



**DONALDSON COAL**

Part of the Yancoal Australia Group

ABN: 87 073 088 945

# Annual Review

**Donaldson Coal Mine**

1 November 2019 – 31 October 2020

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# DONALDSON COAL

PTY LTD

ABN: 87 073 088 945

## Annual Review

for the

## Donaldson Coal Mine

1 November 2019 – 31 October 2020

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**Compiled for:**

Donaldson Coal Pty Ltd  
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BLACK HILL NSW 2322

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**Compiled by:**

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Geological & Environmental Consultants  
ABN: 31 002 033 712



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Ref No. 737/24a

January 2021

## TITLE BLOCK

<b>Name of Operation</b>	Donaldson Coal Mine
<b>Name of Operator</b>	Donaldson Coal Pty Ltd
<b>Development consent / project approval #</b>	DA 98/01173 and 118/698/22
<b>Name of holder of development consent / project approval</b>	Donaldson Coal Pty Ltd
<b>Mining Lease #</b>	ML 1461
<b>Name of holder of mining lease</b>	Donaldson Coal Pty Ltd
<b>Water licence #</b>	20WA218980, 20WA211590 and WAL41522
<b>Name of holder of water licence</b>	Donaldson Coal Pty Ltd
<b>MOP/RMP start date</b>	16/05/2014
<b>MOP/RMP end date</b>	16/05/2021
<b>Annual Review start date</b>	01/11/2019
<b>Annual Review end date</b>	31/10/2020
<p>I, Phillip Brown, certify that, to the best of my knowledge this report is a true and accurate record of the compliance status of the Donaldson Coal Mine for the period 01 November 2019 to 31 October 2020 and that I am authorised to make this statement of behalf of DONALDSON COAL PTY LTD.</p> <p><i>Note.</i></p> <p>a) <i>The Annual Review is an 'environmental audit' for the purposes of section 122B (2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, \$1 million and for an individual, \$250,000.</i></p> <p>b) <i>The Crimes Act 1900 contains other offences relating to false and misleading information: Section 192G (Intention to defraud by false or misleading statement – maximum penalty 5 years imprisonment); Section 307A, 307B and 307C (false or misleading application/information/documents – maximum penalty 2 years imprisonment or \$22,000, or both).</i></p>	
<b>Name of authorised reporting officer</b>	Phillip Brown
<b>Title of authorised reporting officer</b>	Environment and Community Relations Superintendent
<b>Signature of authorised reporting officer</b>	
<b>Date</b>	28 January 2021

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## 1. STATEMENT OF COMPLIANCE

The compliance status of relevant approvals was reviewed for the reporting period (see **Appendix 3**) and is summarised in **Table 1.1**. There were no non-compliances during the reporting period.

**Table 1.1**  
**Statement of Compliance**

<b>Were all conditions of the relevant approval(s) complied with?</b>	<b>Yes / No</b>
Development Consent (combined DA 98/01173)	Yes
Mining Lease 1461	Yes

## 2. INTRODUCTION

### 2.1 OVERVIEW OF OPERATIONS

The Donaldson Coal Mine (“the mine”) was an open cut coal mining operation located ~23km from the Port of Newcastle, north of John Renshaw Drive and west of Weakleys Drive (**Figure 2.1**). The mining lease is contained within the Cessnock and Maitland Local Government Areas. A locality plan and aerial photograph showing the location of the mine in a regional context is attached as **Appendix 1** of this report.

The mine commenced operation on 25 January 2001, following approval by the (then) Minister of Urban Affairs and Planning in 1999.

The first load of coal was railed from the mine on 26 March 2001. Up to 31 October 2013, approximately 13 002 548 tonnes of coal had been produced and exported from the site for either domestic (i.e. Hunter Valley power stations) or international use (via the Port of Newcastle).

Mining operations at the mine were completed in April 2013. Progressive rehabilitation activities were undertaken throughout the operation of the mine and a final rehabilitation project commenced in May 2013. This involved removal of roads, excavation of contaminated material, decommissioning of the fuel storage area, buildings and other surface infrastructure, reshaping surfaces to the final landform, topsoil spreading, drainage line construction and seeding with local tree and shrub species. The rehabilitation works at the mine were completed in March 2014.

### 2.2 SCOPE AND FORMAT

This Annual Review for the Donaldson Coal Mine has been compiled by R.W. Corkery & Co. Pty. Limited on behalf of Donaldson Coal Pty Ltd (“Donaldson”). Donaldson Coal Pty Ltd is a fully owned subsidiary of Yancoal Australia Limited.

This is the fifth Annual Review submitted for the mine, following 12 Annual Environmental Management Reports, and is applicable for the period 1 November 2019 to 31 October 2020 (“the reporting period”).

This Annual Review generally follows the format and content requirements identified in the NSW Government’s *Annual Review Guideline* dated October 2015.

### 2.3 KEY PERSONNEL CONTACT DETAILS

Donaldson owns the mining operation and is the holder of Mining Lease (ML) 1461. Donaldson is also the mining operator. **Table 2.1** outlines the site personnel responsible for the various aspects of the operation during the reporting period.

**Table 2.1**  
**Site Personnel**

Position	Site Personnel
Operations Manager, Donaldson Coal Mine	Mr William Farnworth
Environment and Community Relations Superintendent, Donaldson Coal Mine	Mr Phillip Brown

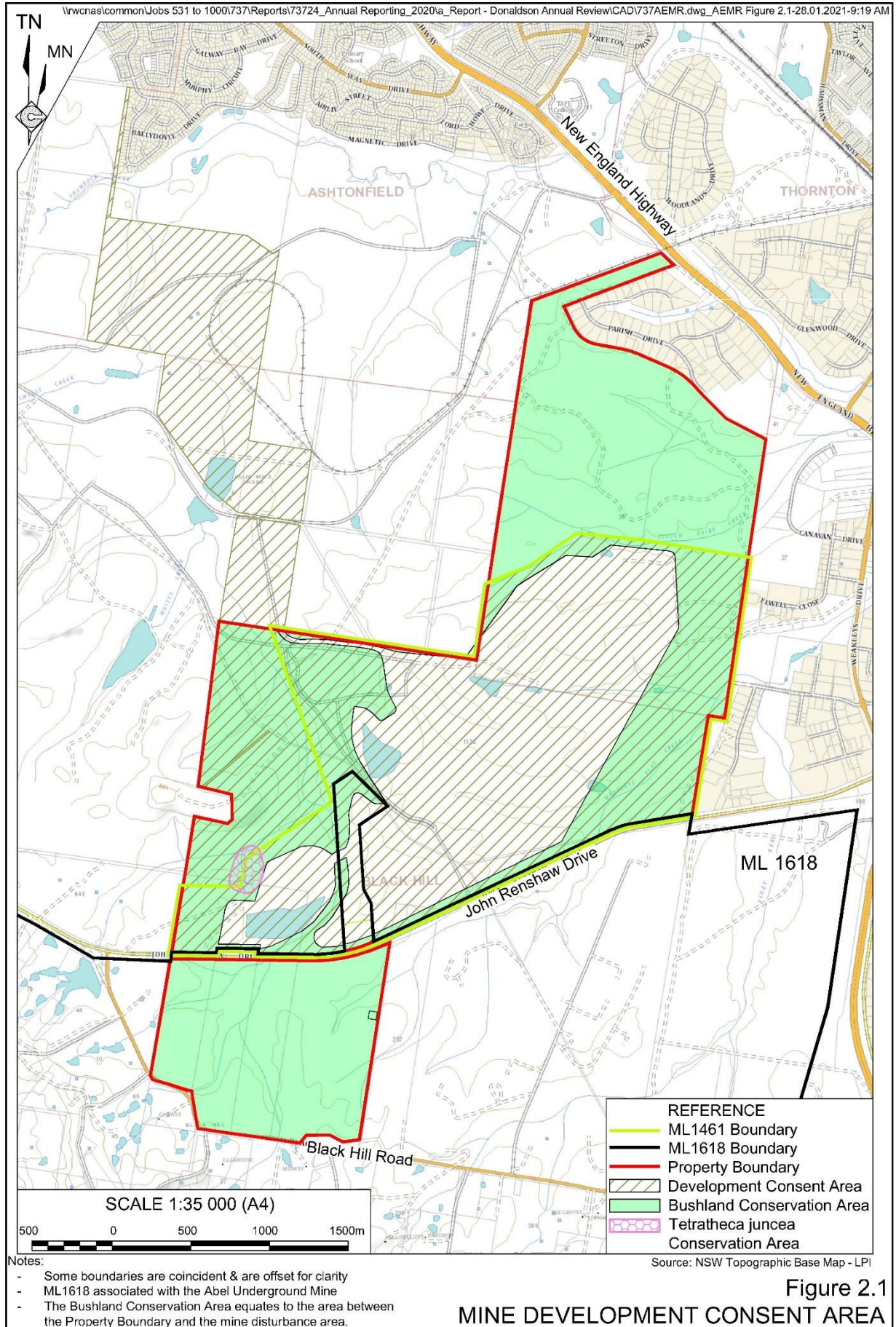


Figure 2.1  
MINE DEVELOPMENT CONSENT AREA

**Table 2.2** outlines the contacts for the Donaldson Coal Operations Manager, Mr William Farnworth, and the Environment and Community Relations Superintendent, Mr Phillip Brown.

**Table 2.2**  
**Contact Details**

<b>Physical Address:</b>	Donaldson Coal Mine 1132 John Renshaw Drive BLACK HILL NSW 2322
<b>Postal Address:</b>	PO Box 2216 GREEHILLS NSW 2323
<b>Community Hotline (24hrs):</b>	1800 111 271
<b>Phone:</b>	(02) 4993 7356 (William Farnworth) (02) 6570 9219 (Phillip Brown)
<b>Fax:</b>	(02) 4015 1159
<b>e-mail:</b>	donaldson@doncoal.com.au
<b>Website:</b>	www.doncoal.com.au

A 24-hour Environmental Hotline (Tel: 1800 111 271) is maintained by Donaldson. Details of calls are recorded by the Environment & Community Relations Superintendent for further actioning, if required.

### 3. APPROVALS

**Table 3.1** provides a current list of statutory instruments in effect, including the date of grant of all leases, subleases, consents, approvals and licenses. It also includes information relating to the current Mining Operations Plan (MOP).

**Table 3.1**  
**Donaldson Coal Mine – Approvals, Leases and Licences**

Approval/Lease/Licence	Issue / Approval Date	Expiry Date	Details / Comments
Mining Lease (No. 1461)	21/12/1999	20/12/2020 Renewal Sought	Granted by the (then) Minister for Mineral Resources. Incorporates a surface area of 515.6ha (following excision of the Abel Surface Infrastructure Area from the lease in 2008). A renewal application for ML1461 was lodged 27 November 2019.
Mining Operations Plan (Amendment B)	1/05/2014	1/05/2021	Amended MOP as approved by the NSW Resources Regulator on 30 September 2020.
Development Consent (combined DA 98/01173 and 118/698/22)	14/10/1999	-	<ul style="list-style-type: none"> <li>Modified on 26 September 2005.</li> <li>Modified on 24 June 2011.</li> <li>Consent for mining operations lapsed on 31 December 2013.</li> <li>Certain conditions of the consent will continue to operate after the consent for mining operations has lapsed.</li> </ul>
Environment Protection Licence (No. 11080).	13/09/2000	Not Applicable	<ul style="list-style-type: none"> <li>Anniversary date 13 September.</li> <li>Current licence version dated 2 December 2011. An application to surrender EPL11080 was lodged 18 April 2018 and remains pending.</li> </ul>
Water Supply Works Approval 20WA218980	01/07/2016	30/06/2029	Bore Licence 20BL168123 was issued to cover groundwater extraction as a result of the active mining area. Following commencement of the <i>Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016</i> in July 2016 20BL168123 was converted to a water supply works approval and water access licence with an allocation of 300ML/year.
Water Access Licence (WAL) 41522	01/07/2016	Continuing	
Water Supply Works Approval 20WA211590	01/08/09	31/07/22	Issued for the works associated with the open cut mining pits as located within the <i>Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009</i> .

## 4. OPERATIONS SUMMARY

### 4.1 MINING OPERATIONS

Coal mining activities ceased in April 2013 and all mining equipment was removed from site. No coal mining was undertaken during the reporting period or is planned during the next reporting period (see **Table 4.1**).

**Table 4.1**  
**Production Summary**

Material	Approved limit (specify source)	Previous reporting period (actual)	This reporting period (actual)	Next reporting period (forecast)
Waste Rock / Overburden	No longer applicable	0	0	0
ROM Coal / Ore		0	0	0
Coarse Reject		0	0	0
Fine Reject (Tailings)		0	0	0
Saleable Product		0	0	0

### 4.2 OTHER OPERATIONS DURING THE REPORTING PERIOD

During the reporting period no exploration, land preparation or construction activities were undertaken. Additionally, no coal processing or transportation activities were undertaken within ML1461 during the reporting period.

Environmental monitoring activities continued throughout the reporting period including surface water, groundwater, flora and fauna and rehabilitation monitoring. Results of this monitoring are summarised in Sections 6 and 7.

Rehabilitation activities were completed in March 2014 with no further rehabilitation work occurring during the reporting period.

Other non-operational activities during the reporting period included a review and update to the MOP (i.e. MOP Amendment B) to include the *Closure Strategy for the West and Square Pits* (Donaldson Coal Pty Ltd, 2020) and the *Donaldson Coal Mine Review of Mine Water Storage Quality* (Hydro Engineering and Consulting Pty Ltd, 2020).

### 4.3 NEXT REPORTING PERIOD

The activities proposed for 2020/2021 will principally involve continued monitoring and, if required, maintenance activities in accordance with the approved management plans and MOP. The following provides a summary of the planned activities.

#### Exploration

Donaldson currently does not intend to undertake any drilling within ML1461 during the 2020/2021 reporting period.

## **Mining**

No further mining will be undertaken.

## **Rehabilitation**

All rehabilitation works have previously been completed. Any rehabilitation works during the 2020/2021 reporting period will relate to ongoing maintenance, principally erosion and sediment control, weed management and vegetation establishment, as required.

## **Monitoring**

The following monitoring will be undertaken during the next reporting period.

- Surface water – ongoing surface water quality monitoring in accordance with the site Water Management Plan. Monitoring will be undertaken by CBased Environmental.
- Groundwater – ongoing groundwater level and quality monitoring will be undertaken by CBased Environmental.
- Flora and Fauna – Kleinfelder Australia Pty Ltd will continue to undertake annual flora and fauna surveys and reporting.

## **Community Consultation and Liaison**

The 24-hour environmental hotline will be maintained and a register retained of any complaints received.

## **Other**

A new or amended MOP (or equivalent documents) will be prepared and submitted for approval prior to the expiry of the current MOP on 16 May 2021.

## 5. ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

The 2018/2019 Annual Review was submitted to the Department of Planning, Industry and Environment (DPIE) compliance unit and the Resources Regulator on 30 January 2020. Feedback from the DPIE compliance unit was received on 31 March 2020 confirming the Annual Review was considered to generally satisfy the requirements of DA 98/01173 and DA 118/698/22 and the Department's *Annual Review Guideline* (October 2015). The feedback also requested that future Annual Reviews include a figure showing the approved consent boundary and the Bushland Conservation Area.

No feedback was received from the Resources Regulator.

A summary of actions required from the previous Annual Review is provided in **Table 5.1**.

**Table 5.1**  
**Actions from the previous Annual Review**

Action required from previous Annual Review / Notice	Requested by	Action Taken	Where discussed in Annual Review
1. Include a figure(s) showing the approved consent boundary and the Bushland Conservation Area.	DPIE	<b>Figure 2.1</b> included to show the Development Consent Area and the Bushland Conservation Area.	<b>Figure 2.1</b>



## 6. ENVIRONMENTAL PERFORMANCE

### 6.1 SUMMARY OF ENVIRONMENTAL PERFORMANCE

A summary of environmental performance for the principal environmental aspects is provided in **Table 6.1**. Further detail regarding specific environmental aspects is also provided in the following subsections.

**Table 6.1**  
**Environmental Performance**

Aspect	Approval criteria / EIS prediction	Performance during the reporting period	Trend/key management implications	Implemented/ proposed management actions
Noise	DA Condition 15 – approved noise limits range from 35dB(A) to 50dB(A).	No mining or earthmoving activities occurred and rehabilitation has been completed.	No community noise complaints were received for the mine during the reporting period. Implies management measures are currently adequate.	No noise monitoring undertaken. No additional management action required.
Blasting	DA Condition 24 – Overpressure 115dB(A) and max 120dB(A) -Vibration 5mm/s and max 10mm/s	No blasts undertaken.	No specific management implications given no blasts undertaken.	No specific management actions required.
Air Quality	DA Condition 37 – Annual Average TSP 90ug/m <sup>3</sup> and deposited dust 4g/m <sup>2</sup> /month.	No mining or earthmoving activities occurred and rehabilitation has been completed. Exceedances of PM <sub>10</sub> criteria due to bushfire smoke / haze.	No community air quality complaints were received for the mine during the reporting period. Implies management measures are currently adequate.	No additional management action required.
Biodiversity	DA Condition 70 – Provision of compensatory habitat.	There have been no significant negative impacts on biodiversity within the Donaldson Bushland Conservation Area over the last 19 years. <i>Tetratheca juncea</i> numbers continued to decline but remain within the range previously recorded.	Trend has been an increase in biomass which has now plateaued. Overall fauna diversity consistent, however, decrease in birds with an interior habitat speciality since 2012 (possibly due to large-scale clearing associated with adjacent industrial estate in 2012). Continued maturation of mine rehabilitation areas may reverse this trend. Continued increase in ground species density appears to be the probable cause for the decline in the <i>Tetratheca juncea</i> population. A hazard reduction burn completed within the BCA as recommended by ecologist.	Continued monitoring of flora and fauna trends and further hazard reduction burns.
Heritage	DA Condition 81-86 – Aboriginal Heritage Conservation Area and Management Plan	No heritage items identified or disturbed during the reporting period. No complaints or other management issues.	No heritage complaints were received and no heritage-related issues were identified during the reporting period. Implies no specific management actions were necessary.	No additional management action required.

## 6.2 METEOROLOGICAL MONITORING

An on-site automated weather station continued to be operated during the reporting period, recording rain, wind speed and direction. **Figure 6.1** presents the monthly wind roses for the reporting period whilst **Table 6.2** provides the monthly rainfall data.

**Table 6.2**  
**Monthly Rainfall**

Average Monthly Rainfall (mm)													
Period	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
2000	61.0	32.0	279.0	146.0	45.0	24.0	27.0	31.0	33.0	47.0	106.0	32.0	863.0
2001	46.0	169.0	193.0	114.0	244.0	3.4	63.0	22.0	12.0	31.0	91.0	38.0	1026.4
2002	48.0	281.0	184.0	66.4	62.1	30.0	30.0	21.0	17.4	18.8	56.2	149.2	964.1
2003	6.0	90.0	22.2	77.0	135.0	13.2	43.0	27.4	0.0	63.2	137.6	39.0	653.6
2004	86.0	176.6	80.0	33.6	17.4	9.4	15.4	43.1	61.2	136.0	77.4	69.8	805.9
2005	64.4	95.8	127.8	57.4	61.8*	56.8	7.2	0.8	37.0	84.0	22.8	9.6	625.4
2006	29.8	47.4	63.6	4.6	7.8	43.8	42.6	49.2	162.4	25.4	37.8	35.6	550.0
2007	13.4	88.0	102.0	86.0	60.0	301.0	17.0	79.6	19.8	17.2	163.8	49.5	997.3
2008	153.4	154.3	46.0	237.6	2.2	122.9	30.0	28.5	195.3	62.2	73.3	62.6	1168.3
2009	11.3	97.7	136.5	157.2	125.7	75.7	32.1	1.8	29.2	59.8	51.4	62.0	840.4
2010	0.0	52.1	83.9	37.1	89.4	112.8	65.3	38.5	26.4	80.6	171.1	39.9*	797.1
2011	26.0	34.5	65.6	137.9	98.8	152.0	129.0	49.0	103.0	100.0	171.9	75.9	1143.6
2012	96.1	207.0	137.6	114.7	11.8	172.3	53.8	26.6	18.7	5.7	21.8	1.2	867.3
2013	1.0	100.0	64.2	65.8	59.8	63.8	71.8	9.6	21.8	27.0	261.8	2.6	1094.0
2014	15.6	108.3	112.8	99.3	44.3	31.4	24.6	104.0	42.4	55.0	38.4	133.4	809.5
2015	167.0	48.0	73.3	412.0	89.4	44.6	17.9	30.6	56.8	59.0	69.8	103.8	1172.2
2016	430.8	26.0	78.0	31.8	13.4	113.0	44.2	74.2	60.0	43.8	44.5	41.8	1001.5
2017	66.9	71.7	150.4	94.5	12.7	128.5	3.2	6.0	12.6	77.7	66.8	41.6	624.2
2018	6.6	120.0	191.4	52.8	7.0	107.4	4.2	21.4	55.4	109.0	92.2	65.0	832.4
2019	17.2	32.8	158.0	27.0	19.4	97.4	26.0	66.6	69.4	22.0	<b>28.2</b>	<b>0.0</b>	564.0
2020	<b>55.2</b>	<b>214.8</b>	<b>106.3</b>	<b>52.0</b>	<b>45.4</b>	<b>80.2</b>	<b>166.6</b>	<b>41.0</b>	<b>35.6</b>	<b>146.6</b>	-	-	-
<i>Minimum</i>	<i>0.0</i>	<i>26.0</i>	<i>22.2</i>	<i>4.6</i>	<i>2.2</i>	<i>3.4</i>	<i>3.2</i>	<i>0.8</i>	<i>0.0</i>	<i>5.7</i>	<i>21.8</i>	<i>0.0</i>	<i>550.0</i>
<i>Average</i>	<i>67.3</i>	<i>101.6</i>	<i>117.5</i>	<i>102.6</i>	<i>60.3</i>	<i>85.2</i>	<i>37.4</i>	<i>36.5</i>	<i>51.7</i>	<i>56.2</i>	<i>92.4</i>	<i>56.3</i>	<i>870.0</i>
<i>Maximum</i>	<i>430.8</i>	<i>281.0</i>	<i>279.0</i>	<i>412.0</i>	<i>244.0</i>	<i>301.0</i>	<i>166.6</i>	<i>104.0</i>	<i>195.3</i>	<i>146.6</i>	<i>261.8</i>	<i>149.2</i>	<i>1172.2</i>

Note: Results relevant to this reporting period are in **bold**.

During the reporting period, winds dominated from the south-eastern quadrant during summer months (i.e. between December 2019 and February 2020) and from the north-western quadrant during autumn, winter and early spring (i.e. between April 2020 and September 2020). Winds dominated from both the south-eastern and north-western quadrants during periods of transition between cooler and warmer periods (i.e. November 2019, March 2020 and October 2020).

Total rainfall during the reporting period was 971.9mm, 101.9mm more than the average rainfall recorded to date. Rainfall recorded during December 2019 (0.0mm) represents the lowest total rainfall recorded for December since the commencement of monitoring in 2000. Conversely, rainfall recorded during both July (166.6mm) and October (146.6mm) 2020 represents the highest total rainfall recorded for those months since the commencement of monitoring in 2000.

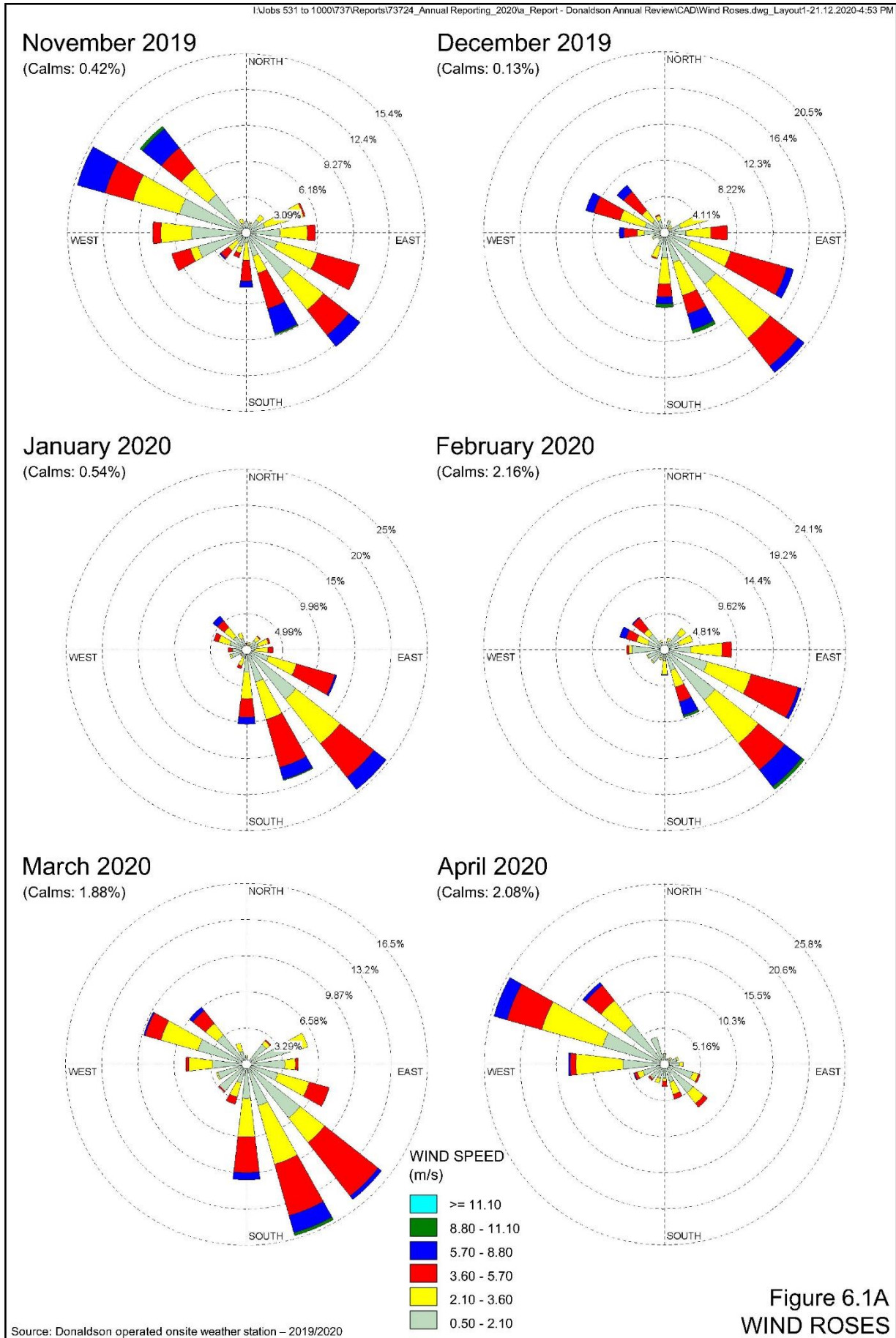


Figure 6.1A  
WIND ROSES

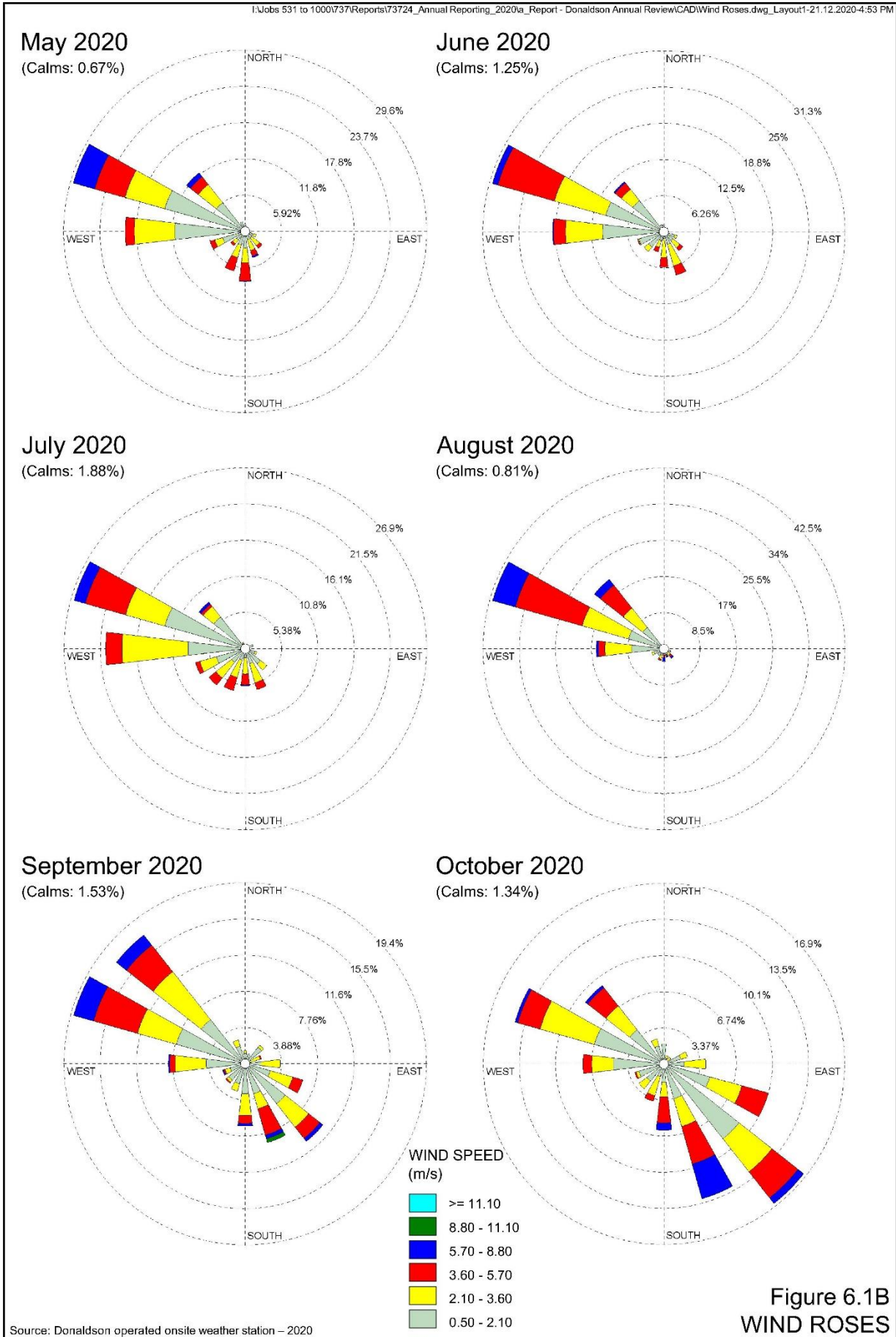


Figure 6.1B  
WIND ROSES

### 6.3 NOISE

As mining ceased in April 2013, no noise monitoring was undertaken for the Donaldson Open Cut Coal Mine during the reporting period. Based on the absence of activities and community complaints, no specific noise management measures were required and no further improvements are currently considered necessary. No further monitoring is currently proposed.

### 6.4 BLASTING

No blasting was undertaken during the reporting period.

### 6.5 AIR QUALITY

#### Environmental Management

The Donaldson Air Quality and Greenhouse Gas Management Plan (Donaldson Coal Pty Ltd, 2019) was revised during the previous reporting period to reflect reduced air quality monitoring requirements during the care and maintenance period of the mine in accordance with recommendations made in the 2019 Independent Environmental Audit for the Abel Underground Mine<sup>1</sup>. As a result of this revision, the air quality monitoring network employed at the mine was reviewed. The following dust monitoring equipment is proposed to be decommissioned following the surrender of EPL 11080.

- Nine Depositional Dust Gauges measuring insoluble solids.
- Two HVAS measuring PM<sub>10</sub>.
- One High Volume Air Sampler (HVAS) measuring TSP.

The locations of dust monitoring equipment, including both active equipment and equipment to be decommissioned, are outlined in **Appendix 1**.

As there were no operational activities during the reporting period and the majority of the site has been rehabilitated, no specific air quality management measures were required throughout the reporting period.

#### Environmental Performance

Donaldson operated the following dust monitoring equipment during the reporting period.

- Nine Depositional Dust Gauges measuring insoluble solids.
- Two HVAS measuring PM<sub>10</sub>.
- One High Volume Air Sampler (HVAS) measuring TSP.
- One continuous E-Sampler monitor measuring PM<sub>10</sub> (installed 31 October 2019 to replace the DustTrak monitor which was at end of life).

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<sup>1</sup> Note: the Air Quality Management Plan is a joint management plan covering both the mine and the Abel Underground Coal Mine.

The locations of dust monitoring equipment are outlined in **Appendix 1** and the results of monitoring presented as follows. It is noted that measurements taken at any of these locations will include all background air pollution relevant to those locations, as well as any contribution occurring from the mine.

### Depositional Dust Gauges

A summary of the deposited dust results for the reporting period is presented in **Table 6.3**. With the exception of the November 2019 sample for gauge D9 and the May 2020 sample for gauge D12, results were generally obtained with acceptable levels of contamination from other sources such as insects, bird droppings and vegetation. The two contaminated samples were still analysed, however, their results (3.9 and 18.3g/m<sup>2</sup>/month) are excluded from the statistical summary.

**Table 6.3**  
**Depositional Dust Monitoring Results November 2019 to October 2020**

Sample Site	No. Samples Required	No. samples collected and analysed	Maximum Insoluble Solids (g/m <sup>2</sup> /month)	Minimum Insoluble Solids (g/m <sup>2</sup> /month)	Annual Average Insoluble Solids (g/m <sup>2</sup> /month)
DG1	12	12	2.1	0.3	0.9
DG2	12	12	3.2	0.3	1.2
DG3	12	12	3.7	0.5	1.6
DG4	12	12	2.6	0.3	1.1
DG7	12	12	3.9	0.3	1.4
DG8	12	12	3.1	0.4	1.5
DG9	12	12	3.6	0.4	1.6
DG11	12	12	4.7	0.4	1.9
DG12	12	12	5.7	0.7	2.5
<b>Average</b>	<b>12</b>	<b>12</b>	<b>3.6</b>	<b>0.4</b>	<b>1.5</b>

During the reporting period, all gauges were in compliance with the Donaldson Air Quality Management Plans targeted air quality goals, with annual average insoluble solid results for each gauge substantially below the Annual Average criteria of 4g/m<sup>2</sup>/month. Given that all mining and earthmoving activities have been completed at the Donaldson Coal Mine, results are indicative of the background environment inclusive of other local or regional sources. **Figure 6.2** shows the historical rolling annual averages for each depositional dust gauge. Results are generally consistent with the trends and ranges previously recorded.

### High Volume Air Samplers

This section outlines the results of the HVASs located at Black Hill Public School and the Beresfield Golf Course. Two sets of measurements have been performed during the reporting period, PM<sub>10</sub> (particulate matter of diameter less than 10µm) and TSP (total suspended particulate matter). **Table 6.4** displays the data capture rate for the three high volume air sampler units during the period.

**Table 6.4**  
**High Volume Air Sampler Data Capture Rate**

Monitoring Location	Data Capture Rate (%)
Black Hill Public School (PM <sub>10</sub> )	100
Black Hill Public School (TSP)	100
Beresfield Golf Course (PM <sub>10</sub> )	100

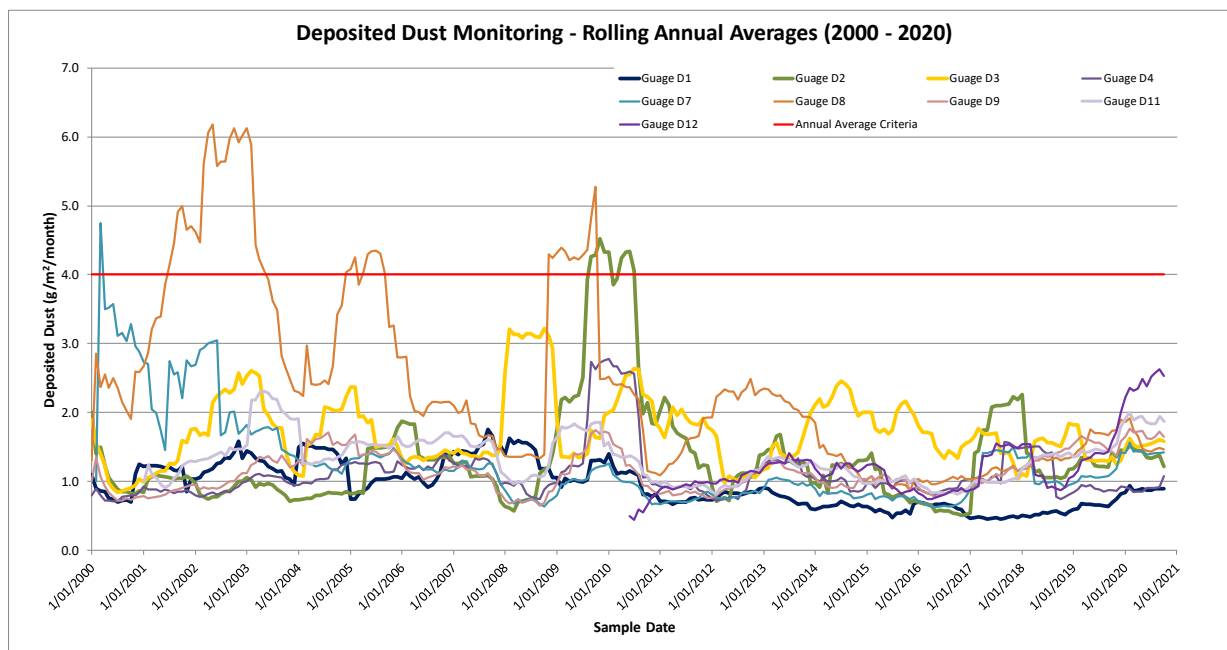


Figure 6.2 Deposited Dust Monitoring 2000 to 2020

**PM<sub>10</sub>**

Table 6.5 provides a summary of the PM<sub>10</sub> monitoring results for the reporting period whilst Figure 6.3 displays the monitoring results since commencement of monitoring.

Table 6.5  
HVAS Monitoring Results – PM<sub>10</sub> (November 2019 to October 2020)

Sample Site	No Samples Required	No samples collected and analysed	Maximum PM <sub>10</sub> Value (µg/m <sup>3</sup> )	Minimum PM <sub>10</sub> Value (µg/m <sup>3</sup> )	Average PM <sub>10</sub> Value (µg/m <sup>3</sup> )
Black Hill Public School	61	61	118.0	2.2	22.0
Beresfield Golf Course	61	61	104.0	3.8	24.6

Five exceedances and seven exceedances of the *National Environment Protection Measures* (NEPM) 24hr maximum PM<sub>10</sub> goal (50µg/m<sup>3</sup>) were recorded at the Black Hill Public School and Beresfield Golf Course monitoring locations respectively during the reporting period.

Exceedances at the Black Hill Public School location included the following measurements.

- 75.3µg/m<sup>3</sup> on 22 November 2019
- 68.3µg/m<sup>3</sup> on 28 November 2019
- 106.0µg/m<sup>3</sup> on 4 December 2019
- 118.0µg/m<sup>3</sup> on 10 December 2019
- 65.2µg/m<sup>3</sup> on 3 January 2020

Exceedances at the Beresfield Gold Course location included the following measurements.

- 75.3µg/m<sup>3</sup> on 22 November 2019
- 69.9µg/m<sup>3</sup> on 28 November 2019
- 83.8µg/m<sup>3</sup> on 4 December 2019

- 104.0µg/m<sup>3</sup> on 10 December 2019
- 77.5µg/m<sup>3</sup> on 3 January 2020
- 50.4µg/m<sup>3</sup> on 11 October 2020
- 67.5µg/m<sup>3</sup> on 17 October 2020

Exceedances recorded between November 2019 and January 2020 are consistent with regionally high PM<sub>10</sub> levels recorded at the DPIE monitoring stations at Wallsend, Beresfield and Newcastle due to bushfires.

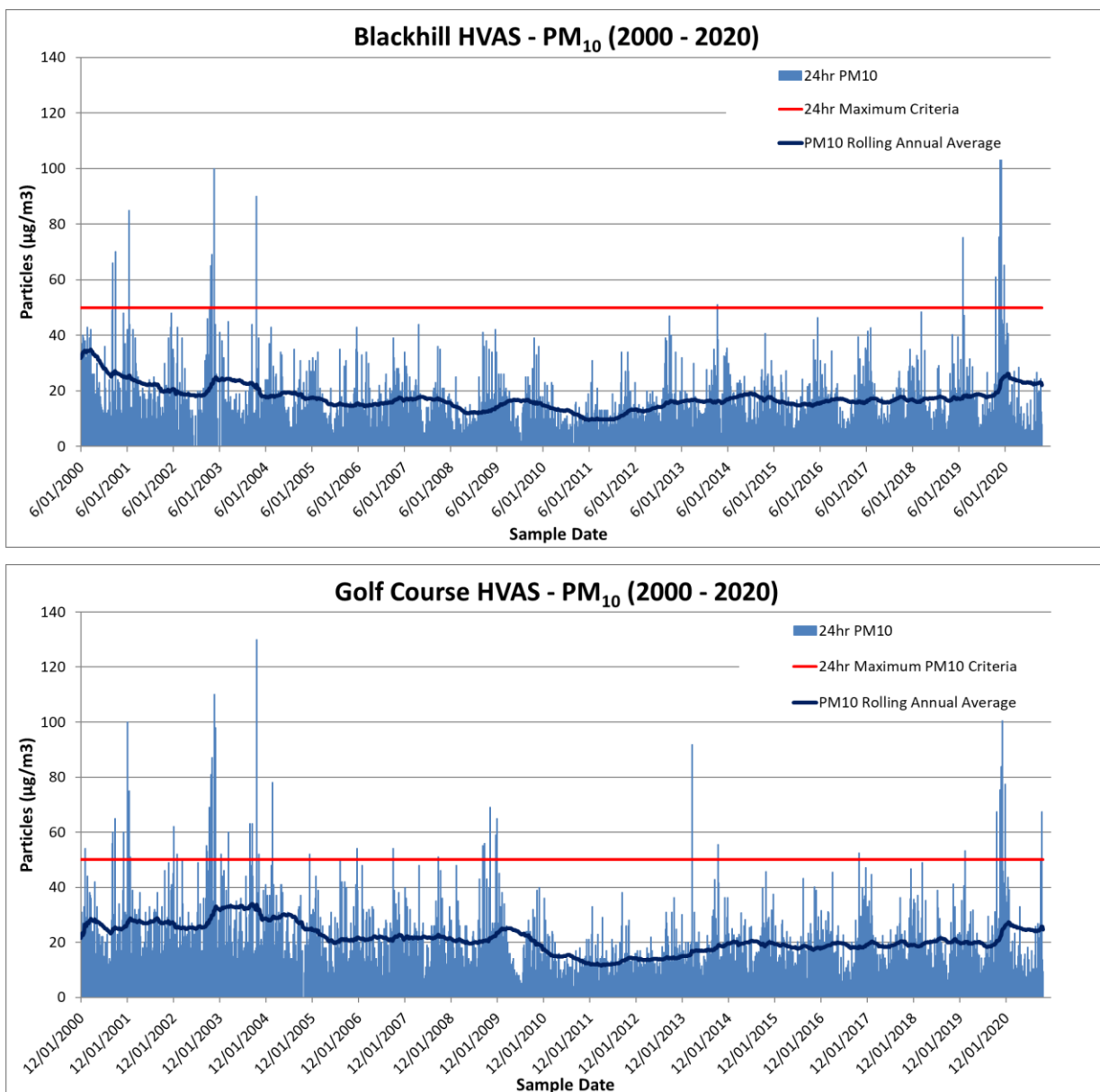


Figure 6.3 HVAS Results – PM<sub>10</sub> (2000 to 2020)

Exceedances recorded at the Beresfield Golf Course monitoring location in October 2020 are not reflected in regional PM<sub>10</sub> levels or levels recorded at the Black Hill Public School monitoring location. These exceedances therefore are considered to reflect local activities which are not associated with the mine as no operational activities occurred during the reporting period.



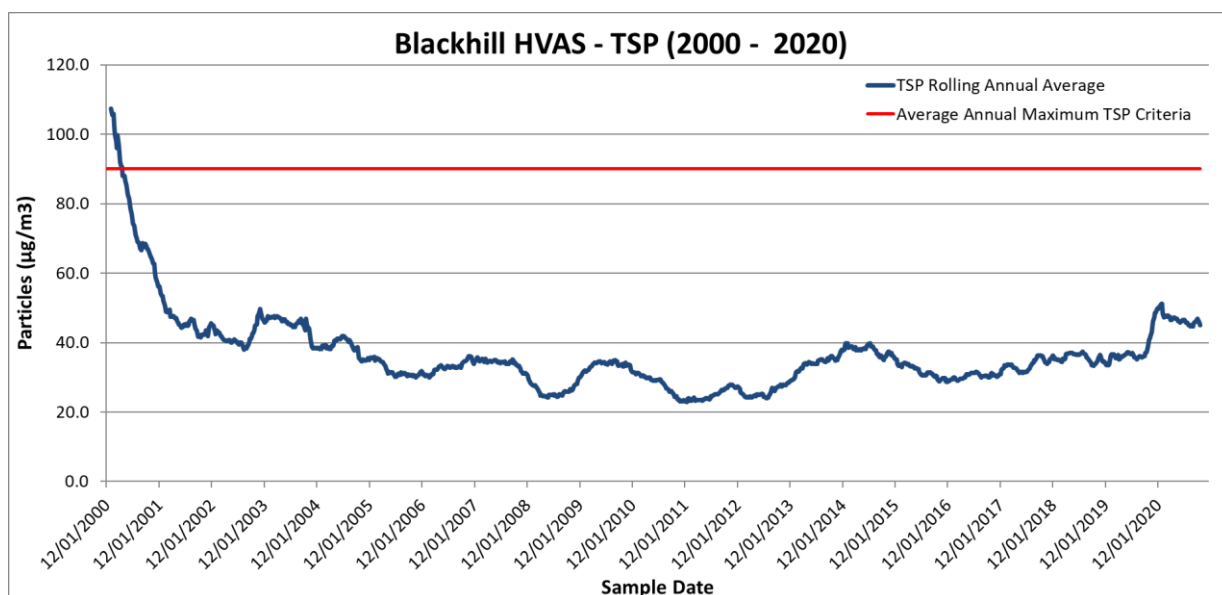
Excepting an annual trend of lower 24-hour average PM<sub>10</sub> during the winter months and higher 24-hour averages during the summer months, no long-term trends are currently apparent. Similarly, rolling annual average PM<sub>10</sub> levels have remained relatively consistent since 2005 with the exception of elevated levels associated with bushfire events.

### Total Suspended Particles

TSP results for the reporting period are displayed in **Table 6.6** with the results since the commencement of monitoring shown in **Figure 6.4**.

**Table 6.6**  
**HVAS Results – TSP (November 2019 to October 2020)**

Sample Site	No Samples Required	No samples collected and analysed	Maximum TSP Value (µg/m <sup>3</sup> )	Minimum TSP Value (µg/m <sup>3</sup> )	Annual Average TSP Value (µg/m <sup>3</sup> )
Black Hill Public School	61	61	168.0	6.1	45.0



**Figure 6.4** HVAS Results – Annual Average TSP (2000 to 2020)

The annual average TSP result at Black Hill Public School during the reporting period was 45.0µg/m<sup>3</sup>, well below the annual average criteria of 90µg/m<sup>3</sup>. While there are no specified criteria for a 24-hr TSP maximum in the development consents or Environment Protection License, the maximum TSP of 168.0µg/m<sup>3</sup> results is well below the US EPA short term good air quality criteria of 260µg/m<sup>3</sup>.

The ratio of the average PM<sub>10</sub> to TSP over the 2019/2020 Annual Review reporting period was approximately 49%, which is generally consistent with the previous reporting period (53%). No long-term trends are evident within the TSP data.

In summary, when reviewing the results in light of there having been no mine-related dust producing activities since March 2014, this indicates that between 2005 and 2014 Donaldson’s operational activities had a low contribution to both PM<sub>10</sub> and TSP. This is consistent with the previous environmental assessments which predicted no exceedance of air quality goals as a result of the operations.

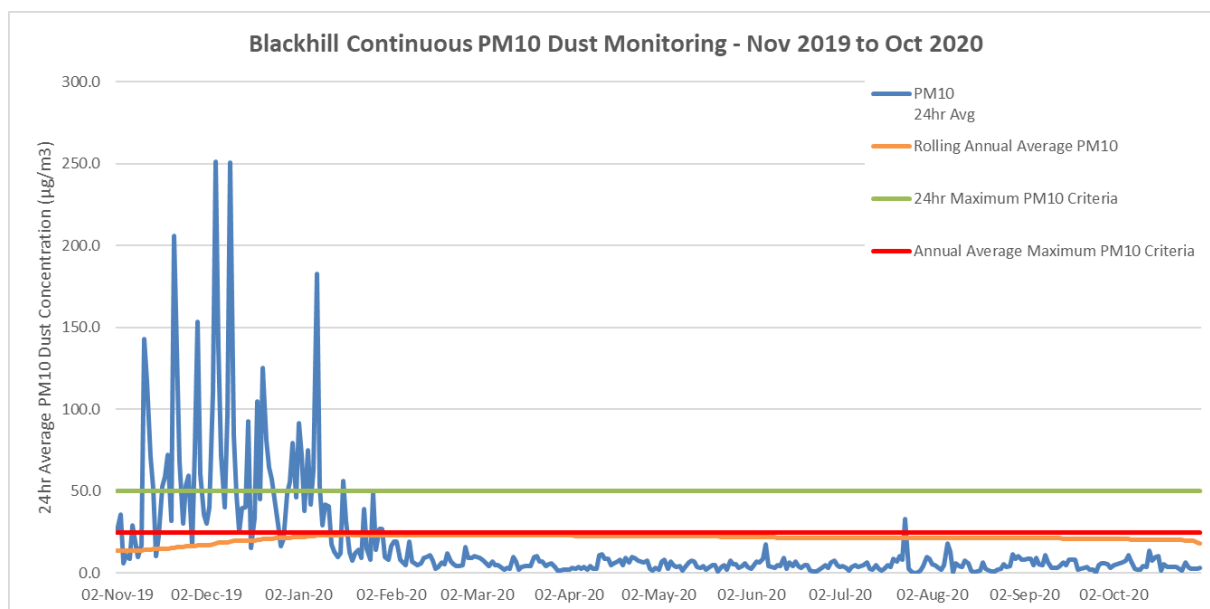
### Continuous Monitor

Donaldson operated one continuous E-Sampler air quality monitor at Black Hill Public School during the reporting period. **Table 6.7** and **Figure 6.5** summarise the continuous monitoring data for the reporting period. The measurement of PM<sub>10</sub> by optical methods (such as by DustTrak and E-Sampler monitors) is known to be particularly sensitive to rainfall or high humidity events. Monthly inspections of the E-Sampler monitor and regular servicing of the instrument assist with reducing occasions when the measurements become unstable or drift from sensible values.

**Table 6.7**  
**E-Sampler Results – PM<sub>10</sub> (November 2019 to October 2020)**

Site	Data Collection	Days Sampled	Highest 24-hour average PM <sub>10</sub> (µg/m <sup>3</sup> )	Annual average PM <sub>10</sub> (µg/m <sup>3</sup> )	Lowest 24-hour average PM <sub>10</sub> (µg/m <sup>3</sup> )
Black Hill Public School	Continuous	365	251.1	18.0	0.1

Note: Data in this table is for the annual reporting period 1 November 2019 to 31 October 2020.



**Figure 6.5 Results of Continuous Monitoring**

As can be seen from **Table 6.7**, samples were successfully collected for 365 days or 100% of the sampling period.

The average annual PM<sub>10</sub> result of 18.0µg/m<sup>3</sup> from the continuous monitoring is similar to the 22.0µg/m<sup>3</sup> obtained from the PM<sub>10</sub> HVAS at the Black Hill Public School. No exceedances of the annual average criteria of 25µg/m<sup>3</sup> were recorded during the reporting period.

On 37 days during the reporting period the 24hr results exceeded the 24-hour NEPM maximum criteria of 50µg/m<sup>3</sup>, the highest being 251.1µg/m<sup>3</sup> recorded on 5 December 2019.

All exceedances were recorded during periods of bushfire smoke and/or haze within the area. Given that no mining or earthmoving activities occurred and rehabilitation has been completed, the Donaldson Coal Mine is considered to have not contributed to these exceedances.

## Reportable Incidents

No reportable air quality incidents were recorded during the 2019/20 Annual Review reporting period.

## Further Improvements

No improvements relating to air pollution are planned or considered necessary. Once the application to surrender EPL 11080 has been approved, existing depositional dust gauges and the HVAS will be decommissioned to reflect revised monitoring requirements in accordance with the approved 2019 Air Quality and Greenhouse Gas Management Plan.

## 6.6 BIODIVERSITY

During the reporting period, biodiversity values have principally been managed through the ongoing implementation of the flora and fauna monitoring program. These management measures are outlined in detail within the 'Flora and Fauna Management Plan' (dated June 2019) prepared for the mine. Full copies of the monitoring reports are provided as **Appendices 4 and 5**.

### 6.6.1 Flora

#### Environmental Management

Flora monitoring has been conducted through several flora surveys throughout the reporting period. Surveys have been conducted in the Bushland Conservation Area (BCA), rehabilitation areas, and on *Tetralthea Juncea*. Management and monitoring of flora within rehabilitation areas is discussed in Section 8.2.

#### Bushland Conservation Area

Annual flora quadrat monitoring has been conducted in the BCA since 2001. In 2019, nine 20m x 20m quadrats were monitored for species richness, density, floristic composition and biomass parameters. Quadrat monitoring occurs in late spring to early summer each year and aims to monitor the influence of mining activities on flora around the mine site.

Regular inspections for weeds were also undertaken during the reporting period. Weed control measures were undertaken during the reporting period, including targeted treatment of Pampas Grass (*Cortaderia* sp.), *Lantana camara* (West Indian Lantana), Cassia (*Senna pendula* var. *glabrata*) and Mother-of-millions (*Bryophyllum* species). The primary means of controlling weeds was through herbicide use.

#### *Tetralthea Juncea*

There was one species of threatened flora identified during the preparation of the 1998 Environmental Impact Statement (EIS), namely *Tetralthea juncea* (Black-eyed Susan). As a result, a *Tetralthea Juncea* Management Plan was developed (Gunninah, 2000a) and a survey and identification report (Gunninah, 2000b) was completed, which located the boundaries of the population and defined the limit of the conservation precinct. Subsequent works during 2001 and 2002 extended the boundary and up to an additional two hundred (200) plants were found during routine monitoring and vegetation characterisation.

In addition, approximately four hundred (400) plants were discovered during routine pre-clearing surveys and monitoring episodes. A large proportion of these plants fell outside of the active mine area, adding further conservation significance to the area(s) identified and managed by Donaldson as the *Tetratheca Juncea* Conservation Area (TJCA) (see **Figure 2.1**).

In addition to the creation of the TJCA, the following additional control measures have previously been employed.

- The protection of 650ha of bushland around the mine to conserve habitat.
- Ongoing mapping and management protocols.
- Pre-clearing surveys by a qualified biologist prior to any clearing activities.

In 2005, a design was also developed for the experimental translocation of *Tetratheca Juncea* from the planned mine disturbance area. The experimental design for the translocation was based on a study being conducted in the Gwandalan area (Ecobiological, 2005). The ongoing monitoring of the translocated plants focused upon collecting data and information about the circumstances under which the plants are growing. Each plant and each recipient site was photographed following translocation and every twelve months for 5 years. The plants were monitored and watered on a weekly basis for 6 weeks post planting to help ensure maximum initial survival and inspected twice per year for the 5 year period.

## Environmental Performance

### Bushland Conservation Area

The following summary of environmental performance has been extracted and compiled from Kleinfelder (2020a). A full copy of this report, including survey methodology, data and statistical analysis, is presented in **Appendix 4**.

The 2019 flora survey results show that the floristic composition of the monitoring sites is similar to the previous year, with an overall increase in plant species richness and structural components since the baseline survey in 2001. To date, a total of 291 flora species have been recorded across all survey events with 134 species recorded during the baseline survey and 170 species recorded during the 2019 survey. The cumulative number of species steadily increased until 2009 and has since levelled and stabilised. This is consistent with expected ecological processes and variables. Minor variations from year to year are most likely due to fluctuations in flowering times, particularly of annual herbaceous and orchid species, most likely caused by variation in climatic conditions and/or the life cycle of the species.

Despite minor year-to-year fluctuations, all biomass variables examined (i.e. basal area, height, foliage projective cover (FPC), and stand volume) have also shown substantial increases over the last 19 years since the baseline survey in 2001. The regression analyses also confirmed that the relationship between time and increases in FPC and stand volume were highly significant indicating that the community biomass has increased substantially over time.

Notwithstanding the significant increase since 2001, the progressive increase in biomass variables has slowed in recent years. In 2019 a slight increase was recorded for parameters including stand volume and a slight decrease was recorded for FPC compared to the previous year. The plateau, which began from approximately 2010, may be a result of the system reaching equilibrium and suggests that the vegetation may have reached the maximum biomass that

conditions will allow. The protection of the Bushland Conservation Area from a history of logging, clearing, frequent fire, firewood collection and rubbish dumping has likely contributed to the significant increase in biomass at all monitored sites since 2001.

Overall, the recorded trends are indicative of a dynamic plant community with high recruitment from the seed pool, normally an indicator of a healthy, regenerating native plant community. Overall, Kleinfelder conclude that there have been no significant negative impacts on floristic diversity within the Donaldson Bushland Conservation Area over the last 19 years.

### *Tetratheca Juncea*

A baseline report was completed in January 2003 by Barker Harle. This report describes the implementation of the *Tetratheca Juncea* Management Plan and includes baseline information for use in subsequent reports. Subsequent monitoring and reporting is undertaken on an annual basis.

The 2019 annual monitoring was completed by Kleinfelder (see **Appendix 5**). Kleinfelder (2020b) reported that the monitoring data has shown a declining population between 2005 and 2014, with a small recovery, followed by a continued decline. The probable cause for the continuing reduction was a measured increase in the density of ground species outcompeting *Tetratheca juncea*. The monitoring indicates that the *Tetratheca juncea* population would benefit from a fire which would both reduce the current level of competition and provide more nesting areas for tunnelling native bee pollinators.

Notwithstanding the overall decline, Kleinfelder note that there is a core of clumps that have survived over all, or for the majority of, the 14 year monitoring period potentially representing a permanent population.

### **Reportable Incidents**

No reportable flora related incidents were recorded during the 2019/2020 Annual Review period.

### **Further Improvements**

Excluding ongoing weed monitoring and control, including targeting of *Lantana camara*, there are no proposed improvements to the management of flora in the BCA or TJCA in the next reporting period. It is noted that Kleinfelder (2020a) considered that sufficient data had been collected within the BCA for ongoing flora (and fauna) surveys to be extended to between every 3 and 5 years. However, at this stage, annual monitoring will be continued, as requested by the (then) Office of Environment and Heritage during consultation for the 2019 update to the Flora and Fauna Management Plan.

In response to recommendations from Kleinfelder, applications were submitted to the NSW Rural Fire Service (RFS) for 'hazard reduction burns' in several areas including the TJCA in order to improve the *Tetratheca juncea* habitat. One hazard reduction burn was undertaken in the northern part of the BCA, but not within the TJCA, by the RFS in October 2020 (**Figure 8.1**). A further hazard reduction burn is planned during the next reporting period and will be undertaken pending appropriate climatic conditions, the availability of the RFS and other resourcing requirements for protection of existing physical infrastructure or assets.

## 6.6.2 Fauna

### Environmental Management

Several species of threatened fauna were identified during the 1998 EIS and supplementary reports, including both the areas proposed for mining and the immediate environs. They include the following.

- The Powerful Owl
- The Masked Owl
- The Barking Owl
- Sooty Owl
- Varied Sittella
- Yellow-bellied Sheath-tail Bat
- Eastern Bent-wing Bat
- Eastern Freetail Bat
- Eastern Cave Bat
- Greater Broad-nose Bat
- Little Bent-winged Bat
- Southern Myotis
- Little Lorikeet
- Squirrel Glide
- Eastern False Pipistrelle

To ensure a high level of conservation for the threatened fauna species found on the site, the following measures have been taken.

- The protection of 650ha of bushland around the mine to conserve habitat.
- Ongoing survey and management protocols.
- Routine annual quadrant monitoring.
- Wild dog and fox baiting programs.
- Placement of nest boxes in the Bushland Conversation Area to replace nesting sites destroyed by clearing.
- Ongoing and progressive rehabilitation of disturbed areas.

The following fauna monitoring activities were undertaken during the 2019/2020 reporting period.

- Terrestrial and arboreal mammal trapping
- Microbat trapping
- Microbat call detection
- Owl call playback
- Spotlighting
- Bird surveys
- Nest box monitoring
- Opportunistic herpetofauna recording

These monitoring activities were carried out during summer and winter surveys, as well as during recolonisation surveys of rehabilitated areas at the mine. Kleinfelder (2020a) reported that 30 out of the 40 nest boxes were available for fauna use during the reporting period, indicating the need for further nest box repairs or replacement during the next reporting period.

A wild dog and fox baiting program was undertaken during the reporting period in November 2019. Baits were placed at 22 locations surrounding the mine between 4 November and 25 November 2019.

## Environmental Performance

The following summary of environmental performance has been extracted and compiled from Kleinfelder (2020a). A full copy of this report, including survey methodology, data and statistical analysis, is presented in **Appendix 4**.

A total of 178 fauna species have been recorded since monitoring began in 2001. The 2019 survey detected a total of 80 fauna species consisting of 52 bird, three arboreal and four terrestrial mammal, 17 bat, one amphibian and three reptile species. Five of the bat species are listed as threatened under the *NSW Biodiversity Conservation Act 2016*. The fauna survey results were found to be similar to previous years with no significant decrease or increase in species richness during the 2019 survey. One vulnerable owl species, the Powerful Owl (*Ninox strenua*), was detected in 2019.

Similarity analysis of faunal assemblages recorded in 2019 indicates a similarity of 68% compared to all previous years, representing a decrease in similarity of 4% compared to 2018. Analysis of assemblage similarity for various faunal groups revealed the following.

- Arboreal Mammals
  - Species assemblages for all years show a minimum similarity of 65%, with the most similar years being 2010 and 2017 to 2019 (100% similarity).
  - Variation can likely be attributed to sporadic detections of highly mobile or less common species.
- Terrestrial Mammals
  - Species assemblages for all years show a minimum similarity of 60%, with several clusters of years showing similarities  $\geq 80\%$ .
- Bats
  - Species assemblages for all years show a minimum similarity of 65%, with several clusters of years showing similarities  $\geq 80\%$ .
- Birds
  - Bird assemblages from 2016 and 2019 were the most dissimilar compared to other years.
  - Further breakdown based on habitat preferences undertaken in 2016 indicates that birds with generalist habitat preference have remained consistent, however, there has been an approximately 12.5% decrease in the number of forest-interior specialist bird species but a 25% increase in forest edge/open grassland species since 2012 (with mining having ceased in April 2013). This analysis will be repeated in 2020 to determine whether the identified trends have continued.

In relation to similarity of bird species assemblages, it is possible that changes in disturbance from mining have resulted in specialist species to move in or out of the area. However, it is possible that the change is a result of the large-scale clearing that occurred in the neighbouring

industrial precinct in 2012. The creation of more edge habitat along nearly the entire eastern edge of the Bushland Conservation Area as a result of the industrial precinct may have made the habitat less suitable for interior specialists. Notwithstanding, with the continued maturation of the adjacent mine rehabilitation areas, these interior specialist species may return or recover to previous population levels.

Nest box surveys in 2019 recorded 100% of all available boxes (30 out of 30) showing signs of use (both actual animals present and evidence of usage). Since installation in 2011, useable nest box utilisation has steadily increased to a maximum of 100% recorded during this reporting period. An increase in nest box utilisation was expected following the completion of a replacement and repair program in September 2018. It is noted that 30 of the total 40 nest boxes were considered available for use during the reporting period, with unavailable boxes requiring repair or replacement in order to facilitate robust comparison of annual monitoring results.

During the 2019 wild dog and fox baiting program a total of four bait takes by wild dogs and six takes by foxes were recorded, representing an overall baiting efficiency of 15% confirmed takes by target species.

### Reportable Incidents

No reportable Fauna related incidents were recorded during the 2019/2020 reporting period.

### Further Improvements

Improvements during the next reporting period will principally be repairs or replacement of damaged nest boxes and the ongoing assessment of the effectiveness of the installed nest boxes and continued general fauna survey within the Bushland Conservation Area together with statistical analysis of trends. There are no other proposed improvements to the management of fauna in the next reporting period.

## 6.7 HERITAGE

The following section outlines the commitment made by Donaldson for the protection of cultural and natural heritage of the area. A copy of a plan along with a summary table showing the known Aboriginal cultural heritage sites is attached as **Appendix 2** of this report.

Thirty-one (31) sites of Aboriginal Cultural Heritage were previously identified on property owned by Donaldson. However, none of these sites were impacted by general management activities undertaken during the 2019/2020 Annual Review period.

There are no European heritage sites within the development consent or mining lease areas for the mine.

### Archaeological Studies

The mine has been the subject of four archaeological studies since 1998. During each study the principal aims were to:

- consult and involve the Aboriginal Community at every stage of the investigation and to provide continuous opportunities for the Aboriginal Community through the Mindaribba Local Aboriginal Land Council (MLALC) to participate in the interpretation and decision making process;



- identify and record by field survey the material evidence of Aboriginal cultural heritage or locations of potential evidence with the land owned by Donaldson;
- assess the archaeological significance and understand the Aboriginal significance of material evidence of Aboriginal cultural heritage of the study area; and
- assess the impacts of the mine on Aboriginal Cultural Heritage.

No further archaeological studies have been required since the cessation of mining operations at the mine.

### **Management**

In accordance with Conditions 84, 85 and 86 of the Development Consent, Donaldson has prepared an Aboriginal Sites Management Plan for the mine. Separate plans were produced for each year of operation at the mine. This provided a better opportunity to address specific issues for each year as well as an opportunity to review and address the management of Aboriginal Sites both inside the mine impact area and within associated bushland areas surrounding the mine.

The following control measures have been employed at the mine in order to ensure that reasonable duty of care is taken to ensure sites of Aboriginal cultural significance are not knowingly disturbed or destroyed.

- An Aboriginal Sites Management Plan was developed and implemented for the mine in consultation with the MLALC and other registered Aboriginal parties, where relevant.
- The MLALC is actively involved in the management of Aboriginal Sites at Donaldson.
- Representatives of the Lands Council were invited on site to monitor clearing and topsoil stripping activities during development and operation of the mine.

### **Performance**

Donaldson and MLALC enjoy a good working relationship and to date there have been no complaints or incidents recorded in relation to the management of sites of Aboriginal cultural heritage.

### **Reportable Incidents and Further Improvements**

No reportable incidents were recorded during the 2019/2020 reporting period and no further improvements are currently considered necessary.

## 7. WATER MANAGEMENT

### 7.1 WATER BUDGET

The mine area is primarily free draining with runoff from rehabilitated areas now returning to local catchments. With the exception of the localised Big Kahuna Dam catchment, all rehabilitated areas to the east of the site access road are now clean water catchments and drain off site. The Big Kahuna Dam continues to be used as an operational water storage for the Abel Underground Mine. Water from the Abel underground, Square Pit and West Pit are pumped to the Big Kahuna for storage.

During the reporting period the Abel underground mine transferred a total of 182.1ML into the Donaldson's Big Kahuna Dam. Runoff from the Abel surface facilities and water stored within the Square Pit and West Pit were also transferred to the Big Kahuna Dam as required. A total of 454.2ML of water was transferred from the Big Kahuna Dam to the Bloomfield mine site to be stored and used for operational purposes. There was no water discharged from the mine's licenced discharge point into Four Mile Creek.

There was no water used or imported to the mine for rehabilitation or other purposes during the reporting period. **Table 7.1** summarises the status of water storage at the beginning and end of the reporting period.

**Table 7.1**  
**Water Stored at Donaldson**

	Volumes Held (ML)		
	Start of Period	End of Period	Storage Capacity
Big Kahuna	232	232	400
Discharge to Creek	0	0	0
Contaminated Water	N/A	N/A	N/A

This data assumes that water in the West and Square Pits are managed and used by the Abel Underground Coal Mine. Water take is reported as part of the Annual Review for the Abel Underground Coal Mine

### 7.2 SURFACE WATER

#### Environmental Management

The Water Management Plan (Donaldson Coal Pty Ltd, 2019) details the measures employed by Donaldson to ensure protection of surface water on and around the mine site. Surface water monitoring has been ongoing since June 2000. A plan showing the location of the water monitoring sites is provided in **Appendix 1**. Routine sampling and analysis is undertaken at six (6) permanent surface water stream monitoring locations, when in flow. Opportunistic samples are also taken from various other locations around the mine area as required (sediment dams and mine water storage dams). The surface stream water monitoring sites include:

- Four Mile Creek Upstream (FMCU) (EM1);
- Four Mile Creek Downstream (FMCD) (EM2);

- Scotch Dairy Creek Upstream (SDCU) (EM3);
- Scotch Dairy Creek Downstream (SDCD) (EM4);
- Weakleys Flat Creek Downstream (WFCD) (EM5); and
- Weakleys Flat Creek Upstream (WFCU) (EM6).

Samples collected from the six existing stream sites are analysed for Electrical Conductivity (EC), pH, Total Dissolved Solids (TDS), Total Suspended Solids (TSS) and Sulfates (SO<sub>4</sub>), on a monthly basis. A full suite analysis is also carried out on a quarterly basis and includes analysis for EC, pH, TDS, TSS, SO<sub>4</sub>, Calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K), Chloride (Cl), Fluoride (F), Arsenic (As), Aluminium (Al), Barium (Ba), Cadmium (Cd), Cobalt (Co), Copper (Cu), Chromium (Cr), Iron (Fe), Manganese (Mn), Lead (Pb), Zinc (Zn), Total Alkalinity as CaCO<sub>3</sub>, Turbidity, Nitrates and Phosphates (total).

In addition to the physical and chemical water quality work, biological monitoring (macroinvertebrates) was undertaken between 2000 and 2019 as previously required under the Water Management Plan. The program consisted of:

- a pre-mining baseline survey;
- a construction survey; and
- twice yearly operational surveys.

In accordance with the revised Water Management Plan, biological monitoring ceased following the September 2019 monitoring survey as rehabilitation and rehabilitation establishment is now considered to have been completed at the mine. Results of previous monitoring is presented in the respective Annual Reviews and AEMRs.

In addition to ongoing water quality monitoring, the following control measures are employed at the mine to ensure an appropriate level of protection to surface water on and around the mine site.

- Minimal disturbance and progressive rehabilitation (noting operational activities have now ceased).
- Source separation in order to separate water of differing quality.
- Collection and containment of mine water for dust suppression at the Abel Underground Mine surface facilities and/or transfer to the Bloomfield Colliery for operational use, as required.

In addition to these measures, inspections of drainage channels and structures were undertaken throughout the reporting period. No stabilisation or remedial works were required.

## Environmental Performance

### ***Chemical and Physical Monitoring***

A summary of three key parameters, required by EPL 11080, for the reporting period as well as the pre-mining baseline is included in **Table 7.2**. Monitoring results for pH and EC since the year 2000 are also presented graphically in **Figure 7.1** to assist in identifying trends.

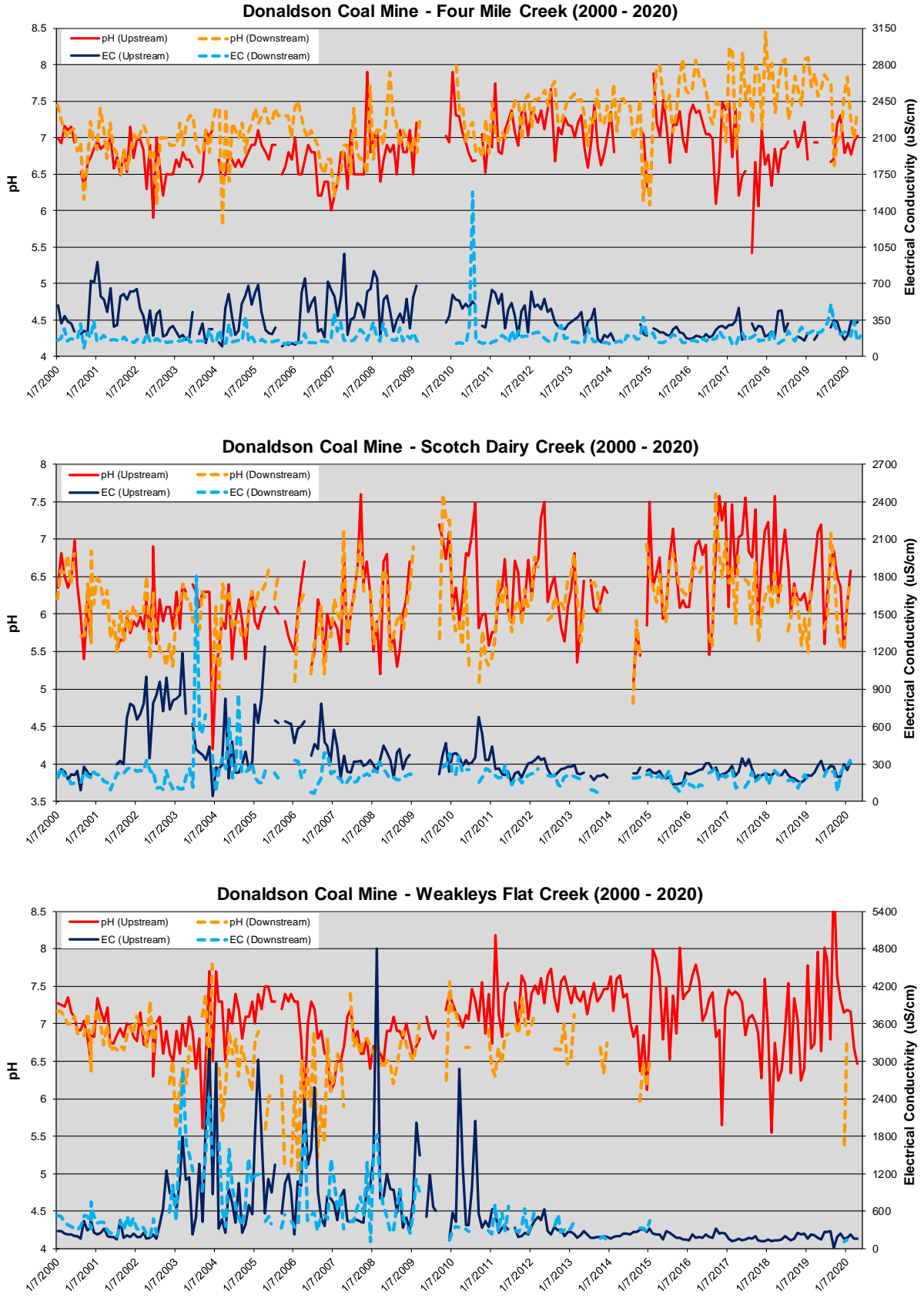


Figure 7.1 Surface Water Monitoring – 2000 to 2020

**Table 7.2**  
**Summary of Surface Water Quality Monitoring Results – 2019/2020**

Sample Site	Pre-mining	2019		2020										Mean 2019 / 2020	Long-term Mean
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct		
<b>Rainfall (mm)</b>															
-	-	28.2	0.0	55.2	214.8	106.3	52.0	45.4	80.2	166.6	41.0	35.6	146.6	-	-
<b>pH</b>															
FMCU	6.70 - 7.44	Dry	Dry	Dry	<b>6.66</b>	<b>6.71</b>	7.19	7.31	6.79	6.92	6.77	6.96	7.02	6.93	6.86
FMCD	<b>6.40</b> - 7.73	<b>7.86</b>	<b>7.79</b>	7.73	6.61	6.99	7.01	7.58	<b>7.83</b>	7.26	6.98	7.37	7.21	7.35	7.2
SDCU	<b>5.90</b> - 6.81	6.66	<b>7.09</b>	<b>7.20</b>	<b>5.60</b>	<b>6.23</b>	6.70	<b>6.85</b>	6.50	<b>6.36</b>	<b>5.56</b>	<b>6.13</b>	6.58	<b>6.46</b>	<b>6.25</b>
SDCD	<b>5.80</b> - 6.80	Dry	Dry	Dry	<b>5.81</b>	<b>5.96</b>	<b>7.08</b>	6.63	<b>5.78</b>	<b>5.57</b>	<b>5.53</b>	<b>6.11</b>	<b>6.41</b>	<b>6.10</b>	<b>6.11</b>
WFCU	6.60 - 7.49	6.63	<b>8.02</b>	<b>7.86</b>	6.79	<b>8.97</b>	<b>7.63</b>	7.33	7.15	7.19	7.16	6.68	<b>6.47</b>	7.32	7.07
WFCD	<b>6.40</b> - 7.28	Dry	Dry	Dry	Dry	Dry	Dry	Dry	<b>5.38</b>	6.77	Dry	Dry	Dry	<b>6.08</b>	6.6
<b>Electrical Conductivity (µS/cm)</b>															
FMCU	265 – 522	Dry	Dry	Dry	276.4	350	335.4	<b>233.4</b>	<b>161.2</b>	<b>210.6</b>	338.2	307	335.1	283	358.9
FMCD	120 - 265	<b>274</b>	<b>332</b>	<b>501</b>	<b>304.5</b>	236.1	212.9	231	235.8	193.4	<b>338.8</b>	151.3	191.5	<b>266.9</b>	185.8
SDCU	71 - 200	<b>231</b>	<b>283</b>	<b>326</b>	<b>244.1</b>	<b>252.5</b>	<b>281.1</b>	<b>274.4</b>	193.9	195	<b>298.3</b>	<b>250.4</b>	<b>317</b>	<b>262</b>	<b>352</b>
SDCD	145 - 270	Dry	Dry	Dry	199.6	252.1	237	238.8	<b>80.4</b>	234.1	<b>283.7</b>	<b>274</b>	<b>328.8</b>	236.5	217.9
WFCU	200 - 310	<b>146.9</b>	263	259	274.5	<b>9.5</b>	<b>177.9</b>	240.5	<b>153.7</b>	<b>169.6</b>	225	<b>157.8</b>	<b>156.3</b>	<b>186</b>	<b>531.5</b>
WFCD	230 - 546	Dry	Dry	Dry	Dry	Dry	Dry	Dry	<b>115.8</b>	<b>141.8</b>	Dry	Dry	Dry	<b>128.8</b>	<b>606.2</b>
<b>Total Suspended Solids (mg/L)</b>															
FMCU	32 - <b>180</b>	Dry	Dry	Dry	<5	<b>12</b>	<b>14</b>	<b>17</b>	<b>22</b>	<b>19</b>	<5	<b>7</b>	<b>8</b>	<b>12</b>	<b>24</b>
FMCD	2 - 32	10	<b>68</b>	<b>74</b>	15	6	<5	<5	<5	18	<5	<5	5	18	31.8
SDCU	9 – 47	<b>74</b>	<b>52</b>	<b>104</b>	<5	<5	<5	10	14	21	<5	15	29	28	<b>145.5</b>
SDCD	12 - <b>1283</b>	Dry	Dry	Dry	<5	<b>10</b>	<b>121</b>	<b>7</b>	<b>187</b>	<b>208</b>	22	16	16	<b>66</b>	<b>93</b>
WFCU	1 – 3	<5	<5	<5	<5	<5	<5	<5	<5	<b>155</b>	<5	<5	15	<b>18</b>	<b>25</b>
WFCD	3 - 17	Dry	Dry	Dry	Dry	Dry	Dry	Dry	15	13	Dry	Dry	Dry	14	<b>54.9</b>
<b>Bold</b> values exceed pre-mining levels. <b>Red</b> values exceed ANZECC Guideline criteria for the protection of aquatic ecosystems.															
FMCU = Four Mile Creek Upstream, FMCD = Four Mile Creek Downstream, SDCU = Scotch Dairy Creek Upstream SDCD = Scotch Dairy Creek Downstream, WFCU = Weakleys Flat Creek Upstream, WFCD = Weakleys Flat Creek Downstream															

During the reporting period monthly pH values have been variable with a number of pH values recorded below the ANZECC Guideline criteria for freshwater 95% level protection (pH 6.5) and one value (WFCU March 2020 pH 8.97) recorded above the ANZECC Guideline criteria for freshwater 95% level protection (pH 8.5). The lowest pH of 5.38 was recorded at the WFCU site on 19 June 2020 where water was reported as being still with no flow evident in the creek. The average pH for both Scotch Dairy Creek upstream (pH 6.25) and downstream (pH 6.11) was also below the ANZECC Guideline. However these values are consistent with the long-term average and within the pre-mining range and are not considered to be affected by the mine. Samples collected at WFCU in June and July 2020 represent the first samples collected at this location since July 2015. Samples had previously not been collected due to dry conditions. Results for pH at location WFCU varied considerably between June 2020 (pH 5.38) and July 2020 (pH 6.77), likely reflecting changes following the initial flushing of the creek.

