

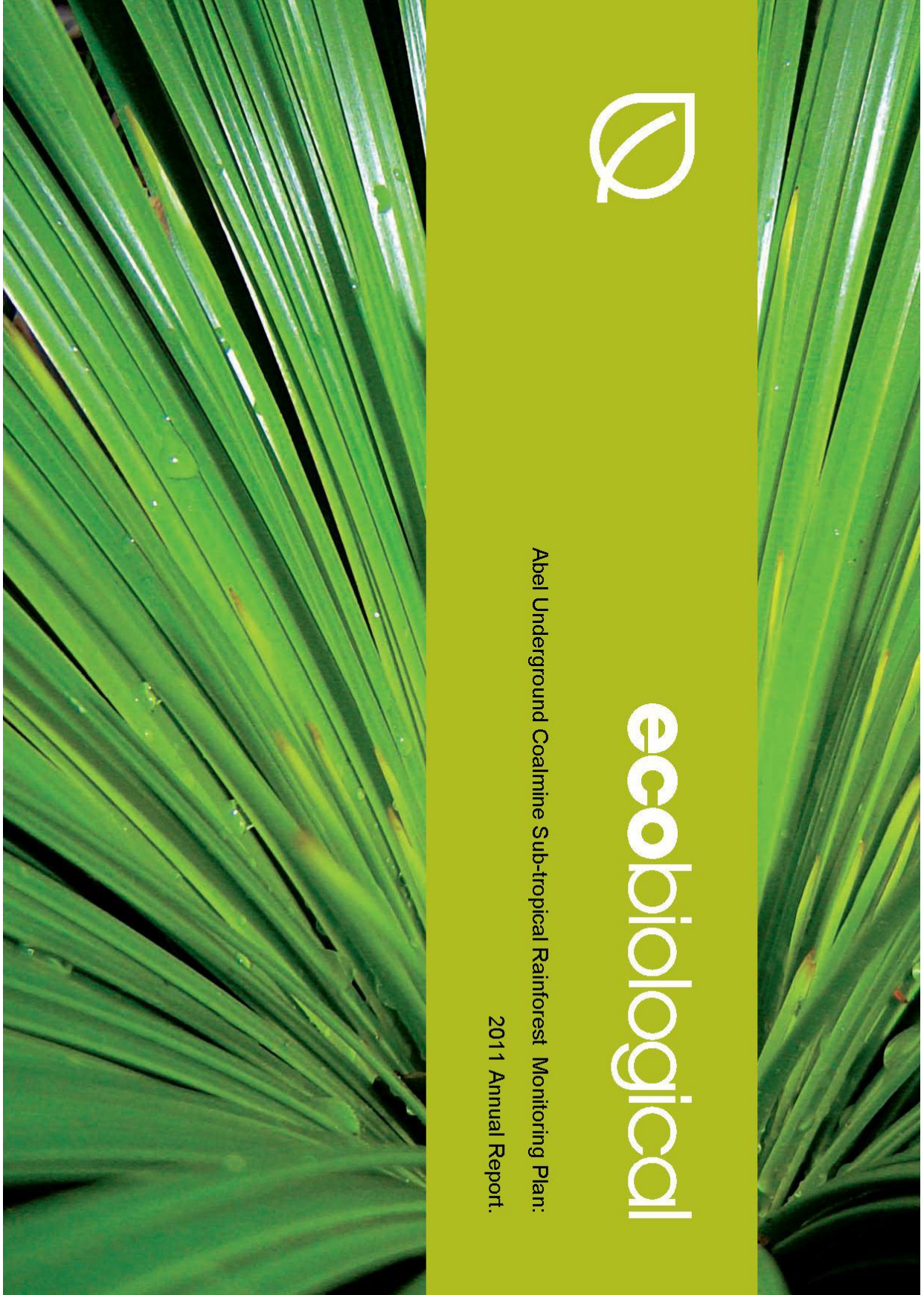
Appendix 5*

Abel Underground Coal Mine Sub-tropical Rainforest Monitoring Plan: 2011 Monitoring Report

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Abel Underground Coalmine Sub-tropical Rainforest Monitoring Plan:

2011 Monitoring Report

November 2011

Report prepared for Donaldson Coal Pty Ltd.

This report was prepared for the sole use of the proponents, their agents and any regulatory agencies involved in the development application approval process. It should not be otherwise referenced without permission.

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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 three years (2008, 2009, and 2010). 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 fourth 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 2011 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 2011, 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 also occurred, which can be explained by the dieback of the exotic species *Lantana camara*. These changes are identified as minor and are consistent with what is expected to occur in rainforest systems.



In total, 48 fauna species were recorded during the survey period, comprising three arboreal mammal species, four terrestrial mammal species, four bat species, 34 bird species, two amphibian species and one reptile species. Two of these species, the Little Bentwing-bat *Miniopterus australis* and the Powerful Owl *Ninox strenua* are listed as threatened under the NSW *Threatened Species Conservation Act 1995*. Almost all arboreal and terrestrial mammal species recorded during baseline monitoring in 2008 were also recorded during the 2011 survey effort. Compared to 2010 data, bird species diversity at each transect showed signs of an increase, however, overall diversity was similar to species counts from 2008 and 2009. A relatively low number of bat species were identified (four species in 2011 compared to three species in 2010, six species in 2008 and eight species in 2009). Reasons for the decline in bat species numbers is not certain, but may be due to a combination of sporadic occurrence (varying frequency of detection) and weather conditions around the time of survey.

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1. Introduction

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 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 fourth 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.

1.1. Background – 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 derived from igneous rocks such as basalt or alluvium, which are high in nutrients such as phosphorus and calcium. 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.



