



Kanmantoo

Fauna Survey 2018

Kanmantoo Fauna Survey 2018

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Prepared by EBS Ecology for Hillgrove Resources

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EXECUTIVE SUMMARY

EBS Ecology (EBS) has been engaged by Hillgrove Resources since 2011 to conduct an annual fauna monitoring program over the Kanmantoo Copper (Kanmantoo Mine) Mining Lease (ML). The fauna monitoring program was undertaken in accordance with the conditions and outcomes required in Program for Environment Protection and Rehabilitation (PEPR) for Kanmantoo Mine. As such, there must be no net adverse impacts on native fauna abundance or diversity in the ML and in adjacent areas.

The fauna monitoring program aimed to determine whether Kanmantoo Mine had met its conditions and outcomes detailed in the PEPR by:

- Conducting roaming transect surveys to record the abundance and diversity of birds;
- Performing targeted spotlighting surveys to record the abundance of Common Brush-tailed Possums (*Trichosurus vulpecula*) as well as other nocturnal fauna; and
- Opportunistically recording all other fauna species encountered within the Project area.

The 2018 bird surveys recorded a total of 700 birds from 56 species over the Project area. This included five State threatened species, including the State rare Restless Flycatcher (*Myiagra inquieta*), which had not previously been recorded in the Project area. In 2018, species richness was the second highest on record at Kanmantoo Mine. However, the number of birds was substantially less than that recorded in 2017. Over the lifetime of the fauna monitoring program, the abundance and species richness of birds has shown annual fluctuations, which may be driven by a series of factors including rainfall, food resources and the presence (or absence) of nomadic and flocking species.

Twenty (20) Common Brushtail Possums were observed within the ML during the 2018 spotlight survey, while no individuals were observed in the Significant Environmental Benefit (SEB) area. To date there have been no observations of Common Brushtail Possums within the SEB area due to an absence of suitable habitat. Over the lifetime of the fauna monitoring program the numbers of Common Brushtail Possums have remained relatively stable despite annual fluctuations.

The results from the 2018 fauna monitoring program confirm that there is no discernible loss of native fauna abundance or diversity within the ML and in adjacent areas as demonstrated by the results of the bird and Common Brushtail Possum surveys. As such, Hillgrove Resources has satisfied the condition (13) and outcome (21) required within the PEPR relating to the conservation of fauna.

EBS recommends the following measures to improve the management and monitoring of fauna within the Kanmantoo Mine Project area:

- Continue the fauna monitoring program at the same time each year (early spring);
- Suspend spotlighting with the SEB areas due to the low likelihood of Common Brushtail Possums using these areas within the life of mine;
- Conduct a control program to reduce the numbers of Western Grey Kangaroos, rabbits and hares within the Project area.

GLOSSARY AND ABBREVIATION OF TERMS

| | |
|------------------|--|
| BOM | Bureau of Meteorology |
| EBS | EBS Ecology |
| EPBC | <i>Environment Protection and Biodiversity Conservation Act 1999</i> |
| Kanmantoo (Mine) | Kanmantoo Copper |
| LOM | Life of Mine |
| ML | Mining Lease |
| PEPR | Program for Environment Protection and Rehabilitation |
| Project area | Combined area of the ML and SEB areas |
| SA | South Australia/South Australian |
| SEB | Significant Environmental Benefit |

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1 INTRODUCTION

EBS Ecology (EBS) has been engaged by Hillgrove Resources since 2011 to conduct an annual fauna monitoring program over the Kanmantoo Copper (Kanmantoo) Mining Lease (ML). The 2018 monitoring program marks the fifth year that EBS has also monitored the Significant Environmental Benefit (SEB) areas, located adjacent to the Kanmantoo ML. The Kanmantoo ML and the Kanmantoo SEB area in combination are named herein as the Project area. The fauna monitoring program was undertaken in accordance with the conditions and outcomes required in Program for Environment Protection and Rehabilitation (PEPR) for Kanmantoo.

1.1 Objectives

The objective of the fauna monitoring program is to meet the conditions and outcomes as outlined in the PEPR. With regards to fauna (Condition 13), *“the lessee must in constructing and operating the Lease, ensure that there is no adverse impacts from the site operations on the native fauna abundance or diversity in the Lease area and in adjacent areas”*. As such, the Outcome (21) required is *“no net adverse impacts from the site operations on native fauna abundance or diversity in the lease area and in adjacent areas”*. More specifically, the fauna monitoring program aimed to determine the abundance and diversity of fauna within the Project area by:

- Conducting roaming transect surveys to record the abundance and diversity of birds;
- Performing a targeted spotlighting survey to record the abundance of Common Brush-tailed Possums (*Trichosurus vulpecula*) as well as other nocturnal fauna species; and
- Opportunistically recording all other fauna species encountered within the Project area.

1.2 Project area

The Project area is located approximately 45 km south-east of Adelaide in the eastern Mount Lofty Ranges of South Australia and 1.5 km south-west of the Kanmantoo township (Figure 1). The area is representative of a transitional zone on the eastern face of the Mount Lofty Ranges, between the Adelaide Hills woodland regions and the Murray River Plains mallee. It has a long-term average rainfall of 470 mm (Figure 3) and encompasses a variety of soil types and geological structures, conducive to an assortment of vegetation types and habitat niches.

The Project area had a history of mining activity, which started in the mid-nineteenth century and then continued between 1971 and 1976 (Hillgrove Resources 2007). Over the past 150 years, much of the ML has been extensively cleared for cropping, whilst most of the vegetated areas have been grazed by domestic stock. As a result, only small remnant patches of native vegetation in the mining lease have persisted, including native grasslands and woodland communities.

The SEB offset areas are located adjacent to the Kanmantoo Mine (Figure 2). SEB offset areas associated with the Life of Mine (LOM) extension have been located as near as possible to the ML on suitable Hillgrove Resources owned land parcels. The SEB Project area is approximately 109.5 hectares and is comprised of five properties (Figure 2). All properties within the SEB area have been managed

under a mixed cropping / sheep grazing regime for over 100 years. Cropping has been confined to the flats and grazing has been on crop stubble and the higher/rockier areas. Consequently, only small remnant patches of native vegetation remain in the SEB areas, including native grasslands and a mallee community.