With the exception of the high pH value (pH 8.97) recorded at the WFCU on 17 March 2020, pH values recorded at all other locations remained within previously recorded operational ranges and are consistent with the long-term averages recorded since the commencement of monitoring in July 2000. The high pH value recorded at WFCU in March 2020 may be associated with the low flow event observed during sampling following 10 months of no flow conditions (where water was ponded but not flowing). Whilst high, this pH value follows the trend of increasing pH which has been recorded for the WFCU site since mid-2018 associated with the period of regional drought conditions. These drought conditions weakened in 2020 and there has been a corresponding reversal of the trend of rising pH with increased rainfall. Notwithstanding, as no mining operations have occurred during this period, the high pH value is not considered to reflect impacts associated with the mine.

As noted during previous reporting periods, lower pH values appear to be correlated to periods of low flow within the creeks and could be the result of acidification from the surrounding soils which naturally have a pH in the order of 4.5 to 4.8 (GSS, 2015).

It is also noted that the divergence of the pH between the FMCU and FMCD locations appeared to be less prominent during the reporting period. Previous divergence of pH values is thought to be the result of leakage from the Stoney Pinch Reservoir (now Black Hill Reservoir) above the FMCD sample point. As can be seen from the results, lower pH values generally originate upstream and improve to neutral / slightly alkaline downstream. This phenomenon is not mine related given that no operational activities or discharges occurred from either the Donaldson Open Cut Coal Mine or Abel Underground Coal Mine. As repair works have been completed on the reservoir these effects may become less prominent and/or more readily reflect rainfall conditions that result in overflows from the reservoir.

### Electrical Conductivity

During the reporting period, the average electrical conductivity (EC) values at all monitoring locations remained below the long-term averages with the exception of FMCD which was slightly higher than the long-term average. EC values recorded during the reporting period were also typically slightly higher than pre-mining values at the FMCD and SDCU sites and typically lower than pre-mining values at the FMCU, WFCU and WFCU sites, whilst EC values recorded at site SDCD were both lower and higher than pre-mining values. Since monitoring commenced in July 2000, at the Four Mile Creek and Scotch Dairy Creek sites, with a few exceptions, the EC at the downstream sites has been consistently lower or similar to the upstream sites with no obvious trends evident (see **Figure 7.1**). However, previous

monitoring results showed that, between 2003 and 2010, both the upstream and downstream EC levels varied to a substantially greater extent than the Four Mile and Scotch Dairy Creek sites. Since 2011, EC levels in Weakleys Creek have remained relatively consistent and the June and July 2020 samples maintain this trend.

During the reporting period there was one abnormal result, an EC of 9.5µS/cm recorded at WFCU on 17 March 2020. This very low result corresponds to the recommencement of flow within the creek at this location following 10 months of no flow (ponded conditions). This also corresponds to an abnormally high pH result (discussed above).

Overall, the available results suggest that the mine has had a negligible impact on the EC of surface waters in the surrounding area.

### Total Suspended Solids

During the reporting period, TSS values at monitoring locations were generally low and similar to the respective pre-mining levels. Nine exceedances of the TSS criteria of 50mg/L were recorded across four of the six monitoring locations during the reporting period. These results likely reflect high TSS levels associated with flow events following regional drought conditions. High TSS levels are not considered to reflect mine-related impacts as no mining operations or mine-related disturbance occurred during the reporting period.

### **Review of Mine Water Storage Quality**

In response to a Notice issued to Donaldson by the NSW Resources Regulator under Section 240 of the NSW Mining Act 1992 on 11 July 2019 (during the previous reporting period), during this reporting period a review of water quality in mine water storages was undertaken by Hydro Engineering and Consulting Pty Ltd (HEC). The resulting report, the *Donaldson Coal Mine Review of Mine Water Storage Quality* (HEC, 2020), was provided to the Resources Regulator as Attachment 2 of the amended MOP. The key findings of this review were as follows.

- Water quality in sediment dams:
  - was generally consistent with ANZECC (2000) guidelines for stock water use;
  - displayed consistently high turbidity levels compared to the ANZECC (2000) default guideline for the protection of aquatic ecosystems;
  - displayed pH levels which were occasionally below the ANZECC (2000) default guideline for the protection of aquatic ecosystems; and
  - displayed concentrations of some metals (e.g. aluminium, chromium, copper and zinc) which were elevated above the ANZECC (2000) default guideline for the protection of aquatic ecosystems.
- Water quality in the Big Kahuna Dam, West Pit Sump and Square Pit Sump:
  - was generally consistent with ANZECC (2000) guidelines for stock water use;
  - displayed elevated pH and aluminium concentrations relative to the ANZECC (2000) default guideline for the protection of aquatic ecosystems; and

- displayed elevated salinity relative to the sediment dams and the ANZECC (2000) default guideline for the protection of aquatic ecosystems, with salinity dominated by sulphate, chloride, sodium and magnesium.

The review provided the following three management action recommendations.

1. Conduct an investigation of water storage construction material, including an inspection of upstream drainage features, to identify the source of elevated turbidity.
2. Confirm the short- and long-term functional requirements of sediment dams and identify the need to retain, alter or remove sediment dams as part of the final landform and land use.
3. Identify any sediment dam design enhancement works required to meet short- and long-term functional requirements (e.g. stabilisation works, reshaping, planting of aquatic plants, conversion into ephemeral wetlands).

The above recommendations are planned for potential commencement in consultation with the NSW Resources Regulator during the next reporting period.

### Reportable Incidents and Further Improvements

No reportable incidents were recorded during the 2019/2020 reporting period. Implementation of the above recommendations provided in the *Donaldson Coal Mine Review of Mine Water Storage Quality* report will commence during the next reporting period in consultation with the NSW Resources Regulator.

## 7.3 GROUNDWATER

### Environmental Management

The Water Management Plan (Donaldson Coal Pty Ltd, 2019) details the measures employed by Donaldson to ensure protection of groundwater on and around the mine site.

Groundwater monitoring has been ongoing since June 2000. The groundwater monitoring locations at the mine were reviewed by the (then) DEC (EPA) as part of the EPL 11080 review. There are six (6) current monitoring sites, the locations of which are provided in **Appendix 1**.

The groundwater piezometers are monitored to determine impacts on both Standing Water Levels (SWL) and groundwater quality. A regional site, REG DPZ1, is also included in the monitoring program and is located in Avalon Estate approximately 1.2km north of the mine.

Samples collected from the seven (7) bores are analysed for EC, pH, TDS, TSS and Sulfates (SO<sub>4</sub>), on a monthly basis. A full suite analysis is also carried out on a quarterly basis and includes analysis for EC, pH, TDS, TSS, Sulfates (SO<sub>4</sub>), Calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K), Chloride (Cl), Fluoride (F), Arsenic (As), Aluminium (Al), Barium (Ba), Cadmium (Cd), Cobalt (Co), Copper (Cu), Chromium (Cr), Iron (Fe), Manganese (Mn), Lead (Pb), Zinc (Zn), Total Alkalinity as CaCO<sub>3</sub> and Turbidity.

The standing water level of each of the monitoring bores is measured each month, as metres below ground level.



## Environmental Performance

Monthly water monitoring results were routinely reviewed to determine whether there were any changes as a result of activities at the mine.

A summary of the three key parameters required by the EPL (Standing Water Level, pH and EC) for the 2019/2020 reporting period, along with the pre-mining baseline, is included in **Table 7.3**. Monitoring results since commencement of monitoring are also presented graphically in **Figure 7.2**.

### Standing Water Levels

REGDPZ-1: Regional control bore located in strata well below the Donaldson Seams. Shows groundwater level trends that generally reflect long-term rainfall patterns, declining gradually from 2000 to 2005 (a period of below average rainfall); rising gradually from 2007 to 2013 (a period of slightly above average rainfall) before plateauing between 2013 and 2016; and declining gradually since 2016, reflecting regional drought conditions.

DPZ3: Located in the open cut area and screened in coal measures below Donaldson Seam. An unexplained rise in water level was recorded from 2004 to 2010 followed by a decline which was a response to mining from the Donaldson Open Cut. Over the past 5 years the SWL has remained relatively stable and slightly higher than pre-mining levels, with a slight decline evident during the reporting period.

DPZ6: Showed drawdown during latter stages of the Donaldson Open Cut and then more pronounced drawdown once development of the Abel Underground South Mains started in April 2008. A partial recovery was subsequently evident during 2013 to 2016, most likely due to recovery within in the completed Donaldson Open Cut. Levels during the reporting period have remained relatively stable compared to the previous reporting period.

DPZ8: Screened in Donaldson and Big Ben Seams. Responded to mining in the Donaldson Open Cut in 2007 and then slight post-mining recovery. The water level has remained steady since 2014.

DPZ10: Screened in the Beresfield Seam and shows modest open cut mining effect from 2001 to 2006, then modest recovery, and more recent response to Abel Underground mining from 2011. The SWL has remained relatively stable since 2011.

DPZ13: Screened in Donaldson Seam overburden, and showed no response to open cut mining, but clear response to Abel Underground mining from early 2012. Groundwater level has remained consistent since 2013. Access has not been available to DPZ13 since April 2017 due to ongoing restricted access to the landholding. As a result, DPZ13 will no longer form part of the monitoring network.

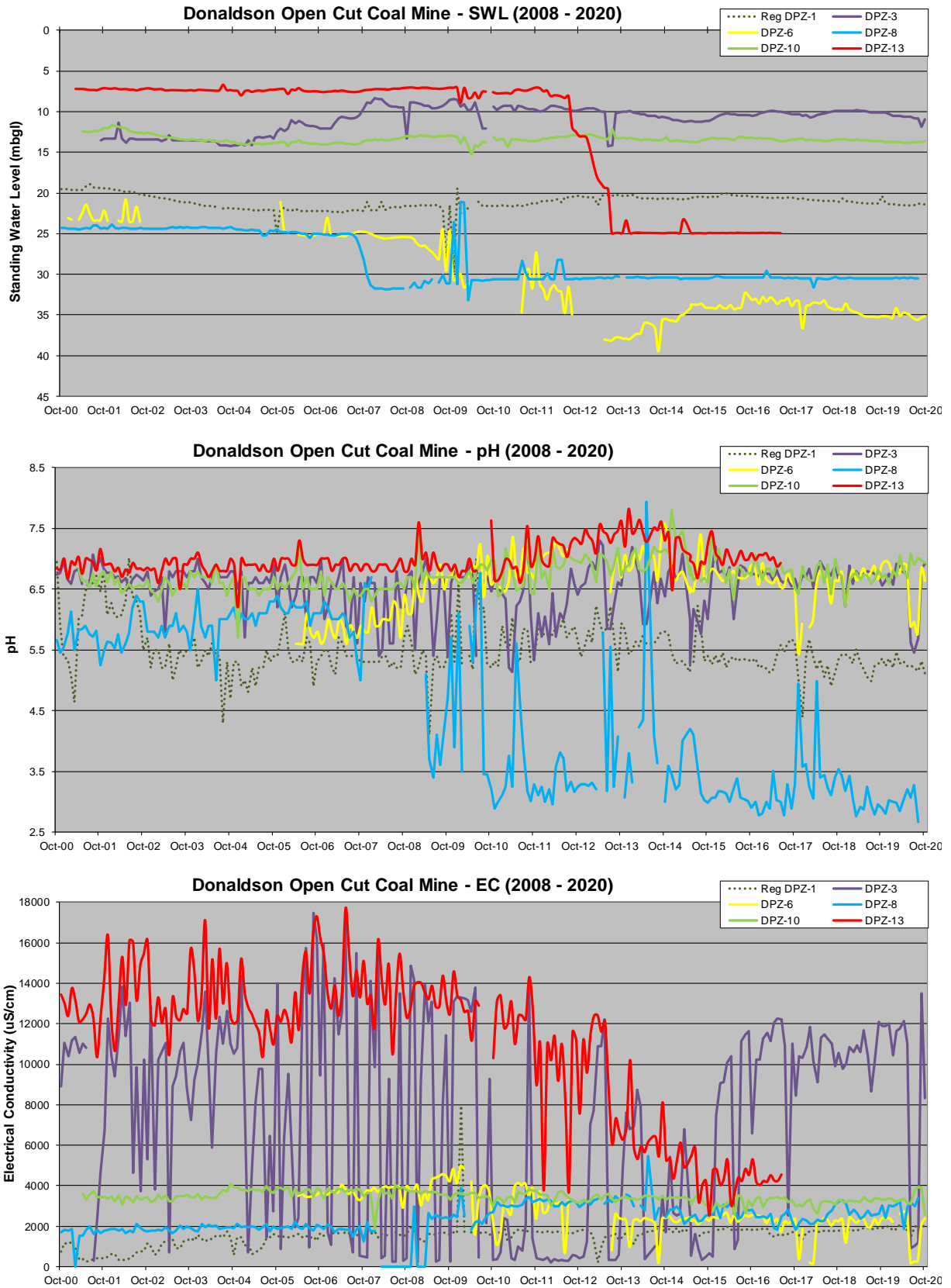


Figure 7.2 Groundwater Monitoring – 2000 to 2020

**Table 7.3**  
**Summary of Groundwater Monitoring Results – 2019/2020**

Sample Site	Pre-mining	Site Average <sup>1</sup>	2019		2020									
			Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
<b>Standing Water Level (m below natural ground surface)</b>														
REG DPZ-1	N/A	21.14	21.23	21.36	21.4	21.37	21.47	21.48	21.56	21.52	21.48	21.32	21.44	21.38
DPZ3	12.05 - 11.51	11	10.56	10.64	10.65	10.67	10.81	10.81	11.85	10.96	10.94	10.95	11.4	11.11
DPZ6	N/A	30.7	35.18	35.25	35.4	34.15	35.13	34.74	34.85	35.12	35.49	35.65	35.34	35.19
DPZ8	24.35	28.32	30.47	30.48	30.5	30.48	30.47	30.45	30.52	30.45	30.46	30.44	30.46	30.53
DPZ10	12.4	13.39	13.78	13.79	13.87	13.86	13.78	13.7	13.68	13.67	13.62	13.44	13.42	14.38
DPZ13	7.01 - 7.25	12	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<b>pH</b>														
REG DPZ-1	N/A	5.5	5.24	5.36	5.2	5.47	5.27	5.31	5.24	5.25	5.2	5.15	5.31	5.11
DPZ3	5.99 - 6.96	6.5	6.87	6.78	6.78	5.62	5.45	5.69	6.83	6.92	6.75	5.1	6.23	6.43
DPZ6	N/A	6.6	6.96	6.93	6.76	N/A	6.76	6.92	6.88	5.89	5.96	5.77	6.84	6.64
DPZ8	5.46 - 5.66	4.51	2.96	2.89	2.8	3.03	3	2.98	2.84	3.01	3.21	3.07	3.27	2.66
DPZ10	6.48 - 6.97	6.73	7.05	6.82	6.68	7.09	6.9	7.02	6.98	6.93	6.92	6.75	6.98	6.84
DPZ13	6.67 - 7.22	7.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<b>Electrical Conductivity (mS/cm)</b>														
REG DPZ-1	N/A	1519	1972	1969	1793	1845	2055	2243	1730	1454	1972	1977	1876	2102
DPZ3	10200 - 11350	7241	11780	12150	11010	925	1043	1202	13500	8330	12090	847.1	1152	1768
DPZ6	N/A	2786	2370	2410	2210	N/A	2615	2710	2689	188.4	275	271.9	2065	2391
DPZ8	1690 - 1820	2408	2600	3010	2380	3010	2962	3080	3280	1876	2950	3170	2970	3400
DPZ10	3670	3440	3280	3340	3140	3100	3750	3930	3910	2570	3180	3440	3370	3790
DPZ13	12200 - 13750	5 838	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1. Since monitoring commenced at that site. N/A = Not Accessible														

### Groundwater Quality

Salinity (EC and TDS) varies over a wide range from bore to bore, but within each bore, salinity generally is quite stable over time. Some of the monitored bores have reported occasional outliers of significantly lower salinity and corresponding reduction in pH which are likely due to ingress of rainwater temporarily lowering the salinity in the bore. This occurred during the reporting period for both DPZ3 and DPZ6 with notable decreased in August 2020 following significant rainfall in July 2020.

A downward trend in EC is observed at bores DPZ6 and DPZ13, starting in 2010 or 2011, which could be due to enhanced recharge following drawdowns in the coal measures as a result of open cut mining. The downward trend has levelled out from the start of 2015.

Conversely, a rise in EC was observed at DPZ8, starting in 2008 or 2009, which is almost certainly related to open cut mining. However, the EC in DPZ8 has not continued rising, having stabilised at about 500 $\mu$ S/cm to 1 000 $\mu$ S/cm higher than pre-2008.

Apart from the EC rise in DPZ8 in 2008, the monitoring has not indicated any rising trend in salinity in any bore, apart from the regional control bore REGDPZ1, which is unrelated to any mining activity, and is thought to be a result of increased urbanisation.

Likewise, although there are some pH variations from bore to bore, the monitoring has generally reported consistent pH values at individual bores over the past 4 to 5 years. In the past, both DPZ3 and DPZ8 show changes in pH that are probably related to mining or associated activities.

The pH values reported from DPZ3 were generally in the range 6.5 to 7.0 until around 2006, when the pH started to be more erratic, and more frequent lower pH values than previously, possibly indicating slightly more acidic conditions. Since around May 2006, pH values at DPZ3 have been generally in the range 5.2 to 7.2. During the reporting period, pH levels within DPZ3 continued to display variability and ranged between 5.10 and 6.92.

The pH values reported from DPZ8 were generally in the range 5.0 to 6.5 until late 2007, when the pH started to be more erratic, and generally much lower than previously, indicating more acidic conditions. Water levels in DPZ8 dropped sharply in September 2007, at the same time that EC noticeably increased and pH started to be erratic and eventually fell to a much lower level. Since February 2009, pH values at DPZ8 have been generally in the range 3.0 to 4.0 albeit with a number of higher outlier values, but significantly lower than the pre-mining levels. This is most likely due to the open cut exposing sulphides or other acid-forming minerals present in the coal seams or interburden strata to oxidation, leading to the reduction in pH at the time that mining reached the vicinity of this bore. This is an expected outcome given the nature of the geology, of which some strata are known to be net acid producing, and the predicted drawdown resulting from mining operations.

### **Reportable Incidents and Further Improvements**

No reportable incidents were recorded during the 2019/2020 reporting period and no future improvements to groundwater management are currently planned.

## 8. REHABILITATION

### 8.1 REHABILITATION PERFORMANCE DURING THE REPORTING PERIOD

Assorted infrastructure was removed from site as part of the final rehabilitation activities during the 2013/14 reporting period. This included the removal of fuel storage tanks, traffic control boom gates and a number of bitumen and dirt roads. No additional infrastructure was removed during the reporting period. As at the end of the reporting, the mine-related infrastructure remaining within ML1461 included the following.

- Administration office
- Workshop
- Core shed
- Selected access roads

As outlined within the current MOP, these infrastructure are not proposed to be removed during the MOP term and may be retained for future land uses as discussed below.

Rehabilitation works previously completed, as outlined in the Mine Closure Plan for Donaldson Open Cut, include the following.

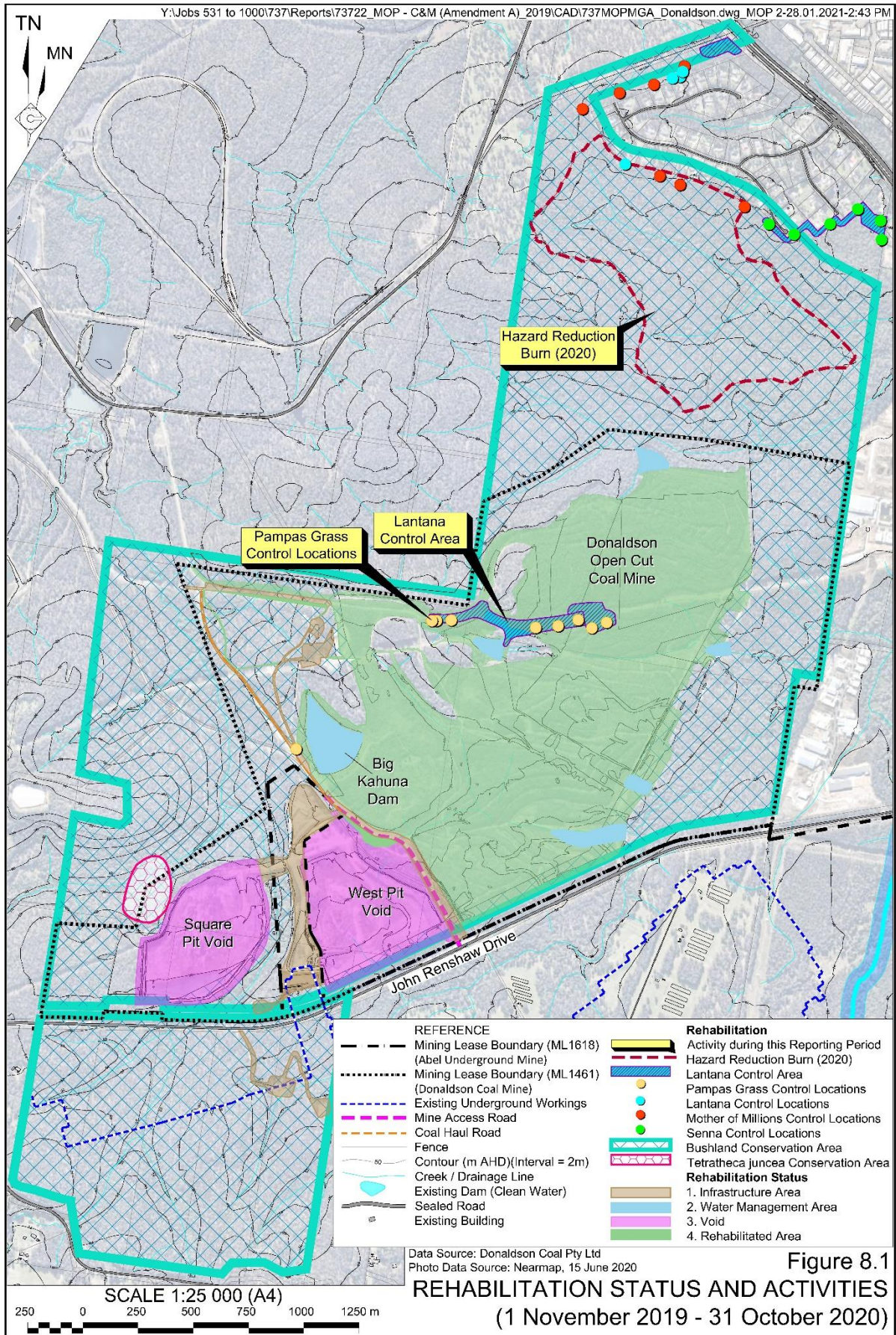
- Excavation of waste rock and contaminated material to the West Pit.
- Reshaping of the land surface to as near as possible to natural topography.
- Spreading of topsoil on reshaped surfaces.
- Spreading of a seed mix of local tree and shrub species, as well as fast growing, sterile groundcovers which grow rapidly to provide erosion control, of the remaining 27.7ha of rehabilitated area.

The post rehabilitation land uses for Donaldson include conservation area, open spaces and light industrial area. The rehabilitated open cut area is completely vegetated with native shrubs and trees. These areas will be conserved and managed similar to the adjacent Bushland Conservation Area. Subject to future approval, the areas around the former open cut maintenance workshop and administration building may be used as a light industrial area.

The West Pit and Square Pit have been made safe and left for use by the Abel Underground Mine which will be responsible for ongoing management. Management of these areas during the reporting period included undertaking fence repair works. No other specific management was required.

No further areas remain to be rehabilitated as part of the Donaldson Coal Mine operation and no additional rehabilitation works were undertaken during the 2019/2020 reporting period.

**Figure 8.1** shows the final landform and current revegetation status. A summary of the total area of rehabilitation is provided in **Table 8.1**.



**Table 8.1**  
**Rehabilitation Summary (Cumulative)**

Mine Area Type	Previous Reporting Period (Actual)	This Reporting Period (Actual)	Next Reporting Period (Forecast)
	Year 16 (ha)	Year 17 (ha)	Year 18 (ha)
Total mine footprint	308	308	308
Total active disturbance	78 <sup>1</sup>	78 <sup>1</sup>	78 <sup>1</sup>
Land being prepared for rehabilitation	0	0	0
Land under active rehabilitation	230	230	230
Completed rehabilitation	0	0	0

Notes:  
1. Includes 60ha for the Square Pit and West Pit and 18ha for other retained infrastructure. These areas are used to support the operation of the Abel Underground Mine.

The areas shown in **Table 8.1** are consistent with the approved MOP which states:

- the total ‘active disturbance’ would total ~78ha at both the beginning and end of the MOP term (comprising retained infrastructure areas, the Square Pit and West Pit); and
- ‘land under active rehabilitation’ would total ~230ha at both the beginning and end of the MOP term (comprising 220ha of revegetated land and 10ha of water management).

As outlined in the approved MOP and noted in **Table 8.1**, the ‘active disturbance’ area for the Donaldson Coal Mine includes the Square Pit (27ha) and West Pit (33ha). The areas encompassing these pits will be subject to closure and rehabilitation in accordance with the *Abel Underground Mine and Donaldson Open Cut Mine – Closure Strategy for the West and Square Pits* with final closure scenarios to be confirmed depending on the closure or resumption of mining operations at the Abel Underground Mine (currently under care and maintenance). The rehabilitation security for these areas will continue to be held against Mining Lease 1461.

## 8.2 REHABILITATION MONITORING

Assessment of rehabilitation performance (fauna and habitat) was conducted by Kleinfelder in January 2020 (see **Appendix 6**). Rehabilitation performance (flora) monitoring, scheduled on a 2-yearly basis and previously undertaken by Global Soil Systems in September 2019, will be undertaken during the next reporting period.

The monitoring undertaken by Kleinfelder aims to determine the effectiveness of the rehabilitation program in re-establishing pre-mining / natural biodiversity levels. Surveys are undertaken within a total of four monitoring plots, including one control plot, and four nesting box plots. Monitoring commenced in 2008.

The monitoring undertaken by Global Soil Systems includes one control plot in the remnant bushland (Plot 1) and nine monitoring plots in the rehabilitated areas of the mine (Plots 2 to 10). The plots have been established for between 5 and 16 years.

The results of these assessments are compared with the completion criteria adopted by Donaldson. These criteria cover soil quality, vegetation, growth rates, species diversity and stem densities. A summary of the results of the 2020 fauna and habitat monitoring and previous 2019 flora compared to the completion criteria is provided in **Table 8.2**.

**Table 8.2**  
**Status of Monitoring Against Completion Criteria**

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Feature	Completion Criteria	Current Status
General	Stable landform	All monitoring plots were observed to be 'stable' with no signs of significant erosion.
	Effective drainage	The rehabilitated areas are effectively draining with no evidence of pooling water.
	Resilience to drought episodes in rehabilitated area.	Decreasing canopy cover and increasing leaf litter indicate some drought stress.
Flora	Re-establishment of a dense and diverse mixture of local native understory and overstorey vegetation species, specifically four (4) overstorey and four (4) understory species in each monitoring plot.	Plot 1 (control) = 11 understory and 5 overstorey species. Plots 2 to 10 = 4 to 13 understory and 4 to 19 overstorey species.
	Limited presence of weeds	Increasing evidence of weeds ( <i>Lantana camara</i> , <i>Cortaderia selloana</i> , <i>Senecio madagascariensis</i> and annual weeds) noted in Plots 2, 5, 7, 8, 9 and 10.
	Tree/shrub densities of 3000 stems/ha after 5 years and 1000 stems/ha after 15 years.	Plot 1 (control) = 6 600. Plots 2 to 10 range from 2 400 to 11 100.
	Evidence of natural regeneration in at least four species.	Natural recruitment was observed in most plots and evidence of flowering and seed production in some eucalypts and acacias.
Fauna	Reinvasion of rehabilitated area by native fauna.	The similarity of fauna diversity between the rehabilitation quadrats and the analogue site has increased from 20% similarity in 2011 to 40% in 2019. Similarity between the rehabilitation quadrats was 60% in 2019. These results show that the rehabilitation areas are trending towards the remnant forest analogue site conditions, with some year-to-year variation.
Soil Loss	Minimal erosion and soil movement, specifically soil loss from less than 40t/ha/year	Soil loss per annum for Plots 2 to 10 (ranged between 210 and 40 tonnes/ha) was generally lower than the analogue plot (175 tonnes/ha).
Soil Quality	Soil pH to be no lower than 10% of analogue plot pH after 5 years.	Plot 1 (analogue) – pH 5.3 Plots 2 to 10 – pH 5.1 to 5.6
	Conductivity of replaced soil to be below 900uS/cm after 5 years	EC for all plots ranged from 29 to 81µS/cm.
	Surface layer to be free of any hazardous material to a depth of at least 1m.	There has been no evidence of hazardous material following deep ripping.
	Runoff water conductivity to be less than 1 000µS/cm after 5 years.	Internal monitoring of the retained on-site sediment dams confirms ECs generally ranging between 118µS/cm and 175µS/cm.
Soil Quality	Soil nitrogen and phosphorous levels to be within 20% of levels in analogue site after 5 years.	The phosphorous levels within all rehabilitation plots remained lower than the analogue site. Phosphorous levels at both the analogue and rehabilitation plots decreased to levels previously recorded in 2015 (following a spike in 2017 – potentially due to sampling technique). All plots had nitrogen levels similar to or above the analogue plot value.



**Table 8.2 (Cont'd)**  
**Status of Monitoring Against Completion Criteria**

Page 2 of 2

Feature	Completion Criteria	Current Status
Pollution	Soil should not be a source of pollutants. Quality of water leaving the site to be in accordance with EPL requirements.	No non-compliance with EPL 11080 surface water quality requirements have been recorded with no discharges required. Internal due diligence monitoring within the on-site sediment dams confirms that all measured ECs and the majority of pH and total suspended solid results during the reporting period would be compliant with discharge criteria.
Source: GSS (2019), Kleinfelder (2020c), Donaldson Coal.		

To date, the monitoring has found that several of the rehabilitated areas have already met the completion criteria and that all rehabilitated areas assessed are on track to meet the required completion criteria.

## 8.3 ACTIONS FOR THE NEXT REPORTING PERIOD

### 8.3.1 Rehabilitation

The primary activity planned to occur in the next reporting period is monitoring as outlined in the current MOP for the mine. This will include ongoing weed control activities as identified in the 2020 rehabilitation monitoring.

Additionally, rehabilitation works recommended under the *Donaldson Coal Mine Review of Mine Water Storage Quality* assessment (see MOP Attachment 2) and proposed as part of the *Abel Underground Mine and Donaldson Open Cut Mine – Closure Strategy for the West and Square Pits* (see MOP Attachment 1) will potentially be commenced during the next reporting period, including consideration of the following activities.

- Short-term stabilisation of water storages (e.g. gypsum treatment, removal or isolation of dispersive material, rock stabilisation of eroding drains and spillways).
- Water storage reshaping to enhance sediment capture capacity and planting of aquatic plants to enhance sediment filtering and reduce erosion.
- Removal and/or lowering of the embankment and water storage area to convert the water storage area into a functional ephemeral wetland.

### 8.3.2 Monitoring

Rehabilitation monitoring required to be undertaken at the mine under the development consent and other regulatory documents will continue to be carried out in the 2020/2021 reporting period.

## 9. COMMUNITY

No complaints were received and no matters of concern or environmental queries were raised with Donaldson during the 2019/2020 reporting period.

In accordance with the conditions of the mine's development consent, Donaldson established a community consultative committee for the mine. The last committee meeting was held on 7 August 2013. No meetings were held during the reporting period and further meetings are currently deemed unnecessary.

No other specific community engagement activities relating to the mine were undertaken during the reporting period.

Given that coal mining activities ceased in April 2013 and rehabilitation was completed by March 2014, there has been negligible social impact to the community throughout the reporting period. As a result, during the reporting period Donaldson did not:

- provide community donations;
- need to conduct mitigation works to address any community impacts; or
- undertake any mine-related property acquisitions.

However, continued community benefits have occurred as a result of the utilisation of locally based employees for completion of maintenance activities within the rehabilitated areas. Additionally, contractors who are engaged to conduct routine and non-routine land management works are also sourced locally.

## 10. INDEPENDENT AUDIT

The last and final independent environmental audit of the mine was undertaken in March 2015 following the completion of mining in 2013 and rehabilitation in 2014. The audit found a high degree of compliance and identified the conditions of the development consent which were considered to remain active following the completion of mining. These remaining conditions have been treated as ‘recommendations’ and the status of these conditions is outlined within the 2014/2015 AEMR and further updated in **Table 10.1**.

**Table 10.1**  
**2015 Independent Audit Recommendations and Status Update**

Page 1 of 2

Cond No.	Development Consent Condition	Comment	Update
63(xiv)	<p><b>Biological Monitoring</b></p> <p>The Applicant shall prepare and implement a detailed monitoring program for groundwater and surface water</p> <p>(xiv) monitoring of macro-invertebrates and vegetation in accordance with protocols developed for the Hunter SIGNAL biological assessment criteria, with an assessment of inflows to the wetlands.</p>	<p>The biological monitoring will continue in accordance with Development Consent Condition 63(xiv) “for a period of at least five years after the completion of mining, or other such period as determined by the Director- General.”</p>	<p>Monitoring has been undertaken for period of at least 5 years from completion of mining (i.e. until April 2018). Annual monitoring ceased at the end of the previous reporting period in accordance with the approved updated Water Management Plan.</p>
69	<p><b>Tetratheca juncea Management Plan</b></p> <p>The Plan shall be consistent with the Flora and Fauna Management Plan and include measures for fire management.</p>	<p>The ongoing control measures employed at the Donaldson Coal Mine site ensure a high level of conservation for the <i>Tetratheca juncea</i>.</p>	<p>The <i>Tetratheca juncea</i> area is contained within the Bushland Conservation Area (BCA). Refer to comment below.</p>
72(ii) & (iii)	<p><b>Bushland Conservation Area Management</b></p> <p>(ii) retain management and ownership of the land for a minimum of 36 years from the commencement of construction, unless other arrangements are agreed in accordance with Condition 73; and</p> <p>(iii) prepare and implement a Management Plan for that area in consultation with OEH and to the satisfaction of the Director-General, during the period in which the Applicant is responsible for management.</p>	<p>Donaldson Coal Pty Ltd will retain management and ownership of the land for a minimum of 36 years from the commencement of construction, unless other arrangements are agreed in accordance with Development Consent condition 73.</p>	<p>The BCA is currently being managed in accordance with the BCA Management Plan and will be maintained for the period as per Condition 73 (i.e. until January 2037 or as agreed).</p>

**Table 10.1 (Cont'd)**  
**2015 Independent Audit Recommendations and Status Update**

Page 2 of 2

Cond No.	Development Consent Condition	Comment	Update
78	<p><b>Rehabilitation</b></p> <p>The Flora and Fauna Management Plan shall also include a Rehabilitation Plan that details the measures to be undertaken to progressively rehabilitate disturbed areas of the mine to replicate the original vegetation cover that existed before mining occurred. The Applicant shall be responsible for the management and monitoring of the rehabilitated mine site until such time as the Director-General agrees that restoration has been successful.</p>	<p>The Rehabilitation Plan is included in the Mining Operations Plans (MOP) and amendments for the Donaldson Coal Mine. The current MOP is for May 2014 to May 2021.</p> <p><i>Recommendation:</i></p> <p>As the reporting on the Mining Operations Plan is required under the Mining Lease, the rehabilitation progress and monitoring will be reported to the DRE and it is recommended that approval be sought from DPE to submit this MOP report to DPE to satisfy this condition.</p>	<p>Currently the Annual Reviews are provided to both Resources Regulator and the DPIE compliance team and will continue to be provided.</p>
114	<p><b>ANNUAL ENVIRONMENTAL MANAGEMENT REPORT</b></p> <p>The Applicant shall prepare and submit an Annual Environmental Management Report (AEMR) throughout the life of the mine to the satisfaction of the Director-General. The AEMR shall review the performance of the mine against the Environmental Management Strategy and the Conditions of this Consent, and other licences and approvals relating to the mine.</p>	<p>The preparation of the Annual Environmental Management Report for the Donaldson Coal Mine will be required unless an exemption is obtained from the Director-General/Secretary of DPE.</p> <p><i>Recommendation:</i></p> <p>It should be considered that reporting on the rehabilitation progress, the biological monitoring and bushland conservation area could be achieved by submitting the expert consultant reports and placing the reports on the Donaldson Coal website.</p>	<p>Donaldson is continuing to prepare the full Annual Review, however, this recommendation will be further considered in future reporting periods.</p>

Email correspondence from the Department of Planning dated 31 October 2018 confirms that, given the completion of mining in 2013 and the previous independent audit in 2015, no further independent audits are required unless otherwise directed by the Secretary (see **Appendix 7**).

## 11. INCIDENTS AND NON-COMPLIANCES DURING THE REPORTING PERIOD

During the reporting period there were no:

- non-compliances;
- reportable incidents or exceedances; or
- official cautions, warning letters, penalty notices or prosecution proceedings.

## 12. ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

Activities planned to be completed during the next reporting period are outlined in Sections 4.3 and 8.3 and planned improvements in environmental management practices are outlined in Sections 6 and 7. In summary, the key activities planned for the next reporting period are as follows.

- Continued environmental monitoring.
- Continued weed control within the BCA and rehabilitation areas. Lantana will be the primary targeted weed in the next reporting period.
- Potential commencement of rehabilitation works recommended under the *Donaldson Coal Mine Review of Mine Water Storage Quality* assessment (see MOP Attachment 2) and proposed as part of the *Abel Underground Mine and Donaldson Open Cut Mine – Closure Strategy for the West and Square Pits* (see MOP Attachment 1), including:
  - short-term stabilisation of water storages (e.g. gypsum treatment, removal or isolation of dispersive material, rock stabilisation of eroding drains and spillways);
  - water storage reshaping to enhance sediment capture capacity and planting of aquatic plants to enhance sediment filtering and reduce erosion; and
  - removal and/or lowering of the embankment and water storage area to convert the water storage area into a functional ephemeral wetland.

# Appendices

(Total No. of pages including blank pages = 244)

- Appendix 1 Site Locality Plan and Monitoring Locations (8 pages)
- Appendix 2 Description and Location of Known Aboriginal Sites (4 pages)
- Appendix 3 Compliance Review (50 pages)
- Appendix 4 2019 Annual Flora and Fauna Monitoring prepared by Kleinfelder Australia Pty Ltd (88 pages)
- Appendix 5 Annual Survey of the Tetratheca Juncea Conservation Area 2019 prepared by Kleinfelder Australia Pty Ltd (28 pages)
- Appendix 6 2019 Rehabilitation Monitoring prepared by Kleinfelder Australia Pty Ltd (60 pages)
- Appendix 7 Approval to Cease Independent Environmental Audits (4 pages)

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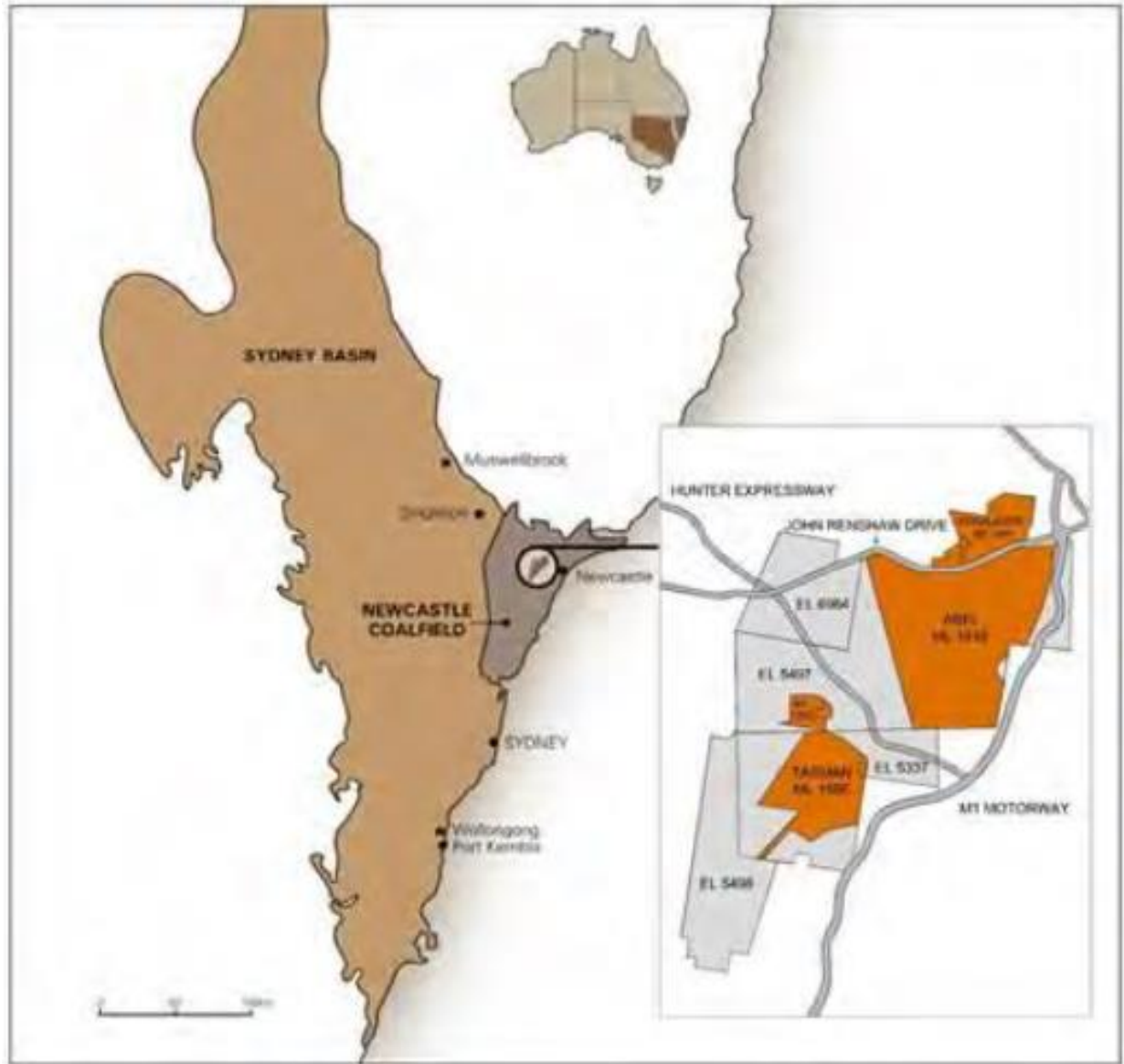


# Appendix 1

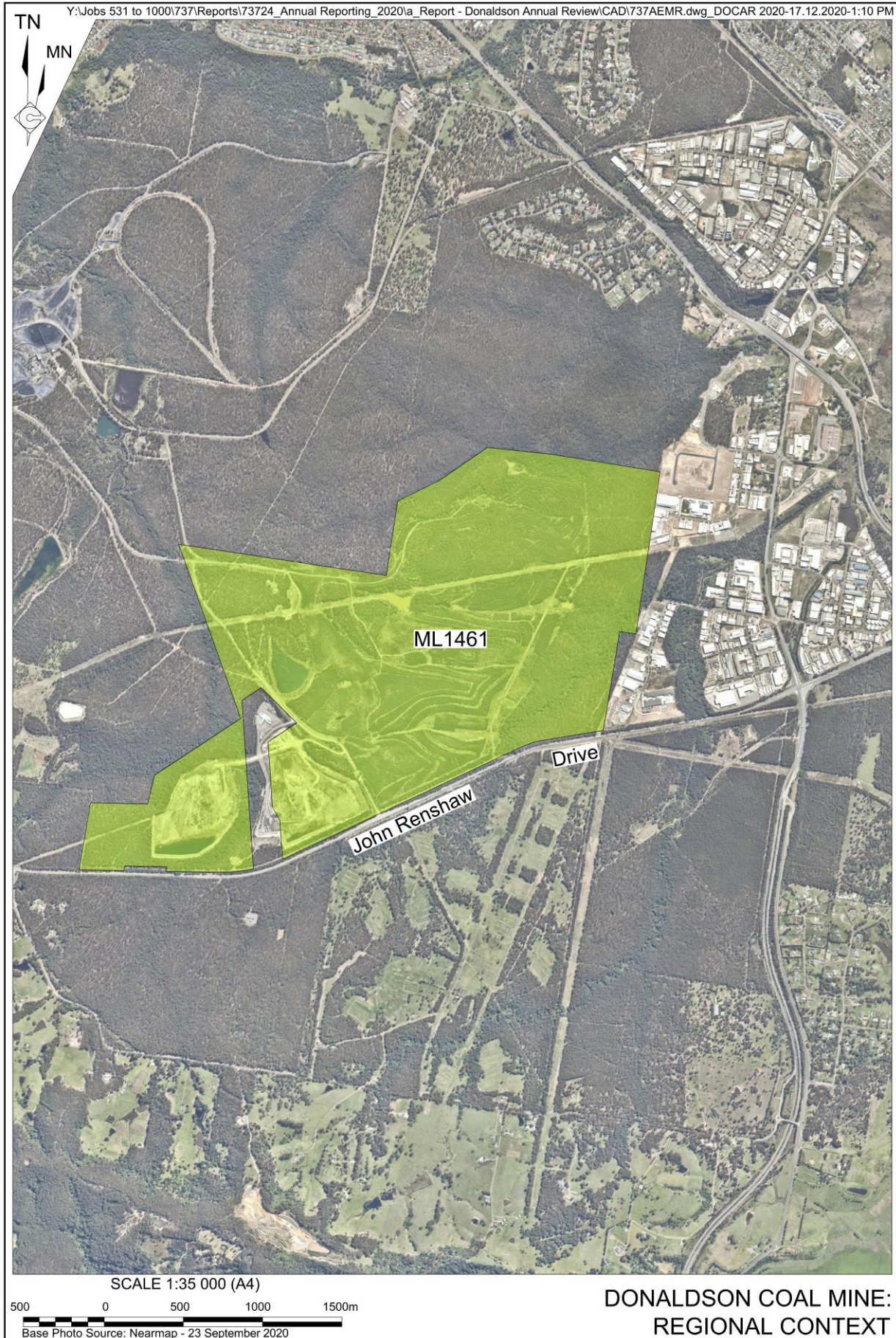
## Site Locality Plan and Monitoring Locations

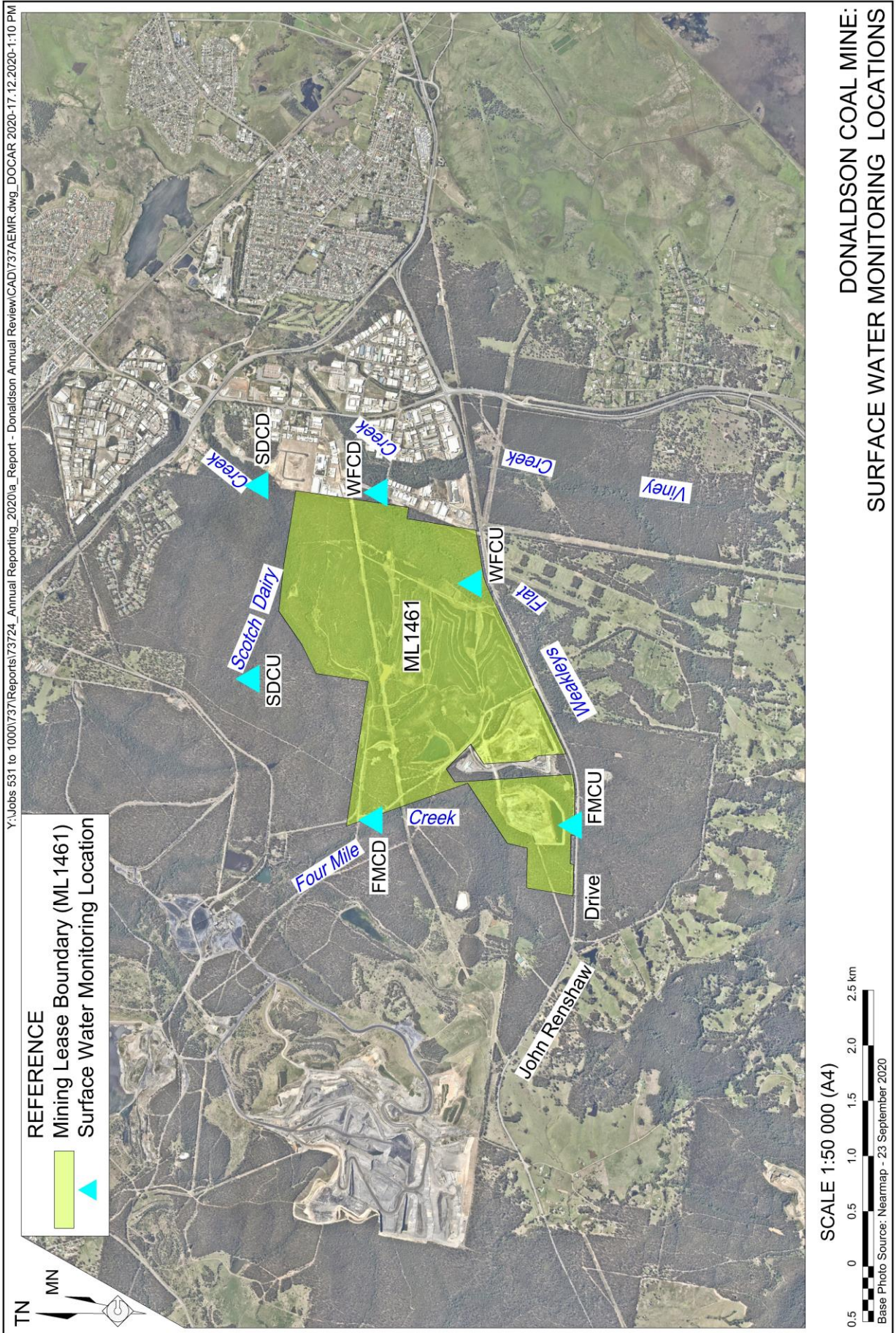
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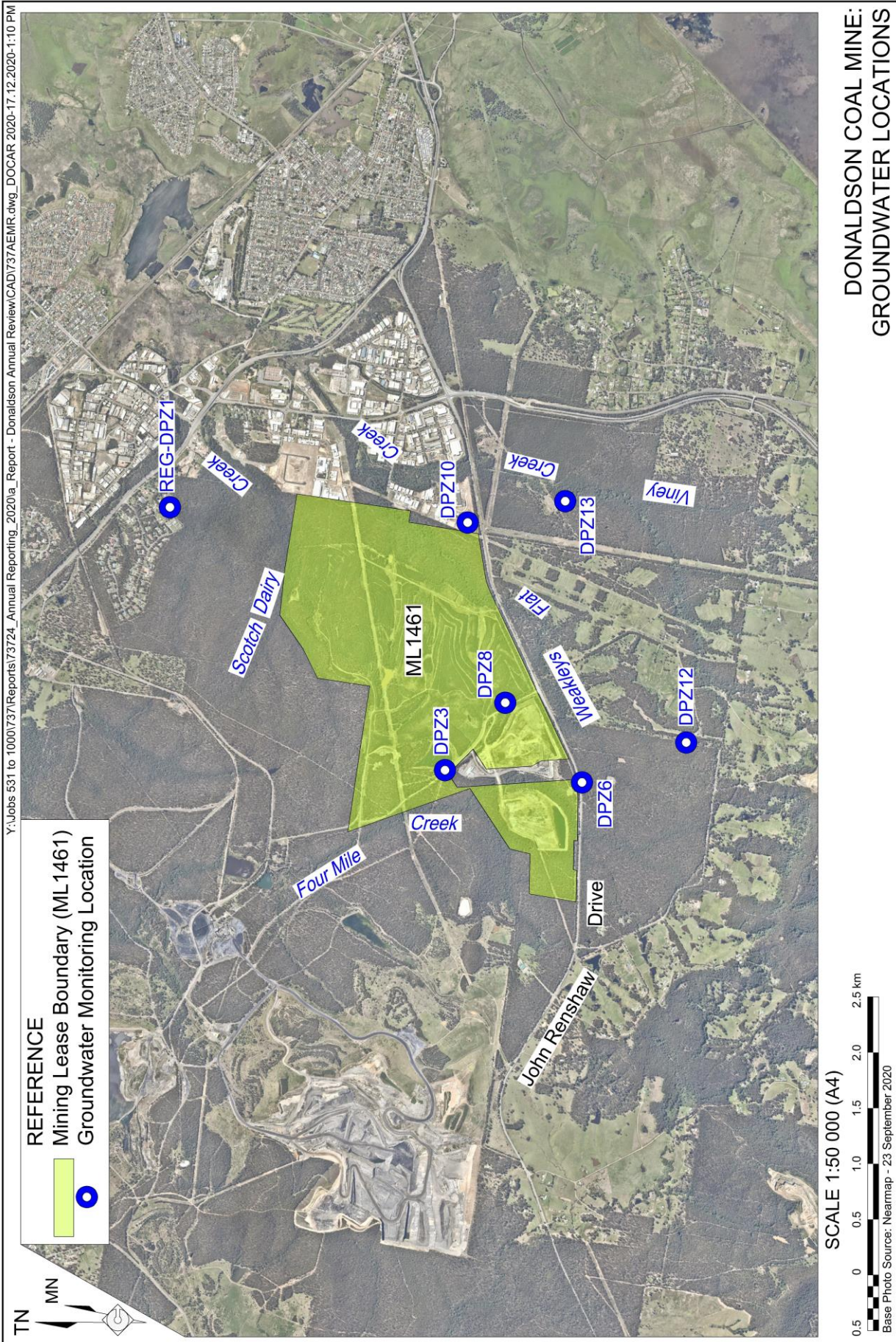
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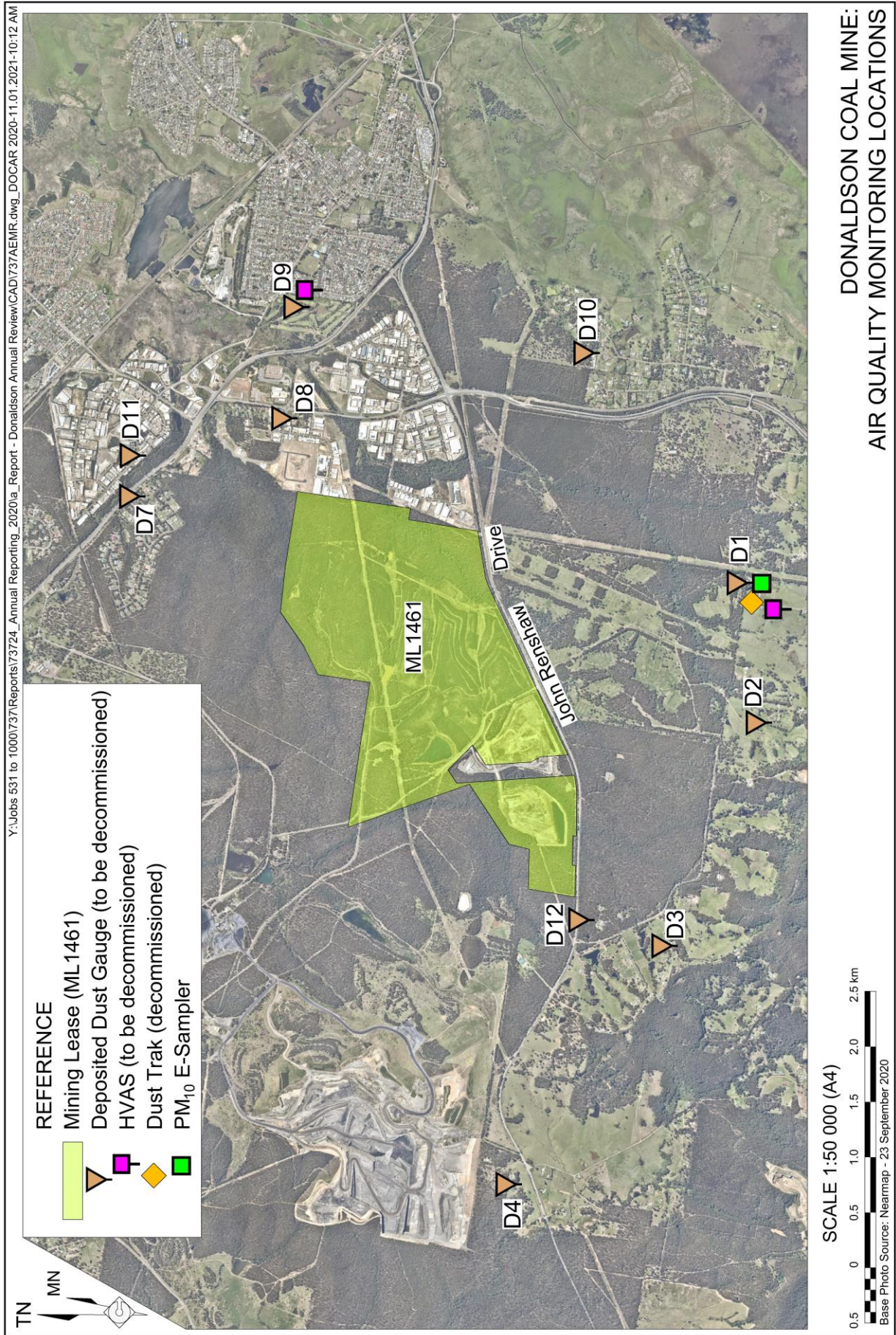


Locality Plan









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# Appendix 2

## Description and Location of Known Aboriginal Sites

(Total No. of pages including blank pages = 4)

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Site Name	Recorder	Location	Description	Comments
<b>Bushland Conversation Area</b>				
FMC3	Effenberger (1997)	368300E 6368900N Bank of Four Mile Creek	Artefact scatter (5 artefacts), one axe grinding groove	
FMC4	Effenberger (1997)	368250E 6368650N Lower slope above Four Mile Creek	Artefact scatter (2 artefacts)	
FMC5	Effenberger (1997)	368500E 6368700N Lower slope above Four Mile Creek	Artefact scatter (2 artefacts)	
FMC6	Effenberger (1997)	368400E 6366100N Upper slope above Four Mile Creek	Artefact scatter (4 artefacts)	
FMC7	Effenberger (1997)	367600E 6366500N Crest between Four Mile Creek and a major tributary	Artefact scatter (3 artefacts)	
FMC8	Effenberger (1997)	367600E 6366850N Upper slope above tributary of Four Mile Creek	Scarred tree	
WFC1	Effenberger (1997)	371200E 6369200N Lower slope above Weakleys Flat Creek	Artefact scatter (3 artefacts)	
ISF3	Umwelt (1998)	368750E 6367650N Lower slope above Four Mile Creek	Isolated find	
ISF4	Umwelt (2001)	370550E 6368625N Mid slope above Weakleys Flat Creek	Isolated find	
Four Mile Creek 1 (38- 4-139)	Brayshaw (1985)	368130E 6367020N Bank of Four Mile Creek	Artefact scatter (19 artefacts)	
Four Mile Creek 2 (38- 4-140)	Brayshaw (1985)	367820E 6366880N Terrace of Four Mile Creek	Artefact scatter (10 artefacts)	
CA1	Umwelt (2001)	370658E 6368051N Mid slope, south of Weakleys Flat Creek	Isolated find	
CA2	Umwelt (2001)	371132E 6369039N Lower slope, north west of Weakleys Flat Creek	Artefact scatter (2 artefacts)	
CA3	Umwelt (2001)	370985E 6370511N Lower slope above a tributary of Scotch Dairy Creek	Isolated find	
CA4	Umwelt (2001)	369568E 6370040N Mid slope above Scotch Dairy Creek	Isolated find	
CA5	Umwelt (2001)	368391E 6366747N Mid slope, east of Four Mile Creek	Isolated find	
CA6	Umwelt (2001)	368229E 6366592N Lower slope above a tributary of Four Mile Creek	Isolated find	

Site Name	Recorder	Location	Description	Comments
CA7	Umwelt (2001)	367617E 6366456N Mid slope above Four Mile Creek	Isolated find	
CA8	Umwelt (2001)	370746E 6369747N Lower slope, south of Scotch Dairy Creek	Isolated find	
DMS2	Umwelt (2002)	370966E 6368184N Mid slope, south of Weakleys Flat Creek	Artefact scatter (2 artefacts)	
DMS4	Umwelt (2002)	368649E 6368181N Mid slope, east of Four Mile Creek	Isolated find	
DMS5	Umwelt (2002)	370665E 6368177N Mid slope, south of Weakleys Flat Creek	Isolated find	
DMS6	Umwelt (2002)	370809E 6369721N Mid slope, south of Scotch Dairy Creek	Scarred tree	
<b>Mine Impact Area</b>				
ISF1	(Effenberger 1997)	370500E 6369100N Lower slope above small tributary of Weakleys Flat Creek	Isolated find	Consent to Destroy granted (2002)
ISF2	(Effenberger 1997)	369800E 6368950N Lower slope above tributary of Weakleys Flat Creek	Isolated find	Consent to Destroy granted (2002)
ISF5	Umwelt (2001)	370275E 6368626N Mid slope above Weakleys Flat Creek	Isolated find	Application being prepared for consent to remove
ISF6	Umwelt (2001)	370305E 6368600N Mid slope above Weakleys Flat Creek	Isolated find	Application being prepared for consent to remove
Ironbark 2 (38-4-339)	Ruig (1993)	369190E 6367890N Upper slope above tributary of Weakleys Flat Creek	Isolated find	
DMS1	Umwelt (2002)	369734E 6369122N	Isolated find	Consent to Destroy granted (2002)
DMS3	Umwelt (2002)	369090E 6367962N Mid slope above Four Mile Creek	Isolated find	

# Appendix 3

## Compliance Review

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**Table A3.1  
Donaldson Development Approval – Compliance Review**

Page 1 of 37

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>OPERATION OF DEVELOPMENT</b>			
1	<p>(1) Applicant shall carry out the development generally in accordance with the:</p> <ul style="list-style-type: none"> <li>• Development application DA 8/01173, dated 13 February 1998, lodged with Maitland City Council and DA 118/698/22 dated 19 February 1998, lodged with Cessnock City Council and the accompanying Environmental Impact Statement (EIS) dated 10 February 1998, and prepared by PPK Environment and Infrastructure, as modified by reports in Schedule 4;</li> <li>• Submissions to the Commission of Inquiry by the applicant;</li> <li>• Statement of Environmental Effects titled Modification to the approved mining area at the Donaldson Open Cut Cola Mine, Beresfield, dated 10 November 2004, and prepared by GSS Environmental;</li> <li>• modification application DA 98/01173 &amp; DA 118/698/22 MOD 2 and supporting information, prepared by Donaldson Coal Pty Limited and dated 16 December 2010 and 25 March 2011; and</li> </ul> <p>Conditions of this consent.</p> <p>(2) If there is any inconsistency between the above, the most recent document shall prevail to the extent of the inconsistency. However, the conditions of this approval shall prevail to the extent of any inconsistency.</p> <p>(3) Unless otherwise specifically stated, the conditions of consent do not apply to lot 131 DP 234203 (owned by Steggles Limited at the date of this consent), provided the Deed of Agreement between Steggles Limited and the Applicant is in effect.</p>	YES	<p>The Donaldson Coal project has been developed generally in accordance with the specified documents, with the mine pits and rehabilitation conducted in accordance with the Mining Operations Plan (Amendment) approved by the Resources Regulator (30 September 2020).</p>
2	<p>Except as expressly provided by the Statement of Environmental Effects, dated 10 November 2004, the development shall be restricted as follows:</p> <p>(i) the mine plan in the EIS shall be reduced such that no mining shall be undertaken in any area identified in accordance with these Conditions as a Conservation Area. This includes the Tetratheca Juncea Conservation Area (Condition 68); and</p> <p>(ii) the Applicant shall not clear any land or erect any structures within any Conservation Area without obtaining any further development approval from the Director-General.</p>	YES	<p>The mining area is delineated on the mine plans with the Conservation Area that surrounds the disturbed area of the mine managed for the protection of the vegetation and habitat value.</p> <p>The relocation of the 11kV power line required clearing a small area of the Bushland Conservation Area on the western end of the site and rehabilitation of the existing power line easement.</p> <p>The clearing and rehabilitation of these areas and the adjustment to the boundaries of the Bushland Conservation Area were approved by DoP in Nov 2006.</p>

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes																														
<b>OPERATION OF DEVELOPMENT (Cont'd)</b>																																	
3	(1) Subject to (2) the approved hours of operation are as follows: <table border="1"> <thead> <tr> <th>Works</th> <th>Period</th> <th>Hours</th> </tr> </thead> <tbody> <tr> <td>Construction, including construction of any lands</td> <td>Monday to Friday</td> <td>7am to 6pm</td> </tr> <tr> <td></td> <td>Saturday</td> <td>8 am to 1pm</td> </tr> <tr> <td>Mining operations, including mining, haulage of waste to dumps and coal processing</td> <td>Monday to Friday</td> <td>24 hours per day</td> </tr> <tr> <td></td> <td>Saturday, Sunday</td> <td>7am to 6pm</td> </tr> <tr> <td>Road transportation and stockpiling of coal</td> <td>7 days per week</td> <td>24 hours per day</td> </tr> <tr> <td>Rail loading of coal</td> <td>7 days per week</td> <td>7am to 10pm</td> </tr> <tr> <td>Maintenance of mobile and fixed plant</td> <td>7 days per week</td> <td>24 hours per day</td> </tr> <tr> <td>Blasting, not involving closure of John Renshaw Drive</td> <td>Monday to Saturday</td> <td>7am to 5pm</td> </tr> <tr> <td>Blasting, involving closure of John Renshaw Drive</td> <td>Monday to Saturday</td> <td>10am to 2pm</td> </tr> </tbody> </table> <i>Table 1: Approved Hours of Operation</i> <i>Notes: Restrictions on Public Holidays are the same as Sundays.</i>	Works	Period	Hours	Construction, including construction of any lands	Monday to Friday	7am to 6pm		Saturday	8 am to 1pm	Mining operations, including mining, haulage of waste to dumps and coal processing	Monday to Friday	24 hours per day		Saturday, Sunday	7am to 6pm	Road transportation and stockpiling of coal	7 days per week	24 hours per day	Rail loading of coal	7 days per week	7am to 10pm	Maintenance of mobile and fixed plant	7 days per week	24 hours per day	Blasting, not involving closure of John Renshaw Drive	Monday to Saturday	7am to 5pm	Blasting, involving closure of John Renshaw Drive	Monday to Saturday	10am to 2pm	YES	No construction or mining activities occurred during the reporting period.
	Works	Period	Hours																														
Construction, including construction of any lands	Monday to Friday	7am to 6pm																															
	Saturday	8 am to 1pm																															
Mining operations, including mining, haulage of waste to dumps and coal processing	Monday to Friday	24 hours per day																															
	Saturday, Sunday	7am to 6pm																															
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Maintenance of mobile and fixed plant	7 days per week	24 hours per day																															
Blasting, not involving closure of John Renshaw Drive	Monday to Saturday	7am to 5pm																															
Blasting, involving closure of John Renshaw Drive	Monday to Saturday	10am to 2pm																															
(2) The Applicant shall submit a report to the Director-General's satisfaction demonstrating that the noise limits in Condition 15 can be met while rail loading of coal is occurring during the period from 6pm to 10pm. If that report does not demonstrate that the noise limits can be met to the Director-General's satisfaction, then the hours of operation for rail loading of coal shall be restricted to 7am to 6pm.	YES	Report previously submitted.																															
4	The Applicant shall comply with any order of the Director-General to cease activities causing serious or irreversible environmental concerns, until those concerns have been addressed to the satisfaction of the Director-General.	Not Activated	No order issued to date.																														
<b>COMMENCEMENT AND DURATION</b>																																	
5	(1) To ensure the employment benefits of this development are realised without delay, the Applicant shall commence mining within two years of the date of this Consent. This does not remove the obligation of the Applicant to comply with any other requirement listed in the Conditions of this Consent. (2) To minimise potential delays to development on adjoining lands, consent for mining operations shall lapse on 31 December 2013. Note: Under this consent, the Applicant is required to rehabilitate the site and perform additional undertakings to the satisfaction of the Director-General and DRE. Consequently this approval will continue to apply in all other respects other than the right to conduct mining operations until the site has been properly rehabilitated.	YES	Mining commenced on 25 January 2001 (i.e. within 2 years of granting of the Consent) therefore this condition was complied with. Extension of time approved by Department of Planning.  The Donaldson Open Cut Coal Mine operations ceased in April 2013.																														
	6	The Applicant shall notify the Director-General and the Councils in writing of the dates of commencement of: (i) construction works, (ii) mining, and (iii) coal processing operations, 14 days prior to the commencement of such works.	YES	Donaldson Coal provided written Notification to the Director-General and Councils prior to commencement of construction works, mining and coal processing operations.																													
7	No construction or mining shall commence until: (i) the relevant compliance reports in Condition 121 have been completed to the satisfaction of the Director-General; and (ii) the Applicant provides evidence to the Director-General of an agreement with the adjoining Bloomfield mine for the use of rail loading infrastructure.	YES	Compliance Reports for construction and mining were prepared and submitted to DUAP prior to commencement of the activities on the site in 2001.																														



**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>ENVIRONMENTAL OFFICER</b>			
8	The Applicant shall employ an Environmental Officer, whose qualifications are suitable to the Director-General, throughout the life of the mine. The Environmental Officer shall: (i) be responsible for the preparation of the Environmental Management Strategy (Conditions 10-13) and environmental management plans; (ii) be responsible for considering and advising on matters specified in the Conditions of this Consent and compliance with such matters; (iii) be responsible for receiving and responding to complaints in accordance with Condition 113; (iv) facilitate an induction and training program for all persons involved with construction activities, mining and environmental management activities; and (v) have the authority and independence to require reasonable steps to be taken to avoid or minimise unintended or adverse environmental impacts and failing the effectiveness of such steps, to stop work immediately if an adverse impact on the environment is likely to occur.	YES	Phillip Brown was employed as Environmental Manager in May 2003 and Planning NSW was notified on 7 April 2003 as required by MCoA 8.
9	The Applicant shall notify the Director-General, OEH, NOW, DRE, Councils and the Community Consultative Committee (Conditions 107-110) of the name and contact details of the Environmental Officer upon appointment and upon any changes to that appointment.	YES	The Director-General, EPA, DLWC, DMR, NPWS, Councils and the Community Consultative Committee were notified 30 May 2003 by letter of the appointment of Phillip Brown.
<b>ENVIRONMENTAL MANAGEMENT STRATEGY</b>			
10	The Applicant shall prepare an Environmental Management Strategy (the Strategy) for the development, providing a strategic context for environmental management. All environmental management plans required by the Conditions of this Consent shall be consistent with the Strategy. The Strategy shall be prepared in consultation with the relevant authorities and the Community Consultative Committee and to the satisfaction of the Director-General, prior to commencement of construction.	YES	The Environmental Management Strategy was prepared in May 2000 for the Donaldson Mine for construction of the mine and mining operations.  Revision of the EMS occurred to integrate the requirements of the Donaldson Mine and the mining contractor to provide a single EMS for the project occurred in 2002.  Review and revision of the EMS has occurred as management plans for the Donaldson Coal operations are revised and an integrated Environmental Management Strategy to include the Tasman and Abel Coal projects was approved by DoP on 26 February 2008. The current version of the EMS was updated August 2018 and approved by DPE on 31 August 2018.
11	The Strategy shall cover the area of mining, the haul road and rail loading facility, and the Conservation Areas. The Strategy shall include: (i) statutory and other obligations which the Applicant is required to fulfil during construction and mining, including all approvals and consultations and agreements required from authorities and other stakeholders, and key legislation and policies;	YES	The Environmental Management Strategy prepared for the Abel and Donaldson Mine includes sections addressing each of the requirements of MCoA 11.

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

Page 4 of 37

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>ENVIRONMENTAL MANAGEMENT STRATEGY (Cont'd)</b>			
11 Cont'd	(ii) definition of the role, responsibility, authority, accountability and reporting of personnel relevant to environmental management including the Environmental Officer; (iii) overall environmental management objectives and performance outcomes, during construction, mining and decommissioning of the mine for each of the key environmental elements for which management plans are required under this Consent; (iv) overall ecological and community objectives and a strategy for restoration and management including habitat areas, creeklines and drainage channels, within the context of those objectives; (v) identification of cumulative environmental impacts and procedures for dealing with these at each stage of the development; (vi) overall objectives and strategies for minimising the impacts of the development on economic productivity; (vii) steps to be taken to ensure that all approvals, plans, and procedures are being complied with; (viii) processes for conflict resolution in relation to the environmental management of the project; and (ix) documentation of the results of consultations undertaken in the development of the Strategy.	YES	
12	The Applicant shall make copies of the Environmental Management Strategy available to Councils, OEH, NOW, DRE and the Community Consultative Committee within 14 days of approval by the Director-General.	YES	Copies of the Environmental Management Strategy and revisions prepared for Donaldson Coal projects have been made available.
<b>ENVIRONMENTAL MONITORING AND REVIEWING</b>			
13	(1) Except as provided in (2), the Applicant shall provide six-monthly monitoring reports on all environmental monitoring required under this Consent for the first three years of the project and for any further period as may be determined necessary by the Director-General. The reports shall contain interpretations of the monitoring data, and summarise exceedances and action taken. The Applicant shall make copies of the monitoring reports available to the Director-General, NOW, OEH, DRE, Councils and the Community Consultative Committee. (2) Noise monitoring reports shall be provided six-monthly for the life of the mine, unless the Director-General, on the advice of the independent noise expert (Condition 48) requires more frequent reports.	YES	Monitoring Reports including all noise, blasting, air quality, surface and groundwater, indigenous heritage, flora and fauna, employment statistics, community consultation and complaints, were prepared six monthly and provided to the relevant authorities listed in MCoA 13 (1) between 2001 and 2004.  DIPNR approved the reporting of monitoring on an annual basis on 1 April 2004.  All monitoring data and reporting has occurred in the AEMR's / Annual Reviews since 2004.
14	All sampling strategies and protocols undertaken as part of any monitoring program shall include a quality assurance/quality control plan and shall require approval from the relevant regulatory agencies to ensure the effectiveness and quality of the monitoring program. Only accredited laboratories shall be used for laboratory analysis.	YES	Quality assurance/Quality Control information and data is included in the laboratory reports from the NATA registered laboratory, with the monitoring data.  All sampling and analysis has been conducted by NATA or AS/NZS ISO 17025 registered laboratories, as from 23 May 2002.

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes																											
<b>NOISE AND VIBRATION</b>																														
<b>Noise Limits</b>																														
15	<p>Except as may be expressly provided by a OEH licence under the <i>Protection of the Environment Operations Act 1997</i>, or unless subject to a negotiated agreement in accordance with Condition 23, the Applicant shall ensure that the noise emission from construction or mining operations, when measured or computed at the boundary of any dwelling not owned by the Applicant (or within 30 metres of the dwelling, if the boundary is more than 30 metres from the dwelling), shall not exceed the following limits:</p> <table border="1"> <thead> <tr> <th colspan="3">Location LA10(15 minute) noise limits (dB(A))</th> </tr> <tr> <th></th> <th>Daytime</th> <th>Night-time</th> </tr> </thead> <tbody> <tr> <td>Beresfield (residential)</td> <td>45</td> <td>35</td> </tr> <tr> <td>Steggles Poultry Farm</td> <td>50</td> <td>40</td> </tr> <tr> <td>Ebenezer Park</td> <td>46</td> <td>41</td> </tr> <tr> <td>Black Hill Area</td> <td>40</td> <td>38</td> </tr> <tr> <td>Buchanan/Louth Pk</td> <td>38</td> <td>36</td> </tr> <tr> <td>Ashtonfield Area</td> <td>41</td> <td>35</td> </tr> <tr> <td>Thornton Area</td> <td>48</td> <td>40</td> </tr> </tbody> </table> <p><i>Table 2: Noise Limits</i> <i>Note: Daytime is 7am to 10pm Monday – Saturday, and 8am to 10pm Sundays and Public Holidays. Night-time is 10pm to 7am Monday – Saturday, and 10pm to 8am Sundays and Public Holidays.</i> The noise limits apply for prevailing meteorological conditions (winds up to 3 m/s), except under conditions of temperature inversions.</p>	Location LA10(15 minute) noise limits (dB(A))				Daytime	Night-time	Beresfield (residential)	45	35	Steggles Poultry Farm	50	40	Ebenezer Park	46	41	Black Hill Area	40	38	Buchanan/Louth Pk	38	36	Ashtonfield Area	41	35	Thornton Area	48	40	YES	Given that mining operations have ceased, no noise monitoring was undertaken during the reporting period. Previous Quarterly Noise Surveys generally identified that noise levels contributed by Donaldson Mine operations do not exceed noise emission goals for any of the periods. In the absence of operations, complaints and previous monitoring results, compliance is considered likely.
Location LA10(15 minute) noise limits (dB(A))																														
	Daytime	Night-time																												
Beresfield (residential)	45	35																												
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Ashtonfield Area	41	35																												
Thornton Area	48	40																												
<b>Noise Management</b>																														
16	Prior to 31 October 2005, the Applicant shall prepare a Noise Monitoring Program for the development in consultation with OEH, and to the satisfaction of the Director-General, which includes a noise monitoring protocol for evaluating compliance with the criteria in condition 15.	YES	The Mine Noise Monitoring Plan was forwarded to DoP and DEC in Oct 2005 and a final revised copy submitted on 27 Dec 2005 for approval. The Plan was approved by DoP on 22 Jan 2007. An updated Noise Management Plan was approved by the (then) DPE in June 2019 and covers both the Abel and Donaldson mines.																											
17	Deleted in Notice of Modification 26 August 2005																													
18	Deleted in Notice of Modification 26 August 2005																													
19	Deleted in Notice of Modification 26 August 2005																													
20	In the event that a landowner or occupier considers that noise or vibration from the project at their property is in excess of the relevant criteria set out in this Consent, the Applicant shall, upon receipt of a written request and at its own expense immediately undertake direct discussion with the landowners or occupiers affected to determine their concerns. Independent investigations of the noise complaints shall be carried out if the matter is not resolved within six weeks, in accordance with Conditions 48-53	Not activated	No request for acquisition by any landowners due to noise or vibration impact had been initiated.																											