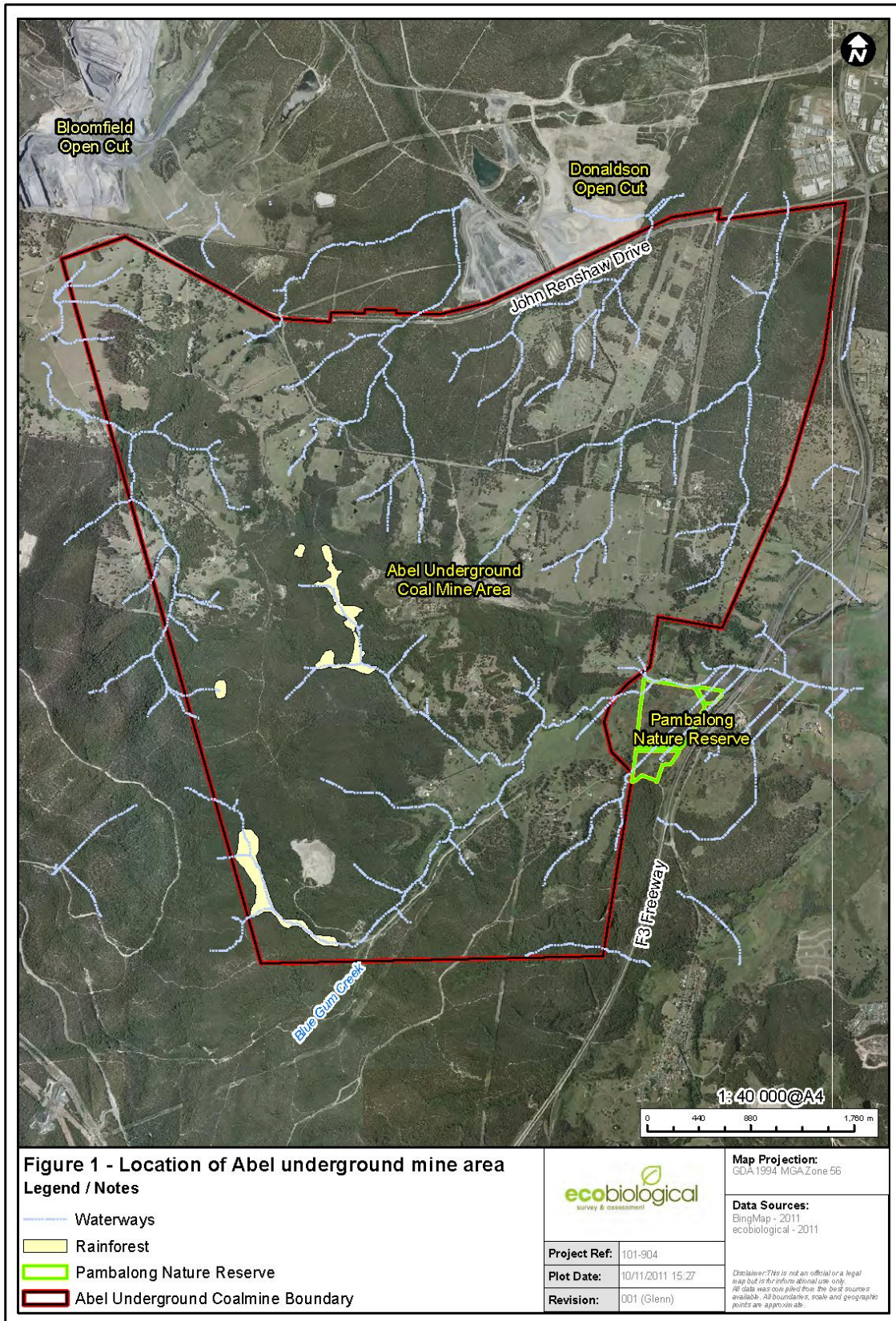
2. Location

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 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.



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3. Methods

3.1. Floral 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 20 October 2011.



3.2. Faunal 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 13 October to 27 October 2011.

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

3.2.1. 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 checked 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.



3.2.2. 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.

3.2.3. 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.

3.2.4. Birds

A 20 minute bird survey of both the rainforest and dry forest transect was undertaken by walking the length of each transect on 13 October 2011 and again on 19 October 2011. 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.

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).

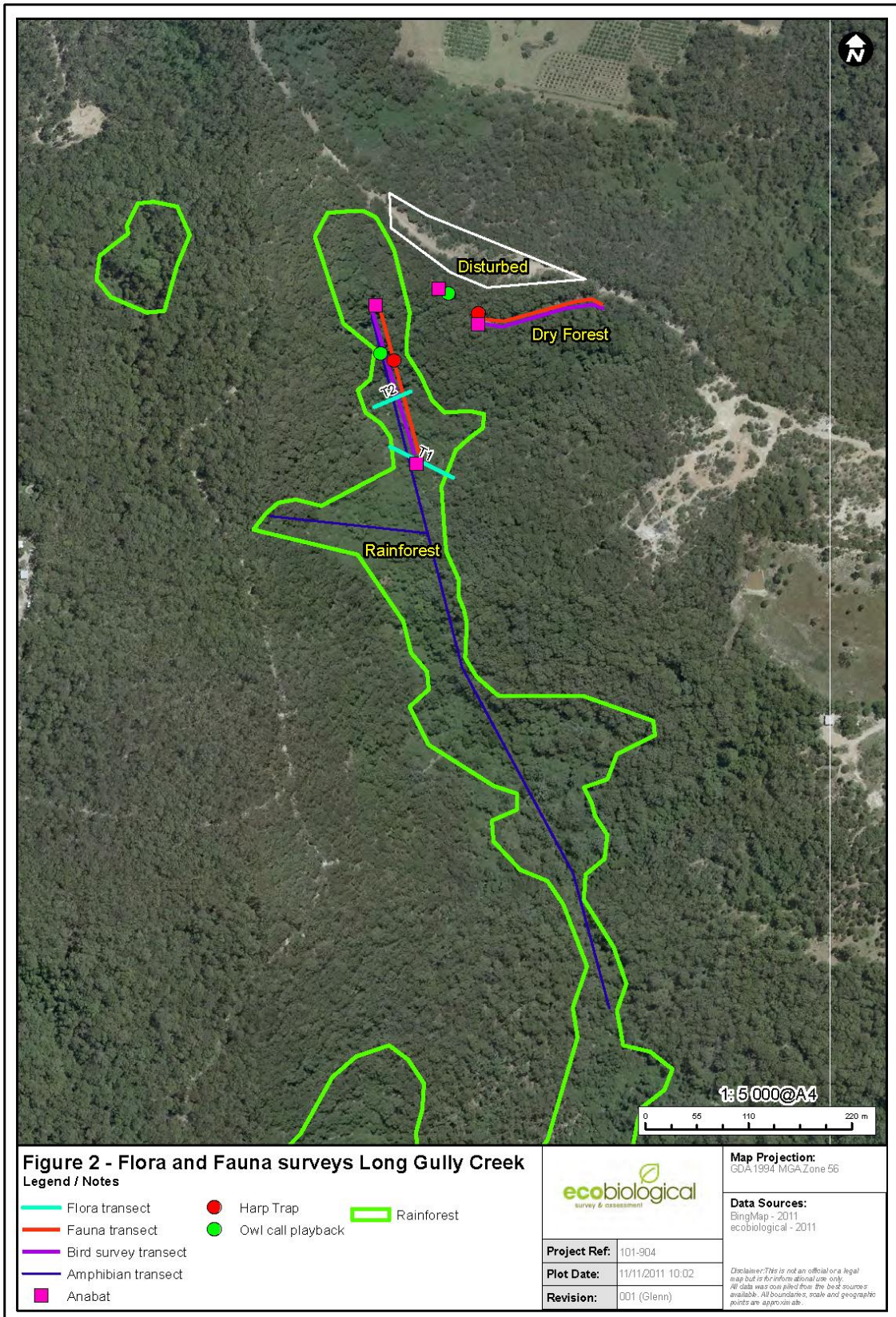


3.2.5. Amphibians

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).



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4. Results

4.1. Weather Conditions and Survey Activities

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 25.8° C.

A full list of survey activities and weather conditions during the survey period are provided in **Table 2**.

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

Activity	Day	Date	Weather Conditions
Flora			
Transect 1 and 2	Thursday	20/10/11	Warm day, sunny, light breeze, no rain
Fauna			
Trapping	Monday-Friday	17 - 21/10/11	Warm days and mild nights, high humidity, light rain on some nights, light to moderate winds
Nocturnal field work (Spotlighting, owl call playback, Anabat recording)	Wednesday	19/10/11	Mild temperature, no cloud, wind or rain
	Thursday	20/10/11	Mild temperature, no cloud, wind or rain
Bird survey	Thursday	13/10/11	Mild temperature, light cloud and moderately humid
	Wednesday	19/10/11	Sunny, no cloud or wind.
Amphibian survey	Wednesday	26/10/11	Heavy rain at times, raining steadily most of night, moderate wind.
	Thursday	27/10/11	Light drizzle, no wind and heavily overcast.