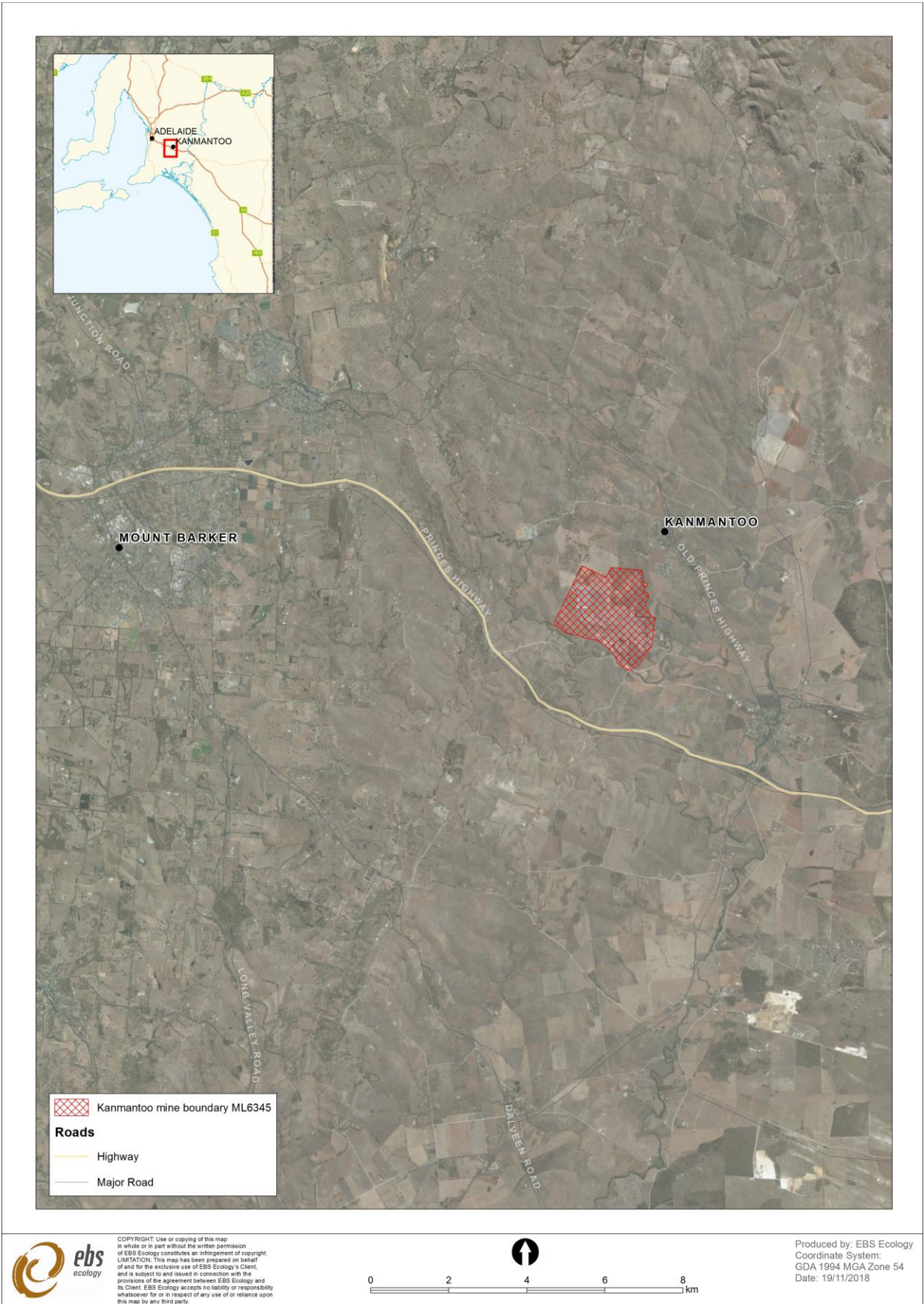


Figure 1. Location of Kanmantoo Mine with respect to local townships and Adelaide, South Australia.



Figure 2. Location of the ML and SEB areas over the Project area.

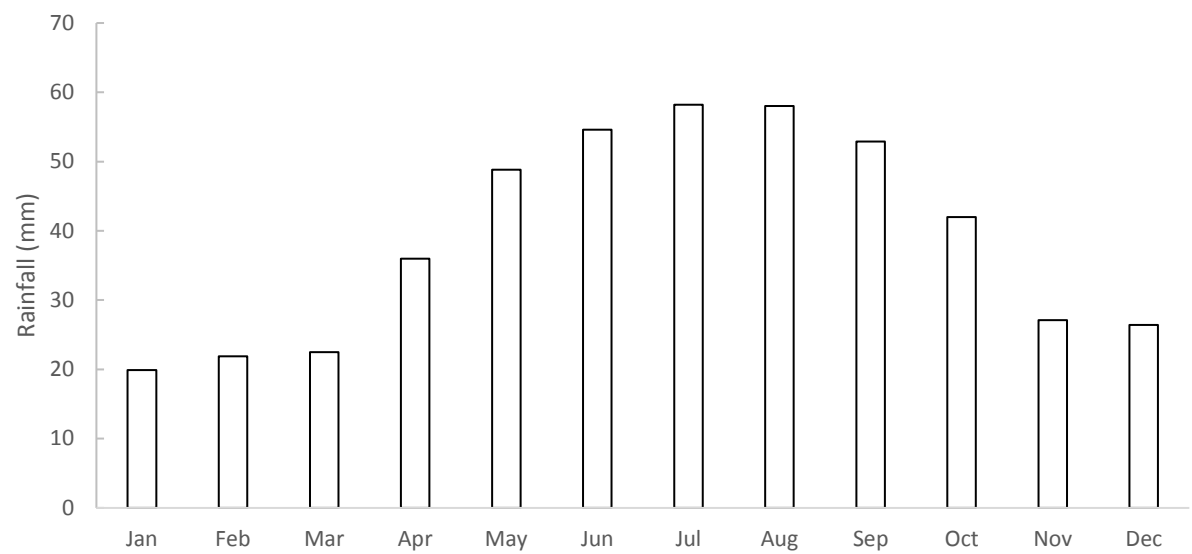


Figure 3. Mean monthly rainfall at Kanmantoo Weather Station (23724) from 1874-2018 (BOM 2018a)

2 METHODS

2.1 Field Survey

The field survey was conducted by Gareth Oerman (Senior Ecologist) and supported by Steve McGovern (Restoration Officer) on 18, 19, 20 and 26 September 2018.

2.1.1 Weather conditions

Weather data were sourced from the Pallamana weather station (Murray Bridge Aero), South Australia, located 19.7 km to the east, as the Kanmantoo weather station is limited to rainfall data only. The weather conditions over the 2018 survey period were characterised by cold mornings and mild afternoon temperatures (Table 1) (BOM 2018b). Rain fell on 20 September 2018, with 1.6 mm recorded (BOM 2018a). The wind was typically moderate; however, strong winds were recorded on 18 September 2018 (BOM 2018b).

