Silverton Wind Farm: Barrier Range Dragon Population Monitoring 2019

Prepared for GE Renewable Energy

19 August 2019

Biosis offices

NEW SOUTH WALES

Albury
Phone: (02) 6069 9200
Email: albury@biosis.com.au

Newcastle
Phone: (02) 4911 4040
Email: newcastle@biosis.com.au

Sydney
Phone: (02) 9101 8700
Email: sydney@biosis.com.au

Wollongong
Phone: (02) 4201 1090
Email: wollongong@biosis.com.au

VICTORIA

Ballarat
Phone: (03) 5304 4250
Email: ballarat@biosis.com.au

Melbourne (Head Office)
Phone: (03) 8686 4800
Email: melbourne@biosis.com.au

Wangaratta
Phone: (03) 5718 6900
Email: wangaratta@biosis.com.au

Document information

Report to:	GE Renewable Energy
Prepared by:	Jules Farquhar
Biosis project no.:	29556

File name: 29556.SilvertonWF.BRD.Monitoring2019.FIN01.20190625

Citation: Biosis 2019. Silverton Wind Farm: Barrier Range Dragon Population Monitoring 2019. Report for GE Capital Renewable Energy. Author: Farquhar, J. Biosis Pty Ltd, Melbourne. Project no. 29556

Document control

Version	Internal reviewer	Date issued
Draft version 01	I. Smales	13/06/2019
Final version 01	I. Smales	25/06/2019

Acknowledgements

Biosis acknowledges the contribution of the following people and organisations in undertaking this study:

- GE Renewable Energy
- Catcon Construction

Biosis staff involved in this project were:

- Caitlin Potts, Lauren Stoot, Matt Jones (fieldwork)

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Summary

Biosis Pty Ltd was commissioned by GE Renewable Energy to undertake Barrier Range Dragon *Ctenophorus mirrityana* population monitoring at the Silverton Wind Farm. The survey forms part of a three year investigation in partial fulfilment of a monitoring and adaptive management approach outlined in the Barrier Range Dragon Management Plan (BRDMP; Biosis 2018a). The purpose of Barrier Range Dragon monitoring is to provide understanding of the on-going values of management actions to be implemented on behalf of the species. In turn, this will allow adaptive management to be based on good empirical evidence of responses by the species. At the conclusion of the first three years of monitoring, results of the investigations will be thoroughly reviewed to ascertain the status of the Barrier Range Dragon population and the nature of its responses to operation of the wind farm and to management actions set out in the BRDMP.

This report presents the results of Barrier Range Dragon population monitoring undertaken in February 2019 – the first of ongoing surveys to be undertaken from 2019-2021, inclusive. These survey finding will be compared to pre-disturbance survey data obtained in 2018.

Population monitoring results 2019

Barrier Range Dragons were detected at all 16 survey sites and on 40 of the 64 survey counts. The combined results of all counts at all sites include records of 38 adult male, 58 adult female and three juvenile Barrier Range Dragons. This is compared with 71 adult male, 75 adult female and seven juvenile lizards recorded in 2018 surveys. Statistical analysis revealed that the difference in lizard numbers observed between years was significant. However, this difference does not necessarily reflect an actual population decline caused by wind farm operation, due to the likely influence of environmental irregularity on population numbers between years.

Conclusions

- During the 2019 surveys for Barrier Range Dragons the species was detected at all locations where surveys had been conducted in 2018.
- There is inter-annual variation in Barrier Range Dragon abundance on the site. However, interpretation of this variation at this stage in the monitoring program is potentially confounded by the influence of inter-annual climatic variation on lizard activity.
- The present survey results should be compared against the results of future surveys to determine how lizard populations are responding to sustained operation of the wind farm and to management actions for the species.

1. Introduction

1.1 Project background

The Silverton Wind Farm is located approximately 5 kilometres north of Silverton and 25 kilometres northwest of Broken Hill in the far west of NSW (Figure 1). The Silverton Wind Farm was approved by the then Minister for Planning in May 2009. The Wind Farm was declared to be a critical infrastructure project under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act), as an energy generating development with the capacity to generate at least 250MW.

