

Appendix 4

2013 Sub-tropical Rainforest Monitoring Abel Underground Coal Mine

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2013 Subtropical Rainforest Monitoring



Donaldson Coal Pty Ltd

Abel Underground Coalmine
1132 John Renshaw Drive
Black Hill NSW 2322

February 2013

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2013 Subtropical Rainforest Monitoring

Abel Underground Coalmine
1132 John Renshaw Drive
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EXECUTIVE SUMMARY

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

The F&FMP identified the need to establish a plan to monitor the Subtropical 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.

Annual monitoring has been continuously conducted at Long Gully Creek for the past six years (2008 - 2013). This area has been identified as potentially susceptible to impacts from mine subsidence. The Subtropical Rainforest Monitoring Plan (SRMP) is designed to examine the stability of the rainforest/dry forest interface and floristic and faunal diversity. The current study has gathered information on the presence and status of threatened species at the site and will allow best practice measures to be incorporated into the mine's Subsidence Management Plan (SMP). The Subtropical Rainforest Monitoring Plan (SRMP) will continue until one year after mining has passed under the Long Gully and Blue Gum Creek catchments.

This document reports results of the sixth annual monitoring event since a baseline survey conducted by ecobiological in 2008. Changes in the assemblages of flora, fauna and threatened species over time are analysed to detect significant trends.

*Flora survey results from 2013 were similar to those of the baseline survey, representing no substantial change in floral diversity. The transition between dry and moist forest has changed slightly in 2013, with a slight increase in the width of the rainforest within the gully. This is likely to be due to natural changes in species composition occurring within the subject site. A slight retraction of the shrub layer has also occurred, which can be explained by the dieback of the weed *Lantana camara*. Groundcover species richness appears to have decreased, which may be attributed to dry conditions during months leading up to the survey period. These changes are only minor and are consistent with expectations of a dynamic natural ecosystem.*

In total, 53 fauna species were recorded during the 2013 survey period, comprising three arboreal mammals, four terrestrial mammals, eight bats, 37 birds, and one amphibian. Three



species detected are listed as threatened under the NSW Threatened Species Conservation Act 1995 and include Sooty Owl (Tyto tenebricosa), Southern Myotis (Myotis macropus), and Little Bentwing-bat (Miniopterus australis).

Four new bird species were detected in 2013 surveys including Dollarbird, Mistletoebird, Regent Bowerbird, and Sulphur-crested Cockatoo. Fauna species richness in 2013 is close to the average for most species groups in both dry forest and rainforest. The data show a high variability in the bat diversity, with relatively low numbers of species in the years 2008, 2010 and 2011; and high numbers in years 2009, 2012 and 2013. This is more likely to be due to variations in detectability between years rather than actual changes in bat numbers.



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ABBREVIATIONS

| | |
|---------------------|---|
| EP&A Act | <i>Environmental Planning and Assessment Act 1979 (NSW)</i> |
| EPBC Act | <i>Environment Protection and Biodiversity Conservation Act 1999 (C'th)</i> |
| GIS | Geographic Information System |
| ha | hectares |
| LGA | Local Government Area |
| TSC Act | <i>Threatened Species Conservation Act 1995 (NSW)</i> |



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 in 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 rural residential and forested areas at Black Hill. 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). The key environmental concern 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.

Development approval for the Abel coal mine imposed a number of conditions of consent. These conditions included a requirement for 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 against



subsidence impacts on three distinct habitat areas: farm dams 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 document reports results from the sixth annual monitoring event for the Subtropical Rainforest Monitoring and Management Plan (SRMP) since completion of the baseline study in 2008, and is 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.

1.3 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 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 M1 Pacific Motorway (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 2,750 ha and consists of low undulating forested hills with patches of cleared land occurring on 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.

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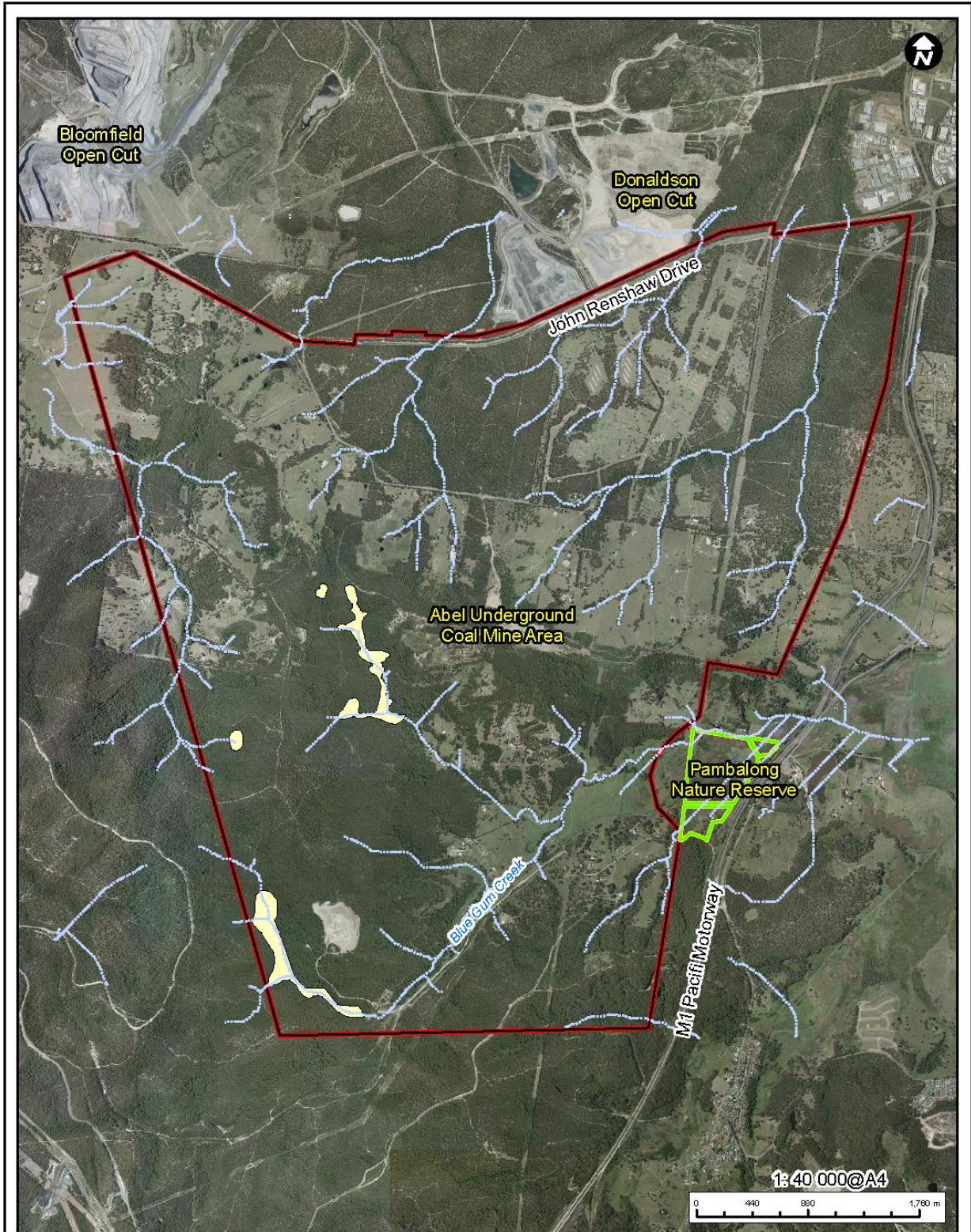






Figure 1 - Location of Abel underground mine area

Legend / Notes

-  Waterways
-  Rainforest
-  Pambalong Nature Reserve
-  Abel Underground Coalmine Boundary



Project Ref: 137630
Plot Date: 12/02/2014 11:38
Revision: 001 (gjoyce)

Map Projection:
GDA 1994 MGA Zone 56

Data Sources:
LPI - 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.

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2. METHODS

2.1 FLORA

Field sampling for flora aims to measure the spatial extent of the rainforest community in Long Gully Creek order to determine if it is stable, expanding or contracting. Two transects spanning the width of the rainforest start and end in the adjoining dry forest (**Figure 2**). The lengths of Transects 1 and 2 are 70 m and 50 m respectively. Transects were divided into 5 m long by 1 m wide consecutive quadrats. Flora surveys were conducted in October 2013.

Information recorded in each quadrat is described below.

- Total floristic content, with species recorded being classified as typically occurring in dry or moist forest habitats, and whether they formed part of the ground, shrub, midstorey or overstorey/emergent stratum; and,
- An estimate of the foliage projective cover (FPC) (Walker & Hopkins 1988) of vegetation in the ground, shrub, midstorey, overstorey and vine stratum. 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 specimen is collected of plants unable to be identified in the field for later identification. Floristic identification and nomenclature was based on Harden (1992, 1993, 2000, 2002) with subsequent revisions as published on PlantNet (Royal Botanic Gardens and Domain Trust 2013). Plants of local conservation significance and/or listed by the ROTAP scheme (Briggs & Leigh 1996) are noted.



2.2 FAUNA

Field surveys for fauna are centred on two transects approximately 200 m long, one located in the rainforest and the other in the adjacent dry forest. Fauna surveys were conducted from 27 October to 1 November 2013.

The number and type of traps used in each transect is equal except for the number of Elliott B traps in trees (Table 1). Seven traps were placed in trees in the dry forest compared to three in the rainforest due to the difficulty inserting trap platform brackets into hard rainforest tree trunks and the presence of poisonous plant species surrounding these trees. The location of fauna survey activities is shown in Figure 2.

Table 1 Trapping statistics for the subject site

| Trap type | Rainforest Transect | Dry Forest Transect | Nights | Trap nights |
|-----------------------|------------------------|------------------------|--------|-------------|
| Elliott A | 20 | 20 | 4 | 160 |
| Elliott B Tree | 3 | 7 | 4 | 40 |
| Elliott B Ground | 5 | 5 | 4 | 40 |
| Harp Trap | 1 | 1 | 4 | 8 |
| Hair tubes (in trees) | 8 | 8 | 4 | 64 |

2.2.1 Arboreal Mammals

Elliott B traps and hair tubes are placed in trees at heights of 3 m or more along transects and baited with a mixture of rolled oats, honey, peanut butter and treacle. The trunks of trees containing the traps are sprayed with a mixture of honey and water. Traps are checked daily. Wafers from the hair tubes are collected after a 4-night period and checked for hair samples. Hair identification methods follow those of Brunner et al. (2002). Samples from threatened species are sent to hair identification expert, Barbara Triggs for confirmation.

Spotlighting is undertaken after dusk for one person hour at each transect and repeated on two separate nights (four person hours total). Trees hollows are watched at dusk to detect emerging nocturnal birds or mammals.



2.2.2 Terrestrial Mammals

Elliott A and B are baited with a mix of rolled oats, honey, peanut butter and treacle and placed on the ground at regular intervals along each transect. Traps are left in position for four consecutive nights and checked each morning.

Anecdotal observations of the indirect signs of terrestrial mammals such as diggings, droppings or scratch marks are noted and recorded.