Table 1. Daily weather observations and survey activities during the spring survey 2018, Murray Bridge Weather Station (BOM 2018a, BOM 2018b).

| Date | Min temp | Max temp | Rain | Time | Temp | Relative humidity | Wind direction | Wind speed | Activity |
|----------|----------|----------|------|---------|------|-------------------|----------------|------------|--------------------------|
| | °C | °C | mm | | °C | % | | km/h | |
| 18/09/18 | 4.3 | 18.5 | 0 | 9:00 am | 14.3 | 54 | W | 26 | Birds (ML) |
| | | | | 3:00 pm | 14.6 | 50 | W | 35 | |
| 19/09/18 | 1.1 | 17.4 | 0 | 9:00 am | 13.5 | 45 | WSW | 24 | Birds, Spotlighting (ML) |
| | | | | 3:00 pm | 16.7 | 34 | WSW | 22 | |
| 20/09/18 | 1.6 | 18.1 | 1.6 | 3:00 pm | 17.2 | 49 | WSW | 20 | Spotlighting (SEB) |
| 26/09/18 | -0.5 | 25.7 | 0 | 9:00 am | 13.0 | 47 | NNE | 26 | Birds (SEB) |
| | | | | 3:00 pm | 25.3 | 18 | NW | 19 | |

2.1.2 Long-term Rainfall

Long term rainfall data (1874-2018) were sourced from Kanmantoo weather station. Rainfall at Kanmantoo shows annual variability, as annual rainfall ranged from 345 mm in 2017/18 to 586 mm in 2016/17 (BOM 2018a). Overall, 2010/11, 2011/12, 2015/16 and 2016/17 had above average rainfall (470 mm), while 2012/13, 2013/14, 2014/15 and 2017/18 all had below average rainfall (Figure 4) (BOM 2018a). It must be noted that there is missing rainfall data for the years 2012/13 and 2017/18 and therefore their rainfall totals may be greater the values presented in Figure 4.

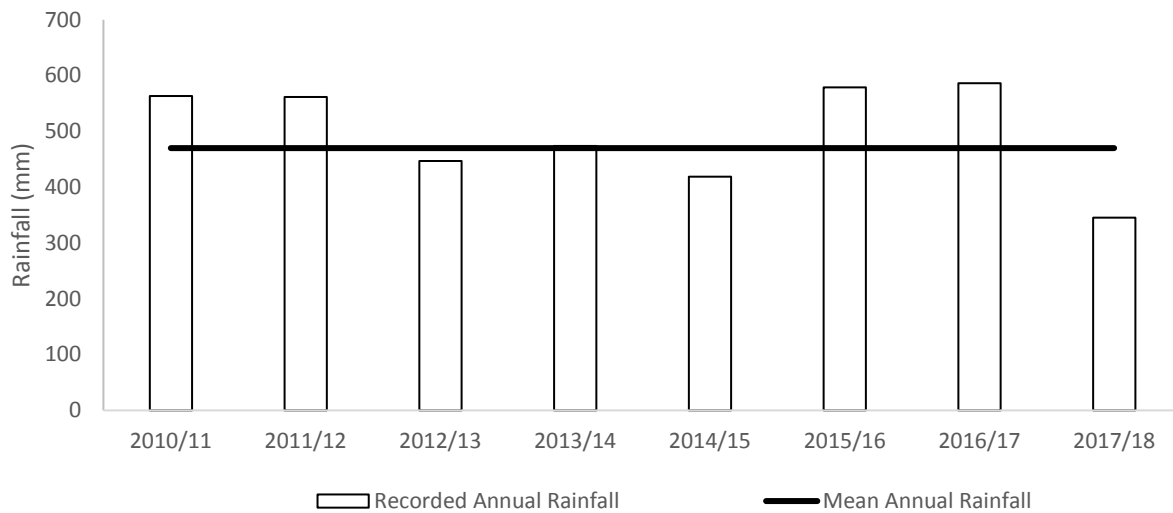


Figure 4. Mean annual rainfall (measured from October to September) at Kanmantoo weather station (23724) from 2010 to 2018. There is missing data for Oct 2012 and Oct 2017, and therefore, the total rainfall for these years may be lower than the true value (BOM 2018a).

2.1.3 Survey effort per year

Mining Lease

Fauna within the ML have been monitored annually since 2011 (Table 2). Bird monitoring transects within the ML varied in number (11 to 15) before the sites were formalised in 2015, however, the areas within which birds were surveyed were comparable between years. Since 2015, the same bird monitoring transects have been monitored annually.

The spotlighting transects have remained consistent since the inaugural year of monitoring in 2011. However, the number of spotlighting nights has reduced from three nights (2011) to one night (2014 to present).

Significant Environmental Benefit Areas

The SEB areas were monitored for the first time in 2014 (Table 2). However, monitoring in 2014 solely focused on spotlighting possums, though, opportune observations of birds were also made. The number of spotlight night (1) and the transects surveyed have remained consistent since inception in 2014. In 2015, nine bird monitoring transects were established. Each bird monitoring transects is monitored annually.

Table 2. Fauna survey effort per year with the ML and SEB areas of Kanmantoo Mine.

| Year | ML | | SEB | |
|------|----------------|------------------|------------|------------------|
| | Bird transects | Spotlight nights | Bird sites | Spotlight nights |
| 2011 | 15* | 3 | N.M. | N.M. |
| 2012 | 11* | 2 | N.M. | N.M. |
| 2013 | 11* | 2 | N.M.. | N.M. |
| 2014 | 12* | 1 | N.M. | 1 |
| 2015 | 14 | 1 | 9 | 1 |
| 2016 | 14 | 1 | 9 | 1 |
| 2017 | 14 | 1 | 9 | 1 |
| 2018 | 14 | 1 | 9 | 1 |

*sites not formalised
N.M. = not monitored

2.1.4 Birds

Twenty-three (23) bird transects are located over the Project area; 14 in ML and nine in the SEB area (Figure 5). These transects have been strategically positioned to represent the main habitat types and rehabilitation areas across the Project area. Each transect was surveyed by a single surveyor, who walked the entire length of the transect. The following information was recorded for each bird observed:

- Species;
- Number of individuals per species;
- Behaviour of individuals (foraging, resting, or flying); and
- the substrates individuals were using (ground, shrub, or tree).

Furthermore, all birds heard were recorded to species and the number of individuals estimated.

2.1.5 Common Brushtail Possum targeted survey

Spotlighting was conducted over repeated routes within the ML and SEB areas to systemically determine the numbers of Common Brushtail Possums in the Project area (Figure 5). The ML was surveyed from a vehicle, while the SEB area was surveyed by foot as well as from a vehicle. The spotlighting routes within the ML and SEB were surveyed over one night for two hours, each. All surveys commenced approximately one hour after sunset.

The following information was recorded for each bird observed:

- Number of individuals;
- GPS location; and
- Habitat.

Any other fauna species observed opportunistically during spotlighting were recorded.

2.1.6 *Opportunistic observations*

Any fauna species recorded within the ML or SEB area outside of systematic surveys were noted as opportune. For each opportune record, the following information was recorded:

- Species;
- Number of individuals;
- GPS location;
- Method, i.e. sight or sound; and
- Habitat.