**Table A3.1 (Cont'd)  
Donaldson Development Approval – Compliance Review**

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes						
<b>Noise Acquisition</b>									
21	If noise monitoring or independent noise investigations indicate that noise from construction or operation of the mine at the boundary of a dwelling, or within 30 metres of the dwelling where the boundary is more than 30 metres from the dwelling, is in excess of the noise limits set out in this Consent under adverse weather conditions and if appropriate noise control measures cannot be achieved on the mine site, the landowner may request the Applicant in writing to acquire the whole of the property or such part of the property requested by the landowner where subdivision is approved.  Note: Adverse weather conditions means the presence of winds up to 3 metres per second, and/or temperature inversions of up to 4 degrees Celsius per 100 metres.	Not activated	As above.						
22	Any such request shall be referred to the Director-General for determination in consultation with the independent expert. If the Director-General determines acquisition is necessary, the Applicant shall acquire the property in accordance with Conditions 54-55.	Not activated	As above.						
<b>Negotiated Agreements</b>									
23	If monitoring or independent investigations indicate that noise or dust from the mine is in excess of the criteria set out in this Consent and the affected landowner does not wish to be acquired, the Applicant shall, if requested by the affected landowner, enter into a negotiated agreement. Where a negotiated agreement is required, the Applicant shall, within the time period specified by the Director-General:  (i) appoint an independent facilitator, approved by the Director-General; (ii) negotiate a package of benefits for the landowner, which may include undertaking noise reduction measures on the property or at the dwelling(s) or compensation; (iii) pay all reasonable costs of the process; and (iv) report to the Director-General and the OEH on the agreement reached.	Not activated	No requirement has arisen for a negotiated agreement with any land owners.						
<b>BLASTING</b>									
<b>Blasting Criteria</b>									
24	The Applicant shall ensure that the airblast over pressure level from blasting at the development does not exceed the criteria in Table 3, and the ground vibration level does not exceed the criteria in Table 4, at any residence on privately-owned land or noise sensitive location as defined in the EPA's Industrial Noise Policy. <table border="1"> <tr> <td>Airblast overpressure (db(Lin Peak))</td> <td>Allowable exceedance</td> </tr> <tr> <td>115</td> <td>5% of total number of blasts in a 12 month period</td> </tr> <tr> <td>120</td> <td>0%</td> </tr> </table> <i>Table 3: Airblast Overpressure Impact Assessment Criteria</i>	Airblast overpressure (db(Lin Peak))	Allowable exceedance	115	5% of total number of blasts in a 12 month period	120	0%	YES	No blasting occurred during the reporting period.
Airblast overpressure (db(Lin Peak))	Allowable exceedance								
115	5% of total number of blasts in a 12 month period								
120	0%								

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>BLASTING (Cont'd)</b>			
<b>Blasting Criteria (Cont'd)</b>			
24 Cont'd	Peak Particle Velocity mm/s	Allowable exceedance	YES
	5	5% of total number of blasts in a 12 month period	
	10	0%	
<i>Table 4: Ground Vibration Impact Assessment Criteria</i>			
<b>Blasting Design and Management</b>			
25e	(1) The Applicant shall not blast within 500 metres of an occupied residence.	YES	No blasting occurred during the reporting period.
	(2) The Applicant shall not blast within 500 metres of private lands unless there is a written agreement between the Applicant and the landowner/occupier(s) to the satisfaction of the Director-General that guarantees the safety of persons who might use those lands.	YES	No blasting occurred during the reporting period.
	(3) The Applicant shall not blast within 500 metres of public lands unless public access to those areas is prevented at times of blasting.	YES	No blasting occurred during the reporting period.
	(4) The Applicant shall not blast within 500 metres of a public road unless the road is closed with the prior written agreement of the Regional Traffic Committee (or in the absence of the Regional Traffic Committee, the Director-General). A copy of any such agreement shall be supplied to the Director-General within 14 days of the agreement. If determined necessary by the Regional Traffic Committee, the Applicant shall prepare a Traffic Study to identify upgrading of the surrounding road system commensurate with the additional traffic volumes. The Study shall be prepared in consultation with Councils and the RTA, and to the satisfaction of the Regional Traffic Committee. All recommended traffic management measures and road infrastructure upgrading are to be undertaken at the Applicant's expense prior to any closure of John Renshaw Drive. If the study identifies the need for acquisition to enable the works to be undertaken, acquisition shall occur in accordance with the acquisition procedures established under this Consent.	YES	No blasting occurred during the reporting period.
	(5) The 500 metre distance may be reduced by the Director-General if a risk analysis undertaken by the Applicant to the Director-General's requirements indicates a lesser distance provides an appropriate level of safety.	Not activated	The 500m setback distance was not requested to be reduced.

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>BLASTING (Cont'd)</b>			
<b>Blasting Design and Management (Cont'd)</b>			
26	The Applicant shall prepare and implement a Blast Management Plan in consultation with DRE and Councils, prior to the commencement of blasting (including trial blasting). The Applicant shall make copies of the Blast Management Plan available to the independent noise expert (Condition 48), OEH, /DRE, Councils and the Community Consultative Committee within 14 days of approval by the Director-General.	YES	Blast Management Plan was developed for the Donaldson Mine in consultation with the DMR and Maitland City Council, Cessnock City Council, and Newcastle City Council, prior to the commencement of blasting at the Donaldson Mine and copies of the Plan were distributed to the relevant authorities and the CCC. The Blast Management Plan was revised in 2007 and approved by the (then) DoP.
27	The Blast Management Plan shall: (i) provide details of any proposed trial blasting;	YES	The Blast Management Plan 2001 addresses Trial Blasting in Section 6.2.
	(ii) identify a monitoring program, including locations and justification for selection of locations such as the Steggle's Black Hill poultry operations and areas of old underground mine workings;	YES	The Blast Management Plan 2007 Section 6 addressed the Monitoring Program for the specified areas.
	(iii) detail measures to ensure that air blast overpressure and vibration monitoring and control is generally carried out in accordance with the recommendations of Australian Standard AS-2187-1993 (or its latest version) and in terms of ANZECC Guidelines;	YES	The Blast Management Plan 2007 addresses Monitoring Procedures, in Section 4 and 6. The monthly Blast Monitoring and Assessment Reports by Hunter Acoustics addressed the quality control and monitored the data collection and recording.
	(iv) detail methods to measure weather data as soon as practicable prior to blasting and from that data predict whether noise levels are likely to be increased above the levels expected under prevailing meteorological conditions;	YES	The Blast Management Plan 2007 addresses Meteorological Data Collection in Section 5.1.  The meteorological station located at the Donaldson Mine provides continuous records of the prevailing weather conditions and this data was available immediately prior to blasting.
	(v) detail measures to be taken to minimise disruptions from blasting, including any road closures agreed in accordance with Condition 25, and management of impacts on local traffic and pedestrian movements;	YES	The Blast Management Plan 2007 addresses minimisation of disruptions caused by blasting in Section 5.2.
	(vi) specify procedures for ensuring that the occurrence of concurrent blasts with the adjoining coal mine operators is avoided; and	YES	The Blast Management Plan 2007 addresses timing of blasts in Section 5.1.
	(vii) identify procedures for notifying landowners/occupiers within 2 km of the site of the general blasting program and for notifying landowners or occupiers within 500m of blasting events (or any reduced area approved by the Director-General under Condition 25(5)) prior to blasting occurring.	YES	The Blast Management Plan 2007 addresses notification of blasting events to land owners in Section 5.3.
28	The Applicant shall not blast if weather conditions indicate that air blast overpressure levels are likely to be exceeded at residences not owned by the Applicant.	Not Applicable	No blasting occurred during the reporting period.

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

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Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
29	The Applicant shall report on blasting practices (including any trial blasting), weather data and the results of blast emissions monitoring in the six-monthly environmental monitoring reports and in the AEMR.	Not Applicable	No blasting occurred during the reporting period.
30	The Applicant shall revise the Blast Management Plan as necessary and provide an updated Plan five years after commencement of mining to the Director-General, the independent noise expert, OEH, DRE, Councils and the Community Consultative Committee.	YES	The Blast Management Plan was revised and submitted to the DoP on 16 July 2007. Approval from DoP was received on 17 July 2007.
<b>Blasting Impacts</b>			
31	Prior to the commencement of blasting, the Applicant shall undertake baseline structural surveys of all buildings and structures within 1.5 kilometres of blasting locations, unless it can be demonstrated to the satisfaction of the Director-General in consultation with DRE that surveys of certain properties are unnecessary because blasting damage is unlikely to occur to those properties. In conducting these structural surveys, the Applicant shall ensure that: (i) the surveys are carried out by a technically qualified person, as agreed in consultation with the Director-General and relevant landowners; and (ii) a copy of any inspection report (including video or photographs, if requested), certified by the person who undertook the inspection, is supplied to the relevant property owner within 14 days of receipt of same.	YES	Two consultants - Burke Engineering Services and Geoff Craig & Associates, were offered to building owners for the structural survey reports in 2000.  All the required surveys of residences had been conducted when blasting commenced at the mine site, except for buildings on the Steggles property (as per a commercial agreement with Steggles). The survey of ABAKK House at the western end of the property was carried out later when the Donaldson Mine operations progressed to the west.  Donaldson Coal corresponded with ABAKK Pty Ltd in 2007 in relation to three dwellings and infrastructure that would be within 1500m of the area of blasting at the Donaldson Mine and arranged for structural inspections.  A copy of the structural survey reports were provided to the property owners for each residence/structure.
32	In the event that a landowner or occupier considers that blast emissions from the development may have affected the material condition of their property, the landowner may make a written request to the Director-General for an independent dilapidation assessment. If the Director-General, in consultation with the DRE, is satisfied that an independent investigation is required, the Applicant shall ensure: (i) the survey is carried out by a technically qualified person, as agreed in consultation with the Director-General and the relevant landowners or occupiers; and (ii) a copy of any inspection report (including video or photographs, if requested), certified by the person who undertook the inspection, is supplied to the relevant property owner within 14 days of receipt of same.	Not activated	No requests for structural surveys have been received during this reporting period.
33	Where a dilapidation assessment concludes that structural damage has occurred as a result of blast emissions, the Applicant shall undertake immediate preventative and/or remedial measures at its expense.	YES	No dilapidation assessments have been requested during this reporting period.

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

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Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>Newcastle Herald's Printing Facilities at Holmwood Business Park</b>			
34	Prior to commencement of mining, the Applicant shall: (i) conduct ambient vibration monitoring adjacent to (on the floor) and if required, on the most vibration-sensitive component of the printing facilities in order to establish both the levels of ambient vibration generated by the operation of the Printing Facility itself and that of any other nearby vibration sources; (ii) provide a detailed report on the monitoring procedures and the monitoring results and findings to the Newcastle Herald upon completion of the survey; (iii) meet with Herald representatives to discuss the results of the survey and determine whether the initially agreed limit of 0.3 mm/s is appropriate; and (iv) design initial blasting for compliance with a peak particle velocity vibration criterion of 0.3 mm/s adjacent to or on the Printing Facility, unless a more appropriate limit is mutually agreed.	YES	Blast Vibration Assessment was conducted for the Newcastle Fairfax Printing facility in 2001. The report results established the ambient vibration levels at the site.  Discussions with Fairfax in 2001 resulted in an agreement that the vibration criteria be 3 mm/s ppv. Correspondence in relation to the 3mm/s ppv was received by Donaldson and DUAP advised of the change on 18 December 2001.
35	The Applicant shall monitor the impacts of blasting on the Printing Facility throughout the life of the mine, at a mutually agreed location in or adjacent to the Printing Facility during every blast. The Applicant shall provide results of the monitoring to the Newcastle Herald and provide a summary in the AEMR.	Not Applicable	No blasting occurred during the reporting period.
<b>Hunter Water Corporation Pipelines</b>			
36	The Applicant shall ensure that blasting is undertaken in a manner that protects the Hunter Water Corporation's pipeline to the satisfaction of the Hunter Water Corporation.	YES	Consultation with HWC resulted in agreement of a peak particle velocity of 100mm/sec at the pipeline.  Vibration monitoring has previously been conducted for each blast at monitors located along the pipeline corridor.  No blasting occurred during the reporting period.
<b>AIR QUALITY</b>			
<b>Air Quality Criteria</b>			
37	The Applicant shall take all practical steps to manage the mine's operations so that the ambient air quality goals for total suspended particles (TSP) of 90ug/m <sup>3</sup> (annual average) and the dust deposition goal of 4gm/m <sup>2</sup> (annual average) are not exceeded as a result of the development when monitored at any monitoring location specified in the Air Quality Management Plan.	YES	The air quality results reported for the Donaldson Mine are compliant with the criteria in MCoA 37.  The dust deposition criteria of 4gm/m <sup>2</sup> and the TSP goal of 90ug/m <sup>3</sup> have not been exceeded during this reporting period.
<b>Air Quality Management</b>			
38	The Applicant shall prepare and implement an Air Quality Management Plan, containing strategies to manage the mine's contribution to dust deposition, TSP, PM10 and PM2.5 to the satisfaction of the Director-General, prior to the commencement of construction. The Applicant shall make copies of the Air Quality Management Plan available to the independent expert (Condition 48), OEH, Councils and the Community Consultative Committee within 14 days of approval by the Director-General.	YES	The Air Quality Management Plan for the Donaldson Mine was finalised in November 2000 and presented to the CCC on 13 November 2000.



**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>Air Quality Management (Cont'd)</b>			
38 Cont'd			The Air Quality Management Plan was reviewed in 2007 by Holmes Air Services and no revision was required. A revised plan was prepared 3 June 2019 for care and maintenance and approved by the (then) DPE 4 June 2019. A copy is provided on the Company website and the CCC was notified of the revised plan.
39	The Air Quality Management Plan shall: (i) identify potential sources of dust deposition, TSP and fine particulates (PM10 and PM2.5) and specify appropriate monitoring intervals and locations. The purpose of the monitoring is to evaluate, assess and report on these emissions and the ambient impacts with the objective of understanding the mine's contribution to levels of dust deposition, TSP and fine particulates in ambient air around the mine site;	YES	The 2019 Air Quality Management Plan addresses potential sources of dust emissions and presents an appropriate monitoring program in Section 8.  The monitoring program was implemented and the results of the dust deposition, TSP and PM <sub>10</sub> recording are presented in Section 6 of the Annual Review.
	(ii) provide the mine's monitoring plan having regard to local meteorology and the relevant Australian Standards, identifying the methodologies to be used, including justification for monitoring intervals, weather conditions, seasonal variations, selecting locations, periods and times of measurements;	YES	The 2019 Air Quality Management Plan addresses the monitoring plan in Section 8.
	(iii) provide the design of any modelling or other studies, including the means for determining the contribution to dust deposition, TSP and fine particulates from the development;	YES	The 2019 Air Quality Management Plan addresses modelling and other studies in Section 10.
	(iv) provide details of dust suppression measures for all sources of dust from the development (including the haul road and the rail loading site);	YES	The 2019 Air Quality Management Plan addresses dust suppression measures in Section 7.2.
	(v) provide details of actions to ameliorate impacts if they exceed the relevant criteria; and	YES	The 2019 Air Quality Management Plan addresses amelioration and mitigation measures for dust control in Section 10.3.
	(vi) provide the design of the reactive management system intended to reduce the day-to-day impacts of dust and fine particulates due to the mine's operation.	YES	The 2019 Air Quality Management Plan addresses dust management procedures in Sections 7.2 and 10.3.
40	The Applicant shall ensure the prompt and effective rehabilitation of all disturbed areas as soon as practicable to minimise the generation of dust.	YES	Rehabilitation progressively occurred on disturbed land at the Donaldson Mine overburden and backfill areas to minimise generation of wind blown dust, with revegetation established using local indigenous species.

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>Air Quality Management (Cont'd)</b>			
41	The Applicant shall cease offending work at such times when the hourly average wind speed exceeds 5 metres per second and the operations are resulting in visible dust emissions blowing in a direction so as to cross onto public roads or lands not owned by the Applicant.	YES	The meteorological station installed at the Donaldson Mine site (and relocated to the Abel mine area in 2017) provides continuous reading of wind speed. Results are available instantly on computer. Wind speed above 5 m/s triggers a response to stop work at the mine site until wind conditions return to below 5 metres/sec. No earthmoving activities occurred during the reporting period.
42	The Applicant shall revise the Air Quality Management Plan as necessary and provide an updated Plan five years after commencement of mining and to the Director-General, independent air quality expert (Condition 48), OEH, Councils and the Community Consultative Committee.	YES	The Air Quality Management Plan and monitoring program was reviewed by Holmes Air Services in 2007 and it was concluded that the plan was adequate and did not require to be updated. A further review was undertaken in 2019 and the plan updated to reflect care and maintenance.
<b>Air Quality Monitoring</b>			
43	The Applicant shall install, maintain and continuously operate a meteorological station in accordance with the relevant Australian Standards and to the satisfaction of the OEH. The meteorological station shall be installed within six weeks of the date of this consent and remain for the life of the mine. The Applicant shall analyse and report the meteorological data on a monthly basis to adequately characterise the site, and shall use the data collected by the wind monitoring and recording station to determine when and how the mine operation is to be modified in accordance with the Air Quality Management Plan and the Conditions of this Consent.	YES	A meteorological station installed at the Donaldson Mine site since December 2000 and was relocated to the Abel mine area in 2017.  Meteorological data is collected continuously and analysed monthly.
44	The Applicant shall install, maintain and operate dust deposition gauges in accordance with the relevant Australian Standards and to the satisfaction of the OEH. The dust deposition gauges shall be installed and operational within six weeks of the date of this consent and the Applicant shall determine the dust deposition rate in grams/m <sup>2</sup> /month in each calendar month so that any increases in dust deposition rates can be presented in the AEMR.	YES	Nine (9) dust deposition gauges have been installed on the Donaldson Mine site, in accordance with Australian Standards.  Dust deposition is analysed monthly and the data is presented by CBased Environmental in a monthly report to Donaldson Coal.  Approval from the (then) DPE was granted on 4 June 2019 for the decommissioning of deposited dust monitoring gauges following this reporting period in accordance with the revised Air Quality Management Plan (2019).

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>Air Quality Monitoring (Cont'd)</b>			
45	<p>(1) The Applicant shall install, maintain and operate an air quality monitoring network in accordance with the relevant Australian Standards and to the satisfaction of the OEH. The network shall be installed and operational within six weeks of the date of this consent and in each calendar year the Applicant shall determine the concentrations of TSP in g/m<sup>3</sup> (annual average) and fine particulates (PM<sub>10</sub> and PM<sub>2.5</sub>) in g/m<sup>3</sup> (24 hour average and annual average) so that the contribution of the mine to regional ambient air quality can be presented in the AEMR.</p> <p>(2) The Applicant shall also participate in (and if appropriate contribute reasonable funds to) regional air quality studies conducted by or on behalf of the OEH or the Director-General.</p>	YES	<p>See MCoA 44 above.</p> <p>All air quality meteorological data is stored on the air quality database at the Donaldson Mine site.</p> <p>High Volume Air Samplers (HVAS) were previously installed at Bartter Enterprise site and Beresford Golf Course for collection of TSP and PM<sub>10</sub>. The revised Air Quality Management Plan, approved by the (then) DPE on 4 June 2019, replaces the previously installed HVAS and Dustrak monitors with a PM<sub>10</sub> E-Sampler.</p> <p>No approach has been made to Donaldson Mine in relation to regional air quality studies during this reporting period.</p>
<b>Air Quality Acquisition</b>			
46	If dust monitoring or independent dust investigations indicate that dust from operation of the mine at a dwelling is in excess of the criteria set out in this Consent and if appropriate dust control measures cannot be achieved on the mine site, the landowner may request the Applicant in writing to acquire the whole of the property or such part of the property requested by the landowner where subdivision is approved.	Not activated.	No such requests received.
47	Any such request shall be referred to the Director-General for determination. If the Director-General determines acquisition is necessary, the Applicant shall acquire the property in accordance with Conditions 54-55.	Not activated.	No such requests received.
<b>INDEPENDENT MONITORING OF NOISE, VIBRATION OR DUST</b>			
48	<p>The Applicant shall bear the reasonable costs of the appointment by the Director-General of an independent noise and air quality expert(s) and/or mediator to assist in the implementation of the Conditions of this Consent. The independent expert(s) shall:</p> <p>(i) receive and advise the Director-General on the Noise, Blast and Air Quality Management Plans;</p> <p>(ii) receive and advise the Director-General on noise and dust monitoring results;</p> <p>(iii) be responsible for, or supervise, the independent investigation of complaints; and</p> <p>(iv) advise the Director-General on the need for acquisition due to noise, vibration or dust.</p> <p>The independent expert(s) shall report directly to the Director-General and provide such advice as agreed by the Director-General to the Applicant and the landowner or occupier.</p>	Not activated	No independent experts have been required to be appointed.

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

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Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>INDEPENDENT MONITORING OF NOISE, VIBRATION OR DUST (Cont'd)</b>			
49	In the event that a landowner or occupier considers that noise, vibration and/or dust from the project at their property is in excess of the relevant criteria set out in this Consent the landowner may make a written request to the Applicant for an investigation. If the Director-General, on the advice of the independent expert, is satisfied that an investigation is required, the independent expert shall ensure that: (i) direct discussions are undertaken with the landowners or occupiers affected to determine their concerns and to plan and implement an investigation to quantify the impact and determine the sources of the effect; (ii) independent investigations are conducted to quantify the impact and determine the source of the effect; and (iii) a report is submitted to the Director-General, the Applicant and the landowner or occupier.	Not activated	No such requests received.
50	If exceedances are identified, within six weeks or as otherwise directed by the Director-General, the Applicant shall modify the mining activity which may be causing the impacts and/or enter into a negotiated agreement (Condition 23) with the affected landowner.	Not activated	As above.
51	The Applicant shall bear the cost of the independent investigations and make available plans, programs and other information necessary for the independent expert(s) to form an appreciation of the past, present and future works and their effects on noise, vibration and/or dust emissions.	Not activated	As above.
52	Investigations shall be carried out in accordance with a documented Plan. The Plan shall be designed and implemented to measure and/or compute (with appropriate calibration by measurement) the relevant noise, vibration and/or dust levels at the complainant's residence/property boundary emitted by the development.	Not activated	As above.
53	Further independent investigations shall cease if the Director-General, in consultation with the independent expert, is satisfied that the relevant approval levels are not being exceeded and are unlikely to be exceeded in the future.	Not activated	As above.
<b>ACQUISITION PROCEDURE</b>			
54	Upon determination of the Director-General in relation to the purchase of a property in accordance with any Conditions of this Consent, the Applicant shall negotiate and purchase the whole of the property (unless the request specifically requests acquisition of only part of the property and subdivision has already been approved) within six months of receipt of notification from the Director-General. The Applicant shall pay the landowners an acquisition price resulting from proper consideration of: (i) a sum not less than the current market value of the owner's interest in the land, whosoever is the occupier, having regard to:	Not activated	As above.

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>ACQUISITION PROCEDURE (Cont'd)</b>			
54 Cont'd	<p>(a) the existing use and permissible use of the land in accordance with the applicable planning instruments at the date of the written request;</p> <p>(b) the presence of improvements on the land and/or any Council approved building or structure which although substantially commenced at the date of the request is completed subsequent to that date; and</p> <p>(c) as if the land was unaffected by the development proposal.</p> <p>(ii) the owner's reasonable compensation for disturbance allowance and relocation within the Lower Hunter Region;</p> <p>(iii) the owner's reasonable costs for obtaining legal advice and expert witnesses for the purposes of determining the acquisition price for the land and the terms upon which it is to be acquired; and</p> <p>(iv) the purchase price determined by reference to points (i), (ii) and (iii) shall be reduced by the amount of any compensation awarded to a landowner pursuant to the Mining Act, 1992 or other legislation providing for compensation in relation to coal mining but limited to compensation for dwellings, structures and other fixed improvements on the land, unless otherwise determined by the Director-General in consultation with the DRE.</p>		
55	Notwithstanding any other Condition of this Consent, the Applicant may, upon request of the landowner, acquire any property affected by the project during the course of this Consent on terms agreed to between the Applicant and the landowner.	Not activated	As above.
<b>INDEPENDENT VALUATION</b>			
56	In the event that the Applicant and the landowner cannot agree within three months upon the acquisition price of the land and/or the terms upon which it is to be acquired under the terms of this Consent, then either party may refer the matter to the Director-General who shall request an independent valuation to determine the acquisition price. The independent valuer shall consider any submissions from the landowner and the Applicant in determining the acquisition price.	Not activated	As above.
57	<p>If the independent valuer requires guidance on any contentious legal, planning or other issues, the independent valuer shall refer the matter to the Director-General, who, if satisfied that there is a need for a qualified panel, shall arrange for the constitution of the panel. The panel shall consist of:</p> <p>(i) the appointed independent valuer;</p> <p>(ii) the Director-General; and/or</p> <p>(iii) the President of the Law Society of NSW or nominee.</p> <p>The qualified panel shall, on the advice of the valuer, determine the issue referred to it and advise the valuer.</p>	Not activated	As above.
58	The Applicant shall bear the costs of any independent valuation or survey assessment requested by the Director-General.	Not activated	As above.

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>INDEPENDENT VALUATION (Cont'd)</b>			
59	The Applicant shall, within 14 days of receipt of a valuation by the independent valuer, offer in writing to acquire the relevant land at a price not less than the said valuation.	Not activated	As above.
<b>WATER</b>			
<b>Water Management</b>			
60	The Applicant shall prepare and implement a Water Management Plan in consultation with NOW, Councils, OEH and the Hunter Catchment Management Trust, and to the satisfaction of the Director-General, prior to the commencement of construction. The Applicant shall make copies of the Water Management Plan available to the OEH, NOW, DRE, Councils, the Hunter Catchment Management Trust and the Community Consultative Committee within 14 days of approval by the Director-General.	YES	The Water Management Plan 2000 was developed in consultation with the EPA, DLWC, Councils, Hunter Catchment Management Trust and to the satisfaction of the Director-General, prior to the commencement of construction.  The Water Management Plan was reviewed in 2005 and a revision of the Plan occurred in 2008. The Water Management plan was again revised in 2019.
61	The Water Management Plan shall include but not be limited to:	YES	(i) The Water Management Plan addresses the management of impacts of the development on the quality and quantity of surface and ground water in Sections 3 and 5.
	(i) management of the impacts of the development on the quality and quantity of surface and groundwater, including water in dirty water dams and clean water diversion dams;		(ii) The Water Management Plan addresses the management of impacts of the development on the quality and quantity of surface and ground water in Sections 3, 4 and 5.
	(ii) stormwater and general surface runoff diversion to ensure separate effective management of clean and dirty water;		(iii) The Water Management Plan addresses the stormwater management issues, in Sections 3 and 5.
	(iii) stormwater management facilities designed to at least a 1:10 year storm design criteria;		(iv) The Water Management Plan addresses possible adverse effects of the development on water supply sources, in Sections 3 and 5.
	(iv) identification of any possible adverse effects on water supply sources (both surface and groundwater) of landowners or occupiers from the development, and implementation of mitigation measures as necessary;		(v) The Water Management Plan addresses the quality of groundwater zones within the DA area, in Sections 4 and 5.
	(v) identification of the fresh quality groundwater zones within the DA area and appropriate protection strategies;		(vi) The Water Management Plan addresses the management of impacts on the quality and quantity of groundwater within 2km of the DA area, in Sections 4 and 5.
	(vi) management of the impacts of the development on the quality and quantity of groundwater within 2 kilometres of the boundary of the DA area, with particular attention to mobilisation of salts and contingency plans for managing any adverse impacts;		(vii) The Water Management Plan addresses the management of impacts on the quality and quantity of surface water discharged, including scheduling of mining operations to minimise the area excised from the catchment draining to Woodberry Swamp at any one time;
	(vii) management of the impacts of the development on the quality and quantity of surface water discharged, including scheduling of mining operations to minimise the area excised from the catchment draining to Woodberry Swamp at any one time;		(viii) The Water Management Plan addresses the buffer zone and protection Four Mile Creek in Sections 3 and 5.
	(viii) identification of a defined buffer zone between the mine pit and Four Mile Creek and measures to minimise the risk of blast-induced fractures in the buffer zone to prevent saline seepage from the rehabilitated landform toward Four Mile Creek in the post-mining period;		

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

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Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>Water Management (Cont'd)</b>			
61 Cont'd	(ix) procedures for the maintenance of drainage systems and water management structures; and	YES	(ix) The Water Management Plan addresses the procedures for maintenance of drainage systems and water management structures in Sections 3 and 5.
	(x) development of a strategy for the decommissioning of water management structures, including dirty water dams and clean water diversion dams, and long term management of the final void.		(x) The Water Management Plan addresses the strategy for decommissioning of the water management structures in Sections 3, 4 and 5.
62	The Applicant shall revise the Water Management Plan as necessary and provide an updated Plan five years after commencement of mining to the Director-General, OEH, NOW, DRE, Councils, the Hunter Catchment Management Trust and the Community Consultative Committee.	YES	The Water Management Plan was reviewed in 2005 and Tasman Mine requirements included. The Plan was further revised in 2008 to include the Abel Mine water management and again revised in 2019 to cover the care and maintenance period for the Abel Underground Mine.
<b>Water Monitoring</b>			
63	The Applicant shall prepare and implement a detailed monitoring program for groundwater and surface water in consultation with DP&I, OEH, DRE, and the Hunter-Central Rivers Catchment Management Authority, throughout the life of the mine and for a period of at least 5 years after the completion of mining, or other such period as determined by the D_G. The results of the monitoring shall be included in the AEMR (Conditions 114-116). The monitoring program shall contain: (i) details of proposed monitoring sites, frequency and parameters to be tested; (ii) pre-mining baseline data;	YES	(i) Water Quality Management Plan section 3.6 and 4.2. (ii) Water Quality Management Plan section 3.6 and 4.1. (iii) Water Quality Management Plan section 3.6. (iv) Biological monitoring, including monitoring locations located upstream and downstream in the three creeks using SIGNAL and AUSRIVAS assessment criteria, was undertaken between 2000 and 2019. Biological monitoring ceased in 2019 in accordance with the revised Water Management Plan (2019). (v) Macro-invertebrate surveys included bank and bed stability. (vi) Continuous metering of water transfer volumes between the Donaldson and Bloomfield operations occurs. (vii) Whilst four (4) monitoring bores were previously destroyed as part of the mining operations, a review of the groundwater monitoring network by Dundon Consulting Pty Ltd concluded that the existing network is adequate with no changes considered necessary.
	(iii) monitoring of surface water quality to detect any changes in ambient water quality between the mine site and the wetlands; (iv) monitoring of macroinvertebrates and vegetation in accordance with the protocols developed by the Hunter SIGNAL biological assessment criteria, with an assessment of inflows to the wetlands; (v) monitoring of stream bank and bed stability; (vi) monitoring of the volume and quality of water transfer between the Donaldson and Bloomfield operations; and (vii) a program for replacement of any monitoring bores destroyed by the development.		
64	Prior to 31 October 2005, the Applicant shall revise, and then implement any necessary changes in the monitoring program for groundwater and surface water to the satisfaction of the Director-General.	YES	The Water Management Plan was revised in 2005 under the Notification of Modification condition with comments received from DLWC and DoP and response from Peter Dundon & Associates.

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>Water Supply</b>			
65	On request of a landowner whose water supply from licensed bore holes or springs has been determined by NOW at any time to have been affected by the project, the Applicant shall replace lost water supply with water of an equivalent quality and quantity to meet the landowner's requirements, to the satisfaction of NOW.	Not activated	No such request received.
<b>EROSION AND SEDIMENT CONTROL</b>			
66	The Applicant shall prepare and implement an Erosion & Sediment Control Plan for the development (including the haul road and the relocation of utilities and services) to the satisfaction of NOW and submit the Plan to the OEH as part of applications for a licence under the Protection of the Environment Operations Act. The Plan shall be prepared prior to the commencement of work in the relevant areas. The Applicant shall make copies of all Erosion & Sediment Control Plan available to Director-General, Councils and the Community Consultative Committee within 14 days of approval.	YES	Erosion and Sediment Control Plan was submitted to the EPA on 4 May 2000 as part of the application for Environment Protection Licence No. 11080.  A review of the Erosion and Sediment Control Management Plan was conducted in 2005 following the DPI-MR inspection in May 2005, and the Plan revised.
67	The Erosion and Sediment Control Plan(s) shall include consideration and management of erosion and sedimentation of watercourses and water bodies, including Woodberry Swamp.	YES	The Erosion and Sediment Control Plan addresses the management of erosion and sedimentation of watercourses and water-bodies on the Donaldson Mine site, in Sections 4.  Control of erosion and monitoring of water quality of watercourses and water bodies on the mine site and to the boundaries of the Donaldson property, results in management of impact from the mine on downstream habitats (e.g. Woodberry Swamp).  Monitoring also previously included assessment of bank and bed stability as part of the macroinvertebrate survey reports.
<b>FLORA AND FAUNA</b>			
<b>Tetratheca Juncea Conservation Area</b>			
68	Prior to the commencement of construction, the Applicant shall: (i) undertake a survey of potential Tetratheca Juncea habitat in the southwest portion of the site. The survey shall: (a) be undertaken by a suitably qualified botanist, with the assistance of a suitably qualified surveyor, both approved by the Director-General; (b) re-examine the outcomes of previous surveys; (c) be undertaken between the months of August and December (inclusive); (d) record the location of Tetratheca Juncea clumps on the ground using suitable tags and by using either theodolite and electronic measuring equipment or differential GPS;	YES	(i) Figures 1 and 4 of the Tetratheca Juncea Management Plan show the Southwest Conservation Area. (a) a T. Juncea survey of the Conservation Area was undertaken by Gunninah Environmental Consultants and the aerial survey of the area was conducted by a qualified surveyor. (b) The results of previous T. Juncea surveys were assessed and collated with the current data for the preparation of the maps and T. Juncea Management Plan. (d) T. Juncea clumps have been located using GPS and surveyed onto the site maps in the T. Juncea Management Plan.



**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>FLORA AND FAUNA (Cont'd)</b>			
<b>Tetratheca Juncea Conservation Area (Cont'd)</b>			
68 Cont'd	(e) investigate the occurrence of any native sonicating bee habitat within 500 metres of the Tetratheca Juncea population; and  (ii) establish a Conservation Area for the Tetratheca Juncea based on the findings of the survey. The Conservation Area shall include a 50 metre buffer. The boundaries of the Conservation Area shall be surveyed and marked by a suitably qualified surveyor, with the assistance of a botanist, using either a theodolite and electronic measuring equipment or differential GPS. No clearing, construction or mining shall commence until the boundary of the Conservation Area has been approved by the Director-General.	YES	e) Bee habitat is discussed in Section 5.2.2 of the T. Juncea Management Plan. (ii) The southwest Conservation Area has been established with a 50 metre buffer to the closest area that may become part of the mine operations (see Figure 1 from the Flora and Fauna Management Plan). The area is pegged but not fenced.
69	The Applicant shall prepare a Management Plan for the Tetratheca Juncea Conservation Area in consultation with OEH and to the satisfaction of the Director-General, prior to commencement of construction. The Plan shall be consistent with the Flora and Fauna Management Plan (Conditions 76-79); and include measures for fire management. The Applicant shall clearly mark the boundary of the Conservation Area and make provision for signage which specify that no dumping, clearing or other works are permitted in the Conservation Area. Such signage shall be replaced as required. The Applicant shall make copies of the Tetratheca Juncea Management Plan available to OEH, Councils and the Community Consultative Committee within 14 days of approval by the Director-General.	YES	NPWS provided correspondence advising they were satisfied with the T Juncea Management Plan in November 2000. The property boundary of the Conservation Area is fenced along John Renshaw Drive and the T.Juncea areas are pegged but not fenced or signed. (The presence of a fence or signage around the specific areas of T.Juncea would highlight their location and result in unwanted attention and possibly vandalism to the area). The current status of the Conservation Area indicates that there is no intrusion of work areas or other disturbance to the T.Juncea locations.  A biologist monitors the T.Juncea areas to keep records of the status of growth and flowering.
70	Within six months of this Consent, or as otherwise agreed by the Director-General, the Applicant shall identify a bushland area(s) in the region that will adequately compensate for the impact of the mine on biodiversity, provide compensatory habitat and be managed for the primary purposes of conservation. The area shall be identified in consultation with OEH and Councils and be to the satisfaction of the Director-General. Identification of the bushland area(s) shall include: (i) a detailed assessment of the current characteristics and ecological values of existing ecosystems affected by the mine, including the habitat of threatened species identified in the EIS as possibly occurring in the area and the Spotted Gum Ironbark community; (ii) identification of conservation objectives to be achieved by the establishment of the bushland area(s), with reference to the Regional Biodiversity Strategy and the principles of Ecologically Sustainable Development;	YES	(i) A detailed assessment of the current flora and fauna and habitat values of the mine site was conducted by Barker Harle in 2001.  (ii) The Bushland Area Management Plan was prepared and submitted to the Director-General in 2005 for approval. The Plan included identification of conservation objectives.  (iii) NPWS provided Donaldson Mine with a number of compensatory bushland areas to consider in 2001. Donaldson assessed inclusion of land around the mining lease, and have established the Conservation Area for bushland protection, within the mine lease area.

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>Tetratheca Juncea Conservation Area (Cont'd)</b>			
70 Cont'd	(iii) consideration of alternative locations within the region, including, but not limited to, the land proposed as compensatory area in the EIS (i.e. land adjoining the mine site); (iv) a detailed assessment of appropriate boundaries, size and shape of the bushland area(s), in relation to the characteristics, values and objectives; (v) consideration of appropriate management options necessary to protect the conservation values; and (vi) consideration of opportunities to incorporate cultural heritage conservation into the bushland area(s).		
<b>BUSHLAND AREA</b>			
71	In identifying the bushland area(s), the following broad criteria shall be applied: (i) a ratio of 2:1 in terms of compensatory area to the area to be directly impacted by mining and associated infrastructure; (ii) the vegetation communities and habitat values of the bushland area(s) are to be broadly representative of the area which will be subject to mining and contain a similar suite of fauna species; (iii) the location of the bushland area(s) will aim to consolidate existing reserves in the lower Hunter Area; and (iv) reserve design criteria, including edge-to-area ratio, size and connectivity shall be taken into account.	YES	(i) The Donaldson owned property around the mine area has been retained as a buffer and compensatory conservation area.  (ii) The compensatory area of bushland is adjacent to and surrounds the mining area and is representative of the vegetation communities and habitat present on the disturbed areas.  (iii) The compensatory area around the Donaldson Mine is contiguous with the Ironbark-Spotted Gum vegetative corridors in the Maitland area.
72	Upon approval of the identified bushland area(s) by the Director-General, the Applicant shall: (i) secure care, control and management of the bushland area(s) prior to the commencement of mining; (ii) retain management and ownership of the land for a minimum of 36 years from the commencement of construction, unless other arrangements are agreed in accordance with Condition 73; and (iii) prepare and implement a Management Plan for that area in consultation with OEH and to the satisfaction of the Director-General, during the period in which the Applicant is responsible for management. The Management Plan shall be consistent with the Flora and Fauna Management Plan (Conditions 76-79) and consider the integration of cultural conservation objectives and management. The Applicant shall make copies of the Management Plan available to OEH and the Community Consultative Committee within 14 days of approval by the Director-General. For the purposes of the Conditions of this Consent, the bushland area(s) approved by the Director-General shall be known as the Bushland Conservation Area until the completion of the period referred to in Condition 72(ii) and any Conditions relating to Conservation Areas shall apply to that area during that period. The Management Plan referred to in Condition 72(iii) shall be referred to as the Bushland Conservation Area Management Plan.	YES	(i) The bushland area around the mine operations is owned by Donaldson Mine and managed as part of the overall land management strategies.  (ii) See above. Management will continue until 2036.  (iii) The Bushland Conservation Area Management Plan was developed in consultation with the NWPS and the Plan submitted to the Director-General on 31 October 2005. (Refer to MCoA 74).

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>BUSHLAND AREA (Cont'd)</b>			
73	The Applicant shall undertake negotiations with the OEH and Councils to reach agreement on the long term tenure and management status of the Bushland Conservation Area. These negotiations must commence within six months of commencement of construction.	YES	<p>Donaldson Coal provided information on the management of the proposed bushland conservation area to NPWS in May 2001 and undertook consultation and negotiations with the authorities. A Draft Plan of Management for the Bushland Conservation Area was presented to the D-G in February 2005 and the Plan revised and submitted to the D-G in October 2005.</p> <p>Studies by DEC during 2006 in preparation for the Draft Lower Hunter Conservation Plan (LHCP), which was to be released together with the final LHRS, identified parts of the Donaldson land for conservation reserve and bio-banking investment (NAPS Map). The identified conservation land does not align exactly with the Donaldson Bushland Conservation Area.</p> <p>Donaldson, along with other Lower Hunter major landowners, was formally requested by DEC to consider dedication of lands for conservation in the reserve system prior to announcement of the final LHRS and Draft LHCP.</p> <p>Donaldson presented a formal proposal to DEC in late 2006, and discussions with B&amp;CD are continuing for a major portion of the Donaldson land to be dedicated as conservation reserve or nominated as Bio-banking investment area. The likely outcome of the intensive investigations described above is that some 400-500 hectares of the Donaldson land may be placed in permanent conservation (via either the reserve system or bio-banking) and the remainder of the land will be zoned consistent with the final LHRS (yet to be finalised).</p>
74	Prior to 31 October 2005, the Applicant shall revise the Bushland Conservation Area Management Plan to compensate for the extension of the disturbance area in the vicinity of Weakleys Flat Creek, to the satisfaction of the Director-General, and provide an updated Plan to the OEH, Councils and the Community Consultative Committee.	YES	The Bushland Conservation Area Management Plan was prepared and revised following consultation with the NPWS/OEH.

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

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Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>BUSHLAND AREA (Cont'd)</b>			
74A	By 30 September 2011, the Applicant shall revise the Bushland Conservation Area Management Plan to the satisfaction of the Director-General. The revised plan must:  (i) be prepared in consultation with OEH; and (ii) include the 3 hectares of land removed from the approved mining area, as detailed in the letter from Donaldson Coal Pty Limited to the Minister for Planning dated 25 March 2011.	Yes	The Bushland Conservation Area Management Plan was prepared, submitted to OEH 22 September 2011 and revised following consultation with the NPWS/OEH. The map of the bushland conservation area was updated to compensate for the extension of the disturbance area in the vicinity of Weakleys Flat Creek.
<b>Flora and Fauna Management</b>			
75	The Applicant shall bear the reasonable costs of the appointment by the Director-General of an independent flora and fauna expert(s) to assist in the implementation of the Conditions of this Consent. The independent expert(s) shall:  (i) be selected in consultation with the applicant; (ii) assess and advise the Director-General on the Applicant's proposed Conservation Areas and Management Plans for those areas; (iii) assess and advise the Director-General on the Applicant's proposed bushland area(s); (iv) assess and advise the Director-General on the Applicant's proposed Flora and Fauna Management and the Rehabilitation Plan; and (v) assess and advise the Director-General on the Applicant's monitoring of flora and fauna management and rehabilitation.	Planning NSW - condition of approval	Robert Payne was commissioned as an independent flora and fauna expert by Director-General to assess and advise on the flora and fauna management for the Donaldson Mine proposed conservation areas and flora and fauna management plans.
76	The Applicant shall prepare and implement a Flora and Fauna Management Plan for the mine site (in addition to the management plans for specific Conservation Areas), in consultation with NOW, OEH and Councils, and to the satisfaction of the Director-General, prior to the commencement of construction. The Applicant shall make copies of the Flora and Fauna Management Plan available to NOW, OEH, Councils and the Community Consultative Committee within 14 days of approval by the Director-General.	YES	The Flora and Fauna Management Plan was prepared and approved by DUAP in December 2000. The Flora and Fauna Management Plan was implemented for the Donaldson Mine site and the Plan reviewed in 2007 and 2019.  The flora and fauna monitoring programs have been conducted and results summarised in the AEMR's / Annual Reviews.
77	The Flora and Fauna Management Plan shall include but not be limited to:  (i) additional surveys to more precisely identify the distribution of known and potential nest and roost trees for owl species. The surveys shall:  (a) be undertaken by a person experienced in the identification of owl nest and roost trees, approved by the Director-General; and (b) record the location of known and potential nest and roost trees on the ground by marking the tree and by using either theodolite and electronic measuring equipment or differential GPS;  (c) a vegetation map delineating major vegetation communities, topographic features and the location of threatened species habitats, including potential and known owl nest and roost trees;	YES	(i)(a) Additional surveys of owl habitat were conducted by Rod Kavanagh on the Donaldson Mine site during Sept - Oct 2000.  (ii) Figure 4-1 and 4-3 in the Flora and Fauna Management Plan present vegetation communities and locations of threatened species habitats on the Donaldson Mine site.

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>Flora and Fauna Management (Cont'd)</b>			
77 Cont'd	<p>(ii) details of measures to manage the impacts of the development, including:</p> <p>(a) restoration of degraded areas;</p> <p>(b) management of invasive weeds and feral animals;</p> <p>(c) establish an appropriate hazard reduction regime in keeping with the ecological values of the area;</p> <p>(d) revegetation and provision of compensatory areas of equivalent ecological and habitat value where necessary; and</p> <p>(e) strategies to provide increased security for existing habitats and communities;</p> <p>iii) details of measures to manage the impacts of environmental management on flora and fauna, including the impact of erosion and sediment control measures and hazard reduction burning;</p> <p>(v) priorities for action and a timetable for all works outlined in the Plan; and</p> <p>(vi) a program to monitor flora and fauna impacts on undisturbed portions of the mining lease area and downstream environments (such as the Woodberry Swamp). The program shall extend for the life of the mine and for a period thereafter as approved by the Director-General, and include:</p> <p>(a) justification for monitoring intervals and locations;</p> <p>(b) monitoring of the presence and persistence of native flora and fauna species over time, particularly threatened species; and</p> <p>(c) monitoring the effectiveness of management measures.</p>	YES	<p>(iii)(a) Degraded area restoration procedures are presented in the Rehabilitation Plan Dec 2000 section 4.3.7.</p> <p>(iii)(b) Weed management and feral animal control are presented in the Rehabilitation Plan sections 5.2 and 5.3.</p> <p>(iii)(c) Hazard reduction addressed in the Rehabilitation Plan Section 5.4, and the Bushfire Management Plan.</p> <p>(iii)(d) See comments on MCoA 71 to 74.</p> <p>(iii)(e) Protection strategies for existing habitats and communities include pre-clearing surveys of all areas to be disturbed, fenced perimeter of the mine lease area, and the Flora and Fauna Management Plan section 4.</p> <p>(v) The priorities for action in relation to protection of flora and fauna are outlined in section 7 of the 2019 Flora and Fauna Management Plan.</p> <p>(vi) Section 5 of the 2019 Flora and Fauna Management Plan describes the proposed monitoring programs.</p> <p>A detailed survey and reporting of the flora and fauna on the Donaldson Mine site was conducted during Sept and Oct 2001 by Barker Harle. The quadrants used for the surveys were recorded and the report provides a detailed quantitative description of the flora and fauna species present within the boundaries of the Donaldson property. As the Donaldson property has no boundary with the Woodberry Swamp the surveys did not extend to the Woodberry Swamp. There are a large number of developments downstream of Donaldson that have the potential to affect the environment of the swamp. The surveys to the boundary of the Donaldson property will specifically identify potential impacts from the mine activities.</p>

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

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Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>Flora and Fauna Management (Cont'd)</b>			
78	The Flora and Fauna Management Plan shall also include a Rehabilitation Plan that details the measures to be undertaken to progressively rehabilitate disturbed areas of the mine to replicate the original vegetation cover that existed before mining occurred. The Applicant shall be responsible for the management and monitoring of the rehabilitated mine site until such time as the Director-General agrees that restoration has been successful.	YES	The Rehabilitation Management Plan was updated in 2019 and is presented as Appendix 1 in the 2019 Flora and Fauna Management Plan and as a separate document on the Company website.
78A	By 31 October 2011, the Applicant shall revise the Rehabilitation Plan to the satisfaction of the Director-General. The revised plan must: (i) be prepared in consultation with DRE; (ii) include: <ul style="list-style-type: none"> <li>• the rehabilitation objectives for the site;</li> <li>• a strategic description of how the rehabilitation of the site would be integrated with surrounding land uses;</li> <li>• a general description of the short and long term measures that would be implemented to rehabilitate the site, including; <ul style="list-style-type: none"> <li>– managing remnant vegetation and habitat on site;</li> <li>– minimising impacts on fauna;</li> <li>– minimising visual impacts;</li> <li>– conserving and reusing topsoil;</li> <li>– controlling weeds, feral pests, and access; and</li> <li>– managing bushfires;</li> </ul> </li> <li>• detailed performance and completion criteria for the rehabilitation of the site;</li> <li>• a detailed description of how the performance of the rehabilitation works would be monitored over time to achieve the stated objectives and against the relevant performance and completion criteria; and</li> <li>• details of who is responsible for monitoring, reviewing and implementing the plan.</li> </ul>	Yes	The Rehabilitation Plan is also addressed as part of the current MOP (period ending 1 May 2021) for the Donaldson Mine and was prepared in consultation with the (then) DRE and includes: <ul style="list-style-type: none"> <li>• Section 5.2 Domain Rehabilitation Objectives for the site;</li> <li>• Section 5 Rehabilitation Planning and Management provides a strategic description of integration of the rehabilitation of the site with surrounding land uses;</li> <li>• Section 7 Rehabilitation Implementation describes the short and long term measures to be implemented to rehabilitate the site;</li> <li>• performance and completion criteria for rehabilitation;</li> <li>• Section 8 Rehabilitation Monitoring addresses monitoring performance of the rehabilitation works over time to achieve stated objectives and against performance and completion criteria; and</li> <li>• responsibilities for monitoring, reviewing and implementing the plan.</li> </ul>
79	The Applicant shall revise the Flora and Fauna Management Plan as necessary and provide an updated Plan five years after commencement of mining to the Director-General, OEH, Councils and the Community Consultative Committee.	YES	The Flora and Fauna Management Plan was reviewed by Ecobiological in March 2007 and a Revised Flora and Fauna Management Plan submitted to DoP on 17 July 2007. DoP approved the revised Plan on 25 July 2007. A further revision to reflect care and maintenance was prepared on 3 June 2019 and approved by the (then) DPE 4 June 2019.

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

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Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>Flora and Fauna Management (Cont'd)</b>			
80	The Applicant shall participate in (and if appropriate, contribute such reasonable funds as determined by the Director-General in consultation with OEH) research into the Powerful Owl and Masked Owl habitat requirements in the region, and the habitat requirements and lifecycle of <i>Tetratheca Juncea</i> .	YES	Donaldson Mine supported projects by the University of Newcastle with financial and technical help for: Deborah Landenberger - 2 year Honours project 'Defining the Niche of <i>T. Juncea</i> '; and Adam Blundell with Rod Kavanagh during 2002-2003 for 'Comparing Ecology of Powerful Owl in Disturbed and Undisturbed Environments'. Both these projects have been completed.
<b>HERITAGE</b>			
<b>Heritage Statutory Requirements</b>			
81	Prior to commencement of construction, the Applicant shall: (i) comply with the statutory requirements of OEH in relation to works affecting Aboriginal sites; and (ii) undertake a targeted archaeological survey of the slopes component within the mining impact area in cooperation with the Aboriginal community. Any Aboriginal sites located will be recorded, the significance of the sites assessed, and management strategies for the sites identified.	YES	Management of the Aboriginal heritage sites occurs in accordance with the Aboriginal Sites Management Plan and the status of management is reported in the AEMR / Annual Review.
82	If, during the course of construction, the Applicant becomes aware of any heritage or archaeological material, all work likely to affect the material shall cease immediately and the relevant authorities consulted about an appropriate course of action prior to recommencement of work. The relevant authorities may include OEH, the Heritage Office, and the Local Aboriginal Land Councils. Any necessary permits or consents shall be obtained and complied with prior to recommencement of work.	YES	Section 90 Consents to Destroy under the <i>National Parks and Wildlife Act 1979</i> , were obtained for Aboriginal artefact areas DMS1 on 22 April 2000 and ISF1 and ISF2 on 3 May 2000. No further Section 90 Consents have been required since that time.
<b>Aboriginal Heritage Management</b>			
83	Prior to commencement of construction, the Applicant shall establish an Aboriginal Conservation Area along Four Mile Creek and tributaries in accordance with a plan approved by the Director-General. The plan shall include: (i) identification of an appropriate boundary and the basis on which the boundary has been selected; (ii) a map at a scale of 1:1000 or larger which clearly delineates the Conservation Area boundary and specific features; and (iii) documentation of consultations with OEH and Aboriginal community groups in relation to the definition of the Conservation Area.	YES	(i) A 50 metre buffer along Four Mile Creek as an Aboriginal Conservation Area (ACA) has been established by Donaldson Coal.  The ACA boundary is shown in Figure 2.3 of the Aboriginal Sites Management Plan. ii) Maps of the Four Mile Creek Conservation Area and other Conservation Areas (1:1000 scale) have been prepared by Donaldson Coal for the Donaldson Mine area.  (iii) Consultation with the Mindaribba Aboriginal Local Land Council was held during the preparation of the Aboriginal Sites Management Plan. NPWS consultation and correspondence was available on file.

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

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Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>Aboriginal Heritage Management (Cont'd)</b>			
84	The Applicant shall prepare and implement an Aboriginal Sites Management Plan in consultation with the Aboriginal community, Councils and OEH, and to the satisfaction of the Director-General, prior to the commencement of construction. The Applicant shall make copies of the Aboriginal Sites Management Plan available to the Director-General, Aboriginal community, Councils and the Community Consultative Committee within 14 days of approval by OEH.	YES	An Aboriginal Sites Management Plan was prepared prior to commencement of mining operations in 2000, with Supplementary Plans prepared for Years 2 to 5 of the operations. The Aboriginal Sites Management Plan has been submitted to the relevant authorities within 14 days of approval by the NPWS. The Aboriginal Sites Management Plan has not required revision since 2005.
85	The Management Plan shall include, but not be limited to: (i) documentation of consultation with the relevant Aboriginal community groups to identify any outstanding concerns they may have with the project and a clear statement about how these concerns will be addressed, including any action to be taken; (ii) identification of conservation objectives for the site as a whole and for the Conservation Area specifically; (iii) a program to monitor the impacts of the development on the Conservation Area, including justification for monitoring locations and intervals; (iv) strategies to achieve conservation objectives, including an access policy; (v) the provision of fencing to permit faunal movement and the removal of fencing within six months of completion of mining; (vi) further investigations; and (vii) long term management requirements upon completion of mining.	YES	(i) Consultation with the Mindaribba Aboriginal Local Land Council is addressed in the Plan with relevant correspondence attached in Appendix 1 of the Plan. (ii) Conservation objectives are addressed in Section 1.3 of the Aboriginal Sites Management Plan. (iii) Monitoring of the Conservation Area is outlined in Section 2.1 and 3 of the Aboriginal Sites Management Plan. The location of the monitoring datum points are illustrated in Figure 2.4 of the Plan. (iv) Strategies to achieve the conservation objectives are outlined in Section 2 of the Aboriginal Sites Management Plan. (v) The boundary of the Mining lease area and the Donaldson owned land is fenced. (vi) The mining lease area was re-surveyed for Year 2 to 5 of the mining operations. Ongoing monitoring and surveys will occur prior to disturbance of any new areas required for mining.
86	The Applicant shall revise the Aboriginal Sites Management Plan as necessary and provide an updated Plan five years after commencement of mining to the Director-General, OEH, Councils and the Community Consultative Committee.	YES	The Aboriginal Sites Management Plan was subjected to annual review until 2005 and amendments to the Plan made by Umwelt as required. The Plan has not required revision since 2005.



**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

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Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>WASTE</b>			
87	The Applicant shall prepare and implement a Waste Management Plan in consultation with OEH, DRE and the Hunter Waste Planning and Management Board, and to the satisfaction of the Director-General, prior to commencement of construction. The Applicant shall make copies of the Waste Management Plan available to Councils and the Community Consultative Committee within 14 days of approval by the Director-General.	YES	The Waste Management Plan was prepared prior to commencement of construction of the mine. The Plan was submitted to DUAP and approved on 10 October 2000.  Copies of the Waste Management Plan were distributed to the Councils and the CCC, within 14 days of approval by the Director-General.
88	The Waste Management Plan shall include, but not be limited to the management of the mine site to prevent dumping of waste; and the management and treatment of Potentially Acid Forming waste.	YES	Management of waste streams including overburden, coarse rejects material and fine reject material is included in Section 7 of the Waste Management Plan.  The management and treatment of potential acid forming (PAF) material is addressed in the geotechnical report and there is ongoing assessment of PAF material to ensure application of best practice management options.
89	The Applicant shall meet the requirements of Councils, OEH and Hunter Water Corporation with respect to water and sewer.	YES	Potable water for use on the mine site is supplied from the Hunter Water Corporation.  There is no discharge to sewer from the site operations. All ablutions are connected to onsite biocycle systems.
<b>VISUAL AMENITY</b>			
<b>Landscaping</b>			
90	The Applicant shall provide a minimum of 50 metres of landscaping between the outer edge of the bund wall and the edge of John Renshaw Drive. The 50 metres may include landscaping within the road verge if agreed by Cessnock Council.	YES	The Landscape Management Plan has been implemented with revegetation of the 50m strip along the power-line easement between John Renshaw Drive and the earthen bund on the edge of the high-wall of the open cut.
91	The Applicant shall, within three months of the date of this Consent, or within such further period as Councils may require, submit for the Councils' approval a detailed Landscaping Plan covering all land within the proposed mining area (including the haul road and transmission line easements) and road reserve along the frontage to John Renshaw Drive. The Applicant shall engage a suitably qualified person to assist in the landscaping plan.	YES	The Landscape Management Plan was reviewed and revised in March 2008 by GSS Environmental. The 2008 Landscape Management Plan is an integrated plan for all the Donaldson Coal projects (i.e. the Donaldson Mine, Tasman Mine and Abel Mine). The 2008 Plan has the Rehabilitation Management Plan, Final Void Management Plan and Integrated Mine Closure Plan appended to provide an overall strategy for the mines.

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

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Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>VISUAL AMENITY (Cont'd)</b>			
<b>Landscaping (Cont'd)</b>			
92	The Landscaping Plan shall be consistent with the Environmental Management Strategy and include: (i) provision for the establishment of trees and shrubs and the construction of mounding or bunding along the planned highwall and any other areas identified as necessary by the Councils for the maintenance of satisfactory visual amenity and the re-establishment of flora and fauna habitats and corridors; (ii) appropriate erosion control and sediment control practices for earthworks associated with the landscaping; (iii) details of the visual appearance of all buildings, structures, facilities or works (including paint colours and specifications). Buildings and structures shall be designed and constructed so as to present a neat and orderly appearance and to blend as far as possible with the surrounding landscape; and (iv) details, specifications and staged work programs to be undertaken, including a maintenance program of all landscape works, building materials and cladding.	YES	The Landscape Management Plan 2000 addresses the establishment of trees and shrubs for visual amenity and re-establishment of flora and fauna corridors in Section 4.3. The Landscape Management Plan 2000 addresses erosion and sediment control in Section 4.3 and refers to the Erosion and Sediment Management Plan. The Landscape Management Plan 2000 addresses the visual appearance of buildings, structures, facilities and works in Section 4.0. The Landscape Management Plan 2000 addresses the staged work programs for maintenance program of all landscape works, building materials and cladding in Section 4.2
93	The Applicant shall implement the approved Plan in accordance with Councils' requirements and make copies available to the Community Consultative Committee within 14 days of approval by Councils.	YES	Copies of the Landscape Management Plan 2000 were provided to the CCC following approval by the Councils 9 March 2000.  The revised Landscape Management Plan was submitted to the CCC in 2008.
94	The Applicant shall plant screening vegetation on properties at higher elevation and with views across the mine site in the Black Hill area if requested in writing by the landowner, within three months of that request. The species, density and location of the plantings shall be determined in consultation with the landowner.	Not activated	No such requests received.
95	The Applicant shall lodge a landscaping bond with Cessnock Council, to a maximum of \$10,000 at any one time, for landscaping during the life of mine. This bond does not affect rehabilitation works covered by the <i>Mining Act</i> .	No Longer Applicable	Landscaping bond of \$10,000 was lodged with the Cessnock City Council on 19 April 2007. This bond was previously refunded due to the satisfactory completion of the works.
<b>Lighting</b>			
96	The Applicant shall screen or direct all onsite lighting and vehicle lights away from residences and roadways to the satisfaction of Councils. All screening to be completed prior to commissioning of the coal preparation plant and associated facilities.	YES	Lighting from the mine activities has not given rise to complaints. No lighting is used on high points at night and no light scatter occurs to roadways or residential areas from the Donaldson Mine operations.

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>HAZARDS, RISKS AND SAFETY</b>			
97	The Applicant shall: (i) provide adequate fire protection works on site. This shall include one fully equipped fire fighting unit on standby and hazard reduction works at a time determined by the relevant Council, with particular attention to boundaries of adjoining land holdings;	YES	(i) Meetings have been held between Donaldson Mine and the Cessnock City Council / Thornton Fire Rural Fire Brigade/ Benwerrin Rural Fire Brigade in relation to access to the mine site in case of fire.
	(ii) submit an annual report on fire management activities to the local Bush Fire Management Committee; and	YES	(ii) A Bushfire Management Plan for the areas owned by Donaldson Coal was prepared in 2004 and submitted to the Rural Fire Service for review. Following a site inspection the RFS provided comments and the Plan was updated and finalised. A report on controlled burn-off at the Donaldson site was forwarded to the RFS for inclusion in the Bush Fire Management Committee folder in Oct 2005. Hazard burning is conducted on the Donaldson Mine site and reported to the Bushfire Management Committee by the RFS. Mechanical works along the southern and eastern sections of the Avalon Estate at Thornton is also carried out annually by Donaldson and reported to RFS. An inspection of the Donaldson Mine site with the RFS is conducted at least annually.
	(iii) ensure that all dangerous goods and materials stored on site are stored in accordance with the relevant Australian standards.	YES	Fuels and lubricants are no longer stored within the Donaldson Open Cut Coal Mine area.
<b>UTILITIES AND SERVICES</b>			
98	The Applicant shall consult with affected service authorities and make arrangements satisfactory to those authorities for the protection or relocation of utilities and services (such as transmission lines and pipelines) at the Applicant's expense, prior to any existing utilities or services being affected by mining activity. Relocation of utilities and services shall be conducted in accordance with the relevant Management Plans and the Erosion and Sediment Control Plan(s).	YES	The Energy Australia 11kV power-line was relocated along an easement adjacent to the John Renshaw Drive boundary of the mine lease, in 2002.  Part of the Hunter Water Corporation water pipeline was relocated for the progression of the Donaldson Mine, in accordance with the MOP.  Telstra lines off the new intersection on John Renshaw Drive were relocated in 2006.

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

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Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
99	Prior to commencement of construction, or as otherwise agreed by the Councils, the Applicant shall design, construct and seal the private haul road and access road to the satisfaction of the Councils, and with consideration of the impact on the fragmentation of fauna habitat and fauna movement.	YES	The internal haul road was constructed from Donaldson Mine to Bloomfield CPP and Coal Loader in 2001. Cessnock City Council advised it did not require to approve the road construction as it was an internal haul road.  The Flora and Fauna Management Plan included pre-clearing protocol, road design and general measures covering erosion and sediment control, removal of weeds and rubbish, and incident reporting that were applied to the construction of the road.
100	No coal shall be hauled on public roads.	YES	No coal is transported on public roads.
<b>TRANSPORT AND ACCESS</b>			
101	The Applicant shall carry out intersection improvements as determined necessary by the Regional Traffic Committee as a result of the development and by such times as directed by the Regional Traffic Committee.	YES	A Development Application was submitted to the Cessnock City Council for the John Renshaw Drive intersection in November 2001.  The Hunter Regional Traffic Committee considered the DA and recommended a number of changes, and the plan was amended and re-submitted to the Council. The Council re-exhibited the DA and granted consent in July 2003.  The intersection from John Renshaw Drive to the Donaldson Mine access road was completed in accordance with the consent.
102	If closure of John Renshaw Drive is agreed by the Regional Traffic Committee under Condition 25(4), the Applicant shall: (i) pay \$20,000 to Cessnock City Council to upgrade the alignment and surface of the unsealed western end of Black Hill Road; (ii) provide a water cart and apply water to the unsealed western end of Black Hill Road to the requirements of Cessnock City Council prior to each closure of John Renshaw Drive for blasting; and (iii) prepare a Traffic Management Plan for the approval of the RTA in relating to the closure of John Renshaw Drive during blasting.	YES	The \$20,000 contribution was provided to the Cessnock City Council in November 2004 for the upgrade of the western end of Black Hill Road. The improvements to Black Hill Road were completed by Cessnock City Council.  The improvement of the Black Hill Road intersection with a John Renshaw Drive turning lane, was constructed during 2010 as part of the Abel Underground approval.  Donaldson received a Road Occupancy Licence for the closure of John Renshaw Drive during blasting.

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>INITIAL COAL WASHING (Cont'd)</b>			
103	The Applicant shall provide for signalling of the Bloomfield rail loop to the satisfaction of Freight Corp prior to the commencement of mining.	YES	Freightcorp correspondence provided options for implementation of safe working procedures for the rail loop to satisfy MCoA 103.  Bloomfield upgraded the rail system alarm signals on the Entry road to the mines, from the old key system. The management of trains on the loop has been upgraded with implementation of safe work practices.
<b>INITIAL COAL WASHING</b>			
104	Upon commencement of coal extraction, the Applicant shall initially make use of the coal preparation plant (CPP) at the adjoining Bloomfield coal mine for up to two years from commencement of mining or such other period as approved by the Director-General. This will allow the Applicant to: (i) trial the washing of Donaldson coal to assist in the determination of its washing characteristics; and (ii) commence the earliest possible coal extraction at Donaldson, and hence hasten project completion.	YES	Approval for the ongoing use of the Bloomfield CPP is now in place under the Abel Mine consent with an extended agreement between Bloomfield Coal and Donaldson Coal.
105	The haulage route for raw coal from the Donaldson pit to the Bloomfield CPP shall be the same as that proposed for haulage of product coal from the proposed Donaldson CPP to the existing Bloomfield rail loading facility up to the point of intersection with the Bloomfield Mine access road, and thence westward along the Bloomfield Mine access road to the CPP, unless otherwise agreed to with the owners of Bloomfield. However, any variation to the route shall be considered to determine whether a modification to this Consent is required to enable the variation.	YES	Donaldson Coal constructed an internal sealed haul road to transport ROM coal to the Bloomfield CPP, the road alignment crossing Four Mile Creek.
106	The Applicant shall notify the Director-General within eighteen months of the commencement of mining as to the results of the Bloomfield washery trials.	YES	See comment on MCoA 104.
<b>COMMUNITY INVOLVEMENT</b>			
<b>Community Consultative Committee</b>			
107	The Applicant shall establish a Community Consultative Committee which shall be chaired by an independent chairperson approved by the Director-General. Selection of representatives shall be agreed by the Director-General and include (unless otherwise agreed by the Director-General) two representatives from the Applicant (including the Environmental Officer), four community representatives (including a representative of the local Aboriginal Community) and representatives of the local Councils. Representatives from relevant government agencies (including DUAP) may be invited to attend meetings of the Committee as required.	YES	The CCC was established on 30 May 2000 and meetings have been held regularly during operations. As the mine has ceased operations and been rehabilitated, no further meetings are currently planned.

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

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Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>COMMUNITY INVOLVEMENT (Cont'd)</b>			
<b>Community Consultative Committee (Cont'd)</b>			
108	The Committee may make comments and recommendations about the implementation of the development. The Applicant shall ensure that the Committee has access to the necessary plans and/or studies for such purposes. The Applicant shall consider the recommendations and comments of the Committee and provide a response to the Committee and the Director-General.	YES	Management Plans have previously been provided to the CCC for comment and information. Discussion of management plans occurred at the CCC meetings.
109	The Applicant shall, at its own expense: (i) provide appropriate facilities for meetings of the Committee;	YES	CCC Meetings were previously held at Donaldson Mine offices. Donaldson arranged and provided the required material and administrative backup for the meetings.
	(ii) nominate a representative to attend all meetings of the Committee;	YES	Donaldson Coal nominated representative to attend all meetings is the Environmental Manager- Phillip Brown.
	(iii) ensure that the first meeting is held prior to commencement of construction, that meetings are held at least every six months for the first 24 months from the date of the mining lease and at least annually thereafter;	YES	The first meeting of the CCC was held on 30 May 2000 prior to commencement of construction and subsequent meetings were held on a regular basis. The meetings were arranged by the Independent Chairperson as required.
	(iv) provide to the Committee regular information on the progress of the work and monitoring results;	YES	Reports on project status, monitoring results and AEMR's/Annual Reviews and complaints are provided to the CCC and published on the Company website.
	(v) promptly provide to the Committee such other information as the Chairperson of the Committee may reasonably request concerning the environmental performance of the development; and	YES	Material is provided to the CCC as and when requested as detailed in the CCC Minutes.
	(vi) provide reasonable access for site inspections by the Committee.	YES	Site inspections by members of the CCC to view the mine and rehabilitation areas, following CCC Meetings.
110	The Applicant shall establish a trust fund to be managed by the Chairperson of the Committee to facilitate functioning of the Committee, and pay \$2000 per annum to the fund for the duration of mining operations. The payment shall be indexed according to the Consumer Price Index (CPI) at the time of payment. The first payment shall be made by the date of the first Committee meeting.	YES	A trust fund for the functioning of the CCC was established in May 2000 and has been managed by the Independent Chairperson. Donaldson Coal provides all the requirements for the CCC Meetings with any additional funding reported to be provided upon request by the Chairperson.

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>COMMUNITY INVOLVEMENT (Cont'd)</b>			
<b>Community Information</b>			
111	The Applicant shall, in consultation with Councils, ensure that the local community is kept informed of the progress of the project, including prior notice of: (i) the nature of works proposed for the forthcoming period; (ii) hours of construction; (iii) a 24 hour contact telephone number; (iv) any traffic disruptions and controls; (v) proposed blasting program, and any changes to the program; (vi) work required outside the normal working hours; (vii) individuals' rights under the Conditions of this Consent (such as the rights for acquisition or independent monitoring) and mechanisms proposed to be used to safeguard the community and individual properties against adverse impacts from the development.	YES	Since June 2003, community information has been made available on the Donaldson website.
112	By 30 September 2011, the Applicant shall: (i) make copies of the following publicly available on its website: <ul style="list-style-type: none"> <li>all relevant statutory approvals for the development;</li> <li>all approved strategies, plans and programs required under the conditions of this consent;</li> <li>monitoring results, reported in accordance with the specifications in any approved plans or programs required under the conditions of this consent or any other approval;</li> <li>a complaints register, which is to be updated on a monthly basis;</li> <li>minutes of CCC meetings;</li> <li>the Annual Environmental Management Reports required under condition 114;</li> <li>any independent environmental audit of the development, and the Applicant's response to the recommendations in any audit;</li> <li>any other matter required by the Director-General; and</li> </ul> (ii) keep this information up-to-date, to the satisfaction of the Director-General.	YES	Donaldson website has been established and information on the CCC, monitoring and company status and activities is available on the site, including Minutes of the CCC Meetings, AEMR's / Annual Reviews and any project Newsletters.
<b>Complaints</b>			
113	(1) The Applicant shall record details of all complaints received and ensure that a response is provided to the complainant within 24 hours. (2) If the Applicant's response does not address the complaint to the satisfaction of the complainant within six weeks, the Applicant shall refer the matter to an independent mediator (approved by the Director-General) and bear the costs of such mediation. The Applicant shall immediately carry out such works as agreed through the mediation process. (3) The Applicant shall make available a 3 monthly report on complaints to the Community Consultative Committee and to relevant government agencies and the Councils upon request; and include a summary in the AEMR. The report shall include the complaints that have been resolved with or without mediation.	YES	(1) The Complaints Register is on a database held at the Donaldson Mine office and maintained by the Environment Manager. (2) This requirement of the condition had not been activated at the time of the audit. (3) A Complaints Report was prepared and presented to the CCC at each meeting. A summary of complaints/actions/status is presented in the AEMR's / Annual Reviews.

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>ANNUAL ENVIRONMENTAL MANAGEMENT REPORT</b>			
114	<p>The Applicant shall prepare and submit an Annual Environmental Management Report (AEMR) throughout the life of the mine to the satisfaction of the Director-General. The AEMR shall review the performance of the mine against the Environmental Management Strategy and the Conditions of this Consent, and other licences and approvals relating to the mine. To enable ready comparison with the EIS's predictions, diagrams and tables, the report shall include, but not be limited to, the following matters:</p> <p>(i) an annual compliance audit of the performance of the project against Conditions of this Consent and statutory approvals;</p> <p>(ii) a review of the effectiveness of the environmental management of the mine in terms of OEH, NOW, DRE, and the Councils' requirements and provide an explanation of any variance;</p> <p>(iii) results of all environmental monitoring required under this Consent or other approvals, including interpretations and discussion by a suitably qualified person;</p> <p>(iv) identification of trends in monitoring results over the life of the mine;</p> <p>(v) a comparison of the actual impacts with predictions made in the EIS and supporting documents;</p> <p>(vi) a review of the social impact of the mine, including mitigation works and acquisition;</p> <p>(vii) a listing of any variations obtained to approvals applicable to the subject area during the previous year;</p> <p>(viii) the outcome of the water budget for the year, the quantity of water used from water storages and details of discharge of any water from the site;</p> <p>(ix) rehabilitation report; and</p> <p>(x) environmental management targets and strategies for the next year, taking into account identified trends in monitoring results.</p>	YES	<p>The AEMR's / Annual Review have been prepared in accordance with the relevant guidelines and submitted to the DPIE and Resources Regulator.</p>
		YES	<p>(i) Compliance Audit conducted by Donaldson Mine in August 2001. Compliance with the conditions of consent is commented on in each AEMR / Annual Review.</p> <p>(ii) Commented on throughout the Annual Review.</p> <p>(iii) Environmental monitoring data included in the Annual Review in the relevant sections.</p> <p>(iv) Trends in monitoring data are presented under each specific heading in Sections 6 &amp; 7 of the Annual Review.</p> <p>(v) Comparison with the EIS predictions for the development are provided in each AEMR / Annual Review taking account of the approved MOP.</p> <p>(vi) No acquisition requests have been made to the time of this audit. Mitigation measures are part of the normal mine operation.</p> <p>(vii) Approval status is summarised in Section 3 of the Annual Review</p> <p>viii) No discharge has occurred from the mine site during the 2007 to 2020 period. Water management is reported in Section 7 of the Annual Review.</p> <p>(ix) Rehabilitation progress is reported in Section 8 of the Annual Review.</p> <p>(x) Targets and strategies for the next 12 months are reported in Section 12 of the Annual Review.</p>
115	<p>In preparing the AEMR, the Applicant shall:</p> <p>(i) consult with the Director-General during preparation of each report for any additional requirements;</p> <p>(ii) comply with any requirements of the Director-General or other relevant government agency and with any guidelines current at the time of reporting; and</p> <p>(iii) ensure that the first report is completed and submitted within 12 months of this Consent, or at a date determined by the Director-General in consultation with the DRE and the OEH.</p>	YES	<p>Actions / requirements raised by DPIE and Resources Regulator from previous Annual Review have been summarised and addressed within this Annual Review (Section 5).</p>



**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>ANNUAL ENVIRONMENTAL MANAGEMENT REPORT (Cont'd)</b>			
116	The Applicant shall ensure that copies of each AEMR are submitted at the same time to DP&I, OEH, NOW, Councils and the Community Consultative Committee, and made available for public information at Councils within 14 days of submission to these authorities.	YES	Copies of the previous AEMR's / Annual Reviews prepared for the Donaldson Mine have been submitted to the authorities following receipt of acceptance of the document by the (then) DII (or DPI-MR) and the Director-General.  The AEMR's / Annual Reviews are made publicly available on the Company website.
<b>INDEPENDENT ENVIRONMENTAL AUDIT</b>			
117	At 3 yearly intervals after the commencement of mining and at the completion of mining, unless the Director-General directs otherwise, the Applicant shall commission and pay the full cost of an Independent Environmental Audit of the development.	YES	An Independent Environmental Audit was conducted in March 2015 by Trevor Brown & Associates to fulfil the requirements of MCoA 117. The (then) DPE confirmed via email on 31 October 2018 that no further audits are required unless otherwise directed by the Secretary.
	This audit must: (i) be conducted by a suitably qualified, experienced and independent person whose appointment has been endorsed by the Director-General; (ii) be consistent with <i>ISO 19011:2002 – Guideline for Quality and/or Environmental Systems Auditing</i> , or equivalent updated versions of these guidelines; (iii) assess the environmental performance of the development, and its effects on the surrounding environment; (iv) assess whether the development is complying with the relevant standards, performance measures and statutory requirements; (v) review the adequacy of the Applicant's Environmental Management Strategy and Environmental Monitoring Program; (vi) and if necessary, recommend measures or actions to improve the environmental performance of the development, and/or the environmental management and monitoring systems.	YES	The March 2015 audit was conducted by Trevor Brown of Trevor Brown & Associates Applied Environmental Management Consultants. The conduct of the 2015 audit was consistent with the requirements of ISO19011. The environmental performance of the development was reviewed and comments are provided in Section 4 of the audit report. The development demonstrated a high degree of compliance with the standards, performance measures and statutory requirements relevant to the development (v) Comment on the Environmental Management Strategy and Environmental Monitoring Program are provided in Sections 4.1 and 4.2 of the audit report
118	The audit shall: (i) assess compliance with the requirements of this Consent, licences and approvals; (ii) review the effectiveness of the environmental management of the mine, and any mitigation works; (iii) be carried out at the Applicant's expense; and (iv) be conducted by a duly qualified independent person or team approved by the Director-General in consultation with the Councils.	YES	An Independent Environmental Audit was conducted in March 2015 by Trevor Brown & Associates to fulfil the requirements of MCoA 117 and 118.
119	The Director-General may, after assessing compliance in accordance with this Consent and after considering any submission made by the OEH, NOW, DRE, the Councils or the Community Consultative Committee on the report, notify the Applicant of any reasonable requirements for compliance with this Consent. The Applicant shall comply with those requirements within such time as the Director-General may require.	Noted	

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

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Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>COMPLIANCE</b>			
120	The Applicant shall comply with all requirements of the Director-General in respect of the implementation of any measures arising from the Conditions of this Consent. The Applicant shall bring to the attention of the Director-General any matter that may require further investigation and the issuing of instructions from the Director-General. The Applicant shall ensure that these instructions are implemented to the satisfaction of the Director-General within such time that the Director-General may specify. If necessary, the Director-General may order the Applicant to cease work until non-compliance has been addressed to her satisfaction.	Noted	
121	The Applicant shall submit for the approval of the Director-General compliance reports concerning the implementation of Conditions of this Consent as applicable: (i) before the commencement of construction works; and (ii) before the commencement of mining.	YES	Compliance Reports were prepared and submitted to DUAP for construction of the Donaldson Mine on 20 October 2000, and a Compliance Report was submitted to DUAP prior to commencement of mining works on 17 January 2001.
<b>Y2K COMPLIANCE</b>			
122	One month prior to the commencement of operation of any automated system, included embedded systems used for operation, pollution control, monitoring and safety (including fire safety), the Applicant shall provide the Director-General with a report confirming that the system(s) has been tested in accordance with the most recent edition of BSI/DISC PD2000-1 to confirm continuous time and date functionality of that system.	YES	The Donaldson Mine commenced after 1 January 2000. Systems installed and operated for the Donaldson Mine are Y2K compliant.
<b>DISPUTE RESOLUTION</b>			
123	In the event that the Applicant and an individual, the Councils or a Government agency, other than DP&I, cannot agree on the specification or requirements applicable under this Consent, the matter shall be referred by either party to the Director-General or if not resolved within six months, to the Minister for Planning and Infrastructure, whose determination of the disagreement shall be final and binding on the parties.	Noted	The development consent was accepted by the parties and construction and commencement of mining occurred after 1 January 2000.

