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# Biodiversity Monitoring Report



Wallerawang Quarry

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Annual Monitoring Report (2023)

Prepared for: Walker Quarries

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## Glossary and abbreviations

Acronym	Description
ASL	Above sea level (m)
BAM	Biodiversity Assessment Method
BMP	Biodiversity Management Plan
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DPIE	Former Department of Planning, Industry and Environment, now DCCEEW
HBT	Hollow Bearing Trees
HTE	High Threat Exotics
PCB	Purple Copper Butterfly
PCT	Plant Community Type
TSR	Travelling Stock Route
VIS	Vegetation Integrity Score



# 1 Introduction

Walker Quarries Pty Ltd (Walker Quarries) currently operates Wallerawang Quarry ('the Quarry'), located on land adjoining the Great Western Highway to the south of Wallerawang, approximately 8 km northwest of Lithgow (**Figure 1.1**). A Biodiversity Management Plan (BMP; Umwelt 2021) has been prepared to guide the management of biodiversity values on the Quarry and in accordance DA 344-11-2001 (Condition 3(26)).

Section 6 of the BMP for the Quarry (Umwelt 2021) outlines the ecological monitoring program for the Quarry. The monitoring is designed to assess the adequacy of the ecological management strategies to be undertaken as part of the BMP. The specific objectives of the monitoring program are to:

- evaluate the success of flora and fauna management strategies.
- facilitate continuous improvement in rehabilitation and revegetation practices.
- record and document changes in retained vegetation within the Quarry and allow for comparison with previous records.
- record and document fauna population changes and identify any breeding and critical habitat, and
- ensure the ecological significance of the remnant vegetation or rehabilitated areas are maintained or improved as a result of ongoing management practices.

The BMP includes specific monitoring procedures in relation to the Purple Copper Butterfly (*Paralucia spinifera*; PCB) and local flora. This report presents the method and results of monitoring for the PCB and local flora undertaken in spring 2023 and in accordance with the BMP.



Figure 1.1: Site location

## 2 Methods

### 2.1 Local flora

In accordance with the requirements of the BMP, monitoring of local flora involved annual monitoring of vegetation within six monitoring plots in line with the Biodiversity Assessment Method ('BAM'; DPIE 2020). Flora data from fixed quadrats were collected by Michael Sommerville on 13 December 2023. In brief, the BAM involves collecting floristic data within a 20 m x 20 m plot as well as a number of vegetation metrics (e.g. litter cover) along a 50 m transect. These data are entered into the BAM calculator (BAM-C) to derive a Vegetation Integrity Score (VIS) that reflects a site's vegetation condition relative to a benchmark condition for the same vegetation type in the contemporary landscape.

The locations of floristic monitoring plot-transects were consistent with monitoring locations in 2021 (**Figure 2.1**). As of 2021 and continuing into 2023, the former monitoring site BAM04 was no longer included among the monitoring locations as BAM04 was impacted by approved vegetation clearing during 2021. A new monitoring site ('BAM07') was established in 2021 to replace BAM04. The location of BAM07 was selected to match the Plant Community Type (PCT) and general vegetation condition present within former monitoring site BAM04. Location details for the current monitoring locations are shown in **Table 2.1**.

**Table 2.1: Floristic monitoring plot locations**

Monitoring plot	Coordinates (GDA94 z56)		Orientation (°)	Plant Community Type
	Easting	Northing		
BAM01	227963	6296432	95	732 – Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion
BAM02	227842	6296341	250	
BAM03	228015	6296433	130	
BAM05	228130	6296822	130	1093 – Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
BAM06	228290	6296629	55	
BAM07	228339	6296510	50	





Figure 2.1: Monitoring plot locations



## 2.2 Purple Copper Butterfly

Monitoring surveys for the PCB at the Quarry and control site were undertaken on 30 October 2023 by Sam Mullins and Ailis Chapman. In accordance with the BMP, five patches of *Bursaria spinosa* subsp. *lasiophylla* (Blackthorn) within the Quarry were monitored. The locations of the five monitoring sites are shown in **Figure 2.2** and summarised in **Table 2.2**. At each of the monitoring sites the following methods were employed:

- Surveyor positioned themselves to survey the site and conduct visual inspections to observe any butterfly activity for at least 10 minutes per site.
- Random *Bursaria spinosa* subsp. *lasiophylla* individuals were searched for PCB caterpillars.
- Random *Bursaria spinosa* subsp. *lasiophylla* individuals were selected and searched for the ant species *Anonychomyrma itinerans*, as this ant has a mutualistic relationship with PCB.
- Selected *Bursaria spinosa* subsp. *lasiophylla* plants were gently shaken to trigger a flight response from any butterflies present.
- Any butterflies observed were captured using a butterfly net and identified using Braby (2016). All animals captured were released at their point of capture.
- The age of plants (large plants and seedlings present), health (any new shoots present) and evidence of grazing (chewed leaves) were recorded.