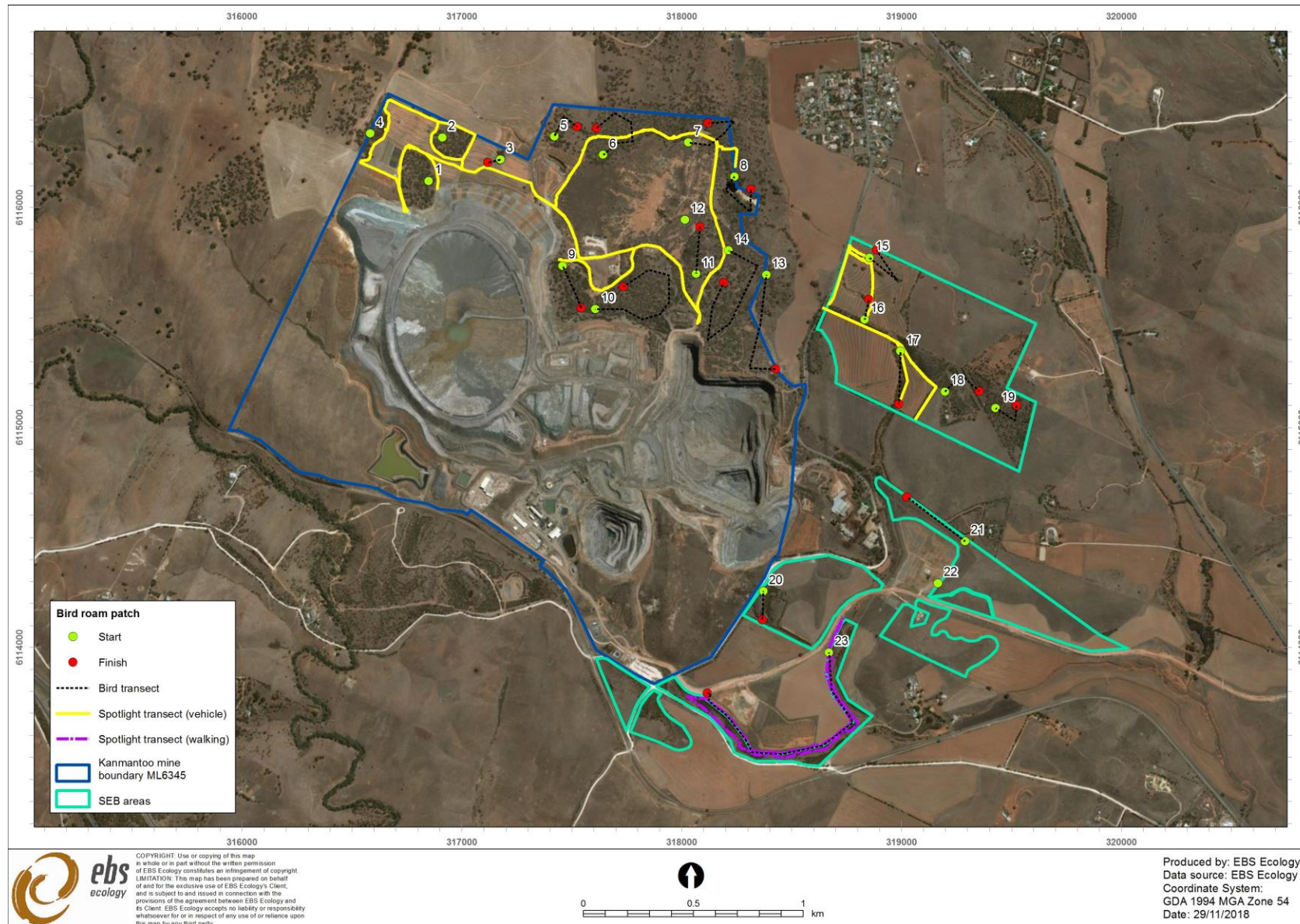


Figure 5. Locations of bird survey transects and spotlight (Common Brushtail Possum targeted survey) transects (vehicle and on foot) over the Project area.

3 RESULTS

3.1 Bird Survey 2018

3.1.1 Species richness

Fifty-six (56) bird species were recorded over the Project area at survey sites and opportunistically in 2018 (Appendix 1). The families of birds with the greatest representation were:

- Meliphagidae (Honeyeaters; nine species);
- Psittaculidae (Parrots; four species);
- Acanthizidae (Australian Warblers; three species); and
- Columbidae (Pigeons and Doves; three species).

Seven species were observed at Kanmantoo Mine for the first time in 2018, which were:

1. Yellow Thornbill (*Acanthiza nana*);
2. Yellow-faced Honeyeater (*Caligavis chrysops*);
3. Peaceful Dove (*Geopelia placida*);
4. Restless Flycatcher (*Myiagra inquieta*);
5. White-naped Honeyeater (*Melithreptus lunatus*);
6. Red-browed Finch (*Neochmia temporalis*); and
7. Grey Fantail (*Rhipidura albiscapa*).

3.1.2 Bird abundance

A total of 700 birds from 56 species were recorded over the Project area at survey sites and opportunistically in 2018 (Appendix 1). The most abundant species over the Project area in 2018 were:

- White-winged Chough (*Corcorax melanorhamphos*) (76 individuals);
- Yellow-rumped Thornbill (*Acanthiza chrysorrhoa*) (54 individuals); and
- Crimson Rosella (*Platycerus elegans*) (51 individuals).

3.1.3 Threatened species

Four State threatened bird species were observed in 2018, including the State Rare Restless Flycatcher, which had not previously been recorded. The Restless Flycatcher was represented by a lone individual in the SEB area, where it was recorded in a *Callitris* sp. plantation. The State Rare White-winged Choughs were abundant over the Project area, primarily within the ML, however, were also recorded in the SEB area. State Rare Elegant Parrots (*Neophema elegans*) were widespread over the Project area, in both the ML and SEB areas, while Diamond Firetails (*Stagonopleura guttata*) were found at three locations in the SEB area (Figure 6).



Figure 6. Locations of State threatened bird species observed during the 2018 fauna monitoring program.

3.2 Bird Survey 2011-2018

3.2.1 Species richness

The species richness of birds at Kanmantoo Mine has fluctuated over the lifetime of the fauna monitoring program (Figure 7). The mean bird species richness recorded per year over the monitoring program is $47.3 \mu \pm 3.2$ S.E. (2011-2018). Fewer bird species were recorded from 2011 to 2013 due to lower search effort, with survey sites confined to the ML only (see Section 2.1.3 above). Despite greater consistency in search effort since 2015, species richness has remained variable between years (Figure 7). This variability in species richness does not appear to be correlated with rainfall. In 2018, species richness was the second highest on record at Kanmantoo Mine with a total of 56 species observed.

3.2.2 Bird abundance

The abundance of birds at Kanmantoo Mine has fluctuated over the lifetime of the fauna monitoring program (Figure 8). The average number of birds recorded per year over the monitoring program was $643.6 \mu \pm 90.3$ S.E. (2011-2018). Fewer birds were recorded from 2011 to 2014 due to lower search effort, with survey sites confined to the ML only. Despite greater consistency in search effort since 2015, bird abundance has remained variable between years. This variability in bird abundance does not appear to be correlated with rainfall. In 2018, species richness was the second highest on record at Kanmantoo Mine. However, bird abundance in 2018 (700 individuals) was substantially less compared to the abundance in 2015 (948 individuals) and 2017 (1042 individuals).