2.2.3 Bats

Harp traps are erected across likely bat 'flyways' such as natural forest openings on each transect. The harp traps are left in position for four consecutive nights and checked each morning. Captured bats are identified in the field and then released into an artificial bat box tethered to a nearby tree. This provides shelter from predators during the day and allows the bats to exit the box on nightfall.

Anabat™ II ultrasonic call detectors (Titley Electronics, Ballina) are used to record the calls of Microchiropteran bats feeding in the area. The units are set up at dusk and recording occurs for one hour at each transect and repeated on two separate nights (four hours total). Spotlight searches of blossoming trees are also undertaken to detect Megachiropteran bat species.

2.2.4 Birds

Each transect is walked for 20 minutes and birds detected within the immediate vicinity are recorded. Birds are identified either visually, with the aid of binoculars, or by call interpretation. Surveys were conducted in the morning when bird activity is highest (Bibby et al. 2000). Opportunistic sightings were also recorded and listed separately to results from systematic surveys.

After dark, the calls of threatened owl species (Powerful Owl, Masked Owl, Sooty Owl and Barking Owl) are broadcast over a loudspeaker in an attempt to encourage a call response. The size, shape and content of any owl regurgitation 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).

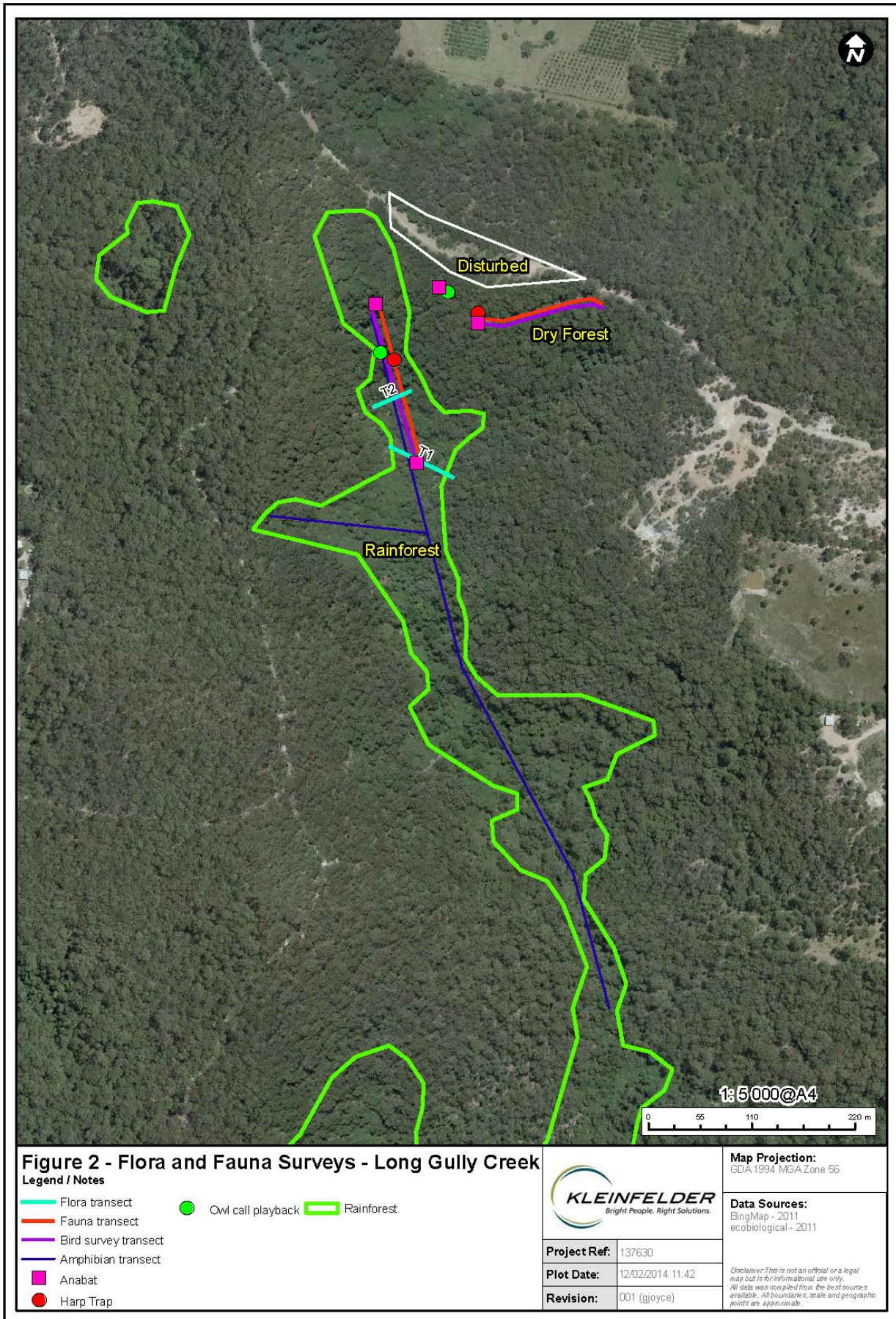


2.2.5 Amphibians

Searches for amphibians are conducted along a portion of the length of the Long Gully rainforest. This involves diurnal habitat searches, nocturnal spotlight surveys and dip netting for tadpoles. Call playback is also conducted for two species of threatened barred river frogs (*Mixophyes balbus* and *M. iteratus*) due to the presence of potential habitat.

Diurnal surveys involving dip netting and visual searches are carried out to detect tadpoles in water bodies. Nocturnal surveys involve walking lengths of suitable habitat and using head torches to search for frog eye shine or movement.

Adult frogs are identified either visually or by their distinct advertisement calls. Tadpoles are 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).



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3. RESULTS

1.1 WEATHER CONDITIONS AND SURVEY ACTIVITY

The prevailing weather conditions during the trapping survey period were warm to mild and humid days, with light to overcast conditions, no rain, and light to moderate winds. The temperature range was between 10 and 30° C. Data on weather conditions during the survey period are provided in **Table 2**.

Table 2: Weather conditions during the fauna survey period (Cessnock Airport)

| Weather | Date | | | | |
|-------------------------------|------------|------------|------------|------------|------------|
| | 28/10/2013 | 29/10/2013 | 30/10/2013 | 31/10/2013 | 01/11/2013 |
| Temp. Min. (°C) | 11.6 | 9.0 | 13.1 | 6.3 | 13.0 |
| Temp Max. (°C) | 29.5 | 32.6 | 22.8 | 26.6 | 26.7 |
| Humidity 9am | 71 | 60 | 58 | 61 | 55 |
| Humidity 3pm | 21 | 77 | 43 | 26 | 43 |
| Rain | 0 | 0 | 9 | 0 | 0 |
| Barometric pressure 9am (hPa) | 1018.6 | 1006.5 | 1018.6 | 1021.5 | 1022.9 |
| Barometric pressure 3pm (hPa) | 1012.5 | 1006.4 | 1017 | 1017.6 | 1018.8 |
| Max wind gust (km/hr) | 41 | 54 | 37 | 37 | 31 |
| Wind direction | SE | N | ESE | E | E |

3.1 FLORA DIVERSITY

Field surveys in 2013 found a total count of 51 and 49 flora species on Transects 1 and 2 respectively (**Appendix 1**). This is slightly less than found during the baseline study in 2008, in which 54 and 51 flora species were detected.

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 grouped according to whether they are typically found in dry or moist forest habitat (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 in 2008. **Figure 4** and **Figure 6** show this relationship in 2013. The trend lines for Transect 1 have changed since the baseline survey indicating that the transition between dry and moist forest has expanded slightly over the past 6 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 overall increase of approximately 10 m since 2008.

The trend lines for Transect 2 in 2013 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.

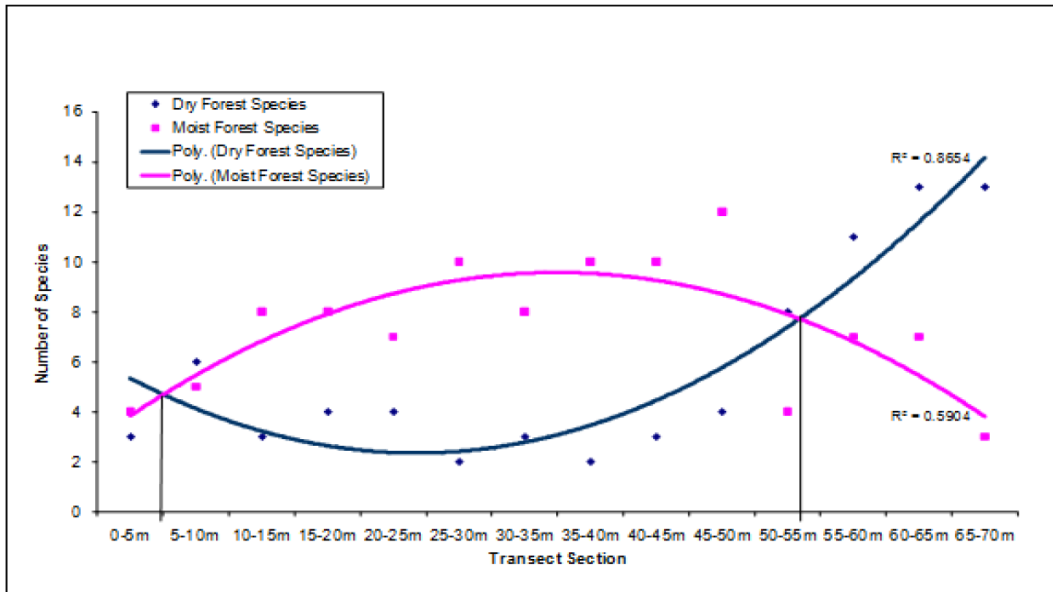


Figure 3 Transect 1 forest species curves, showing the relationship between dry and moist forest species across the length of the transect in 2008. Black lines indicate the forest transition zones determined in 2008

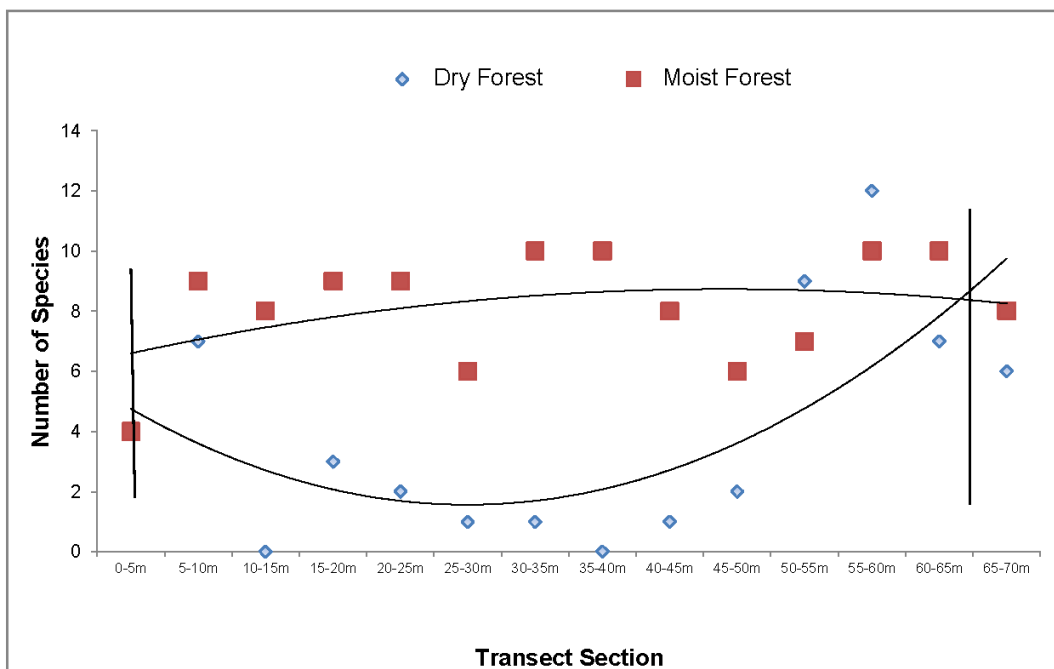


Figure 4 Transect 1 forest species curves, showing the relationship between dry and moist forest species across the length of the transect in 2013. Black lines indicate the forest transition zones determined in 2013