Project and Concept Approval was approved in May 2009, pursuant to Part 3A of the EP&A Act. Further modification (Modification 3) was then approved in December 2016 in accordance with Clause 8J (8) of the *Environmental Planning and Assessment Regulation 2000* and the transitional arrangements of the EP&A Act. Approval was granted for the modifications to the project approval (08_022 MOD 3) and concept approval (08_0022MOD2) subject to the conditions set out in the instrument of approval (Notice of Modification Project Approval 08_022 under the EP&A Act. The detailed project history and compliance with conditions of consent is outlined in the Silverton Wind Farm Biodiversity Adaptive Management Plan BAMP (Biosis 2018b).

Condition 18(c) of the Project Approval requires that prior to the commencement of construction, the Proponent must prepare a Biodiversity Management Plan for the project, which includes a Barrier Range Dragon Management Plan BRDMP (Biosis 2018a) for the site. The BRDMP was developed to satisfy that condition, and as applicable at the time of preparing the plan, Statement of Commitments (2009) 26 and 29 for the operational phase of the wind farm.

In partial fulfilment of the monitoring and adaptive management approach outlined in the BRDMP, population monitoring of Barrier Range Dragons at Silverton Wind Farm will be undertaken as part of an initial three year investigation. The purpose of the Barrier Range Dragon monitoring is to provide understanding of the on-going values of management actions to be implemented on behalf of the species. In turn, this will allow adaptive management to be based on good empirical evidence of responses by the species. At the conclusion of the first three years of monitoring, results of the investigations will be thoroughly reviewed to ascertain the status of the Barrier Range Dragon population and the nature of its responses to operation of the wind farm and to management actions set out in the BRDMP. Changes in numbers and distribution of Barrier Range Dragons, as determined by the population monitoring program, will provide the primary metrics of response by the species to the wind farm and to management measures set out in the BRDMP. This will provide performance indicators as required by condition 18(c) of Notice of Modification Project Approval under the EP&A Act.

This plan has been developed in consultation with:

- Department of Planning and Environment
- Office of Environment and Heritage
- GE Renewable Energy

1.2 Purpose

This document provides the survey results of the 2019 Barrier Range Dragon population monitoring across Silverton Wind Farm. These survey results will be compared to baseline population data obtained from surveys undertaken in early 2018 (Biosis 2018a), and to future surveys (i.e., 2020, 2021), to ascertain the

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nature of the species response to operation of the wind farm and to management actions set out in the BRDMP.

1.3 Relationship to other plans

This Barrier Range Dragon Population Monitoring report is to be read in conjunction with the BRDMP (Biosis 2018a), which provides an overview of the management of Barrier Range Dragons across the Silverton Wind Farm. The specific management actions, monitoring and adaptive management responses in relation to Barrier Range Dragon management are described in the implementation section of the Biodiversity Adaptive Management Plan BAMP (Biosis 2018b). The overarching BAMP provides a cohesive document that details the methods, actions, monitoring and reporting identified for the Barrier Range Dragon Management Plan, Goat Management Plan (Biosis 2018c), Porcupine Grass Sparse Woodland Recovery Plan (Biosis 2018d) and Vegetation Management Plan (Biosis 2018e), into one cohesive implementation document. This allows for an integrated approach to on-ground monitoring and management of biodiversity at the Silverton Wind Farm site.

2. Methods

2.1 Fieldwork

The year-one Barrier Range Dragon survey was undertaken between 25 and 28 February 2019, inclusive. Late February was chosen because it is the same time of year that baseline population data were collected in 2018 (Biosis 2018a). Consistently surveying at the same time of year is important because it prevents seasonal variation in climate from confounding interpretation of inter-annual population changes. Furthermore, late summer is a suitable time of year to survey for arid zone reptiles because temperatures are sufficiently high for lizards to be active and therefore readily observable.

A total of 16 survey sites were selected during an initial on-site inspection. Sites were chosen to represent a sample of the following:

1. Natural rock outcrops with a complex of exposed bedrocks and loose fractured boulders of varying sizes that offered multiple potential basking and refuge microsites.
2. A mixture of naturally outcropping rocks and rocks that have been artificially moved, aggregated or turned out of the ground during wind farm construction.
3. Entirely artificial aggregations of rocks such as batters of roads and turbine hardstands created during wind farm construction.

