**	**1**
Terrestrial Mammals															
Dasyuromorphia	Dasyuridae	*Antechinus stuartii*	Brown Antechinus	P	Trapping	x	x	x	x	x	x	x	x	x	x
		Antechinus swainsonii	Dusky Antechinus	P	Trapping				x						
Rodentia	Muridae	*Rattus fuscipes*	Bush Rat	P	Trapping	x	x		x		x	x	x	x	x
		Rattus rattus	Black Rat	U	Trapping										x
Peramelemorphia	Peramelidae	*Perameles nasuta*	Long-nosed Bandicoot	P	Trapping	x		x			x	x	x		
Diprotodonta	Macropodidae	*Wallabia bicolor*	Swamp Wallaby	P	Trapping				x		x				
					Total	**3**	**2**	**2**	**4**	**1**	**4**	**3**	**3**	**2**	**3**
		Bats													
Chiroptera	Molossidae	*Mormopterus norfolkensis*	Eastern Freetail-bat	V	Anabat analysis							x			
		Mormopterus sp. 2		P	Anabat analysis					x		x			x
		Tadarida australis	White-striped Free-tailed Bat	P	Anabat analysis					x					x
	Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	Spotlighting	x									

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Order	Family	Scientific Name	Common Name	Legal Status	Method	Location									
						Dry forest					Rainforest				
						08	09	10	11	12	08	09	10	11	12
	Rhinolophidae	*Rhinolophus megaphyllus*	Eastern Horseshoe Bat	P	Anabat analysis										x
	Vespertilionidae	*Miniopterus australis*	Little Bentwing-bat	V	Trapping & Anabat analysis	x	x	x		x	x	x		x	x
		Chalinolobus gouldii	Gould's Wattled Bat	P	Anabat analysis	x	x					x			x
		Chalinolobus morio	Chocolate Wattled Bat	P	Trapping & Anabat analysis	x	x		x					x	
		Falsistrellus tasmaniensis / Scotorepens orion	Eastern False Pipistrelle / Eastern Broad-nosed Bat	P	Anabat analysis		x					x			
		Nyctophilus geoffroyi	Lesser Long-eared Bat	P	Trapping				x						
		Nyctophilus gouldi	Gould's Long-eared Bat	P	Trapping		x					x			
		Nyctophilus sp.		P	Anabat analysis					x					
		Scoteanax rueppellii	Greater broad-nosed bat	V	Anabat analysis										x
		Vespadelus pumilus	Eastern Forest Bat	P	Anabat analysis	x	x			x		x	x		x
		Vespadelus troughtoni	Eastern Cave Bat	V	Anabat analysis					x					x
		Vespadelus vulturnus	Little Forest Bat	P	Trapping & Anabat analysis	x	x	x	x	x	x	x			x
					Total	**6**	**7**	**2**	**3**	**7**	**2**	**8**	**1**	**2**	**9**

V = Vulnerable, P = Protected, U = Unprotected (NSW TSC and NPWS Acts)

APPENDIX 3: PHOTOGRAPHS OF SELECTED FAUNA SPECIES DETECTED AT LONG GULLY CREEK

Common Brushtail Possum (*Trichosurus vulpecula*)

Sugar Glider (*Petaurus breviceps*)

Brown Antechinus (*Antechinus stuartii*)

Bush Rat (*Rattus fuscipes*)

Long-nosed Bandicoot (*Perameles nasuta*)

Feathertail Glider (*Acrobates pygmaeus*)

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Bats, reptiles, amphibians and birds

Gould's Wattled Bat (*Chalinolobus gouldii*)

Little Forest bat (*Vespadelus vulturnus*)

Gould's Long-eared Bat (*Nyctophilus gouldi*)

Peron's Tree Frog (*Litoria peronii*)

Powerful Owl (*Ninox strenua*)

Lace Monitor (*Varanus varius*)

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APPENDIX 4: CONTRIBUTIONS

Name	Qualification	Title	Contribution
Gilbert Whyte	PhD	Ecologist (Botanist)	Flora survey and report writing
Alejandro Barreto	BSc.Env, Dip.Cons& Land Mgt	Ecologist (Botanist)	Flora Survey
Dan O'Brien	BEnvSc&Mgt (Hons)	Ecologist (Zoologist)	Fauna Survey
Luke Foster	MEnvSc, BEnvSc&Mgt	Ecologist (Zoologist)	Fauna Survey and report writing

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6. LICENSING MATTERS

Kleinfelder-Ecobiological employees involved in the current study are licensed or approved under the National Parks and Wildlife Act 1974 (License Number: SL100730, Expiry: 31st March 2013) and the Animal Research Act 1985 to harm/trap/release protected native fauna and to pick for identification purposes native flora and to undertake fauna surveys.