**Table A3.1 (Cont'd)**  
**Donaldson Development Approval – Compliance Review**

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Cond. No.	Minister's Conditions of Consent (MCoA)	Compliance	Comments/Notes
<b>OTHER ISSUES</b>			
124	The Applicant shall participate in (including a financial contribution if appropriate, to a maximum of \$10,000) the preparation of a revised Planning Strategy for the Thornton-Beresfield area. Any such financial contribution shall be paid as directed by the Director-General and any amounts not expended in the review upon completion of mining shall be refunded to the Applicant.	Not activated	<p>The Thornton-Beresford Area has been incorporated into the Lower Hunter Area and a Planning Strategy as an employment generating area with a transport internodal hub proposed for the area.</p> <p>Donaldson has participated in meetings associated with the Thornton-Killingworth study, Lower Hunter Regional Strategy and Lower Hunter Conservation Plan.</p> <p>Donaldson also made some financial contributions including analysis and participation in the planning of a Newcastle rail by-pass line through the Stony Pinch site.</p> <p>The Lower Hunter Regional Strategy and Conservation Plan is not yet finalised, but Donaldson Coal continues to be involved in discussions with the authorities on the Strategy and Plan.</p>
125	The Applicant shall provide reasonable funding to Councils for independent counselling services for any landowner within 1.5 kilometres of the mining lease area who may request support on stress-related matters resulting from the development.	Not Activated	No requests have been made for the activation of this condition.
126	Within six months of the date of this Consent and in each AEMR thereafter, the Applicant shall report to the Director-General on the number of personnel employed by the mine in construction, mining and environmental management during that reporting period. The report shall compare the employment figures with those predicted in the EIS.	YES	As the mine is now on care and maintenance there are a total of eight full-time equivalent positions on site.

**Table A3.2  
Mining Lease 1461 – Compliance Review**

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Cond. No.	Requirement	Compliance	Comments/Notes
<b>EXTRACTION OF COAL</b>			
1	The lease holder shall extract as large a percentage of the coal in the subject area as is practicable consistent with the provisions of the Coal Mines Regulations Act 1982 and the Regulations thereunder and shall comply with any direction given or which may be given in this regard by the Minister.	YES	Coal recovery was maximised during operations. No further economic coals approved for extraction. No mining occurred during this reporting period.
<b>MINING, REHABILITATION, ENVIRONMENTAL MANAGEMENT PROCESS (MREMP)</b>			
<b>MINING OPERATIONS PLAN (MOP)</b>			
2 (1)	Mining operations, including mining purposes, must be conducted in accordance with a Mining Operations Plan (the Plan) satisfactory to the Director-General. The Plan together with environmental conditions of development consent and other approvals will form the basis for: a) ongoing mining operations and environmental management; and b) ongoing monitoring of the project.	YES	Operations have been undertaken in accordance with the MOP for Closure for the period ending 16 May 2021 as approved by DRE 16 May 2014 and 30 September 2020 (as amended).
2(2)	The Plan must be prepared in accordance with the Director-General's guidelines current at the time of lodgement.	YES	The MOP was prepared in accordance with <i>ESG3: Mining Operations Plan (MOP) Guidelines (September 2013)</i>
2(3)	A Plan must be lodged with the Director-General: a) prior to the commencement of operations; b) subsequently as appropriate prior to the expiry of any current Plan; and c) in accordance with any direction issued by the Director-General.	YES	The current MOP was submitted prior to the expiry of the previous MOP.
2(4)	The Plan must present a schedule of proposed mine development for a period of up to seven (7) years and contain diagrams and documentation which identify:- a) area(s) proposed to be disturbed under the Plan; b) mining and rehabilitation method(s) to be used and their sequence; c) areas to be used for disposal of tailings/waste; d) existing and proposed surface infrastructure; e) progressive rehabilitation schedules; f) areas of particular environmental sensitivity; g) water management systems (including erosion and sediment controls); h) proposed resource recovery; and i) where the mine will cease extraction during the term of the Plan, a closure plan including final rehabilitation objectives/methods and post mining land use/vegetation	YES	The MOP addresses these issues as relevant to the closure activities.
2(5)	The Plan when lodged will be reviewed by the Department of Mineral Resources.	YES	The MOP was reviewed and approved by DRE 16 May 2014. The amended MOP (Amendment B) was reviewed by the Resources Regulator and approved on 30 September 2020.
2(6)	The Director-General may within two (2) months of the lodgement of a Plan, require modification and re lodgement.	Not Applicable	No request for modification was received.
2(7)	If a requirement in accordance with clause (6) is not issued within two months of the lodgement of a Plan, the lease holder may proceed with implementation of the Plan submitted subject to the lodgement of the required security deposit within the specified time.	Not Applicable	The MOP was processed as required.

**Table A3.2 (Cont'd)**  
**Mining Lease 1461 – Compliance Review**

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Cond. No.	Requirement	Compliance	Comments/Notes
<b>MINING OPERATIONS PLAN (MOP) (Cont'd)</b>			
2(8)	During the life of the Mining Operations Plan, proposed modifications to the Plan must be lodged with the Director-General and will be subject to the review process outlined in (5) - (7) above.	YES	Amendment A prepared November 2014 to account for changes in use of the West and Square Pits. Amendment B was reviewed by the Resources Regulator and approved on 30 September 2020.
<b>ANNUAL ENVIRONMENTAL MANAGEMENT REPORT (AEMR)</b>			
3(1)	Within 12 months of the commencement of mining operations and thereafter annually or, at such other times as may be allowed by the Director-General, the lease holder must lodge an Annual Environmental Management Report (AEMR) with the Director-General.	YES	The Annual Review for this reporting period was lodged within the required timeframes.
3(2)	The AEMR must be prepared in accordance with the Director-General's guidelines current at the time of reporting and contain are view and forecast of performance for the preceding and ensuing twelve months in terms of: - a) the accepted Mining Operations Plan b) development consent requirements and conditions; c) Environment Protection Authority and Department of Land and Water Conservation licences and approvals; d) any other statutory environmental requirements; e) details of any variations to environmental approvals applicable to the lease area. and f) where relevant, progress towards final rehabilitation objectives.	YES	This Annual Review was prepared in accordance with the current guidelines.
3(3)	After considering an AEMR the Director-General may, by notice in writing, direct the lease holder to undertake operations, remedial actions or supplementary studies in the manner and within the period specified in the notice to ensure that operations on the lease area are conducted in accordance with sound mining and environmental practice.	YES	Remedial actions were request following submission of the previous 2017/2018 AEMR. The requested actions were required to be addressed by 31 August 2020. The requested actions were addressed through the preparation and submission of the amended MOP, Closure Strategy for the West and Square Pits, and the Donaldson Coal Mine Review of Mine Water Storage Quality.
3(4)	The lease holder shall, as and when directed by the Minister, co-operate with the Director-General to conduct and facilitate review of the AEMR involving other government agencies.	Not Applicable	No request received during the reporting period.
<b>SHAFTS, DRIFTS, ADITS</b>			
3(4)	The lease holder shall, as and when directed by the Minister, co-operate with the Director-General to conduct and facilitate review of the AEMR involving other government agencies.	Not Applicable	No request received during the reporting period.

**Table A3.2 (Cont'd)**  
**Mining Lease 1461 – Compliance Review**

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Cond. No.	Requirement	Compliance	Comments/Notes
<b>SHAFTS, DRIFTS, ADITS (Cont'd)</b>			
3(4)	The lease holder shall, as and when directed by the Minister, co-operate with the Director-General to conduct and facilitate review of the AEMR involving other government agencies.	Not Applicable	No request received during the reporting period.
<b>SHAFTS, DRIFTS, ADITS</b>			
14	Operations shall be conducted in such a manner as not to cause any danger to persons or stock and the lease holder shall provide and maintain adequate protection to the satisfaction of the Minister around each shaft or excavation opened up or used by the lease holder.	YES	Retained pits have been appropriately fenced and bunded.
<b>DUMPS</b>			
15	The lease holder shall comply with any direction, given or which may be given by the Inspector regarding the dumping, depositing or removal of material extracted as well as the stabilisation and revegetation of any dumps of coal, minerals, mine residues, tailings or overburden situated on the subject area or the associated colliery holding.	Not Yet Applicable	A Section 240 Notice / direction was received 11 July 2019 with actions required to be completed prior to 31 August 2020. The requested actions were addressed through the preparation and submission of the amended MOP, Closure Strategy for the West and Square Pits and the Donaldson Coal Mine Review of Mine Water Storage Quality. Consultation with the Resources regulator regarding the implementation of recommendations is ongoing.
16	The lease holder shall comply with any direction given or which may be given by the Minister regarding the spraying of coal dumps on the subject area.	Not Applicable	No such direction received during the reporting period.
<b>DUST</b>			
17	The lease holder shall take such precautions as are necessary to abate any dust nuisance.	YES	Dust management measures were considered effective during the reporting period.
<b>MANAGEMENT AND REHABILITATION OF LANDS (GENERAL)</b>			
18	The lease holder shall not interfere in any way with any fences on or adjacent to the subject area unless with the prior written approval of the owner thereof or the Minister and subject to such conditions as the Minister may stipulate.	YES	The Company did not interfere with any such fences during the reporting period.
19	The lease holder shall observe any instruction given or which may be given by the Minister with a view to minimising or preventing public inconvenience or damage to public or private property.	Not Applicable	No instruction given during the reporting period.
20	If required to do so by the Minister and within such time as may be stipulated by the Minister the lease holder shall carry out the satisfaction of the Minister surveys of structures, buildings and pipelines on adjacent landholdings to determine the effect of operations on any such structures, buildings and pipelines.	Not Applicable	No instruction given during the reporting period.

**Table A3.2 (Cont'd)**  
**Mining Lease 1461 – Compliance Review**

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Cond. No.	Requirement	Compliance	Comments/Notes
<b>MANAGEMENT AND REHABILITATION OF LANDS (GENERAL)</b>			
18	The lease holder shall not interfere in any way with any fences on or adjacent to the subject area unless with the prior written approval of the owner thereof or the Minister and subject to such conditions as the Minister may stipulate.	YES	The Company did not interfere with any such fences during the reporting period.
19	The lease holder shall observe any instruction given or which may be given by the Minister with a view to minimising or preventing public inconvenience or damage to public or private property.	Not Applicable	No instruction given during the reporting period.
20	If required to do so by the Minister and within such time as may be stipulated by the Minister the lease holder shall carry out the satisfaction of the Minister surveys of structures, buildings and pipelines on adjacent landholdings to determine the effect of operations on any such structures, buildings and pipelines.	Not Applicable	No instruction given during the reporting period.
21	If so directed by the Minister the lease holder shall rehabilitate to the satisfaction of the Minister any lands within the subject area which may have been disturbed by the lease holder.	Not Yet Applicable	A Section 240 Notice / direction was received 11 July 2019 with actions required to be completed prior to 31 August 2020. The requested actions were addressed through the preparation and submission of the amended MOP, Closure Strategy for the West and Square Pits and the Donaldson Coal Mine Review of Mine Water Storage Quality. Consultation with the Resources regulator regarding the implementation of recommendations is ongoing.
22	Upon completion of operations on the surface of the subject area or upon the expiry or sooner determination of this authority or any renewal thereof, the lease holder shall remove from such surface such buildings, machinery, plant, equipment, constructions and works as may be directed by the Minister and such surface shall be rehabilitated and left in a clean, tidy and safe condition to the satisfaction of the Minister.	YES	All buildings, structures, plant etc. not potentially required for future operations have been removed. All areas of disturbance not potentially required for future operations have been rehabilitated.
23	If so directed by the Minister the lease holder shall rehabilitate to the satisfaction of the Minister and within such time as may be allowed by the Minister, any lands within the subject area which may have been disturbed by mining or prospecting operations whether such operations were or were not carried out by the lease holder.	Not Yet Applicable	A Section 240 Notice / direction was received 11 July 2019 with actions required to be completed prior to 31 August 2020. The requested actions were addressed through the preparation and submission of the amended MOP, Closure Strategy for the West and Square Pits and the Donaldson Coal Mine Review of Mine Water Storage Quality . Consultation with the Resources regulator regarding the implementation of recommendations is ongoing.

**Table A3.2 (Cont'd)**  
**Mining Lease 1461 – Compliance Review**

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Cond. No.	Requirement	Compliance	Comments/Notes
<b>MANAGEMENT AND REHABILITATION OF LANDS (GENERAL)</b>			
24	The lease holder shall take all precautions against causing outbreak of fire on the subject area.	YES	Measures were implemented as appropriate to the activities undertaken.
25	The lease holder shall provide and maintain to the satisfaction of the Minister efficient means to prevent contamination, pollution, degradation, erosion or siltation of any river, stream, creek, tributary, lake, dam, reservoir, watercourse, groundwater or catchment area or any undue interference to fish or their environment and shall observe any instruction given or which may be given by the Minister with a view to preventing or minimising the contamination, pollution, degradation, erosion or siltation of any river, stream, creek, tributary, lake, dam, reservoir, watercourse, groundwater or catchment area or any undue interference to fish or their environment.	Not Yet Applicable	A Section 240 Notice / direction was received 11 July 2019 with actions required to be completed prior to 31 August 2020. The requested actions were addressed through the preparation and submission of the amended MOP, Closure Strategy for the West and Square Pits and the Donaldson Coal Mine Review of Mine Water Storage Quality. Consultation with the Resources regulator regarding the implementation of recommendations is ongoing..
<b>BLASTING</b>			
26	The lease holder shall carry out all blasting in accordance with the conditions of the Development Consent, File No N97/00147, given on 14/10/99. All noise, vibration and institute controls shall be generally in accordance with the recommendations of Australian Standard AS-2187-1993 and ANZEC Guidelines.	Not Applicable	No blasting occurred during the reporting period.
	a) Ground Vibration The lease holder shall design all blasts on the basis that the ground vibration peak particle velocity generated by any blasting with in the subject area, shall not exceed the levels in or conditions of the EPA Licence for the mine, at any dwelling or occupied premises not owned by the lease holder, the holder of an authority under the Mining Act, or not subject to a valid agreement with the lease holder, with respect to the effects of blasting.	Not Applicable	No blasting occurred during the reporting period.
	b) Blast Overpressure The lease holder shall design all blasts on the basis that the blast overpressure noise level generated by any blasting within the subject area, shall not exceed the levels in or conditions of the EPA Licence for the mine, at any dwelling or occupied premises not owned by the lease holder, the holder of an authority under the Mining Act, or not subject to a valid agreement with the lease holder, with respect to the effects of blasting .	Not Applicable	No blasting occurred during the reporting period.
<b>TREES (PLANTING AND PROTECTION OF) FLORA AND FAUNA AND ARBOREAL SCREENS</b>			
27	If so directed by the Minister, the lease holder shall ensure that operations are carried out in such manner so as to minimise disturbance to flora and fauna within the subject area.	Not Applicable	No such direction received during the reporting period.
28	The lease holder shall maintain an arboreal screen to the satisfaction of the Minister with in such parts of the subject area as may be specified by the Minister and shall plant such trees or shrubs as may be required by the Minister to preserve the arboreal screen In a condition satisfactory to the Minister.	YES	The 50m buffer has been maintained in accordance with the Landscape Management Plan.



**Table A3.2 (Cont'd)**  
**Mining Lease 1461 – Compliance Review**

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Cond. No.	Requirement	Compliance	Comments/Notes
<b>SOIL EROSION</b>			
29	The lease holder shall conduct operations in such a manner as not to cause or aggravate soil erosion and the lease holder shall observe and perform any instructions given or which may be given by the Minister with a view to minimising or preventing soil erosion.	YES	Rehabilitation works have minimised the potential for erosion and previous erosion areas have been stabilised.
<b>ROADS</b>			
31	The lease holder shall pay to Cessnock City and Maitland City Council, Department of Land and Water Conservation or the Chief Executive, Roads and Traffic Authority the cost incurred by such Council or Department or Chief Executive of making good any damage caused by operations carried on by or under the authority of the lease holder to any road adjoining or traversing the surface or the excepted surface, as the case may be of the subject area.  PROVIDED HOWEVER that the amount to be paid by the lease holder as aforesaid shall be reduced by such sum of money if any as may be paid to the said Council the Department of Conservation and Land Management or the Chief Executive, Roads and Traffic Authority as the case may be from the Mine Subsidence Compensation Fund constituted under the Mine Subsidence Compensation Act, 1961, in settlement of a claim for compensation for the same damage.	Not Applicable	No payments occurred and no claims occurred during the reporting period.
32	In the event of operations being conducted on the surface of any road, track or firetrail traversing the subject area or in the event of such operations causing damage to or interference with any such road, track or firetrail the lease holder, at his own expense, shall if directed to do so by the Minister provide to the satisfaction of the Minister an alternate road, track or firetrail in a position as required by the Minister and shall allow free and uninterrupted access along such alternate road, track or firetrail and , if required to do so by the Minister, the lease holder shall upon completion of operations rehabilitate the surface of the original road, track or fire trail to a condition satisfactory to the Minister.	Not Applicable	No such direction received during the reporting period.
<b>CATCHMENT AREAS</b>			
33	a) Operations shall be carried out in such a way as not to cause any pollution of the Hunter River Catchment area. b) If the lease holder is using or about to use any process which in the opinion of the Minister is likely to cause contamination of the waters of the said Catchment Area the lease holder shall refrain from using or cease using as the case may require such process within twenty four (24) hours of the receipt by the lease holder of a notice in writing under the hand of the Minister requiring the lease holder to do so. c) The lease holder shall comply with any regulations now in force or hereafter to be in force for the protection from pollution of the said Catchment Area.	YES	All operations were carried out in accordance with the Water Management Plan and Mining Operations Plan.

**Table A3.2 (Cont'd)**  
**Mining Lease 1461 – Compliance Review**

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Cond. No.	Requirement	Compliance	Comments/Notes
<b>TRANSMISSION LINES, COMMUNICATION LINES AND PIPELINES</b>			
41	The lease holder shall as far as is practicable so conduct operations as not to interfere with or impair the stability or efficiency of any transmission line, communication line or pipeline traversing the surface or the excepted surface of the subject area and shall comply with any direction given or which may be given by the Minister in this regard.	YES	No interference or impacts to transmission lines, communication lines or pipelines occurred during the reporting period.
42	Unless with the consent of Energy Australia , the lease holder shall not carry out any operations within any easement for any power transmission line traversing the subject area.	YES	All necessary agreements are in place with Energy Australia.
<b>ABORIGINAL PLACE OR RELIC</b>			
43	The lease holder shall not knowingly destroy, deface or damage any aboriginal place or relic within the subject area except in accordance with an authority issued under the National Parks and Wildlife Act, 1974, and shall take every precaution in drilling, excavating or disturbing the land against any such destruction, defacement or damage.	YES	No Aboriginal sites are known to have been disturbed during the reporting period.
<b>LABOUR/EXPENDITURE</b>			
44	This condition removed 3 September 2018.		
<b>ADDITIONAL INFORMATION</b>			
45	The lease holder shall if directed by the Minister and within such time as the Minister may stipulate furnish to the Minister: a) information regarding the ownership of the land within the subject area; b) information regarding the ownership of the coal within the subject area prior to 1 January 1982; c) an indemnity in a form approved by the Minister indemnifying the Crown and the Minister against any wrong payment effected as a result of incorrect information furnished by the lease holder; d) information regarding the financial viability of the lease holder and operations within and associated with the subject area ; and e) information regarding shareholdings in the lease holder.	Not Applicable	No such direction received during the reporting period.
<b>SERVICE OF NOTICES</b>			
46	Within a period of three (3) months from the date of this authority or a period of three (3) months from the date of service of the notice of renewal, or within such further time as the Director General may allow the lease holder shall serve on each owner and occupier of the private land and on each occupier of the Crown land held under a pastoral lease within the subject area a notice in writing indicating that this authority has been granted or renewed and whether the authority includes the surface. The notice shall be accompanied by an adequate plan and description of the subject area.  If there are ten (10) or more owners or occupiers affected the lease holder may serve the notice by publication in a newspaper circulating in the region where the subject area is situated. The notice shall indicate that this authority has been granted or renewed, state whether the authority includes the surface and shall contain an adequate plan and description of the subject area.	Not Applicable	ML1461 expired 20/12/2020. A lease renewal was sought within the required timeframe and remains pending. Notification will be undertaken following receipt of notice of renewal.

**Table A3.2 (Cont'd)**  
**Mining Lease 1461 – Compliance Review**

Cond. No.	Requirement	Compliance	Comments/Notes
<b>INSPECTORS</b>			
47	<p>a) Where an Inspector under the Mining Act 1992 is of the opinion that any condition of this authority relating to operations within the subject area, or any provision of the Mining Act, 1992, relating to operations within the subject area, are not being complied with by the lease holder, the Inspector may serve on the lease holder a notice stating that and give particulars of the reason why, and may in such notice direct the lease holder:</p> <p>i) to cease operations within the subject area in contravention of that condition or Act; and</p> <p>ii) to carry out within the specified time works necessary to rectify or remedy the situation.</p> <p>b) The lease holder shall comply with the directions contained in any notice served pursuant to sub paragraph (a) of this condition.</p> <p>The Director General may confirm, vary or revoke any such direction.</p> <p>c) A notice referred to in his condition may be served on the Colliery Manager.</p>	Not Applicable	No such notice received during the reporting period.
<b>INDEMNITIES</b>			
48	The lease holder shall indemnify and keep indemnified the Crown from and against all actions suits and claims and demands of whatsoever nature and all costs charges and expense which may be brought against the lease holder or which the lease holder may incur respect of any accident or injury to any person or property which may arise out of the construction maintenance or working of any workings now existing or to be made by the lease holder within the boundaries of the subject area or in connection with any of the operations notwithstanding that all other conditions of this authority shall in all respects have been observed by the lease holder or that any such accident or injury shall arise from any act or thing which the lease holder may be licensed or compelled to do hereunder.	YES	Liability Insurance for \$100 million currently in place.
49	The lease holder shall save harmless the Crown from payment of compensation and from and against all claims, actions, suits or demands whatsoever in the event of any damage resulting from mining operations under or near the subject area.	YES	No such claims issued. Liability insurances were maintained for the reporting period.
<b>PROSPECTING (GENERAL)</b>			
50	<p>a) Where the lease holder desires to commence prospecting operations in the subject area the lease holder shall notify the Director General in writing and shall comply with such additional conditions as the Minister may impose including any condition requiring the lodgement of an additional bond of other form of security or rehabilitation of the area affected by such operations .</p> <p>b) Where the lease holder notifies the Director General pursuant to sub paragraph (a) of this condition the lease holder shall furnish with that notification details of the type of prospecting methods that would be adopted and the extent and location of the area that would be affected by them.</p>	Not Applicable	The Company did not undertake any prospecting operations within the lease area during the reporting period.

**Table A3.2 (Cont'd)**  
**Mining Lease 1461 – Compliance Review**

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Cond. No.	Requirement	Compliance	Comments/Notes
<b>SECURITY DEPOSIT</b>			
51	<p>a) The lease holder shall, upon request by the Director General, lodge with the Minister the sum of \$250,000, in accordance with Instructions for Manner of Lodgement of Security Deposits as security for the fulfillment of the obligations of the lease holder under this authority. In the event that the lease holder fails to fulfill any of the lease holder's obligations under this authority the said sum may be applied at the discretion of the Minister towards the cost of fulfilling such obligations. For the purposes of the clause a lease holder shall be deemed to have failed to fulfill the lease holder's obligations under this authority, if the lease holder fails to comply with any condition or provision of this authority, any provision of the Act or regulations made thereunder or any condition or direction imposed or given pursuant to a condition or provision of this authority or of any provision of the Act or regulations made thereunder.</p> <p>b) The Minister may at times after the commencement of this authority or any renewal thereof, vary the amount of security required in accordance with this condition.</p> <p>c) Where the amount of security has been increased pursuant to Clause (b) hereof the lease holder shall, within two (2) months of being requested by the Minister, lodge a security for the amount of security required, in which case the Minister shall refund or release to the lease holder the security previously lodged.</p>	YES	A security deposit, as determined in accordance with (then) DREs calculation tool, remained current during the reporting period.
<b>ROYALTY AT ADDITIONAL RATE</b>			
54	The lease holder shall during the term of this authority pay to the Minister royalty at the additional rate as prescribed by the Regulations for coal recovered by open cut mining methods from the area.	Not Applicable	All economic coal as approved for extraction has been recovered. No mining operations during the reporting period.
<b>METHODS OF OPERATION (PRESCRIBED DAMS)</b>			
55	See attached Annexure "A".		
<b>ADDITIONAL CONDITIONS</b>			
56	The lease holder shall not carry out mining in areas identified as conservation areas in accordance with the conditions of the development consent.	YES	No mining operations occurred during the reporting period.
57	The lease holder shall not clear any land or erect any structures in areas identified as conservation areas in terms of the conditions of the development consent, other than in accordance with provisions of the development consent.	YES	No land clearing or construction activities occurred during the reporting period.
58	The lease holder shall carry out all operations in accordance with the approved hours of operation contained in the conditions of the development consent.	YES	All activities during the reporting period were in accordance with the approved hours.
59	Any risk analysis undertaken by the lease holder in order to seek a reduction (by the Director General of the Department of Urban Affairs and Planning) in the requirement for blasting to be a minimum of 500 meters from occupied residences, public lands and unclosed public roads, must be assessed by the Chief Inspector of Coal Mines, prior to lodgement with the Director General of the Department of Urban Affairs and Planning.	Not Applicable	No such reduction sought during the reporting period.

**Table A3.2 (Cont'd)**  
**Mining Lease 1461 – Compliance Review**

Page 10 of 10

Cond. No.	Requirement	Compliance	Comments/Notes
<b>ADDITIONAL CONDITIONS (Cont'd)</b>			
60	The lease holder shall prepare a Traffic Management Plan to the satisfaction of the Chief Inspector of Coal Mines, for the haulage of coal to the Bloomfield Colliery coal preparation plant and rail loading facility.	YES	A Traffic Management Plan in place. However no coal was hauled from within ML1461.
61	The lease holder shall notify the Principal Environmentalist, the name and contact details of the Environmental Officer upon appointment, and upon any changes to that appointment.	YES	The Department has been notified of the contact details of the Environmental Officer. These are also included within this Annual Review.
<b>ANNEXURE "A" - METHODS OF OPERATION (PRESCRIBED DAMS)</b>			
1.	A) Subject to paragraphs (C) and (D) the lease holder shall not mine coal from within any part of the subject area which is within the notification area of the Stoney Pinch Reservoir. Dam without the consent of the Minister pursuant to paragraph (E) of this condition.	YES	No mining operations occurred during the reporting period.
	B) Where the lease holder desires to mine coal from within any part of the subject area which is within the notification area he shall-  i) at least twelve (12) months before such mining is to commence or such lesser time as the Minister may permit, notify the Minister of his desire to do so. A plan of the mining system to be implemented must accompany the notice to the Minister,  ii) provide such information as the Minister may direct.	Not Applicable	No mining operations occurred during the reporting period.
	C) No coal shall be mined from within any part of the subject area which is within the notification area except in accordance with such system as may be consented to by the Minister and subject to such conditions as he may impose. The Minister shall not grant any such consent unless the requirements referred to in sub-paragraph (i) of this paragraph have been complied with.	YES	No mining operations occurred during the reporting period.
	I) This sub-paragraph is complied with if:-  a) the Dams Safety Committee as constituted by Section 7 of the Dams Safety Act and the owner of the dam have been notified in writing of the desire to mine referred to in Condition No 1 (8).  b) the notification referred to in paragraph (a) is accompanied by a description or plan of the area that would be mined or continued to be mined,  c) the Director-General has complied with any reasonable request made by the Dams Safety Committee or the owner of the dam for further information in connection with the mining proposal,  d) the Dams Safety Committee has made its recommendations concerning the mining proposal or has informed the Minister in writing that it does not propose to make any such recommendations, and	Not Applicable	No mining operations occurred during the reporting period.

**Table A3.2 (Cont'd)**  
**Mining Lease 1461 – Compliance Review**

Page 11 of 11

Cond. No.	Requirement	Compliance	Comments/Notes
<b>ANNEXURE "A" - METHODS OF OPERATION (PRESCRIBED DAMS) (Cont'd)</b>			
1. Cont'd	<p>e) where the Dams Safety Committee has made recommendations under paragraph (d), the consent is in terms that are :-</p> <p>I) in accordance with those recommendations, or,</p> <p>ii) where the Minister does not accept those recommendations or any of them - in accordance with a determination under subparagraph (ii) of this paragraph .</p> <p>iii) where the Minister does not accept the recommendations of the Dams Safety Committee made as provided by sub-paragraph (i), or where the Dams Safety Committee has failed to make any such recommendations and has not informed the Minister in writing that it does not propose to make any such recommendations, the consent shall be in terms that are, in relation to matters dealing with the safety of the dam:-</p> <p>a) as determined by agreement between the Minister and the Minister administering the Dams Safety Act, 1978, or</p> <p>b) in the event of failure to reach such agreement - as determined by the Premier.</p>	Not Applicable	No mining operations occurred during the reporting period.
	<p>d) The Minister, on notice from the Dams Safety Committee, may at any time or times:</p> <p>i) cancel any consent to a system where a notice pursuant to Section 18 of the Dams Safety Act, 1978 is given, ii) suspend for a period of time, alter, omit from or add to any system consented to or conditions imposed by him.</p>	Noted	No mining operations occurred during the reporting period.

# **Appendix 4**

## **2019 Annual Flora and Fauna Monitoring**

prepared by

**Kleinfelder Australia Pty Ltd**

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## 2019 Annual Flora and Fauna Monitoring



### Yancoal Australia Ltd

Donaldson Open-Cut Coal Mine  
Beresfield, NSW

7 February 2020

## 2019 Annual Flora and Fauna Monitoring

Donaldson Open-Cut Coal Mine  
Beresfield, NSW

**Kleinfelder Document Number:** NCA20R107013

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## EXECUTIVE SUMMARY

*Findings of the 2019 annual quadrat monitoring survey are presented in this document in accordance with Section 5.1 Monitoring Program of the Donaldson Coal Flora and Fauna Management Plan (F&FMP). Data collected biannually since 2001 have been analysed in order to investigate trends in the flora and fauna species composition over time.*

*The 2019 flora survey results show that the floristic composition of the monitoring quadrats is similar to the 2018 monitoring event; however a reduction in the diversity and cover of ground layer species was observed. This can be attributed to the below average rainfall and higher mean maximum temperature recorded in 2019.*

*An overall increase in plant species richness and structural components has been recorded since the baseline survey in 2001. This trend is indicative of a dynamic plant community with high recruitment from the seed pool, normally an indicator of a healthy, regenerating native plant community. While the species composition recorded in each quadrat has changed slightly over the entire survey period, the number of species identified within each quadrat has remained relatively consistent over time.*

*All biomass variables examined (i.e. basal area, height, foliage projective cover (FPC) and stand volume), have shown consistent increases since the baseline survey. The regression analyses confirmed that the relationship between time and increases to stand volume were highly significant indicating that the community biomass has increased substantially across time with no significant year-to-year variation. The regression analyses of FPC shows a slight downward trend although the cover has significantly increased since the baseline surveys except for Q6 which was impacted by Myrtle rust in previous years.*

*The 2019 survey detected a total of 80 fauna species consisting of 52 bird, three arboreal and four terrestrial mammal, 16 bat, one amphibian and three reptile species. Four of the bat species are listed as vulnerable under the NSW Biodiversity Conservation Act 2016 (BC Act). The fauna survey results were found to be like previous years with no significant decrease or increase in species richness following the 2019 survey. One listed vulnerable owl species under the BC Act, Powerful Owl, was detected in 2019.*

*Nest box surveys in 2019 (winter and summer average) saw 40% (Winter) and 37% (Summer) of all available boxes showing signs of use (both actual animals present and evidence of usage). Nest box utilisation has stayed the same this year (from a winter and summer average*

*of 38% in 2018). This was due to 15 nest boxes being replaced and three nest boxes being repaired. It is expected that the usage rate will increase in coming years as uptake of these boxes occurs.*

*Overall results conclude that there have been minimal impact to floristic and fauna diversity within the Donaldson Bushland Conservation Area (BCA) over the last 19 years. Fluctuations in ecological diversity across all quadrats have been observed which are consistent with natural ecosystem functioning, weather patterns and the changing nature of the adjoining habitat, resulting from past mining activities and neighbouring development.*

*It is recommended that post 2020, survey intervals for flora and fauna could be extended out to every 3 or 5 years (dependent on consent authority approval). It is considered that sufficient data has been collected annually to discern any operational impacts.. Nestbox inspection and maintenance should continue at least annually to gather data on the uptake of recently replaced boxes and undertake repairs as required.*

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# 1. INTRODUCTION

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Yancoal Australia Ltd operated Donaldson Coal Open Cut Mine from 2001 until 2013, when operations ceased due to the exhaustion of resources. Donaldson Coal is located on a mining lease near Beresfield in the Lower Hunter Valley, NSW (**Figure 1**). As part of the Conditions of Consent, a Flora and Fauna Management Plan (F&FMP) was prepared prior to the commencement of operations (Gunninah 2000) with subsequent revisions made by ecobiological in 2007.

The F&FMP prescribes the approach and the frequency of monitoring of the remnant bushland surrounding the mine disturbance area, referred to hereafter as the Bushland Conservation Area (BCA). Regular monitoring activities are conducted at nine permanently established 20 x 20 m quadrats positioned across the mining lease (**Figure 1**). A Baseline Report (Barker Harle 2001) was prepared at the commencement of mining activities and each year since, to monitor the impact of mining activities on flora and fauna at the mine.

This report provides a comparison of flora and fauna species richness and composition, as well as several specific vegetation parameters over time to determine potential impacts of mining activities at Donaldson Coal on flora and fauna in the BCA. Statistical analyses were conducted to detect significant patterns in any data set that was deemed comprehensive enough to pick up significant trends or changes overtime. Due to the adaptive nature of the monitoring program, including changes to methodologies and to the intensity of survey effort over time, not all data sets were considered to be comprehensive, only relevant data was analysed and discussed.

## 1.1 COMPLIANCE WITH THE F&FMP

The nine permanent quadrats were established in accordance with Section 5.1 Monitoring Program in the F&FMP. One of the permanent quadrats was to be established downstream of the mine in Woodbury Swamp, however this location was not situated within Donaldson Coal's mining lease. In consultation with the Donaldson Environmental Officer (EO) it was decided not to establish this quadrat. In 2003 Quadrat 9 was established in an area of bushland of similar type to that originally found over the pit area.

The monitoring program was to include a quarterly assessment of:

- Condition and type of vegetation and fauna habitat;
- Flora and fauna species list and the Braun-Blanquet cover scale of each plant species within a quadrat; and
- Proximity of the quadrat to the mine site and other areas having the potential to affect the quality of the vegetation.

The Baseline Report (Barker Harle 2001) prepared to fulfil part of the requirements of Section 5.0 of the F&FMP provides a detailed discussion of the program requirements. During initial discussions with the Donaldson EO it was decided that the program requirements could be met by a very detailed annual assessment and a quarterly general inspection of each quadrat for any significant change. In 2004, winter fauna monitoring methods were changed from trapping to artificial nestbox inspection. The change was implemented as a result of poor trapping results and the high risk of mortality to captured animals from cold exposure.

Reporting requirements outlined in Section 6.1 of the F&FMP include the following:

- Pre-clearing Verification Reports and Clearing Verification Reports prepared for bushland to be cleared as mining and associated activities require.

*Both the Pre-clearing Verification Reports and the Clearing Verification reports were prepared.*

- Monitoring reports which are provided six-monthly and summarise all monitoring activities carried out in the preceding six months and brief monitoring reports to be provided following each monitoring event.

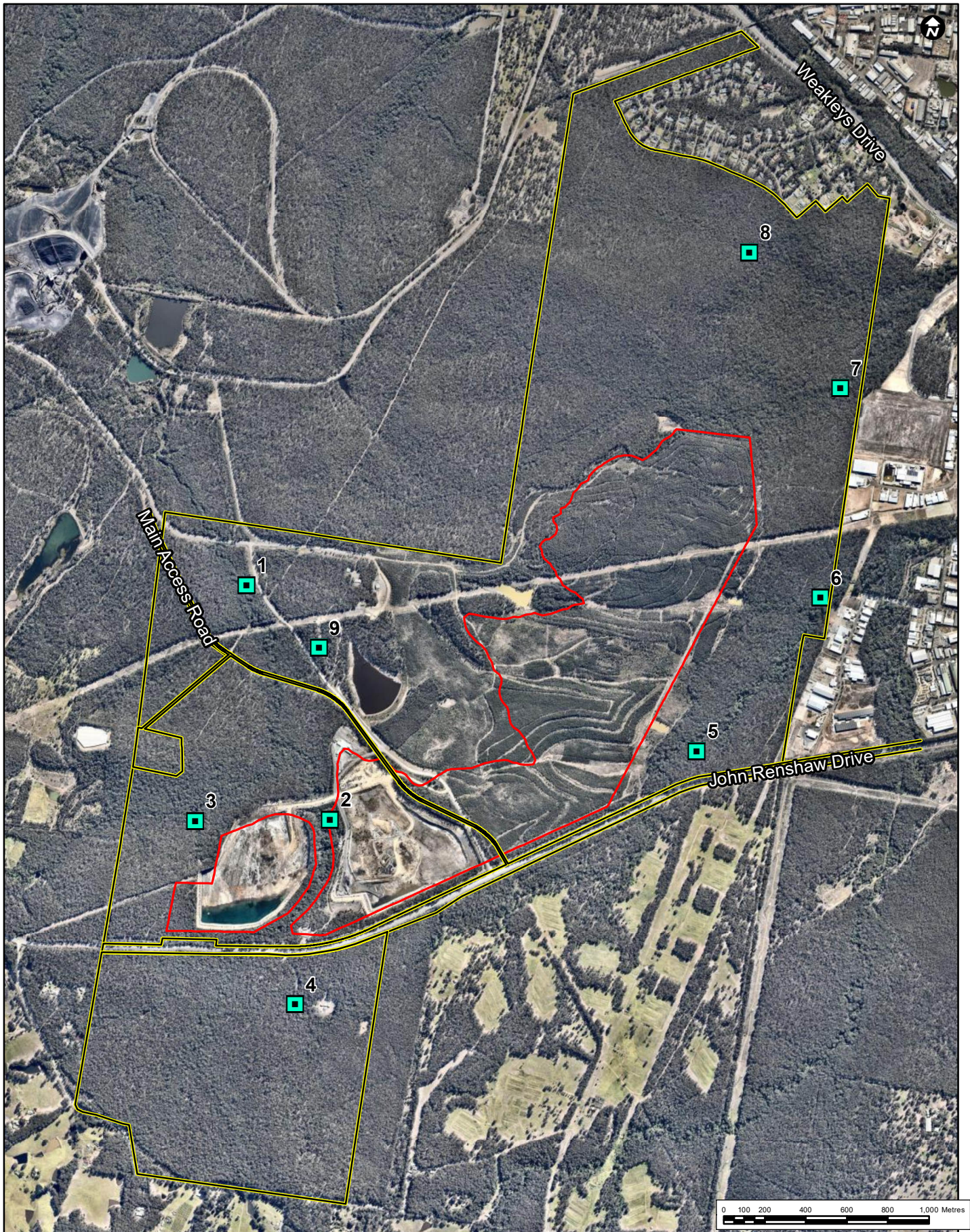
*In order to meet Condition 13(1) of the Conditions of Consent a six-monthly environmental monitoring report should be provided to the stakeholders. A six-monthly fauna report was provided.*

## 1.2 AIMS AND OBJECTIVES

The aim of the monitoring program is to assess the diversity and abundance of flora and fauna species at a temporal and spatial scale across the BCA.

The long-term objectives of the program include:

- Monitor flora and fauna present on the BCA on an annual basis through targeted surveys;
- Document and report annually on the flora and fauna present on the BCA;
- Document and report changes in species diversity and floristic composition of flora on the site;
- Document and report changes in stand volume and biomass parameters;
- Provide recommendations that will assist in the management of flora and fauna species;
- Make recommendations that will contribute to minimising mine disturbance on the remnant vegetation around the mine site; and
- Determine the temporal impacts of mining operations on the ecological attributes of the BCA.



**Figure 1: Extent of Donaldson Open Cut Mine and the Location of Nine Permanent Monitoring Quadrats**

- Donaldson Coal Mine Disturbance (Pit) Area
- Subject Site
- Quadrat Locations



**Map Projection:**

GDA 1994 MGA Zone 56

**Data Sources:**

Nearmap - 2020  
Kleinfelder Ecobiological - 2013

**Project Ref:** 20202671

**Plot Date:** 2020/02/19 16:21

**Revision:** 001 (GJoyce)

Disclaimer: This is not an official or a legal map but is for informational use only. All data was compiled from the best sources available. All boundaries, scale and geographic points are approximate.

## 2. METHODOLOGY

---

Field surveys are conducted annually from late spring to early summer (October – December). Field survey methods are summarised below. More detailed information regarding survey methodologies are available in the Baseline Report (Barker Harle 2001). Nest boxes are inspected twice a year, once in winter and again in late spring/summer.

### 2.1 FLORA SURVEY

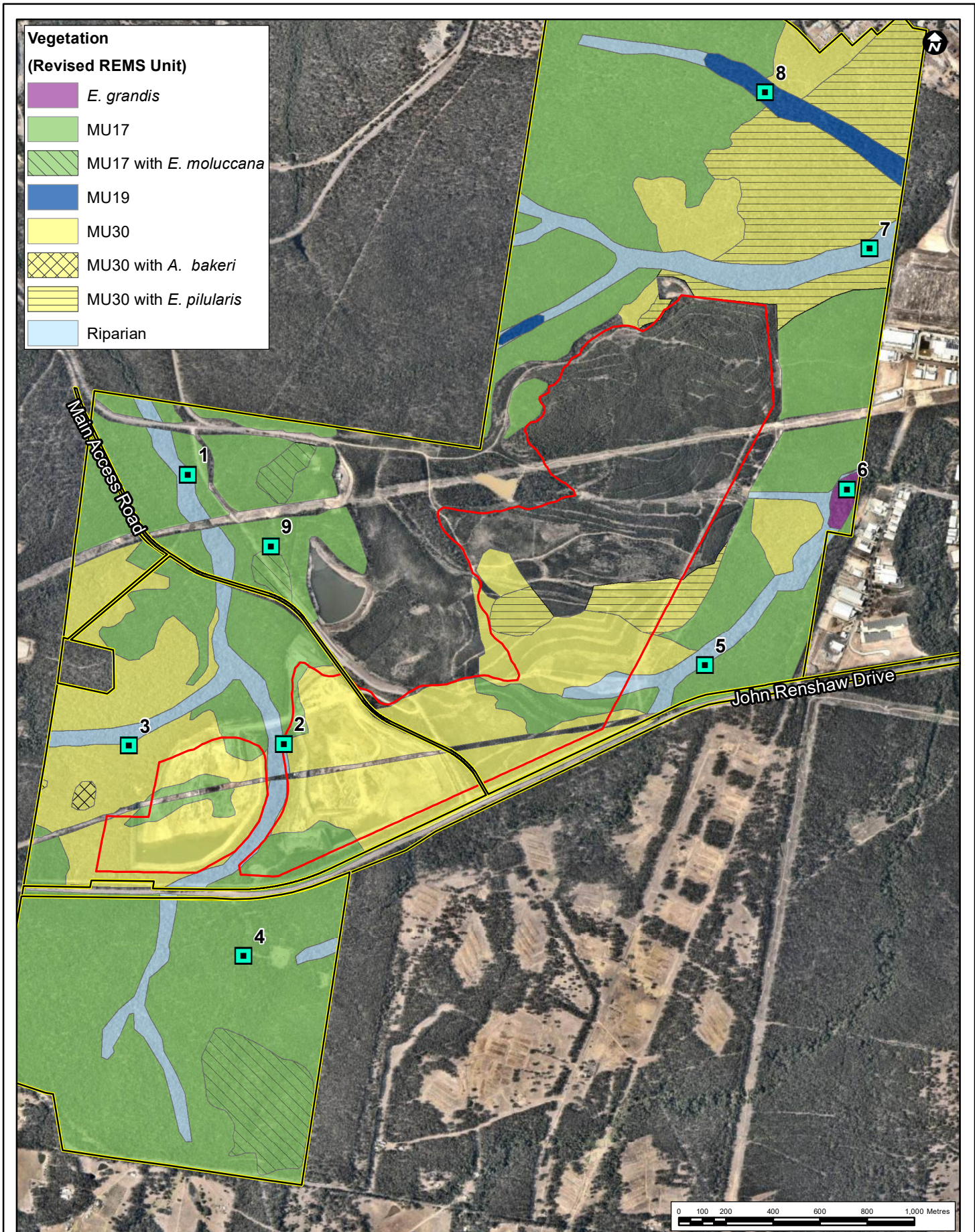
Eight permanent 20 m x 20 m (0.04 ha) monitoring quadrats (Quadrats 1-8) were established in 2001 across the Donaldson coal mine property (**Figure 1**). An additional quadrat (Quadrat 9) was established in 2003. These quadrats are permanently marked with star pickets to allow precise replication of the measurement of floristic structure, content and biomass on an annual basis.

#### 2.1.1 Vegetation Communities

The vegetation communities present within the BCA, as confirmed by ecobiological (2004), are presented in **Figure 2**. Each quadrat was classified according to its vegetation type (i.e. dominant association). Brief descriptions on the condition and structure of each vegetation community are provided in **Section 3.2**.

#### 2.1.2 Floristic Identification and Nomenclature

Floristic identification and nomenclature was based on Harden (1992, 1993, 2000 and 2002) with subsequent revisions as published on PlantNET (<http://plantnet.rbgsyd.nsw.gov.au>). If a plant was unable to be identified using these references, a sample was sent to the National Herbarium, Royal Botanic Gardens, Sydney, NSW.



**Figure 2: Vegetation Communities Surrounding Donaldson Coal Open Cut Mine**

- Donaldson Coal Mine Disturbance (Pit) Area
- Subject Site
- Quadrat Locations



**Map Projection:**

GDA 1994 MGA Zone 56

**Data Sources:**

Nearmap - 2019  
Kleinfelder Ecobiological - 2014

**Project Ref:** 20202671

**Plot Date:** 2020/02/19 16:22

**Revision:** 001 (GJoyce)

Disclaimer: This is not an official or a legal map but is for informational use only. All data was compiled from the best sources available. All boundaries, scale and geographic points are approximate.

## 2.1.3 Biomass

### 2.1.3.1 Foliage Projective Cover

Foliage Projective Cover (FPC) is described as the horizontal spread of the foliage of all the vegetation covering any area and is a measure of the total photosynthetic respiratory surface over that area (Specht 1983; Specht & Specht 1999). A system for classifying structure of vegetation communities is detailed in Specht & Specht (1999). This method allows for precise and repeatable comparison of plant communities. An example of this classification technique can be found in Le Brocque & Buckney (1997).

Foliage Projective Coverage (FPC) was measured in each quadrat. Methods used were adapted from Specht (1981) and Specht (1983). FPC was recorded for canopy species and for groups of species making up the shrub and ground cover. The spread of foliage was measured on a 1 m by 1 m grid, set out with measuring tapes and recorded on grid paper. Vegetation layers included ground cover, shrubs ( $\leq 2$  m), overstorey and emergent trees. **Plate 1** shows an example (Quadrat 5) of the grid layout with measuring tapes for each quadrat.

All vegetation covering the quadrat was recorded, including plants with overlapping foliage inside the quadrat and bases located outside. A vertical sighting device adapted from the cross-wire sighting device described by Winkworth and Goodall (1962) was used to determine the position of overhead foliage. The outline of each predominant species or group of species foliage was established by walking the foliage perimeter and at specific points recording the locations from the tape measures onto grid paper. These points were then joined to give polygons representing FPC.

### 2.1.3.2 Basal Area

The location of individual shrub and tree stems was recorded on grid paper to allow temporal comparisons. Trees taller than two metres had their girth measured at 1.4 m above the ground. The girth was used to assess the Diameter at Breast Height (DBH). Trees over two metres also had their height measured with a Hagl f digital hypsometer.

Basal area was determined for all trees over two metres tall. The total basal area and total basal area of each species in the quadrats was determined. The basal area was calculated using the below equation:

- Basal area  $m^2 = a^2 \div 4\pi$ , where girth (a) in metres is measured at 1.4 m high.



### 2.1.3.3 Total Stand Volume

Total stand volume was calculated from basal areas and tree heights. The below equation was used:

- Total stand volume  $\text{m}^3/\text{ha} = (b \div 0.04\text{ha}) \times (c \div 3)$ , where (b) is basal area in  $\text{m}^2$  and (c) is tree height in m.

Research has shown that there is a relationship between the growth of one part of an organism and another part that is known as allometric (where a part is a constant exponential function of the whole). The relationship between the basal area of a tree and the height can be used to monitor the development of the trees within the quadrats over time.



**Plate 1: Example of grid layout for collection of biomass measurements (Quadrat 5).**

## **2.2 FAUNA SURVEY**

Field surveys were conducted in accordance with the revised F&FMP (ecobiological 2007). Early surveys followed a methodology designed around the observation of fauna species within the 20 x 20 m quadrats. This method proved inadequate to accurately assess fauna species richness. The revised field survey methodologies are summarised below.

### **2.2.1 Terrestrial and Arboreal Mammal Trapping**

Terrestrial and arboreal trapping was undertaken at Quadrats 1, 2, 3, 4 and 9 on 9 – 13 December 2019 and at Quadrats 5, 6, 7 and 8 on 25 – 29 November 2019. Trapping was conducted within a 300-metre radius of each quadrat. Trapping effort spanned four nights and employed 20 Elliott A, three Elliott B and three cage traps set on the ground and five Elliott B traps set about two metres above the ground, mounted on the trunks of trees. Traps were checked each morning.

### **2.2.2 Microbat Trapping**

Since 2004, one harp trap per quadrat has been used for four nights total trapping effort. These are used in addition to microbat call detection, as not all species can be identified by echolocation calls alone.

### **2.2.3 Microbat Call Detection**

One Anabat™ Express bat detector (Titley Scientific, Lawnton, Qld) per quadrat was used to undertake passive monitoring of bats flying or foraging within each quadrat. Detectors were set up at dusk when bat activity is highest, and recording occurred for one hour on one night.

### **2.2.4 Owl Call Playback**

Calls of four threatened owl species (Powerful Owl, Sooty Owl, Masked Owl and Barking Owl) were broadcast by loudspeaker in the area of each quadrat after dusk. Each species' call was played for a 2-3-minute period followed by quiet listening for approximately 10 minutes.

## 2.2.5 Spotlighting

Spotlighting was undertaken from dusk for at least one-person hour (i.e. one observer for an hour or two observers for 30 minutes) in the area of each quadrat to detect the presence of nocturnal fauna species.

## 2.2.6 Bird Surveys

A two hectare area centred on each quadrat was searched by one observer for 30 minutes and all birds detected were identified either visually with the aid of binoculars, or by call interpretation. Surveys were conducted in the early morning when bird activity is highest.

## 2.2.7 NEST BOX MONITORING

Forty-five nest boxes were originally installed in 2005. Nest boxes are inspected twice a year, once in winter and again in late spring/summer. Evidence of usage is determined through either direct detection of animals at the time of the visit or indirect evidence such as recent chew marks, hair, or leaf nests.

## 2.3 STATISTICAL ANALYSIS

### 2.3.1 Flora

Data for FPC and stand volume (a derivative of basal area and tree height) for flora survey quadrats from 2001 to 2019 were analysed to determine whether the plant communities were increasing in biomass over time and undergoing succession towards a mature plant community structure (Specht & Specht 2002, pp 28-41). An increase in these parameters over time is taken as an indicator of plant community health and viability, in addition to other measures such as species diversity and richness. The analysis was undertaken using a linear regression model, with time as the explanatory variable.  $R^2$  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.

Similarity indices were calculated for all pairs of quadrats in the baseline survey to determine the level of floristic similarity between the different plant communities surveyed across the quadrats. Similarity indices were also calculated for each quadrat between two different monitoring events (i.e. 2001 vs 2002), to determine changes in floristic composition at each

quadrat over time. The index used was Sorensen's Similarity Index (Krebs, 1999, p. 377) computed as  $SI = 2a / (2a + b + c)$  where  $a$  = the number of species present in both quadrats,  $b$  = the no. of species present in only one quadrat of a pair, and  $c$  = no. of species present in only the second quadrat of a pair. Quadrat pairs with a low index (minimum possible = 0; no species in common) share fewer species in common, and pairs with a higher index share more species in common (maximum possible = 1.00 where all species recorded in the pair of quadrats are present in both).

### 2.3.2 Fauna

Data on fauna species detected between 2001 and 2019 were analysed to determine changes in species richness and diversity over time. Non-metric Multidimensional Scaling (nMDS) and cluster analysis were undertaken to explore the relationship between fauna species assemblages detected in different sample years. The Primer-E software program was used with the Kulczynski Similarity Index for presence only data (Clarke and Gorley, 2006). This analysis produced scatterplots which depict, in 2-dimensional space, the similarity between species assemblages of different survey years. Associated dendrograms were also produced that graphically depict the relationship between sample years.

The strength of any clusters apparent in the scatterplot were tested by running a similarity profile routine (SIMPROF) over branches in the dendrogram. Solid black lines in the dendrogram indicate statistically significant differences between clusters at the 95% confidence level. Broken red lines link clusters that are not significantly different. The results of the SIMPROF analysis are shown in **Appendix 8**.

Single factor Analysis of Variance (ANOVA) was used to determine if there was a significant difference between nest box usage in summer and winter with all years combined. Percentages were arcsine transformed before analysis.

## 3. RESULTS

### 3.1 WEATHER

Monthly temperature and rainfall data from 2001-2019 are presented in **Table 1** and **Table 2**. Data was accessed from the Bureau of Meteorology weather station at Maitland Visitors Centre (BOM station ID 061388, 2016) up until July 2016, when this station closed. For the remainder of the year, data was collected from the Maitland Airport (BOM station ID 061428). Average monthly and annual figures are used to derive overall climatic trends.

Monthly average maximum temperatures for 2019 are higher than the average maximum temperatures for each month over the 19 years. The lowest annual rainfall and the lowest monthly mean rainfall were recorded in 2019 in comparison to all other years (2001 – 2018). March recorded the highest monthly rainfall in 2019 (156 mm) and December recorded the lowest monthly rainfall in 2019 (1 mm).

**Table 1: Monthly and annual average maximum temperatures for Maitland Visitors Centre (2001 – July 2016) and Maitland Airport (August 2016 onwards)**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean
2001	31.4	29.8	25.9	24.8	19.8	19.5	18.2	19.7	23.2	25.4	25.4	29.3	24.4
2002	30	27.1	27.2	24.8	20.6	18.6	18.8	20.6	24	28.3	29.6	28.9	24.9
2003	29.9	29.1	26.2	23.3	20.7	20	18.2	19.7	23.9	23.3	26.2	28.7	24.1
2004	31.5	31.5	26.8	25.5	21.9	19.7	18.5	20.4	23.3	24.8	27.4	28.2	25
2005	30.2	30	25.8	26	21.1	19	19	20.6	22	26.1	27.1	32.8	25
2006	31.6	31.4	28.2	25.7	21.3	18.1	18.2	20.3	23.7	26.2	28.5	28.2	25.1
2007	31.6	30.1	28.7	24.3	23.1	16.9	17.3	20.8	22.8	28.5	26.7	27.6	24.9
2008	28.5	26.1	27.1	22.7	21.4	19.1	17.8	18.3	23.2	25.4	25.4	29	23.7
2009	31.2	29.5	27.9	23.5	21.1	18.9	18.3	22.4	24.6	24.2	30	28.7	25
2010	31.4	30	28.1	25.8	21.4	18.3	17.7	18.5	22.6	23.8	26.2	28.5	24.4
2011	30.8	31.4	28.5	23.6	20.2	18.5	17.5	20.5	23.3	23.9	27.6	24.6	24.2
2012	28.2	27.1	26.4	23.9	21.3	18.1	17.6	20.3	24.4	25.8	27.7	29.2	24.2
2013	30.9	27.8	27.6	25.2	21.4	18.1	19.3	21.7	26.6	28.4	26.6	29.1	25.2
2014	30	28.1	27.9	25.1	22.8	19.1	18.5	19.1	22.8	27.8	29.8	-	24.6
2015	30	29	30	24	21	19	18	20	22	28	28	30	24.9
2016	29.3	30.7	30.3	26.9	24.1	18.8	17.2	19.4	21.8	24.7	29.6	31.6	25.4
2017	32.8	33.2	27.2	23.9	21.4	18	19.1	20.2	25.5	26.8	25.8	31.8	25.5
2018	33.3	31.4	28.5	26.5	21.7	17.4	19.6	20.0	22.3	24.1	27.3	31.3	25.3
2019	35.2	31.9	29.6	25.8	22.3	18.8	19.5	20.7	23.7	27.2	31.2	33.0	26.5

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean
<b>Mean</b>	<b>30.9</b>	<b>29.7</b>	<b>27.8</b>	<b>24.8</b>	<b>21.5</b>	<b>18.6</b>	<b>18.3</b>	<b>20.2</b>	<b>23.5</b>	<b>25.9</b>	<b>27.7</b>	<b>29.5</b>	<b>24.9</b>

Source: Bureau of Meteorology. (-) indicates no temperature data available.

**Table 2: Monthly and yearly rainfall (mm) totals and totals for Maitland Visitors Centre (2001 – July 2016) and Maitland Airport (August 2016 onwards)**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average monthly	Annual total
<b>2001</b>	20	128	170	74	145	5	51	21	15	28	76	59	<b>66</b>	<b>792</b>
<b>2002</b>	26	247	103	61	44	29	25	13	25	10	51	106	<b>62</b>	<b>740</b>
<b>2003</b>	11	75	59	77	107	16	30	43	0	53	125	61	<b>55</b>	<b>657</b>
<b>2004</b>	90	166	74	38	20	10	28	31	49	172	71	89	<b>70</b>	<b>838</b>
<b>2005</b>	-	141	141	22	120	65	12	1	43	68	61	21	<b>63</b>	<b>695</b>
<b>2006</b>	28	55	106	31	12	58	65	50	157	6	-	45	<b>56</b>	<b>613</b>
<b>2007</b>	21	57	86	55	44	392	23	-	-	24	-	-	<b>88</b>	<b>702</b>
<b>2008</b>	-	170	35	213	4	121	38	19	178	83	97	70	<b>93</b>	<b>1028</b>
<b>2009</b>	8	234	50	164	70	62	23	2	26	66	33	58	<b>66</b>	<b>796</b>
<b>2010</b>	66	48	75	22	73	111	62	32	20	60	192	63	<b>69</b>	<b>824</b>
<b>2011</b>	37	38	48	140	92	160	87	57	76	105	142	157	<b>95</b>	<b>1139</b>
<b>2012</b>	84	174	102	79	12	125	45	14	22	7	46	45	<b>63</b>	<b>755</b>
<b>2013</b>	141	134	79	67	51	80	30	12	17	51	365	16	<b>87</b>	<b>1043</b>
<b>2014</b>	21	86	115	81	30	45	22	111	31	50	22	164	<b>65</b>	<b>778</b>
<b>2015</b>	155	41	35	358	80	42	15	38	57	44	102	135	<b>92</b>	<b>1102</b>
<b>2016</b>	405	35	26	26	7	114	7	-	71	48	44	95	<b>80</b>	<b>878</b>
<b>2017</b>	74	59	181	57	22	95	1	7	11	93	28	55	<b>57</b>	<b>683</b>
<b>2018</b>	10	103	182	35	6	78	1	15	49	108	78	43	<b>59</b>	<b>708</b>
<b>2019</b>	30	28	156	13	18	62	20	47	49	16	12	1	<b>38</b>	<b>452</b>
<b>Mean</b>	<b>72</b>	<b>106</b>	<b>96</b>	<b>84</b>	<b>50</b>	<b>88</b>	<b>31</b>	<b>30</b>	<b>50</b>	<b>57</b>	<b>91</b>	<b>71</b>	<b>69</b>	<b>801</b>

Source: Bureau of Meteorology. (-) Indicates no rainfall data available.

## 3.2 VEGETATION COMMUNITIES

Four vegetation communities (ecobiological 2004), have been mapped across the Donaldson Coal BCA. Also present are some variants within each of these communities. Of note is the “riparian zone” as indicated in **Figure 2**. These areas should be regarded as being of a similar vegetation type to the surrounding vegetation, albeit with some floristic differences associated with minor gullies.

These vegetation communities are listed below:

- Tall Moist Forest with *E. grandis*;
- Hunter Lowland Redgum Forest;
- Riparian Moist Forest;
- Smooth-barked Apple Forest;
- Spotted Gum Communities;
- Smooth-barked Apple Forest with *A. bakeri*;
- Spotted Gum with *E. moluccana*;
- Smooth-barked Apple Forest with *E. pilularis*.

The Lower Hunter Central Coast Regional Environmental Management Strategy (LHCCREMS) (NPWS 2000) mapping for the BCA maps large areas as the endangered MU 17 – Lower Hunter Spotted Gum Ironbark Forest. Ground-truthing of the BCA by ecobiological (2004) confirmed the identity of this ecological community as most consistent with MU 16 Seaham Spotted Gum – Ironbark Forest. The following account was given in the analysis by ecobiological (2004):

*“The Spotted Gum data from Donaldson was compared with 126 other sites from the Central Coast and Hunter region using both cluster analysis (PATN) and non-metric Multi-Dimensional Scaling (nMDS). The analysis indicates that there are five probable Spotted Gum community types across the region, and that the Spotted Gum vegetation at Donaldson is more closely related to the Seaham Spotted Gum – Ironbark Forest than the Lower Hunter Spotted Gum – Ironbark Forest. From this analysis, it would appear that the Lower Hunter Spotted Gum – Ironbark Forest is restricted to the area immediately around Cessnock and that the Quorrobolong Valley vicinity marks the transition from Seaham Spotted Gum – Ironbark Forest to Coastal Foothills Spotted Gum – Ironbark Forest.”*

Some sites show distinct riparian characteristics which makes them very different from the surrounding vegetation (Quadrat 1 and Quadrat 2), referred to as “Riparian Moist Forest”. The characteristics of this vegetation are summarised below (ecobiological 2004).

*“A range of sites extending from Clarence Town to the Holgate Ranges near Gosford support a moist forest type which has been tentatively termed here Hunter Valley Moist Forest. However, NPWS (2000) do not map this community south of Quorrobolong Valley, but sites from Gosford and Wyong fall within this group. There may be some overlap with some of the other moist forest communities defined by NPWS (2000), but further clarification is beyond the scope of this report. Two riparian sites from within Donaldson Coal occur within this group.”*

Brief descriptions of the vegetation communities occurring at each quadrat and a summary of key vegetation parameters are provided in **Table 3**. Note that some vegetation layers have changed their cover considerably over the 18 years of monitoring and only 2019 data is provided in this table.



**Table 3: Summary of vegetation communities occurring at Quadrats 1-9**

Quadrat	Vegetation Community	Revised REMS Unit	Dominant Overstorey Species	Midstorey/Shrub Cover (%)	Ground cover (%)	Overall Condition
1	Riparian Moist Forest	-	<i>Backhousia myrtifolia</i> <i>Corymbia maculata</i> <i>Syncarpia glomulifera</i> <i>Angophora costata</i> <i>Eucalyptus umbra</i>	0%	5%	The vegetation at Q1 was identified as being in moderately good condition due to the reduction in ground cover species from 20% to 5%. A total of 42 plant species were identified in 2019 which is two less than that recorded in 2018. No weed species were identified or any other forms of land degradation (i.e. erosion).
2	Riparian Moist Forest	-	<i>Backhousia myrtifolia</i> <i>Corymbia maculata</i> <i>Eucalyptus acmenoides</i> <i>Glochidion ferdinandi</i> <i>Syncarpia glomulifera</i>	9%	30%	The vegetation at Q2 was identified as being in moderately good condition this year due to the impact of the drought and a fallen tree. A total of 47 plant species were identified in 2019 which is a substantial decrease in comparison to the 60 species recorded in 2018. The ground cover reduced from 55% in 2018 to 30% in 2019. The shrub layer cover was stable compared to the 2018 survey. <i>Lantana camara</i> is present and although it has occurred since 2001, it appears to have stabilised in low abundance (c.a.1) and does not appear to be having a severe impact.
3	Smooth-barked Apple Forest	MU 30	<i>Angophora costata</i> <i>Eucalyptus fibrosa</i> <i>Eucalyptus umbra</i> <i>Melaleuca styphelioides</i> <i>Syncarpia glomulifera</i>	35%	15%	The vegetation at Q3 was identified as being in good condition. A total of 59 plant species were identified in 2019 which is comparable to the 60 recorded in 2018. The ground layer cover reduced from 30% in 2018 to 15% this year (2019). The shrub layer canopy cover reduced by 10%. <i>L. camara</i> continues to be present (c.a. 1).
4	Spotted Gum – Ironbark Forest	MU 17	<i>Corymbia maculata</i> <i>Eucalyptus acmenoides</i> <i>Eucalyptus fibrosa</i>	9%	35%	The vegetation at Q4 was identified as being in good condition. A total of 48 plant species were identified in 2019 which is slightly higher than the 47 recorded in 2018. The ground layer cover reduced from 75% in 2018 to 35% in 2019. The shrub layer cover reduced by 5%. No weed species were identified.

Quadrat	Vegetation Community	Revised REMS Unit	Dominant Overstorey Species	Midstorey/Shrub Cover (%)	Ground cover (%)	Overall Condition
5	Spotted Gum – Ironbark Forest	MU 17	<i>Corymbia maculata</i> <i>Eucalyptus acmenoides</i> <i>Eucalyptus siderophloia</i> <i>Syncarpia glomulifera</i>	1%	35%	The vegetation at Q5 was identified as being in good condition. A total of 49 plant species were identified in 2019 which is five less than that recorded in 2018. The ground cover recorded reduced from 75% in 2018 to 35% in 2019. The shrub cover was stable in 2019 compared to 2018. Only a small amount of <i>Lantana camara</i> (c.a.1) was present within the quadrat during the 2019 survey, which is the same as that recorded in 2018.
6	Tall Moist Forest with <i>Eucalyptus grandis</i>	-	<i>Cryptocarya microneura</i> <i>Eucalyptus acmenoides</i> <i>Eucalyptus grandis</i> <i>Syncarpia glomulifera</i> <i>Melaleuca styphelioides</i> <i>Melicope micrococca</i>	5%	55%	The vegetation at Q6 was identified as being in moderately good condition. A total of 58 plant species were identified in 2019 which is two more than identified in 2018. The ground cover reduced from 90% (2018) to 55% (2019). The shrub cover result in 2019 was similar to the 2018 result. Two weed species were identified in the 2019 survey: <i>Tradescantia fluminensis</i> and <i>L. camara</i> . <i>T. fluminensis</i> is the dominant ground cover species and <i>L. camara</i> occurs along the edge of the quadrat along the creek line. Despite the presence of these weeds, the site currently has relatively high native species richness. Targeted spraying of large stands of <i>L. camara</i> adjacent to Q6 was undertaken in the past however, regrowth is now occurring in these areas and requires follow-up control for effective long-term management.
7	Smooth-barked Apple Forest with <i>Eucalyptus pilularis</i>	MU 30	<i>Angophora costata</i> <i>Eucalyptus pilularis</i> , <i>Glochidion ferdinandi</i> <i>Melaleuca linariifolia</i> <i>Eucalyptus acmenoides</i> <i>Allocasuarina torulosa</i>	39%	20%	The vegetation at Q7 was identified as being in good condition. A total of 53 plant species were identified in 2019 which is an increase of two compared to the 2018 survey. The ground cover reduced from 85% (2018) to 20% (2019) despite the species diversity and the shrub cover remaining stable. The weed species <i>L. camara</i> has occurred within the site since 2001. Targeted spraying of large stands of <i>L. camara</i> adjacent to Q7 was undertaken in previous years. The spraying has been effective within the quadrat although other large patches remain along the creek line.

Quadrat	Vegetation Community	Revised REMS Unit	Dominant Overstorey Species	Midstorey/Shrub Cover (%)	Ground cover (%)	Overall Condition
8	Hunter Lowland Redgum Forest	MU 19	<i>Corymbia maculata</i> <i>Eucalyptus punctata</i> <i>Eucalyptus siderophloia</i> <i>Eucalyptus tereticornis</i> <i>Melaleuca linariifolia</i> <i>Melaleuca styphelioides</i>	21%	35%	<p>The vegetation at Q8 was identified as being in good condition. A total of 54 plant species were recorded in 2019 compared to 60 plant species identified in 2018. The recorded ground cover reduced from 80% in 2018 to 35% in 2019. The shrub layer coverage slightly reduced this year compared to the 2018 survey. One weed species, <i>L. camara</i> was recorded in 2019 and in previous survey. Targeted spraying of <i>L. camara</i> adjacent to Q8 was undertaken in previous years which appears to have been effective in controlling most of the large stands.</p>
9	Spotted Gum – Ironbark Forest with <i>Eucalyptus moluccana</i>	MU 30	<i>Corymbia maculata</i> <i>Eucalyptus fibrosa</i> <i>Eucalyptus umbra</i> <i>Eucalyptus punctata</i> <i>Eucalyptus moluccana</i>	15%	50%	<p>The vegetation at Q9 was identified as being in moderately good condition. A total of 48 native plant species were identified in 2018 compared to 60 in 2019 which is a notable reduction of 12 species. The ground cover reduced from 80% (2018) to 50% (2019). The shrub layer cover slightly increased this year (15%) compared to 2018 (13%). No weed species were identified at Q9 in 2019 or in the 2018 survey.</p>

## 3.3 BIOMASS

### 3.3.1 Foliage Projective Cover

Each quadrat has shown an increase in FPC when compared to the baseline survey results. A general decrease in FPC occurred at most quadrats between the years of 2015 to 2017, with the exception of 2018 where canopy cover increased at all quadrats (**Figure 3; Appendix 1**). The 2019 results are similar the trend observed from 2015 to 2017. All quadrats recorded a decrease of FPC compared to 2018 and 2017 results with the exception of Quadrat 2 which has a slightly increased FPC compared to 2017 and slightly decreased FPC compared to 2018.

Fluctuations in FPC are likely to be a result of one or a combination of factors:

- Observer variation, where no noticeable canopy dieback or fallen limbs were observed;
- Dieback of canopy and shrub species;
- Wilting of midstorey species, decrease of ground cover and species diversity due to the impact of the drought;
- The lack of fire or an inappropriate fire regime for the ecological community over time will decrease the density and diversity of species.

In 2014, *Rhodomyrtus psidioides* seedlings were recorded in Quadrat 6. Most of these seedlings were observed to be infected with a rust fungus (most likely Myrtle Rust). By 2016, the mature trees of this species had completely died, and only one small seedling was observed within the quadrat. No *R. psidioides* were recorded during the current survey in Quadrat 6 or in any of the additional quadrats. No evidence of Myrtle Rust was observed.

### 3.3.2 Basal Area

Basal area in 2019 has generally increased since baseline surveys (2001 for Quadrats 1-8; 2009 for Quadrat 9) with the exception of Quadrat 6, where the decrease of midstorey species such as *R. psidioides* and minimal recruitment has negatively impacted the total basal area over time. Quadrat 6 has decreased from 2.45 m<sup>2</sup> in 2018 to 2.24 m<sup>2</sup> in 2019 is due to the combination of the death of one specimen and the die back of another (**Figure 4, Appendix 2**). The basal area in 2019 compared to 2017 has increased over all quadrats with the exception of Quadrat 6 which may be attributed to bark shed and minor dieback.

The average height of Q3, Q4 and Q7 decreased slightly this year due to dieback. Q2 reduced slightly from 18.49m to 18.01m due to the impact of the tree fall within the plot. New trees were added to Q6 which reduced the average height from 14.05m in 2018 to 13.61m in 2019. The remaining quadrats were stable or slightly increased this year compared to the 2018 survey.

A noticeable reduction in tree height between 2003 and 2004 may be attributable to the change in methodology associated with the use of the Hypsometer.

### 3.3.3 Total Stand Volume

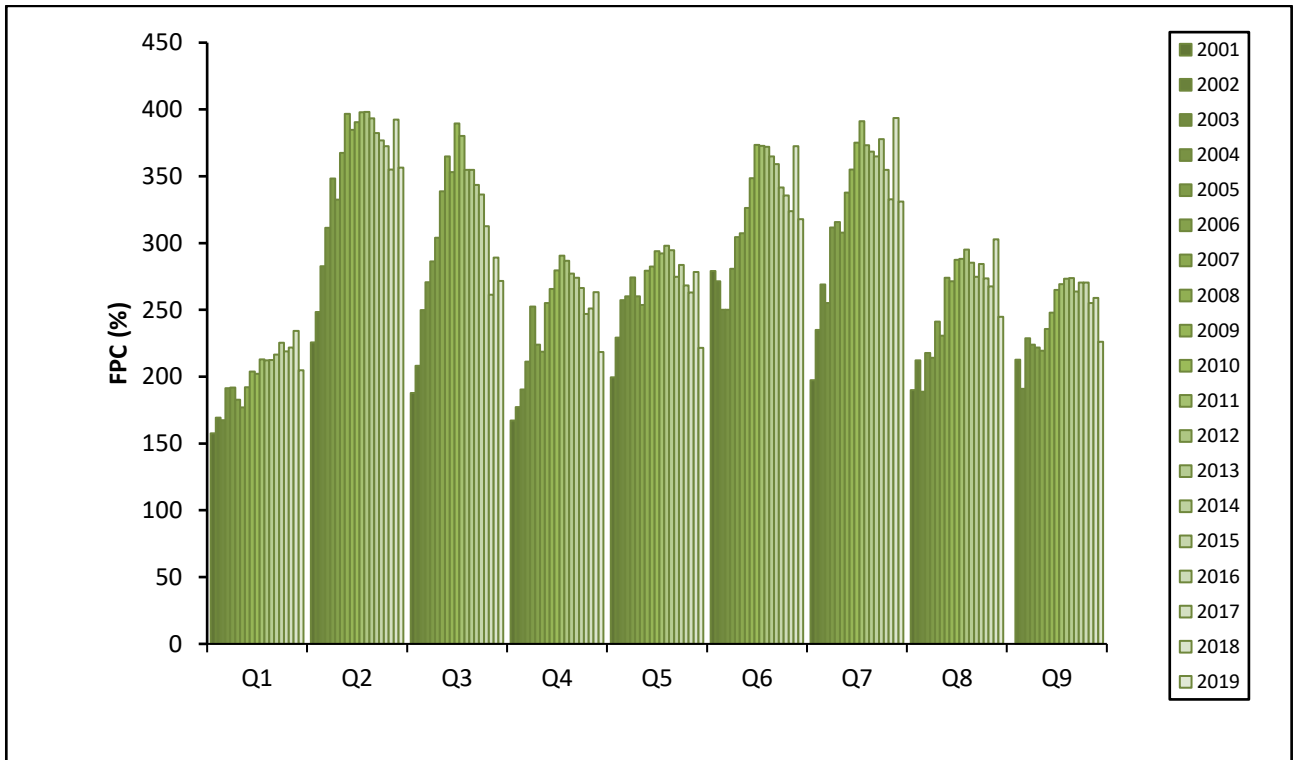
Total stand volume (derived from height and basal area measurements) has increased by an average of 131.71 m<sup>3</sup>/ha across the quadrats since the initial monitoring event in 2001 (2003 for Quadrat 9) (Error! Reference source not found.). Most quadrats recorded an increase in total stand volume in 2019 compared to 2018. Quadrat 2 and Quadrat 6 recorded a decrease of total stand volume in 2019. The canopy cover of Quadrat 2 was impacted by a fallen tree, resulting in a reduction of total stand volume from 371.27 m<sup>3</sup>/ha in 2018 to 365.87 m<sup>3</sup>/ha in 2019. Quadrat 8 decreased from 300 m<sup>3</sup>/ha in 2018 to 297.92 m<sup>3</sup>/ha in 2019 which may be attributed to dieback and increased visibility of the upper canopy layer through the midstorey.

The total stand volume has been presented in this report instead of the average stand volume which was used prior to 2012. The use of total stand volume allows for the recruitment and addition of new trees in the quadrats without lowering the values.