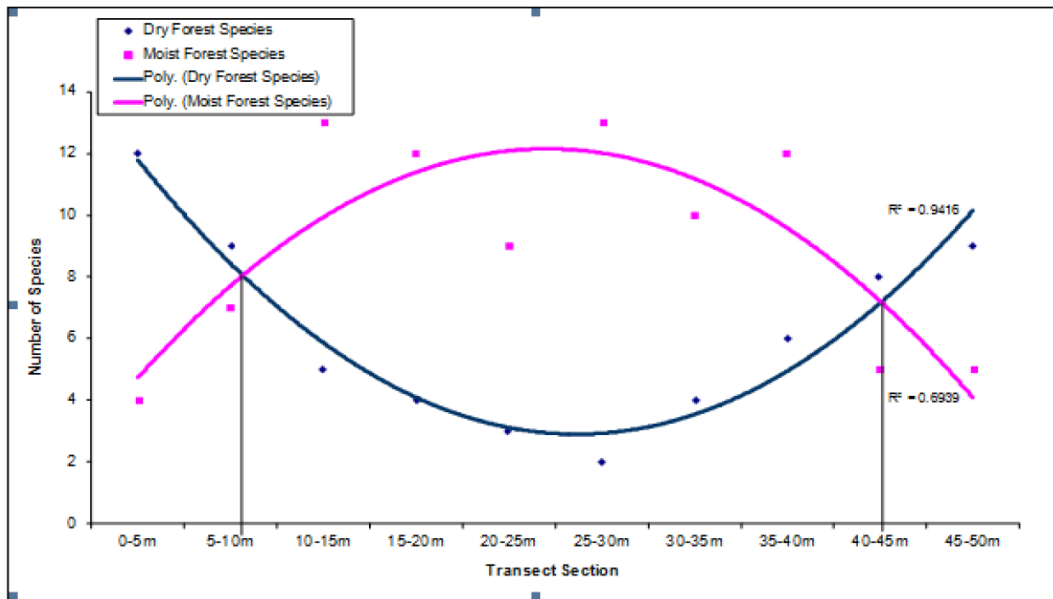


Figure 5 Transect 2 forest species curves, showing the relationship between dry and moist forest species across the length of the transect in 2008. Black lines indicate the forest transition zones determined in 2008.

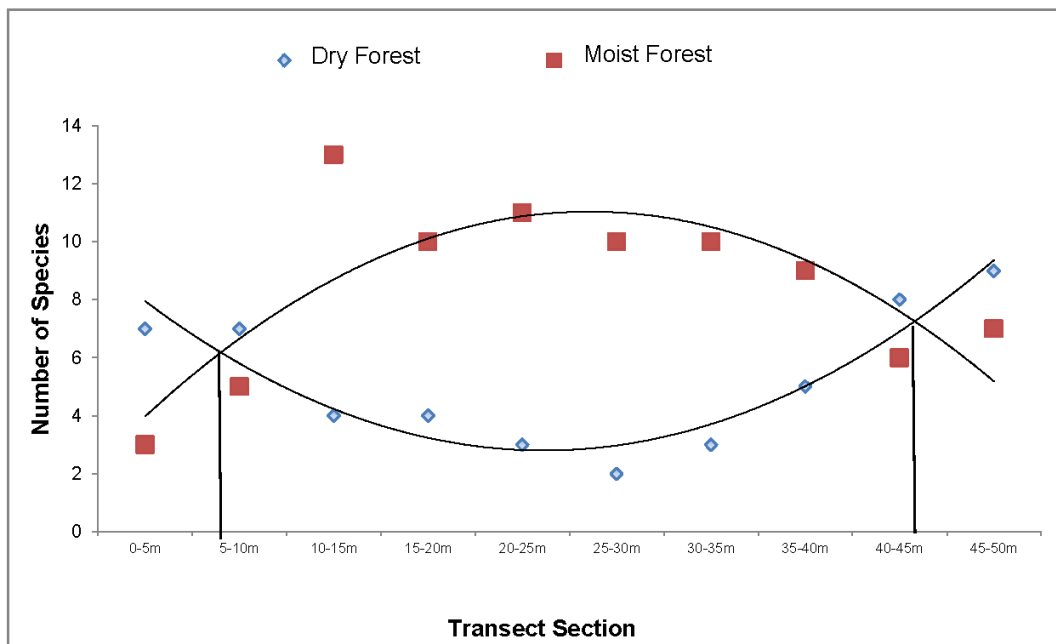


Figure 6 Transect 2 forest species curves, showing the relationship between dry and moist forest species across the length of the transect in 2013. Black lines indicate the forest transition zones determined in 2013.



3.2 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**). Two spikes in the figure indicate a significant increase in groundcover at two points along Transect 1. This may have been triggered by favourable conditions such as high rainfall and temperature.

The shrub layer FPC has dropped between intervals 6 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 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.

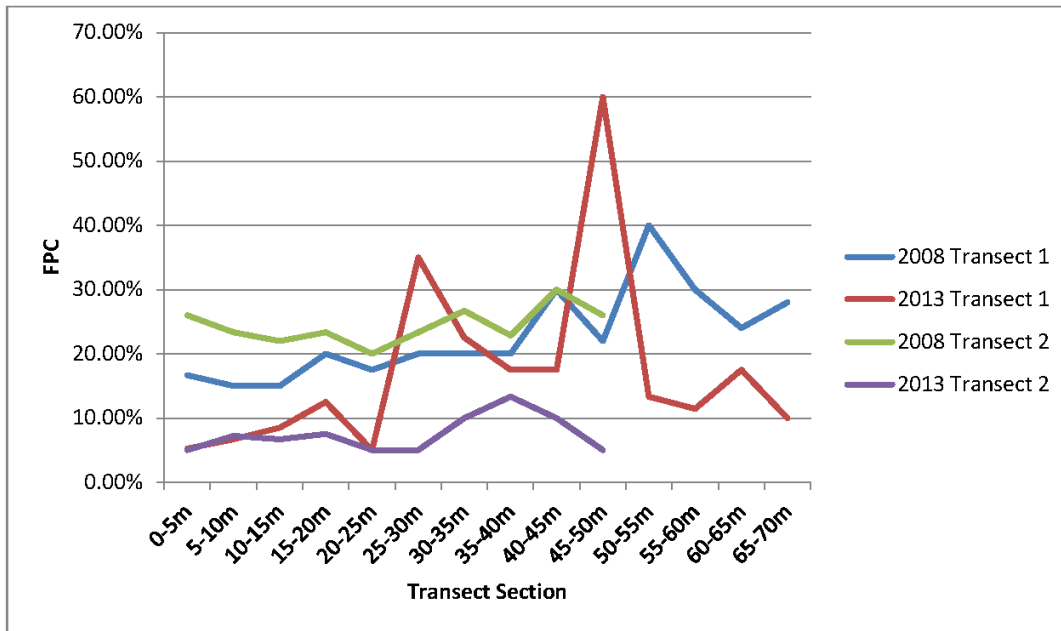


Figure 7 Estimated ground layer FPC for Transect 1 and Transect 2 in 2008 and 2013.

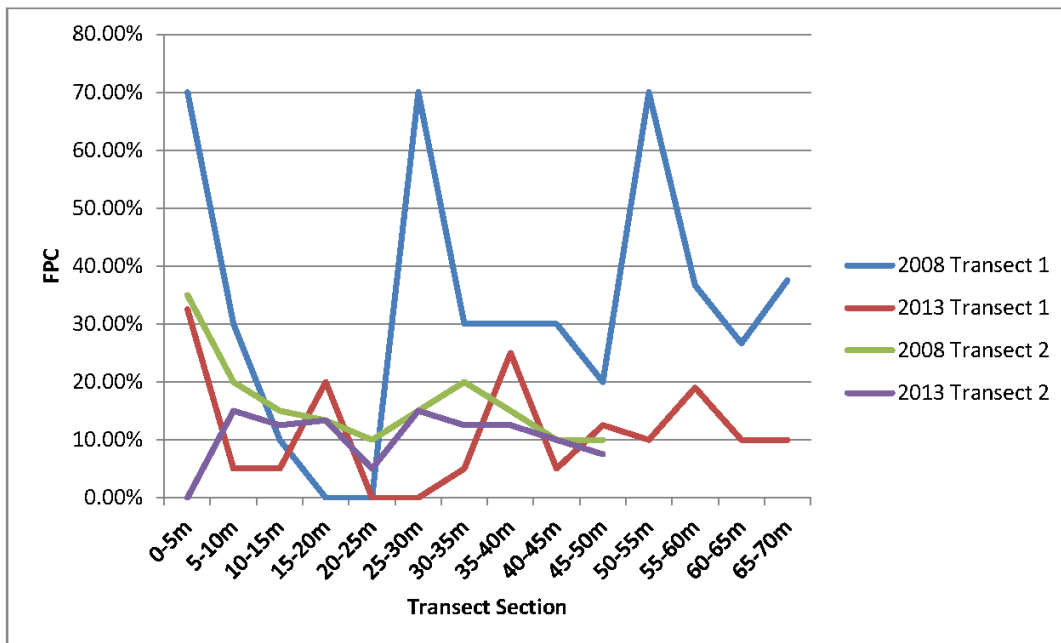


Figure 8 Estimated shrub layer FPC for Transect 1 and Transect 2 in 2008 and 2013.