All sites were adjacent to wind farm roads both for ease of access and to permit monitoring of the potential effects of roads on the species. The GPS location of each survey site was recorded for the purposes of future monitoring. The site overview and locations of all survey sites are shown on maps in Appendix 1. GPS co-ordinates for each site are listed in Table 1.

Table 1 GPS co-ordinates of Barrier Range Dragon survey sites

Site	Easting	Northing
1	530627	6489369
2	530787	6489085
3	529747	6488968
4	531089	6487956
5	530858	6487848
6	531418	6487346
7	531188	6486984
8	531093	6486731
9	529399	6485563
10	528220	6484368
11	528262	6483465
12	522865	6483628
13	522797	6483931
14	522797	6483976
15	522058	6481599
16	523980	6482600

Thirteen survey sites were outside of the Area 7 Goat Fence and three were inside it (see also Biosis 2018b). The dominant vegetation community within the Area 7 Goat Fence is Porcupine Grass Sparse Woodland Community. Goat density is planned to be managed within the fenced area for the purpose of protecting that community. A small number of survey sites for Barrier Range Dragons were chosen within that area to permit the effects of goat management on the species to be monitored.

The basic habitat type (according to the three types of rocky environments outlined above) and whether they are inside or outside of the Goat Fence are set out in Table 2, below. In addition, the presence and abundance of goat scats was documented for each site. This was not quantified but was recorded as a relative and qualitative value (low / medium / high) allowing comparison between survey sites.

Table 2 Habitat characteristics of 16 survey sites

Site	Location	Rocky habitat type	Presence & relative abundance of goat scats
1	Outside Goat Fence	B	Low
2	Outside Goat Fence	A	Low
3	Outside Goat Fence	A	Medium
4	Outside Goat Fence	A	Low
5	Outside Goat Fence	C	Not present
6	Outside Goat Fence	A	Low
7	Outside Goat Fence	B	Low
8	Outside Goat Fence	A	Low
9	Outside Goat Fence	B	Low
10	Outside Goat Fence	B	Low
11	Outside Goat Fence	B	Low
12	Inside Goat Fence	B	Low
13	Inside Goat Fence	B	Low
14	Inside Goat Fence	B	Low
15	Outside Goat Fence	B	Low
16	Outside Goat Fence	A	High

The following meteorological data were recorded for each survey:

- Air temperature
- Humidity
- Average wind speed
- Percentage cloud cover
- Time of survey start and finish

Surveys of Barrier Range Dragons at selected sites took the form of standardised timed counts of dragons. Each survey was carried out by two experienced herpetologists. Each count was for 25 minutes (50 person-minutes). For safety reasons the two team members remained within visual distance of each other during counts, but each took a separate random path such that they were not likely to observe the same individual Barrier Range Dragons. During the surveys, observers paused frequently and used binoculars to scan habitat for dragons. The survey design using timed random meander was chosen rather than using defined area surveys because the habitat for the species was not continuous at all sites and because, while all habitat could be scanned from a distance, at some sites it was precipitous and too dangerous to access directly.

During four days of surveys each site was surveyed on four occasions. This permitted the mean number of dragons observed at each site over the duration of the entire survey to be determined. The time of day of counts at each site was varied and all sites were counted during both morning and afternoon. Surveys were not commenced during the hottest part of the day between 1300 and 1500 hrs when surface temperatures of many rocks exceeded 50°C and it was evident that dragons were less active and less observable.

In each count the total number of adult Barrier Range Dragons of each sex and the number of juveniles, were documented. Adult males and females are readily distinguished on the basis of very different colouration. Juveniles were distinguished from adults based on their smaller size.

2.2 Statistical analysis

Differences in mean Barrier Range Dragon abundance between survey years were compared statistically using a Wilcoxon signed-rank test, which is a nonparametric paired analysis (the assumptions for parametric analysis were not met for the 2018 data) that does not require normal distributions of survey data across sites and can be used with small sample sizes (n = 16 sites). Statistical significance was assigned at <0.05. Survey data between years was also compared visually using box-plots.

3. Results

3.1 Survey results February 2019

The results of all surveys are shown in Table 3. Barrier Range Dragons were detected at all 16 survey sites and on 40 of the 64 survey counts.