4.2. Floral Diversity

A total of 52 and 47 flora species were identified on Transect 1 and Transect 2 in 2011, 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 (Rare or Threatened Australian Plants) 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). Figures 3 and 5 show the relationship between dry forest species and moist forest species over the length of each transect for 2008. Figures 4 and 6 show this relationship for 2011. 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 in 2011, with the width of the moist forest increasing for three consecutive 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 2011 data is more variable than the baseline survey, as denoted by the lower R² values.

The trend lines for Transect 2 in 2011 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.

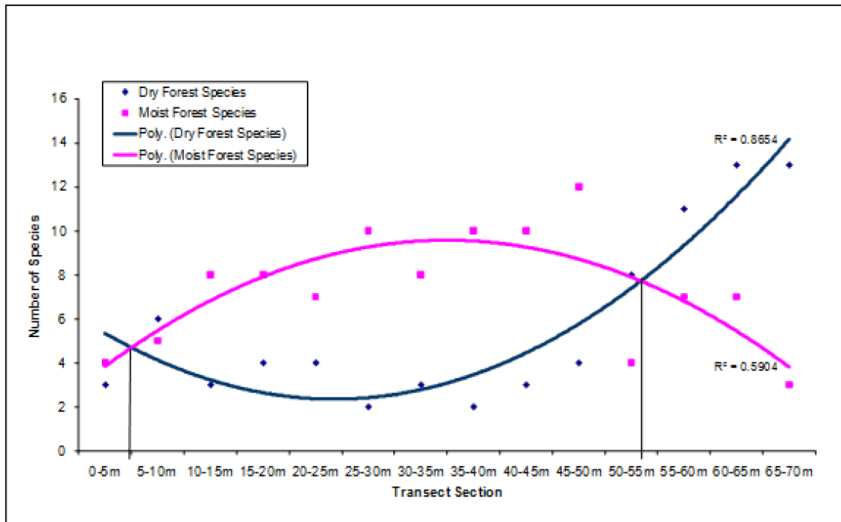


Figure 3: Transect 1 forest species curves, showing the relationship between dry and moist forest species across the length of the transect in 2008. Black lines indicate the forest transition zones determined in 2008.

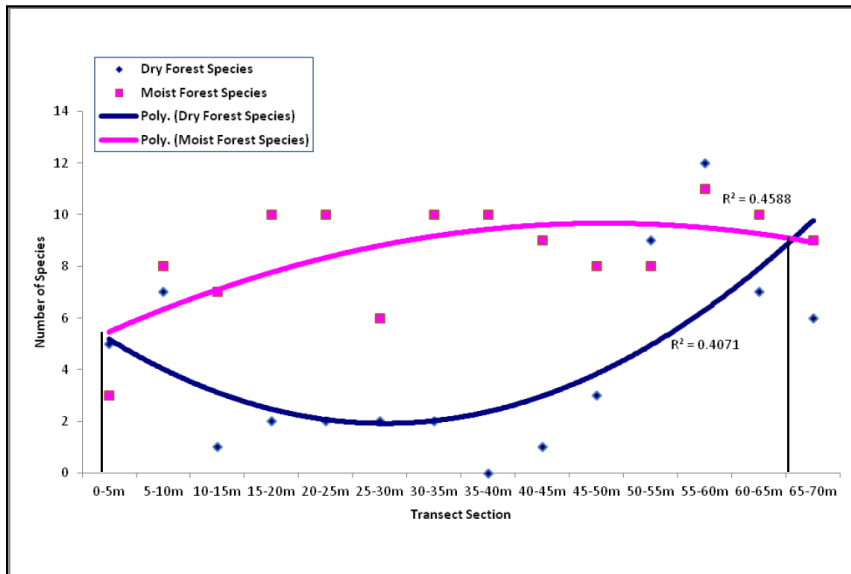


Figure 4: Transect 1 forest species curves, showing the relationship between dry and moist forest species across the length of the transect in 2011. Black lines indicate the forest transition zones determined in 2011.

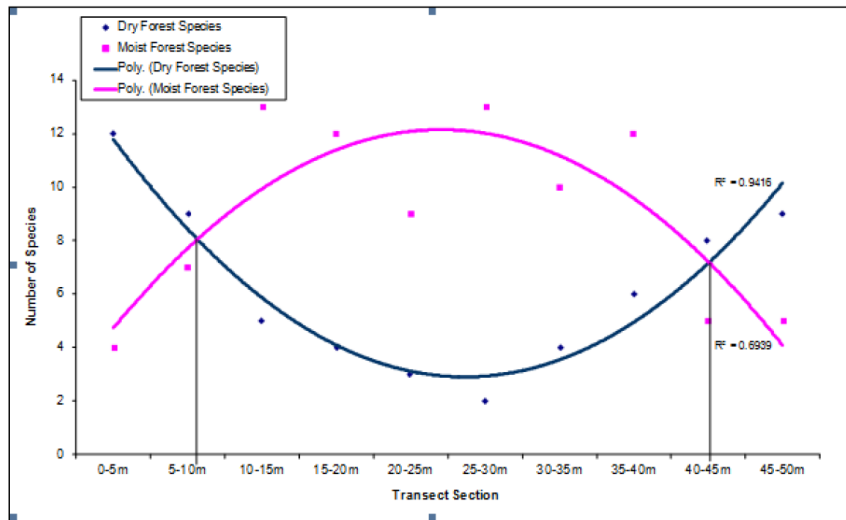


Figure 5. Transect 2 forest species curves, showing the relationship between dry and moist forest species across the length of the transect in 2008. Black lines indicate the forest transition zones determined in 2008.

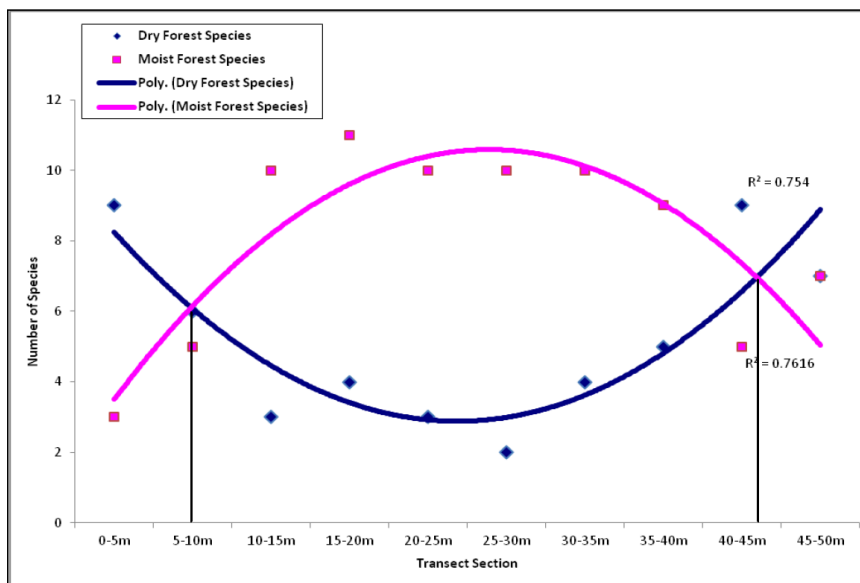


Figure 6: Transect 2 forest species curves, showing the relationship between dry and moist forest species across the length of the transect in 2011. Black lines indicate the forest transition zones determined in 2011.