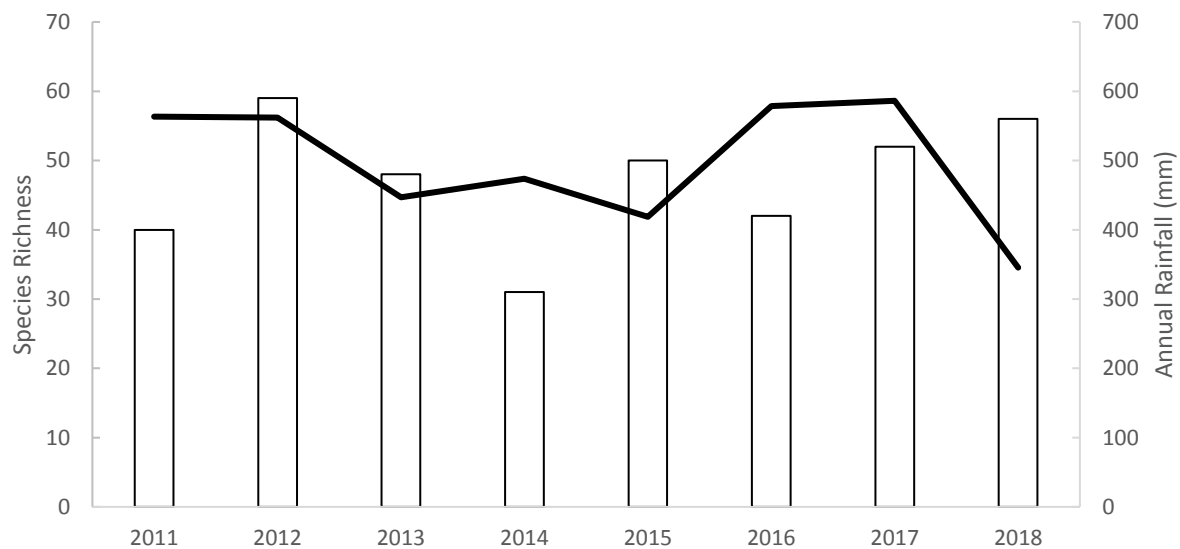


Figure 7. Bird species richness recorded over the fauna monitoring program 2011-2018. Please note that monitoring was confined to the ML from 2011 to 2014 and expanded to include SEB areas from 2015.

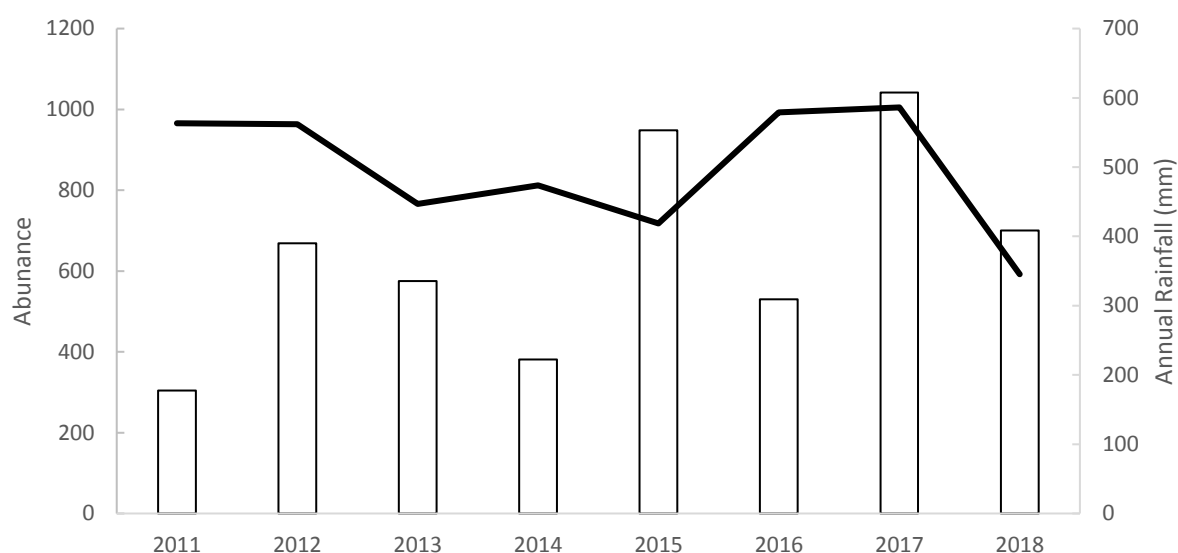


Figure 8. Bird abundance recorded over the fauna monitoring program 2011-2018. Please note that monitoring was confined to the ML from 2011 to 2014 and expanded to include SEB areas from 2015.

3.2.3 Threatened species

A total of eight State threatened species have been observed at Kanmantoo Mine over the lifetime of the fauna monitoring program (Table 3). The White-winged Chough and Elegant Parrot were the only two threatened species which have been recorded on each annual survey, while the Diamond Firetail was observed on six of the eight survey years. The abundance of White-winged Choughs and Elegant Parrots appear to be stable, if not, increasing, while the numbers of Diamond Firetails also appear stable.

The Peregrine Falcon (*Falco peregrinus*) has been observed on four surveys, the Yellow-tailed Black Cockatoo (*Calyptorhynchus funereus*) on three surveys, while the Jacky Winter (*Microeca fascians fascians*), Hooded Robin (*Melanodryas cucullata cucullata*) and Restless Flycatcher were observed only on one survey, respectively. Due to the lack of records of these species, trends in the number of individuals using Kanmantoo Mine cannot be assessed.

Table 3. Bird species of conservation significance recorded between 2011 and 2018.

| Species name | Common name | EPBC | SA | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---------------------------------|------------------------------|------|----|------|------|------|------|------|------|------|------|
| <i>Calyptorhynchus funereus</i> | Yellow-tailed Black Cockatoo | | V | | 7 | | | 8 | | 65 | |
| <i>Corcorax melanorhamphos</i> | White-winged Chough | | R | 22 | 24 | 16 | 34 | 97 | 36 | 45 | 76 |
| <i>Falco peregrinus</i> | Peregrine Falcon | | R | 2 | 2 | | | 4 | 1 | | |
| <i>Myiagra inquieta</i> | Restless Flycatcher | | R | | | | | | | | 1 |

| Species name | Common name | EPBC | SA | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|--|------------------|------|----|------|------|------|------|------|------|------|------|
| <i>Melanodryas cucullata cucullata</i> | Hooded Robin | | R | 2 | | | | | | | |
| <i>Microeca fascinans fascinans</i> | Jacky Winter | | R | | | 1 | | | | | |
| <i>Neophema elegans</i> | Elegant Parrot | | R | 7 | 16 | 12 | 9 | 19 | 55 | 28 | 27 |
| <i>Stagonopleura guttata</i> | Diamond Firetail | | V | 6 | 16 | 4 | | 5 | | 4 | 13 |

SA: South Australia (*National Parks and Wildlife Act 1972*). **VU/V:** **Conservation Codes:** V: Vulnerable. R: Rare. **EPBC:** *Environment Protection and Biodiversity Conservation Act 1999*.