Weather conditions during the week of surveys were ideal for observing Barrier Range Dragons, which were active throughout all but the hottest, early afternoon parts of each day. Air temperatures during surveys ranged from 26 to 36 degrees C. Sunny conditions prevailed during the majority of most counts, with cloud cover of up to 100 percent on a very few occasions. Examination of climate data from the Bureau of Meteorology (Broken Hill Airport measurements) showed that maximum temperatures and mean monthly rainfall over the four months preceding surveys did not differ substantially between 2018 and 2019 surveys.

The value of undertaking multiple counts is demonstrated by the fact that no dragons were observed on at least one of four counts at each of thirteen sites, but they were recorded during other counts at the same sites. Overall, there was little variation in numbers of dragons detected between sites, which ranged from 0 to 7 for a given 25 minute survey. The greatest number of dragons were recorded at sites 6, 9, 10 and 13.

The majority of dragons were observed basking on rocks and a smaller number were detected sheltering in rock crevices. While a few Barrier Range Dragons were observed on large bedrocks, it appeared that they generally prefer to use scree of jumbled and broken rocks, often around the edges and immediately downslope of outcropping bedrocks, rather than bedrocks themselves. In this respect, results of the survey concur with the finding of NGH Environmental (2008) and Biosis (2018a) that percentage cover of rocks between 251-500 mm in size was important for the species.

The mean and range of the number of individuals observed at each site are also shown in Table 3. These values provide a baseline against which to compare results of future surveys during operation of Silverton Wind Farm. Overall, the numbers of dragons observed during 'am' (surveys that commenced prior to 1200 hrs) and 'pm' (surveys that commenced after 1500 hrs) did not differ substantially.

Overall, the density of dragons varied little and there was no obvious indication of substantial differences in numbers of dragons according to the three basic habitat types; sites with different values for goat scats; and, sites within and outside of the Goat Fence. It should be noted that the maximum number of Barrier Range Dragons recorded in any one count is the measure most likely to reflect the absolute number of individuals inhabiting the site, albeit that it should not be taken as a true census. The mean number has been calculated and is shown in Table 3 for the primary purpose of comparison with results of surveys in past and future years.

While goat scats were present at most sites, their density was very variable over any given rock outcrop and we were not able to determine whether any relationship might exist between specific locations where dragons were found and locations of goat scats. In addition, at many locations scats of Euros *Macropus robustus* were also present and variable in their densities. There was no apparent correlation between documented levels of goat scats and numbers of Barrier Range Dragons.

The combined results of all counts at all sites include records of 38 adult male and 58 adult female Barrier Range Dragons. As each site was surveyed four times it is very likely that these totals include multiple records of some individuals. The records may not represent the true adult sex ratio of the species as females are

more cryptically coloured than males and they may have been less readily observed. The survey method was not designed to counter any potential biases in records of males and females.

Two juvenile Barrier Range Dragons were observed. They demonstrate that the species had successfully bred during the preceding spring/summer months.

Table 3 Results of February 2019 survey for Barrier Range Dragons at Silverton Wind Farm

Results of timed Barrier Range Dragon counts at selected survey sites											
Site	25-Feb		26-Feb		27-Feb		28-Feb		BRD observed per count		
	am	pm	am	pm	am	pm	am	pm	Mean	Min	Max
1		0	3		3	0			**1.5**	0	3
2		0	1		0	0			**0.3**	0	1
3		0	6		0	2			**2.0**	0	6
4		0	1		2		1		**1.0**	0	2
5		0		1	2		3		**1.5**	0	3
6		1	1		4			4	**2.5**	1	4
7	0	3	0	0					**0.8**	0	3
8	1	0	0	3					**1.0**	0	3
9	1	2	7	3					**3.3**	1	7
10	0	3		6	0				**2.3**	0	6
11	0				2	4		1	**1.8**	0	4
12	2			3		3	0		**2.0**	0	3
13	2			2		1	4		**2.3**	1	4
14					1	0	1	1	**0.8**	0	1
15	1		0	0		4			**1.3**	0	4
16	0			1			0	1	**0.5**	0	1
Mean number of BRD per count	**0.8**	**0.9**	**2.1**	**2.1**	**1.6**	**1.8**	**1.5**	**1.8**			