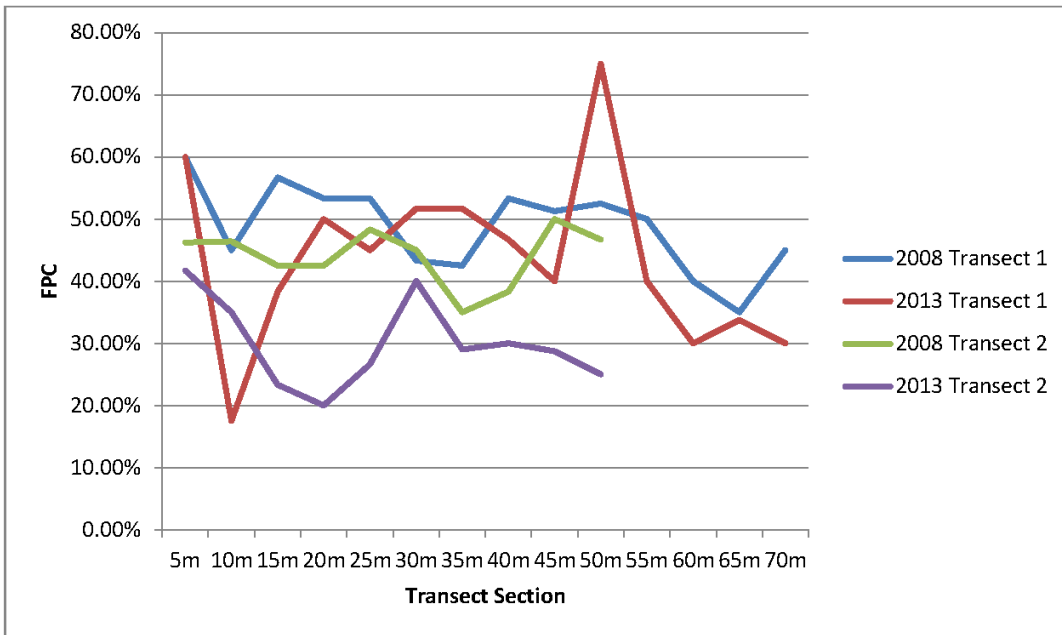


Figure 9 Estimated midstorey layer FPC for Transect 1 and Transect 2 in 2008 and 2013.

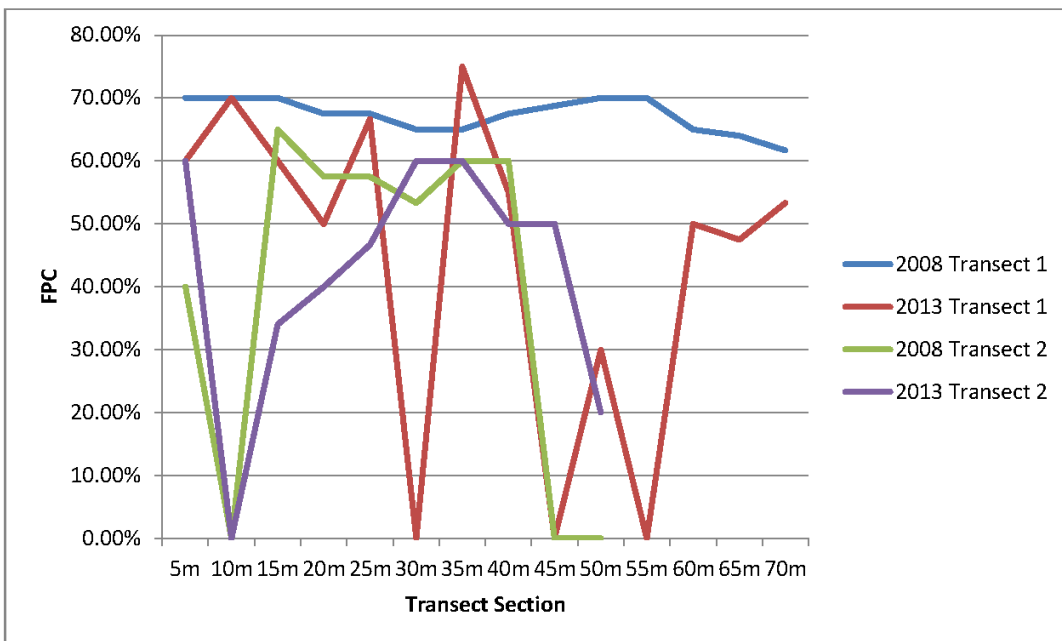


Figure 10 Estimated overstorey layer FPC for Transect 1 and Transect 2 in 2008 and 2013.

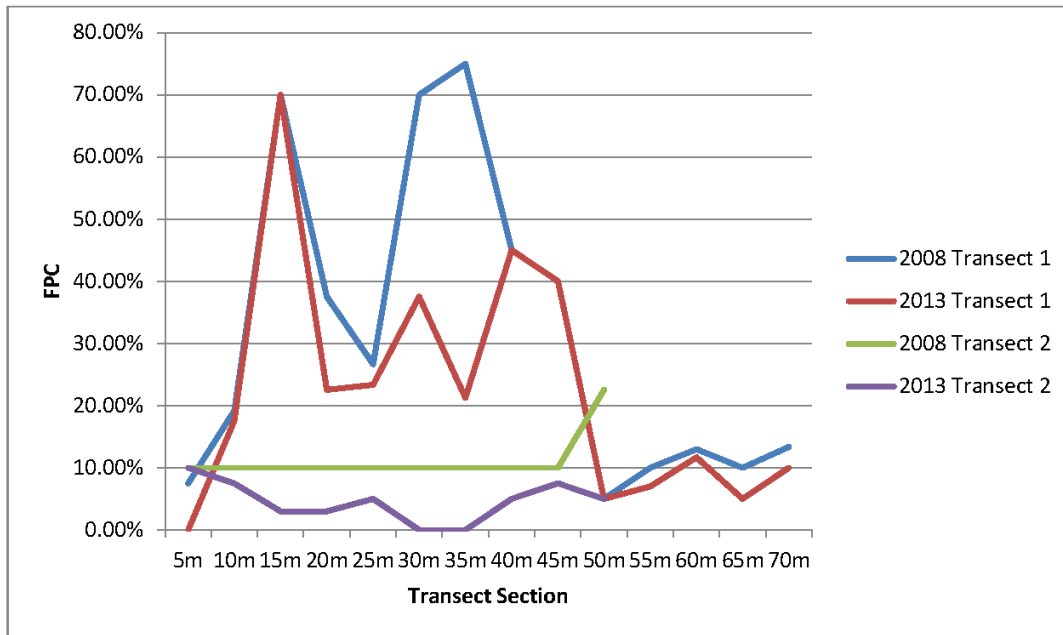


Figure 11 Estimated vine layer FPC for Transect 1 and Transect 2 in 2008 and 2013.



3.3 FAUNA SPECIES RICHNESS

In total, 52 fauna species were recorded during the 2013 survey period, comprising three arboreal mammal species, four terrestrial mammal species, seven bat species, 37 bird species, one amphibian species and no reptile species (**Appendix 2**). Two of these species, the Sooty Owl (*Tyto tenebricosa*) and Little Bentwing-bat (*Miniopterus australis*) are listed as threatened under the *TSC Act 1995*.

In 2013 a total of 39 and 37 fauna species were recorded in the Dry Forest and Rainforest habitats respectively. These results are similar to the average number of species recorded across all years which is 38 in the Dry Forest and 33 in the Rainforest (**Figure 12**).

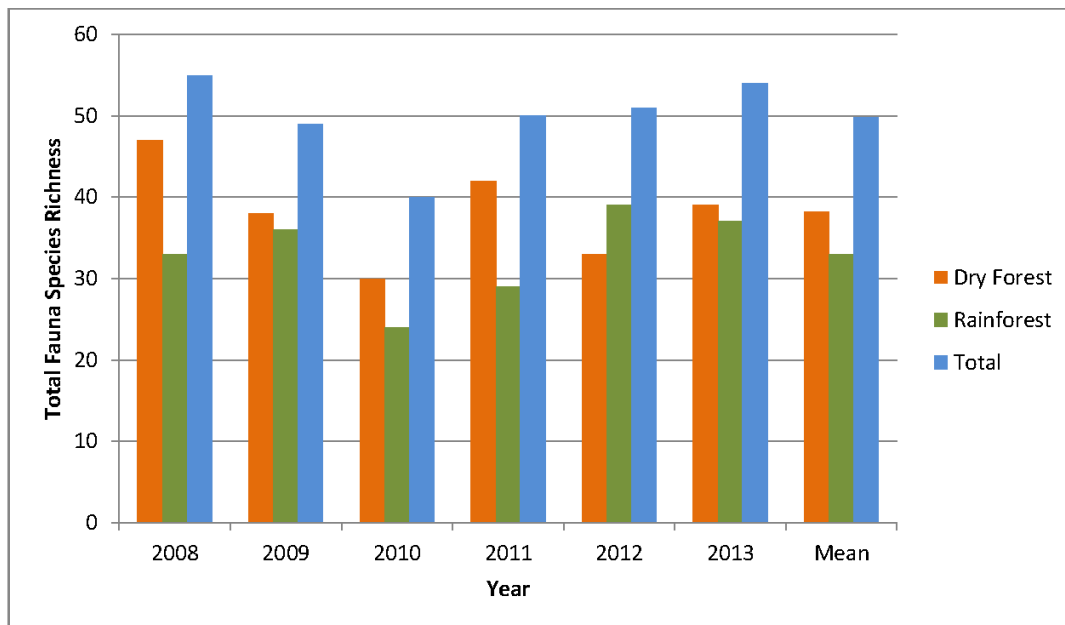


Figure 12 Fauna Species Richness in Dry Forest and Rainforest transects from 2008 to 2013.

Each fauna 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 from all years are also provided in **Appendix 3**.



3.3.1 Arboreal Mammals

Three arboreal mammal species were recorded during the survey period. These included the Common Brushtail Possum (*Trichosurus vulpecular*), the Common Ringtail Possum (*Pseudocheirus peregrinus*) and the Greater Glider (*Petauroides volans*). The number of arboreal mammal species recorded in the dry rainforest transect was lower in 2013 (n = 2) than in the years from 2010 to 2012 (n = 3, 3 & 4 respectively). The number of arboreal mammals recorded in the rainforest transect in 2013 was the greatest recorded. The total number of species recorded in 2013 was equal to the average for all years (Figure 13).

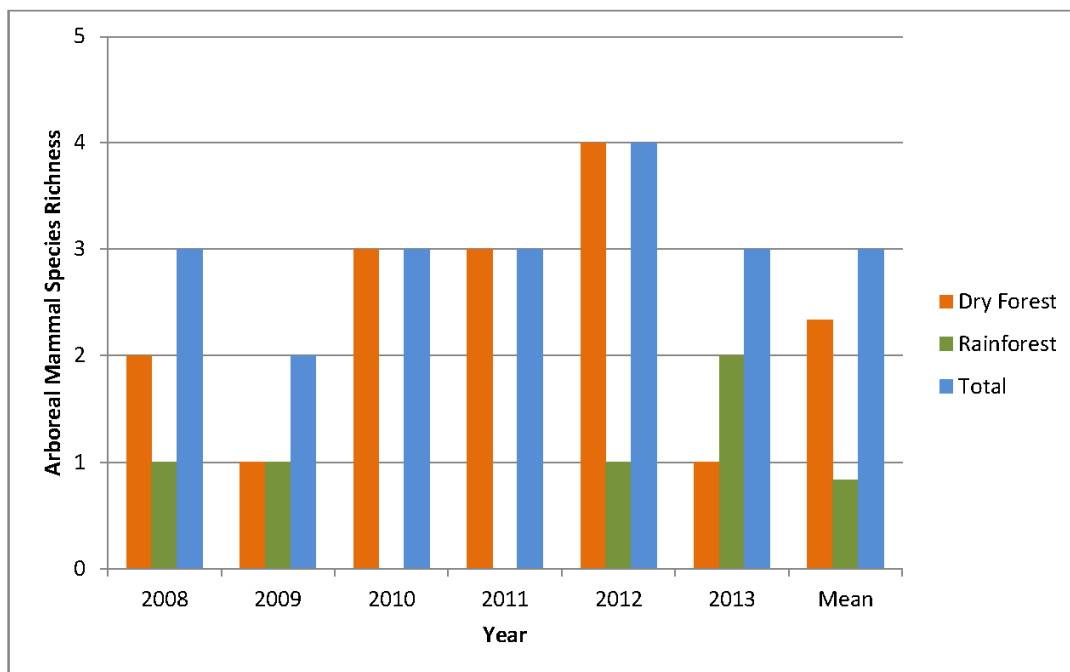


Figure 13 Arboreal Mammal Species Richness within the Dry Forest and Rainforest transects from 2008 to 2013.