4.2.1. 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 the intervals 5 m and 70 m on Transect 1 (Figure 8). This occurred due 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 not changed significantly. The low values recorded at 0 m and 30 m on Transect 1 may be attributed to the transect beginning on the edge of the rainforest canopy and to the loss of a single tree, respectively; canopy gaps are an expected occurrence in rainforest systems (Figure 10). The vine layer has not changed substantially in either transect (Figure 11).

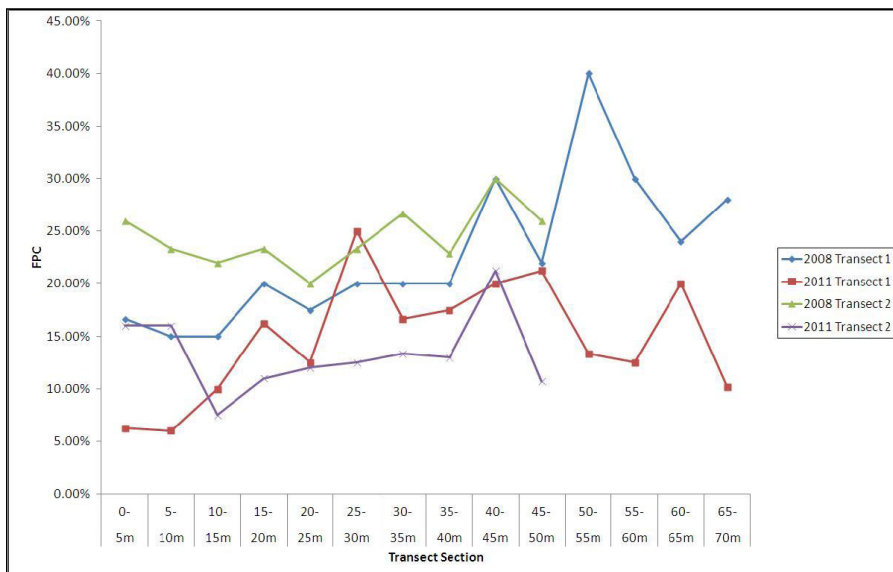


Figure 7: Estimated ground layer FPC for Transect 1 and Transect 2 in 2008 and 2011.

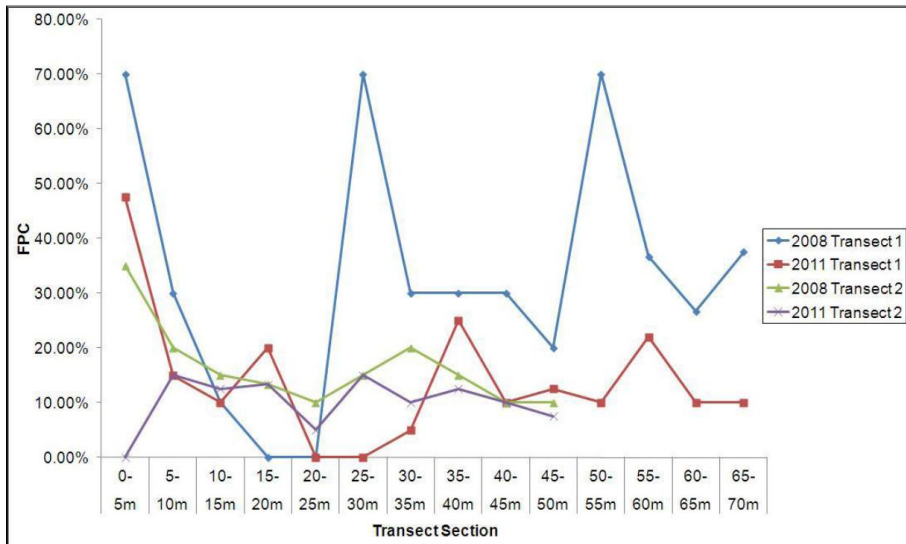


Figure 8: Estimated shrub layer FPC for Transect 1 and Transect 2 in 2008 and 2011.

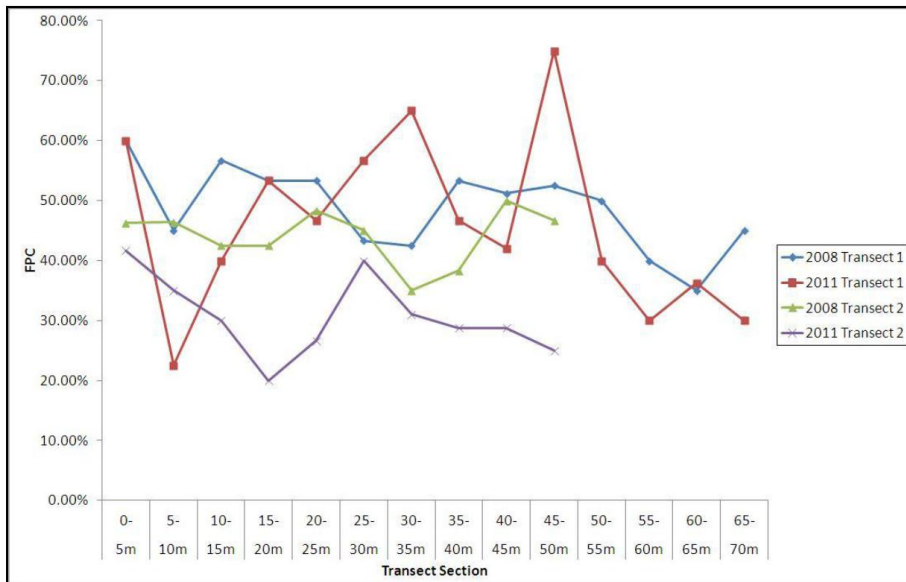


Figure 9: Estimated midstorey layer FPC for Transect 1 and Transect 2 in 2008 and 2011.

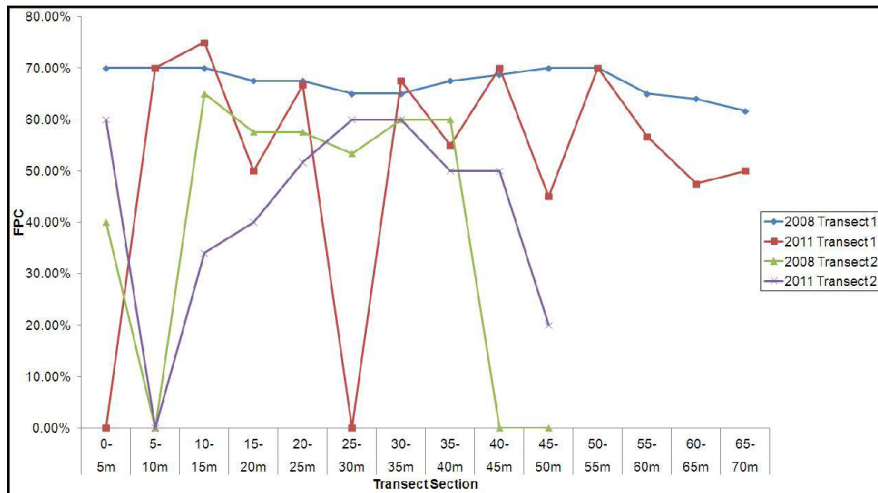


Figure 10: Estimated overstorey layer FPC for Transect 1 and Transect 2 in 2008 and 2011.