3.3 Possum survey 2018

A total of 20 Common Brushtail Possums were observed within the ML, while no observations of the species occurred in the SEB area (Figure 9; Table 4).

3.4 Possum survey 2011-2018

To date there have been no observations of Common Brushtail Possums within the SEB area. In the ML, the number of individuals observed per night has ranged from 14 in 2016 to 44 in 2012. The average number of possums per night was $22.4 \mu \pm 3.9$ S.E. (2011-2018). Over the lifetime of the fauna monitoring program the numbers of Common Brushtail Possums have remained relatively stable despite annual fluctuations.

Table 4. Observations of Common Brushtail Possums 2011-2018.

| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|--|------|------|------|------|------|------|------|------|
| Number observed | 43 | 88 | 53 | 9 | 21 | 14 | 30 | 20 |
| Number of nights surveyed within ML | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| Average number of possums observed per night | 14.3 | 44.0 | 26.5 | 9.0 | 21.0 | 14.0 | 30.0 | 20.0 |

3.5 Opportunistic observations 2018

3.5.1 Frogs

Two frog species were opportunistically heard within the Project area: Common Froglet (*Crinia signifera*) and the Spotted Marsh Frog (*Limnodynastes tasmaniensis*). More than 50 calling Common Froglet males and two calling Spotted Marsh Frog males were heard over a five-minute period.

3.5.2 Pest and over-abundant species

The Western Grey Kangaroo (*Macropus fuliginosus*) was the only native mammal species recorded in the Project area and were most abundant (38 individuals) within the ML (33 individuals) compared to the SEB area (five individuals). Two introduced mammal species were recorded; the Rabbit (*Oryctolagus cuniculus*) (seven individuals: three in the ML and four in the SEB area) and the European Brown Hare (*Lepus europeaeus*) (four individuals three in the ML and one in the SEB area).



Figure 9. Locations and number of the Common Brushtail Possums (*Trichosurus vulpecula*) observed during the 2018 fauna monitoring program

4 DISCUSSION

4.1 Birds

Fluctuations in the number of birds observed at Kanmantoo Mine appear to be in part influenced by the presence of nomadic and flocking species and variations in the numbers of ground foraging species as well as nectivorous species. For example, a flock of 260 Black-faced Woodswallows (*Artamus cinereus*), a nomadic species, and 65 Yellow-tailed Black Cockatoos, a flocking species, were observed in the 2017 survey and greatly increased the total number of birds recorded for the monitoring program that year. The cause of variations in the number of ground foraging and nectivorous species is difficult to determine.

Annual rainfall data does not appear to be correlated to bird abundance or species richness (Figure 7; Figure 8). However, if rainfall data were treated with greater sensitivity, such as looking at the quantity and timing of rainfall within a given year and linking this to the flowering requirements for dominant tree and shrub species, such as Peppermint Box (*Eucalyptus odorata*), then the variability in the number and species richness of nectivorous species may be further explained. Likewise, determining how the rainfall influences soil moisture and the growth of understorey weeds may help explain the variability in the numbers of ground-foraging species.

Given the variable nature of the bird community at Kanmantoo Mine, it is imperative that a suite of indicator species are identified to determine whether the mine has impacted on birds. Indicator species should be resident, woodland dependent species that are not favoured by impaired tree health nor human mediated landscapes (Read *et al.* 2015). The following species meet these criteria:

1. Brown Treecreeper (*Climacteris picumnus*);
2. Diamond Firetail (*Stagonoplerua guttata*).
3. Grey Shrike-thrush (*Colluricincla harmonica*);
4. Rufous Whistler (*Pachycephala rufiventris*);
5. White-winged Chough (*Corcorax melanorhamphos*); and
6. Yellow-rumped Thornbill (*Acanthiza chrysorrhoa*).

The abundance of these species show variability between years, however, none of the species have been identified to be in decline since the fauna monitoring program commenced in 2011 (Table 5).

It is recommended that future monitoring should focus upon these six indicator species when analysing the impact of the mine for future years in order to determine whether Kanmantoo Mine has satisfied its requirements under the PEPR.

Table 5. Observations of indicator species 2011-2018.

| Species name | Common name | EPB C | S A | 201 1 | 201 2 | 201 3 | 201 4 | 201 5 | 201 6 | 201 7 | 201 8 |
|---------------------------------|-------------------------|----------|--------|----------|----------|----------|----------|----------|----------|----------|----------|
| <i>Climacteris picumnus</i> | Brown Treecreeper | | | | 5 | 12 | 17 | 9 | 8 | 11 | 5 |
| <i>Stagonopleura guttata</i> | Diamond Firetail | | V | | 6 | 16 | 4 | | 5 | | 4 |
| <i>Colluricincla harmonica</i> | Grey Shrike-thrush | | | | 4 | 1 | 3 | 3 | 14 | 13 | 4 |
| <i>Pachycephala rufiventris</i> | Rufous Whistler | | | | 6 | 9 | 6 | 2 | 3 | 6 | 9 |
| <i>Corcorax melanorhamphos</i> | White-winged Chough | | R | | 22 | 24 | 16 | 34 | 97 | 36 | 45 |
| <i>Acanthiza chrysorrhoa</i> | Yellow-rumped Thornbill | | | | 33 | 43 | 31 | 21 | 90 | 43 | 38 |

4.2 Brushtail Possum

Common Brushtail Possums were restricted to the remnant Peppermint Box (*Eucalyptus odorata*) woodlands of the ML, with no individuals observed within the SEB area. The occurrence of Common Brushtail Possums within the ML are associated with the availability of den sites in the form of hollows within Peppermint Box. Common Brushtail Possums prefer large hollows that are deeper than 1 m (Inions *et al.* 1989). Such hollows take approximately 200 to 400 years to develop in other eucalypt species (Inions *et al.* 1989), and therefore, the habitat within the SEB area may only become suitable after centuries without intervention. Even with the installation of possum boxes, Common Brushtail Possums may not colonise the SEB areas located outside the ML as dispersal is uncommon for adult and even for juvenile possums. Furthermore, crossing a fragmented landscape would make them vulnerable to Red Fox (*Vulpes vulpes*) predation (Byrom *et al.* 2015), which may delay potential colonisation. Additionally, food resources within the SEB areas may be insufficient until the planted Peppermint Box reach maturity, which could take over 20 years.

4.3 Pest and over-abundant species

Grazing pressure from over-abundant native and pest herbivore species could be negatively impacting the quality of remnant vegetation in the ML and the success of revegetation. Western Grey Kangaroos, rabbits and hares were all frequently sighted throughout the ML and their control through shooting and baiting may be warranted to ensure that native fauna species are not adversely impacted by reduced habitat quality.

5 CONCLUSION

The results from the 2018 fauna monitoring program confirm that there is no discernible loss of native fauna abundance or diversity in the Mine Lease area and in adjacent SEB areas as demonstrated by the results of the bird and Common Brushtail Possum surveys. As such, Hillgrove Resources has satisfied the condition (13) and outcome (21) required for fauna conservation within the PEPR.