3.3.2 Terrestrial Mammals

Four terrestrial mammal species were detected during the 2013 survey and included Brown Antechinus (*Antechinus stuartii*), Swamp Wallaby (*Wallabia bicolor*), Bush Rat (*Rattus fuscipes*), and Short-beaked Echidna (*Tachyglossus aculeatus*). Terrestrial mammal species richness was equal to the average for all years in both the dry forest and the rainforest transects (Figure 14).

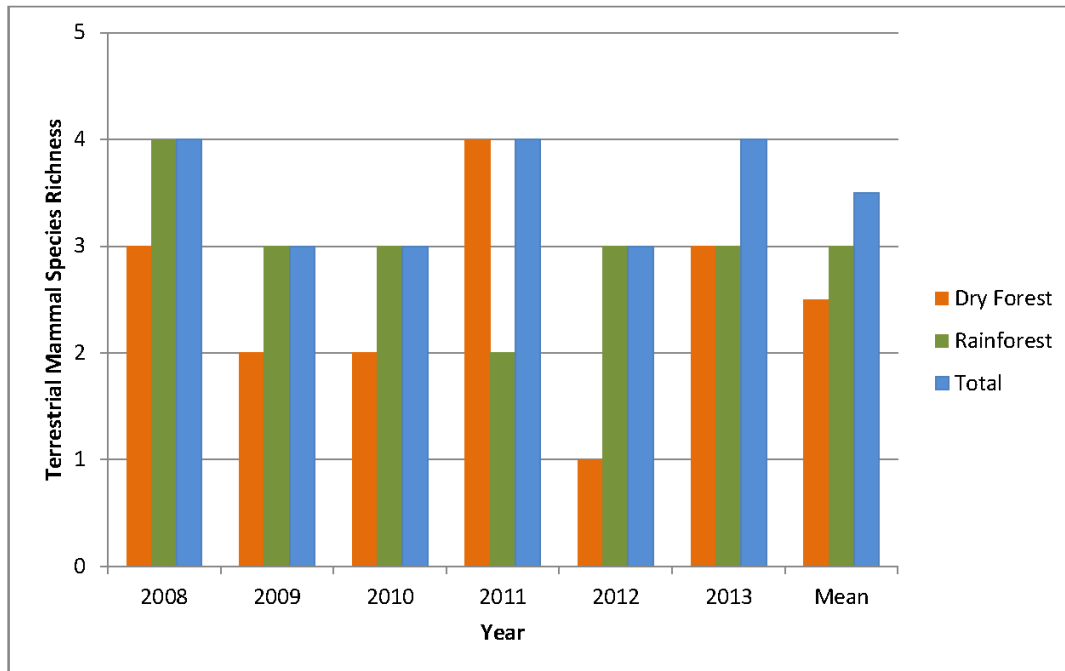


Figure 14 Terrestrial Mammal Species Richness within the Dry Forest and Rainforest transects from 2008 to 2013.

3.3.3 Bats

Seven species of insectivorous bat could be confirmed as occurring on the subject site during the 2013 survey with most being detected from Anabat™ ultrasonic call recordings. A long-eared bat species could only be confidently identified to the genus *Nyctophilus sp.* based on ultrasonic call recordings. Little Bentwing-bat (*Miniopterus australis*) was recorded in both dry forest and rainforest and is listed as threatened under the *TSC Act 1995*. A possible call of the threatened Southern Myotis (*Myotis macropus*) was recorded but could not be positively confirmed. The number of species recorded is the same as the average for all years ($n = 7$). Bat diversity was relatively low in the years 2008 (6), 2010 (3), and 2011 (4) when compared to 2009 (9), 2012 (10) and 2013 (7) (Figure 15).

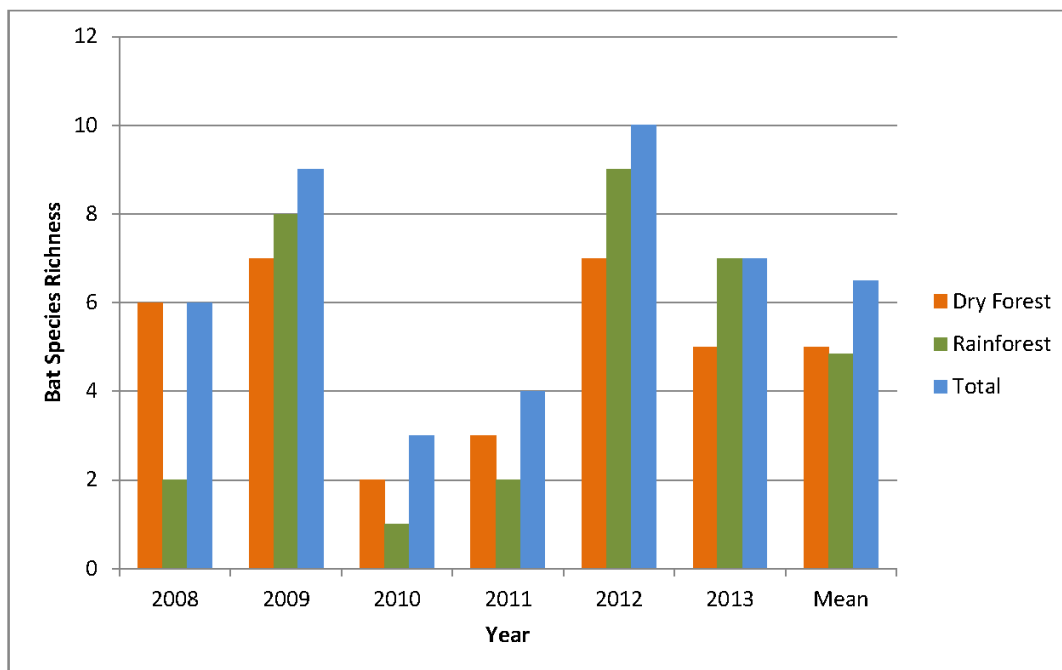


Figure 15 Bat Species Richness within the Dry Forest and Rainforest transects from 2008 to 2013.

3.3.4 Birds

A total of 37 bird species were detected in 2013 which the second highest recorded compared to 30 in 2012, 34 in 2011, 30 in 2010, and 35 in 2009. In 2008, 39 species were recorded (Figure 16).

Four previously unrecorded bird species were detected in 2013 including Dollarbird (*Eurystomus orientalis*) in the dry rainforest; and Mistletoebird (*Dicaeum hirundinaceum*), Regent Bowerbird (*Sericulus chrysocephalus*), and Sulphur-crested Cockatoo (*Cacatua galerita*) in the rainforest.

Bird species richness for the dry rainforest (30 species) was the third highest recorded, compared to 33 in 2008 and 31 in 2011, and up markedly from the 19 species recorded in 2012 which was the lowest recorded (Figure 16). In 2013 bird species richness was above the average for the dry forest transect and close to the average for the rainforest transect (Figure 16).



The threatened Powerful Owl (*Ninox strenua*), recorded in 2008 (rainforest), 2010 (dry rainforest and rainforest), 2011 (dry rainforest and rainforest), 2012 (rainforest), was not recorded in the 2013 survey. The threatened Sooty Owl (*Tyto tenebricosa*), recorded in 2010 (dry rainforest) and 2012 (dry rainforest and rainforest), was heard on the rainforest transect during the 2013 spotlight survey.

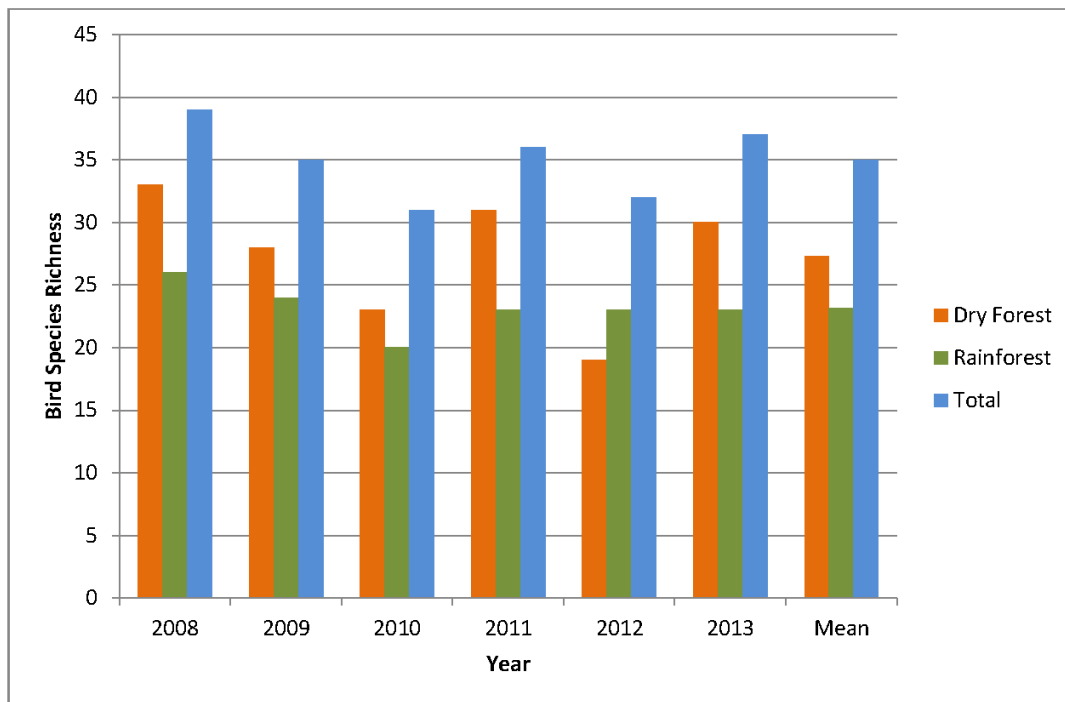


Figure 16 Bird Species Richness within the Dry Forest and Rainforest transects from 2008 to 2013.

3.3.5 Amphibians

Only one amphibian species, the Eastern Dwarf Tree Frog (*Litoria fallax*) was detected during the 2013 survey. Amphibian species richness has also been low in previous years of the survey (Figure 17).