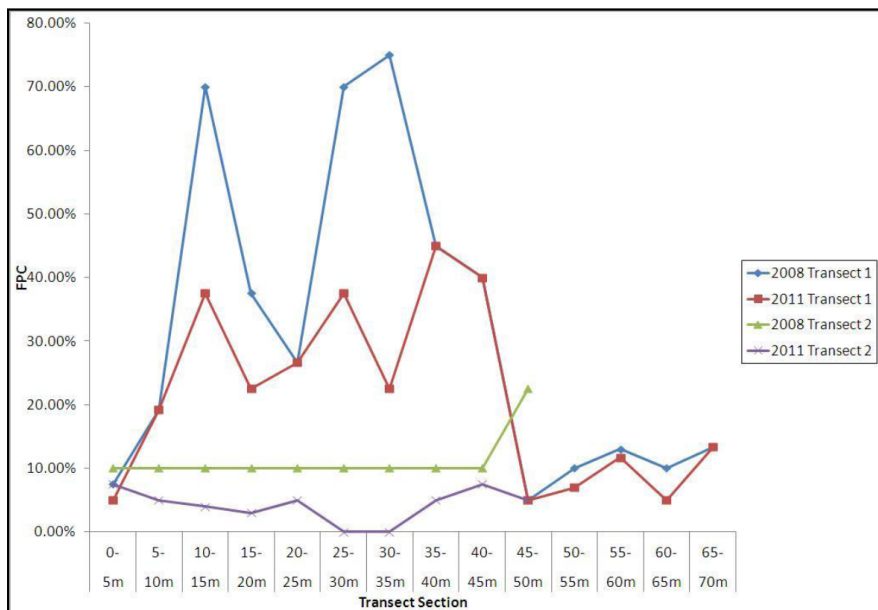


Figure 11: Estimated vine layer FPC for Transect 1 and Transect 2 in 2008 and 2011.



4.3. Faunal Diversity

In total, 48 fauna species were recorded during the survey period, comprising three arboreal mammal species, four terrestrial mammal species, four bat species, 34 bird species, two amphibian species and one reptile species (**Appendix 2**). Two of these species, the Little Bentwing-bat *Miniopterus australis* and the Powerful Owl *Ninox strenua* are listed as threatened under the NSW *Threatened Species Conservation Act 1995*. A total of 28 and 39 fauna species were recorded in the Rainforest and Dry Forest habitats respectively, which is similar to the average of 30 (Rainforest) and 38 (Dry Forest) species recorded over the four survey events.

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**.

4.3.1. Arboreal Mammals

Three arboreal mammal species (Sugar Glider *Petaurus breviceps*, Common Brushtail Possum *Trichosurus vulpecula* and Feathertail Gilder *Acrobates pygmaeus*) were recorded during the survey period. Arboreal mammal species richness between the 2008 baseline survey, the 2009 survey, the 2010 survey and the 2011 survey were found to be similar. The Feathertail Glider *Acrobates pygmaeus*, which had previously been recorded in the 2008 and 2010 surveys, was again recorded in 2011. The Greater Glider *Petauroides volans*, has not been recorded since 2008.

4.3.2. Terrestrial Mammals

Four terrestrial mammal species were detected during the 2011 surveys (Brown Antechinus *Antechinus stuartii*, Bush Rat *Rattus fuscipes*, Swamp Wallaby *Wallabia bicolor* and the Dusky Antechinus *Antechinus swainsonii*). The Dusky Antechinus is a new addition to the species list in this area as it has not been recorded during any other surveys. The Long-nosed Bandicoot *Perameles nasuta* recorded in 2010 was not recorded again during 2011. Overall, terrestrial mammal species richness was similar between the 2008 baseline survey and subsequent survey events.

4.3.3. Bats

Four species of insectivorous bat could be confirmed as occurring on the subject site during the 2011 survey, compared with six species recorded in 2008, eight species in 2009 and three in 2010. One species, the Little Forest Bat *Vespadelus vulturinus* was captured in harp traps only, and three other species, Eastern Forest Bat *Vespadelus pumilus*, Little Bentwing-bat *Miniopterus australis* and Chocolate Wattleed Bat *Chalinolobus morio* were detected via Anabat recorders only. The Little



Bentwing-bat *Miniopterus australis* is listed as vulnerable under the NSW TSC Act 1995.

Reasons for the decline in bat species numbers is not certain, but may be due to a combination of sporadic occurrence (varying frequency of detection) and weather conditions at the time of survey. Weather conditions on the nights Anabats were placed out were mild, clear to partly cloudy evenings with a light breeze. However, throughout the week conditions overall were unsettled with warm to hot humid days, with scattered to heavy showers.

4.3.4. Birds

Bird species richness rose slightly compared to the 2010 survey results. A total of 34 species were detected in 2011, compared to 30 in 2010, 35 in 2009 and 36 in 2008. Two new bird species (Pied Butcherbird and Channel-billed Cuckoo) were recorded during the current survey, while 20 species detected in 2008, 2009 and 2010 were not detected in 2011. Bird species diversity within the Dry Forest transect recovered to previous levels after declining in 2010, with a total of 28 species recorded in 2011, compared to 33 in 2008, 28 in 2009 and 21 in 2010. This trend was also evident in the Rainforest Gully transect with 23 species detected compared to 26 in 2008, 24 in 2009 and 20 in 2010.

Surveys were conducted under similar weather conditions and during the early morning (7 - 9 am), as occurred in previous monitoring events.

The threatened Powerful Owl (*Ninox strenua*) previously recorded in 2008 and 2010, was once again recorded in 2011. A male was observed over two days (19/10/11 and 20/10/11) both during the night and the next day. The threatened Sooty Owl (*Tyto tenebricosa*) previously recorded at the subject site in the ridge habitat via call playback in 2010 was not detected in 2011.

4.3.5. Amphibians

Two amphibian species (Eastern Dwarf Tree Frog *Litoria fallax* and Peron's Tree Frog *Litoria peronii*) were detected during the 2011 surveys, with the only amphibian records prior to the current surveys being in 2008. Despite relatively heavy and prolonged rainfall events in the area during the time of surveys, the section of Long Gully Creek where the amphibian survey was undertaken was predominantly dry with some small pools of water present.

4.3.6. Reptiles

Reptiles are not specifically targeted as part of the fauna monitoring program, however, all opportunistic sightings during other survey activities are noted. One



reptile species (Pink-tongued Skink *Cyclodomorplus gerrardii*) was detected within the Dry Forest transect during the 2011 surveys. No other reptile species have been detected since an opportunistic sighting of a Lace Monitor *Varanus varius* in 2008.

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5. Conclusion

Monitoring of the Sub-tropical Rainforest area within Long Gully Creek has been undertaken in 2011 in accordance with the F& FMP for Abel Underground Coalmine (ecobiological 2007). The results of this fourth 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 47 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 2011 at Transect 1, with the width of the moist forest increasing. However, this is likely due to the variability of 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 were determined as being very similar in 2011 to that measured in the baseline study. The FPC along both 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, 48 fauna species were recorded during the survey period, comprising three arboreal mammal species, four terrestrial mammal species, four bat species, 34 bird species, two amphibian species and one reptile species. Two of these species, the Little Bentwing-bat *Miniopterus australis*, and the Powerful Owl *Ninox strenua* are listed as threatened under the NSW *Threatened Species Conservation Act 1995*. Almost all arboreal and terrestrial fauna species recorded during baseline monitoring in 2008 were also recorded during the 2011 survey effort. Bird species diversity showed signs of increasing compared to 2010's lower species count. A relatively low number of bat species were identified (four species in 2011 compared to three species in 2010, six species in 2008 and eight species in 2009). Reasons for the decline in bat species numbers is not certain, but may be due to a combination of sporadic occurrence (varying frequency of detection) and weather conditions around the time of survey.