3.2 Comparison with 2018 survey results

Surveys for Barrier Range Dragons in 2019 at Silverton Wind Farm, reported here, found Barrier Range Dragons at all survey locations where they had been detected during surveys for the species in 2018 and individuals were readily observed at each survey site. However, total Barrier Range Dragon counts for 2019 (*n* = 98) were less than 2018 (*n* = 153). Barrier Range Dragons were not detected on 21 of the 64 survey counts in 2019, compared with a non-detection on 13 of the 64 surveys counts in 2018. As with the 2018 survey, site 9 yielded the highest number of Barrier Range Dragons in 2019 with seven individuals recorded in a single count, compared with 11 individuals in 2018.

Of the 16 sites surveyed in 2019, 10 had a lower mean lizard count than those surveyed in 2018. At three sites there was no difference in mean lizard counts between years and at another three sites there was an increase in mean lizard counts compared to 2018. A comparison of mean Barrier Range Dragon count data is

presented in Table 4. The results of the paired Wilcoxon signed-rank test showed that mean Barrier Range Dragon counts were significantly different from the previous survey year ($Z = 2.341$, $p = 0.019$). This difference is visualised in Figure 1.

Table 4 Comparison of 2018 and 2019 mean Barrier Range Dragon counts for all sites.

Mean BRD observed per count			
Survey site	2018 (baseline)	2019 (year 1)	Difference
1	3.3	1.5	**1.8**
2	1.8	0.3	**1.5**
3	3.3	2.0	**1.3**
4	3.3	1.0	**2.3**
5	1.5	1.5	**0.0**
6	1.0	2.5	**1.5**
7	0.8	0.8	**0.0**
8	2.0	1.0	**1.0**
9	6.5	3.3	**3.2**
10	5.0	2.3	**2.7**
11	1.8	1.8	**0.0**
12	1.5	2.0	**0.5**
13	1.3	2.3	**1.0**
14	2.3	0.8	**1.5**
15	3.8	1.3	**2.5**
16	1.0	0.5	**0.5**

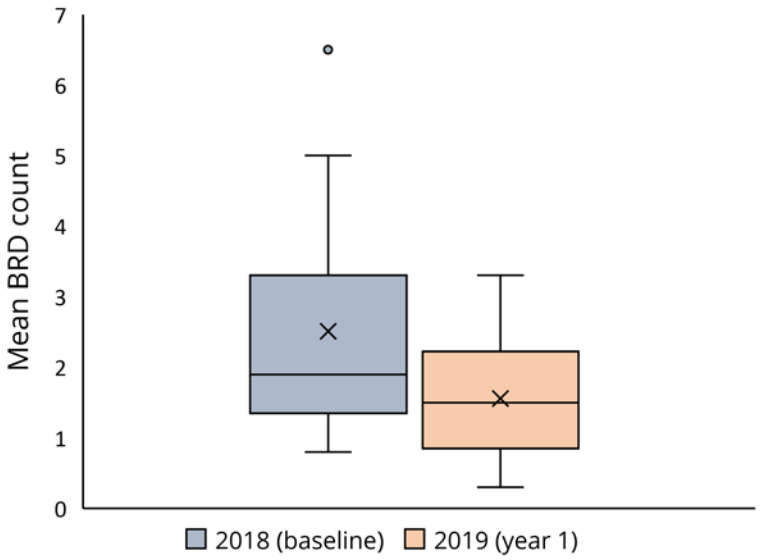

Figure 1 Box-plot showing difference in mean Barrier Range Dragon abundance between survey years. The 'X' denotes mean value and the line within each box denotes the median.

4. Discussion

Overall, Barrier Range Dragons were observed less frequently in the 2019 survey than the 2018 survey. However, this change must be interpreted with the view that this is only the first year of survey data with which to compare against the baseline (2018) survey results. Examining population change between only two years of survey data can give misleading results because stochastic ecological events may effect great change in populations within small time-frames (i.e., a year). For example, inter-annual variation in climate (e.g., temperature, precipitation) can influence reptile activity and therefore produce differences in measures of population abundance between years. Therefore, attempts to detect actual demographic changes as a result of wind farm operation or management actions must be based on long-term data.