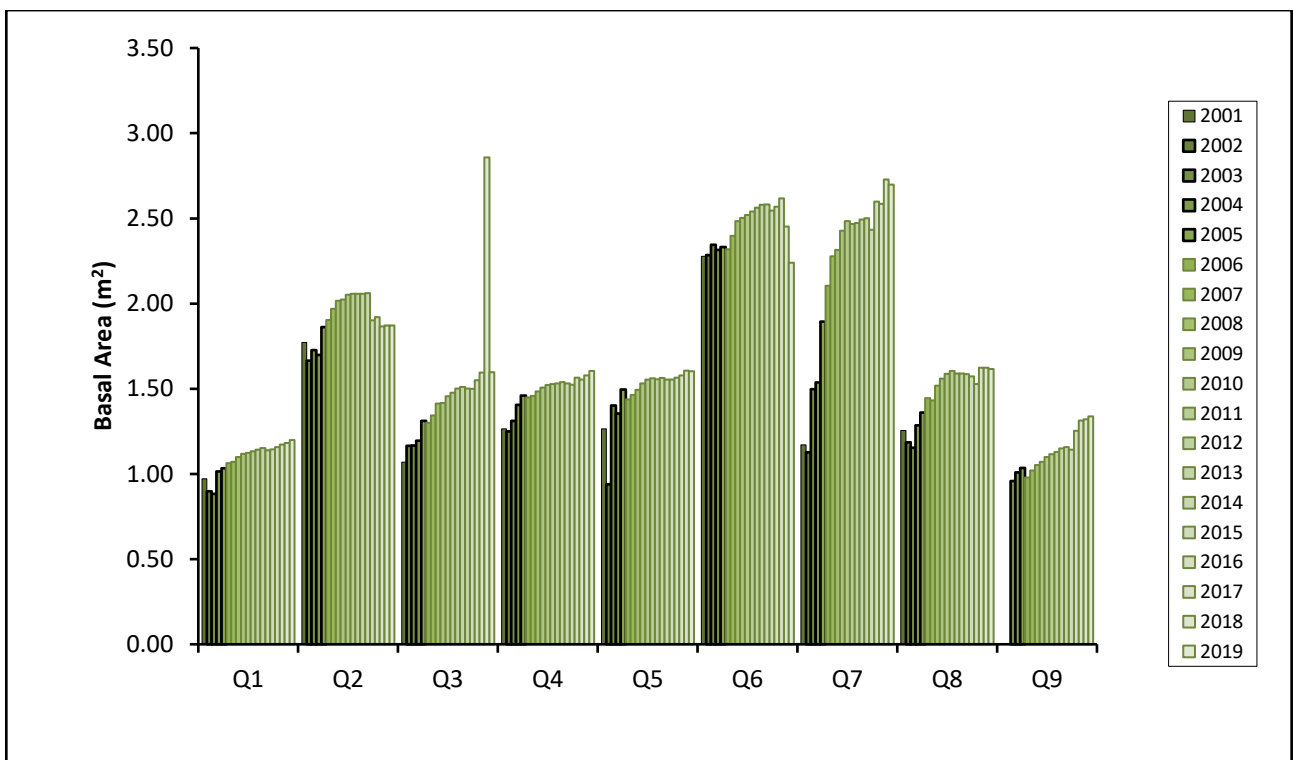
### 3.3.4 Biomass Trends

Despite minor year-to-year fluctuations in these vegetation parameters, overall positive trends in growth have been observed for all quadrats from the baseline survey to the current survey. The protection of remnant bushland surrounding the pit area from a history of logging, clearing, frequent fire, firewood collection and rubbish dumping has likely contributed to the overall increase in biomass at all quadrats between the baseline survey and current survey year.

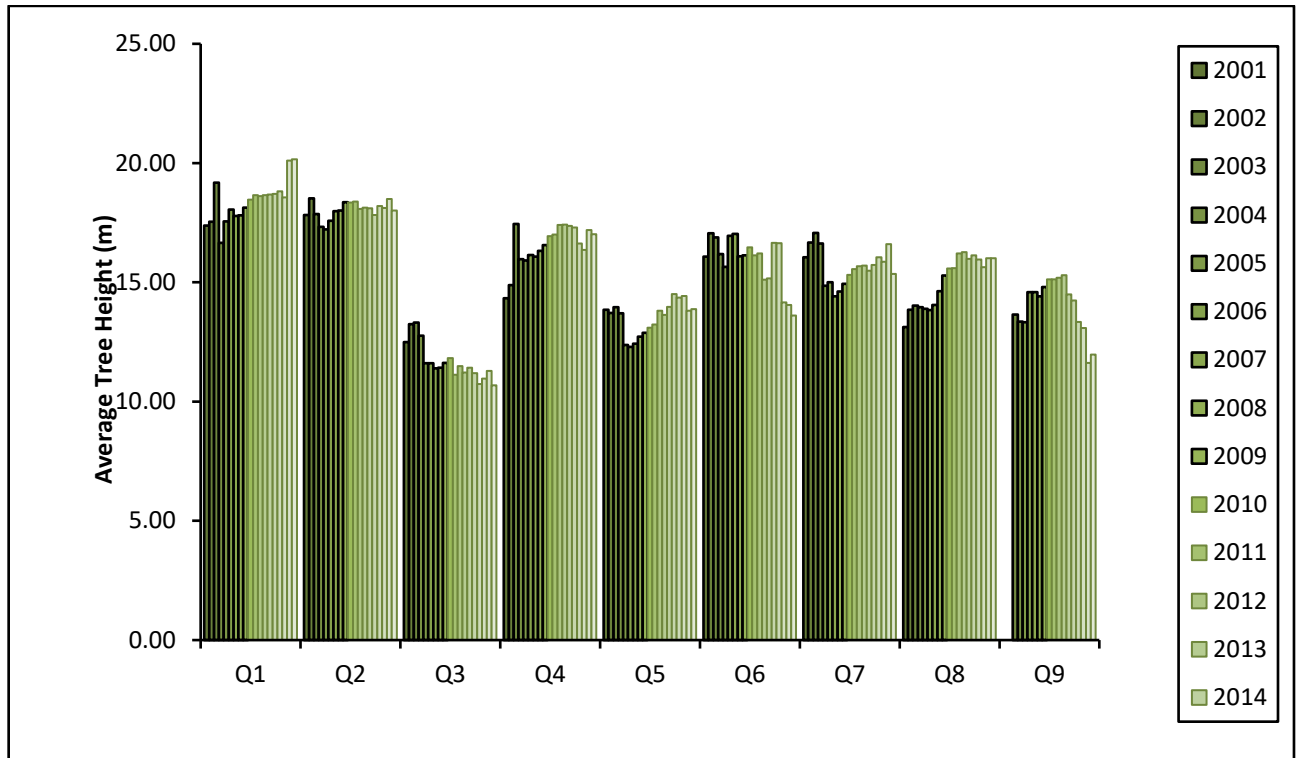
Vegetation parameters are presented graphically in **Figures 3** through to **6**. The raw data for tree height, foliage cover, basal area and stand volume recorded at each quadrat from the baseline, 2001, 2007, 2015, 2016, 2017, 2018 and 2019 are provided in **Appendix 1** through to **3**. Note that the dramatic increase in Basal Area in Q3 in the 2018 data has been identified as being due to a data collection error here. This error will be amended in future monitoring reports.



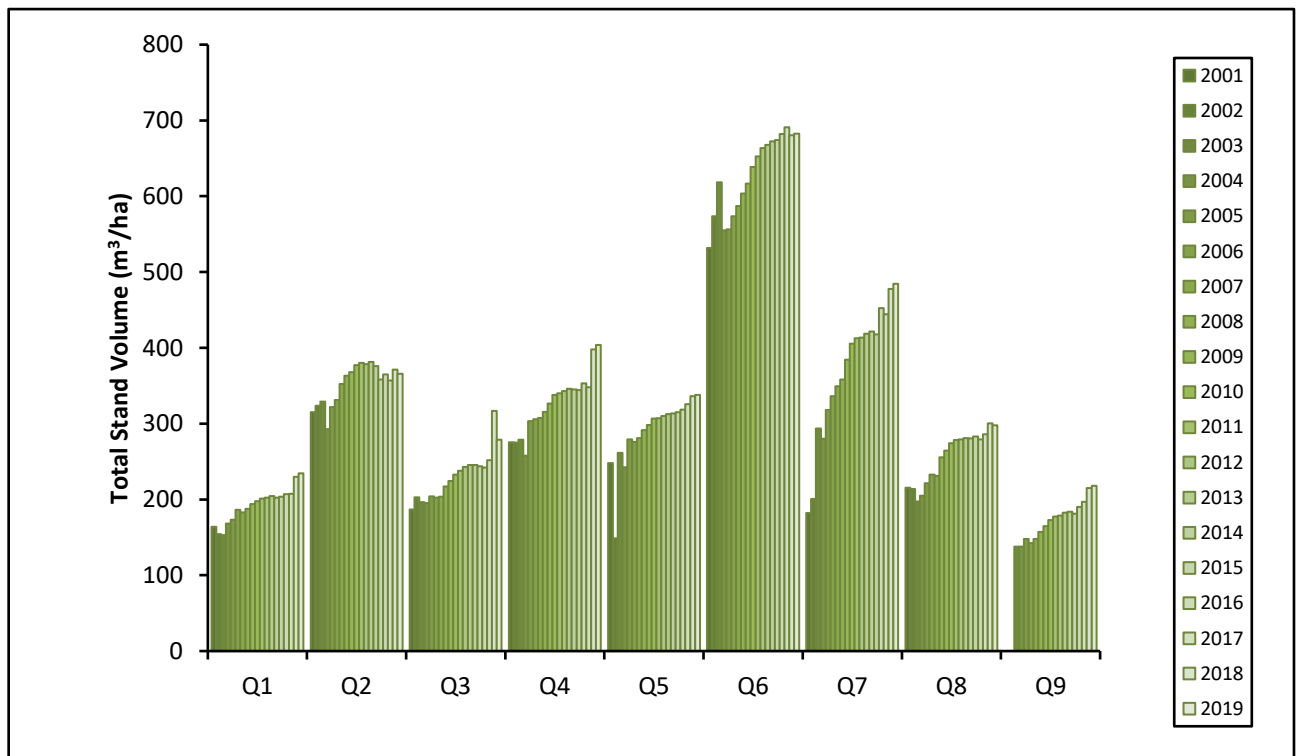
**Figure 3: Total foliage projective cover for each quadrat between 2001 and 2019**



**Figure 4: Basal area for each quadrat between 2001 and 2019.**



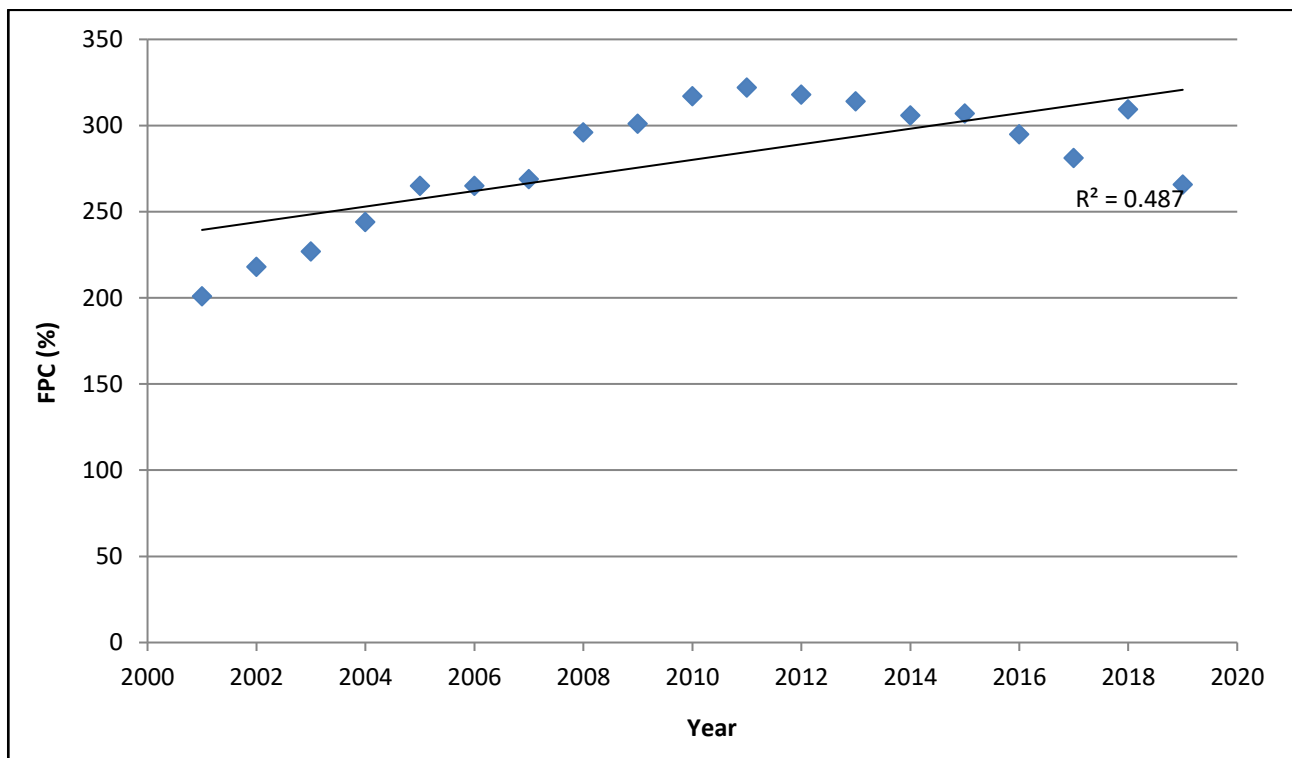
**Figure 5: Average tree height for each quadrat between 2001 and 2019**



**Figure 6: Total stand volume for each quadrat between 2001 and 2019**

Linear regression analysis was performed for all quadrat data to assess the relationship between biomass measurements (FPC and stand volume) and time. The analysis highlights

variations in vegetation growth and development over time, which may be attributed to edge effects from mining activities (i.e. dust, weed invasion, changes in hydrology). The analysis indicates that FPC has increased since baseline across all quadrats ( $F_{1, 16} = 16.13$ ;  $p = 0.0008$ ) although there has been an overall gradual decrease since 2011. The  $R^2$  value has decreased from 0.64 (2018) to 0.48 (2019) which indicates that there has been a slight increase in the variation from previously modelled results (**Figure 7**).

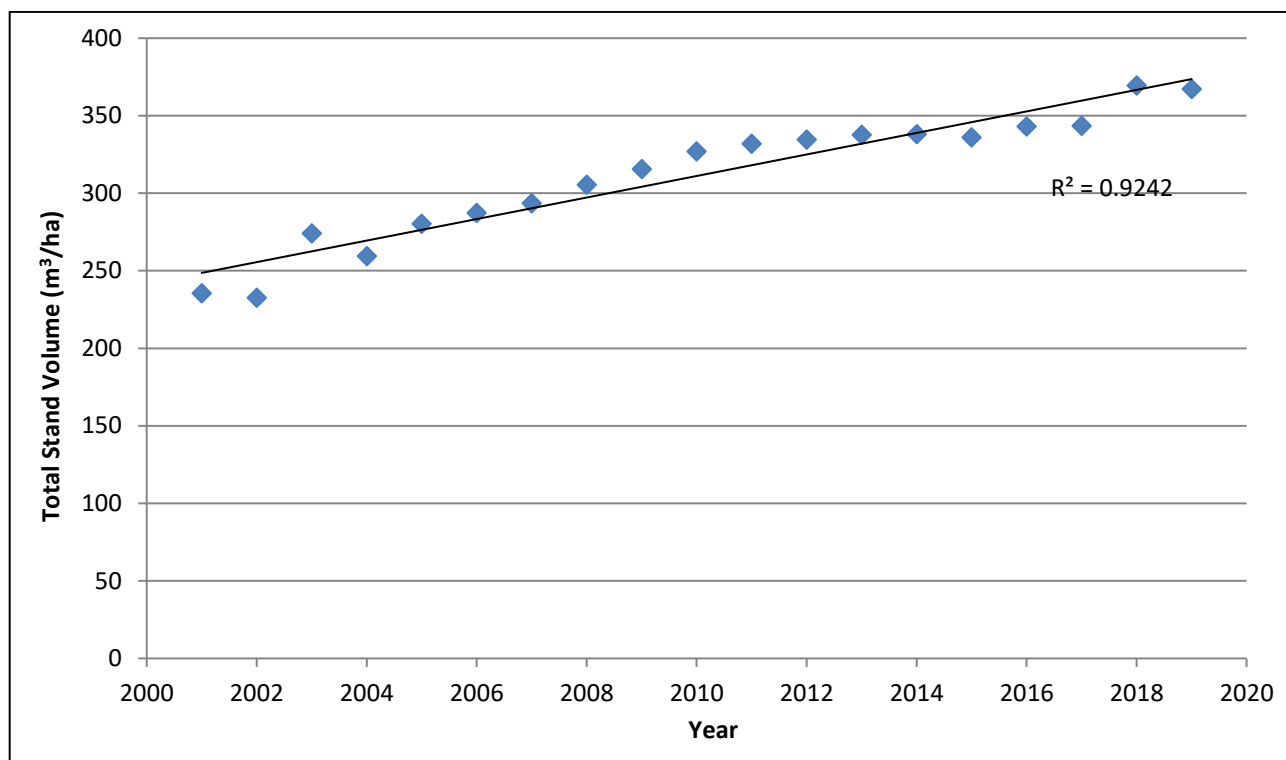


**Figure 7: Total FPC (%) for combined quadrats across time (2001-2019). R-squared values from linear regression analysis displayed.**

The linear regression analysis for stand volume indicates that this parameter has increased significantly over time across all quadrats ( $F_{1, 16} = 207.31$ ;  $p = <0.05$ ). The  $R^2$  value is high ( $>0.92$ ), which indicates that there is little variation in stand volume from year-to-year among the quadrats (**Figure 7**).

Total stand volume (m<sup>3</sup>/ha) for combined quadrats across time is shown in (**Figure 8**). An overall progressive increase in stand volume since the baseline survey is evident. Some variation may be attributed to the maturation of trees to over 2 m and /or trees dyeing.





**Figure 8: Total stand volume (m³/ha) for combined quadrats across time (2001-2019). R-squared values from linear regression analysis displayed**

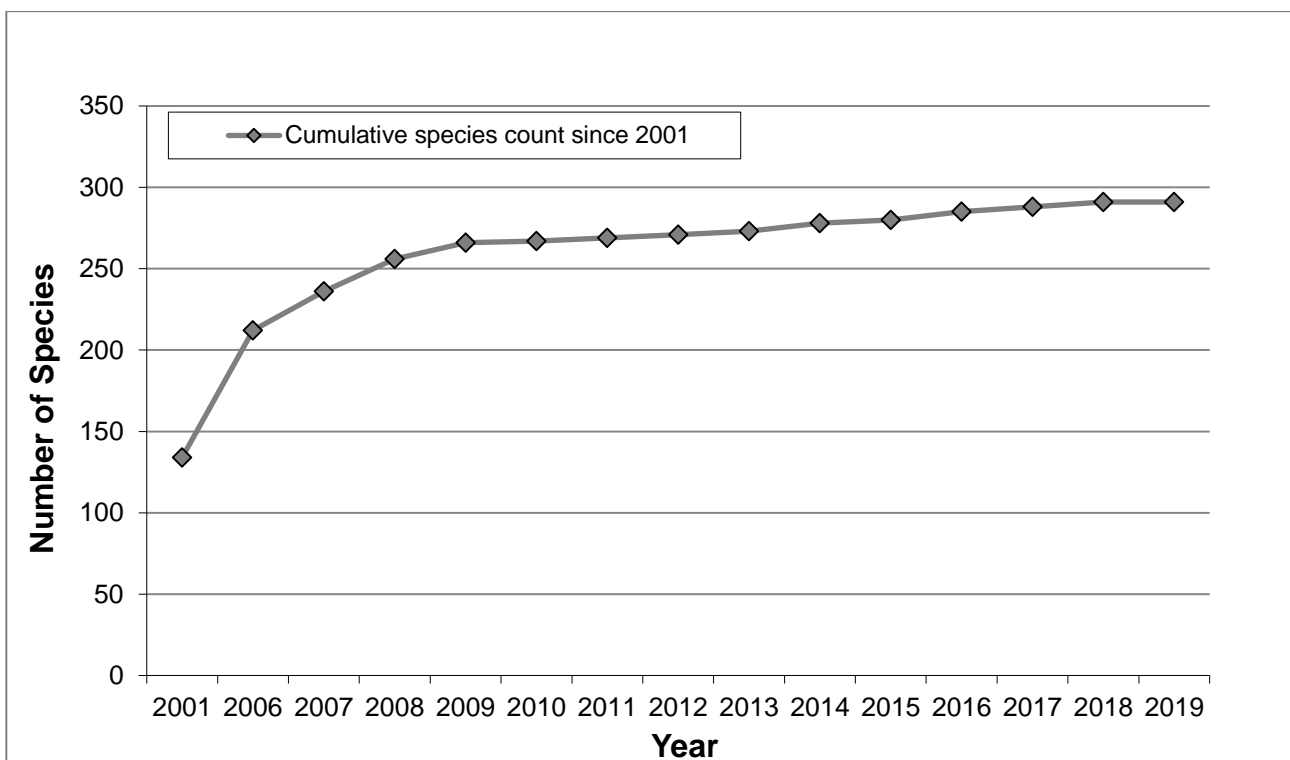
### 3.4 FLORISTICS

The species recorded in Quadrats 1 through to 8 during the baseline survey baseline (2001), baseline for Quadrat 9 (2003) and the 2018 and 2019 surveys are shown in **Appendix 4**. A total of 291 species have been recorded across all survey events. The number of species recorded during the baseline, 2018 and 2019 surveys totalled 134, 179 and 170 respectively. **Figure 9** presents the cumulative number of species recorded since the baseline report. The number of species steadily increased until 2009, levelled off and then stabilised until 2018. Current survey saw a decrease in species numbers which is likely attributed to lower than average rainfall, which is natural ecological variable discussed below. No new species were recorded.

The overall levelling of the species recorded over time can be explained by the species-time relationship (STR), which is similar to the pattern observed for species-area relationship (SAR), whereby the species richness of a given plant community being observed typically fits a power or exponential model. The potential number of plant species within a defined area (i.e. a quadrat) is expected to increase substantially over the short-term, and then plateau to an

asymptotic maximum value as the time period increases (White *et al.* 2006; Specht and Specht 2002).

Ecological processes and variables which generally explain the observation of most plant species within the short-term include disturbance events, detectability (i.e. sporadic flowering time, dormancy), and variable climatic conditions such as rainfall. The expected decrease in the cumulative number of observed species richness over a longer time scale is less influenced by short-term variables and affected more by processes such as metapopulation dynamics and successional changes (White *et al.* 2006). For example, a reasonable proportion of many plant community assemblages consist of dormant/ephemeral species which are only detectable when conditions are suitable for germination, such as post-fire or high rainfall events. The majority of these species are likely to be detected within the short-term (i.e. within 5 years). The floristic results of the quadrat surveys within the BCA are consistent with this fundamental ecological pattern.



**Figure 9: Cumulative species count since the baseline (2001) survey event.**

Similarity indices were calculated for all pairs of quadrats in the baseline survey to determine how similar in species composition to each other the plant communities were in the quadrats surveyed. The similarity indices are shown in **Table 4**. Values from the baseline survey varied between 0.000 and 0.517 indicating a wide range in the degree of similarity between pairs of quadrats, from pairs with no shared species (Quadrat 6 and Quadrat 9), to pairs with many

shared species (i.e. Quadrat 6 and Quadrat 2). This indicates that the nine quadrats sampled capture a wide degree of community and species diversity across the mining lease.

**Table 4: Sorensen’s Similarity Index for all pair-wise comparisons between quadrats 1-9 determined from the presence/absence data for all plant species recorded during the baseline flora survey**

Similarity Index Matrix: Baseline Flora									
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Q1		0.290	0.427	0.281	0.222	0.207	0.328	0.273	0.310
Q2	0.290		0.160	0.063	0.222	0.517	0.149	0.182	0.103
Q3	0.427	0.160		0.234	0.241	0.113	0.425	0.278	0.423
Q4	0.281	0.063	0.234		0.255	0.033	0.261	0.324	0.367
Q5	0.222	0.222	0.241	0.255		0.146	0.160	0.163	0.195
Q6	0.207	0.517	0.113	0.033	0.146		0.063	0.032	0.000
Q7	0.328	0.149	0.425	0.261	0.160	0.063		0.254	0.222
Q8	0.273	0.182	0.278	0.324	0.163	0.032	0.254		0.419
Q9	0.310	0.103	0.423	0.367	0.195	0.000	0.222	0.419	
Mean	0.292	0.211	0.288	0.227	0.201	0.139	0.233	0.241	0.255
SD	0.068	0.142	0.124	0.119	0.041	0.167	0.112	0.116	0.153
Overall Mean	0.232								
SD	0.125								

Values from 0.3-0.4 highlighted green (moderate similarity); > 0.4 highlighted orange (high similarity).

A comparison of the similarity indices for Quadrats 1-9 between 2001 (2003 baseline for Q9), 2007 and 2015 (i.e. 7 and 15 year intervals), as well as the previous (2018) and current (2019) survey periods are presented in **Table 5**. This analysis was performed on interval data to examine the across-time trends in floristic changes for each quadrat. The analysis shows that generally the similarity of the quadrats has stabilised over time. The comparison between consecutive years shows a very high similarity between survey periods (i.e. >0.85 similarity for all quadrats between 2018 and 2019 surveys).

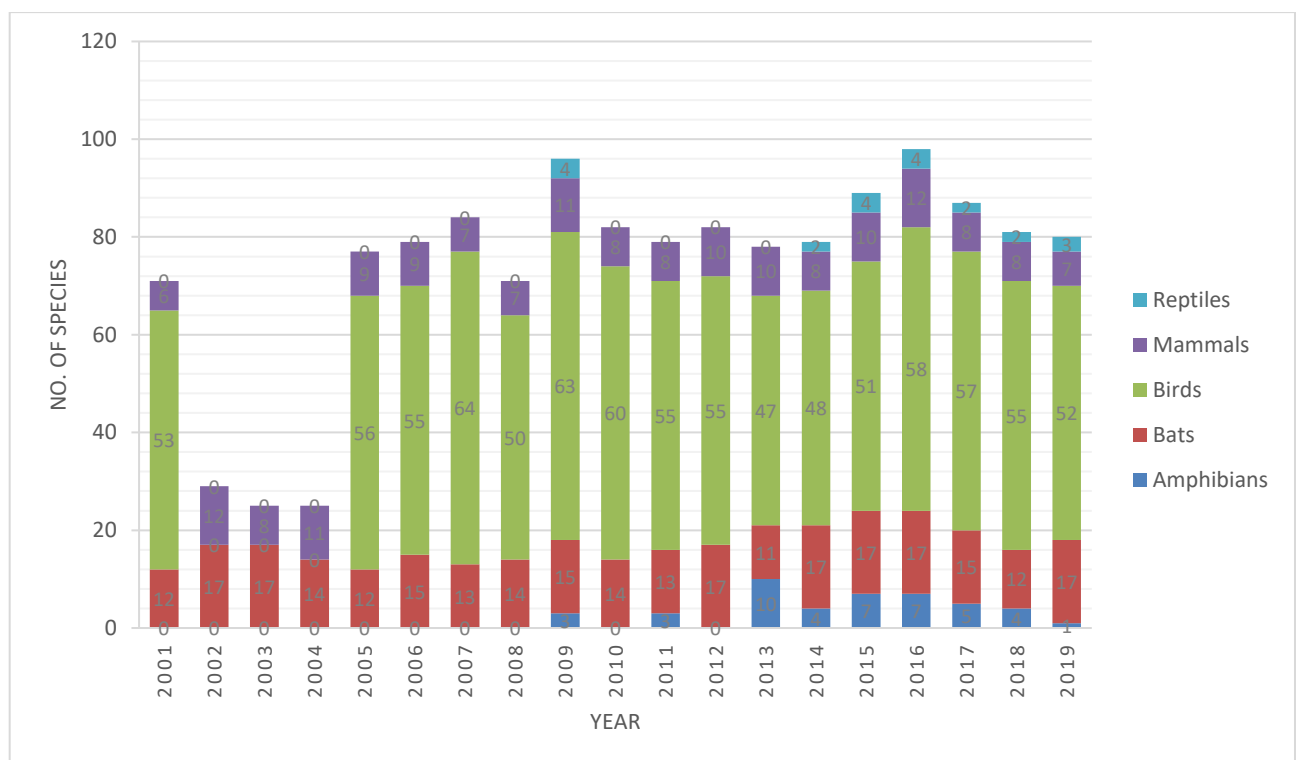
The baseline survey compared to 2007 recorded a similarity of less than 0.5 for Quadrat 2, Quadrat 4, Quadrat 5, Quadrat 6 and Quadrat 9. The baseline survey compared to 2015 recorded similarities less than 0.5 in Quadrat 4, Quadrat 5, Quadrat 7 and Q9. The comparison between 2007 and 2015 recorded similarity indices greater than 0.5 over all quadrats. Quadrats 4, 5, 6 and 9 were observed as having the lowest similarity between baseline and 2019 (<0.5). Overall, these indices are indicative of a dynamic plant community responding to climatic conditions and ecological variables over time.

**Table 5: Sorensen's Similarity Index for Quadrats 1-9, comparing species composition from baseline (2001 for Q1-Q8; 2003 for Q9), 2007, and 2015, as well as the previous and current surveys. Values for quadrats may range between 0 (no species present at both survey periods) to 1.0 (all species present in both surveys).**

		Baseline vs '07	2007 vs '15	Baseline vs '15	Baseline vs 2019	2018 vs '19
<b>Q1</b>	No. of sp. present only 1 year	32	22	34	31	8
	No. of sp. present in both years	22	33	20	21	39
	Similarity Index	0.579	0.75	0.541	0.575	0.907
<b>Q2</b>	No. of sp. present only 1 year	45	37	40	32	13
	No. of sp. present in both years	22	40	25	23	47
	Similarity Index	0.494	0.684	0.556	0.590	0.879
<b>Q3</b>	No. of sp. present only 1 year	47	32	51	46	7
	No. of sp. present in both years	27	44	29	29	56
	Similarity Index	0.535	0.733	0.532	0.558	0.941
<b>Q4</b>	No. of sp. present only 1 year	44	28	52	45	11
	No. of sp. present in both years	19	37	17	18	42
	Similarity Index	0.463	0.725	0.395	0.444	0.884
<b>Q5</b>	No. of sp. present only 1 year	39	39	42	41	17
	No. of sp. present in both years	10	28	11	11	43
	Similarity Index	0.339	0.589	0.344	0.349	0.835
<b>Q6</b>	No. of sp. present only 1 year	36	30	40	47	4
	No. of sp. present in both years	17	33	20	19	55
	Similarity Index	0.486	0.688	0.500	0.447	0.965
<b>Q7</b>	No. of sp. present only 1 year	43	30	47	41	10
	No. of sp. present in both years	22	38	22	24	47
	Similarity Index	0.506	0.717	0.484	0.539	0.904
<b>Q8</b>	No. of sp. present only 1 year	40	42	46	43	14
	No. of sp. present in both years	23	33	23	23	50
	Similarity Index	0.535	0.611	0.500	0.517	0.877
<b>Q9</b>	No. of sp. present only 1 year	52	34	50	47	12
	No. of sp. present in both years	16	40	17	14	48
	Similarity Index	0.381	0.702	0.405	0.373	0.889

### 3.5 FAUNA

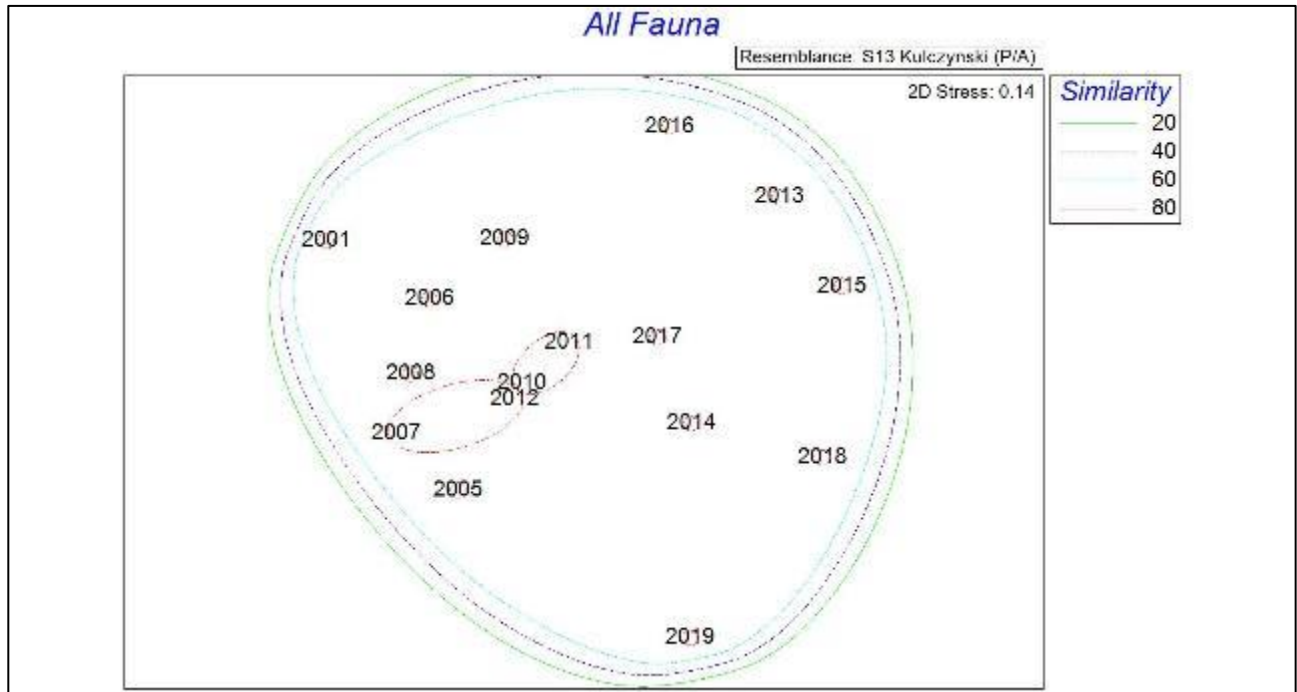
A total of 178 fauna species have been recorded since monitoring began in 2001, including 12 frog, 18 non-flying mammal, 26 bat, 111 bird and 11 reptile species. Fauna species recorded in 2019 totalled 80, consisting of 52 bird, 17 bat, four terrestrial mammal, three arboreal mammal, one frog and three reptile species (**Figure 10**). Five of the bat species are listed as Vulnerable under the NSW *Biodiversity Conservation Act 2016* (BC Act). The low numbers observed in 2002, 2003 and 2004 are due to the lack of bird surveys completed in those years.



**Figure 10: Total fauna species recorded across all years (2001 – 2019).**

The nMDS analysis (**Figure 11**) illustrates the degree of similarity, across years, for the number of fauna species detected within each survey period. Two clusters of years containing 2007 and 2010-2012 show 80% similarity (indicated by the red dotted line) with all other years having at least 60% similar fauna assemblages.

Fauna assemblages for all year’s show at least 68% similarity, 4% less similar than last year’s (2018) result of 72% similarity. The SIMPROF test (**Appendix 8**) showed that the greatest similarity of fauna assemblages exists between years 2010 and 2011 (83%). This year’s results (2019) shows a statistically significant difference from previous years of monitoring. This difference is likely to be due to differences in the composition of bird species detected. This is discussed in greater detail in **Section 3.5.1.4**.

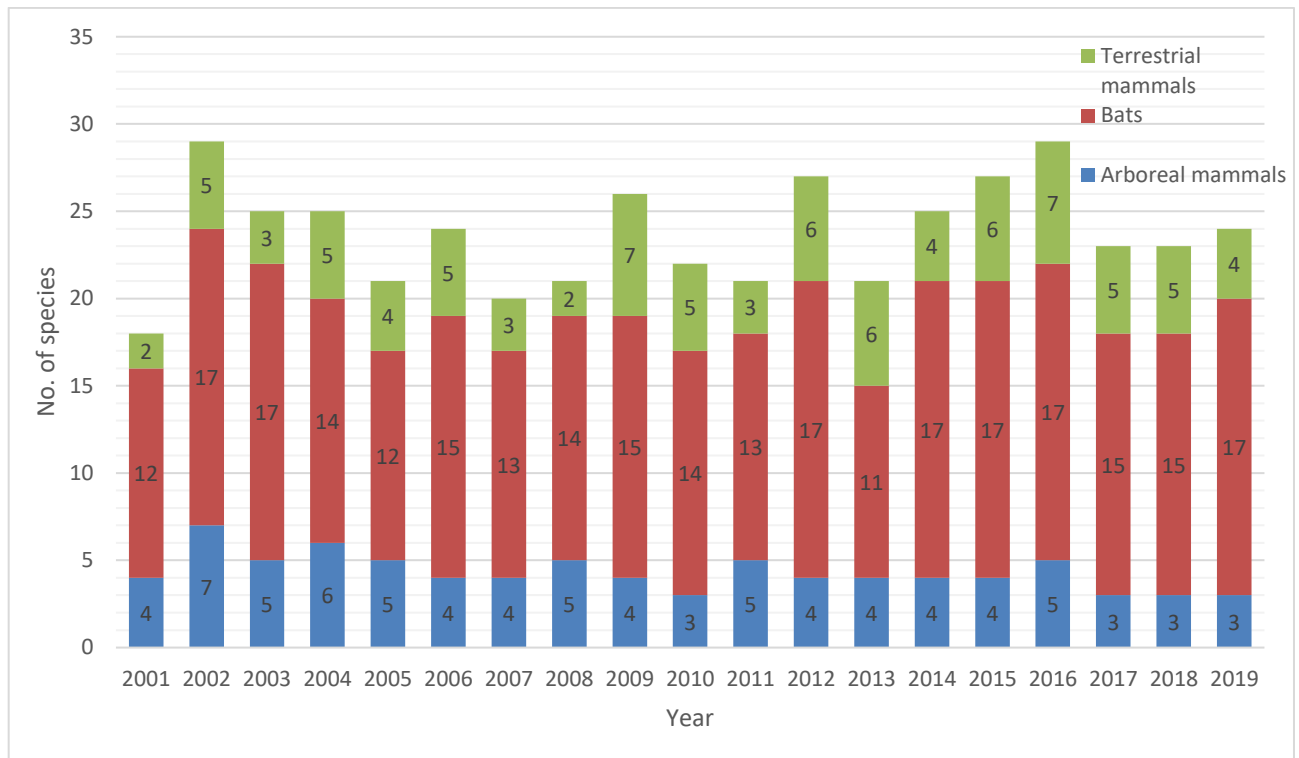


**Figure 11: nMDS analysis of all fauna species detected in all quadrats 2001 – 2019 (excluding 2002 – 2004)**

### 3.5.1 Mammals

A total of 24 mammal species were detected during the 2019 surveys, comprising 16 microbats, one megabat, four terrestrial species and three arboreal species. The five BC Act listed bat species include: Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Little Bentwing-bat (*Miniopterus australis*), Large-footed Myotis (*Myotis macropus*), Greater Broad-nosed Bat (*Scoteanax rueppellii*) and Grey-headed Flying-fox (*Pteropus poliocephalus*). The number of mammals detected during the current survey (24) is slightly above the yearly average of 23.7 species across all survey years (**Figure 12**).

During the 2019 surveys no introduced pest species were detected.



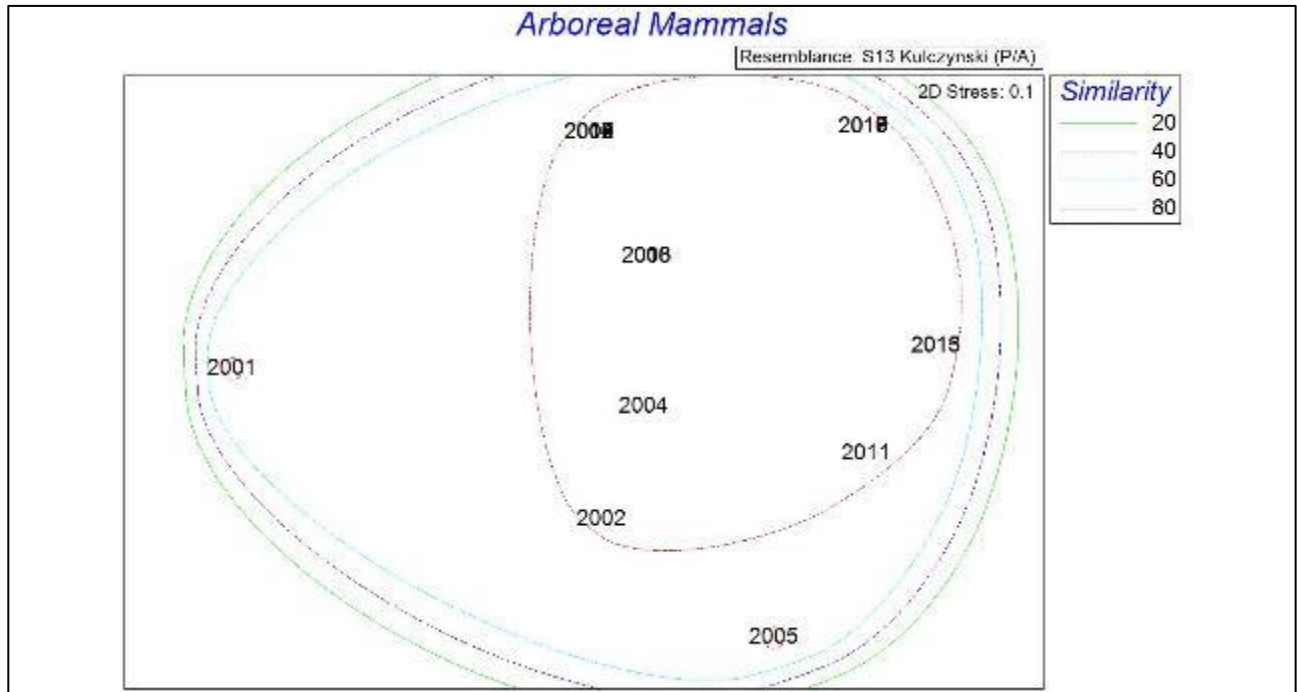
**Figure 12: Total mammal species recorded at each survey event 2001 – 2019.**

A list of all mammal species detected from 2001-2019 is provided in **Appendix 5**. To investigate trends in species assemblages across the years, mammals were categorised for analysis into arboreal species, highly mobile flying species (Chiroptera or bats) and terrestrial species.

### 3.5.1.1 Arboreal Mammals

During the 2019 fauna surveys three species of arboreal mammal were detected (**Figure 12**), which is slightly below the yearly average (four species). The arboreal mammals detected included Sugar Glider (*Petaurus breviceps*) recorded during all survey periods except for 2001, as well as the Brown Antechinus (*Antechinus stuartii*) and Common Brushtail Possum (*Trichosurus vulpecula*), which have been detected every year.

The nMDS analysis demonstrates that overall, the assemblages of arboreal mammal species have remained similar since 2001 (**Figure 13**). All years' show at least 65% similarity, with the most similar years being 2010, 2017-2019 (100% similarity) also year groupings of (2013 and 2015) (2003, 2006, 2008) and (2006, 2007, 2009, 2012, 2014) all have 100% similarity within each grouping. Variation of arboreal mammal assemblages, year to year, can be attributed to the sporadic detections of less common or highly mobile species such as the Greater Glider (*Petauroides volans*) and Squirrel Glider (*Petaurus norfolcensis*).

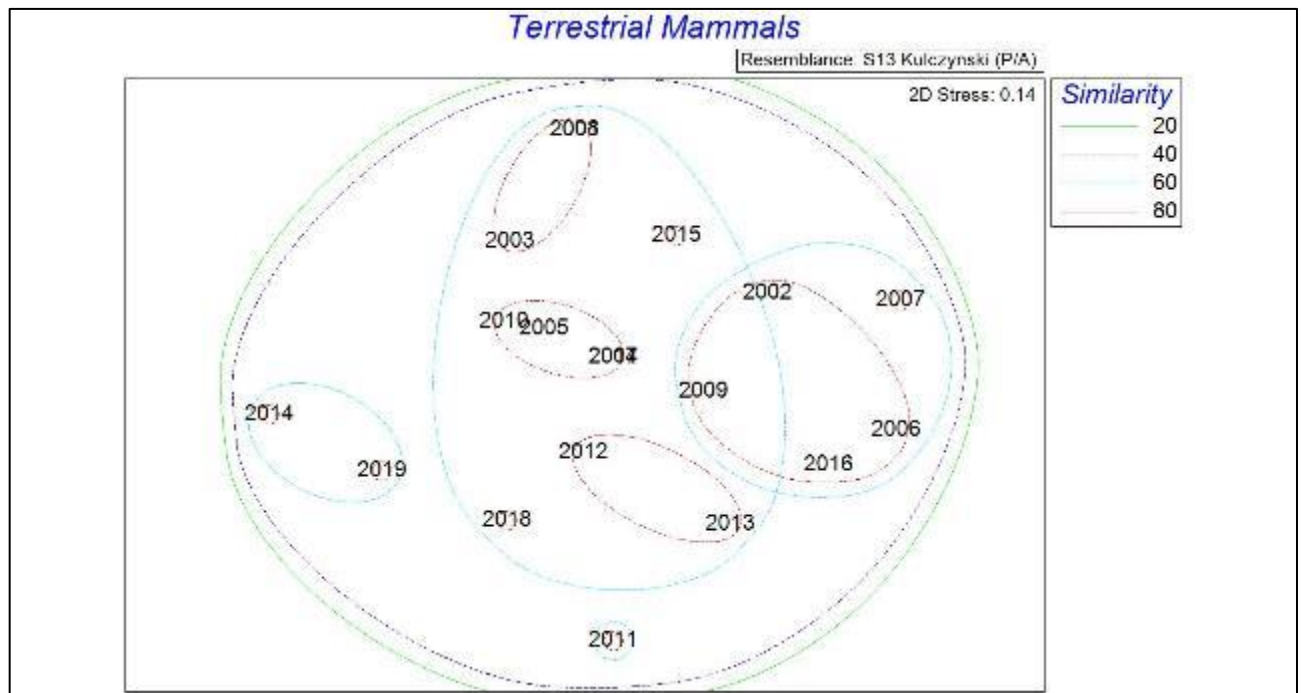


**Figure 13: nMDS analysis of arboreal mammal species detected in all quadrats 2001 – 2019**

### 3.5.1.2 Terrestrial Mammals

The 2019 surveys recorded a total of four terrestrial mammal species (**Figure 12**) which is slightly below the average for all years (4.5 species). The terrestrial species comprised four native species; Bush Rat (*Rattus fuscipes*), Eastern Grey Kangaroo (*Macropus giganteus*), Swamp Wallaby (*Wallabia bicolor*) and Echidna (*Tachyglossus aculeatus*) with no feral species detected in this year's surveys. The nMDS analysis of terrestrial mammals (**Figure 14**) shows some variation in species assemblages throughout the monitoring period with all years being at least 60% similar with several clusters of years being highly similar to each other ( $\geq 80\%$ ).



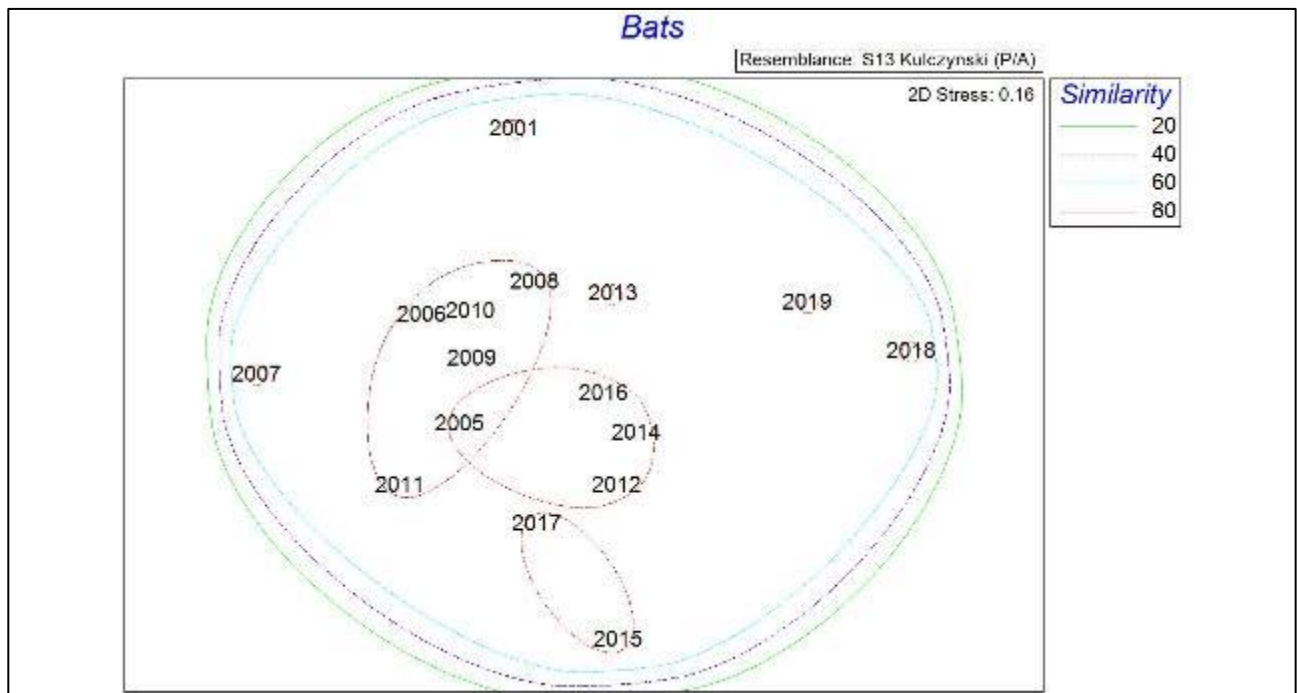


**Figure 14:** nMDS analysis of terrestrial mammal species detected in all quadrats 2001 – 2019.

### 3.5.1.3 Bats

A total of 17 species of bat were recorded across all nine quadrats during 2019 (**Figure 12**). This was slightly above the yearly average of 15 species. Five of the 17 bat species recorded during the 2018 survey are listed as threatened under the BC Act. The five threatened bat species included: Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Little Bentwing-bat (*Miniopterus australis*), Large-footed Myotis (*Myotis macropus*), Greater Broad-nosed Bat (*Scoteanax rueppellii*) and Grey-headed Flying-fox (*Pteropus poliocephalus*). Bats account for 18% of all fauna species detected in the 2019 surveys.

The nMDS showed the bat assemblages of all years were at least 65% similar, with three clusters of years that were at least 80% similar (**Figure 15**). The 2018 and 2019 results are 78% similar with each other but only 65% similar with other years. There was no clear pattern in the variation in species assemblages over time.



**Figure 15: nMDS analysis of bat species detected in all quadrats 2001 – 2019 (excluding 2002 – 2004).**

### 3.5.1.4 Birds

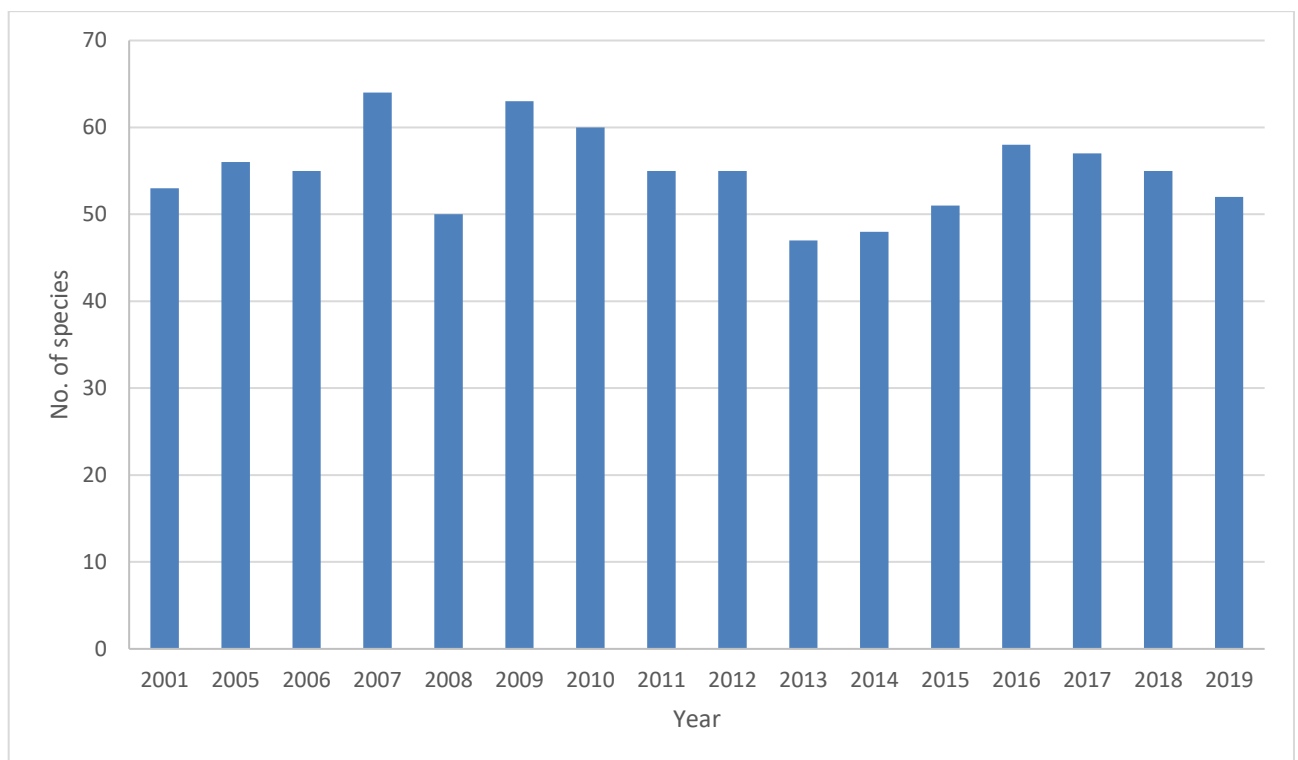
A total of 52 bird species were recorded across the nine quadrats during the 2019 surveys, which is slightly below the average of 54.9 species across all years (**Figure 10**). Overall, the number of bird species recorded each year has remained relatively constant with no marked increase or decrease. One previously undetected species (from quadrat surveys) was recorded in 2019 the White-eared Honeyeater (*Lichenostomus leucotis*). Two species listed as vulnerable under the BC Act, Little Lorikeet (*Glossopsitta pusilla*) and Powerful Owl (*Ninox strenua*) were detected in 2019.

A total of 111 species have been recorded since monitoring began which belong to 41 families, of which the most common are Meliphagidae (Honeyeaters), Psittacidae (Parrots), Acanthizidae (Thornbills, Scrubwrens and Gerygones), Columbidae (Pigeons and Doves), Cuculidae (Cuckoos) and Artamidae (Woodswallows, Butcherbirds, Australian Magpies and Currawongs). A total of 20 families were only represented on site by one species, however, several of these families such as the Podargidae (Frogmouths), Coraciidae (Rollers), Oriolidae (Orioles and Figbird), Dicaeidae (Flowerpeckers) and Megapode (Mound Builders) have only 1 – 3 species present in Australia.

A total of seven threatened bird species have been recorded across the nine quadrats to date. Three of these species are large forest owls (Sooty Owl, Powerful Owl and Masked Owl) and four are woodland bird species (Glossy Black-Cockatoo, Little Lorikeet, Dusky Woodswallow and Varied Sittella).

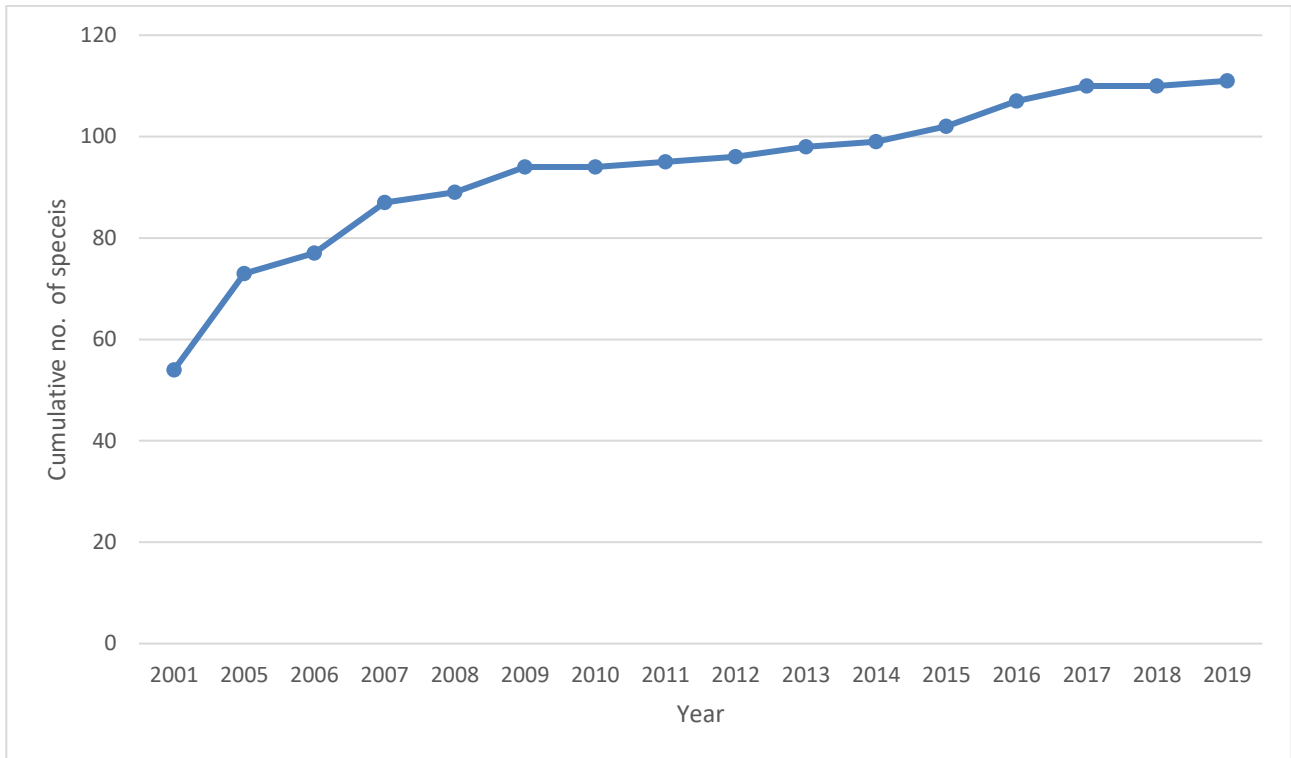
The Sooty Owl has only been recorded within the BCA twice (2001 and 2016). The Masked Owl has been recorded between 2014 and 2018, as well as 2009 and 2010, but was not recorded in this survey period. The Powerful Owl has been recorded in all years except 2009, 2012, 2013 and 2016. The Little Lorikeet and Varied Sittella have been recorded infrequently throughout the monitoring period. The Glossy Black-Cockatoo was recorded for the first time in 2016. No feral bird species have been recorded to occur on or in the immediate vicinity of the quadrats to date.

The total number of bird species recorded each year is displayed in **Figure 16**.



**Figure 16: Total number of bird species recorded in all quadrats 2001 – 2019 (excluding 2002 - 2004).**

**Figure 17** shows the cumulative number of bird species recorded since the baseline survey event. The cumulative number of species has been increasing steadily every year since the baseline. The flattening of the species curves suggests that most species likely to occur at the site have now been recorded; however, new species are still being recorded in recent years.



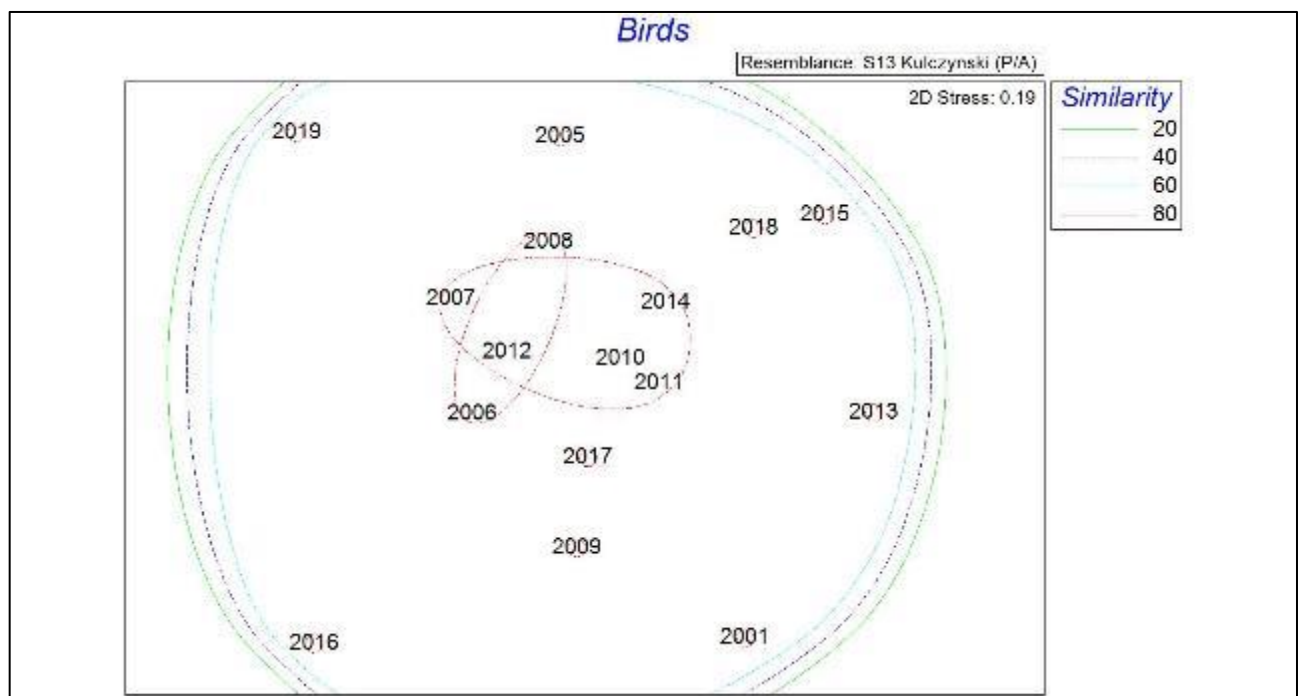
**Figure 17: The cumulative bird species count since the baseline (2001) survey event.**

Despite the total number of bird species recorded each year remaining relatively constant over time, the nMDS similarity analysis (**Figure 18**) showed a pattern of clustering of survey years similar to that observed for all fauna groups, suggesting that changes in bird assemblages may be responsible for the similarity results observed for all fauna (when vertebrate classes are grouped together due to the number of species within the bird group).

The SIMPROF cluster analysis (**Appendix 8**), revealed that bird assemblages from the years 2016 and 2019 are the most dissimilar statistically (95% confidence) compared to other years. With all other years being at least 74% similar with each other. To investigate this recent trend further, bird species were pooled (refer to 2016 annual report) based on general habitat preference (generalist, forest interior specialist, forest edge/open grassland preferred). Survey years were then pooled together to form the groups 2005 – 2008, 2008 – 2012 and 2013 – 2016 (the period since mining operations has ceased).

The analysis found that since 2012, birds with generalist habitat preference have continued to be around 25-26 species per 4-year period. However, there has been an approximately 12.5% decrease in the number of forest-interior specialist species recorded while forest edge/open grassland species have increased by 25% since the cessation of mining operations in 2012.

This analysis will be undertaken again in 2020 (20 years of monitoring) to see whether this identified trend continues.

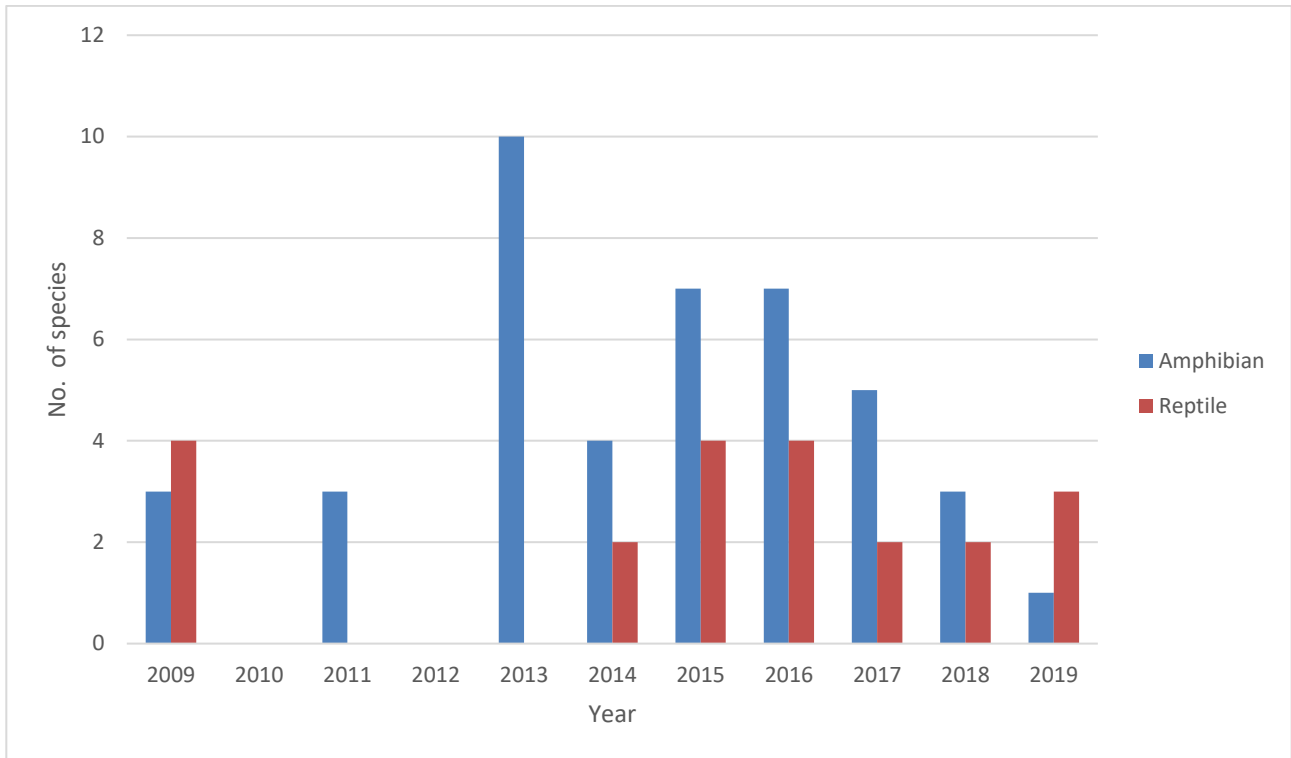


**Figure 18:** nMDS analysis of bird species detected in all quadrats 2001 – 2018 (excluding 2002 – 2004)

### 3.5.2 Herpetofauna

Although herpetofauna monitoring is not officially part of the monitoring program, reptile and amphibian species were recorded opportunistically during survey events. No reptile or amphibian species were recorded prior to 2009, as such, herpetofauna was excluded from the statistical analyses comparing species assemblage similarity for those years.

Current survey identified one amphibian, Eastern Dwarf Tree Frog (*Litoria fallax*), and three reptile species, Yellow-faced Whipsnake (*Demansia psammophis*), Lace Monitor (*Varanus varius*) and Red-bellied Black Snake (*Pseudechis porphyriacus*) were recorded within the quadrats (**Figure 19**). One previously undetected species the Yellow-faced Whipsnake (*Demansia psammophis*) was identified in quadrat 3.

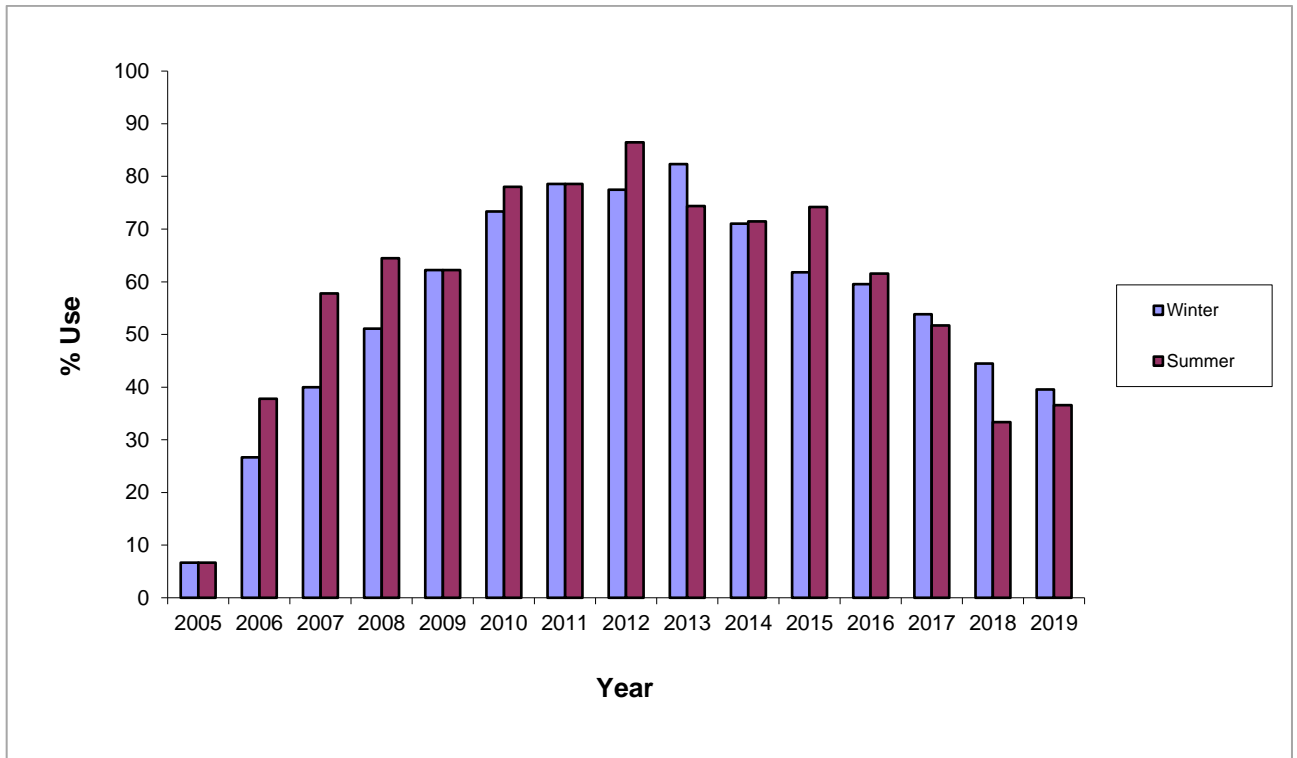


**Figure 19:** Number of amphibian and reptile species recorded within all quadrats over time.

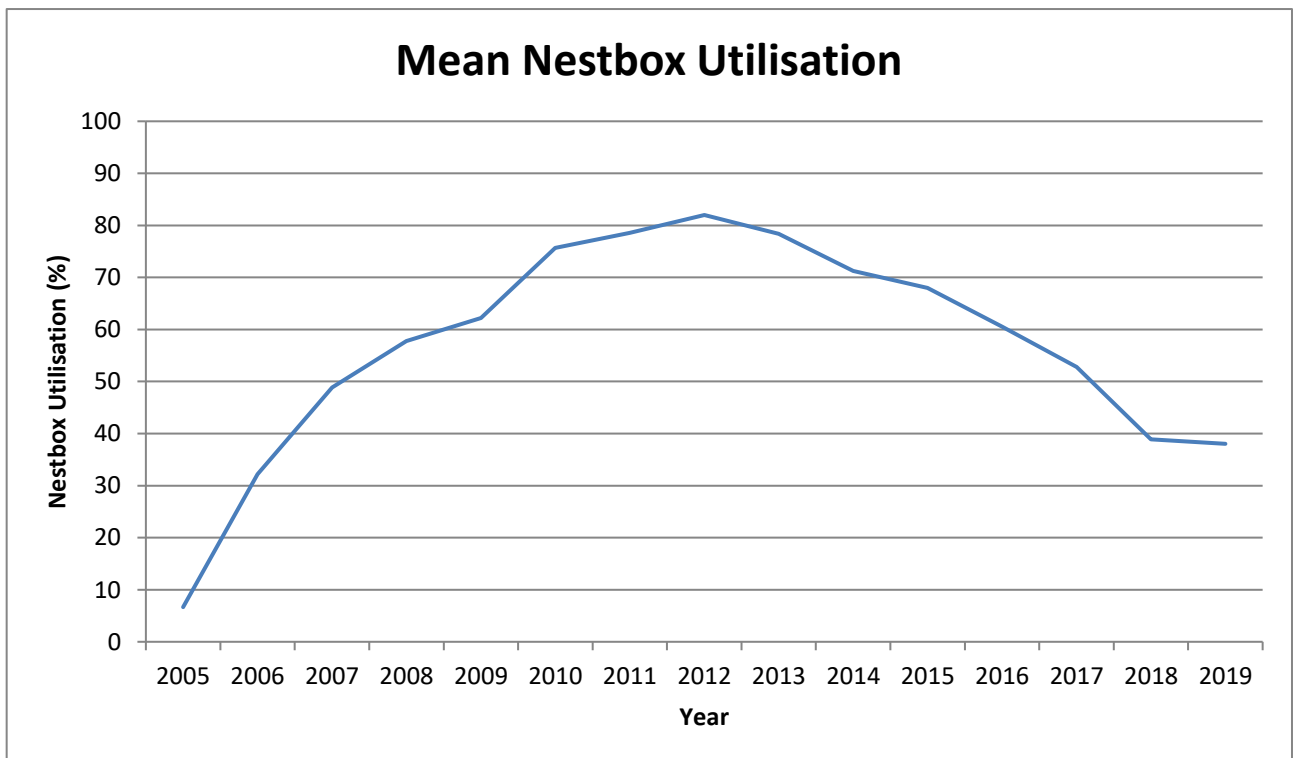
### 3.5.3 Nest Box Monitoring

All 45 nest boxes were checked once during winter and summer in 2019 to determine occupancy rates. Initially, 45 nest boxes were installed across the nine quadrats in 2005, however, three were removed in 2010 due to the construction of the western Square Pit. The three nest boxes removed were replaced in May 2016 with new nest boxes at different locations within Quadrat 2. In total 15 nest boxes were replaced in 2016. After the 2018 winter surveys, 15 nest boxes were replaced and three repaired bringing the total available boxes back to 45. Total nest box utilisation in 2019 was 40% in winter and 37% in summer (**Figure 20**). In 2017 analysis using single factor ANOVA found a significant difference ( $P = 0.04$ ) between usage rates versus season (winter and summer). Summer usage rates were slightly higher (61.9%) in comparison to winter usage rates of (57.2%) when comparing averages over all survey years. Nest box use between summer and winter for 2019 are not comparable as a result of the difference in the number of available boxes between seasons.

Nest box utilisation appears to be plateauing with similar usage rates to last year **Figure 21**. Three mammal species were confirmed to have used the nest boxes, Sugar Glider (*Petaurus breviceps*), Brown Antechinus (*Antechinus stuartii*) and Common Brushtail Possum (*Trichosurus vulpecula*).

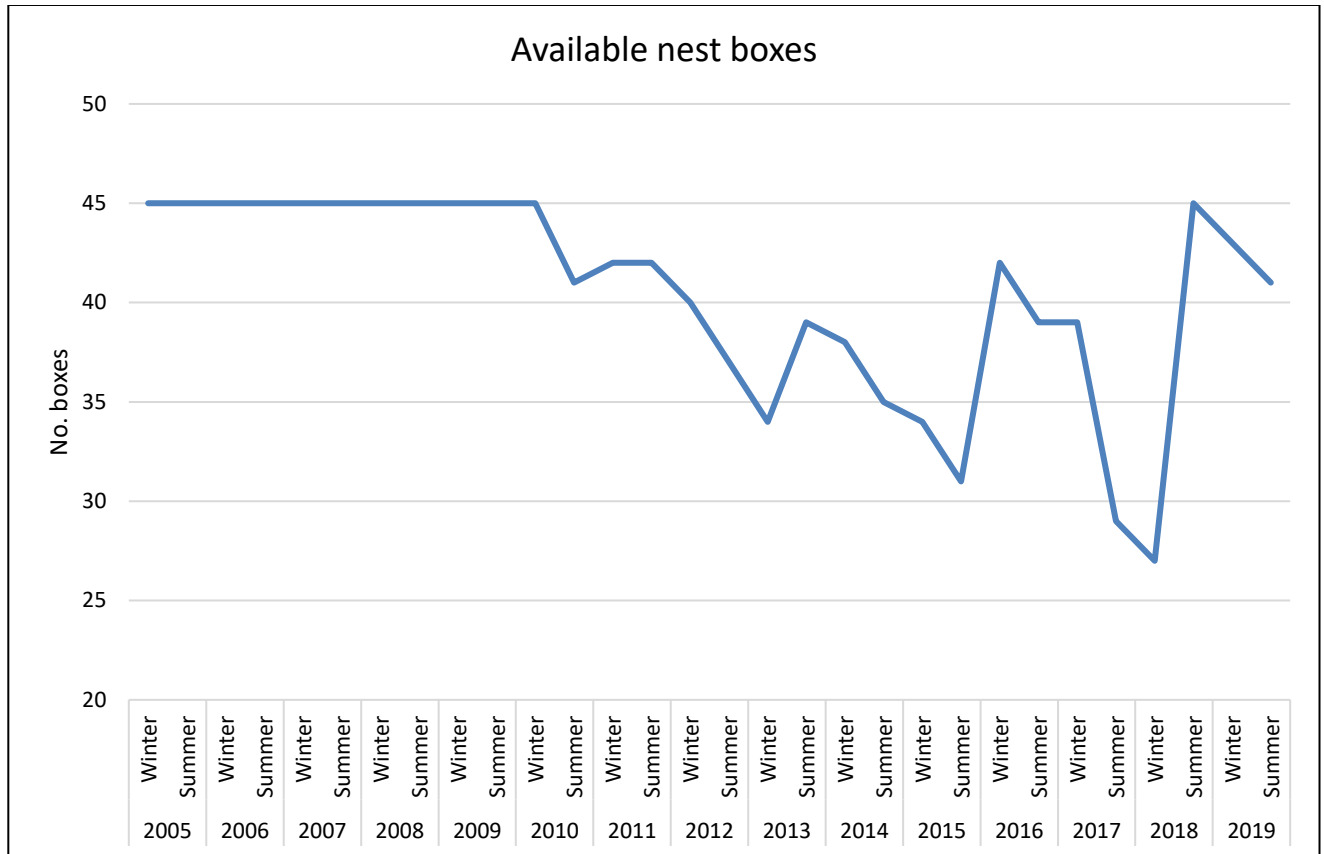


**Figure 20:** The proportion of nest boxes utilised in winter and summer between 2005 and 2019



**Figure 21:** Nest box usage, summer and winter combined (2005 – 2019). Usage rates are calculated based on available boxes

**Figure 22** shows the number of nest boxes available for use since installation in 2005. There was no decline in nest box availability from 2005 until 2010. Since then, nest box availability has fluctuated due to weather and termite damaged and the repair/instalment of new nest boxes.