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. The future implications of any evident trends should be used to inform best practice measures to be incorporated into the Surface Monitoring Plan (SMP).

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Appendix 1: Flora species recorded on the survey transects in 2008, 2009, 2010 and 2011

Family	Scientific Name	Common Name	Forest Type	Stratum	Transect 1				Transect 2			
					2008	2009	2010	2011	2008	2009	2010	2011
Acanthaceae	<i>Pseuderanthemum variable</i>	Pastel Flower	Dry	Ground	✓	✓	✓	✓	✓	✓	✓	✓
Adiantaceae	<i>Adiantum formosum</i>	Giant Maidenhair Fern	Moist	Ground	✓	✓	✓	✓	✓	✓	✓	✓
Adiantaceae	<i>Adiantum hispidulum</i>	Rough Maidenhair Fern	Moist	Ground	✓	✓	✓	✓	✓	✓	✓	✓
Adiantaceae	<i>Pellaea filicata</i>	Sickle Fern	Dry	Ground	✓	✓	✓	✓	✓	✓	✓	✓
Aphanopetalaceae	<i>Aphanopetalum resinosum</i>	Gum Vine	Dry	Vine	✓	✓	✓	✓				
Apocynaceae	<i>Marsdenia rostrata</i>	Common Milk Vine	Dry	Vine	✓	✓	✓	✓				✓
Apocynaceae	<i>Parsonsia straminea</i>	Monkey Rope	Dry	Vine	✓			✓				
Araceae	<i>Gymnostachys anceps</i>	Settlers Flax	Moist	Ground	✓	✓	✓	✓	✓	✓	✓	✓
Bignoniaceae	<i>Pandorea pandorana</i> subsp. <i>pandorana</i>	Wonga Wonga Vine	Dry	Vine	✓	✓	✓	✓	✓	✓	✓	✓
Blechnaceae	<i>Blechnum patersonii</i> subsp. <i>patersonii</i>	Strap Water Fern	Moist	Ground					✓	✓		
Blechnaceae	<i>Doodia aspera</i>	Rasp Fern	Dry	Ground	✓	✓	✓	✓	✓	✓	✓	✓
Boraginaceae	<i>Ehretia acuminata</i>	Koda	Moist	Overstorey					✓	✓	✓	✓
Capparaceae	<i>Capparis arborea</i>	Native Pomegranate	Moist	Shrub	✓	✓	✓	✓	✓	✓	✓	✓
Commelinaceae	<i>Aneilema acuminatum</i>		Moist	Ground				✓	✓	✓	✓	✓
Convolvulaceae	<i>Dichondra repens</i>	Kidney weed	Dry	Ground					✓	✓	✓	✓
Cornaceae	<i>Alangium villosum</i> subsp. <i>polysmoides</i>	Muskwood	Moist	Overstorey	✓	✓	✓	✓				
Cononiaceae	<i>Schizomeria oolata</i>	Crab Apple	Moist	Overstorey			✓	✓				
Cyperaceae	<i>Carex</i> sp.		Moist	Ground				✓	✓	✓	✓	✓
Cyperaceae	<i>Gahnia aspera</i>		Dry	Ground					✓	✓		

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Family	Scientific Name	Common Name	Forest Type	Stratum	Transect 1				Transect 2			
					2008	2009	2010	2011	2008	2009	2010	2011
Davalliaceae	<i>Arthropteris tenella</i>		Moist	Ground	✓	✓	✓	✓	✓	✓	✓	✓
Dicksoniaceae	<i>Calochlana dubia</i>	Rainbow Fern	Moist	Ground	✓	✓	✓	✓	✓	✓	✓	✓
Dioscoreaceae	<i>Dioscorea transversa</i>	Native Yam	Dry	Vine	✓	✓	✓	✓	✓	✓	✓	✓
Ebenaceae	<i>Diospyros australis</i>	Black Plum	Moist	Overstorey	✓	✓	✓	✓	✓	✓		
Elaeocarpaceae	<i>Elaeocarpus obovatus</i>	Blueberry Ash	Moist	Overstorey					✓	✓	✓	✓
Euphorbiaceae	<i>Alchornea ilicifolia</i>	Dovewood	Moist	Midstorey	✓	✓	✓	✓	✓	✓	✓	✓
Euphorbiaceae	<i>Baloghia inophylla</i>	Brush Bloodwood	Moist	Midstorey	✓	✓	✓	✓	✓	✓	✓	✓
Euphorbiaceae	<i>Croton verreauxii</i>	Green Native Cascarilla	Dry	Midstorey	✓	✓	✓	✓	✓	✓	✓	✓
Fabaceae (Mimosoideae)	<i>Acacia longissima</i>	Long-leaf Wattle	Dry	Shrub					✓	✓	✓	✓
Fabaceae (Mimosoideae)	<i>Pararchidendron pruinosum</i> var. <i>pruinoseum</i>	Snow Wood	Moist	Midstorey	✓	✓	✓	✓				
Flacourtiaceae	<i>Scolopia braunii</i>	Flintwood	Moist						✓	✓	✓	✓
Lamiaceae	<i>Clerodendrum tomentosum</i>	Hairy Clerodendrum	Moist	Midstorey	✓							
Lamiaceae	<i>Plectranthus parviflorus</i>		Dry	Ground	✓	✓	✓	✓				
Lauraceae	<i>Cryptocarya micronevna</i>	Murrogon	Moist	Overstorey	✓	✓	✓	✓				
Lauraceae	<i>Neolitsea australiensis</i>	Green Bolly Gum	Moist	Midstorey	✓	✓	✓	✓	✓	✓	✓	✓
Luzuriagaceae	<i>Eustrephus latifolius</i>	Wombat Berry	Dry	Vine	✓	✓	✓	✓				
Luzuriagaceae	<i>Geitonoplesium cymosum</i>	Scrambling Lily	Dry	Vine	✓	✓	✓	✓	✓	✓	✓	✓
Malvaceae	<i>Hibiscus heterophyllus</i>	Native Rosella	Dry	Midstorey	✓	✓	✓	✓	✓	✓	✓	✓
Meliaceae	<i>Synoum glandulosum</i> subsp. <i>glandulosum</i>	Scentless Rosewood	Dry	Shrub	✓	✓	✓	✓				
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		✓	✓	✓				
Menispermaceae	<i>Stephania japonica</i> var. <i>discolor</i>	Snake vine	Moist	Vine	✓							
Monimiaceae	<i>Doryphora sassafras</i>	Sassafras	Moist	Midstorey					✓	✓		✓