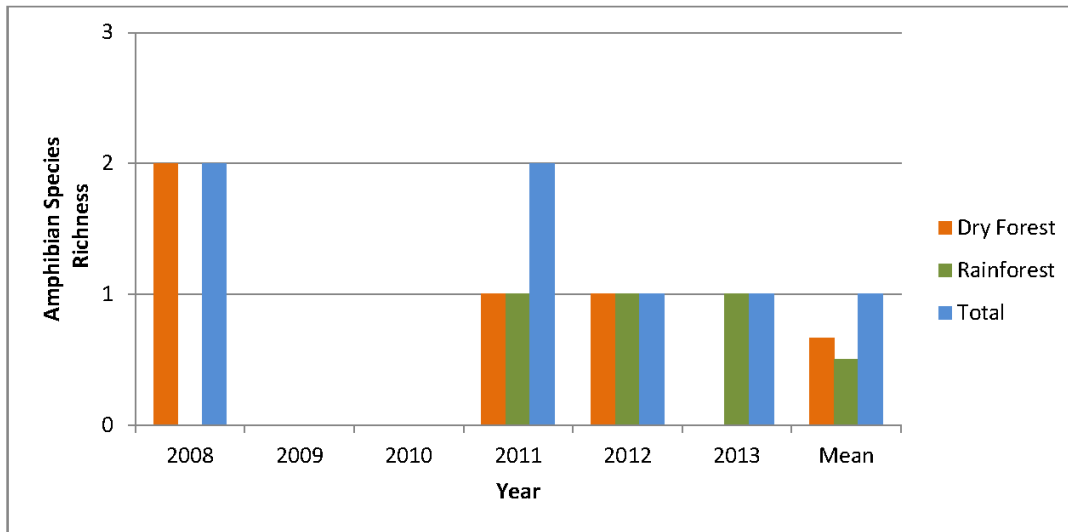


Figure 17 Amphibian Species Richness within the Dry Forest and Rainforest transects from 2008 to 2013.

3.3.6 Reptiles

Reptiles are not specifically targeted by the monitoring program, however any opportunistic sightings are noted. No reptile species were recorded in the 2013 survey.



4. CONCLUSION

Monitoring of the Subtropical Rainforest area within Long Gully Creek has been undertaken in 2013 in accordance with the F&FMP for Abel Underground Coalmine (ecobiological 2007). This sixth annual monitoring report documents the current extent of the Subtropical Rainforest community and the species richness of flora and fauna inhabiting it. Future annual surveys will contribute to a growing dataset from which significant change can be identified.

A total of 51 and 49 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 2013 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 2013 monitoring.

During the 2013 survey period a total of 52 fauna species were recorded, comprising three arboreal and four terrestrial mammals, seven bats, 37 birds, one amphibian and no reptiles (Appendix 2). Two of these, Sooty Owl (*Tyto tenebricosa*) and Little Bentwing-bat (*Miniopterus australis*) are listed as threatened under the TSC Act 1995.

Almost all arboreal and terrestrial fauna species recorded during baseline monitoring in 2008 were also recorded during the 2013 survey effort with the addition of four new bird species and one new bat species. The numbers of species detected in 2013 are close to the average for most species groups for both dry rainforest and rainforest. The data show a high variability in the bat diversity, with relatively low numbers of species in the years 2008 (6 species), 2010 (3 species), and 2011 (4 species); and when compared to 2009 (9 species), 2012 (10 species) and 2013 (9 species) (Figure 15) Bats are a highly mobile species and



their detectability may be influenced by where Anabat™ detectors are placed in relation to canopy gaps.

Annual monitoring is providing robust baseline information on the natural variation in the diversity of species in the Long Gully Creek system. The growing dataset will provide a sound benchmark against which future underground mining impacts can be assessed.



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APPENDIX 1: FLORA SPECIES RECORDED: 2008 - 2013

| Family | Scientific Name | Common Name | Forest Type | Stratum | Transect 1 | | | | | Transect 2 | | | | | | | |
|------------------|---|-----------------------|-------------|---------|------------|------|------|------|------|------------|------|------|------|------|------|------|---|
| | | | | | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | |
| Acanthaceae | <i>Pseuderanthemum variabile</i> | Pastel Flower | Dry | Ground | x | x | x | x | x | x | x | x | x | x | x | x | x |
| Pteridaceae | <i>Adiantum formosum</i> | Giant Maidenhair Fern | Moist | Ground | x | x | x | x | x | x | x | x | x | x | x | x | x |
| Pteridaceae | <i>Adiantum hispidulum</i> | Rough Maidenhair Fern | Moist | Ground | x | x | x | x | x | x | x | x | x | x | | | |
| Pteridaceae | <i>Pellaea falcata</i> | Sickle Fern | Dry | Ground | x | x | x | x | x | x | x | x | x | x | x | x | x |
| Aphanopetalaceae | <i>Aphanopetalum resinosum</i> | Gum Vine | Dry | Vine | x | x | x | x | x | x | | | | | | | |
| Apocynaceae | <i>Marsdenia rostrata</i> | Common Milk Vine | Dry | Vine | x | x | x | x | x | x | x | x | | | | | x |
| Apocynaceae | <i>Parsonia straminea</i> | Monkey Rope | Dry | Vine | x | | | | | | | | | | | | |
| Araceae | <i>Gymnostachys anceps</i> | Settlers Flax | Moist | Ground | x | x | x | x | x | x | x | x | x | x | x | x | x |
| Bignoniaceae | <i>Pandorea pandorana</i> subsp. <i>pandorana</i> | Wonga Wonga Vine | Dry | Vine | x | x | x | 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 | | | | | | | |
|---------------------------|---|---------------------------|-------------|------------|------------|---|---|---|---|---|------------|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | |
| Dioscoreaceae | <i>Dioscorea transversa</i> | Native Yam | Dry | Vine | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| Ebenaceae | <i>Diospyros australis</i> | Black Plum | Moist | Overstorey | x | x | | | | | | | | | | | | |
| Elaeocarpaceae | <i>Elaeocarpus obovatus</i> | Blueberry Ash | Moist | Overstorey | | | | | | | | | | | | | | |
| Euphorbiaceae | <i>Alchornea ilicifolia</i> | Dovewood | Moist | Midstorey | x | x | | | | | | | | | | | | |
| Euphorbiaceae | <i>Baloghia inophylla</i> | Brush Bloodwood | Moist | Midstorey | x | x | | | | | | | | | | | | |
| Euphorbiaceae | <i>Croton verreauxii</i> | Green Native Cascailla | Dry | Midstorey | x | x | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | <i>Acacia longissima</i> | Long-leaf Wattle | Dry | Shrub | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | <i>Pararchidendron pruinoseum</i> var. <i>pruinoseum</i> | Snow Wood | Moist | Midstorey | x | x | | | | | | | | | | | | |
| Flacourtiaceae | <i>Scolopia braunii</i> | Flintwood | Moist | | | | | | | | | | | | | | | |
| Lamiaceae | <i>Clerodendrum tomentosum</i> | Hairy Clerodendrum | Moist | Midstorey | x | | | | | | | | | | | | | |



| Family | Scientific Name | Common Name | Forest Type | Stratum | Transect 1 | | | | | | Transect 2 | | | | | | | | | | | | | | |
|----------------|--|--------------------|-------------|------------|------------|---|---|---|---|---|------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lamiaceae | <i>Plectranthus parviflorus</i> | | Dry | Ground | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | |
| Lauraceae | <i>Cryptocarya microneura</i> | Murrogun | Moist | Overstorey | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| Lauraceae | <i>Neolitsea australiensis</i> | Green Bolly Gum | Moist | Midstorey | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| Luzuriagaceae | <i>Eustrephus latifolius</i> | Wombat Berry | Dry | Vine | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| Luzuriagaceae | <i>Geitonoplesium cymosum</i> | Scrambling Lily | Dry | Vine | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| Malvaceae | <i>Hibiscus heterophyllus</i> | Native Rosella | Dry | Midstorey | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| Meliaceae | <i>Synoum glandulosum</i> subsp. <i>glandulosum</i> | Scentless Rosewood | Dry | Shrub | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| Meliaceae | <i>Toona ciliata</i> | Red Cedar | Moist | Overstorey | | | | | | | | | | | | | | | | | | | | | |
| Menispermaceae | <i>Legnephora moorei</i> | Round-leaf Vine | Moist | Vine | | | | | | | | | | | | | | | | | | | | | |
| Menispermaceae | <i>Sarcopetalum harveyanum</i> | Pearl Vine | Moist | Vine | | | | | | | | | | | | | | | | | | | | | |



| Family | Scientific Name | Common Name | Forest Type | Stratum | Transect 1 | | | | | Transect 2 | | | | | | | | | | | | | |
|----------------|--|----------------------|-------------|------------|------------|--|--|--|--|------------|--|--|--|--|--|--|--|--|--|--|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | |
| Menispermaceae | <i>Stephania japonica</i> var. <i>discolor</i> | Snake vine | Moist | Vine | x | | | | | | | | | | | | | | | | | | |
| Monimiaceae | <i>Doryphora sassafras</i> | Sassafras | Moist | Midstorey | | | | | | x | | | | | | | | | | | x | | |
| Monimiaceae | <i>Wilkiea huegeliana</i> | Veiny Wilkiea | Moist | Shrub | | | | | | x | | | | | | | | | | | | x | |
| Monimiaceae | <i>Wilkiea macrophylla</i> | Large-leaved Wilkiea | Moist | Midstorey | | | | | | x | | | | | | | | | | | | | x |
| Moraceae | <i>Ficus fraseri</i> | Sandpaper Fig | Moist | Midstorey | | | | | | x | | | | | | | | | | | | | |
| Moraceae | <i>Ficus sp.</i> | | Dry | Overstorey | | | | | | x | | | | | | | | | | | | | |
| Moraceae | <i>Streblus brunonianus</i> | Whalebone Tree | Moist | Midstorey | | | | | | x | | | | | | | | | | | | | x |
| Moraceae | <i>Trophis scandens</i> | Burny Vine | Moist | Vine | | | | | | | | | | | | | | | | | | | x |
| Myrtaceae | <i>Backhousia myrtifolia</i> | Grey Myrtle | Moist | Overstorey | | | | | | x | | | | | | | | | | | | | |
| Myrtaceae | <i>Eucalyptus acmenoides</i> | White mahogany | Dry | Overstorey | | | | | | | | | | | | | | | | | | | x |
| Myrtaceae | <i>Eucalyptus fergusonii</i> subsp. <i>fergusonii</i> | Grey Ironbark | Dry | Overstorey | | | | | | | | | | | | | | | | | | | x |