**Figure 22: Number of available nest boxes over time (2005 - 2019)**



## 4. DISCUSSION

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### 4.1 VEGETATION

Plant species numbers have increased since 2001, as have all floristic structural components. This is indicative of a dynamic plant community with high recruitment from the seed pool, indicating a healthy plant community status. While the species composition recorded in each quadrat has changed over the survey period, the number of species identified within each quadrat has remained relatively consistent over time. The current survey results are indicative of the drought with several of the quadrats having a lower diversity and cover of ground layer species.

Previous weed control has been effective in controlling *L. camara* and allowing the subsequent recruitment of native species, particularly in Quadrats 5 and Quadrat 7 where *L. camara* has noticeably declined. Follow-up weed control is critical to ensure the effective long-term management of these infestations and to limit regrowth. Quadrat 6 has a persistently high exotic plant coverage, with an estimated cover of >75% in the ground layer. Immediate control in Quadrat 6 is recommend to prevent further decline.

Given that total weed abundance has been relatively low within the BCA since 2001, it is difficult to identify changes in community condition based on weed abundance. Community condition has more likely been affected by the steady increases in biomass, resulting from the removal of weed species, fire management and tree removal, and a healthy native seed-bank.

Regression analyses examining the change in FPC and stand volume for all quadrats over time demonstrate a steady increase in these parameters. Biomass results indicate minimal discernible adverse impact on vegetation growth and development from the surrounding mining operations. While an overall progressive increase in biomass parameters (FPC and stand volume) in the quadrats is supported by the data, the rate of increase has slowed with both parameters remaining relatively constant since the 2010 survey.

The FPC analysis in 2019 indicate a downward trend. Although there was a slight jump in the results for stand volume in the 2018 survey and an increase in the current survey this is likely due to the inclusion of tree species which had reached the 2 m threshold, new tree species

have been included over the past two years. Minimal regeneration of the canopy layer, a declining shrub layer and reduced ground cover is evident to various degrees at each quadrat - all of which may be attributed to a lack of fire and drought conditions.

### 4.1.1 Myrtle Rust

In 2013 Quadrat 6 recorded a decrease in FPC resulting from the decline of *R. psidioides* species from rust fungus. In 2015, several of the seedlings were still present despite being infected, however the mature trees within and adjacent to Quadrat 6 were declining in health. By 2016, the mature trees had completely died off, and only one seedling was present. During the 2018 and the current survey this species was recorded as absent from Quadrat 6.

Myrtle rust is a plant disease caused by the exotic fungus *Uredo rangelii*. It is a serious pathogen which affects plants belonging to the family Myrtaceae including Australian natives such as *Callistemon* spp., *Melaleuca* spp. and *Eucalyptus* spp. It was first detected in Australia in 2010 on the NSW Central Coast. Over 100 native plant species in NSW are known to be susceptible host species to the fungus, including several species present within the BCA; *Backhousia myrtifolia*, *Callistemon salignus*, *Eucalyptus pilularis*, *Melaleuca linariifolia* and *Syncarpia glomulifera*. While no other evidence of Myrtle Rust was observed within Quadrat 6, or other areas of the BCA, monitoring for evidence of the fungus will continue as part of future surveys.

## 4.2 FAUNA

Fauna species richness has remained stable. The current survey recorded 80 species, which is two below the yearly average of 82.6 (excluding 2002-2004 where no bird surveys were conducted). Species recorded include 52 birds, slightly below the yearly average of 54 species. Seven non-flying mammals were recorded, slightly below the yearly average of nine. The species assemblages of arboreal mammals have been relatively constant throughout the monitoring period as Brown Antechinus, Sugar Glider and Common Brushtail Possum have been recorded every year. Annual variations in species recorded include the Greater Glider (*Petauroides volans*), Squirrel Glider (*Petaurus norfolcensis*) and Long-nosed Bandicoot (*Perameles nasuta*).

The nMDS analysis of terrestrial mammals (**Figure 14**) indicates variation in species assemblages with no clear pattern. This may be attributed to the detectability of species, for

example the Short-beaked Echidna (*Tachyglossus aculeatus*) was recorded in 2014 and 2019 only. This species is somewhat secretive and could easily go undetected despite its presence within the BCA.

Bat species assemblages have remained stable over the years, any variations do not fit a clear pattern. The ecology of most Australian bat species is poorly understood making interpretation difficult. The number of species detected each year has remained high which is a positive. Within the last two years a difference is evident in this nMDS analysis, this is likely a result of the variation of species detected compared to earlier years.

The cluster analysis identified a trend in the bird species assemblages. The assemblages recorded in the most recent years being most different from those recorded prior to 2013. To investigate the cause of the changing species assemblage, species were grouped according to general habitat preference (generalist, forest-interior specialist and forest edge specialist). With the addition of the 2016 bird survey results, trends indicate that the species with generalist habitat requirements have remained relatively stable since 2005. Species that prefer forest edges or open areas have risen since the 2009-2012 period where previously they had remained stable. While interior specialist species appeared to be significantly decreasing (Kleinfelder 2015), the inclusion of 2016 data in the assemblage analysis have shown that the numbers of these species have declined from the 2009-2012 period by 12.5% (5 species).

Given that mining ceased in 2012 it is possible that changes in disturbance have led specialist species to move in or out of the area. Observed changes in species assemblages over time are unlikely to be due to edge-specialists moving into the area, but rather interior-specialists moving out. The change in the bird species assemblage may have been slowly occurring over time as a result of mining activities or due to large-scale vegetation clearing in the neighbouring industrial estate immediately to the east, which occurred in 2012.

The creation of more edge habitat along the eastern edge of the BCA may have made the habitat less suitable for some specialist species. It is most likely a combination of these two factors that has caused the changes observed in the 2016 analysis. The interior-specialist species that were recorded pre-2012 but not post-2012 may still be present within the BCA but might have experienced population decline, reducing their detectability. This trend will be further investigated in 2020 (year 20 of monitoring).

With the cessation of the open-cut mine and the continued maturation of the adjacent rehabilitation area, these species may return or recover to previous population levels. This

observed change in species composition may also be due to natural fluctuations either locally or regionally and not be related to mining activities. Continued monitoring of the quadrats would allow identification of any long-term trends; however, it is suggested that after year 20 of monitoring that biennial surveys (every two years) would be more appropriate (C. Driscoll *pers. comm.*).

The threatened Powerful Owl was detected during the 2019 surveys which has now been recorded for the third consecutive year within multiple locations (Quadrat 3, 6 and 8). The Sooty Owl has rarely been observed over the survey period with the last detection in 2001 (Quadrat 2) and in 2016 (Quadrat 3). The Masked Owl, however, has been more regularly detected with sightings in 2014, 2015, 2016, 2017 and 2018. Given that the species has been recorded for five consecutive years, this would suggest that there is a roosting location nearby. This was supported in 2015 when regurgitated pellets were found around the base of a tree where a Masked Owl was observed.

### 4.3 NEST BOXES

The usage rate of nest boxes (percentage of available nest boxes showing signs of usage) by fauna increased in a linear fashion for the first five years following installation, after which, usage plateaued, followed by a decline. This pattern of nest box usage after five years of deployment has been observed in several other nest box monitoring programs in native forest (Kleinfelder 2015; Lindenmayer *et al.* 2009). For the first few years after installation, reasonable levels of nest box use were recorded. This was followed by high levels of nest box attrition after 8-10 years. These findings led to the suggestion of an 'effective occupancy time' of approximately five years for arboreal mammals. That is, the materials used in current nest box designs have a lifespan of only 8 – 10 years before they reach a point of decay where arboreal fauna no longer use them.

Another explanation for the rapid rise in nest box use, followed by a plateau and subsequent decrease could be due to the installation of new nest boxes as those installed in 2005 began to deteriorate as materials aged. Several nest box repair and replacement events have occurred since 2005. Although nest box utilisation is calculated based on the number of available nest boxes, this does not discount the fact that new nest boxes are not inhabited immediately and take time for fauna to take residence. Similar to the trends experienced for those nest boxes installed in 2005, it may take up to 3-4 years for new nest boxes to reach ~50% utilisation and about eight years for nest boxes to reach peak occupancy.

The current survey demonstrates a slowing of the decline of mean utilisation of nest boxes. If previous trends (as above) continue an increase in the utilisation of nest boxes over the next 2-3 year period should occur. Ongoing maintenance (fixing broken lids and hinges and removal of undesirable species such as termites and wasps) and replacement of broken boxes is required to ensure the ongoing success of the nest box program within the Donaldson BCA.

## 5. CONCLUSION

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The monitoring program indicates that the Donaldson Coal operations are causing minimal impact to biodiversity within the BCA. This conclusion is based on the summary of information provided below:

- All biomass variables examined (i.e. basal area, height, foliage projective cover (FPC) and stand volume), have shown relatively consistent increases over the last 18 years since the baseline survey in 2001. The regression analyses also confirmed that the relationship between time and increases in stand volume were highly significant indicating that the community biomass has increased substantially across time with no significant year-to-year variation from 2001 to 2019. The rate of increase in both biomass parameters has slowed since 2010, with slight decreases in FPC at most quadrats since 2011. The FPC analysis may be indicating a downward trend and subsequent surveys will show whether this is the case.
- Overall plant species numbers have increased since 2001 as have all floristic structural components which is indicative of a dynamic plant community with high recruitment from the seed pool, normally an indicator of healthy, regenerating plant community status. The 2019 drought has impacted the diversity of species and cover of ground layer species across all quadrats.
- The total number of fauna species recorded during the monitoring surveys has remained relatively constant over the 19 years since monitoring began. There has been a general increase in the total number of species recorded since the cessation of mining in 2012.
- The number of mammal species recorded has remained constant. There has been some variation in the species assemblages over time, which is likely due to species detectability and their ecology.
- The number of bird species recorded each year for those with generalist habitat preferences remained relatively constant over the monitoring period. Between 2013 – 2016 the number of species that prefer the forest-interior have declined, the number of forest edge specialists have risen. In recent years, there has been a shift in species assemblages with respect to birds with habitat specialisation. This trend will be investigated further in 2020 (year 20 of monitoring).

- Nest box monitoring shows that fauna utilisation increased from the year of installation (2005) to 2012 and then decreased. A decrease in fauna utilisation following the 2012 monitoring event is likely to be due to weather damage, which makes the nest boxes less habitable. The replacement of damaged boxes is likely to increase fauna utilisation in the future.

## 6. RECOMMENDATIONS

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The following recommendations are considered necessary to maintain biodiversity values within the BCA:

- Monitoring should continue so that trends evident in the first 19 years may be better understood. Following year 20, monitoring should be conducted biennially (every two years). This will require approval from the consent authority.
- Nest-boxes should continue to be monitored annually. Repairs and nest box replacements should be made as required.
- Weed control, targeting *L. camara* is recommended in areas with dense infestations. This should be conducted by a suitably qualified bush regenerator.
- The monitoring program indicates that the Donaldson Coal operations are causing minimal impact to biodiversity within the BCA; however, further monitoring will be required to assess accumulative impacts on biodiversity caused by other direct impacts and indirect pressures. This will elucidate the effects of confounding factors such as the impacts of residential development at the eastern edge of the BCA in 2012 and determine the influence of climate change and seasonal variation. Future years of monitoring should continue to analyse the diversity of specialist and generalist species separately and should focus on abundance trends of sensitive flora and fauna species, including threatened species.



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## APPENDIX 1. TOTAL FOLIAGE PROJECTION COVER 2001 (BASELINE) (2003 FOR Q9), 2007, 2015, 2016, 2017, 2018 AND 2019

Q1	2001	2007	2015	2016	2017	2018	2019
Ground cover	8.40%	10.20%	20.00%	20.00%	20.00%	20.00%	5.00%
Shrubs to 2m	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Overstorey	150.44%	166.72%	205.49%	198.86%	201.75%	214.21%	199.80%
<b>Total FPC</b>	<b>158.83%</b>	<b>176.92%</b>	<b>225.49%</b>	<b>218.86%</b>	<b>221.75%</b>	234.21%	204.80%
Q2	2001	2007	2015	2016	2017	2018	2019
Ground cover	36.21%	70.00%	65.00%	60.00%	65.00%	55.00%	30.00%
Shrubs to 2m	7.96%	9.37%	10.31%	11.87%	8.08%	8.74%	9.45%
Overstorey	181.59%	288.10%	301.56%	300.65%	281.86%	328.71%	317.12%
<b>Total FPC</b>	<b>225.76%</b>	<b>367.48%</b>	<b>376.86%</b>	<b>372.52%</b>	<b>354.94%</b>	<b>392.45%</b>	<b>356.57%</b>
Q3	2001	2007	2015	2016	2017	2018	2019
Ground cover	28.95%	60.00%	65.00%	65.00%	30.00%	30.00%	15.00%
Shrubs to 2m	33.65%	62.96%	61.81%	48.16%	42.92%	45.29%	35.43%
Overstorey	125.30%	215.67%	209.53%	199.57%	188.35%	213.86%	221.28%
<b>Total FPC</b>	<b>187.90%</b>	<b>338.62%</b>	<b>336.34%</b>	<b>312.73%</b>	<b>261.28%</b>	<b>289.15%</b>	<b>271.71%</b>
Q4	2001	2007	2015	2016	2017	2018	2019
Ground cover	53.41%	40.00%	70.00%	70.00%	75.00%	75.00%	35.00%
Shrubs to 2m	0.00%	23.56%	37.69%	22.90%	18.29%	14.22%	8.77%
Overstorey	113.78%	155.08%	158.74%	154.09%	157.75%	173.97%	174.75%
<b>Total FPC</b>	<b>167.19%</b>	<b>218.63%</b>	<b>266.43%</b>	<b>246.99%</b>	<b>251.04%</b>	<b>263.20%</b>	<b>218.52%</b>
Q5	2001	2007	2015	2016	2017	2018	2019
Ground cover	81.73%	80.00%	80.00%	80.00%	75.00%	75.00%	35.00%
Shrubs to 2m	10.00%	1.27%	1.64%	1.87%	1.14%	1.14%	1.12%
Overstorey	107.75%	172.51%	202.07%	186.35%	186.79%	202.22%	185.48%
<b>Total FPC</b>	<b>199.48%</b>	<b>253.78%</b>	<b>283.71%</b>	<b>268.22%</b>	<b>262.93%</b>	<b>278.36%</b>	<b>221.60%</b>

Q6	2001	2007	2015	2016	2017	2018	2019
Ground cover	24.31%	80.00%	90.00%	90.00%	90.00%	90.00%	55.00%
Shrubs to 2m	49.54%	4.19%	3.64%	3.01%	4.26%	4.26%	4.79%
Overstorey	152.61%	225.19%	247.91%	242.57%	229.52%	278.17%	258.17%
<b>Total FPC</b>	<b>278.95%</b>	<b>309.38%</b>	<b>341.54%</b>	<b>335.58%</b>	<b>323.78%</b>	<b>372.43%</b>	<b>317.96%</b>
Q7	2001	2007	2015	2016	2017	2018	2019
Ground cover	89.01%	80.00%	80.00%	80.00%	80.00%	85.00%	20.00%
Shrubs to 2m	20.27%	31.62%	39.29%	36.75%	37.54%	38.54%	38.54%
Overstorey	101.60%	196.31%	258.56%	238.00%	228.19%	270.12%	272.43%
<b>Total FPC</b>	<b>210.88%</b>	<b>307.93%</b>	<b>377.85%</b>	<b>354.75%</b>	<b>345.73%</b>	<b>393.66%</b>	<b>330.97%</b>
Q8	2001	2007	2015	2016	2017	2018	2019
Ground cover	85.38%	50.00%	80.00%	80.00%	80.00%	80.00%	35.00%
Shrubs to 2m	11.00%	23.24%	25.90%	22.03%	20.13%	24.22%	21.40%
Overstorey	93.53%	157.44%	178.55%	171.43%	167.50%	198.53%	188.40%
<b>Total FPC</b>	<b>189.91%</b>	<b>230.67%</b>	<b>284.45%</b>	<b>273.46%</b>	<b>267.63%</b>	<b>302.74%</b>	<b>244.80%</b>
Q9	2001	2007	2015	2016	2017	2018	2019
Ground cover	87.56%	75.00%	85.00%	85.00%	80.00%	80.00%	50.00%
Shrubs to 2m	9.52%	14.43%	22.81%	24.19%	14.06%	12.85%	14.54%
Overstorey	93.75%	130.05%	162.61%	161.27%	161.05%	166.02%	161.46%
<b>Total FPC</b>	<b>190.83%</b>	<b>219.48%</b>	<b>270.42%</b>	<b>270.46%</b>	<b>255.11%</b>	<b>258.87%</b>	<b>226.00%</b>

## APPENDIX 2. TOTAL TREE BASAL AREAS FROM 2001 (BASELINE) (2003 FOR Q9), 2007, 2015, 2016, 2017, 2018 AND 2019

Q1	2001		2007		2015		2016		2017		2018		2019	
<i>Angophora costata</i>	0.241	24.80%	0.258	24.09%	0.254	22.15%	0.252	21.78%	0.252	21.50%	0.252	21.35%	0.252	21.35%
<i>Corymbia maculata</i>	0.293	30.13%	0.313	29.29%	0.337	29.46%	0.337	29.14%	0.343	29.26%	0.345	29.24%	0.350	29.67%
<i>Eucalyptus resinifera</i>	0.228	23.45%	0.240	22.41%	0.248	21.70%	0.252	21.76%	0.253	21.58%	0.253	21.43%	0.261	22.07%
<i>Eucalyptus umbra</i>	0.044	4.56%	0.050	4.70%	0.060	5.20%	0.059	5.08%	0.063	5.37%	0.064	5.46%	0.066	5.58%
<i>Syncarpia glomulifera</i>	0.166	17.07%	0.209	19.51%	0.246	21.49%	0.257	22.24%	0.261	22.29%	0.266	22.52%	0.269	22.81%
<b>TOTAL BA (m<sup>3</sup>/ha)</b>	<b>0.971</b>		<b>1.070</b>		<b>1.14</b>		<b>1.158</b>		<b>1.173</b>		<b>1.181</b>		<b>1.199</b>	
Q2	2001		2007		2015		2016		2017		2018		2019	
<i>Backhousia myrtifolia</i>	0.349	19.71%	0.362	18.37%	0.165	8.66%	0.166	8.64%	0.168	9.01%	0.172	9.17%	0.186	9.92%
<i>Corymbia maculata</i>	0.287	16.18%	0.342	17.39%	0.380	20.00%	0.389	20.24%	0.387	20.76%	0.390	20.82%	0.387	20.69%
<i>Cryptocarya microneura</i>	0.064	3.64%	0.077	3.90%	0.088	4.62%	0.095	4.92%	0.096	5.16%	0.096	5.14%	0.096	5.14%
<i>Eucalyptus acmenoides</i>	0.467	26.37%	0.531	26.96%	0.597	31.40%	0.626	32.58%	0.624	33.43%	0.624	33.32%	0.609	32.52%
<i>Eucalyptus siderophloia</i>	0.038	2.15%	0.044	2.24%	0.047	2.48%	0.050	2.59%	0.048	2.59%	0.048	2.59%	0.050	2.65%
<i>Glochidion ferdinandi</i>	0.064	3.63%	0.076	3.85%	0.075	3.92%	0.077	4.01%	0.025	1.32%	0.025	1.31%	0.024	1.30%
<i>Hymenosporum flavum</i>	0.022	1.21%	0.028	1.43%	0.030	1.56%	0.030	1.57%	0.030	1.59%	0.030	1.58%	0.030	1.58%
<i>Melaleuca styphelioides</i>	0.387	21.85%	0.398	20.20%	0.410	21.57%	0.375	19.54%	0.374	20.06%	0.374	19.99%	0.374	19.98%
<i>Melicope micrococca</i>	0.013	0.74%	0.014	0.70%	0.012	0.64%	0.013	0.66%	0.013	0.68%	0.013	0.68%	0.012	0.65%
<i>Syncarpia glomulifera</i>	0.080	4.52%	0.097	4.95%	0.098	5.16%	0.101	5.25%	0.101	5.40%	0.101	5.39%	0.103	5.49%
<b>TOTAL BA (m<sup>3</sup>/ha)</b>	<b>1.772</b>		<b>1.968</b>		<b>1.90</b>		<b>1.920</b>		<b>1.866</b>		<b>1.872</b>		<b>1.871</b>	
Q3	2001		2007		2015		2016		2017		2018		2019	
<i>Acacia fimbriata</i>	0.0069	0.65%	0.012	0.93%	0.00	0.00%	0.000	0.00%	0.000	0.00%	0.000	0.00%	0.002	0.05%
<i>Acacia linifolia</i>	0.0122	1.14%	0.000	0.00%	0.00	0.00%	0.000	0.00%	0.000	0.00%	0.000	0.00%		
<i>Allocasuarina torulosa</i>	0.0113	1.06%	0.031	2.27%	0.05	3.26%	0.044	2.81%	0.086	5.37%	0.038	1.35%	0.038	1.34%
<i>Angophora costata</i>	0.0690	6.45%	0.073	5.43%	0.08	5.22%	0.080	5.16%	0.081	5.08%	0.083	2.89%	0.082	2.86%
<i>Callistemon salignus</i>	0.0315	2.95%	0.054	3.98%	0.06	4.23%	0.067	4.33%	0.069	4.33%	0.069	2.42%	0.069	2.43%

<i>Corymbia maculata</i>													0.000	0.00%
<i>Corymbia gummifera</i>	0.0709	6.63%	0.084	6.24%	0.09	5.95%	0.095	6.16%	0.096	6.04%	0.100	3.50%	0.101	3.52%
<i>Eucalyptus fibrosa</i>	0.2443	22.86%	0.264	19.62%	0.30	19.97%	0.3026	19.51%	0.3073	19.26%	0.3088	10.81%	0.3120	10.91%
<i>Eucalyptus umbra</i>	0.1288	12.05%	0.148	11.04%	0.17	11.62%	0.181	11.67%	0.185	11.59%	0.195	6.82%	0.199	6.98%
<i>Melaleuca styphelioides</i>	0.0237	2.22%	0.057	4.28%	0.05	3.19%	0.053	3.41%	0.051	3.20%	0.054	1.90%	0.053	1.85%
<i>Syncarpia glomulifera</i>	0.4702	44.00%	0.618	46.01%	0.68	45.65%	0.707	45.58%	0.699	43.79%	1.986	69.50%	0.720	25.20%
<i>Glochidion ferdinandi</i>			0.003	0.19%	0.01	0.92%	0.021	1.38%	0.021	1.34%	0.024	0.83%	0.020	0.71%
<b>TOTAL BA (m³/ha)</b>	<b>1.069</b>		<b>1.343</b>		<b>1.50</b>		<b>1.551</b>		<b>1.595</b>		<b>2.858</b>		<b>1.597</b>	
<b>Q4</b>	<b>2001</b>		<b>2007</b>		<b>2015</b>		<b>2016</b>		<b>2017</b>		<b>2018</b>		<b>2018</b>	
<i>Corymbia maculata</i>	0.110	8.72%	0.118	8.07%	0.12	8.11%	0.126	8.05%	0.125	8.04%	0.128	8.08%	0.128	8.11%
<i>Eucalyptus acmenoides</i>	0.341	26.94%	0.454	31.14%	0.47	30.89%	0.487	31.11%	0.468	30.13%	0.477	30.22%	0.485	30.75%
<i>Eucalyptus fibrosa</i>	0.813	64.34%	0.886	60.78%	0.93	61.00%	0.952	60.84%	0.961	61.84%	0.973	61.69%	0.992	62.90%
<b>TOTAL BA (m³/ha)</b>	<b>1.264</b>		<b>1.458</b>		<b>1.52</b>		<b>1.565</b>		<b>1.554</b>		<b>1.578</b>		<b>1.605</b>	
<b>Q5</b>	<b>2001</b>		<b>2007</b>		<b>2015</b>		<b>2016</b>		<b>2017</b>		<b>2018</b>		<b>2019</b>	
<i>Corymbia maculata</i>	0.167	13.22%	0.21298 9	14.54%	0.23	14.62%	0.238	15.18%	0.226	14.30%	0.230	14.32%	0.233	14.51%
<i>Eucalyptus acmenoides</i>	0.496	39.25%	0.56567 2	38.63%	0.61	39.02%	0.611	39.08%	0.620	39.26%	0.621	38.67%	0.614	38.24%
<i>Eucalyptus siderophloia</i>	0.423	33.44%	0.47867 6	32.69%	0.49	31.45%	0.496	31.72%	0.505	32.00%	0.520	32.35%	0.503	31.34%
<i>Syncarpia glomulifera</i>	0.178	14.08%	0.20709 8	14.14%	0.23	14.92%	0.219	14.02%	0.228	14.44%	0.236	14.66%	0.253	15.72%
<b>TOTAL BA (m³/ha)</b>	<b>1.264</b>		<b>1.464</b>		<b>1.55</b>		<b>1.564</b>		<b>1.578</b>		<b>1.606</b>		<b>1.603</b>	
<b>Q6</b>	<b>2001</b>		<b>2007</b>		<b>2015</b>		<b>2016</b>		<b>2017</b>		<b>2018</b>		<b>2019</b>	
<i>Allocasuarina torulosa</i>	0.042	1.86%	0.045	1.89%	0.000	0.00%	0.000	0.00%	0.000	0.00%	0.000	0.00%		
<i>Backhousia myrtifolia</i>	0.000	0.00%	0.000	0.00%	0.000	0.00%	0.000	0.00%	0.001	0.03%	0.000	0.00%	0.000	0.00%
<i>Claoxylon australe</i>	0.000	0.00%	0.000	0.00%	0.000	0.00%	0.000	0.00%	0.003	0.12%	0.004	0.14%	0.004	0.19%
<i>Cryptocarya microneura</i>	0.090	3.95%	0.116	4.83%	0.150	5.90%	0.158	6.14%	0.163	6.24%	0.168	6.83%	0.168	7.50%
<i>Eucalyptus acmenoides</i>	0.539	23.66%	0.545	22.72%	0.567	22.26%	0.566	22.04%	0.575	21.98%	0.576	23.49%	0.576	25.74%
<i>Eucalyptus grandis</i>	0.933	40.98%	1.061	44.25%	1.140	44.79%	1.158	45.05%	1.179	45.02%	1.187	48.41%	1.012	45.20%
<i>Ficus fraseri</i>	0.007	0.29%	0.010	0.40%	0.011	0.44%	0.012	0.47%	0.011	0.42%	0.011	0.46%	0.003	0.13%
<i>Melaleuca styphelioides</i>	0.018	0.79%	0.019	0.81%	0.020	0.78%	0.020	0.79%	0.022	0.85%	0.023	0.92%	0.022	0.98%
<i>Melicope micrococca</i>	0.038	1.66%	0.042	1.75%	0.050	1.96%	0.051	1.99%	0.055	2.10%	0.056	2.28%	0.056	2.50%

<i>Rhodomyrtus psidioides</i>	0.005	0.22%	0.006	0.25%	0.000	0.00%	0.000	0.00%	0.000	0.00%	0.000	0.00%		
<i>Syncarpia glomulifera</i>	0.606	26.59%	0.554	23.10%	0.606	23.81%	0.603	23.45%	0.607	23.17%	0.426	17.37%	0.381	17.03%
<i>Streblus brunonianus</i>					0.002	0.06%	0.002	0.07%	0.002	0.07%	0.002	0.08%	0.016	0.72%
<b>TOTAL BA (m<sup>3</sup>/ha)</b>	<b>2.278</b>		<b>2.398</b>		<b>2.55</b>		<b>2.569</b>		<b>2.618</b>		<b>2.453</b>		<b>2.239</b>	
<b>Q7</b>	<b>2001</b>		<b>2007</b>		<b>2015</b>		<b>2016</b>		<b>2017</b>		<b>2018</b>		<b>2019</b>	
<i>Allocasuarina torulosa</i>	0.046	3.95%	0.053	2.33%	0.058	2.37%	0.058	2.22%	0.058	2.23%	0.061	2.25%	0.061	2.27%
<i>Angophora costata</i>	0.265	22.62%	0.224	9.85%	0.233	9.57%	0.241	9.29%	0.286	11.06%	0.289	10.59%	0.289	10.69%
<i>Corymbia gummifera</i>	0.295	25.21%	0.712	31.29%	0.707	29.05%	0.707	27.21%	0.638	24.67%	0.704	25.80%	0.704	26.08%
<i>Eucalyptus acmenoides</i>	0.057	4.83%	0.036	1.58%	0.044	1.80%	0.044	1.68%	0.042	1.61%	0.043	1.56%	0.043	1.58%
<i>Eucalyptus pilularis</i>	0.196	16.75%	0.210	9.23%	0.233	9.56%	0.255	9.81%	0.246	9.54%	0.252	9.24%	0.255	9.45%
<i>Eucalyptus paniculata</i>	0.033	2.80%	0.037	1.64%	0.033	1.34%	0.033	1.25%	0.000	0.00%	0.000	0.00%	0.000	0.01%
<i>Glochidion ferdinandi</i>	0.028	2.42%	0.679	29.81%	0.871	35.79%	1.007	38.74%	1.078	41.69%	1.127	41.32%	1.096	40.60%
<i>Melaleuca linariifolia</i>	0.200	17.10%	0.242	10.64%	0.160	6.56%	0.155	5.97%	0.136	5.25%	0.146	5.36%	0.146	5.39%
<i>Notelaea longifolia</i>	0.002	0.14%	0.022	0.95%	0.024	0.97%	0.025	0.94%	0.025	0.98%	0.028	1.03%	0.027	1.02%
<i>Syncarpia glomulifera</i>	0.049	4.17%	0.057	2.53%	0.066	2.71%	0.067	2.59%	0.070	2.69%	0.070	2.58%	0.071	2.63%
<i>Clerodendrum tomentosum</i>			0.004	0.15%	0.007	0.28%	0.007	0.28%	0.007	0.28%	0.008	0.29%	0.008	0.29%
<b>TOTAL BA (m<sup>3</sup>/ha)</b>	<b>1.171</b>		<b>2.277</b>		<b>2.43</b>		<b>2.598</b>		<b>2.585</b>		<b>2.729</b>		<b>2.699</b>	
<b>Q8</b>	<b>2001</b>		<b>2007</b>		<b>2015</b>		<b>2016</b>		<b>2017</b>		<b>2018</b>		<b>2019</b>	
<i>Corymbia maculata</i>	0.312	24.91%	0.309	21.57%	0.337	21.40%	0.354	23.21%	0.3450	21.24%	0.3459	21.30%	0.3437	21.27%
<i>Eucalyptus siderophloia</i>	0.243	19.34%	0.263	18.34%	0.282	17.90%	0.290	19.01%	0.285	17.52%	0.286	17.64%	0.286	17.71%
<i>Eucalyptus fibrosa</i>	0.035	2.80%	0.042	2.96%	0.059	3.74%	0.061	3.99%	0.061	3.75%	0.062	3.80%	0.062	3.81%
<i>Eucalyptus punctata</i>	0.297	23.66%	0.296	20.68%	0.306	19.48%	0.306	20.05%	0.317	19.53%	0.317	19.54%	0.314	19.42%
<i>Eucalyptus tereticornis</i>	0.155	12.33%	0.173	12.11%	0.202	12.85%	0.205	13.41%	0.212	13.08%	0.210	12.93%	0.210	13.00%
<i>Melaleuca linariifolia</i>	0.152	12.09%	0.242	16.89%	0.275	17.47%	0.195	12.79%	0.286	17.62%	0.285	17.52%	0.282	17.48%
<i>Melaleuca styphelioides</i>	0.061	4.88%	0.107	7.45%	0.113	7.15%	0.115	7.54%	0.118	7.26%	0.118	7.27%	0.118	7.30%
<b>TOTAL BA (m<sup>3</sup>/ha)</b>	<b>1.254</b>		<b>1.432</b>		<b>1.57</b>		<b>1.527</b>		<b>1.624</b>		<b>1.624</b>		<b>1.616</b>	
<b>Q9</b>	<b>2003</b>		<b>2007</b>		<b>2015</b>		<b>2016</b>		<b>2017</b>		<b>2018</b>		<b>2019</b>	
<i>Alphitonia excelsa</i>													0.000	0.02%
<i>Angophora costata</i>	0.014	1.49%	0.018	1.72%	0.022	1.92%	0.023	1.82%	0.023	1.77%	0.000	0.00%		
<i>Corymbia maculata</i>	0.288	30.06%	0.286	28.04%	0.296	25.87%	0.376	30.02%	0.421	32.05%	0.447	33.81%	0.453	33.90%

<i>Eucalyptus fibrosa</i>	0.279	29.18%	0.283	27.71%	0.333	29.17%	0.346	27.65%	0.353	26.86%	0.356	26.92%	0.360	26.93%
<i>Eucalyptus moluccana</i>	0.043	4.52%	0.046	4.54%	0.052	4.56%	0.055	4.41%	0.056	4.24%	0.056	4.26%	0.057	4.29%
<i>Eucalyptus punctata</i>	0.060	6.27%	0.072	7.01%	0.084	7.33%	0.088	7.04%	0.091	6.96%	0.091	6.92%	0.092	6.87%
<i>Eucalyptus umbra</i>	0.273	28.48%	0.316	30.97%	0.356	31.14%	0.364	29.06%	0.369	28.12%	0.371	28.09%	0.374	27.99%
<b>TOTAL BA (m<sup>3</sup>/ha)</b>	<b>0.958</b>		<b>1.020</b>		<b>1.14</b>		<b>1.25</b>		<b>1.31</b>		<b>1.32</b>		<b>1.34</b>	



## APPENDIX 3. MEAN TREE HEIGHTS FROM 2001 (BASELINE) (2003 FOR Q9), 2007, 2015, 2016, 2017, 2018 AND 2019

Q1	2001	2007	2015	2016	2017	2018	2019
<i>Angophora costata</i>	19.32	20	20.50	21.30	21.80	21.80	21.80
<i>Corymbia maculata</i>	20.04	21.18	21.93	21.58	21.35	22.60	22.60
<i>Eucalyptus resinifera</i>	18.55	19.27	19.97	20.00	19.53	22.63	22.73
<i>Eucalyptus umbra</i>	17.99	17.3	18.70	18.60	18.00	20.70	20.70
<i>Syncarpia glomulifera</i>	11.029	11.17	12.46	12.63	12.12	12.81	11.41
<b>Average height (m)</b>	<b>17.386</b>	<b>17.785</b>	<b>18.712</b>	<b>18.822</b>	<b>18.560</b>	<b>20.108</b>	<b>19.848</b>
Q2	2001	2007	2015	2016	2017	2018	2019
<i>Backhousia myrtifolia</i>	10.82	8.67	7.55	8.13	7.89	7.62	6.93
<i>Corymbia maculata</i>	29.68	29.00	30.25	30.50	31.20	33.25	33.45
<i>Cryptocarya microneura</i>	26.06	23.60	23.60	23.90	24.10	24.10	24.00
<i>Eucalyptus acmenoides</i>	30.25	30.15	30.70	30.80	30.70	31.30	31.35
<i>Eucalyptus siderophloia</i>	22.94	25.20	26.00	26.60	27.10	27.10	27.10
<i>Glochidion ferdinandi</i>	8.71	10.12	8.50	10.00	9.17	9.83	8.67
<i>Hymenosporum flavum</i>	17.27	18.00	18.70	19.00	18.40	19.00	19.00
<i>Melaleuca styphelioides</i>	9.83	12.35	9.70	9.73	9.83	10.57	7.53
<i>Melicope micrococca</i>	9.82	9.30	11.00	11.20	10.90	10.90	10.90
<i>Syncarpia glomulifera</i>	12.90	13.46	12.22	12.08	11.95	11.23	11.21
<b>Average height (m)</b>	<b>17.827</b>	<b>17.985</b>	<b>17.822</b>	<b>18.194</b>	<b>18.124</b>	<b>18.490</b>	<b>18.015</b>
Q3	2001	2007	2015	2016	2017	2018	2019
<i>Acacia fimbriata</i>	6.03	7.80	0.00	0.00	0.00	0.00	4.50
<i>Acacia linifolia</i>	7.34	0.00	0.00	0.00	0.00		
<i>Allocasuarina torulosa</i>	6.88	7.25	7.53	7.491	7.200	8.260	7.950

<i>Angophora costata</i>	18.42	17.60	19.40	19.05	19.25	20.45	14.90
<i>Callistemon salignus</i>	8.63	10.30	8.45	8.05	7.75	6.97	7.22
<i>Corymbia maculata</i>							5.00
<i>Corymbia gummifera</i>	11.88	12.30	16.53	15.17	15.30	18.63	18.63
<i>Eucalyptus fibrosa</i>	35.93	26.50	28.80	26.20	29.20	29.20	30.40
<i>Eucalyptus umbra</i>	11.00	15.15	15.53	15.63	15.68	17.60	17.60
<i>Melaleuca styphelioides</i>	6.48	7.92	7.71	7.59	7.43	7.60	6.76
<i>Syncarpia glomulifera</i>	12.37	12.52	11.97	11.96	11.81	10.23	10.27
<i>Glochidion ferdinandi</i>		8.00	7.25	7.00	6.92	5.26	5.03
<b>Average height (m)</b>	<b>12.496</b>	<b>11.395</b>	<b>11.197</b>	<b>10.739</b>	<b>10.958</b>	<b>11.291</b>	<b>10.689</b>
<b>Q4</b>	<b>2001</b>	<b>2007</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>
<i>Corymbia maculata</i>	12.27	14.50	15.39	15.54	15.17	15.20	15.40
<i>Eucalyptus acmenoides</i>	14.54	14.38	15.69	15.82	15.52	15.76	14.89
<i>Eucalyptus fibrosa</i>	16.21	19.34	20.81	18.53	18.39	20.60	20.75
<b>Average height (m)</b>	<b>14.339</b>	<b>16.075</b>	<b>17.298</b>	<b>16.630</b>	<b>16.358</b>	<b>17.188</b>	<b>17.014</b>
<b>Q5</b>	<b>2001</b>	<b>2007</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>
<i>Corymbia maculata</i>	14.94	16.26	17.79	17.93	18.72	16.93	16.93
<i>Eucalyptus acmenoides</i>	14.14	13.61	18.08	16.89	16.94	16.49	16.48
<i>Eucalyptus siderophloia</i>	16.37	12.96	14.18	14.20	13.59	13.34	13.48
<i>Syncarpia glomulifera</i>	9.95	6.90	7.99	8.40	8.46	8.50	8.61
<b>Average height (m)</b>	<b>13.847</b>	<b>12.432</b>	<b>14.508</b>	<b>14.356</b>	<b>14.426</b>	<b>13.816</b>	<b>13.875</b>
<b>Q6</b>	<b>2001</b>	<b>2007</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>
<i>Allocasuarina torulosa</i>	16.18	18.00					
<i>Backhousia myrtifolia</i>					5.500	5.500	5.500
<i>Claoxylon australe</i>					6.500	6.500	6.000
<i>Cryptocarya microneura</i>	11.70	12.15	13.43	13.13	11.69	12.26	11.28
<i>Eucalyptus acmenoides</i>	21.88	23.45	24.65	24.80	24.20	24.40	24.40
<i>Eucalyptus grandis</i>	36.16	37.37	41.63	41.47	41.67	42.33	42.33
<i>Ficus fraseri</i>	10.71	9.20	7.30	7.30	6.30	5.40	1.90
<i>Melaleuca styphelioides</i>	10.22	10.35	9.60	9.60	9.35	9.75	9.75
<i>Melicope micrococca</i>	13.70	16.75	10.97	11.10	11.37	11.77	11.77

<i>Rhodomyrtus psidioides</i>	7.81	7.35					
<i>Syncarpia glomulifera</i>	16.35	18.67	19.13	19.30	18.93	16.52	16.18
<i>Streblus brunonianus</i>			6.50	6.40	6.10	6.10	7.00
<b>Average height (m)</b>	<b>16.077</b>	<b>17.031</b>	<b>16.651</b>	<b>16.636</b>	<b>14.161</b>	<b>14.052</b>	<b>13.611</b>
<b>Q7</b>	<b>2001</b>	<b>2007</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>
<i>Allocasuarina torulosa</i>	12.53	13.15	14.45	14.25	14.00	14.95	14.95
<i>Angophora costata</i>	18.73	19.94	21.26	21.80	22.90	23.98	24.58
<i>Corymbia gummifera</i>	20.36	22.85	25.05	25.10	25.65	25.95	26.15
<i>Eucalyptus acmenoides</i>	11.55	9.33	11.57	12.77	12.33	13.07	12.67
<i>Eucalyptus pilularis</i>	29.23	28.10	30.50	30.70	30.70	30.70	31.70
<i>Eucalyptus paniculata</i>	17.16	17.10	18.00	18.00			4.90
<i>Glochidion ferdinandi</i>	8.63	9.48	10.81	11.13	10.65	10.44	10.06
<i>Melaleuca linariifolia</i>	7.64	8.18	8.94	9.15	9.36	9.88	9.84
<i>Notelaea longifolia</i>		6.40	7.10	7.30	6.90	8.30	5.35
<i>Syncarpia glomulifera</i>	18.70	16.00	18.00	18.60	18.10	20.00	20.00
<i>Clerodendrum tomentosum</i>		8.00	7.35	7.75	8.00	8.75	8.75
<b>Average height (m)</b>	<b>16.057</b>	<b>14.411</b>	<b>15.730</b>	<b>16.050</b>	<b>15.859</b>	<b>16.601</b>	<b>15.358</b>
<b>Q8</b>	<b>2001</b>	<b>2007</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>
<i>Corymbia maculata</i>	13.33	14.29	15.55	15.73	15.56	17.09	17.16
<i>Eucalyptus siderophloia</i>	11.33	12.43	11.69	11.36	11.18	11.02	11.18
<i>Eucalyptus fibrosa</i>	16.65	19.70	22.40	22.30	22.20	24.50	24.50
<i>Eucalyptus punctata</i>	19.44	19.85	23.40	22.30	22.17	19.97	20.50
<i>Eucalyptus tereticornis</i>	15.13	11.98	17.30	17.40	16.57	18.60	18.60
<i>Melaleuca linariifolia</i>	6.65	7.32	8.96	9.32	8.72	7.29	6.46
<i>Melaleuca styphelioides</i>	9.38	12.75	13.65	13.30	13.05	13.60	13.65
<b>Average height (m)</b>	<b>13.129</b>	<b>14.045</b>	<b>16.135</b>	<b>15.959</b>	<b>15.634</b>	<b>16.009</b>	<b>16.007</b>
<b>Q9</b>	<b>2003</b>	<b>2007</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>
<i>Alphitonia excelsa</i>							2.50
<i>Angophora costata</i>	11.50	14.4	12.50	11.10	11.40	0.00	
<i>Corymbia maculata</i>	12.79	14.8	14.67	12.83	11.79	12.83	12.86
<i>Eucalyptus fibrosa</i>	16.09	15.65	14.66	12.30	12.26	12.23	12.39

<i>Eucalyptus moluccana</i>	12.53	10.83	10.20	10.33	10.33	9.45	9.45
<i>Eucalyptus punctata</i>	17.53	19.6	20.25	20.50	20.55	23.00	23.00
<i>Eucalyptus umbra</i>	11.47	12.24	13.14	13.00	12.14	12.25	11.64
<b>Average height (m)</b>	<b>13.651</b>	<b>14.587</b>	<b>14.236</b>	<b>13.344</b>	<b>13.079</b>	<b>11.625</b>	<b>11.972</b>

## APPENDIX 4. PLANT SPECIES RECORDED IN THE BASELINE (2001), 2017, 2018 AND 2019 SURVEY EVENTS

A represents the baseline (2001) survey  
 B represents the 2018 survey  
 C represents the 2019 survey

Family Name	Scientific Name	Common Name	Q1			Q2			Q3			Q4			Q5			Q6			Q7			Q8			Q9		
			A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C			
Acanthaceae	<i>Brunoniella australis</i>	Blue Trumpet		2	1				2	2		2	2		2	2				2	1		2	1		2	2		
Acanthaceae	<i>Pseuderanthemum variabile</i>	Pastel Flower		2	2		2	2		2	2	+	2	1		2		2	2	+	2	2		2		2	1		
Adiantaceae	<i>Adiantum aethiopicum</i>	Common Maidenhair Fern	+	2	2	+	2	2	+	3	2				2														
Adiantaceae	<i>Adiantum formosum</i>	Giant Maidenhair Fern				+	2	2																					
Adiantaceae	<i>Adiantum hispidulum</i>	Rough Maidenhair Fern					2	2									1	1											
Adiantaceae	<i>Cheilanthes sieberi subsp. sieberi</i>	Poison Rock Fern										2	1	+	2	1							+	2	2		2		
Adiantaceae	<i>Pellaea falcata</i>	Sickle Fern					2	2																					
Anthericaceae	<i>Arthropodium milleflorum</i>	Pale Vanilla-lily																									1		
Anthericaceae	<i>Caesia parviflora subsp. parviflora</i>																												
Anthericaceae	<i>Thysanotus tuberosus subsp. tuberosus</i>	Common Fringe-lily																											
Anthericaceae	<i>Tricoryne simplex</i>																												
Aphanopetalaceae	<i>Aphanopetalum resinosum</i>	Gum Vine					2	1																					
Apiaceae	<i>Hydrocotyle peduncularis</i>														2						2								
Apiaceae	<i>Centella asiatica</i>	Indian Pennywort					1																2	1					
Apocynaceae	<i>Marsdenia flavescens</i>	Hairy Milk Vine																											
Apocynaceae	<i>Marsdenia rostrata</i>	Common Milk Vine															2	2											
Apocynaceae	<i>Marsdenia suaveolens</i>	Scented Marsdenia																											
Apocynaceae	<i>Parsonsia straminea</i>	Common Silkpod		1		+	1			2	1			1					+	1	1		2	1					
Apocynaceae	<i>Tylophora barbata</i>	Bearded Tylophora								2	1																		
Araceae	<i>Gymnostachys anceps</i>	Settlers Flax				+	2	2											+	1	1								
Araliaceae	<i>Polyscias sambucifolia subsp. sambucifolia</i>									2	1				1							1	1		1	1		2	2
Areaceae	<i>Livistona australis</i>	Cabbage-tree Palm		1	1																								
Asteraceae	* <i>Ageratina adenophora</i>	Crofton Weed																											
Asteraceae	* <i>Cirsium vulgare</i>	Spear Thistle																											
Asteraceae	* <i>Conyza sp.</i>	Fleabane																											
Asteraceae	* <i>Galinsoga parviflora</i>	Potato Weed																											
Asteraceae	* <i>Hypochaeris radicata</i>	Catsear																											
Asteraceae	* <i>Senecio madagascariensis</i>	Fireweed																											
Asteraceae	<i>Brachyscome multifida</i>																												
Asteraceae	<i>Cassinia sp.</i>																												
Asteraceae	<i>Epaltes australis</i>	Spreading Nut-heads																											
Asteraceae	<i>Euchiton sphaericus</i>																												
Asteraceae	<i>Lagenophora stipitata</i>	Blue Bottle-daisy								2	1		1		2	1											1		
Asteraceae	<i>Olearia nemstii</i>	Daisy							+																				
Asteraceae	<i>Ozothamnus diosmifolius</i>	White Dogwood																											
Asteraceae	<i>Senecio linearifolius</i>	Fireweed Groundsel																											
Asteraceae	<i>Sigesbeckia orientalis</i>	Indian Weed																											
Asteraceae	<i>Vernonia cinerea var. cinerea</i>												1	1		1									1	1			
Asteraceae	<i>Vittadinia cuneata</i>	Fuzzweed																											
Bignoniaceae	<i>Pandorea pandorana subsp. pandorana</i>	Wonga Wonga Vine		2	2		2	2		2	1	+	2	1										+	2	2	+	2	
Blechnaceae	<i>Blechnum minus</i>	Soft Water Fern					+																						
Blechnaceae	<i>Doodia aspera</i>	Prickly Rasp Fern	+	1	1	+	4	2															+	2	2				
Blechnaceae	<i>Doodia australis</i>	Common Rasp Fern																						+	2	2			
Campanulaceae	<i>Wahlenbergia gracilis</i>	Australian Bluebell											+																
Casuarinaceae	<i>Allocasuarina torulosa</i>	Forest Oak								+	3	3											+			2	2		
Celastraceae	<i>Maytenus silvestris</i>	Narrow-leaved Orangebark	+	2	1					+	1	1	+	2	2		1	1					+	2	1			1	1













## APPENDIX 5. MAMMAL SPECIES RECORDED 2001-2019

Species Name	Common Name	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
<b>Arboreal mammals</b>																				
<i>Acrobates pygmaeus</i>	Feathertail Glider	+	+	+	+		+	+	+	+			+		+		+			
<i>Antechinus stuartii</i>	Brown Antechinus	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Petauroides volans</i> ^	Greater Glider	+	+			+														
<i>Petaurus breviceps</i>	Sugar Glider		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Petaurus norfolcensis</i> #	Squirrel Glider		+		+	+						+								
<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum		+	+	+				+			+		+		+	+			
<i>Trichosurus vulpecula</i>	Common Brushtail Possum	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<b>Bats</b>																				
<i>Chalinolobus dwyeri</i> #^	Large-eared Pied Bat							+								+				
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Falsistrellus tasmaniensis</i> #	Eastern False Pipistrelle											+	+	+	+	+	+	+	+	+
<i>Miniopterus australis</i> #	Little Bentwing-bat	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Miniopterus oceanensis</i> #	Eastern Bentwing-bat		+	+	+	+	+		+	+	+	+	+		+	+	+	+		
<i>Mormopterus norfolkensis</i> #	East-coast Freetail-bat	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Mormopterus ridei</i>	Eastern Freetail-bat	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+
<i>Mormopterus spp. 4</i>	Undescribed Freetail-bat																			+
<i>Myotis macropus</i> #	Southern Myotis	+	+	+	+	+			+	+	+	+	+	+	+	+	+	+		+
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat														+	+	+	+		
<i>Nyctophilus gouldii</i>	Gould's Long-eared Bat												+		+	+	+	+	+	
<i>Nyctophilus sp.</i>	Unidentified Long-eared Bat	+	+	+	+		+		+	+	+		+	+	+		+	+	+	+
<i>Pteropus poliocephalus</i> #	Grey-headed Flying-fox						+		+	+	+	+			+		+		+	+
<i>Rhinolophus megaphyllus</i>	Eastern Horseshoe Bat				+		+	+		+		+				+		+	+	
<i>Saccolaimus flaviventris</i> #	Yellow-bellied Sheath-tail Bat	+	+	+	+		+									+				
<i>Scoteanax rueppellii</i> #	Greater Broad-nosed Bat		+	+		+	+	+		+	+	+	+	+	+	+	+			+
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat			+									+							
<i>Scotorepens orion</i>	Eastern Broad-nosed Bat	+	+	+	+	+	+	+	+	+	+	+	+	+			+	+	+	+
<i>Scotorepens sp.</i>	Undescribed Broad-nosed Bat	+	+																	
<i>Tadarida australis</i>	White-striped Mastiff Bat	+	+	+	+	+	+	+	+	+			+		+	+	+	+		+
<i>Vespadelus darlingtoni</i>	Large Forest Bat		+	+					+							+				+
<i>Vespadelus pumilus</i>	Eastern Forest Bat		+	+			+	+	+	+	+	+	+	+	+		+	+		+
<i>Vespadelus regulus</i>	Southern Forest Bat							+			+									
<i>Vespadelus troughtoni</i> #	Eastern Cave Bat		+	+	+	+							+		+		+			
<i>Vespadelus vulturnus</i>	Little Forest Bat	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+
<b>Terrestrial Mammals</b>																				
<i>Lepus europaeus</i> *	Brown Hare		+				+	+		+						+	+			
<i>Macropus giganteus</i>	Eastern Grey Kangaroo		+		+	+	+	+		+	+	+	+	+			+	+	+	+
<i>Macropus rufogriseus</i>	Red-necked Wallaby						+			+		+	+	+			+			
<i>Oryctolagus cuniculus</i> *	European Rabbit												+	+	+	+			+	

Species Name	Common Name	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
<i>Perameles nasuta</i>	Long-nosed Bandicoot		+		+		+			+				+		+	+	+	+	
<i>Rattus fuscipes</i>	Bush Rat	+	+	+	+	+			+	+	+	+	+		+	+		+	+	+
<i>Rattus rattus</i> *	Black Rat	+	+	+	+	+	+	+	+	+	+		+	+		+	+	+		
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna														+					
<i>Thylogale thetis</i>	Red-necked Pademelon?										+									
<i>Vulpes vulpes</i> *	Red Fox																+			
<i>Wallabia bicolor</i>	Swamp Wallaby			+	+	+				+	+		+	+	+	+	+	+	+	
<b>Arboreal mammals</b>		<b>4</b>	<b>7</b>	<b>5</b>	<b>6</b>	<b>5</b>	<b>4</b>	<b>4</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>5</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>5</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>Bats</b>		<b>12</b>	<b>17</b>	<b>17</b>	<b>14</b>	<b>12</b>	<b>15</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>14</b>	<b>13</b>	<b>16</b>	<b>12</b>	<b>17</b>	<b>17</b>	<b>17</b>	<b>15</b>	<b>12</b>	<b>15</b>
<b>Terrestrial mammals</b>		<b>2</b>	<b>5</b>	<b>3</b>	<b>5</b>	<b>4</b>	<b>5</b>	<b>3</b>	<b>2</b>	<b>7</b>	<b>5</b>	<b>3</b>	<b>6</b>	<b>6</b>	<b>4</b>	<b>6</b>	<b>7</b>	<b>5</b>	<b>5</b>	<b>2</b>
<b>Total mammals</b>		<b>18</b>	<b>29</b>	<b>25</b>	<b>25</b>	<b>21</b>	<b>24</b>	<b>20</b>	<b>21</b>	<b>26</b>	<b>22</b>	<b>21</b>	<b>26</b>	<b>22</b>	<b>24</b>	<b>27</b>	<b>29</b>	<b>23</b>	<b>20</b>	<b>19</b>

Status: \* = Introduced, # = Threatened under the *Threatened Species Conservation Act 1995* (NSW), ^ = Threatened under the *Environment Protection & Biodiversity Conservation Act 1999*

## APPENDIX 6. BIRD SPECIES RECORDED ACROSS ALL QUADRATS DURING 2001 & 2005-2019 SURVEYS

Scientific Name	Common Name	Status	2001	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
<i>Alectura lathamii</i>	Australian Brush-turkey														+			
<i>Alisterus scapularis</i>	Australian King-Parrot		+	+		+			+	+	+	+	+	+	+			+
<i>Cracticus tibicen</i>	Australian Magpie		+		+	+	+	+	+	+	+		+	+	+	+		
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar		+	+		+		+					+	+	+		+	
<i>Corvus coronoides</i>	Australian Raven		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Chenonetta jubata</i>	Australian Wood Duck				+							+	+					
<i>Alcedo azurea</i>	Azure Kingfisher														+			
<i>Geopelia humeralis</i>	Bar-shouldered Dove		+	+	+	+		+	+	+	+	+	+	+		+	+	+
<i>Zoothera lunulata</i>	Bassian Thrush		+															
<i>Manorina melanophrys</i>	Bell Miner			+	+	+	+	+	+	+	+	+	+	+	+			
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike		+		+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Monarcha melanopsis</i>	Black-faced Monarch		+		+	+	+	+	+	+	+		+		+	+	+	+
<i>Macropygia amboinensis</i>	Brown Cuckoo-Dove		+		+			+	+	+		+	+	+	+	+	+	
<i>Gerygone mouki</i>	Brown Gerygone		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Accipiter fasciatus</i>	Brown Goshawk		+															
<i>Acanthiza pusilla</i>	Brown Thornbill			+	+	+	+	+	+	+	+		+	+	+	+	+	+
<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater		+		+			+	+	+		+			+	+		
<i>Cacomantis variolosus</i>	Brush Cuckoo		+	+		+			+	+		+						
<i>Acanthiza reguloides</i>	Buff-rumped Thornbill			+	+													
<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo			+	+	+	+		+	+	+	+	+	+	+	+	+	+
<i>Anas castanea</i>	Chestnut Teal					+												
<i>Coracina tenuirostris</i>	Cicadabird		+	+	+	+	+	+	+	+	+	+	+		+	+	+	+
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk															+		
<i>Phaps chalcoptera</i>	Common Bronzewing			+														
<i>Ocyphaps lophotes</i>	Crested Pigeon				+													
<i>Falcunculus frontatus</i>	Crested Shrike-tit		+			+		+	+	+	+							
<i>Platycercus elegans</i>	Crimson Rosella							+		+	+							
<i>Eurystomus orientalis</i>	Dollarbird		+			+	+	+				+		+	+	+		+
<i>Artamus cyanopterus</i>	Dusky Woodswallow	V		+							+							
<i>Eudynamys orientalis</i>	Eastern Koel			+	+			+	+			+		+	+			+
<i>Platycercus eximius</i>	Eastern Rosella		+	+	+	+	+	+	+	+	+				+	+	+	+
<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Psophodes olivaceus</i>	Eastern Whipbird		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Eopsaltria australis</i>	Eastern Yellow Robin		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo		+	+	+	+	+	+	+	+	+	+	+	+	+	+		
<i>Cacatua roseicapilla</i>	Galah				+	+	+	+			+				+			
<i>Calyptrorhynchus lathamii</i>	Glossy Black-Cockatoo														+			
<i>Pachycephala pectoralis</i>	Golden Whistler		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Cracticus torquatus</i>	Grey Butcherbird		+	+	+	+	+	+	+	+	+				+	+		+
<i>Rhipidura fuliginosa</i>	Grey Fantail		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Accipiter novaehollandiae</i>	Grey Goshawk			+	+			+							+			
<i>Colluricincla harmonica</i>	Grey Shrike-thrush		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

Scientific Name	Common Name	Status	2001	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
<i>Chrysococcyx basalis</i>	Horsfield's Bronze-Cuckoo		+		+				+									
<i>Microeca fascinans</i>	Jacky Winter			+		+			+									
<i>Dacelo novaeguineae</i>	Laughing Kookaburra		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Myiagra rubecula</i>	Leaden Flycatcher		+	+		+	+	+	+	+	+	+		+	+	+	+	
<i>Meliphaga lewinii</i>	Lewin's Honeyeater		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Cacatua sanguinea</i>	Little Corella													+				
<i>Glossopsitta pusilla</i>	Little Lorikeet	V		+		+									+			+
<i>Grallina cyanoleuca</i>	Magpie-lark					+		+			+							+
<i>Vanellus miles</i>	Masked Lapwing							+				+						
<i>Tyto novaehollandiae</i>	Masked Owl	V						+	+				+	+	+	+	+	
<i>Dicaeum hirundinaceum</i>	Mistletoebird			+				+	+	+	+	+	+	+		+		+
<i>Glossopsitta concinna</i>	Musk Lorikeet										+							
<i>Falco cenchroides</i>	Nankeen Kestrel													+				
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater														+	+		+
<i>Philemon corniculatus</i>	Noisy Friarbird		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Manorina melanocephala</i>	Noisy Miner					+	+		+		+				+			
<i>Oriolus sagittatus</i>	Olive-backed Oriole		+	+	+	+	+	+	+	+	+	+	+	+		+	+	+
<i>Aviceda subcristata</i>	Pacific Baza											+			+			
<i>Anas superciliosa</i>	Pacific Black Duck					+								+				
<i>Turnix varius</i>	Painted Button-quail							+										
<i>Geopelia striata</i>	Peaceful Dove						+		+	+							+	
<i>Falco peregrinus</i>	Peregrine Falcon											+			+			
<i>Centropus phasianinus</i>	Pheasant Coucal													+				
<i>Cracticus nigrogularis</i>	Pied Butcherbird			+	+	+	+		+	+	+	+		+		+	+	+
<i>Strepera graculina</i>	Pied Currawong		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Ninox strenua</i>	Powerful Owl	V	+	+	+	+	+		+	+			+	+		+	+	+
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Anthochaera carunculata</i>	Red Wattlebird															+	+	
<i>Neochmia temporalis</i>	Red-browed Finch		+	+	+	+	+	+	+	+	+	+	+	+		+	+	
<i>Petroica rosea</i>	Rose Robin			+	+	+		+	+		+					+	+	
<i>Rhipidura rufifrons</i>	Rufous Fantail		+	+		+	+	+	+	+	+	+	+	+		+	+	
<i>Pachycephala rufiventris</i>	Rufous Whistler		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Todiramphus sanctus</i>	Sacred Kingfisher		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Ptilonorhynchus violaceus</i>	Satin Bowerbird									+						+	+	+
<i>Myiagra cyanoleuca</i>	Satin Flycatcher		+					+										
<i>Trichoglossus chlorolepidotus</i>	Scaly-breasted Lorikeet						+											+
<i>Myzomela sanguinolenta</i>	Scarlet Honeyeater		+	+	+	+		+	+	+	+	+	+	+	+	+	+	
<i>Chrysococcyx lucidus</i>	Shining-Bronze Cuckoo			+			+		+	+						+	+	
<i>Zosterops lateralis</i>	Silvereye		+	+	+	+	+	+	+	+	+	+	+		+	+	+	+
<i>Tyto tenebricosa</i>	Sooty Owl	V	+												+			
<i>Ninox novaeseelandiae</i>	Southern Boobook		+					+								+	+	
<i>Pardalotus punctatus</i>	Spotted Pardalote		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Cinclosoma punctatum</i>	Spotted Quail-thrush		+		+	+	+	+	+		+							
<i>Threskiornis spinicollis</i>	Straw-necked Ibis					+												

Scientific Name	Common Name	Status	2001	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
<i>Pardalotus striatus</i>	Striated Pardalote			+	+	+	+											+
<i>Acanthiza lineata</i>	Striated Thornbill		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo					+									+			+
<i>Malurus cyaneus</i>	Superb Fairy-wren		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Podargus strigoides</i>	Tawny Frogmouth					+										+	+	+
<i>Lopholaimus antarcticus</i>	Topknot Pigeon		+															
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V		+			+		+				+					
<i>Malurus lamberti</i>	Variegated Fairy-wren		+	+	+	+	+	+	+	+	+	+	+	+		+	+	+
<i>Aquila audax</i>	Wedge-tailed Eagle														+			
<i>Hirundo neoxena</i>	Welcome Swallow			+								+		+				
<i>Sericornis frontalis</i>	White-browed Scrubwren		+	+	+	+	+	+	+	+	+		+	+	+	+	+	+
<i>Phylidonyris niger</i>	White-cheeked Honeyeater												+					+
<i>Lichenostomus leucotis</i>	White-eared Honeyeater																	+
<i>Melithreptus lunatus</i>	White-naped Honeyeater		+	+	+	+	+	+	+	+	+		+				+	+
<i>Gerygone albogularis</i>	White-throated Gerygone					+		+			+				+	+	+	
<i>Hirundapus caudacutus</i>	White-throated Needletail													+			+	
<i>Eurostopodus mystacalis</i>	White-throated Nightjar		+		+		+	+				+					+	
<i>Cormobates leucophaeus</i>	White-throated Treecreeper		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Corcorax melanorhamphos</i>	White-winged Chough				+			+								+		
<i>Rhipidura leucophrys</i>	Willie Wagtail							+							+			
<i>Leucosarcia picata</i>	Wonga Pigeon					+		+	+	+	+		+	+	+	+	+	+
<i>Acanthiza nana</i>	Yellow Thornbill			+	+	+			+		+		+	+	+		+	+
<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Calyptorhynchus funereus</i>	Yellow-tailed Black-Cockatoo					+		+									+	
<i>Sericornis citreogularis</i>	Yellow-throated Scrubwren															+	+	
<b>Total</b>			<b>53</b>	<b>56</b>	<b>55</b>	<b>64</b>	<b>50</b>	<b>63</b>	<b>60</b>	<b>53</b>	<b>55</b>	<b>47</b>	<b>48</b>	<b>51</b>	<b>58</b>	<b>57</b>	<b>55</b>	<b>52</b>

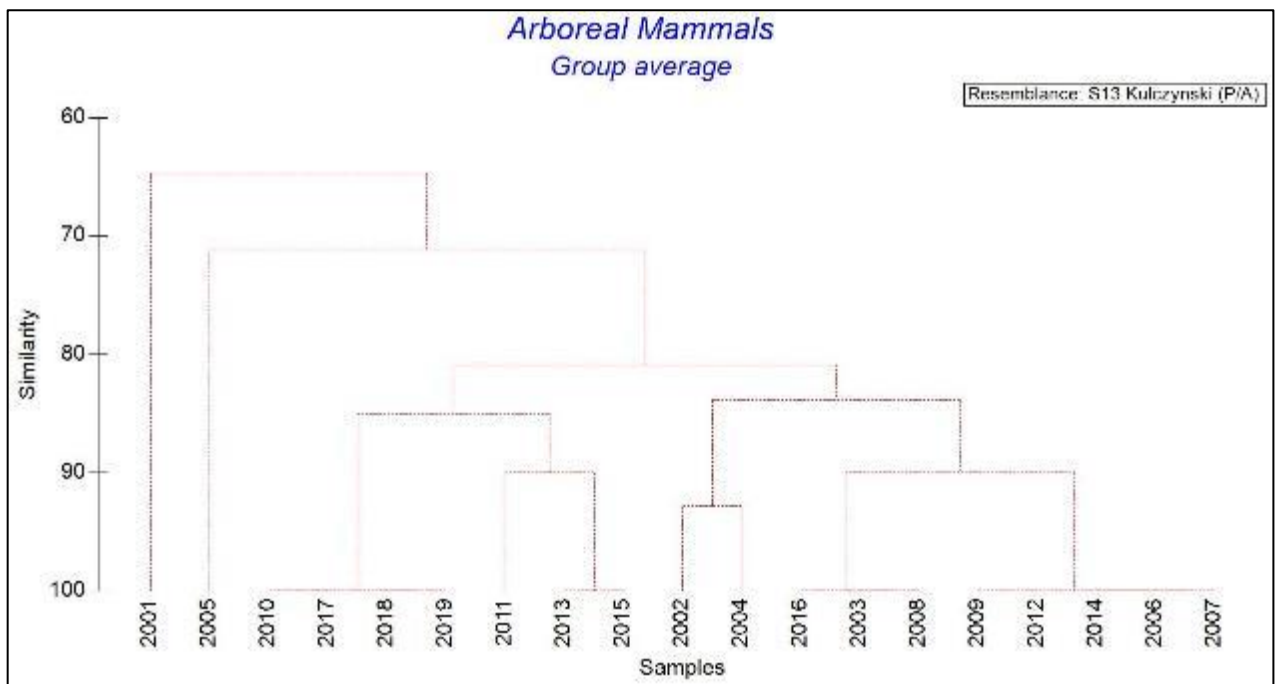
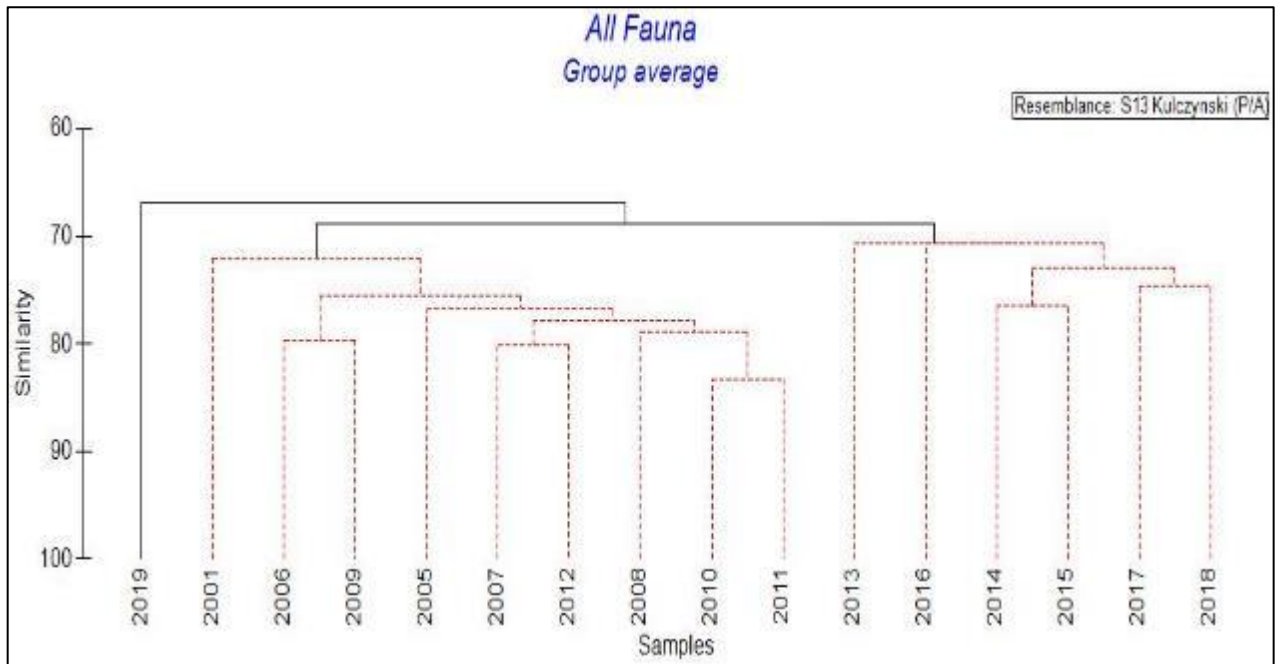
Status: V = Threatened (Vulnerable) under the *Biodiversity Conservation Act 2016* (NSW)

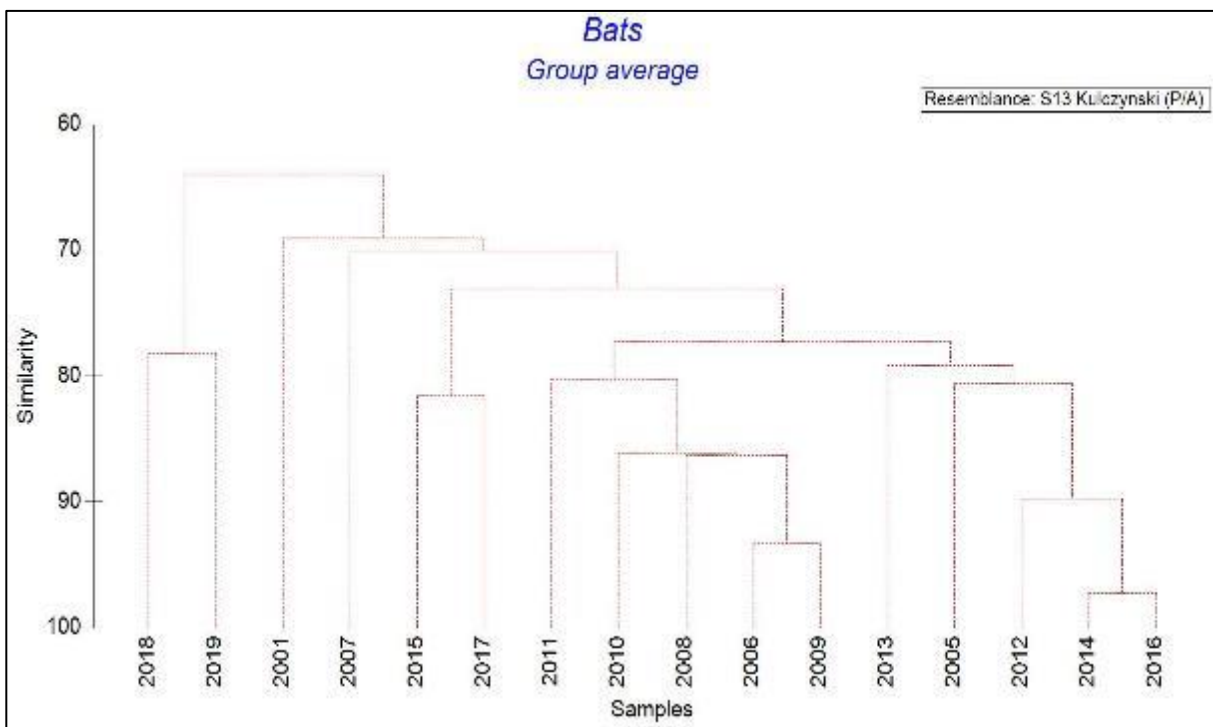
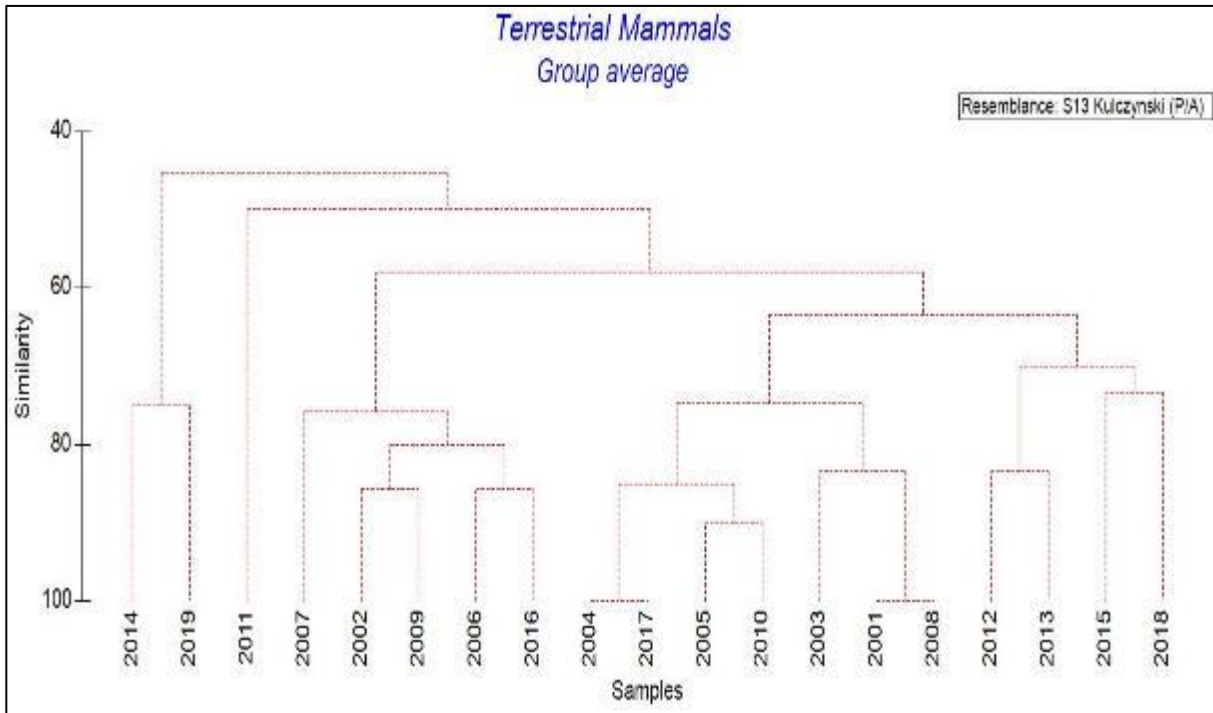
## APPENDIX 7. AMPHIBIAN AND REPTILE SPECIES RECORDED ACROSS ALL QUADRATS 2009 - 2019

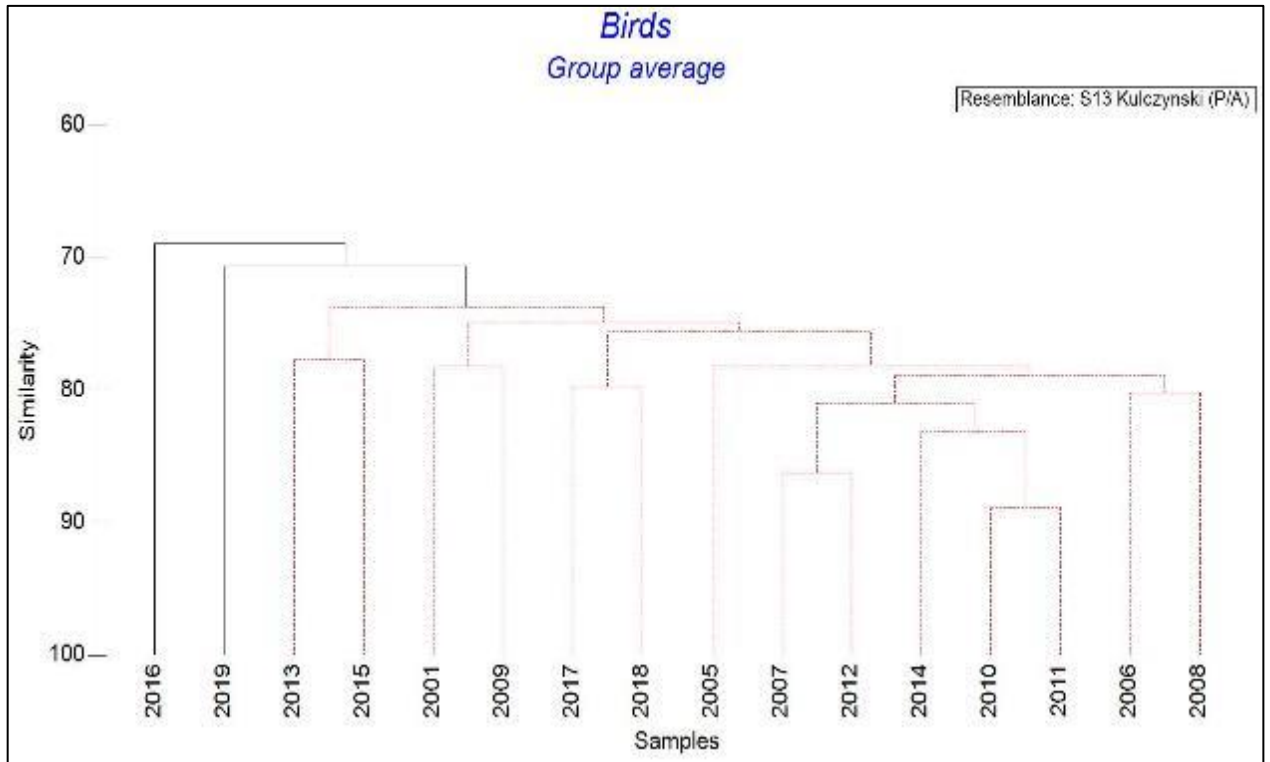
Scientific name	Common name	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
<i>Adelotus brevis</i>	Tusked Frog					+	+	+	+	+		
<i>Crinia signifera</i>	Common Toadlet			+		+	+	+	+	+		
<i>Limnodynastes peronii</i>	Striped Marsh Frog			+		+		+	+			
<i>Limnodynastes tasmaniensis</i>	Spotted Grass Frog					+					+	
<i>Litoria fallax</i>	Sedge Frog	+				+	+	+				+
<i>Litoria latopalmata</i>	Broad-palmed Frog	+				+			+	+	+	
<i>Litoria peronii</i>	Emerald-spotted Tree Frog	+						+	+	+		
<i>Litoria revelata</i>	Revealed Frog					+						
<i>Litoria tylei</i>	Tyler's Tree Frog					+		+	+			
<i>Pseudophryne bibronii</i>	Bibron's Toadlet					+						
<i>Pseudophryne coriacea</i>	Red-backed Toadlet			+		+	+	+	+		+	
<i>Uperoleia laevigata</i>	Eastern Toadlet									+		
<b>Total</b>		<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>10</b>	<b>4</b>	<b>7</b>	<b>7</b>	<b>5</b>	<b>3</b>	<b>1</b>
<i>Amphibolurus muricatus</i>	Jacky Lizard	+										
<i>Dendrelaphis punctulata</i>	Green Tree Snake	+										
<i>Demansia psammophis</i>	Yellow-faced Whipsnake											+
<i>Furina diadema</i>	Red-naped Snake	+										
<i>Hemisphaeriodon gerrardii</i>	Pink-tongued Skink							+				
<i>Intellagama lesueurii</i>	Eastern Water Dragon							+	+	+		
<i>Lampropholis delicata</i>	Delicate Skink							+	+			
<i>Morelia spilota spilota</i>	Diamond Python						+					
<i>Pseudechis porphyriacus</i>	Red-bellied Black Snake								+		+	+
<i>Pseudonaja textilis</i>	Eastern Brown Snake							+				
<i>Varanus varius</i>	Lace Monitor	+					+		+	+	+	+
<b>Total</b>		<b>4</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>4</b>	<b>4</b>	<b>2</b>	<b>2</b>	<b>3</b>