Barrier Range Dragons were particularly abundant at site 9 in both survey years. This site consists of metamorphic and sedimentary rock outcrops. Lizards at this site were mostly observed perched on sparse low metamorphic rocks, rather than on the larger solid outcrops of either rock type. Lizards were also often observed using the artificial disturbed rock piles on the edge of the hardstand at this site, which included individuals basking on these rocks and retreating beneath them for shelter when approached. This was also the case for most other sites. Together, these observations support the notion that the distribution of Barrier Range Dragons is not necessarily dependant on large continuous outcrops, and that the species' structural habitat preferences may be broader than previously appreciated.

The process of crevices being filled with goat scats has previously been identified as a potential threat to Barrier Range Dragons because it may reduce the availability of crevices as shelter resource (NGH 2008). However, after extensive inspection of crevices by Biosis staff during 2018 and 2019 Barrier Range Dragon surveys, we suspect that the magnitude of this threat has been over-stated. We observed that the effect of goat scats on crevices is limited to vertically orientated crevices with openings at the top into which scats can fall. It is noteworthy that Barrier Range Dragons use a variety of crevice types that are not susceptible to being filled with goat scats, such as horizontal crevices. It is certain that dragons still have access to sufficient crevice space within a given rock outcrop, even in areas with high goat activity and scat counts. Furthermore, goat scat counts did not differ between years and it is likely that goat scat densities do not change substantially over short timeframes. This questions the effectiveness of using goat scat counts as a tool for understanding the impact of goats on Barrier Range Dragons.

The results of this survey and the previous year (Biosis 2018a) demonstrate that Barrier Range Dragons are somewhat ubiquitous across the wind farm site, with individuals recorded at all monitoring sites in both the 2018 and 2019 survey seasons. It would therefore be concerning if Barrier Range Dragons were not observed from a large number of survey sites in a given year. Despite the necessity for long-term data from which to draw accurate population trends, failure to detect Barrier Range Dragons from, for example, half of the monitoring sites in a given year would constitute a significant population change. It is however not anticipated that operational activities will have such considerable effect on lizard populations, particularly given that the species appears to be common and is making use of modified road batters and other displaced rocks.

The 2019 survey results have demonstrated their value in allowing comparison of population numbers between years. Although these results have shown an apparent decrease in Barrier Range Dragons counts compared to 2018 numbers, comparing population counts between only two years does not provide the long-term data necessary for meaningful interpretations of population change over time. Such change can only be reliably interpreted in the context of several years of consecutive survey. The present survey results will therefore be compared against the results of the 2020, 2021, and potentially on-going Barrier Range Dragon surveys to determine how lizard populations are responding to sustained operation of the wind farm and to management actions for the species.