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Family	Scientific Name	Common Name	Forest Type	Stratum	Transect 1				Transect 2			
					2008	2009	2010	2011	2008	2009	2010	2011
Monimiaceae	<i>Wilkiea huegeliana</i>	Veiny Wilkiea	Moist	Shrub					✓	✓	✓	✓
Monimiaceae	<i>Wilkiea macrophylla</i>	Large-leaved Wilkiea	Moist	Midstorey					✓	✓	✓	✓
Moraceae	<i>Ficus fraseri</i>	Sandpaper Fig	Moist	Midstorey	✓							
Moraceae	<i>Ficus sp.</i>		Dry	Overstorey	✓							
Moraceae	<i>Strobilus brunonianus</i>	Whalebone Tree	Moist	Midstorey	✓	✓	✓	✓	✓	✓	✓	✓
Moraceae	<i>Trophis scandens</i>	Burny Vine	Moist	Vine					✓	✓		✓
Myrtaceae	<i>Backhousia myrtifolia</i>	Grey Myrtle	Moist	Overstorey	✓	✓	✓	✓				
Myrtaceae	<i>Eucalyptus acmenoides</i>	White mahogany	Dry	Overstorey					✓	✓	✓	✓
Myrtaceae	+ <i>Eucalyptus fergusonii</i> subsp. <i>fergusonii</i>	Grey Ironbark	Dry	Overstorey					✓	✓	✓	✓
Myrtaceae	<i>Melaleuca styphelioides</i>		Dry	Overstorey	✓	✓	✓	✓				
Myrtaceae	<i>Rhodamnia rubescens</i>	Scrub Turpentine	Dry	Midstorey	✓							
Myrtaceae	<i>Syngcarpia glomulifera</i>	Turpentine	Dry	Overstorey	✓	✓	✓	✓				
Oleaceae	<i>Notelaea longifolia</i>	Large Mock-olive	Dry	Shrub	✓	✓			✓	✓	✓	✓
Oleaceae	<i>Olea paniculata</i>	Native Olive	Moist	Overstorey					✓	✓	✓	✓
Orchidaceae	<i>Dendrobium sp.</i>		Dry	-	✓	✓	✓	✓				
Orchidaceae	<i>Sarcodilus falcatus</i>	Orange-blossom Orchid	Moist	-					✓	✓	✓	
Phyllanthaceae	<i>Breynia oblongifolia</i>	Coffee Bush	Moist	Shrub	✓	✓	✓	✓				
Pittosporaceae	<i>Pittosporum multiflorum</i>	Orange Thorn	Moist	Shrub	✓	✓	✓	✓	✓	✓	✓	✓
Poaceae	<i>Oplismenus aemulus</i>	Basket Grass	Dry	Ground	✓	✓	✓	✓	✓	✓	✓	✓
Podocarpaceae	<i>Podocarpus elatus</i>	Plum Pine	Moist	Overstorey							✓	✓
Polyodiaceae	<i>Pyrosia confluens</i> var. <i>confluens</i>	Horse-shoe Felt Fern	Moist	-	✓	✓	✓	✓	✓	✓	✓	✓
Rhamnaceae	<i>Alphitonia exelsa</i>	Red Ash	Moist	Overstorey	✓	✓	✓	✓			✓	✓
Ripogonaceae	<i>Ripogonum album</i>	White Supplejack	Moist	Vine	✓							
Rubiaceae	<i>Morinda jasminoides</i>	Sweet Morinda	Moist	Vine	✓	✓		✓	✓	✓		✓

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Family	Scientific Name	Common Name	Forest Type	Stratum	Transect 1				Transect 2			
					2008	2009	2010	2011	2008	2009	2010	2011
Rutaceae	<i>Geijera salicifolia</i> var. <i>latifolia</i>		Moist	Midstorey					✓	✓		
Sapindaceae	<i>Alectryon subcinerus</i>	Native Quince	Moist	Midstorey	✓	✓	✓	✓	✓	✓	✓	✓
Sapindaceae	<i>Guioa semiglauca</i>		Moist	Midstorey	✓	✓	✓	✓	✓	✓		
Sapotaceae	<i>Flanchonella australis</i>	Black Apple	Moist	Overstorey	✓	✓	✓	✓	✓	✓	✓	✓
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	✓	✓	✓	✓	✓	✓	✓	✓
Urticaceae	<i>Dendrocnide photinophylla</i>	Shiny-leaved Stinging Tree	Moist	Overstorey	✓	✓	✓	✓				✓
Verbenaceae	* <i>Lantana camara</i>	Lantana	Dry	Shrub	✓	✓	✓	✓	✓	✓	✓	✓
Vitaceae	<i>Cayratia clematidea</i>	Native Grape	Dry	Vine	✓	✓	✓	✓	✓	✓	✓	✓
Vitaceae	<i>Cissus antarctica</i>	Water Vine	Moist	Vine	✓	✓	✓	✓	✓	✓		
Vitaceae	<i>Tetragymna nitens</i>		Moist	Vine	✓	✓	✓	✓			✓	✓
				Total	54	48	46	52	51	46	45	47

* denotes an introduced species
+ denotes a ROTAP species

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Appendix 2: Fauna species recorded on the subject site in 2008, 2009, 2010 and 2011

Scientific Name	Common Name	Method	Location							
			Dry forest - 2008	Dry forest - 2009	Dry forest - 2010	Dry forest - 2011	Rainforest - 2008	Rainforest - 2009	Rainforest - 2010	Rainforest - 2011
Amphibians										
<i>Litoria fallax</i>	Eastern Dwarf Tree Frog	Opportunistic record	+							+
<i>Litoria peronii</i>	Peron's Tree Frog	Opportunistic record	+			+				
		Total	2			1				
Reptiles										
<i>Varanus varius</i>	Lace Monitor	Opportunistic sighting	+							
<i>Cyclodomorphus gerrardii</i>	Pink-tongued Skink									+
		Total	1							1
Birds										
<i>Alectura lathami</i>	Australian Brush-turkey	Opportunistic record					+			
<i>Alisterus scapularis</i>	Australian King-Parrot	Bird survey		+		+	+			
<i>Cracticus tibicen</i>	Australian Magpie	Bird survey			+					
	Australian Owllet-nightjar	Spotlighting	+	+			+			
<i>Corvus coronoides</i>	Australian Raven	Opportunistic record	+							
<i>Manorina melanophrys</i>	Bell Miner	Bird survey	+			+				
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	Bird survey		+						
<i>Monarcha melanopsis</i>	Black-faced Monarch	Bird survey	+	+		+	+	+	+	+
<i>Macropygia amboinensis</i>	Brown Cuckoo-dove	Bird survey	+	+			+	+	+	+
<i>Gerygone mouki</i>	Brown Gerygone	Bird survey	+	+	+	+	+	+	+	+
<i>Acanthiza pusilla</i>	Brown Thornbill	Bird survey	+		+	+	+	+		+
<i>Cacomantis variolosus</i>	Brush Cuckoo	Opportunistic record	+			+				
<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo	Bird survey				+				
<i>Coracina tenuirostris</i>	Cicadabird	Opportunistic record	+							