6 RECOMMENDATIONS

EBS recommends the following measures to improve the management and monitoring of fauna within the Kanmantoo Mine Project area:

- Continue the fauna monitoring program at the same time each year (early spring);
- Suspend spotlighting with the SEB areas due to the low likelihood of Common Brushtail Possums using these areas within the LOM;
- Conduct a control program to reduce the numbers of Western Grey Kangaroos, rabbits and hares within the Project area.

7 REFERENCES

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8 APPENDIX

Appendix 1. Total bird species observed during the 2017 spring survey in both the ML and SEB areas (point counts and opportunistic).

| SPECIES NAME | COMMON NAME | EPBC | SA | Exotic | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---------------------------------|---------------------------|------|----|--------|------|------|------|------|------|------|------|------|
| <i>Acanthagenys rufogularis</i> | Spiny-cheeked Honeyeater | | | | | | | | | 2 | | 2 |
| <i>Acanthiza chrysorrhoa</i> | Yellow-rumped Thornbill | | | | 33 | 43 | 31 | 21 | 90 | 43 | 38 | 54 |
| <i>Acanthiza nana</i> | Yellow Thornbill | | | | | | | | | | | 19 |
| <i>Accipiter cirrocephalus</i> | Collared Sparrowhawk | | | | 3 | | | | | | | 1 |
| <i>Aegotheles cristatus</i> | Australian Owlet-nightjar | | | | | | | 1 | 1 | | 1 | |
| <i>Alauda arvensis</i> | Eurasian Skylark | | | * | 1 | | 3 | | 3 | | 1 | 2 |
| <i>Anas gracilis</i> | Grey Teal | | | | | 16 | | | | 6 | 10 | 1 |
| <i>Anas superciliosa</i> | Pacific Black Duck | | | | | 1 | | | | 10 | 9 | |
| <i>Anthochaera carunculata</i> | Red Wattlebird | | | | 1 | 16 | 5 | 1 | 15 | 1 | 27 | 9 |
| <i>Anthus australis</i> | Australian Pipit | | | | | 5 | 4 | | | | 6 | |
| <i>Aphelocephala leucopsis</i> | Southern Whiteface | | | | 6 | 9 | | | | | 3 | |
| <i>Aquila audax</i> | Wedge-tailed Eagle | | | | 3 | 8 | | | | 1 | | |
| <i>Artamus cinereus</i> | Black-faced Woodswallow | | | | 2 | 3 | | | | | 260 | |
| <i>Artamus cyanopterus</i> | Dusky Woodswallow | | | | | | 8 | 2 | 13 | 5 | 3 | 2 |
| <i>Artamus personatus</i> | Masked Woodswallow | | | | | | 4 | | | | | |
| <i>Artamus superciliosus</i> | White-browed Woodswallow | | | | | | 2 | | | | | |
| <i>Aythya australis</i> | Hardhead | | | | | 1 | | | | | 4 | 1 |
| <i>Cacatua galerita</i> | Sulphur-crested Cockatoo | | | | | | | | | 1 | 3 | 14 |
| <i>Cacatua sanguinea</i> | Little Corella | | | | 2 | | | 1 | 54 | 2 | 9 | |

| SPECIES NAME | COMMON NAME | EPBC | SA | Exotic | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|----------------------------------|------------------------------|------|----|--------|------|------|------|------|------|------|------|------|
| <i>Cacomantis pallidus</i> | Pallid Cuckoo | | | | | 1 | | | 1 | | | |
| <i>Caligavis chrysops</i> | Yellow-faced Honeyeater | | | | | | | | | | | 1 |
| <i>Calyptorhynchus funereus</i> | Yellow-tailed Black Cockatoo | | V | | | 7 | | | | | 65 | |
| <i>Carduelis carduelis</i> | European Goldfinch | | | * | | | | | | | | 8 |
| <i>Chalcites basalis</i> | Horsfield's Bronze Cuckoo | | | | 1 | | | | | | 2 | |
| <i>Chalcites osculans</i> | Black-eared Cuckoo | | | | | 1 | | | | | | |
| <i>Chenonetta jubata</i> | Australian Wood Duck | | | | | 3 | | | 19 | | 2 | |
| <i>Cincloramphus crualis</i> | Brown Songlark | | | | | 2 | 1 | | | | | |
| <i>Climacteris picumnus</i> | Brown Treecreeper | | | | 5 | 12 | 17 | 9 | 8 | 11 | 5 | 10 |
| <i>Colluricincla harmonica</i> | Grey Shrike-thrush | | | | 4 | 1 | 3 | 3 | 14 | 13 | 4 | 8 |
| <i>Columba livia</i> | Feral Pigeon [Rock Dove] | | | * | | 20 | 20 | | | | 2 | |
| <i>Coracina novaehollandiae</i> | Black-faced Cuckoo-shrike | | | | 1 | 2 | 4 | 4 | 3 | | 6 | 3 |
| <i>Corcorax melanorhamphos</i> | White-winged Chough | | R | | 22 | 24 | 16 | 34 | 97 | 36 | 45 | 76 |
| <i>Corvus mellori</i> | Little Raven | | | | 5 | 3 | 15 | 12 | 26 | 11 | 65 | 24 |
| <i>Dacelo novaeguineae</i> | Laughing Kookaburra | | | | | | | | 1 | | | 1 |
| <i>Daphoenositta chrysoptera</i> | Varied Sittella | | | | 7 | 5 | 21 | 4 | 3 | 5 | | |
| <i>Egretta novaehollandiae</i> | White-faced Heron | | | | | 1 | | | | 1 | 1 | |
| <i>Elanus axillaris</i> | Black-shouldered Kite | | | | 3 | 2 | 1 | | | | | |
| <i>Elsyornis melanops</i> | Black-fronted Dotterel | | | | | 3 | | | | | 5 | |
| <i>Eolophus roseicapilla</i> | Galah | | | | 12 | 17 | 17 | 15 | 60 | 18 | 43 | 30 |
| <i>Epthianura albifrons</i> | White-fronted Chat | | | | | 33 | 18 | | 2 | | | 1 |
| <i>Falco berigora</i> | Brown Falcon | | | | 4 | 6 | 1 | 3 | 4 | 2 | 4 | 4 |