## APPENDIX 8. CLUSTER ANALYSIS DENDOGRAMS AND SIMPROF RESULTS







## APPENDIX 9. PHOTOS - FAUNA

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**Plate 2: Glossy Black-Cockatoos**



**Plate 3: Pacific Baza**



**Plate 4: Eastern Freetail-bat**



**Plate 5: Sugar Glider nest in new nest box**

## APPENDIX 10. STAFF CONTRIBUTIONS AND QUALIFICATIONS

---

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

Name	Qualification	Title/Experience	Contribution
Chelayne Whyte	BGeog DipSIS)	Senior Environmental Scientist	Report review
Ben Stewart	MMarSc&Mgt	Ecologist	Fauna and flora surveys
Mark Dean	BEnvSc & Mgt	Ecologist (Zoology)	Fauna surveys and report writing
Ashleigh Owen	Dip Science	Ecologist	Flora survey
Elise Connolly	Dip Cons Land Mgt AdvDip Env Mgt	Ecologist (Botanist)	Flora survey and report writing
Gayle Joyce	BSc (Forestry) (Hons)	GIS Specialist	Map preparation
Kane Blundell	BEd	Trainee Ecologist	Fauna Surveys

# Appendix 5

## Annual Survey of the Tetratheca Juncea Conservation Area 2019

prepared by

Kleinfelder Australia Pty Ltd

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## Annual Survey of the *Tetratheca juncea* Conservation Area 2019



**Yancoal Australia Pty Ltd**

Yancoal Donaldson Open-Cut, NSW

03 February 2020

# Annual Survey of the *Tetratheca juncea* Conservation Area 2019

Yancoal Donaldson Open-Cut  
NSW

**Kleinfelder Report Number: NCA20R107011**

**Job Number: 20202674**

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**Prepared for:**

Yancoal Australia Pty Ltd

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Version	Description	Date	Author	Peer Reviewer
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2.0	Final to Client	03 February 2020		

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# 1. INTRODUCTION

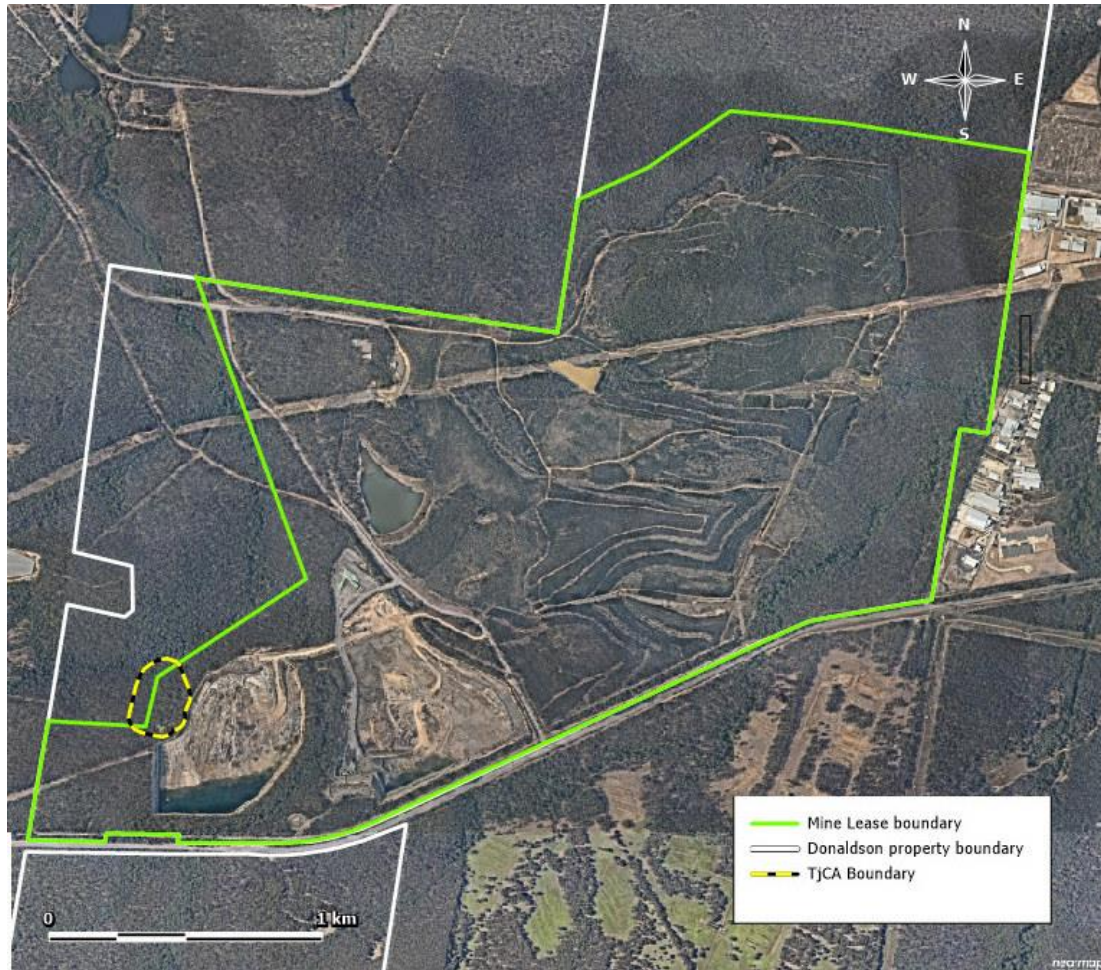
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## 1.1 BACKGROUND INFORMATION

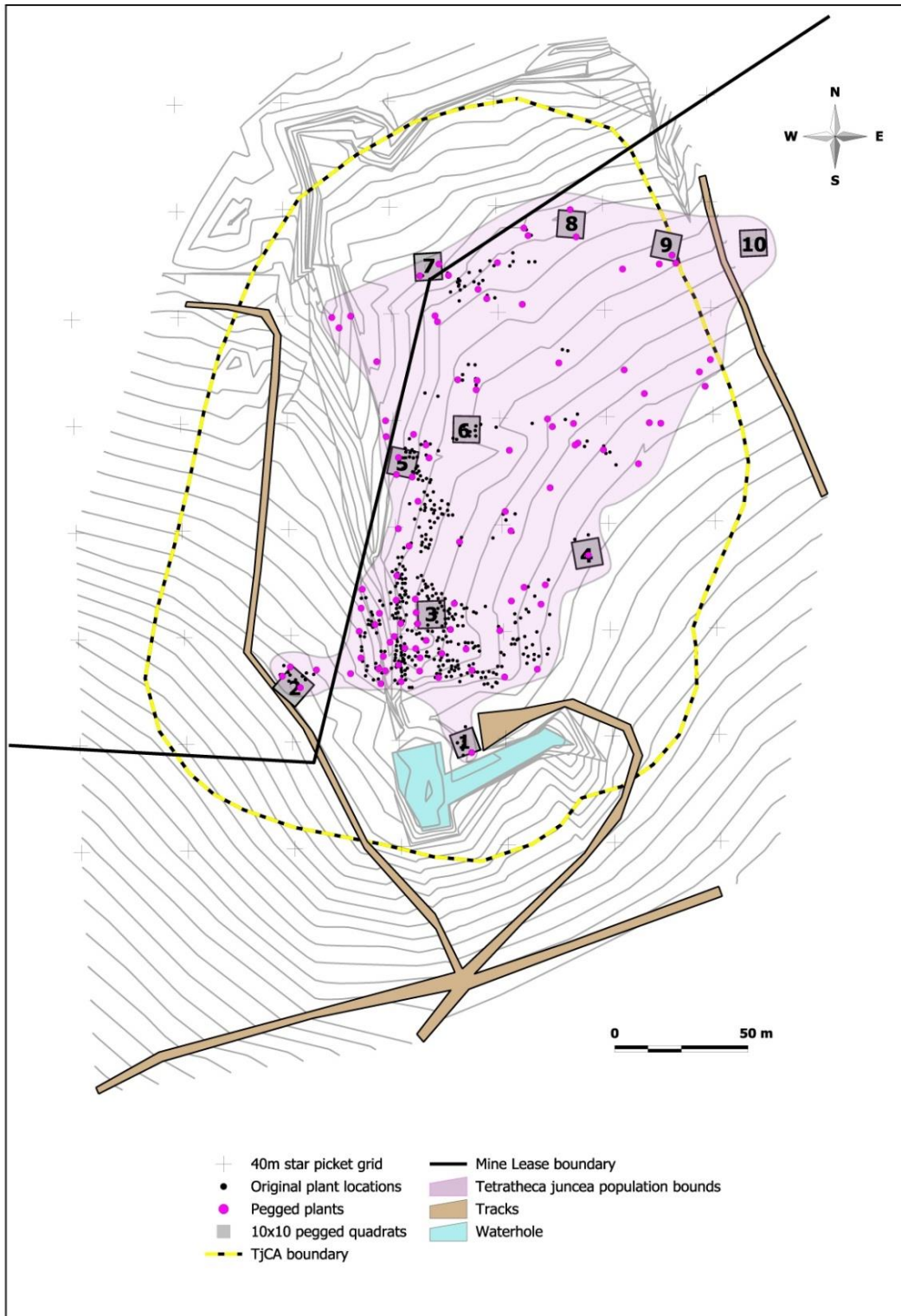
The Yancoal Donaldson open-cut coal mine operated on a mining lease near Beresfield in the lower Hunter region just west of Newcastle NSW from 2001 to 2013 when the resource was exhausted. During the initial flora and fauna investigations for the project, a substantial population of the threatened plant *Tetratheca juncea* was found to be present in about 6 hectares at the western edge of the lease. As part of meeting the Conditions of Consent for this mine, a conservation area was established to preserve these plants in a reserve. This area is known as the *Tetratheca juncea* Conservation Area (TjCA) and the management guidelines are documented in the *Tetratheca juncea* Conservation Area Management Plan (TjCMP) (Gunninah 2000). **Figure 1** shows the TjCA in the context of the overall mine and **Figure 2** shows the TjCA in detail.

The TjCMP details management and monitoring of the TjCA in relation to mining/post-mining operations, conservation area preservation and protection as well as biological and ecological data collection.

The TjCA has been monitored annually since the baseline report by Barker Harle (2003).



**Figure 1:** The *Tetradleca juncea* Conservation Area (TjCA) in the context of the overall mine (Image Nearmap December 2019).



**Figure 2: The *Tetradthecha juncea* Conservation Area (TjCA) detail.**

## 1.2 TETRATHECA JUNCEA

*Tetratheca juncea* Smith (Elaeocarpaceae, formerly Tremandraceae, Crayn *et al.* 2006) is a terrestrial herbaceous plant listed under both the NSW *Threatened Species Conservation Act 1995* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* as Vulnerable and has a ROTAP coding of 3Vca (Briggs and Leigh 1995). It is endemic to NSW with a coastal distribution from the Gosford/Wyong area in the south to Bulahdelah in the north (Gardner & Murray 1992, Payne 2000). The plant grows in disjunct populations throughout its range and there is no consensus about its growing requirements or preferred habitat. It can be found growing on Narrabeen sandstone-derived soil in open woodland amongst a low shrub understorey with grassy ground cover, on Nerong Volcanics derived soil or in coastal sand woodland and heath. Putting aside the limited geographical range of the plant and limited representation in reserves, the species rarity is probably, in part, due to the fact that the plant is virtually leafless and, outside of the flowering season, is very difficult to locate amongst the grasses with which it grows. The flowering period for *Tetratheca juncea* is generally reported as being from mid to late winter through to late summer (Gardner & Murray 1992). Driscoll (2013) confirmed that budding commenced shortly after the winter equinox with flowering peaking in September/October.

The flowers of *Tetratheca juncea* grow from nodes on the leafless stem and are generally solitary but occasionally in pairs with each flower facing downward, suspended on a peduncle approximately 10 mm in length (**Plate 1**).

Commonly there are four petals (can be 5 – 8) ranging in colour from mauve through pink to (rarely) white. There are eight dark mauve poricidal anthers attached by short stout filaments in four pairs surrounding the carpel with the stigma protruding beyond their length. The flowers of *Tetratheca juncea*, in common with other members of the *Tetratheca* genus produce no nectar that could serve as a pollinator attractor, and it would appear that pollen is the sole reward available to an insect such as a bee.



**Plate 1:** *Tetratheca juncea* flowers showing grass like stems.

The reproduction and propagation strategies of *Tetratheca juncea* are seed production and vegetative spread with stems sprouting from underground rhizomes. The species grows in a variety of forms, from single stems through multi-stemmed discrete clumps, to spreading patches covering several square metres. It has been assumed that clonal spread is a significant form of propagation for the species. However, recent genetic research (Jones 2011) has revealed that, even in a closely spaced population, the level of clonality was very low.

The growth form of the species makes counting individual 'plants' difficult and a standard method has been adopted that defines a clump as being a group of stems separated by >30 cm from the next group (Payne et al. 2002). Jones (2011) showed that genetically different individuals were growing <30 cm apart.

### 1.3 TJCA POPULATION SIZE

The TjCA occupies an area of 4.8 ha and the population of *Tetratheca juncea* lies in about 2.2 ha of that area. In 2003, a population density estimate was carried out (Barker Harle 2003) and



**Table 1** shows the results. The population was divided into individually identifiable plant clumps and clonal patches where individual clumps could not be distinguished.

**Table 1: TjCA Population Size Estimate.**

Clumps	476.00
Patches	112.00
Average Patch Size	4.3 m <sup>2</sup>
Combined Patch Area	453 m <sup>2</sup>

This method deviated from the method of Payne *et al.* (2002) by the inclusion of patch size. Driscoll & Bell (2008) developed a regression relationship between patch size and the number of clumps in a patch and while the authors note that the results are not necessarily transferable to other areas, this can be used as an indicator of the total clumps in the Donaldson TjCA. Using the regression, a patch of 4.3 m<sup>2</sup> would contain 6 clumps which would extrapolate to the equivalent of 672 clumps in patches with the total population being 1,171 clumps.

Monitoring was conducted on 100 permanently pegged clumps which represent approximately 10% of the total population. On each annual monitoring occasion, the 100 pegged clumps in the TjCA were inspected with the number of flowers and seed capsules being recorded for each plant clump along with the number of surviving clumps. The sum of flowers and seed capsules gives total flowers produced by the plant and total seed capsules divided by total flowers gives a rate of conversion that indicates pollinator activity. This index is commonly referred to as the fruit-flower ratio (FFR). As used here, FFR is primarily an index of pollinator activity up to the point at which data are collected. A true FFR would be determined by counting total flowers and total fruit produced across the entire flowering season.

## 2. RESULTS AND DISCUSSION

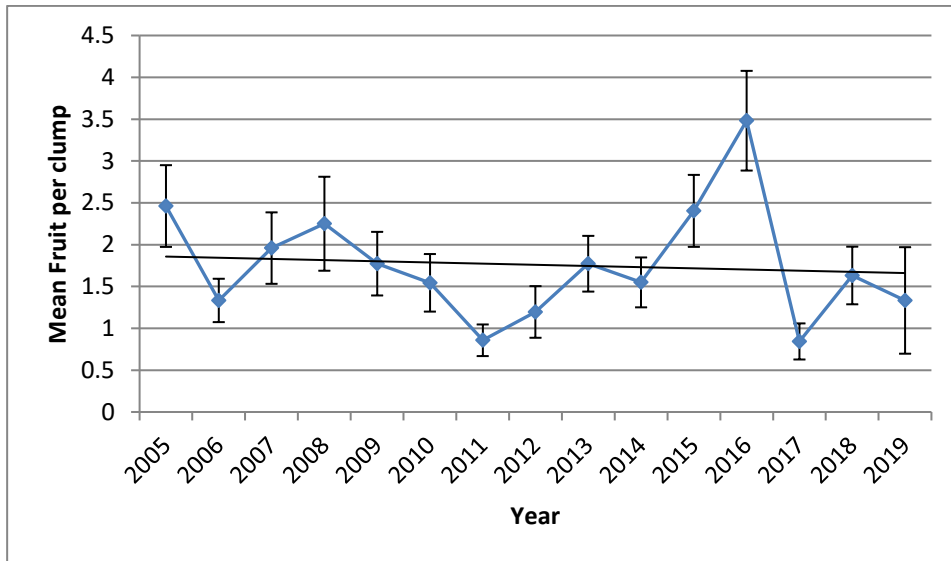
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### 2.1 POLLINATOR ACTIVITY

The *Tetraloche juncea* flower has no nectar and is a pollen source only for native bees to use as food for their developing young. The consequence of this is that flower fertilisation and subsequent seed capsule development is likely to be pollinator limited. This means that the amount of seed produced is entirely dependent on the number of available pollinators. The species has in fact been shown to be pollinator limited (Gross *et al.* 2003). Combined with the fact that the flowers do not self-pollinate (even though the pollination system is self-compatible) the number of seed capsules produced on plants can be used as a direct indicator of pollinator activity (Driscoll 2003; Driscoll 2013).

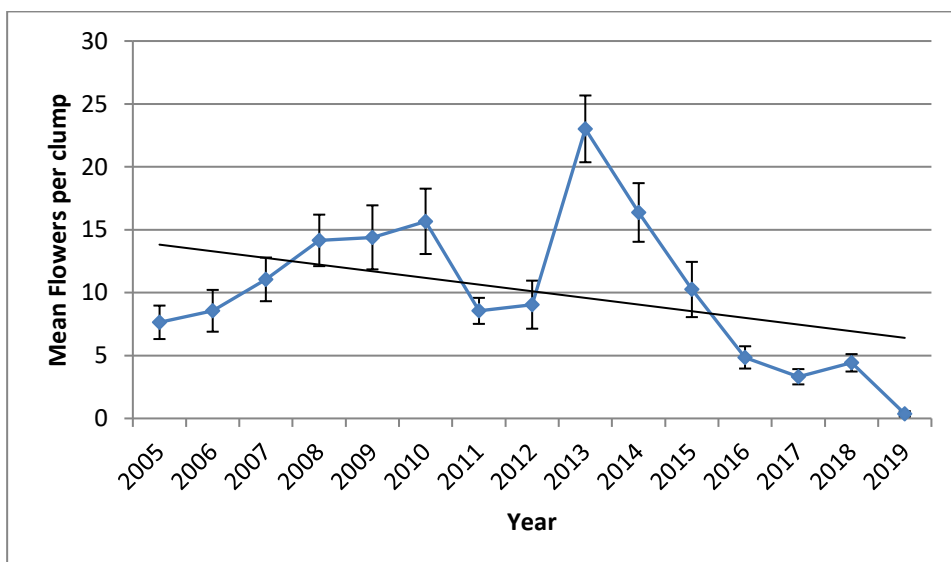
These data have been collected since 2005 so there are now 15 years over which trends can be observed.

**Figure 3** shows a plot of mean fruit per clump versus monitoring year. Up to and including 2014 there was an apparent but not significant decline in the mean number of fruits per plant clump. Subsequently there was a significant increase with 2016 levels the highest recorded following which levels have fallen back into the range previously recorded. This should however be viewed in the context of a decline in plant clumps from 91 in 2005 to 54 in 2016, 51 in 2017, 38 in 2018 and 30 in 2019, along with the plot of mean flowers per clump (**Figure 4**).



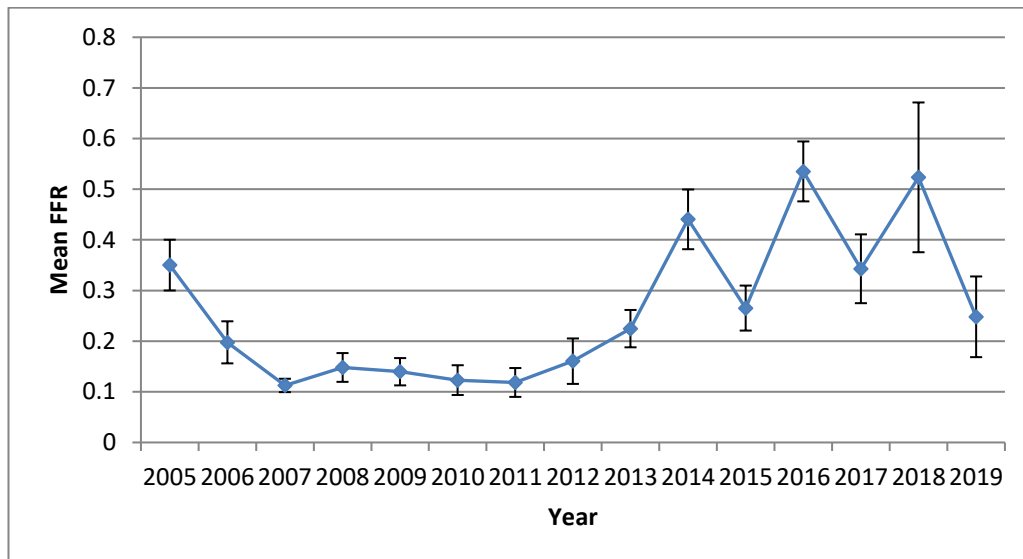
**Figure 3: Mean fruit per clump from 2005 to 2019 (bars are  $\pm 1$  s.e.).**

Decreasing flowers and increasing fruit per clump point to pollinators competing for a declining resource from 2014 to 2016. It would be interesting to know what other pollen sources were available during this period. In retrospect that period was an aberration compared with the overall results.



**Figure 4: Mean total flowers per clump from 2005 to 2019 (bars are  $\pm 1$  s.e.).**

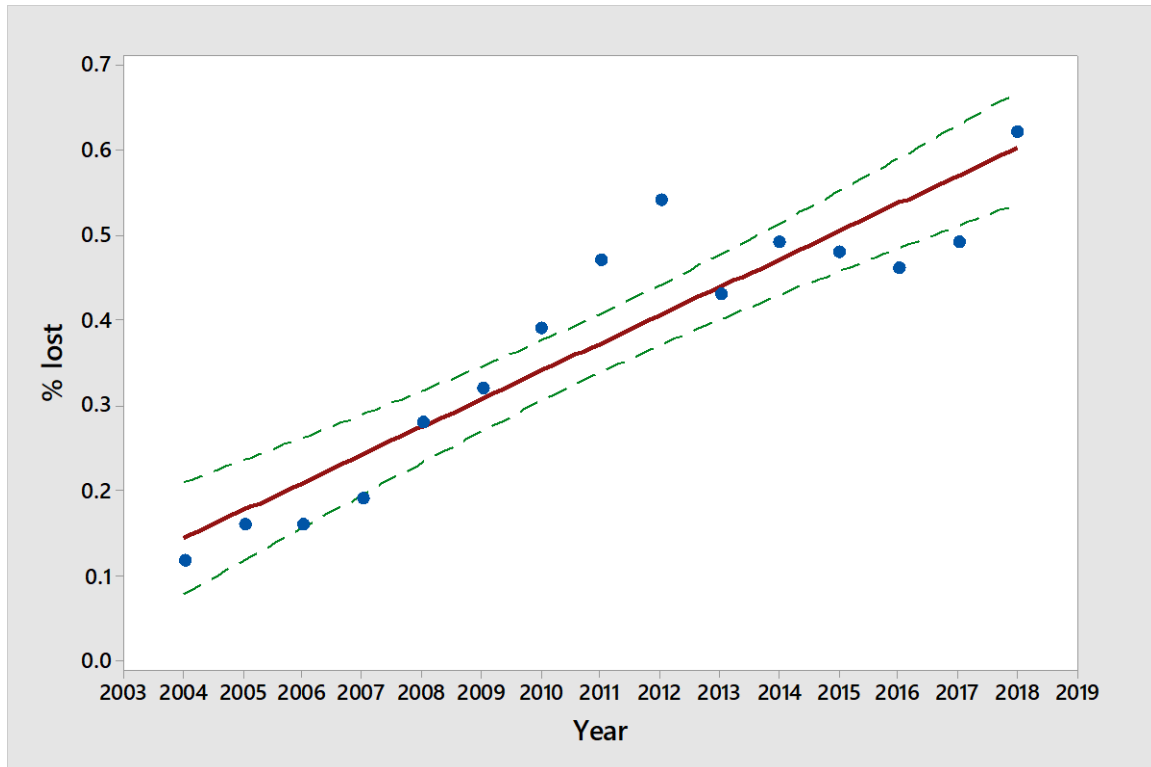
**Figure 5** shows the pattern of FFR values over the 15 years. The shape of this plot is difficult to explain other than to say that there are a number of potential factors influencing pollinator activity, particularly total available pollinators and pollen availability from all floral sources across the *Tetradlea juncea* population. Furthermore, as demonstrated in Driscoll (2013) FFR calculated in this manner is an indicative value rather than a true value.



**Figure 5: Mean fruit-flower ratio (FFR) 2005 to 2019 (bars are ± 1 s.e.).**

## 2.2 POPULATION DYNAMICS

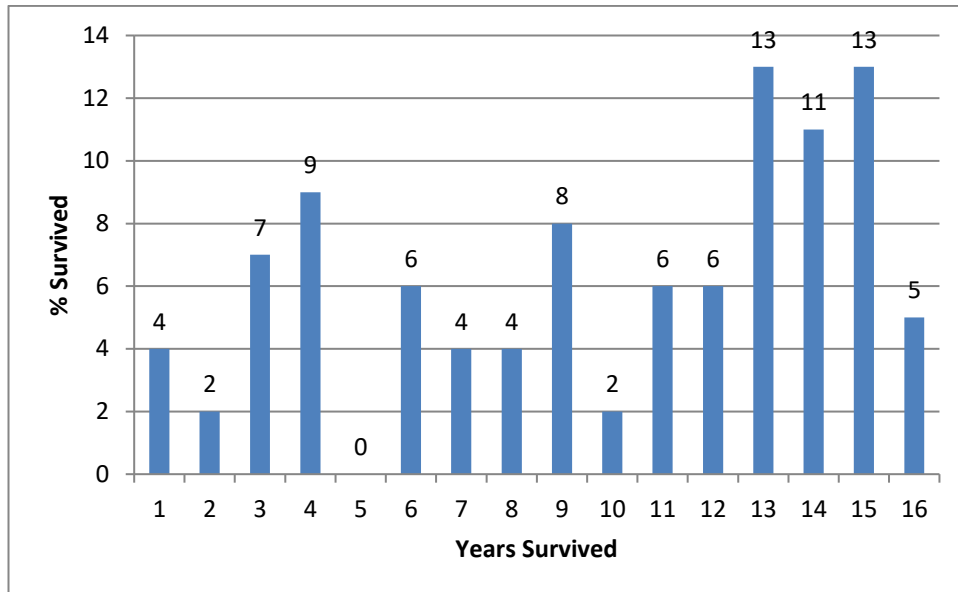
Each year the number of the 100 pegged clumps found missing has been recorded and the summary results from 2004 to 2019 are shown in **Figure 6**. The trendline is significant with  $r^2 = 0.88$ ,  $F_{(1, 15)} = 102.83$   $p = 0.000$ .



**Figure 6:** Percentage of the 100 clumps missing in each year along with 95% confidence intervals.

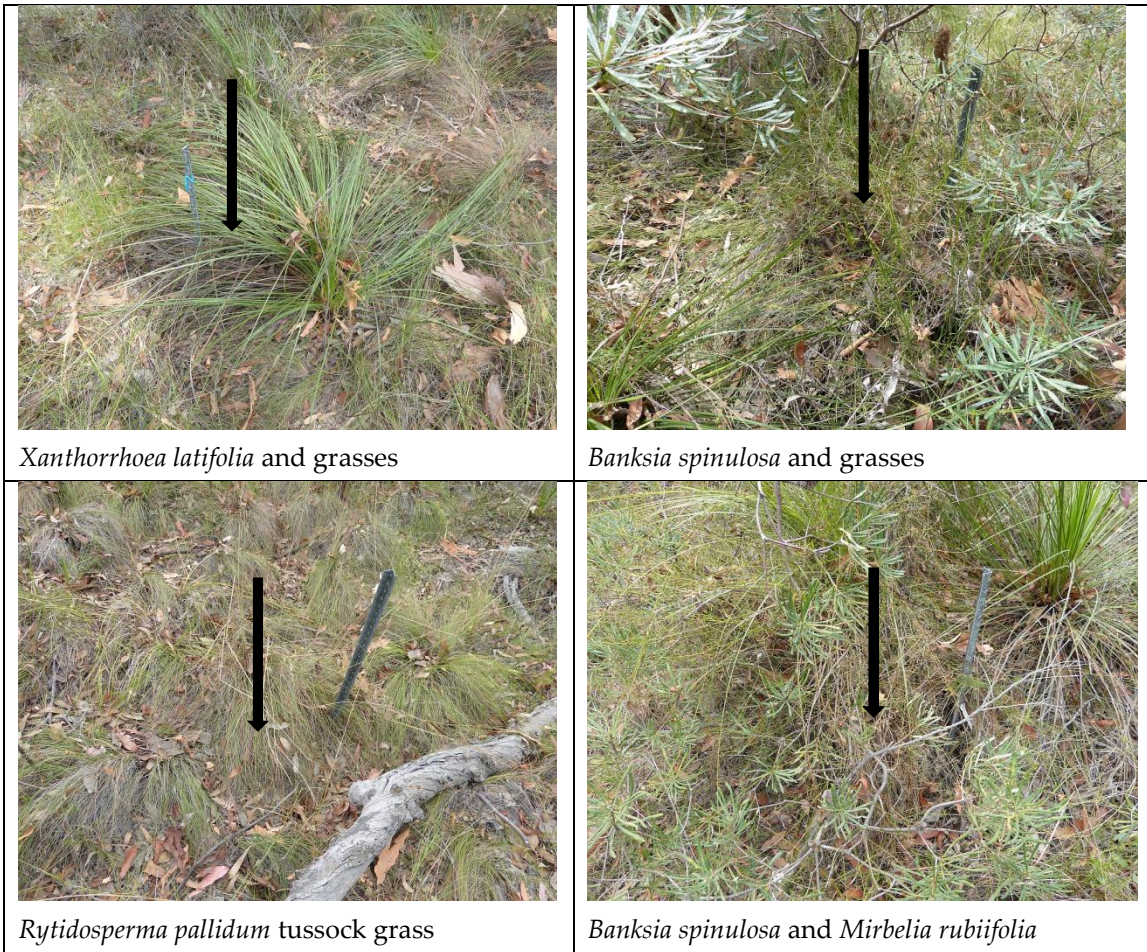
**Appendix 1** provides a graphical summary of the presence/absence of clumps over time.

Figure 7 shows a frequency plot of the percentage survival times of all clumps showing >40% surviving 13 or more years.



**Figure 7: Percentage survival time of the 100 clumps**

Kleinfelder (2012) suggested a probable cause for the continuing reduction in the population was a measured increase in the density of ground species out-competing *Tetradlea juncea* (**Plate 2**).



*Xanthorrhoea latifolia* and grasses

*Banksia spinulosa* and grasses

*Rytidosperma pallidum* tussock grass

*Banksia spinulosa* and *Mirbelia rubiifolia*

**Plate 2: Examples of dense ground cover at the location of a lost clump (vertical arrows indicate the location of the original *Tetraetheca juncea* clump)**

### 3. POTENTIAL ENVIRONMENTAL INFLUENCES

Driscoll (2013) found that there was no temperature or rainfall effect on flower numbers in this population covering years 2006 to 2010. Given a further nine years have elapsed this was re-examined with mean flowers per clump against total rainfall from May to November each year and average monthly temperature for the same months. The data used were from the BOM website (<http://www.bom.gov.au/climate/data>) for Maitland (22008). Again, no effect was found between rainfall or average monthly temperature and total flowers. Figures 8 and 9 show the regression plots with 95% confidence intervals. Rainfall analysis of variance results were  $R^2 = 0.0092$ ,  $F_{1,14} = 0.12$ ,  $p = 0.734$  and temperature results were  $R^2 = 0.0061$ ,  $F_{1,14} = 0.85$ ,  $p = 0.373$  with neither being significant.

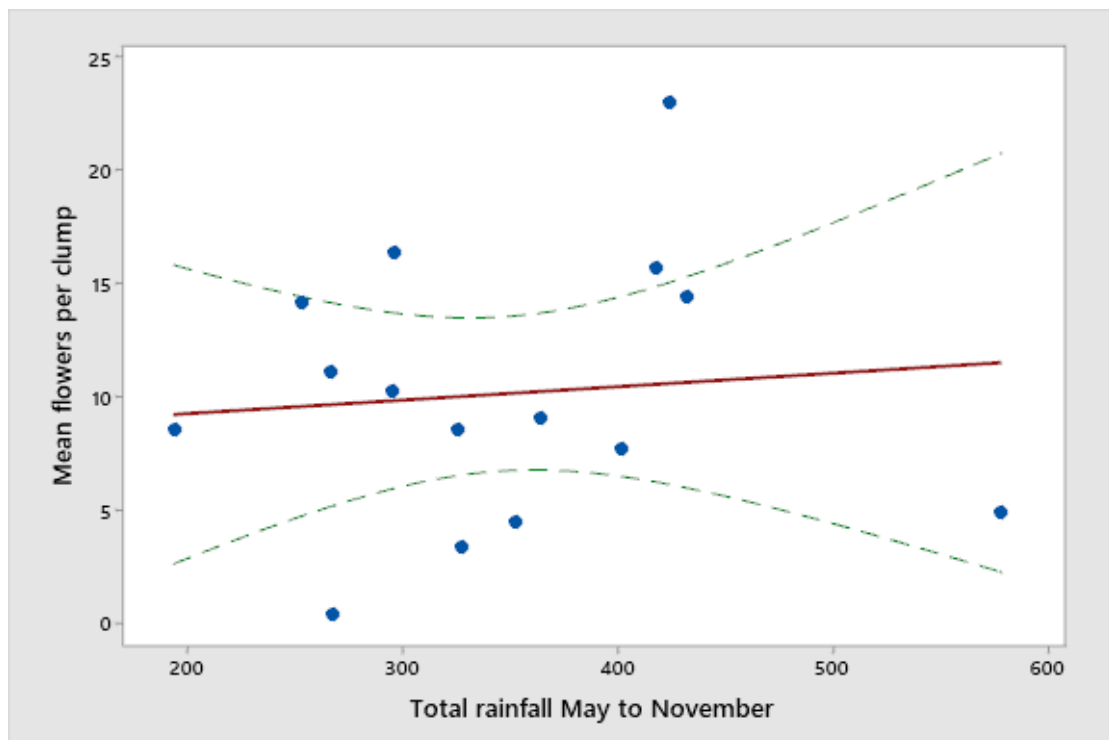
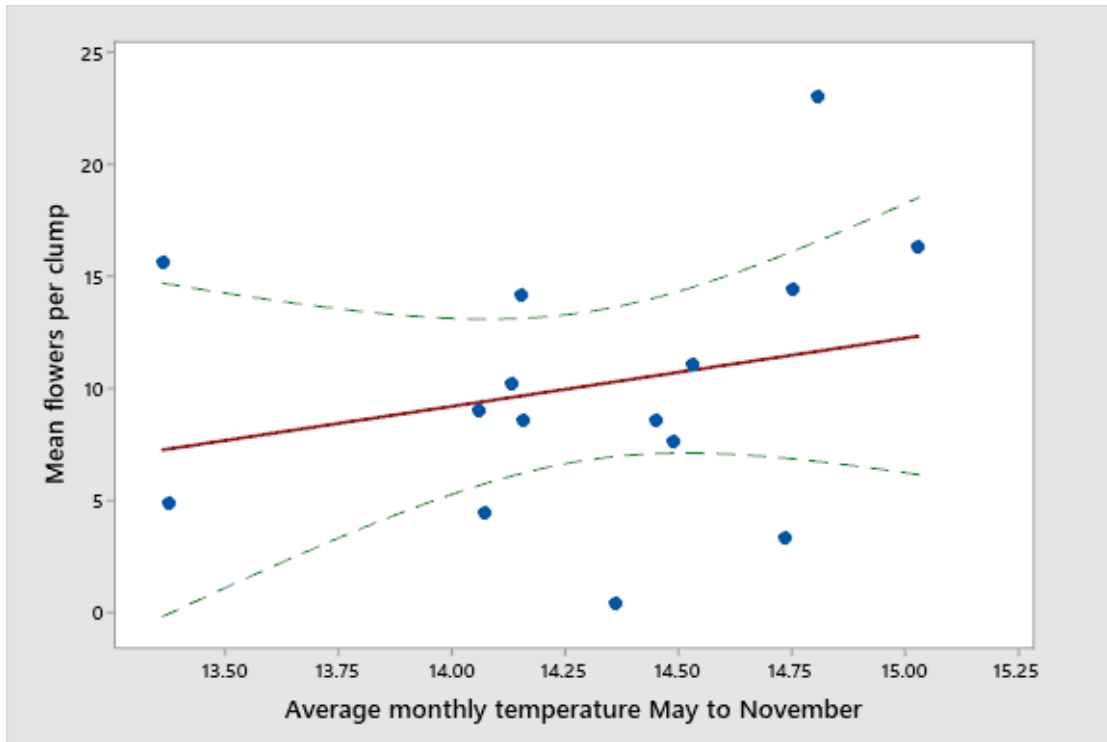


Figure 8: Regression analysis of rainfall and mean flowers per clump years 2005 – 2019.





**Figure 9: Regression analysis of temperature and mean flowers per clump years 2005 – 2019.**

## 4. DISCUSSION AND RECOMMENDATIONS

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The monitoring data has shown a declining population since the start of monitoring, up to 2014, with a small recovery followed by a continued decline. Evidence points to *Tetraloche juncea* being outcompeted by other ground species. Overall, this report builds on previous reports in demonstrating that the TjCA population would benefit from a fire. This would both reduce the current level of competition and provide more nesting areas for tunnelling native bee pollinators.

There has been one published study by Norton (1994) and one unpublished study (Driscoll) looking at the response of *Tetraloche juncea* to fire. Both studies showed that plant clumps re-sprout following fire. Norton (1994) noted that fire temperature and duration of heating experienced by plant clumps had an effect on their ability to re-sprout. High temperatures are likely to burn deep into the rootstock which results in the plants being killed. Driscoll (unpub.) observed that even if the main rootstock was killed, the plant could re-sprout from secondary roots away from the original location. Bartier *et al.* (2001) studied germination of *Tetraloche juncea* seed and found that application of smoke water resulted in a significant increase in germination rate.

As has been recommended since the 2007 annual report, it is again recommended that the TjCA be burned at an appropriate time. An appropriate time would be no later than April in order to take advantage of viable seed and to allow for re-sprouting during warm weather.

However, despite the lack of burning this long-term monitoring program is providing invaluable data about the dynamics of a *Tetraloche juncea* population. There is a core of clumps that have survived over all or the majority of the monitoring period and these give a sense of permanency to the population.

A broad scale analysis has found that neither temperature nor rainfall influence the number of flowers per clump. However, it is possible that these factors do have an effect that is lost due to the regional weather data used. Had these data been collected from the population site itself there might have been a different result.

It should also be noted that large areas of eastern Australia were experiencing severe drought through 2018/2019. It is expected that this would have negatively impacted the Donaldson population through reduced flowering and loss of monitored clumps that were not in a strong condition prior to the onset of the drought.

## 5. COMPLIANCE WITH MONITORING REQUIREMENTS OF THE TETRATHECA JUNCEA MANAGEMENT PLAN

The TjCMP provides an outline of the changes in the TjCA that should be monitored, and **Table 2** summarises the compliance with the TjCMP since the commencement of monitoring.

**Table 2: Compliance with the TjCMP**

Item	Compliance	Comment about non-compliance
Demographic monitoring	Yes	-
Fire response monitoring	No	Ecological burns were recommended in the TjCMP. At that time there was no research that supports the idea that <i>Tetralthea juncea</i> requires fire for the long-term viability of the population. In consultation with the Donaldson PEO it was determined that until further information was available, burns would not be conducted. Further information is now available and burning is <b>recommended</b> .
Changes in native competitors	Yes	-
6-monthly reporting	No	In consultation with the Donaldson PEO it was determined that annual reporting only would be required with periodic inspections and any significant incidents immediately reported.
Annual surveys conducted during flowering period	Yes	This report

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---

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## APPENDIX 1: GRAPHICAL REPRESENTATION OF THE SURVIVAL OF INDIVIDUAL CLUMPS OVER TIME

---

Green = clump present, Pink = clump absent

Clump	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1
3	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
4	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
5	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6	0	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0
7	0	1	1	1	1	1	1	1	1	0	1	1	1	0	0	0
8	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0
9	0	1	1	1	1	1	1	1	0	0	0	1	1	1	1	0
10	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	0
11	1	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0
12	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
13	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
14	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
15	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	0
16	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0
17	1	1	1	1	1	1	1	0	0	1	0	0	0	1	0	0
18	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1
19	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1
20	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
21	1	1	1	1	1	1	0	0	0	1	0	0	0	0	0	0
22	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0

Clump	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
23	1	1	1	1	1	0	0	0	0	0	0	1	0	0	0	0
24	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
26	1	1	1	1	1	0	0	0	0	0	0	0	1	1	1	1
27	1	1	1	1	1	1	0	0	0	0	1	1	0	0	0	0
28	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
29	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0
30	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0
31	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
32	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	0
33	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	-
34	1	1	1	1	1	1	1	1	1	1	0	0	0	0	1	0
35	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0
36	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	0
37	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1
38	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0
39	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
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41	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0
42	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
43	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
45	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0
46	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1
47	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0
48	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0
49	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
50	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1
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52	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	0
53	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
54	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1



Clump	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
55	1	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0
56	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	0
57	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
58	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0
59	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	0
60	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	0
61	1	1	1	1	1	1	1	0	0	1	0	1	1	1	1	1
62	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1
63	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	0
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65	1	1	1	1	1	1	0	1	0	1	1	1	1	0	0	1
66	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
67	1	1	1	1	1	1	0	0	0	1	1	1	1	1	0	
68	1	1	1	1	0	0	1	0	0	1	0	0	0	0	0	
69	1	1	1	1	0	1	0	1	0	0	1	1	1	0	0	0
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72	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
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74	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0
75	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
76	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
77	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1
79	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0
80	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0
82	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
83	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1
84	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
85	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
86	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0

Clump	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
87	1	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0
88	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1
89	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0
90	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0
91	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1
92	1	1	1	1	1	1	1	0	1	0	0	0	1	1	1	1
93	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
94	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
95	1	1	1	1	1	1	1	0	0	1	1	0	0	1	1	1
96	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0
97	1	1	1	1	0	0	0	0	0	1	0	0	0	0	0	1
98	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1
99	1	1	1	1	0	1	1	0	1	1	0	0	0	0	1	0
100	1	1	1	1	1	1	0	0	0	1	0	0	0	0	0	0

# **Appendix 6**

## **2019 Rehabilitation Monitoring**

prepared by

**Kleinfelder Australia Pty Ltd**

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## 2019 Rehabilitation Monitoring



### Yancoal Australia Ltd

Donaldson Open Cut Mine  
John Renshaw Drive  
Beresfield NSW 2311

21 February 2020

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## 2019 Rehabilitation Monitoring

Donaldson Open Cut Mine  
John Renshaw Drive  
Beresfield NSW 2311

**Kleinfelder Report Number:** NCA20R107316

**Kleinfelder Job Number:** 20202672

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 Appendix 2: Terrestrial and arboreal nest boxes  
 Appendix 3: Examples of native fauna observed  
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 Appendix 5: Staff Contributions

# 1. INTRODUCTION

---

## 1.1 BACKGROUND

The Donaldson Coal open cut mine, located in the vicinity of Beresfield in the Lower Hunter Valley of NSW, commenced operations in 2001. The current owner, Yancoal Australia Ltd ceased operation of the open cut mine in 2013 following exhaustion of the resource. The Donaldson Coal mining lease is shown in **Figure 1**.

## 1.2 SCOPE

Kleinfelder (formerly ecobiological) has been engaged since 2008 by Donaldson Coal to undertake annual fauna surveys of the revegetated areas of the Donaldson mining lease. The aim of the survey is to provide information on the habitat requirements of recolonising fauna and to determine the effectiveness of the rehabilitation program in re-establishing pre-mining biodiversity levels. The surveys are carried out as part of the mining Conditions of Consent.

Stage one involved baseline fieldwork and the preparation of a baseline report (ecobiological 2008). A variation to the baseline study was approved by Donaldson Coal, adding an additional three quadrats and incorporating an additional quadrat to target an area of rehabilitation where no woody debris had been deliberately placed. The locations of quadrats are shown in **Figure 1**.

Through the process of adaptive management, nest box monitoring was introduced in 2011 to target the monitoring of specific species: Brown Antechinus (*Antechinus stuartii*) and Sugar Glider (*Petaurus breviceps*) in relation to rehabilitation age and structure. The implementation of the nestboxes and their monitoring has provided insight into the effectiveness of the rehabilitation program and nest boxes as artificial hollows within rehabilitated sites.

Fauna surveys have been conducted annually from 2008 to 2019 and nest box monitoring annually from 2011 to 2019. This report provides results for the 12<sup>th</sup> fauna and 9<sup>th</sup> nest box monitoring surveys conducted for 2019 report this data was collected in January 2020.

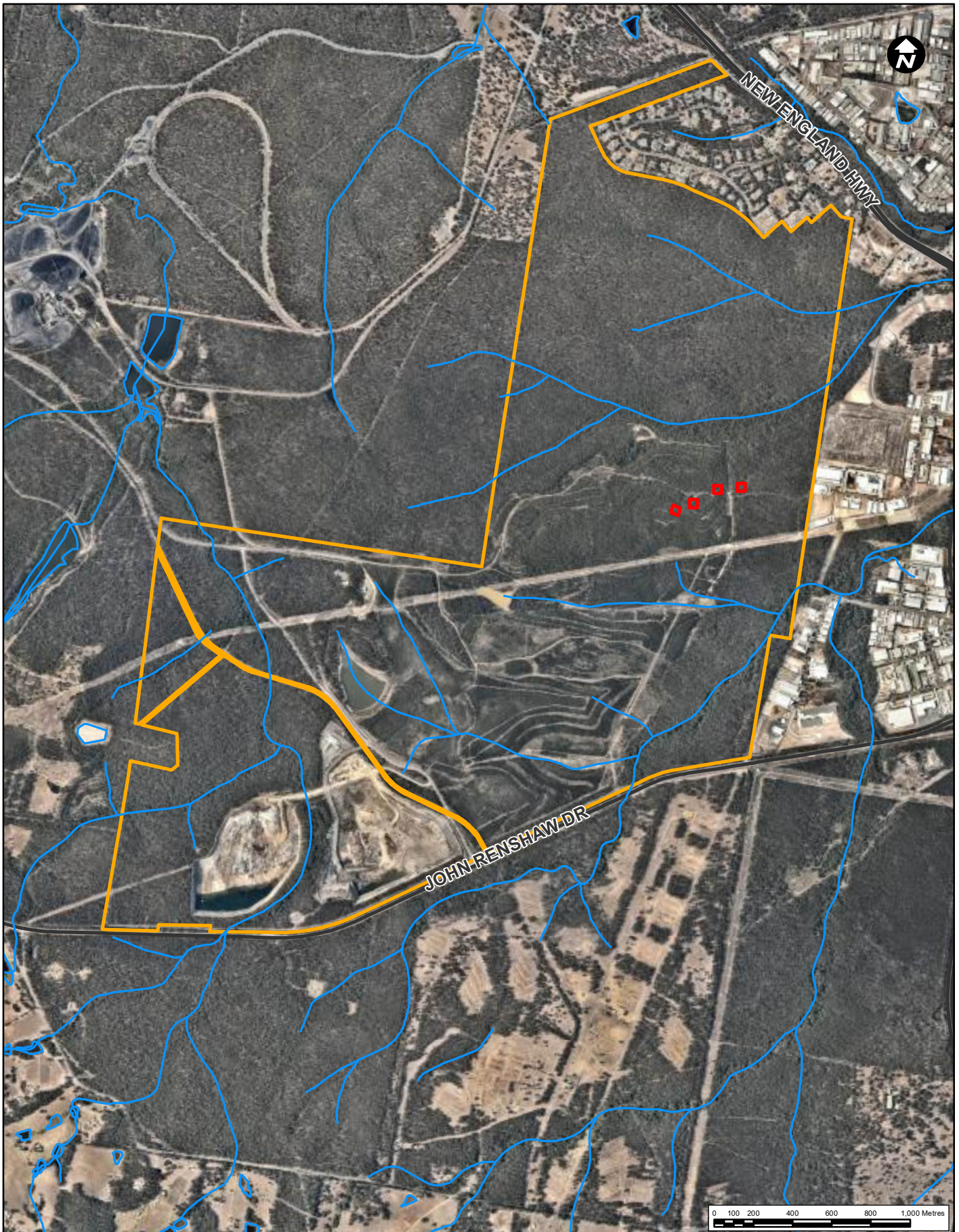
## 1.3 DESCRIPTION OF THE PROPOSAL

Monitoring of the Donaldson mine rehabilitation area aims to assess the level of successful re-colonisation by native terrestrial and arboreal species into differing aged sites. A key question being 'Whether the introduction of woody debris and nest boxes has the ability to successfully facilitate fauna re-colonisation and therefore act as a management tool for current and future mine rehabilitation?'.

In an old growth forest, the development of a complex structure including ground cover and natural hollows is perpetual, consisting of tree growth, tree shed (branches and bark), hollow formation, tree death and ground material build up and decay. In areas that have been previously cleared and rehabilitated it takes long periods of time before the vegetation is old enough to start to produce the type of ground habitat and hollow structures required to support small terrestrial and arboreal mammals, reptiles, amphibians and invertebrates. By designing rehabilitation to include structural elements such as woody debris, rocks and artificial hollows, the time over which a rehabilitated area can be successfully re-colonised by fauna has the potential to be greatly reduced (Ireland *et al.* 1994; Carey and Johnson 1995; Loeb 1999; Butts and McComb 2000; MacNally *et al.* 2001; MacNally 2006; Lada *et al.* 2007).

Stage one of the program, involved preliminary surveys and trapping within the existing rehabilitated areas containing varying amounts of woody debris and in nearby native open forest vegetation as a control. Three 40 x 40 m quadrats were used to monitor fauna species and their relocation into each of the differing aged sites. Additionally, the results from the two rehabilitated sites and the mature open forest area were compared to determine if there was a significant difference in species richness between areas containing varying amounts of woody debris.

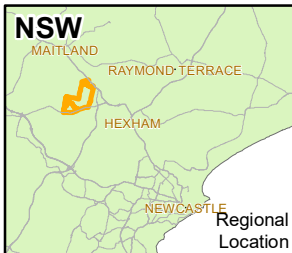
The addition of a fourth quadrat in December 2008 was intended to enable comparison between the natural forested quadrat (Q1), two rehabilitation quadrats (Q2 and Q4) with varying manipulated woody debris levels and the fourth quadrat (Q3) where no woody debris had been deliberately placed. Annual monitoring allows variations in fauna species richness in conjunction with the changing vegetation structure of the rehabilitation area to be assessed. The results from all four quadrats are compared to determine what effect vegetation structure and woody debris levels have on fauna re-colonisation. This information will assist with future rehabilitation design aimed at successful faunal re-colonisation.



**Figure 1: Locality Map & Quadrat Locations**

**Legend**

- Donaldson Coal Mine Lease Boundary
- Study Area Quadrats
- Watercourse



<b>Project Ref:</b>	20202672
<b>Plot Date:</b>	2020/02/19 16:30
<b>Revision:</b>	001 (GJoyce)

**Map Projection:**

GDA 1994 MGA Zone 56

**Data Sources:**

NSW DFSI - 2017  
 OEH - 2012  
 Nearmap - 2019

Disclaimer: This is not an official or a legal map but is for informational use only. All data was compiled from the best sources available. All boundaries, scale and geographic points are approximate.

## 2. METHODS

---

### 2.1 WOODY DEBRIS

Wood-load measurements from each original quadrat (Q1, Q2, and Q4) were undertaken in March 2008 by measuring all pieces of fallen timber with  $\geq 8\text{cm}$  end diameters within the three 40 m x 40 m quadrats. The volume of each piece was calculated by treating pieces as cylinders and multiplying the length and mean diameter of each piece. Volumes were then converted into mass by using the mean density of  $0.6 \text{ tonne/m}^3$  (Mg) (Robinson 1997; MacNally and Horrocks 2007).

The woody debris survey has not been replicated since the 2008 survey as the overall monitoring report results rely on original measurements of mean density to derive a future rehabilitation design. Quadrat 2 (Q2) and Q4 were managed for woody debris while Q3 was not. Quadrat 1 (Q1) remains as mature forest adjoining the rehabilitation area.

The 2008 procedure was adapted from studies undertaken in the Riverina region of NSW (Robinson 1997) which looked at the density and current loads of woody debris. Woody debris of similar ages was measured, and volumes calculated. The findings from this research identified that irrespective of decay status, the volume of woody debris remained at a relatively constant  $0.6 \text{ tonne/m}^3$ . This procedure was also undertaken for the additional quadrat (Q3) added in December 2008.

Re-colonisation results, in conjunction with initial woody debris levels provides information on the potential threshold required to facilitate successful re-colonisation by fauna species in terms of suitable habitat structure. Any new debris would be a result of natural decay and ecological process.

### 2.2 FAUNA

The assessment of fauna (including herpetofauna, Microchiropteran bats and Mammalia) was undertaken across four, 40 x 40 m ( $1600 \text{ m}^2$ ) quadrats (Q1 – Q4) between 13 and 21<sup>st</sup> January 2020.

Quadrat 1 (Q1) is located in mature Spotted Gum – Ironbark open forest; Q2 is situated approximately 80 m west of the first quadrat in a rehabilitated area containing 16-year old vegetation; Q3 is the newly added quadrat within 14-year old rehabilitation and is located approximately 90 m to the southwest of Q2; and Q4 is located 45 m to the southwest of Q3 also in a rehabilitated area containing 16-year old vegetation (**Figure 2**). **Table 1** depicts the total trap night count and the location of trapping activities are shown in **Figure 3**.

**Table 1: Trapping statistics for the four quadrats combined**

Trap type	Traps	Nights	Trap nights
Elliott A	80	8	640
Type IV Funnel	24	8	192
Cage	8	8	64

## 2.2.1 Terrestrial Mammals

Terrestrial mammals were surveyed from 13 – 21 January 2020. Eighty (80) Elliott A traps (20 per quadrat) were placed in an irregular grid pattern (4 x 5 traps). The ‘best lie’ method was used to avoid placing traps in open or exposed positions. Small mammals tend to avoid open spaces, preferring to go around the edge of a clearing rather than across it. Traps are generally more successful when placed against logs, under thick vegetation or along natural pathways through vegetation. Traps were baited with a mix of rolled oats, honey, peanut butter and treacle and set in position for eight consecutive nights and were checked each morning.

A Long-nosed Bandicoot (*Perameles nasuta*) was seen at Q3 during trap layout in December 2009. As a result, two cage traps were added to the trapping methodology for each quadrat to target larger terrestrial mammals. These traps were baited with the same mixture and set in position for eight consecutive nights and checked each morning.

## 2.2.2 Bats

Insectivorous Microchiropteran bat species were surveyed using Anabat recording units (Tittley Scientific, Lawnton QLD). This method was introduced in 2011 and is now replicated annually. An Anabat was placed in the remnant vegetation (Q1), 16-year old rehab (Q2) and 14-year-old rehab (near Q3). The units were set out at 8 pm and recording continued through the night until 6 am for a total of 30 recording hours.



### 2.2.3 Birds

An area search within each quadrat was carried out on 30 January 2020 to survey for diurnal birds for a 20min period. 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.

### 2.2.4 Herpetofauna

Six Type IV funnel traps were set along a 26 m run of drift fence in each quadrat from 13 – 21 January 2020. Trapping lines were left for eight consecutive nights and traps were checked daily.

Diurnal habitat searches for amphibians and reptiles were carried out within each quadrat during the January trapping period. Adult frogs encountered were identified by visual confirmation or their distinct advertisement calls. Suitable reptile habitat was inspected to detect any reptile species directly or indirectly through scats or other detectable traces. Suitable habitat included rock outcrops and crevices, fallen hollow logs and limbs, and burrows.

## 2.3 NESTBOXES

In 2011 an additional project was initiated within the rehabilitation areas involving the use of nest boxes as a method of promoting re-colonisation by arboreal and terrestrial species. Four quadrats located in similar rehabilitation age groups as the monitoring quadrats were selected and 10 nest boxes were erected (six terrestrial, four arboreal). The annual inspection was undertaken on 20 January 2020. The locations of the nest box plots and the existing fauna monitoring plots are provided in **Figure 1**. Photographs of the nest boxes design are provided in **Appendix 2**.

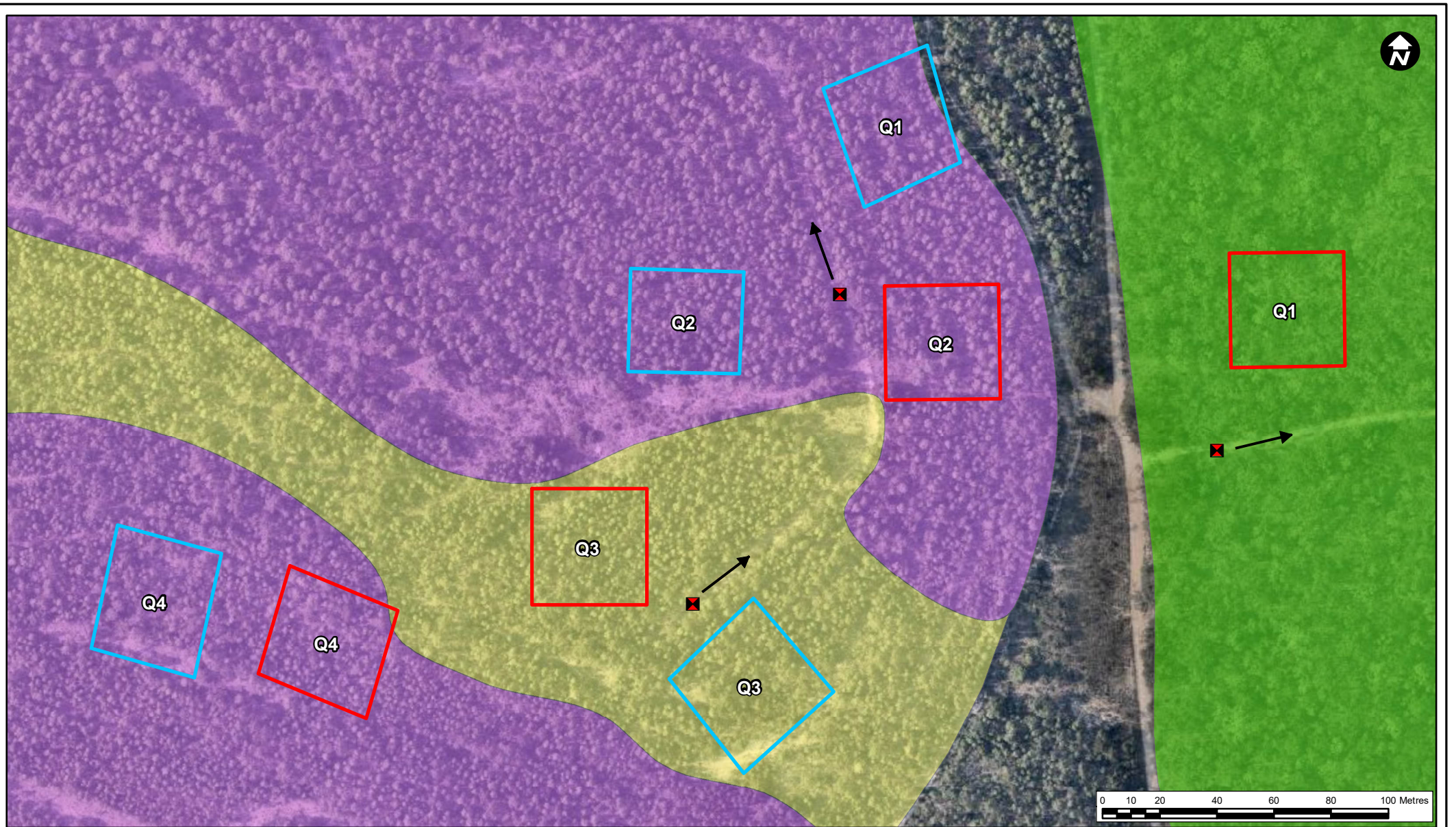
## 2.4 STATISTICAL ANALYSIS

Data on fauna species detected between 2008 and 2019 were analysed to determine whether species richness or diversity differed between rehabilitation ages. Nine of the 10 sample periods were in summer and one in autumn (Baseline study in March 2008). The season in

which surveys were conducted is known to have a significant influence on fauna diversity and abundance so data from March 2008 were excluded from analysis.

The relationship between two variables, species richness and sample year, was explored by linear regression. Regression statistics and charts were produced using Microsoft Excel. Non-metric Multidimensional Scaling (nMDS) and cluster analysis were also undertaken to explore the relationship between the fauna species assemblages detected in different rehabilitation age classes.

The Primer-E software program was used with the Kulczynski Similarity Index for presence only data (Clarke and Gorley, 2006). This analysis produced scatterplots which graphically depicted, in 2-dimensional space, the similarity between species assemblages of different survey years. Associated dendrograms were also produced that graphically depict the relationship between sample years. The strength of any clusters apparent in the scatterplot was tested by running a similarity profile routine (SIMPROF) over branches in the dendrogram. Solid lines in the dendrogram indicate statistically significant clusters whereas dotted lines indicate clusters that are not statistically significant.



**Figure 2: Survey Quadrats & Corresponding Age of Rehabilitation**

**Legend**

- Study Area Quadrats
- Nestbox Quadrats
- Anabat Locations (and Directions)
- 2003 Rehab
- 2005 Rehab
- Spotted Gum - Ironbark Open Forest

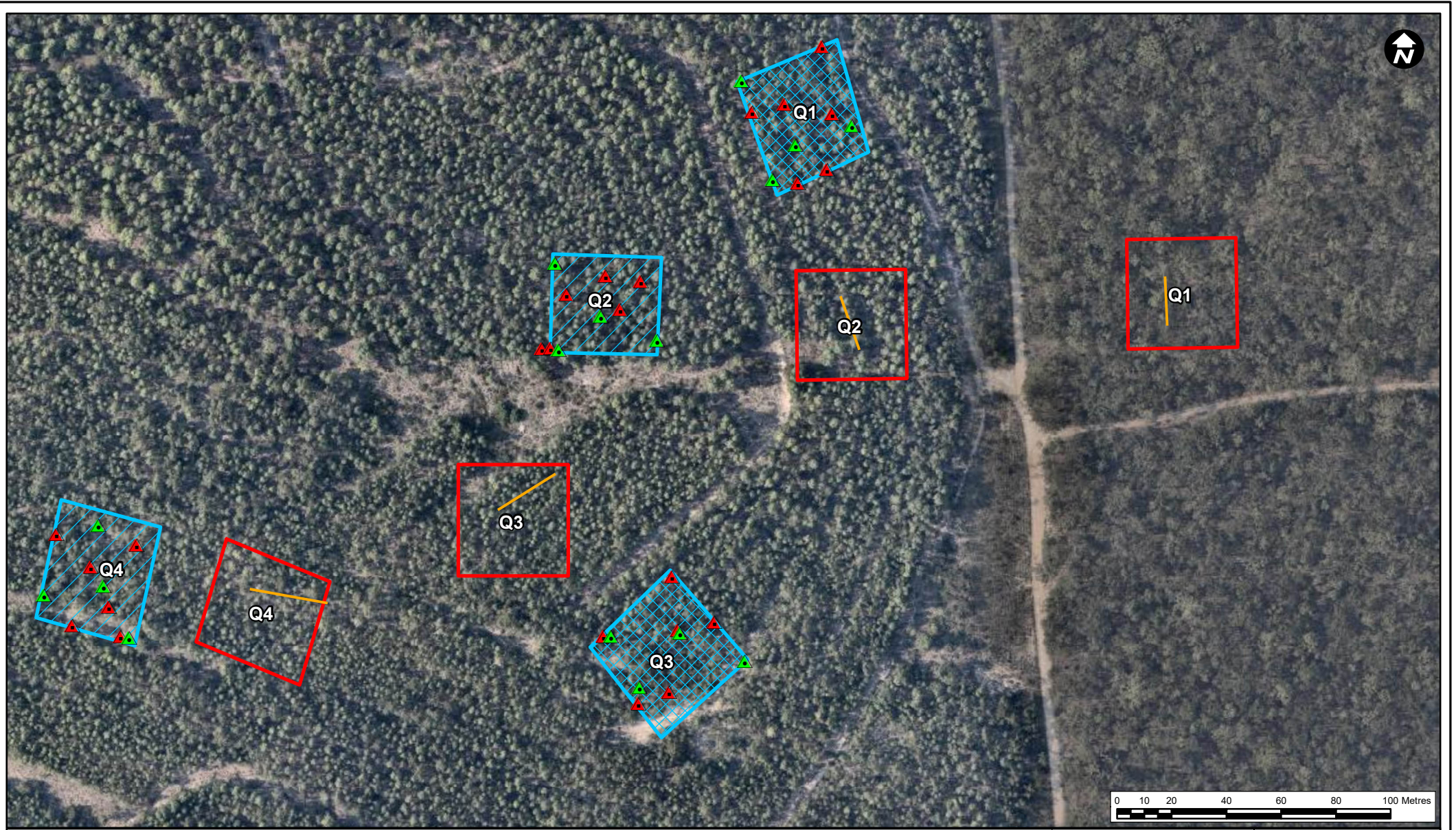


<b>Project Ref:</b>	20202672
<b>Plot Date:</b>	2020/02/19 16:34
<b>Revision:</b>	001 (G.Joyce)

**Map Projection:**  
GDA 1994 MGA Zone 56

**Data Sources:**  
NSW DFSI - 2017  
Kleinfelder - 2013  
Nearmap - 2019

Disclaimer: This is not an official or a legal map but is for informational use only. All data was compiled from the best sources available. All boundaries, scale and geographic points are approximate.



**Figure 3: Nest Box and Fauna Quadrat Trapping Locations - Donaldson Coal Open Cut Mine**  
**Legend**

- |                                                                                                                    |                                                                                                                                          |                                                    |
|--------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| <span style="border: 1px solid red; display: inline-block; width: 15px; height: 10px;"></span> Study Area Quadrats | <b>Nestbox Quadrats</b>                                                                                                                  | <b>Nestbox Location</b>                            |
| <span style="border-bottom: 1px solid yellow; display: inline-block; width: 15px;"></span> Reptile Run             | <span style="border: 1px solid blue; border-style: dashed; display: inline-block; width: 15px; height: 10px;"></span> High Fallen Timber | <span style="color: green;">▲</span> Arboreal box  |
|                                                                                                                    | <span style="border: 1px solid blue; border-style: dotted; display: inline-block; width: 15px; height: 10px;"></span> Low Fallen Timber  | <span style="color: red;">▲</span> Terrestrial box |



**Map Projection:**  
 GDA 1994 MGA Zone 56

**Data Sources:**  
 NSW DFSI - 2017  
 Kleinfelder - 2013  
 NearMap - 2019

<b>Project Ref:</b>	20202672
<b>Plot Date:</b>	2020/02/19 16:37
<b>Revision:</b>	001 (G.Joyce)

Disclaimer: This is not an official or a legal map but is for informational use only. All data was compiled from the best sources available. All boundaries, scale and geographic points are approximate.

## 3. RESULTS

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### 3.1 WEATHER CONDITIONS

The prevailing weather conditions throughout the trapping survey period (13 to 21 January 2020) were warm to hot days and mild/warm nights. Total rainfall for the survey period was 19.6 mm, occurring late in the survey period. During the trapping survey period the mean minimum temperature was 16.0°C and the mean maximum temperature was 35.5°C.

### 3.2 VEGETATION STRUCTURE

Flora monitoring does not form part of the program, however due to its relevance to fauna richness and re-colonisation, observations (**Plates 1 – 5**) regarding changes in floral diversity and structure are provided. Descriptions of all four quadrats are as follows:

- **Q1** – located in an area of remnant vegetation and consists of mature Ironbark and Spotted Gum. Woody debris levels are low (7.26 tonne Ha<sup>-1</sup>) (**Plate 1**).
- **Q2** – located in the rehabilitation areas planted in 2003 which are dominated by a canopy of Eucalypt and Acacia species. Little ground cover is present and woody debris is high (57.36 tonne Ha<sup>-1</sup>) (**Plate 2** and **Plate 3**).
- **Q3** – located in the rehabilitation areas planted in 2005 which are dominated by a canopy of Eucalypt and Acacia species medium shrub growth. No wood was placed in Q3 hence the low woody debris score (3.33 tonne Ha<sup>-1</sup>) (**Plate 4** and **Plate 5**).
- **Q4** – located in the rehabilitation areas planted in 2003. This area is dominated by a canopy of Eucalypt and Acacia species. This area has dense shrub growth and high woody debris levels (33.94 tonne Ha<sup>-1</sup>) (**Plate 6** and **Plate 7**).

As expected, the overstorey vegetation of the rehabilitation quadrats is noticeably taller (~10-15 m) than in March 2008 (average 3 m). The Eucalypt species have continued to grow, but many of the Acacia species that were present in previous surveys have reached the end of

their life cycle and are dead or dying. All quadrats are dominated by a canopy of Eucalypt which have formed dense thickets in some areas mainly in Q3 and Q4 with Q2 understorey being more open with less acacia and shrub layers.

Smaller shrubs and ground species have continued to emerge, and native grasses are plentiful in some areas. Additional ground layer structure (leaf litter and woody debris) is also continuing to develop due to natural processes. Although overall floristic diversity is still relatively low, as the vegetation continues to age, it is likely that thinning of the canopy will facilitate greater species diversity within the understorey. This may take many years to occur.



**Plate 1: Q1 - Understorey**



**Plate 2: Q2 - Understorey**



**Plate 3: Q2 – Mid-storey and Canopy**



**Plate 4: Q3 – Understorey**



**Plate 5: Q3 – Mid-storey and Canopy**



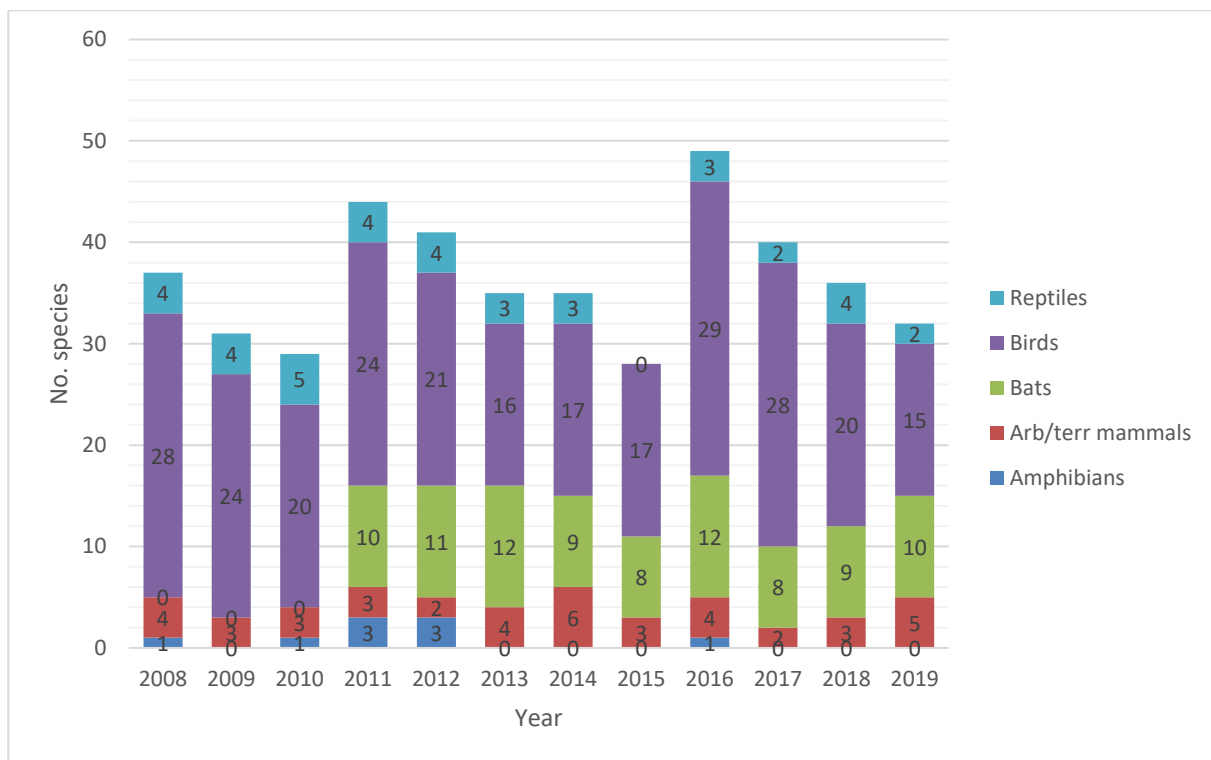


**Plate 6: Q4 – Mid-storey and Canopy**

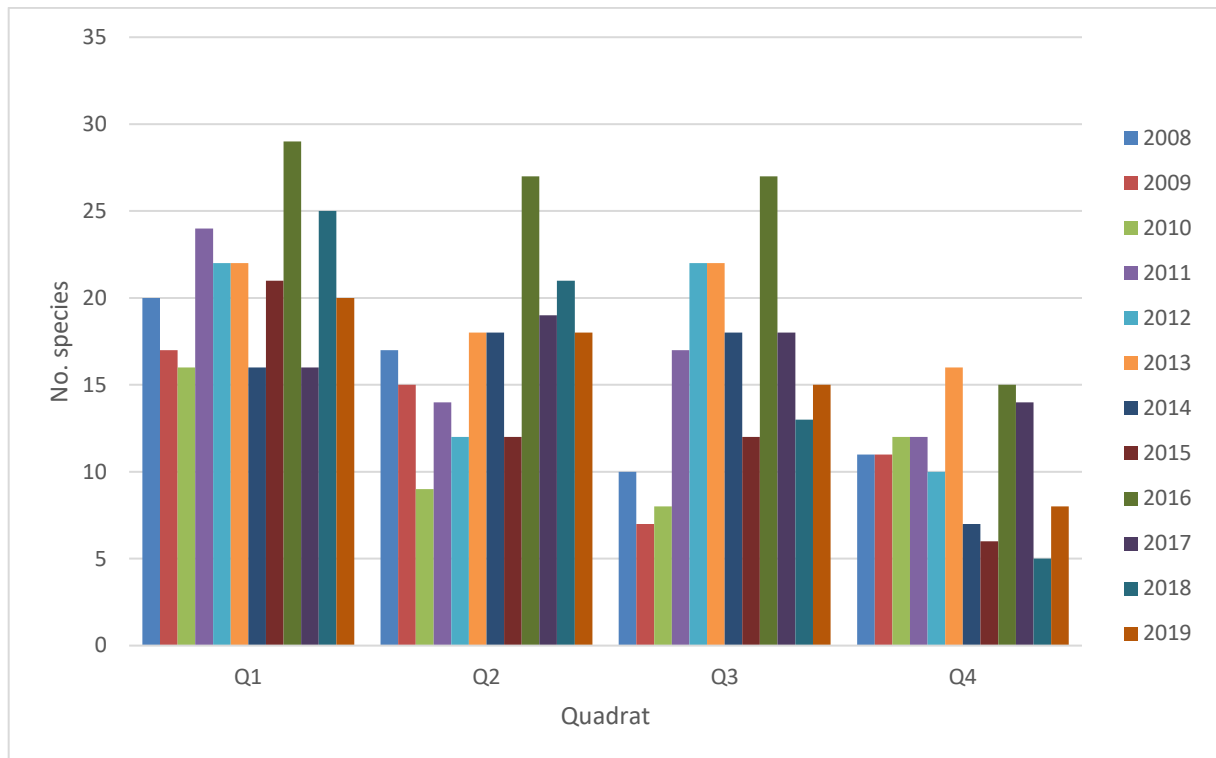
### 3.3 FAUNA

Thirty-two fauna species were recorded during the 2019 survey (below the yearly average  $n=36.4$ ) (**Figure 4**). Three previously undetected species was recorded in 2019: Southern Freetail Bat (*Mormopterus* Sp.2), Eastern Cave Bat (*Vespadelus troughtoni*) and the Swamp Wallaby (*Wallabia bicolor*). Photographs of native fauna species trapped and observed during the current survey are provided in **Appendix 3**. A large increase in the number of species detected across all quadrats between years prior to, and years post 2011 is attributed to the inclusion of Anabat detection of Microchiropteran bat species in Q1, Q2 and Q3 (**Figure 5**).

The current survey results were comprised of two arboreal and one terrestrial mammal, 10 Microchiropteran bats, 15 bird species and two reptiles. No amphibians were detected.