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Scientific Name	Common Name	Method	Location							
			Dry forest - 2008	Dry forest - 2009	Dry forest - 2010	Dry forest - 2011	Rainforest - 2008	Rainforest - 2009	Rainforest - 2010	Rainforest - 2011
<i>Platycercus eximius</i>	Eastern Rosella	Bird survey		+		+		+		
<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill	Bird survey	+	+	+	+	+	+	+	+
<i>Psophodes olivaceus</i>	Eastern Whipbird	Bird survey	+	+	+	+	+	+	+	+
<i>Eopsaltria australis</i>	Eastern Yellow Robin	Bird survey	+	+	+	+	+	+	+	+
<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo	Bird survey	+							+
<i>Pachycephala pectoralis</i>	Golden Whistler	Bird survey	+	+	+	+	+	+	+	+
<i>Atiloedus crassirostris</i>	Green Catbird	Bird survey						+		+
<i>Rhipidura fuliginosa</i>	Grey Fantail	Bird survey	+	+	+	+	+	+	+	+
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	Bird survey	+				+		+	+
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	Bird survey		+		+				
<i>Myiagra rubecula</i>	Leaden Flycatcher	Bird survey	+	+		+	+			
<i>Meliphaga lewinii</i>	Lewin's Honeyeater	Bird survey	+	+	+	+	+	+	+	+
<i>Pitta versicolor</i>	Noisy Pitta	Bird survey						+	+	
<i>Centropus phasianinus</i>	Pheasant Coucal	Opportunistic record	+							
<i>Cracticus nigrogularis</i>	Pied Butcherbird	Bird survey				+				
<i>Strepera graculina</i>	Pied Currawong	Bird survey	+	+						
<i>Ninox strenua</i>	Powerful Owl	Opportunistic record				+	+		+	+
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	Opportunistic record	+							
<i>Neochmia temporalis</i>	Red-browed Finch	Bird survey		+						
<i>Rhipidura rufifrons</i>	Rufous Fantail	Bird survey			+		+			
<i>Pachycephala rufiventris</i>	Rufous Whistler	Bird survey	+		+	+	+	+	+	+
<i>Todiramphus sanctus</i>	Sacred Kingfisher	Bird survey	+	+	+	+	+			+
<i>Ptilonorhynchus violaceus</i>	Satin Bowerbird	Bird survey								+
<i>Myzomela sanguinolenta</i>	Scarlet Honeyeater	Bird survey	+	+	+	+	+	+	+	+
<i>Chrysococcyx lucidus</i>	Shining Bronze-Cuckoo	Bird survey		+			+			
<i>Zosterops lateralis</i>	Silvereye	Bird survey	+	+	+	+	+	+	+	+
<i>Ninox tenebriosa</i>	Sooty Owl	Spotlighting			+					
<i>Ninox novaeseelandiae</i>	Southern Boobook	Spotlighting			+			+		
<i>Pardalotus punctatus</i>	Spotted Pardalote	Bird survey	+	+	+	+	+	+	+	+
<i>Cinclosoma punctatum</i>	Spotted Quail-thrush	Bird survey	+	+			+			
<i>Acanthiza lineata</i>	Striated Thornbill	Bird survey	+		+	+				+
<i>Malurus cyaneus</i>	Superb Fairy-wren	Bird survey		+				+		+
<i>Lopholaimus antarcticus</i>	Topknot Pigeon	Bird survey								+

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Scientific Name	Common Name	Method	Location							
			Dry forest - 2008	Dry forest - 2009	Dry forest - 2010	Dry forest - 2011	Rainforest - 2008	Rainforest - 2009	Rainforest - 2010	Rainforest - 2011
<i>Malurus lamberti</i>	Variiegated Fairy-wren	Bird survey						+		
<i>Sericornis frontalis</i>	White-browed Scrubwren	Bird survey	+	+		+	+	+		
<i>Melithreptus lunatus</i>	White-naped Honeyeater	Bird survey	+							
<i>Cormobates leucophaeus</i>	White-throated Treecreeper	Bird survey	+	+	+	+	+	+	+	
<i>Leucosarcia melanoleuca</i>	Wonga Pigeon	Bird survey	+	+		+			+	+
<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater	Bird survey	+	+	+	+				+
<i>Sericornis citreogularis</i>	Yellow-throated Scrubwren	Bird survey						+	+	+
	Total		33	28	21	28	26	24	20	23
Terrestrial Mammals			Dry forest - 2008	Dry forest - 2009	Dry forest - 2010	Dry forest - 2011	Rainforest - 2008	Rainforest - 2009	Rainforest - 2010	Rainforest - 2011
<i>Antechinus stuartii</i>	Brown Antechinus	Trapping & hair ID	+	+	+	+	+	+	+	+
<i>Antechinus swainsonii</i>	Dusky Antechinus	Trapping				+				
<i>Penameles nasuta</i>	Long-nosed Bandicoot	Trapping	+		+			+	+	
<i>Rattus fuscipes</i>	Bush Rat	Trapping	+	+		+	+	+	+	+
<i>Wallabia bicolor</i>	Swamp Wallaby	Opportunistic diurnal sighting				+	+			
	Total		3	2	2	4	3	3	3	2
Arboreal Mammals			Dry forest - 2008	Dry forest - 2009	Dry forest - 2010	Dry forest - 2011	Rainforest - 2008	Rainforest - 2009	Rainforest - 2010	Rainforest - 2011
<i>Acrobates pygmaeus</i>	Feathertail Glider	Spotlighting	+		+	+				
<i>Petauroides volans</i>	Greater Glider	Spotlighting					+			
<i>Petaurus breviceps</i>	Sugar Glider	Spotlighting	+	+	+	+				
<i>Trichosurus vulpecula</i>	Common Brushtail Possum	Spotlighting			+	+		+		
	Total		2	1	3	3	1	1	0	0
Bats			Dry forest - 2008	Dry forest - 2009	Dry forest - 2010	Dry forest - 2011	Rainforest - 2008	Rainforest - 2009	Rainforest - 2010	Rainforest - 2011
<i>Chalinolobus gouldii</i>	Gould's Wattle Bat	Anabat analysis	+	+				+		
<i>Chalinolobus morio</i>	Chocolate Wattle Bat	Trapping & Anabat analysis	+	+		+				+

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Scientific Name	Common Name	Method	Location							
			Dry forest - 2008	Dry forest - 2009	Dry forest - 2010	Dry forest - 2011	Rainforest - 2008	Rainforest - 2009	Rainforest - 2010	Rainforest - 2011
<i>Falsistrellus tasmaniensis</i> / <i>Scotorepens orion</i>	Eastern False Pipistrelle / Eastern Broad-nosed Bat	Anabat analysis		+				+		
# <i>Miniopterus australis</i>	Little Bentwing-bat	Trapping & Anabat analysis	+	+	+		+	+		+
# <i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	Anabat analysis						+		
<i>Mormopterus sp. 2</i>								+		
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat	Trapping				+				
<i>Nyctophilus gouldii</i>	Gould's Long-eared Bat	Trapping		+				+		
# <i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	Spotlighting	+							
<i>Vespdelus pumilus</i>	Eastern Forest Bat	Anabat analysis	+	+				+	+	
<i>Vespdelus vulturinus</i>	Little Forest Bat	Trapping & Anabat analysis	+	+	+	+	+	+		
	Total		6	7	2	3	2	8	1	2

denotes a threatened species under the NSW TSC Act 1995

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Appendix 3: Photographs of selected fauna species detected at Long Gully Creek

Arboreal and terrestrial mammals



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*)



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 and qualifications of ecobiological staff

Name	Qualification	Title	Contribution
Aaron Mulcahy	B. Env Sc.&Mgt	Ecologist (Botanist)	Flora survey and report writing
Luke Foster	B. Env. Sc.	Ecologist (Mammalogist)	Trap layout and checks, nocturnal surveys, report writing
Kristy Peters	B. ParkMgt.(Hons)	Senior Ecologist (Ornithologist)	Bird surveys, internal report review
Daniel O'Brien	B. Env. Sc. & Mgt. (Hons)	Ecologist	Amphibian surveys
Dr Nigel Fisher	PhD, B. Env Sci	Ecologist/Soil Micro-ecology	Flora survey
Glenn Jeffs	B. App Sci. Certificate IV Geomatic Engineering	GIS Manager	Map preparation

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