| SPECIES NAME | COMMON NAME | EPBC | SA | Exotic | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|--------------------------------------|-------------------------------|------|----|--------|------|------|------|------|------|------|------|------|
| <i>Falco cenchroides</i> | Nankeen Kestrel | | | | 3 | 2 | 1 | 1 | | 3 | 1 | 2 |
| <i>Falco peregrinus</i> | Peregrine Falcon | | R | | 2 | 2 | | | 4 | 1 | | |
| <i>Gallina tenebrosa</i> | Dusky Moorhen | | | | | 3 | | | | | | |
| <i>Gavicalis virescens</i> | Singing Honeyeater | | | | 7 | 8 | 6 | 4 | 14 | 12 | 4 | 28 |
| <i>Geopelia placida</i> | Peaceful Dove | | | | | | | | | | | 1 |
| <i>Glossopsitta concinna</i> | Musk lorikeet | | | | | 6 | | | | 2 | 18 | 3 |
| <i>Glossopsitta porphyrocephala</i> | Purple-crowned Lorikeet | | | | | 20 | | | | | | |
| <i>Grallina cyanoleuca</i> | Magpie-lark | | | | 2 | 1 | 1 | 2 | 3 | 1 | 2 | |
| <i>Gymnorhina tibicen</i> | Australian Magpie | | | | 32 | 16 | 15 | 34 | 57 | 48 | 65 | 22 |
| <i>Hieraaetus morphnoides</i> | Little Eagle | | | | | | | | 1 | | | |
| <i>Hirundo neoxena</i> | Welcome Swallow | | | | 2 | 6 | 17 | | 1 | 37 | 32 | 13 |
| <i>Lalage tricolor</i> | White-winged Triller | | | | | 3 | | | | | | 1 |
| <i>Lichenostomus pencillatus</i> | White-plumed Honeyeater | | | | | 18 | 30 | 7 | | | | |
| <i>Malurus cyaneus</i> | Superb Fairy-wren | | | | 4 | | 1 | | 4 | | | 4 |
| <i>Melanodryas cucullata cullata</i> | Hooded Robin (South East ssp) | | R | | 2 | | | | | | | |
| <i>Melithreptus brevirostris</i> | Brown-headed Honeyeater | | | | | 6 | 18 | 11 | 19 | 3 | 18 | 32 |
| <i>Melithreptus lunatus</i> | White-naped Honeyeater | | | | | | | | | | | 2 |
| <i>Merops ornatus</i> | Rainbow Bee-eater | | | | 7 | 7 | 1 | 2 | 3 | 1 | 4 | |
| <i>Microeca fascianas</i> | Jacky Winter | | R | | | | 1 | | | | | |
| <i>Milvus migrans</i> | Black Kite | | | | | | 1 | | | | | |
| <i>Myiagra inquieta</i> | Restless Flycatcher | | R | | | | | | | | | 1 |
| <i>Neochmia temporalis</i> | Red-browed Finch | | | | | | | | | | | 1 |

| SPECIES NAME | COMMON NAME | EPBC | SA | Exotic | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|-------------------------------------|-------------------------|------|----|--------|------|------|------|------|------|------|------|------|
| <i>Neophema elegans</i> | Elegant Parrot | | R | | 7 | 16 | 12 | 9 | 19 | 55 | 28 | 27 |
| <i>Ocyphaps lophotes</i> | Crested pigeon | | | | | 9 | 4 | | | 4 | 2 | 5 |
| <i>Pachycephala rufiventris</i> | Rufous Whistler | | | | 6 | 9 | 6 | 2 | 3 | 6 | 9 | 10 |
| <i>Pardalotus punctatus</i> | Spotted Pardalote | | | | | 3 | | | | | | |
| <i>Pardalotus striatus</i> | Striated Pardalote | | | | 15 | 26 | 32 | 15 | 26 | 9 | 26 | 37 |
| <i>Passer domesticus</i> | House Sparrow | | | * | | 10 | 8 | 1 | | | | 4 |
| <i>Petrochelidon nigricans</i> | Tree Martin | | | | 12 | 38 | 32 | 50 | 68 | 4 | 41 | 28 |
| <i>Petroica goodenovii</i> | Red-capped Robin | | | | | | | | 1 | | | 1 |
| <i>Phaps chalcoptera</i> | Common Bronzewing | | | | | | 1 | | | 2 | 1 | 2 |
| <i>Phylidonyris novaehollandiae</i> | New Holland Honeyeater | | | | | | 2 | | 21 | 12 | 13 | 25 |
| <i>Platycercus elegans</i> | Adelaide Rosella | | | | 33 | 49 | 64 | 42 | 85 | 58 | 65 | 51 |
| <i>Podargus strigoides</i> | Tawny Frogmouth | | | | | | | | 1 | | 1 | |
| <i>Pomatostomus superciliosus</i> | White-browed Babbler | | | | | | | | 8 | 1 | 5 | 13 |
| <i>Psephotus haematonotus</i> | Red-rumped Parrot | | | | 10 | 57 | 27 | 56 | 19 | 15 | 25 | 13 |
| <i>Ptilotula penicillata</i> | White-plumed Honeyeater | | | | 16 | | | | 13 | 8 | 20 | 28 |
| <i>Rhipidura albiscapa</i> | Grey Fantail | | | | | | | | | | | 9 |
| <i>Rhipidura leucophrys</i> | Willie Wagtail | | | | 10 | 11 | 11 | 8 | 22 | 13 | 11 | 19 |
| <i>Sericornis frontalis</i> | White-browed Scrubwren | | | | | | 1 | | | | | |
| <i>Smicronis brevirostris</i> | Weebill | | | | 3 | | 61 | 20 | 56 | 15 | 8 | 18 |
| <i>Stagonopleura guttata</i> | Diamond Firetail | | V | | 6 | 16 | 4 | | 5 | | 4 | 13 |
| <i>Sturnus vulgaris</i> | Common Starling | | | * | 2 | 27 | 11 | | 52 | 37 | 11 | 6 |
| <i>Tachybaptus novaehollandiae</i> | Australasian Grebe | | | | | 8 | 1 | | | | 4 | 2 |

| SPECIES NAME | COMMON NAME | EPBC | SA | Exotic | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---------------------------------|-------------------------|-----------------|----|--------|------|------|------|------|------|------|------|------|
| <i>Tadorna tadornoides</i> | Australian Shelduck | | | | | | | | | 13 | | |
| <i>Threskiornis spinicollis</i> | Straw-necked Ibis | | | | | | | | 6 | | | |
| <i>Todiramphus sanctus</i> | Sacred Kingfisher | | | | | 1 | | | | | | |
| <i>Tribonyx ventralis</i> | Black-tailed Native Hen | | | | 6 | 3 | | | | | | |
| <i>Trichoglossu haematodus</i> | Rainbow Lorikeet | | | | 2 | 8 | 11 | 2 | | | | |
| <i>Turdus merula</i> | Common Blackbird | | | * | | | | 5 | | | | 1 |
| <i>Tyto delicatula</i> | Eastern Barn Owl | | | | | | | | | | 1 | 1 |
| <i>Vanellus miles</i> | Masked Lapwing | | | | | 3 | | | 4 | 2 | | 1 |
| <i>Zosterops lateralis</i> | Silvereye | | | | | | 4 | | | | | 3 |
| | | Total Abundance | | | 304 | 669 | 575 | 381 | 948 | 530 | 1042 | 700 |
| | | Total Diversity | | | 40 | 59 | 48 | 31 | 50 | 42 | 52 | 56 |

SA: South Australia (*National Parks and Wildlife Act 1972*). **VU/V: Conservation Codes:** V: Vulnerable. R: Rare.

EPBC: *Environment Protection and Biodiversity Conservation Act 1999*.

*Denotes introduced species



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