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| Family | Scientific Name | Common Name | Forest Type | Stratum | Transect 1 | | | | | | Transect 2 | | | | | | | | | |
|----------------|--------------------------------|-----------------------|-------------|------------|------------|---|---|---|---|---|------------|---|---|---|---|---|--|--|--|---|
| | | | | | | | | | | | | | | | | | | | | |
| Myrtaceae | <i>Melaleuca styphelioides</i> | | Dry | Overstorey | x | x | x | x | x | | | | | | | | | | | |
| Myrtaceae | <i>Rhodarnia rubescens</i> | Scrub Turpentine | Dry | Midstorey | x | | | | | | | | | | | | | | | |
| Myrtaceae | <i>Syncarpia glomulifera</i> | Turpentine | Dry | Overstorey | x | x | x | x | x | | | | | | | | | | | |
| Oleaceae | <i>Notelaea longifolia</i> | Large Mock-olive | Dry | Shrub | x | | | | | x | x | x | x | | | | | | | x |
| Oleaceae | <i>Olea paniculata</i> | Native Olive | Moist | Overstorey | | | | | | | | | | x | x | x | | | | x |
| Orchidaceae | <i>Dendrobium sp.</i> | | Dry | - | x | x | x | x | x | | | | | | | | | | | x |
| Orchidaceae | <i>Sarcochilus falcatus</i> | Orange-blossom Orchid | Moist | - | | | | | | | | | | x | x | | | | | |
| Phyllanthaceae | <i>Breynia oblongifolia</i> | Coffee Bush | Moist | Shrub | x | x | x | x | x | | | | | | | | | | | |
| Pittosporaceae | <i>Pittosporum multiflorum</i> | Orange Thorn | Moist | Shrub | x | x | x | x | x | | | | | x | x | x | | | | x |
| Poaceae | <i>Oplismenus aemulus</i> | Basket Grass | Dry | Ground | x | x | x | x | x | | | | | x | x | | | | | x |
| Podocarpaceae | <i>Podocarpus elatus</i> | Plum Pine | Moist | Overstorey | | | | | | | | | | | | | | | | x |



| Family | Scientific Name | Common Name | Forest Type | Stratum | Transect 1 | | | | | | Transect 2 | | | | | | | | | | | | | | | | |
|---------------|--|----------------------|-------------|------------|------------|---|---|---|---|---|------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Polypodiaceae | <i>Pyrrosia confluens</i> var. <i>confluens</i> | Horse-shoe Felt Fern | Moist | - | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | |
| Rhamnaceae | <i>Alphitonia excelsa</i> | Red Ash | Moist | Overstorey | x | x | x | x | x | | | | | | | | | | | | | | | | | | |
| Ripogonaceae | <i>Ripogonum album</i> | White Supplejack | Moist | Vine | x | | | | | | | | | | | | | | | | | | | | | | |
| Rubiaceae | <i>Morinda jasminoides</i> | Sweet Morinda | Moist | Vine | x | x | x | x | x | | | | | | | | | | | | | | | | | | |
| Rutaceae | <i>Geijera salicifolia</i> var. <i>latifolia</i> | | Moist | Midstorey | | | | | | | | | | | | | | | | | | | | | | | |
| Sapindaceae | <i>Alectryon subcinereus</i> | Native Quince | Moist | Midstorey | x | x | x | x | x | | | | | | | | | | | | | | | | | | |
| Sapindaceae | <i>Guioa semiglauca</i> | | Moist | Midstorey | x | x | x | x | x | | | | | | | | | | | | | | | | | | |
| Sapotaceae | <i>Planchonella australis</i> | Black Apple | Moist | Overstorey | x | x | x | x | x | | | | | | | | | | | | | | | | | | |
| Solanaceae | <i>Solanum prinophyllum</i> | Forest Nightshade | Moist | Shrub | | | | | | | | | | | | | | | | | | | | | | | |
| Solanaceae | <i>Solanum stelligerum</i> | Devil's Needles | Moist | | | | | | | | | | | | | | | | | | | | | | | | |
| Urticaceae | <i>Dendrocnide excelsa</i> | Giant Stinging Tree | Moist | Overstorey | x | x | x | x | x | | | | | | | | | | | | | | | | | | |

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| Family | Scientific Name | Common Name | Forest Type | Stratum | Transect 1 | | | | Transect 2 | | | | | | |
|-------------|----------------------------------|----------------------------|-------------|------------|------------|----|----|----|------------|----|----|----|----|----|----|
| | | | | | 54 | 48 | 47 | 52 | 52 | 51 | 51 | 45 | 47 | 45 | 49 |
| Urticaceae | <i>Dendrocnide photinophylla</i> | Shiny-leaved Stinging Tree | Moist | Overstorey | x | x | x | x | | | | | x | x | x |
| Verbenaceae | * <i>Lantana camara</i> | Lantana | Dry | Shrub | x | x | x | x | | | | | x | x | x |
| Vitaceae | <i>Cayratia clematidea</i> | Native Grape | Dry | Vine | x | x | x | x | | | | | | | |
| Vitaceae | <i>Cissus antarctica</i> | Water Vine | Moist | Vine | x | x | x | x | | | | | | | |
| Vitaceae | <i>Tetrastigma nitens</i> | | Moist | Vine | x | x | x | x | | | | | | | x |
| | | | | Total | 54 | 48 | 47 | 52 | 52 | 51 | 51 | 45 | 47 | 45 | 49 |



APPENDIX 2: FAUNA SPECIES RECORDED 2008 - 2013

| Order | Family | Scientific Name | Common Name | Legal Status | Method | Dry forest | | | | | | Rainforest | | | | | | | | |
|-------------------|--------------|----------------------------------|----------------------------|--------------|------------------------|------------|-------|----|----|----|----|------------|----|----|----|----|----|---|--|--|
| | | | | | | 08 | 09 | 10 | 11 | 12 | 13 | 08 | 09 | 10 | 11 | 12 | 13 | | | |
| Amphibians | | | | | | | | | | | | | | | | | | | | |
| Anura | Hylidae | <i>Litoria fallax</i> | Eastern Dwarf Tree Frog | P | Opportunistic record | | | | | | | | | | | | | | | |
| | | | Peron's Tree Frog | P | Opportunistic record | | | | | | | | | | | | | | | |
| | | | | | | | Total | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | | |
| Reptiles | | | | | | | | | | | | | | | | | | | | |
| Squamata | Scincidae | <i>Cyclodomorphus gerrardii</i> | Pink-tongued Skink | P | | | | | | | | | | | | | | | | |
| | Varanidae | <i>Varanus varius</i> | Lace Monitor | P | Opportunistic sighting | | | | | | | | | | | | | | | |
| | | | | | Total | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | | |
| Birds | | | | | | | | | | | | | | | | | | | | |
| Caprimulgiformes | Aegothelidae | <i>Aegothales cristatus</i> | Australian Owllet-nightjar | P | Spotlighting | | | | | | | | | | | | | | | |
| Columbiformes | Columbidae | <i>Leucosarcia picata</i> | Wonga Pigeon | P | Bird survey | | | | | | | | | | | | | | | |
| | | <i>Lopholaimus antarcticus</i> | Topknot Pigeon | P | Bird survey | | | | | | | | | | | | | | | |
| | | <i>Macropygia amboinensis</i> | Brown Cuckoo-dove | P | Bird survey | | | | | | | | | | | | | | | |
| | | <i>Dacelo novaeguineae</i> | Laughing Kookaburra | P | Bird survey | | | | | | | | | | | | | | | |
| Coraciiformes | Alcedinidae | <i>Todiramphus sanctus</i> | Sacred Kingfisher | P | Bird survey | | | | | | | | | | | | | | | |
| | | <i>Eunystomus orientalis</i> | Dollarbird | P | Bird survey | | | | | | | | | | | | | | | |
| | | <i>Centropus phasianinus</i> | Pheasant Coucal | P | Opportunistic record | | | | | | | | | | | | | | | |
| Cuculiformes | Cuculidae | <i>Cacomantis flabelliformis</i> | Fan-tailed Cuckoo | P | Bird survey | | | | | | | | | | | | | | | |
| Cuculiformes | Cuculidae | <i>Cacomantis variolosus</i> | Brush Cuckoo | P | Opportunistic record | | | | | | | | | | | | | | | |





| Order | Family | Scientific Name | Common | Legal | Method | Dry forest | Rainforest | |
|---------------|--------------|-------------------------------------|----------------------------|-------|----------------------|------------|------------|--|
| Galliformes | Megapodiidae | <i>Chalcites lucidus</i> | Shining Bronze-Cuckoo | P | Bird survey | x | x | |
| | | <i>Scythrops novaehollandiae</i> | Channel-billed Cuckoo | P | Bird survey | x | x | |
| Passeriformes | Acanthizidae | <i>Alectura lathami</i> | Australian Brush-turkey | P | Opportunistic record | | x | |
| | | <i>Acanthiza lineata</i> | Striated Thornbill | P | Bird survey | x | x | |
| | | <i>Acanthiza pusilla</i> | Brown Thornbill | P | Bird survey | x | x | |
| | | <i>Gerygone mouki</i> | Brown Gerygone | P | Bird survey | x | x | |
| | | <i>Sericornis citreogularis</i> | Yellow-throated Scrubwren | P | Bird survey | | x | |
| | | <i>Sericornis frontalis</i> | White-browed Scrubwren | P | Bird survey | x | x | |
| | | <i>Cracticus nigrogularis</i> | Pied Butcherbird | P | Bird survey | | x | |
| | | <i>Cracticus tibicen</i> | Australian Magpie | P | Bird survey | x | | |
| | | <i>Strepera graculina</i> | Pied Currawong | P | Bird survey | x | x | |
| | | <i>Coracina novaehollandiae</i> | Black-faced Cuckoo-shrike | P | Bird survey | x | x | |
| Passeriformes | Meliphagidae | <i>Coracina tenuirostris</i> | Cicadabird | P | Opportunistic record | x | | |
| | | <i>Cormobates leucophaea</i> | White-throated Treecreeper | P | Bird survey | x | x | |
| | | <i>Corvus coronoides</i> | Australian Raven | P | Opportunistic record | x | x | |
| | | <i>Neochmia temporalis</i> | Red-browed Finch | P | Bird survey | x | | |
| | | <i>Malurus cyaneus</i> | Superb Fairy-wren | P | Bird survey | x | x | |
| | | <i>Malurus lamberti</i> | Variigated Fairy-wren | P | Bird survey | x | x | |
| | | <i>Acanthorhynchus tenuirostris</i> | Eastern Spinebill | P | Bird survey | x | x | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |