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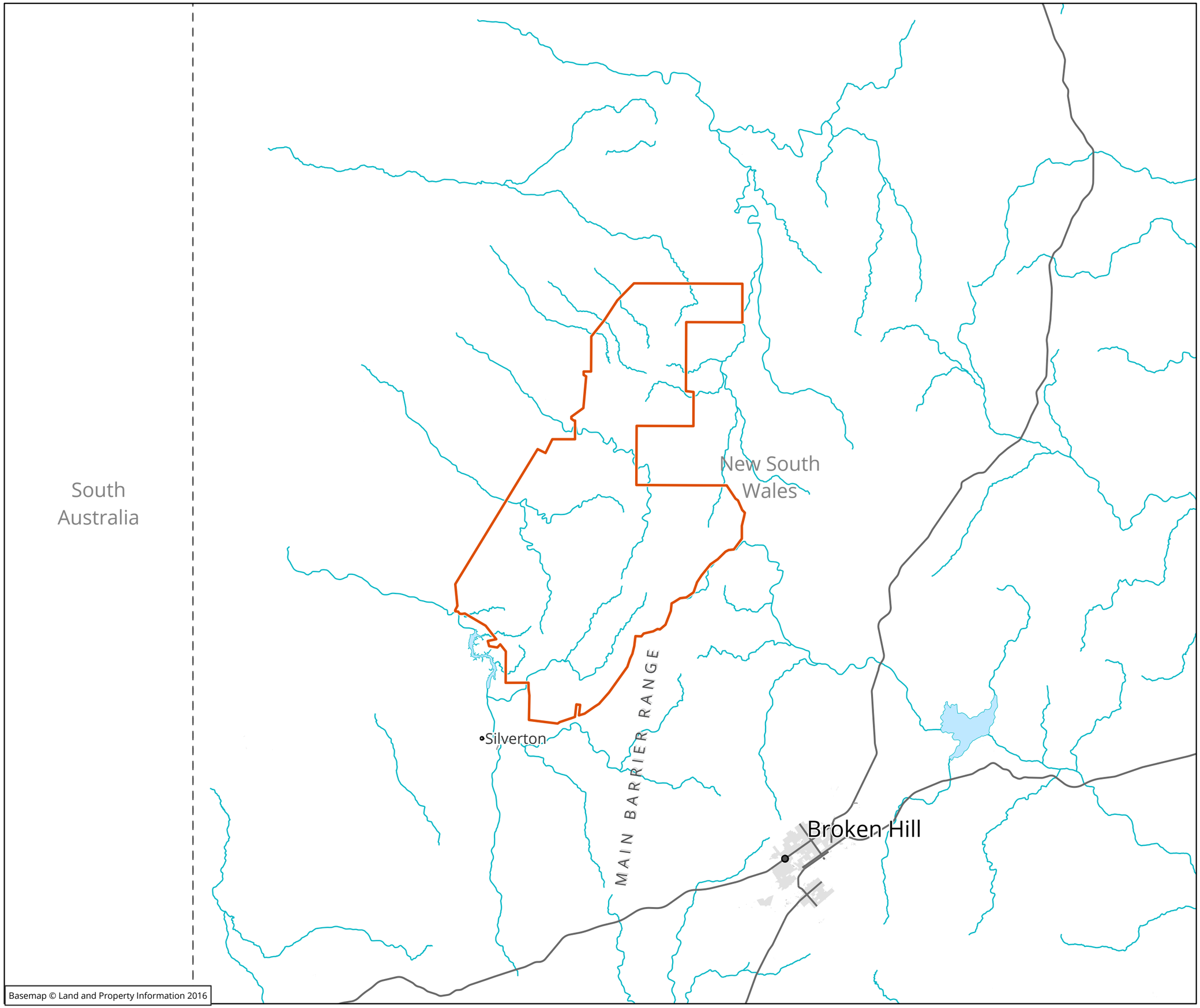
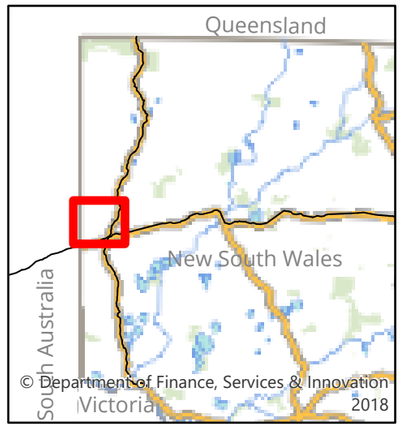
Appendix 1