**Figure 4: Number of fauna species per year (all quadrats combined)**

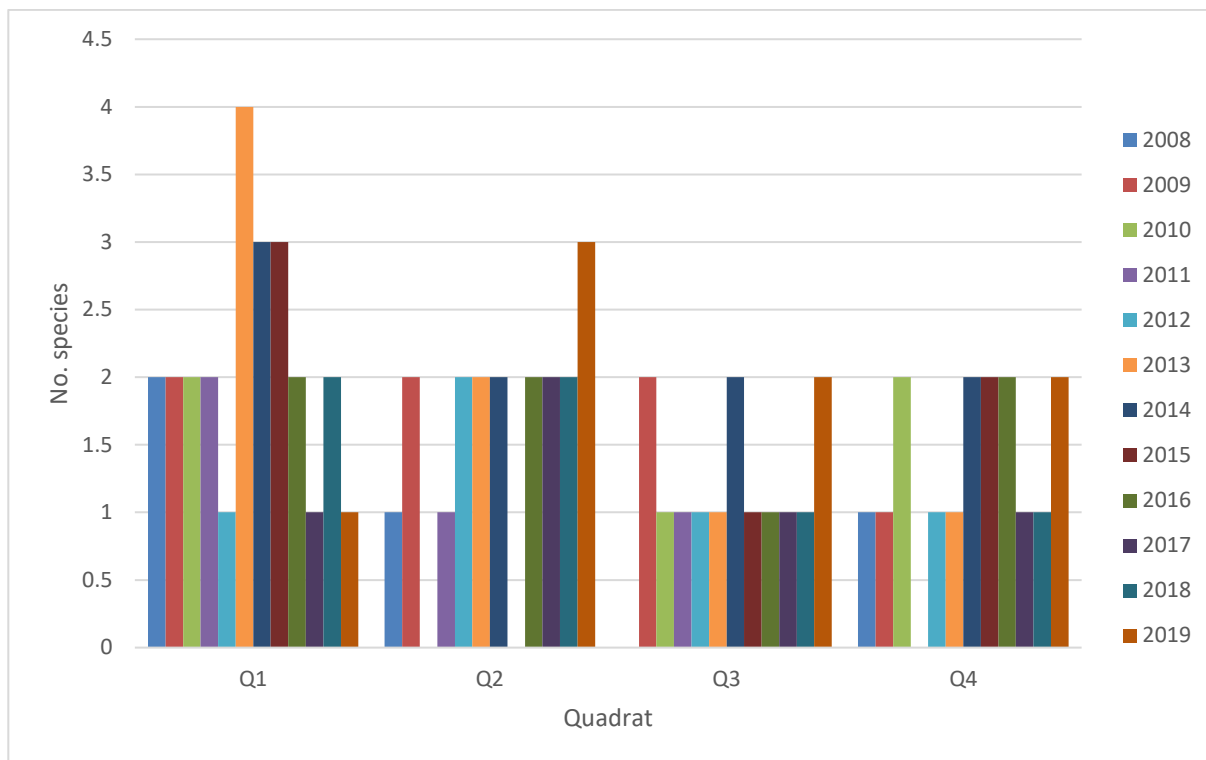


**Figure 5: Number of fauna species per quadrat from 2008 - 2019**

### 3.3.1 Arboreal and Terrestrial Mammals

Two arboreal and one terrestrial mammal species were recorded during survey (**Figure 6**). The Common Brushtail Possum (*Trichosurus vulpecula*) was detected in all quadrats, the Brown Antechinus was detected in Q1 and the Swamp Wallaby was seen opportunistically while checking traps within Q2.

The number of mammal species detected in Q1 has declined since 2013. Mammal species detected in Q2 have remained stable over the past six years except for 2015 when no mammals were detected and this year when three species were detected. Between one and two mammal species have been consistently recorded in Q3 and Q4 over the past 11 years of monitoring (except for Q4 in 2011 where no mammals were recorded).



**Figure 6: Number of arboreal and terrestrial mammal species per quadrat from 2008 - 2019**

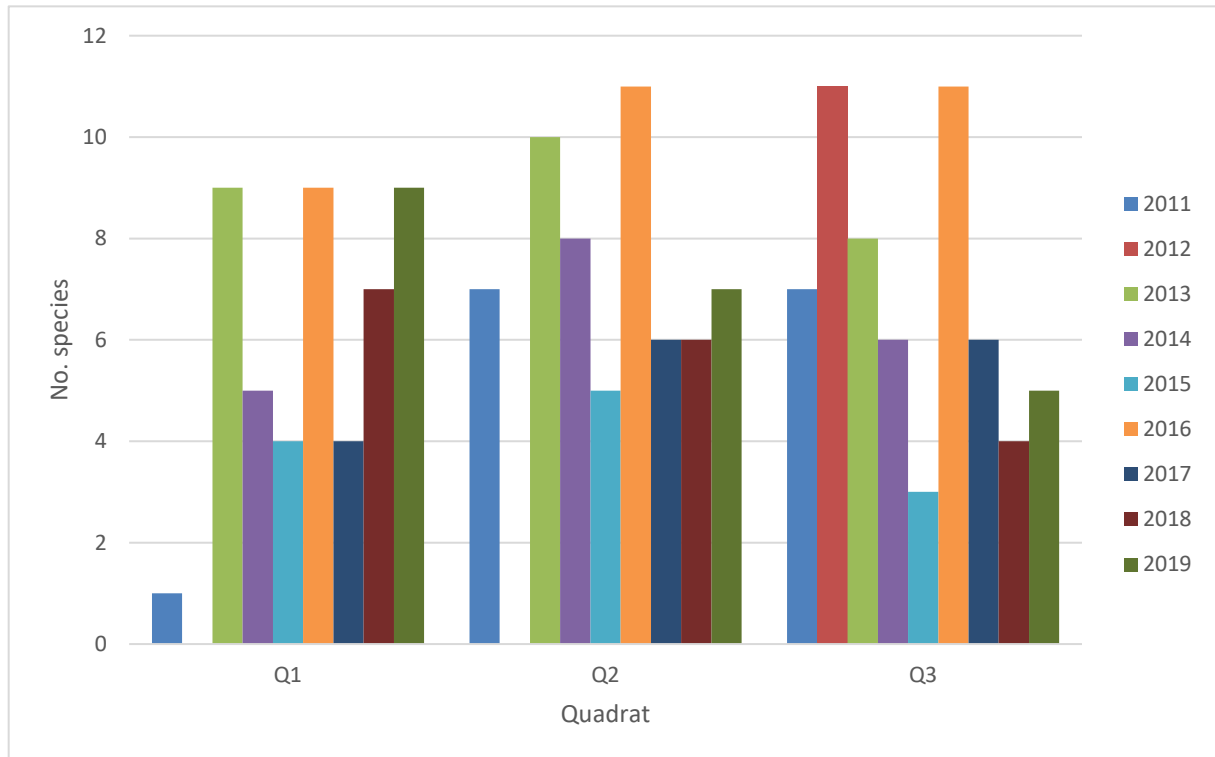
Since surveys began the Brown Antechinus had not been observed in Q3 or Q4, however evidence of use by this species was recorded in 2013 in a nearby nest box quadrat. Usage of the rehabilitation area by Brown Antechinus was confirmed in 2014 with the capture of a male animal in an Elliott A trap in Q4 over two consecutive mornings.

The species was captured again in Q4 in 2015, 2016, 2017 and during the current survey with seven captures - the largest number throughout the program. The first capture of a Brown Antechinus from Q3 was in 2017 and now in 2019 with four captures within the quadrat, indicating that all ages of rehabilitation are now providing suitable habitat for this species. The only quadrat the species was not captured in during the current survey was Q1, making it the second year the species was not captured in this quadrat.

### 3.3.2 Bats

A total of nine bat species were recorded across the mature forest and rehabilitation areas in the January 2020 survey, three of which, Little Bentwing-bat (*Miniopterus australis*), Greater Broad Nosed bat (*Scoteanax rueppellii*) and the Eastern Cave Bat (*Vespadelus troughtoni*) are listed as Vulnerable species under the NSW *Biodiversity Conservation Act 2016* (BC Act). Only Q1, Q2 and Q3 are surveyed for bats according to survey methodologies introduced in 2011.

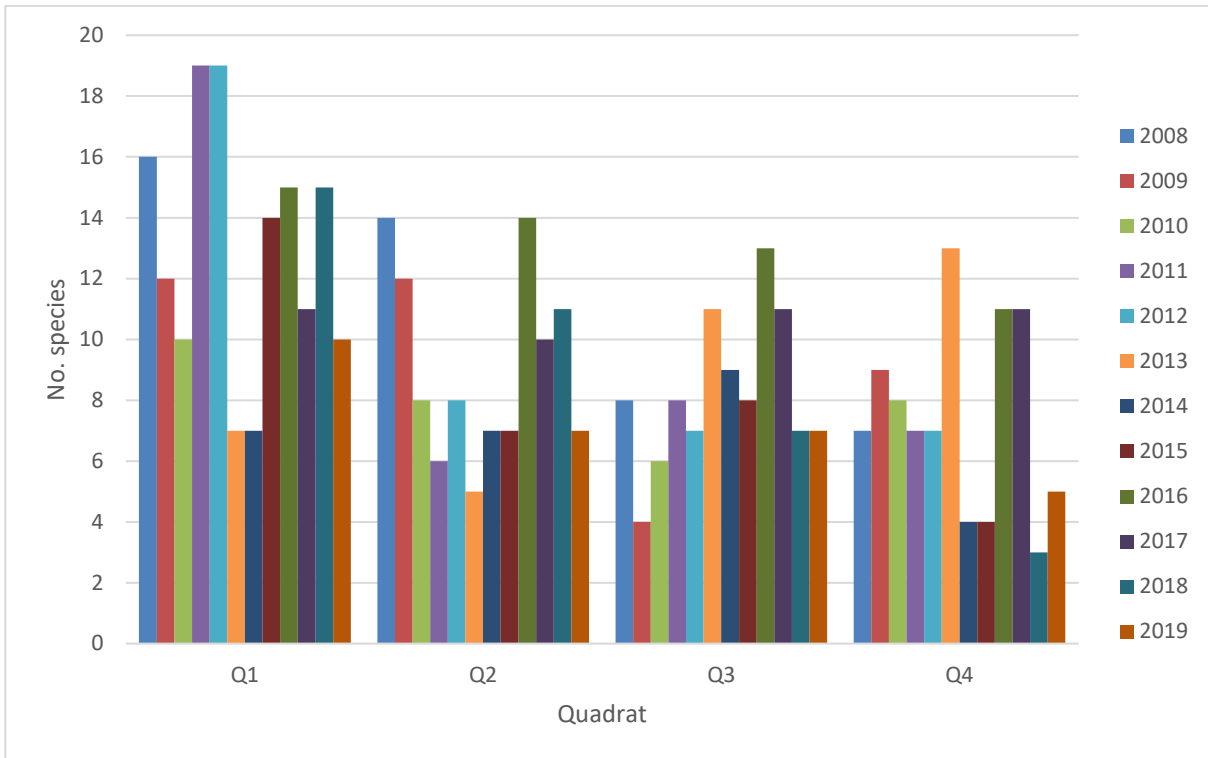
The number of bat species recorded per quadrat during current survey was above average for Q1, equating to the Q2 average and below the Q3 average (**Figure 7**).



**Figure 7: Number of bat species per quadrat from 2011-2019**

### 3.3.3 Birds

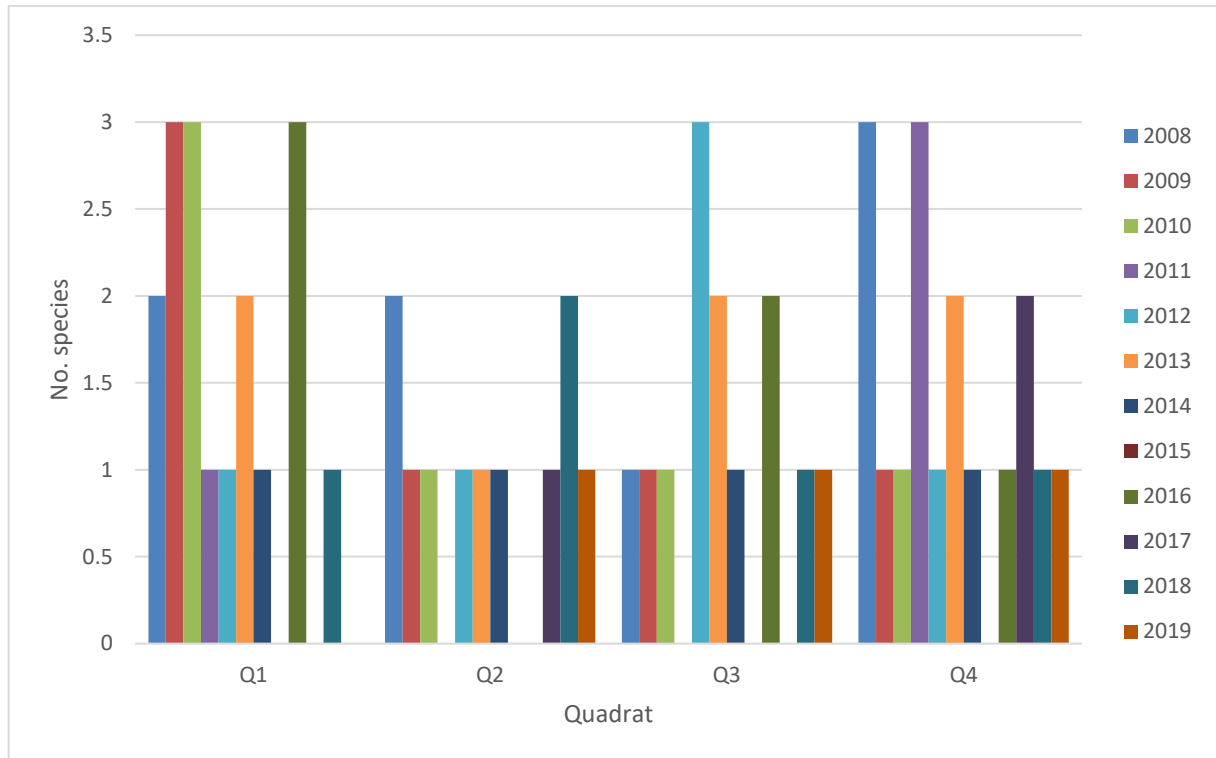
Fifteen bird species were recorded across all quadrats during the current survey (**Figure 8**). The result is below the average of 21.5 species recorded across all quadrats between 2008 and 2019. In 2019, the number of bird species detected was below the yearly average for all quadrats although not the lowest on record. The number of bird species recorded per quadrat each year is highly variable, with some survey years (2011, 2012, 2015 and 2018) recording considerably higher diversity in the mature forest (Q1) in comparison with the rehabilitation quadrats.



**Figure 8: Number of bird species per quadrat from 2008-2019.**

### 3.3.4 Reptiles

Two reptile species were detected during current survey (**Figure 9**). One species, the Yellow-faced Whip Snake (*Demansia psammophis*), was captured in Q3 and Q4. The Garden Skink (*Lampropholis delicata*) has been consistently recorded throughout the monitoring program and was once again detected in Q2.

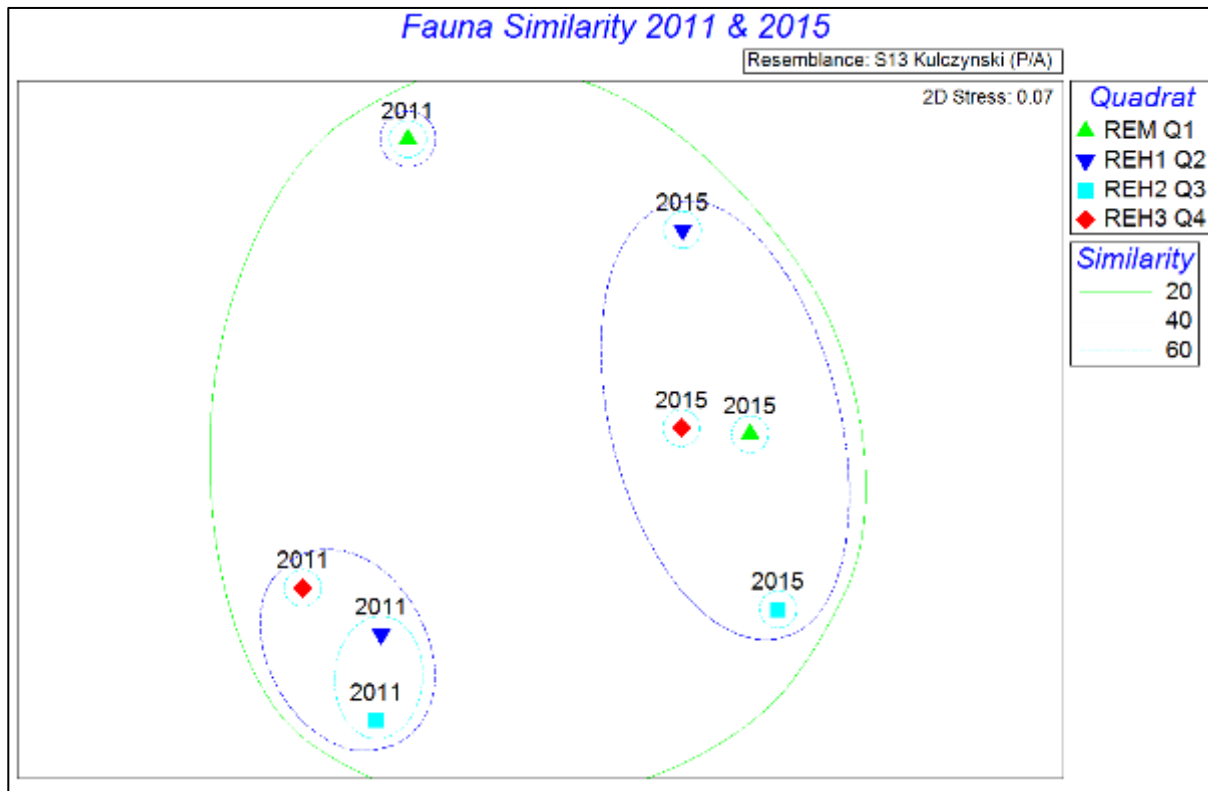


**Figure 9: Number of reptile species per quadrat from 2008-2019.**

### 3.4 FAUNA DIVERSITY PER QUADRAT

Three age classes of vegetation occur across the study area including remnant forest (**Plate 1**), rehabilitation planted in 2003 (**Plates 2, 3 and 5**), and rehabilitation planted in 2005 (**Plate 4**). The location of all quadrats and corresponding rehabilitation age are shown in **Figure 2**. Non-metric Multidimensional Scaling (nMDS) analysis was used to investigate the relationship between the remnant vegetation and the rehabilitation vegetation based on the degree of similarity between fauna assemblages. The closer the data points are to each other, the more similar the fauna assemblages. Remnant refers to Q1, Rehab 1 and Rehab 3 refer to Q2 and Q4, respectively, which was planted in 2003; Rehab 2 refers to Q3 which was planted in 2005.

The nMDS analysis showed that in 2011, after four years of monitoring, all three rehabilitated quadrats (Q2, Q3, Q4) were at least 40% similar to each other with Rehab 1 and 2 being the most similar (greater than 60%) similar. The three rehabilitated areas, however, were marginally similar to the remnant forest in 2011, at only 20% similarity (**Figure 10**). After another four years, in 2015, all quadrats, including the remnant forest and rehabilitated areas, were greater than 40% similar. These findings show that over time the fauna assemblage in the rehabilitation areas is resembling the fauna species diversity of the remnant forest.



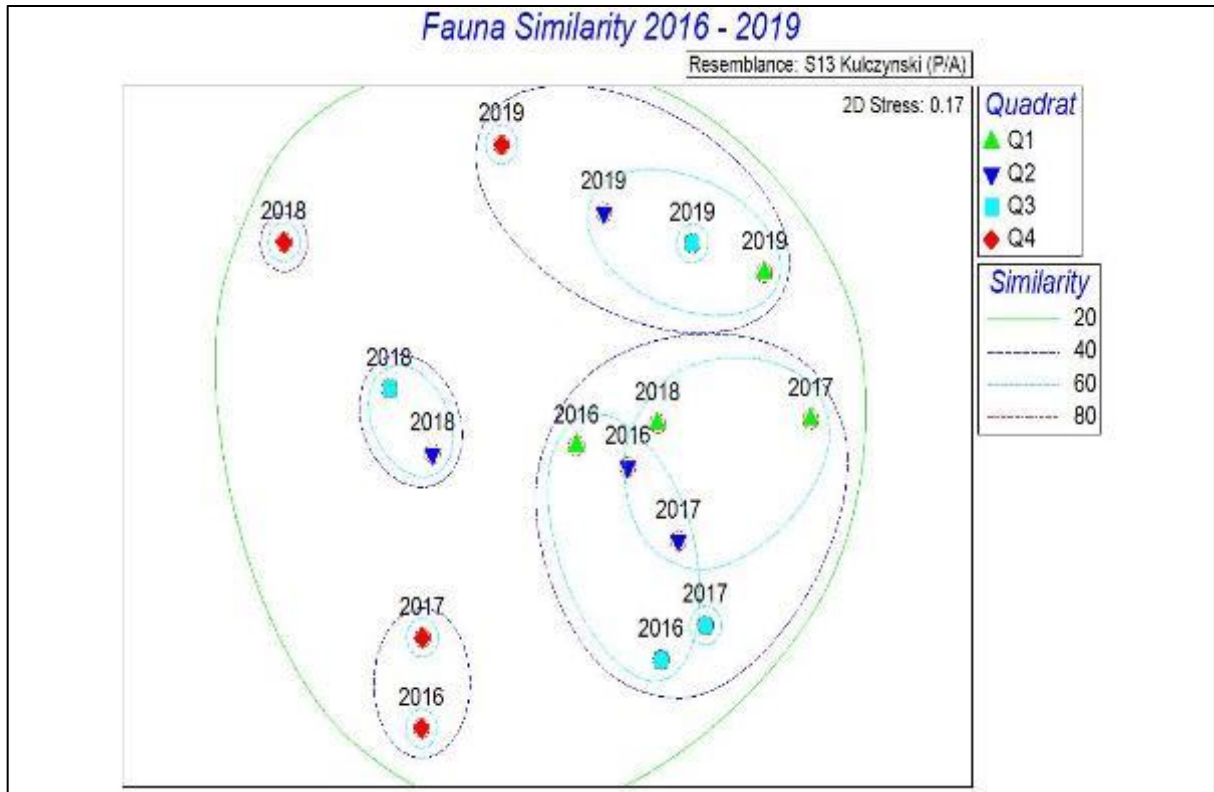
**Figure 10: Non-metric Multidimensional Scaling analysis of all fauna per quad after 4 years (2011) and 8 years (2015). REM (Q1) = remnant vegetation; REH1 (Q2) = rehab planted in 2003; REH2 (Q3) = rehab planted in 2005; REH3 (Q4) = rehab planted 2003**

Similarity measure analysis was also performed, comparing the fauna diversity of remnant and rehabilitated areas between 2016, 2017, 2018 and 2019 (**Figure 11**). In 2016, Q1, Q2 and Q3 were found to have a similarity index of 60%. In 2017, only Q1 and Q2 had a similarity index of 60%, with Q3 reducing in similarity to 50% in comparison to these other quadrats. In 2018, Q2 and Q3 were found to have a similarity index of 60%, with Q1 reducing in similarity to 40% in comparison to these other quadrats. In 2019, Q1 and Q2 had a similarity index of 60% increasing the index of Q1 from 40% in 2018. Both Q3 and Q4 having a 40% similarity in 2019 which is the first time Q4 has had a 40% similarity to Q1 since 2015 being 20% in the previous years.

In all years Q4 was again found to have a similarity index of only 20% when compared with all other quadrats (except current year data). It is expected that the fauna diversity at Q4 will continue to have less similarity to all other quadrats as the survey design does not require Anabat (microbat detector) deployment. Microbat species often contribute to approximately



30-40% of species richness over the last six years at quadrats 1, 2 and 3 where microbats are specifically surveyed (using Anabat detectors).



**Figure 11:** Non-metric Multidimensional Scaling analysis of all fauna per quad between years 2016, 2017, 2018 and 20. REM (Q1) = remnant vegetation; REH1 (Q2) = rehab planted in 2003; REH2 (Q3) = rehab planted in 2005; REH3 (Q4) = rehab planted 2003.

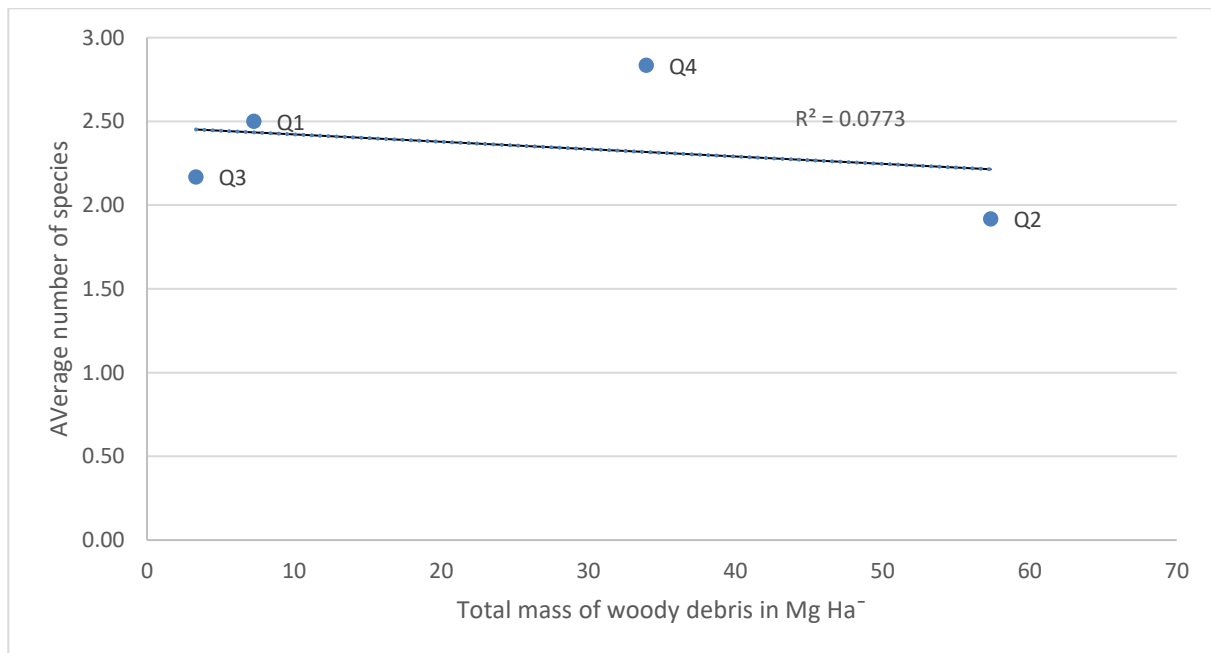
### 3.5 FAUNA DIVERSITY VS. WOODY DEBRIS

The results of the woody debris survey of each quadrat are presented in **Table 2** as background information. These data were collected in the preliminary survey (Q1, Q2 and Q4) and the first (Q3) monitoring event.

**Table 2: Characteristics of woody debris between and within each quadrat**

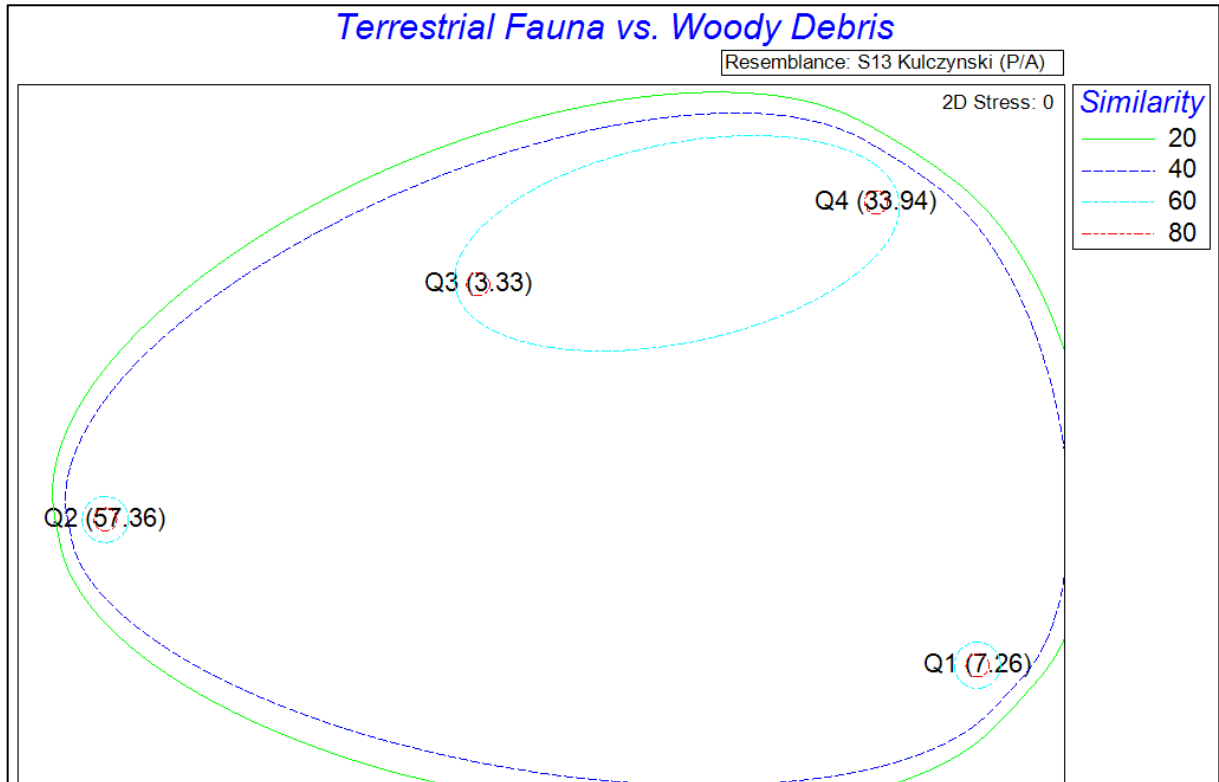
Quadrat No.	No. of pieces of woody debris per quadrat $\geq 8\text{cm}$ diameter	Average diameter of woody debris (cm)	Average length of woody debris (cm)	Total mass of woody debris in Tonne/Ha <sup>-1</sup>
1 – mature forest stand	23	14.00	390.52	7.26
2 – now 16 year old rehab	39	14.79	128.74	57.36
3 – now 14 year old rehab	50	15.45	71.70	3.33
4 – now 16 year old rehab	91	13.75	103.92	33.94

**Figure 12** demonstrates the relationship between the average number of terrestrial species recorded in each quadrat since monitoring began and the total mass of woody debris in each quadrat. The low  $R^2$  (0.0773) value shows no effect regarding the amount of woody debris in each quadrat and the number of terrestrial species recorded.



**Figure 12: Average number of terrestrial species recorded each year, per quadrat and total mass of woody debris (T Ha<sup>-1</sup>).**

Non-metric Multidimensional Scaling (nMDS) was used to determine whether the amount of woody debris influenced terrestrial fauna assemblage. **Figure 13** shows that all quadrats have a similarity index of at least 40%. A single cluster of Q3 and Q4 had a greater similarity (60-80%) than Q1 (remnant) and Q2. However, these clusters are not related to the amount of woody debris as the most similar quadrats, in terms of terrestrial fauna diversity, have significantly different amounts of woody debris.



**Figure 13:** Non-metric Multidimensional Scaling analysis of number of terrestrial fauna species detected from 2008-2019 and its relationship to the amount of woody debris at each quadrat

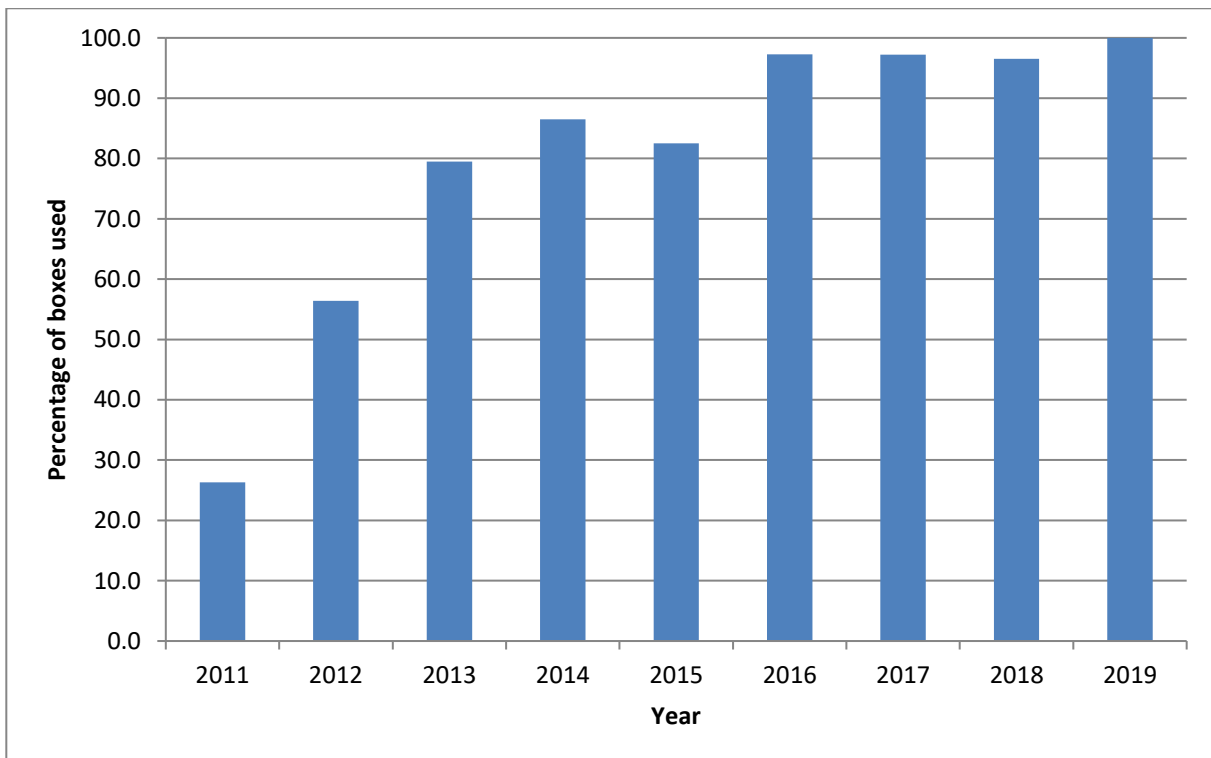
### 3.6 NEST BOXES

Since monitoring began, all quadrats have shown evidence of activity in the form of individuals present, fresh leaf nests, scats, scratches and hairs. The most prevalent species has been the Sugar Glider. **Appendix 4** contains photographs of the nest boxes and contents.

Nest box usage is recorded in four ways:

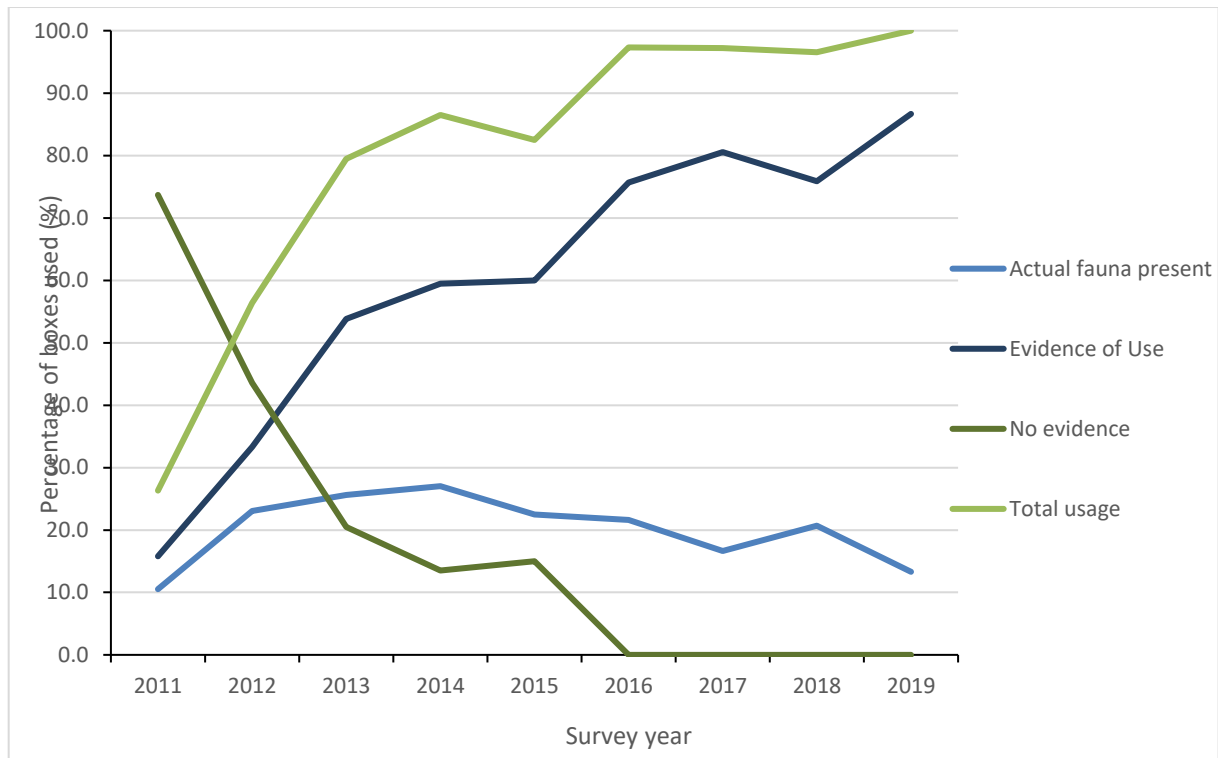
1. Actual use, animals sighted in the nest box (A);
2. Evidence of use which includes nests, scats and hair (E)
3. Unavailable (U) – the box is not habitable due to occupation by insects or from damage such as a missing lid or the box having fallen to the ground; and
4. No evidence (N).

In 2019, the total usage rate (A+ E) for all **usable** nest boxes was 100% (30 out of 30 available boxes), equal to results from the previous 3 years (**Figure 14**). The total actual usage rate (A), where fauna are present within nest boxes, in 2019 was 13.3% (4 of 30 boxes) while evidence of use was 86.7% (26 of 30 boxes) (**Figure 14**).



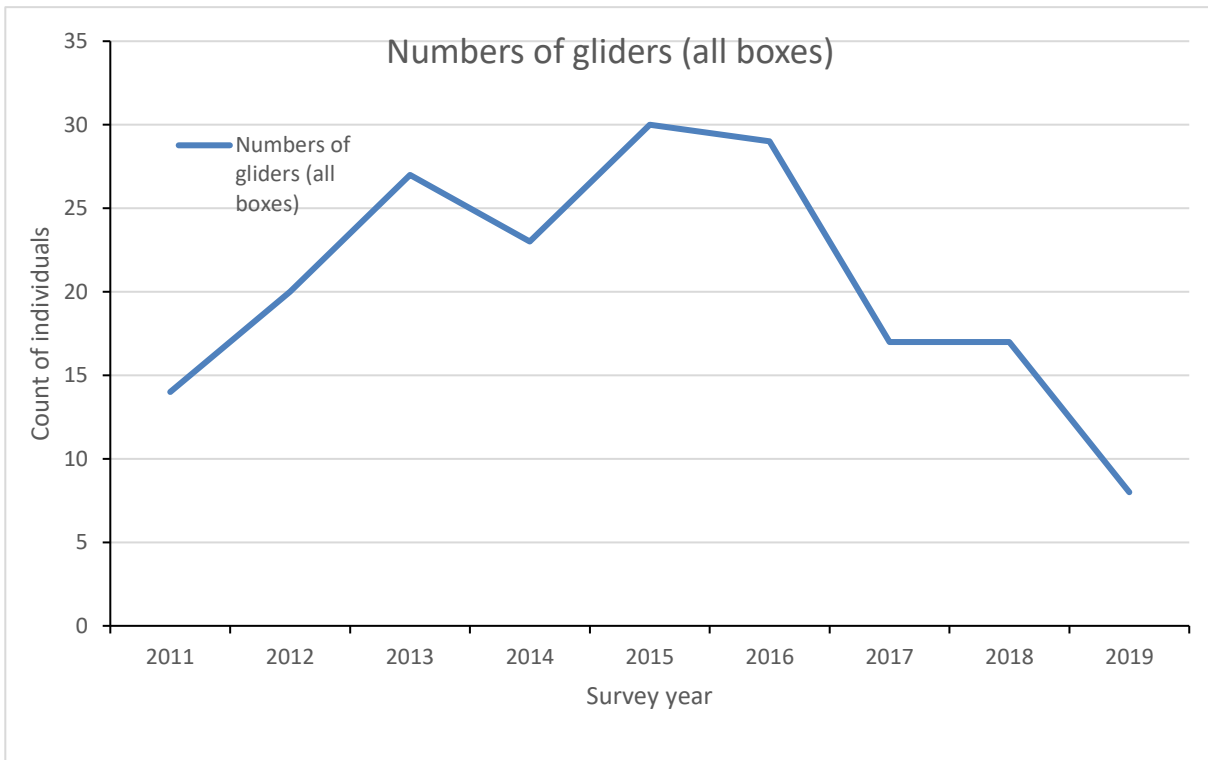
**Figure 14:** The percentage of total nest box usage (A+ E) for all quadrats 2011 – 2019

The percentage of boxes containing resident fauna (A) has remained steady over much of the monitoring period until this year where there is a small decline (**Figure 15**) while evidence of use (E) by fauna has increased every year until 2017 with a small decrease in 2018 with an increase in 2019. The number of available boxes showing no signs of fauna use has now reduced to zero indicating that a greater number of fauna species are inhabiting the rehabilitated areas.



**Figure 15: Percentage of available nest boxes used per usage category 2011 – 2019**

An analysis of Sugar Glider counts over time (2011 – 2019) (**Figure 16**) identified a steady increase from 2011 to 2015. The population has since declined; however the rehabilitated quadrats still have a number of gliders present with 17 individuals observed during the 2017 and 2018 and down to eight during the current survey.

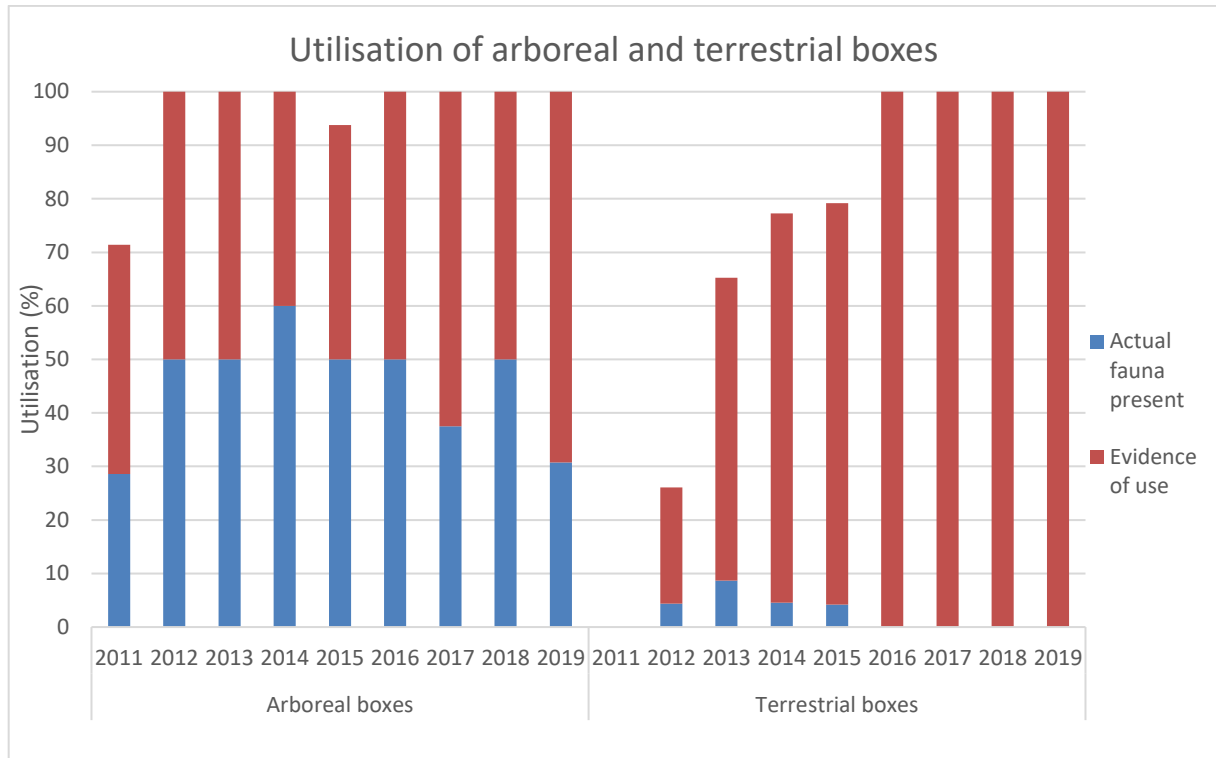


**Figure 16:** Number of Sugar Gliders (*Petaurus breviceps*) observed in boxes 2011 – 2019.

### 3.6.1 Arboreal nest boxes

Since monitoring began the use of available arboreal nest boxes has increased from 71.4% in the initial monitoring period in 2011 to 100% in the 2012, 2013, 2014, 2016, 2017, 2018 and 2019 surveys. (**Figure 17**). A single arboreal nest box contained no evidence of use in 2015, as the box had recently been reinstalled after being found on the ground in 2014 where it was considered unavailable.

All the arboreal nest boxes have been used at some point by *Petaurus* sp. (identified by an actual animal or by the distinctive nest shape constructed by the *Petaurus* genus). In 2019, 23.1% (3 of 13) of the arboreal boxes were occupied by Sugar Gliders with a total of eight individuals recorded. One of the nest boxes was occupied by a Common Brushtail Possum.



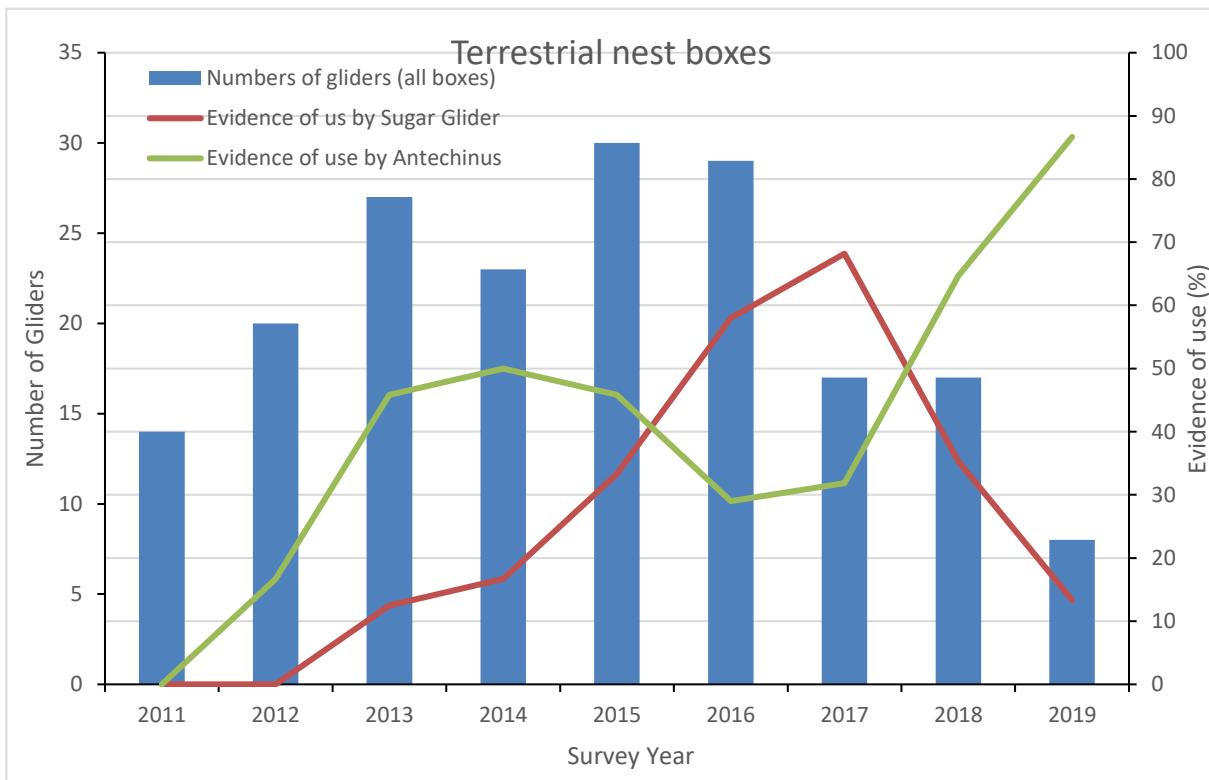
**Figure 17: Evidence of use per nest box type 2011 - 2019.**

### 3.6.2 Terrestrial nest boxes

The total usage of available terrestrial nest boxes has increased from zero usage (2011) to 100% in 2016, 2017, 2018 and 2019 (**Figure 17**). In the 2019 monitoring period no boxes contained actual fauna, however, all available boxes contained some evidence of fauna use. Utilisation of terrestrial boxes by Sugar Gliders, evident by spherical shaped leaf nests was first detected in 2013.

### 3.6.3 Sugar Glider population

Sugar Gliders have been recorded within the rehabilitation area since the first nest box monitoring event in 2011 (**Figure 18**). In 2019, eight individual gliders were recorded using arboreal nest boxes only. Arboreal nest boxes have almost been at capacity for the last eight years though the number of actual Sugar Gliders observed in the available boxes continued to increase. It is therefore expected that, given the lack of natural tree hollows in the rehabilitated areas, Sugar Gliders will begin to take up residence in the available terrestrial nest boxes. Consequently, lower numbers of antechinus use is being detected in nest boxes due to colonisation by Sugar Gliders.



**Figure 18: Utilisation of terrestrial boxes by Sugar Gliders/*Antechinus* and the relationship of actual Sugar Gliders observed**

Evidence of Sugar Glider use in terrestrial nest boxes compared with evidence of use by target species (i.e. Brown *Antechinus*) in terrestrial nest boxes is shown in **Figure 18**. As the glider population increases and available arboreal habitat reaches capacity, terrestrial nest boxes appear to be the next preferable option. With the inclusion of 2017 terrestrial nest box data it is clear that evidence of glider use was continuing to increase and the species was likely to be occupying more terrestrial nest boxes than the Brown *Antechinus* until 2018 and 2019 where antechinus numbers have increased within the terrestrial boxes.

In 2019 the Brown *Antechinus* has more evidence of use in the terrestrial nest boxes than Sugar Gliders. Several terrestrial nest boxes that contained Sugar Glider nests, were also found to have fresh antechinus scats indicating that both species can sequentially utilise boxes when the other species has temporarily vacated. As utilisation of arboreal nest boxes by gliders reaches capacity it is expected that more terrestrial nest boxes will be colonised by gliders as there are no other available nesting locations (natural hollows) in the rehabilitated areas.



## 4. DISCUSSION

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The rehabilitation area is showing positive signs of re-colonisation by a variety of fauna species. Overall, the total number of fauna species detected each year during the fauna surveys has remained reasonably constant (including the remnant quadrat), albeit fluctuating around a stable mean (**Figure 4**). However, when the number of species detected year to year at the one remnant quadrat (Q1) and the three rehabilitated quadrats (Q2, 3, 4) is analysed separately it reveals that surveys during 2016 detected the greatest species diversity. Species diversity during the 2019 survey in all quadrats was near the average for all survey years.

Bird, mammal and herpetofauna species counts have been dynamic throughout the 12-year survey period. For example, five new species were recorded in 2016, two new species in 2014, nine in 2012 and several species recorded in previous survey periods were not recorded in 2017, 2018 and 2019. In 2019 three new species were recorded during the surveys. These changes are considered normal and are likely to continue as the vegetation structure matures addressing different species-specific requirements. In addition, the species detected during an annual survey period will depend largely on the weather conditions prior to, and during the survey period. Of note is that, as of 2017, the Brown Antechinus has been detected in all rehabilitation quadrats but was only detected within Q1 in the 2018 surveys. Whilst in the 2019 surveys the Brown Antechinus was detected in Q2, Q3 and Q4 but not within the remnant Q1 showing variability from year to year. This variability in 2019/2020 could be attributed to the severe drought conditions that were observed over the East coast of Australia.

### 4.1 FAUNA DIVERSITY PER REHAB AGE

Non-metric Multidirectional Scaling (nMDS) analysis and cluster analysis were used to compare the faunal assemblages of each quadrat at two points in time; 2011 (four years post-rehabilitation), and 2015 (eight years post-rehabilitation) after monitoring began. The following abbreviations were used in the analysis and are discussed in the following section: REM = Remnant; REH1 = Q2, 2003-planted rehabilitation; REH2 = Q3, 2005-planted rehabilitation and REH3 = Q4, 2003 planted-rehabilitation.

The original hypothesis was that over time, as the age and structural complexity of the rehabilitation increases, species diversity will gradually match the diversity observed in the remnant forest (Q1, REM). This was expected to take many decades, however as **Figure 10** and **Figure 11** shows, diversity in the two areas is already similar.

The 2011 faunal assemblages in the three quadrats in the rehabilitation area are clustered together and show 40-60% similarity but are only 20% similar to that of the remnant forest. However, after another four years, in 2015, all four quadrats are clustered together showing 40% similarity. In 2016, faunal assemblages of Q2 and Q3 were significantly more similar (60-80%) to the remnant quadrat than in 2015. When comparing 2018 with the previous two years (**Figure 11**) there is one large cluster showing a 40% similarity between Q1, Q2 and Q3 showing that these three areas are becoming similar to each other.

In 2019 a change occurred whereby all four quadrats became dissimilar with the previous years but became more closely related to each other with Q1, Q2 and Q3 being 60% similar. For the first time since 2015 Q4 was found to be 40% similar with the other 2019 quadrats showing an improvement on the previous three years where it was 20%. These findings show that the rehabilitation area is on the right trajectory and is becoming more like the remnant forest whilst also going through phases where species richness fluctuates as seen in the 2019 data.

Overall, it is apparent that the original proposal - that species diversity in the rehabilitation sites will move closer to the species diversity of the remnant vegetation site - is supported by the monitoring data (with some year-to-year variation).

## 4.2 FAUNA DIVERSITY VS. WOODY DEBRIS

Several studies comparing mature forest and rehabilitated sites have found positive correlations between rock cover and woody debris with small mammal species richness and total reptile and amphibian captures. Most studies have found a positive correlation between habitat heterogeneity/diversity and species diversity (Tews *et al.* 2004). However, this may vary considerably depending on species specific requirements.

A comparison of the total number of terrestrial species recorded at each quadrat since monitoring began was made to determine if there is a positive correlation between this and the total mass of woody debris. As **Figure 12** shows there was no relationship between woody debris and number of species recorded. nMDS analysis was then used to determine if the composition of terrestrial species was affected by the amount of woody debris. The analysis, shown in **Figure 13**, highlights one cluster based on similarity of terrestrial species assemblages; Q3 and Q4, with Q1 and Q2 having a low similarity.

The mass of woody debris throughout Q2 and Q4 is heavily skewed due to two large fallen logs which is suspected to make up the majority of debris for that area. These two separate logs are not likely to provide significant amounts of refuge for fauna. The presence of large fallen branches is also absent from the rehab areas with the bulk of woody debris being categorised as immature trees which have fallen over due to poor ground stability. These, also, do not provide much refuge for fauna as they often do not fall flat on the ground nor do they offer much cover underneath.

Originally it was expected that higher woody debris levels would result in greater species diversity. However, as the dataset has grown, it may be the case that woody debris levels may lead to greater abundance of a small number of species, not species diversity as a whole. As discussed previously, habitat structure and composition significantly affect the type and diversity of species present. For example, there is evidence that bird species diversity in forests is determined more by the physical structure of a plant community (i.e. how foliage is distributed vertically) than the diversity and amount of vegetation (MacArthur and MacArthur 1961). This suggests that physical structure may be more important in promoting faunal re-colonisation than the actual composition of plant species and is an important consideration for land rehabilitation practices.

Future monitoring may benefit from surveys to determine species diversity within each quadrat in addition to a classification of each quadrat based on the complexity of its vegetation structure. These results, in conjunction with species diversity may provide insight into what specific factors (e.g. woody debris, vegetation structure) aid in fauna re-colonisation.

It may be that woody debris does affect fauna diversity and abundance but not in a linear pattern and that the differences in total mass of debris between quadrats are not great enough to cause marked differences in fauna species assemblage. Rather than the amount of woody debris being the causal factor of terrestrial fauna species assemblage, it is possible that other factors, such as distance from the remnant forest or vegetation structure and complexity are also important in shaping terrestrial species assemblage.

Strong winds during a storm early in 2015 blew over many of the trees in the rehabilitation area, effectively increasing the total mass of woody debris in the area. Future monitoring should involve a recalculation of the mass of debris at each quadrat to determine if this change has had an impact on fauna diversity.

## 4.3 VEGETATION STRUCTURE

Overstorey vegetation within sections of Q3 and Q4 has increased in height, with height starting to plateau during the past three years of monitoring as the trees mature with no discernible increase in 2019 (~3 m in 2010, 4.5 m in 2011, 4.6 m in 2012, 5 m in 2013, 6 – 9 m in 2014, 7-10 m in 2015-2017 and 8-12m in 2018 -2019). However, where trees are growing in proximity the canopy has become quite thick. This has resulted in some restricted growth and maturation of the trees in addition to preventing appropriate understorey growth and development. Other reasons for restricted growth could be too much competition or limited resources in the spoil of the rehab area.

Where the overstorey is not as dense or is absent (Q3 and Q4 compared to Q2), the understorey is more structurally and floristically diverse. These quadrats (Q3 and Q4) are comprised of tussock grasses, bare ground, rock and pockets of leaf litter build-up below shrubs and juvenile trees. Improvements in understorey structure for Q3 are supported by evidence of use by Brown Antechinus during nest box surveys.

Poor regeneration of the shrub and ground layer could be due to the original high density of planting within Q2 of Eucalypt and Acacia species which have formed a thick canopy preventing enough light to support understorey plants. During the 2019 observations of the vegetation structure it was noted that the Eucalypt species have continued to grow. All quadrats are dominated by a canopy of Eucalypt which have formed dense thickets in some areas. Natural processes will allow the canopy to thin and clear over time in all quadrats (Q2 will be of interest and this process is beginning to happen in 2019). This will in turn support greater understorey growth and diversity.

As noted above, the storm event in 2015 has caused some thinning of Eucalypt trees across the rehabilitation sites. The impacts of this on ground and midstorey vegetation should be monitored in future survey events. During 2019 surveys, no healthy trees were observed to have fallen over, although some trees have suffered in the drought that has occurred prior to the survey period but no tree deaths have been noted within the quadrat areas.

The more complex ground cover and floristic diversity observed in Q3 and Q4 may be related to greater availability of light into those areas with less dense canopy. However, as observed throughout Q2, there are areas in Q3 and Q4 where the ground cover is poor due to Eucalypts forming a closed canopy limiting light reaching the understorey. The ground layer structure of Q2 is still relatively poor but is improving with some grass cover and an increase in leaf litter

observed in 2019. The paucity of ground cover has initially inhibited re-colonisation by small mammals due to a lack of shelter sites or habitat for their prey items. However, as the habitat matures, and the ground layer improves, native dasyurids such as the Brown Antechinus and native rodents such as the Bush Rat (*Rattus fuscipes*) are likely to increase in numbers which has occurred in 2019 with the Brown Antechinus seen in good numbers in Q2, Q3 and Q4.

## 4.4 TERRESTRIAL AND ARBOREAL ANIMALS

The numbers of Brown Antechinus observed in Q1 have remained relatively consistent since surveys began in 2008 except for 2012 and 2019 when no Brown Antechinus were captured. Brown Antechinus numbers were down in 2016 and 2018 (two and three captures in comparison to the yearly average of six) in 2019 there were no captures of Brown Antechinus within Q1.

Native species trapped in past surveys have been in areas of complex undergrowth or areas adjacent to complex vegetation. An encouraging result in 2014 was the capture of an individual Brown Antechinus at Q4, the first trapping of this species in the rehab. This species has been detected in Q4 in all subsequent years except for 2018. However, in 2019 individual capture records were the highest since surveys begun in Q2, Q3 and Q4 for the Brown Antechinus.

The Brown Antechinus could act as an indicator species in determining the success of re-colonisation in the rehabilitated area. This is due to the sensitivity of this species to structural components such as understorey height and complexity, leaf litter and the abundance of logs. Previous observations of Brown Antechinus in Q2 are most likely due to its proximity to remnant vegetation. The nearby remnant vegetation has potentially aided in the re-colonisation of the rehabilitated area as species begin to forage in the new habitat. A similar trend was observed with the Common Brushtail Possum. This suggests that the rehabilitation area currently provides suitable foraging habitat for several species but may lack suitable nesting or breeding habitat for larger species.

The rate of nest box occupancy in the rehabilitation area supports these assumptions and highlights the importance of introducing habitat hollows into rehabilitation areas. In addition, the inconsistency in native terrestrial mammal observations in the rehabilitation area (Q2, Q3 and Q4) compared to the remnant habitat further suggests that the complexity of vegetation does not match that of the remnant vegetation. Connectivity with remnant habitat is positive and will facilitate movement of native species into the rehabilitation area as suitable habitat becomes available.

Annual monitoring has shown slow improvements in the structure and complexity of the rehabilitation vegetation and further monitoring events will continue to provide insight into the relationship between the various vegetation/ground cover characteristics and fauna re-colonisation.

## 4.5 BATS

The recording of Microchiropteran bat species was added to the survey methodology in 2011 to determine whether bats are using the rehabilitation areas for foraging. In total, ten species were detected in January 2020 including two threatened species; Little Bentwing-bat, Eastern Cave Bat and Greater Broad-nosed Bat.

In 2016, both quadrats 2 and 3 were found to have the highest number of bat species ever recorded for an individual quadrat (11 species). Quadrat 1 (Q1) was also found to have the highest species recorded at that quadrat with nine species detected. In 2017, Q1, Q2 and Q3 recorded slightly lower than average bat species diversity. However, numbers were only down by an average of one species per quadrat in 2017.

In 2018 the number of bat species recorded per quadrat was above average for Q1, equal to the average in Q2 and below average in Q3. In 2019 numbers of bat species recorded were equal to the highest recorded within Q1, above average within Q2 and below average for Q3. The survey methodology created in 2011 for bats did not include Anabat detectors at Q4.

Microbats are primarily insectivores, and are voracious feeders. Insects play important ecosystem roles by transporting pollen from one flower to another and thus achieving pollination. High pollination success is vital to the establishment of rehabilitated areas. It is encouraging to detect such a high number of microbat species not only from a fauna diversity perspective, but from an ecosystem perspective.

## 4.6 BIRDS

Species richness has varied slightly between each quadrat over the 11 years; however, Q1 has maintained the highest mean level of richness (**Figure 8**). This is not surprising as Q1 contains structurally diverse and complex habitat able to support different bird species and their habitat requirements. Several studies have confirmed this by showing that bird species richness was higher in complex revegetation compared to simple revegetation (Rossi 2003,

Munro *et al.* 2007). Dynamic changes in species richness observed from year to year highlights the continual change in vegetation structure and complexity and can also be attributed to individual species' detectability and local climatic conditions.

Several nectar feeding birds that have been detected in previous years at both remnant and rehab quadrats were not observed in 2019 most likely due to the lack of flowering nectar trees due to possibly the drought conditions observed prior to surveys. With the absence of nectar feeding birds the results have been below average in 2019. Other small to medium-sized insectivores were once again detected during the 2019 surveys within rehab quadrats including Superb Fairy-wren (*Malurus cyaneus*) Rufous Whistler (*Pachycephala rufiventris*), and Eastern Yellow Robin (*Eopsaltria australis*).

The species recorded in the rehabilitation areas compared to the remnant area are characteristic of the vegetation structure present. Many bird species found in the rehabilitation areas prefer scrub type vegetation and are more commonly found in open and fringe areas while some species that prefer forest with larger trees were only detected within the remnant quadrat: Laughing Kookaburra (*Dacelo novaeguineae*) and Glossy Black Cockatoo (*Calyptorhynchus lathamii*).

Another sign indicating progress of the rehabilitation area is the presence of the hemiparasitic plant, Mistletoe, and the consistent recording of Mistletoe birds. Mistletoes are considered a keystone resource in forests and woodlands throughout the world and the Mistletoe bird, a specialist feeder on mistletoe fruit, is a key dispersal agent. Mistletoes provide food in the form of nectar, fruit and leaves to many bird and mammal species. They also provide a key foraging substrate for insectivorous species, as well as nesting sites for many bird species. Several studies have found greater vertebrate species richness associated with higher mistletoe densities (Watson 2001).

## 4.7 HERPETOFAUNA

Herpetofauna results have remained reasonably constant across the study period. However, as ground cover and understorey continue to develop it is expected that more amphibian and reptile species will recolonise the area. As stated previously, the lack of light penetrating the closed canopy of the rehabilitation sites may be inhibiting re-colonisation. A lack of suitable water bodies within the rehabilitation areas may also be a limiting factor restricting reptile and amphibian re-colonisation.

The 2019 results were on average or lower than previous years with two reptile species observed, including the Yellow-faced Whip Snake (*Demansia psammophis*) which was recorded in Q3 and Q4 with a Garden Skink (*Lampropholis delicata*).

## 4.8 NESTBOXES

Within the relatively new field of restoration ecology there is an assumption that successful rehabilitation of flora will facilitate fauna re-colonisation. However, natural tree hollows and remnant habitat required for successful re-colonisation can take hundreds of years to develop at a rehabilitation site.

To date, there have been very few studies which report successful fauna re-colonisation on mine sites and the effectiveness of artificial hollows/nest boxes within rehabilitation areas remains largely unknown. The information recorded from the 2019 nest box inspections has been extremely promising with 100% of all available arboreal and terrestrial nest boxes exhibiting actual use or evidence of use (equal to results from 2016, 2017 and 18, **Figure 14**).

Usage rates were appearing to plateau from 2013 but have had a positive trend in the past five years of surveys (**Figure 15**). Arboreal nest boxes (**Figure 17**) reached a peak of 60% actual usage in 2014, but have decreased to 31% in 2019, however during the survey period heavy rain was noted onsite and some of the nest boxes became wet and unfavourable. In 2019, no fauna was present during the time of survey in terrestrial nest boxes. However, evidence of use was found in 100% of the usable terrestrial nest boxes by either Brown Antechinus or Sugar Gliders.

**Figure 16** plots Sugar Glider numbers over time (2011 – 2019) with the results showing a steady increase in individual glider numbers from 14 in 2011 to 29 in 2016, however there has been a decrease to 17 gliders observed in 2017 and 2018 with numbers decreasing further in 2019 to eight. The decrease in glider numbers may be due to seasonal variability or the presence of a predator species foraging in the area.

A Powerful Owl was observed/heard during annual monitoring at Q3 during 2019. This species is known to prey on arboreal mammals such as gliders. It is evident that the structural complexity and floristic make-up of the rehabilitation area is at a point where it can provide sufficient food resources and cover from predators to support a population of gliders. The limited number of artificial arboreal hollows (tall nest boxes) in the rehabilitated areas have led



to Sugar Gliders taking up residence in terrestrial nest boxes. Nest boxes near to the ground are not usual nesting locations for Sugar Gliders as predation risks are higher. The target species for terrestrial nest boxes, Brown Antechinus, appears to be competing for nest locations as some individual boxes were found to have both a Sugar Glider nest as well as Antechinus scats and there seems to be a natural increase and decrease of occupancy rates of Sugar Gliders and Brown Antechinus from year to year (**Figure 18**).

The increase in nest box use by Brown Antechinus each year since 2011 has been a positive sign for the re-colonisation of the rehabilitation area. However, with the 2015 and 2016 results showing increased competition from Sugar Gliders for available nest boxes, the data is beginning to show a decline in evidence of use by Brown Antechinus. Since the 2017 results there has been an increase in evidence of use by Brown Antechinus, with evidence of glider use decreasing. This trend could show fluctuations in the denning use between Sugar Gliders and the Brown Antechinus from year to year. More evidence in future years can give us a better understanding of the relationship between the Brown Antechinus and the Sugar Glider. Although, nest box maintenance needs to be conducted within the rehab Quadrats with 30 out of the 40 boxes available for use which could have an impact on results we are currently seeing.

Overall, the trends emerging after eight years of nest box monitoring are extremely positive. The continued uptake and high utilisation of all nest box types is an indicator of the potential of rehabilitated areas to support local fauna species. The observed encroachment of gliders using terrestrial boxes for the last five years further demonstrates how vital hollow availability is to forest ecosystem restoration.

## 5. RECOMMENDATIONS

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Overall, the rehabilitation area is showing positive signs of re-colonisation by a variety of fauna species. The original proposition was that over time, as the age and structural complexity of the rehabilitation increases, species diversity will gradually match the diversity observed in the remnant forest (Q1, REM). This process was expected to take many decades, however as discussed above, the process is already being confirmed by the data analysis.

It is recommended that:

- Monitoring continue so that trends evidenced in the first 11 years may be better described using a larger data set. However, it is suggested that survey intervals could be extended out to every 2, 3 or 5 years, given that positive signs of fauna re-colonisation are already being observed;
- Nest-boxes should continue to be monitored annually and any repairs/replacements made as required. Monitoring of the rehab nest boxes could be problematic in the coming years with only 30 of 40 boxes available for use in 2019. To keep the data consistent from year to year it is recommended that unavailable boxes be replaced or repaired;
- Control of isolated individuals of the weed species *Lantana camara* in the vicinity of the quadrats be undertaken to ensure this species does not become more widespread within the rehabilitation; and
- Monitoring woody debris every 3 to 5 years would provide insight into the natural decay process within the rehabilitation area. This in turn can be correlated to the success of the rehabilitation in terms of observed species richness. Furthermore, this information will allow informed recommendations regarding the initial rehabilitation design and management of ongoing natural processes as the rehabilitation is compared to the natural forest.

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+ indicates presence # Listed on NSW BC Act 2016 * Introduced species		Quadrat 1 (remnant)								Q2 (rehab)								Q3 (rehab)								Q4 (rehab)																								
Scientific Name	Common Name	Dec 08	Dec 09	Dec 10	No v11	Dec 15	Dec 16	Dec 17	Dec 18	Jan 20	Dec 08	Dec 09	Dec 10	No v11	Dec 15	Dec 16	Dec 17	Dec 18	Jan 20	Dec 08	Dec 09	Dec 10	No v11	Dec 15	Dec 16	Dec 17	Dec 18	Jan 20	Dec 08	Dec 09	Dec 10	No v11	Dec 15	Dec 16	Dec 17	Dec 18	Jan 20													
<i>Meliphaga lewinii</i>	Lewin's Honeyeater								+																																									
<i>Hieraaetus morphnoides</i>	Little Eagle																					+																												
<i>Dicaeum hirundinaceum</i>	Mistletoebird		+		+								+		+							+							+		+																			
<i>Glossopsitta concinna</i>	Musk Lorikeet																																																	
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater																																																	
<i>Philemon corniculatus</i>	Noisy Friarbird	+	+		+			+	+					+																												+								
<i>Oriolus sagittatus</i>	Olive-backed Oriole	+			+				+	+																																								
<i>Turnix varia</i>	Painted Button-quail																																																	
<i>Cracticus nigrogularis</i>	Pied Butcherbird	+																																																
<i>Strepera graculina</i>	Pied Currawong	+			+			+	+																																									
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	+			+																																													
<i>Neochmia temporalis</i>	Red-browed Finch																																																	
<i>Rhipidura rufifrons</i>	Rufous Fantail																																																	
<i>Pachycephala rufiventris</i>	Rufous Whistler	+			+																																													
<i>Todiramphus sanctus</i>	Sacred Kingfisher	+			+																																													
<i>Trichoglossus chlorolepidotus</i>	Scaly-breasted Lorikeet																																																	
<i>Myzomela sanguinolenta</i>	Scarlet Honeyeater				+																																													
<i>Zosterops lateralis</i>	Silvereye																																																	
<i>Pardalotus punctatus</i>	Spotted Pardalote																																																	
<i>Acanthiza lineata</i>	Striated Thornbill				+																																													
<i>Malurus cyaneus</i>	Superb Fairy-wren				+																																													
<i>Hirundo nigricans</i>	Tree Martin																																																	
<i>Malurus lamberti</i>	Variegated Fairy-wren				+																																													
<i>Hirundo neoxena</i>	Welcome Swallow																																																	
<i>Sericornis frontalis</i>	White-browed Scrubwren	+			+																																													
<i>Melithreptus lunatus</i>	White-naped Honeyeater	+																																																
<i>Hirundapus caudacutus</i>	White-throated Needletail				+																																													
<i>Eurostopodus mystacalis</i>	White-throated Nightjar				+																																													
<i>Cormobates leucophaeus</i>	White-throated Treecreeper				+																																													
<i>Corcorax melanorhamphos</i>	White-winged Chough				+																																													
<i>Rhipidura leucophrys</i>	Willie Wagtail																																																	
<i>Acanthiza nana</i>	Yellow Thornbill				+																																													
<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater	+			+																																													
<i>Calyptrorhynchus lunereus</i>	Yellow-tailed Black-Cockatoo																																																	
<b>Total</b>		<b>16</b>	<b>12</b>	<b>10</b>	<b>19</b>	<b>14</b>	<b>15</b>	<b>11</b>	<b>15</b>	<b>10</b>	<b>14</b>	<b>12</b>	<b>8</b>	<b>6</b>	<b>7</b>	<b>14</b>	<b>10</b>	<b>11</b>	<b>7</b>	<b>8</b>	<b>4</b>	<b>6</b>	<b>8</b>	<b>8</b>	<b>13</b>	<b>11</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>9</b>	<b>8</b>	<b>7</b>	<b>4</b>	<b>11</b>	<b>11</b>	<b>3</b>	<b>5</b>												
<b>Bats</b>																																																		
<i>Austronomus australis</i>	White-striped Mastiff Bat																																																	
<i>Chalinolobus gouldii</i>	Gould's Wattled bat																																																	
<i>Chalinolobus morio</i>	Chocolate Wattled Bat																																																	
<i>Falsistrellus tasmaniensis</i>	# Eastern False Pipistrelle																																																	
<i>Miniopterus australis</i>	# Little Bentwing-bat				+																																													



## APPENDIX 2: TERRESTRIAL AND ARBOREAL NEST BOXES

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**Arboreal nest box**





**Terrestrial nest box**

## APPENDIX 3: EXAMPLES OF NATIVE FAUNA OBSERVED

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**Common Brushtail Possum**



**Sugar Glider**



**Brown Antechinus**

## APPENDIX 4: LICENSING

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**Kleinfelder** employees involved in the current study are licensed or approved under the *National Parks and Wildlife Act 1974* (License Number: SL100730, Expiry: 31 March 2020) and the *Animal Research Act 1985* to harm/trap/release protected native fauna and to pick for identification purposes native flora and to undertake fauna surveys.

## APPENDIX 5: STAFF CONTRIBUTIONS

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

Name	Qualification	Title/Experience	Contribution
Chelayne Whyte	B Geog, Dip SIS	Ecologist	Report review
Mark Dean	B EnvsMgt	Ecologist	Fauna survey, report preparation
Gayle Joyce	BSc (Forestry) (Hons)	GIS Specialist	Map preparation
Ben Stuart	BMrnSc & Mgt	Ecologist	Fauna survey

# Appendix 7

## Approval to Cease Independent Environmental Audits

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**From:** Ann Hagerthy <Ann.Hagerthy@planning.nsw.gov.au>  
**Sent:** Wednesday, 31 October 2018 3:02 PM  
**To:** Phillip Brown  
**Cc:** James Benson; Leah Cook  
**Subject:** RE: Donaldson 2016/207 AR

Hi Phillip,

Thank you for your letter. The Department notes that Schedule 2, Condition 117 of DA 98/01173 and DA 118/698/22 states that Independent Environmental Audits (IEAs) are required at 3 yearly intervals and at the completion of mining, and notes that the consent for mining lapsed in 2013 with the last IEA completed in 2015. Please be advised that at this time the Department requires no future IEAs as required under Schedule 2, Condition 117 of DA 98/01173 and DA 118/698/22, unless otherwise directed by the Secretary.

Regards,

Ann Hagerthy, PMP  
A/Team Leader  
Compliance  
Department of Planning & Environment | [PO Box 3145 | Singleton NSW 2330](#)  
T [02 6575 3407](#) M [0428 976 540](#)  
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**From:** Phillip Brown <Phillip.Brown@yancoal.com.au>  
**Sent:** Thursday, 25 October 2018 2:02 PM  
**To:** Ann Hagerthy <Ann.Hagerthy@planning.nsw.gov.au>  
**Cc:** James Benson <James.Benson@yancoal.com.au>; Leah Cook <Leah.Cook@planning.nsw.gov.au>  
**Subject:** RE: Donaldson 2016/207 AR

Hello Ann

Further to the email below, please find enclosed Donaldson's response.

Regards

**Phillip Brown** | ENVIRONMENT & COMMUNITY RELATIONS SUPERINTENDENT

**Ashton Coal Operations Pty Ltd**

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**From:** Ann Hagerthy [<mailto:Ann.Hagerthy@planning.nsw.gov.au>]  
**Sent:** Wednesday, 10 October 2018 1:02 PM  
**To:** Phillip Brown <[Phillip.Brown@yancoal.com.au](mailto:Phillip.Brown@yancoal.com.au)>  
**Cc:** James Benson <[James.Benson@yancoal.com.au](mailto:James.Benson@yancoal.com.au)>; Leah Cook <[Leah.Cook@planning.nsw.gov.au](mailto:Leah.Cook@planning.nsw.gov.au)>  
**Subject:** RE: Donaldson 2016/207 AR

Hi Phillip,

Please find attached the Department's response letter to the 2016-2017 Annual Review. Please note that a revision is due 27 November 2018.

Regards,

Ann Hagerthy, PMP  
Senior Compliance Officer (Wed, Thu, Fri)  
Compliance  
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**From:** Phillip Brown <[Phillip.Brown@yancoal.com.au](mailto:Phillip.Brown@yancoal.com.au)>  
**Sent:** Thursday, 25 January 2018 12:44 PM  
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**Cc:** James Benson <[James.Benson@yancoal.com.au](mailto:James.Benson@yancoal.com.au)>  
**Subject:** Donaldson 2016/207 AR

Hello Ann

Please find enclosed the 2016/2017 Annual Review for Donaldson Coal.

Thanks

**Phillip Brown** | ENVIRONMENT & COMMUNITY RELATIONS SUPERINTENDENT

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