| Order | Family | Scientific Name | Common | Legal | Method | Dry forest | | | | Rainforest | | | | | | |
|-------------------|-----------------|------------------------------------|---------------------------------|----------------------|----------------------|-------------|---|---|---|------------|---|---|---|---|---|---|
| | | | | | | x | x | x | x | x | x | x | x | | | |
| Passeriformes | Meliphagidae | <i>Lichenostomus chrysops</i> | Yellow-faced Honeyeater | P | Bird survey | x | x | x | x | x | x | x | x | x | | |
| | | <i>Manorina melanophrys</i> | Bell Miner | P | Bird survey | x | | | | | | | | | | |
| | | <i>Meliphaga lewinii</i> | Lewin's Honeyeater | P | Bird survey | x | x | x | x | x | x | x | x | x | x | |
| | | <i>Melithreptus lunatus</i> | White-naped Honeyeater | P | Bird survey | x | | | | | | | | | x | |
| | | <i>Myzomela sanguinolenta</i> | Scarlet Honeyeater | P | Bird survey | x | x | x | x | x | x | x | x | x | | |
| | | <i>Philemon corniculatus</i> | Noisy Friarbird | P | Bird survey | | | | | x | | | | | x | |
| | | <i>Menura novaehollandiae</i> | Superb Lyrebird | P | Bird survey | | | | | | | | | | x | |
| | | <i>Monarcha melanopsis</i> | Black-faced Monarch | P | Bird survey | x | x | x | x | x | x | x | x | x | x | |
| | | <i>Symphysia chrus trivirgatus</i> | Spectacled Monarch | P | Opportunistic record | | | | | | | | | | | x |
| | | <i>Myiagra rubecula</i> | Leaden Flycatcher | P | Bird survey | x | x | x | x | x | x | x | x | x | | |
| | Nectariniidae | | <i>Dicaeum hirundinaceum</i> | Mistletoebird | P | Bird survey | | | | | | | | | x | |
| | | | <i>Oriolus sagittatus</i> | Olive-backed Oriole | P | Bird survey | | | | | | | | | | x |
| | Pachycephalidae | | <i>Colluricincla harmonica</i> | Grey Shrike-thrush | P | Bird survey | x | | | | x | x | x | x | x | |
| | | | <i>Pachycephala pectoralis</i> | Golden Whistler | P | Bird survey | x | x | x | x | x | x | x | x | x | x |
| | Pachycephalidae | | <i>Pachycephala rufiventris</i> | Rufous Whistler | P | Bird survey | x | x | x | x | x | x | x | x | x | |
| | | | <i>Pardalotus punctatus</i> | Spotted Pardalote | P | Bird survey | x | x | x | x | x | x | x | x | x | x |
| | Petroicidae | | <i>Eopsaltria australis</i> | Eastern Yellow Robin | P | Bird survey | x | x | x | x | x | x | x | x | x | |
| | | | <i>Pitta versicolor</i> | Noisy Pitta | P | Bird survey | | | | | x | | | | | x |
| | Psophodidae | | <i>Cinclosoma punctatum</i> | Spotted Quail-thrush | P | Bird survey | x | x | x | x | x | x | x | x | x | |
| | | | <i>Psophodes olivaceus</i> | Eastern Whippbird | P | Bird survey | x | x | x | x | x | x | x | x | x | x |
| Ptilonorhynchidae | | <i>Ailuroedus crassirostris</i> | Green Catbird | P | Bird survey | | | | | | | | | x | | |
| | | <i>Ptilonorhynchus violaceus</i> | Satin Bowerbird | P | Bird survey | | | | | | | | | | x | |



| Order | Family | Scientific Name | Common | Legal | Method | Dry forest | | | | | | | Rainforest | | | | | | | | | | | | | | |
|---------------------------------|-----------------|---------------------------------|--------------------------|----------------------|----------------------|------------|----|----|----|----|----|----|------------|----|----|----|----|----|----|----|----|----|----|----|---|--|--|
| | | | | | | 33 | 28 | 23 | 31 | 19 | 30 | 26 | 24 | 20 | 23 | 25 | 23 | | | | | | | | | | |
| Psittaciformes | Rhipiduridae | <i>Sericulus chrysocephalus</i> | Regent Bowerbird | P | Bird survey | | | | | | | | | | | | | X | | | | | | | | | |
| | | <i>Rhipidura fuliginosa</i> | Grey Fantail | P | Bird survey | X | | | | X | X | | | | | | | X | | | | | | | | | |
| | Timaliidae | <i>Rhipidura rufifrons</i> | Rufous Fantail | P | Bird survey | | | | | X | X | | | | | | | X | | | | | | | | | |
| | | <i>Zosterops lateralis</i> | Silvereye | P | Bird survey | X | | | | X | X | | | | | | | X | | | | | | | | | |
| | Cacatuidae | <i>Cacatua galerita</i> | Sulphur-crested Cockatoo | P | Bird survey | | | | | | | | | | | | | | X | | | | | | | | |
| | Psittacidae | <i>Alisterus scapularis</i> | Australian King-Parrot | P | Bird survey | | | | | X | X | | | | | | | | X | | | | | | | | |
| <i>Platyercus eximius</i> | | Eastern Rosella | P | Bird survey | | | | | X | | | | | | X | | | | | | | | | | | | |
| <i>Trichoglossus haematodus</i> | | Rainbow Lorikeet | P | Opportunistic record | | | X | | | | | | | | | | | | | | | | | | | | |
| Strigiformes | Strigidae | <i>Ninox strenua</i> | Powerful Owl | V | Opportunistic record | | | | | X | | | | | X | | | X | | | | | | | | | |
| | Strigidae | <i>Ninox novaeseelandiae</i> | Southern Boobook | P | Spotlighting | | | | | | X | | | | | X | | | | | | | | | | | |
| | Tytonidae | <i>Tyto tenebricosa</i> | Sooty Owl | V | Spotlighting | | | | | | X | X | | | | | | | X | | | | | | | | |
| | | Total | | | | | | | | | | | 33 | 28 | 23 | 31 | 19 | 30 | 26 | 24 | 20 | 23 | 25 | 23 | | | |
| Arboreal Mammals | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Diprotodonta | Acrobatidae | <i>Acrobates pygmaeus</i> | Feathertail Glider | P | Spotlighting | | | | | X | | | | | | | | | | | | | | | | | |
| | Petauridae | <i>Petaurus breviceps</i> | Sugar Glider | P | Spotlighting | | | | | X | X | | | | | | | | | | | | | | | | |
| | | <i>Trichosurus vulpecula</i> | Common Brushtail Possum | P | Spotlighting | | | | | X | X | | | | | | | | X | X | | | | | | | |
| | Pseudocheiridae | <i>Petauroides volans</i> | Greater Glider | P | Spotlighting | | | | | | X | | | | | | | | X | X | | | | | | | |
| | Pseudocheiridae | <i>Pseudocheirus peregrinus</i> | Common Ringtail Possum | P | Spotlighting | | | | | | X | | | | | | | | | | | | | | | | |
| | Total | | | | | | | | | | | 2 | 1 | 3 | 3 | 4 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 2 | | |
| Terrestrial Mammals | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Dasyuromorphia | Dasyuridae | <i>Antechinus stuartii</i> | Brown Antechinus | P | Trapping | | | | X | X | | | | | | | | | | X | X | | | | | | |
| | Dasyuridae | <i>Antechinus swainsonii</i> | Dusky Antechinus | P | Trapping | | | | | | | | | | X | | | | | | | | | | | | |
| | Total | | | | | | | | | | | 2 | 1 | 3 | 3 | 4 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 2 | | | |



| Order | Family | Scientific Name | Common | Legal | Method | Dry forest | | | | Rainforest | | | | | | | | |
|-------------|-----------------------------|---|---|-----------------|----------------------------|--------------|----------|----------|----------|------------|----------|----------|----------|----------|----------|----------|---|---|
| | | | | | | 3 | 2 | 2 | 4 | 1 | 2 | 4 | 3 | 3 | 2 | 3 | 3 | |
| Rodentia | Muridae | <i>Rattus fuscipes</i> | Bush Rat | P | Trapping | x | x | x | x | x | x | x | x | x | x | x | | |
| | | <i>Rattus rattus</i> | Black Rat | U | Trapping | | | | | | | | | | | | | |
| | Peramelidae | <i>Perameles nasuta</i> | Long-nosed Bandicoot | P | Trapping | x | | | | | | | | | | | | |
| | | <i>Wallabia bicolor</i> | Swamp Wallaby | P | Trapping | | | | | | | | | | | | | |
| Bats | | | | | | Total | 3 | 2 | 2 | 4 | 1 | 2 | 4 | 3 | 3 | 3 | | |
| Chiroptera | Molossidae | <i>Mormopterus norfolkensis</i> | Eastern Freetail-bat | V | Anabat analysis | | | | | | | | | | | | | |
| | | <i>Mormopterus sp. 2</i> | | P | Anabat analysis | | | | | x | | | | | | | x | |
| | | <i>Tadarida australis</i> | White-striped Free-tailed Bat | P | Anabat analysis | | | | | | x | | | | | | | x |
| | Pteropodidae | <i>Pteropus poliocephalus</i> | Grey-headed Flying-fox | V | Spotlighting | x | | | | | | | | | | | | |
| | | <i>Rhinolophus megaphyllus</i> | Eastern Horseshoe Bat | P | Anabat analysis | | | | | | | | | | | | | x |
| | Vespertilionidae | <i>Chalinolobus gouldii</i> | Gould's Wattled Bat | P | Anabat analysis | | | | | | | | | | | | | x |
| | | <i>Chalinolobus morio</i> | Chocolate Wattled Bat | P | Trapping & Anabat analysis | x | x | | | | | | | | | | | x |
| | | <i>Falsistrellus tasmaniensis / Scotorepens orion</i> | Eastern False Pipistrelle / Eastern Broad-nosed Bat | P | Anabat analysis | | | | | | | | | | | | | x |
| | | <i>Miniopterus australis</i> | Little Bentwing-bat | V | Trapping & Anabat analysis | x | x | | | | | | | | | | | x |
| | | <i>Nyctophilus geoffroyi</i> | Lesser Long-eared Bat | P | Trapping | | | | | | | | | | | | | |
| | <i>Nyctophilus gouldi</i> | Gould's Long-eared Bat | P | Trapping | | | | | | | | | | | | | | |
| | <i>Nyctophilus sp.</i> | | P | Anabat analysis | | | | | | | | | | | | | | |
| | <i>Scoteanax rueppellii</i> | Greater broad-nosed bat | V | Anabat analysis | | | | | | | | | | | | | | |



| Order | Family | Scientific Name | Common | Legal | Method | Dry forest | | | | Rainforest | | | | | | | |
|-------|------------------|------------------------------|--------------------|-------|----------------------------|------------|----------|----------|----------|------------|----------|----------|----------|----------|----------|----------|----------|
| | | | | | | | | | | | | | | | | | |
| | | <i>Vespadelus pumilus</i> | Eastern Forest Bat | P | Anabat analysis | x | x | | | X | x | x | x | x | | | |
| | | <i>Vespadelus troughtoni</i> | Eastern Cave Bat | V | Anabat analysis | | | | x | | | | | x | | | |
| | | <i>Vespadelus vulturnus</i> | Little Forest Bat | P | Trapping & Anabat analysis | x | x | x | x | | x | | x | x | | | |
| | Vespertilionidae | <i>Vespadelus</i> sp. | | | Anabat analysis | | | | | x | | | | x | | | |
| | | | | | Total | 6 | 7 | 2 | 3 | 7 | 5 | 2 | 8 | 1 | 2 | 9 | 8 |

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

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APPENDIX 3: SELECTED PHOTOGRAPHS



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*)



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*)



APPENDIX 4. STAFF CONTRIBUTIONS

The following staff were involved in the compilation of this report.

| Name | Qualification | Title/Experience | Contribution |
|----------------|-------------------------------|---|---------------------------------|
| Daniel O'Brien | BScEnv & Mgt (Hons) | Ecologist (Zoologist/Herpetologist) | Amphibian survey |
| David Russell | BSc, BioBanking Accredited | Senior Ecologist | Report writing |
| Gilbert Whyte | PhD | Senior Ecologist (Botanist)/Entomologist | Flora survey and report writing |
| Shawn Capararo | BNatRes (Hons) | Senior Ecologist/GIS Specialist | Fauna survey and report review |

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APPENDIX 5. LICENSING

Kleinfelder employees involved in the current study are licensed or approved under the National Parks and Wildlife Act 1974 (License Number: SL100730, Expiry: 31st March 2014) and the Animal Research Act 1985 to harm/trap/release protected native fauna and to pick native plants for identification purposes.

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