Legend

Study area

Figure 1: Location of the study area

0 5 10

Kilometres

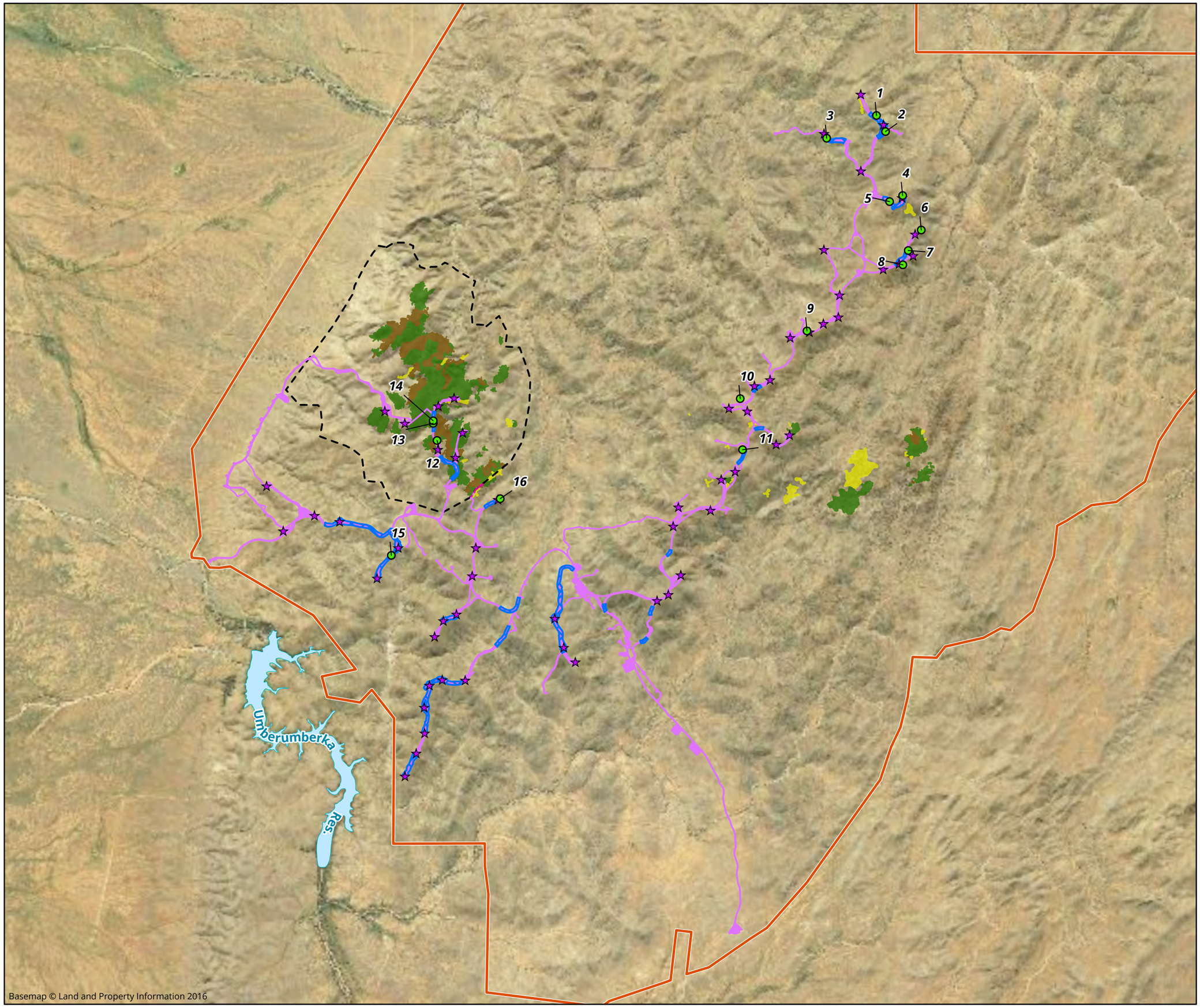
Scale: 1:1:250,000@ A3
Coordinate System: GDA 1994 MGA Zone 54

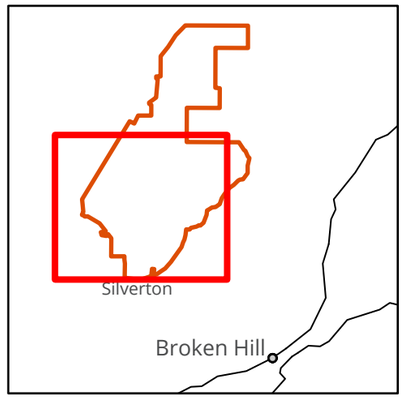
N

Biosis Pty Ltd

Albury, Ballarat, Melbourne,
Newcastle, Sydney, Wangaratta & Wollongong

Matter: 29556
Date: 11 December 2018
Checked by: rwoodward, Drawn by: ARL, Last edited by: jturner
Location:\\bio-data-01\matters$\26300s\26380\Mapping\26380_BarrierRangeDragon





Legend

- Study area
- Goat fence
- Infrastructure
- Pre-existing road
- Roadside BRD habitat
- Turbine
- BRD survey site

PGSW structural variants

- Porcupine grass with eucalypts
- Porcupine grass only
- Eucalypts only

Figure 2: Barrier Range Dragon survey effort - overview

0 1,000 2,000

Metres

Scale: 1:62,500 @ A3

Coordinate System: GDA 1994 MGA Zone 54

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Matter: 26380
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Last edited by jturner on 25 June 2019
Location:
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