The BMP identifies that this survey methodology is also to be undertaken at two control sites, with control sites located at Cox's Creek, Wallerawang, and Eusdale Road, Yetholme surveyed in previous seasons (2016 and 2017). Consultation with the NSW Department of Planning, Industry and Environment (DPIE) prior to the 2018 surveys identified an alternative control site at the Cheetham Flats TSR (Hampton Road, Rydal) located approximately 13 km south-west of the Quarry. Similar to the 2018 to 2022 surveys, the 2023 surveys for PCB at control sites were limited to the single site at Cheetham Flat TSR.

Weather conditions during the survey period (30 October 2023), as recorded onsite, were warm and with only minor cloud cover. Winds were light to moderate. Weather conditions recorded at the nearest meteorological station at Marrangaroo (station 063308), located approximately 5 km east of the Quarry, are presented in **Table 2.3**. Monthly rainfall totals for 2016 to 2022, as recorded at the Lidsdale (Maddox Lane) Meteorological Station (Station number 063132), is presented in **Table 2.4**.

The survey timing for PCB (30 October 2023), was identified as being towards the end of the typical active period for PCB. However, late project commissioning restricted opportunities to undertake the surveys earlier in the season.



Figure 2.2: Purple Copper Butterfly monitoring locations



**Table 2.2: Purple Copper Butterfly site details**

Monitoring plot	Coordinates (GDA94)		Elevation (m ASL), aspect & slope (°)	Approx. stand size
	Easting	Northing		
17	227716	6295941	~922 m ASL. North facing slope, ~10°	100 x 30 m
18	227887	6295945	~917 m ASL. North facing slope, ~5°	20 x 20 m
19	227948	6296046	~915 m ASL. East facing slope, ~30°	20 x 20 m
20/21	228005	6296045	~910 m ASL. South facing slope, ~30°	30 x 20 m
24	228244	6295945	~955 m ASL. North-east facing slope, ~20°	20 x 20 m

ASL – Above Sea Level

**Table 2.3: Weather conditions during Purple Copper Butterfly surveys, as recorded at Marrangaroo meteorological station (#063308)**

Date	Temperature (°C)		Rainfall (mm)	Wind - 9 am		Wind – 3 pm	
	Min	Max		Direction	Speed (km/hr)	Direction	Speed (km/hr)
30/10/2023	1.1	27.8	0	NW	6	WNW	17

**Table 2.4: Total monthly rainfall (mm) from 2016 to 2021, as recorded at the Lidsdale (Maddox Lane) Meteorological Station**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2016	142	28.8	69.6	6.2	26	173.4	91.4	52.2	118.6	71.4	58.4	86.4
2017	37.2	12.2	141.4	21.2	32.6	19.6	6.6	41.8	4.2	106	28.8	75.2
2018	49	65.2	56.6	13.6	12.6	34.6	5.4	38	67.6	79.8	124.6	80.6
2019	154.6	21.4	84.2	1	37.2	16.2	10.8	18	52	9.4	35.8	2.8
2020	46.8	131.6	115.0	93.6	47.8	39.0	77.8	103.8	57.0	68.6	Not available	
2021	82.8	87.4	154	0.6	25.2	51.8	60.6	81.4	43.2	53.2	172.4	63.0
2022	156.4	87.8	175.4	60.4	68.0	22.6	139.8	86.6	124.8	131.2	126.6	26.8
2023	104.8	41.4	87.4	66.8	4.6	29.0	21.0	45.2	20.8	42.4	113.0	116
<b>Mean</b>	<b>87.0</b>	<b>76.7</b>	<b>70.8</b>	<b>43.2</b>	<b>47.2</b>	<b>48.9</b>	<b>51.0</b>	<b>63.5</b>	<b>53.5</b>	<b>67.5</b>	<b>74.9</b>	<b>73.4</b>



## 3 Results and discussion

### 3.1 Local flora

The photos and floristic data recorded within each of the six monitoring plots are presented in **Appendix A** and **Appendix B**.

#### 3.1.1 Photo-point monitoring

No disturbance to vegetation or soils including vegetation clearing, widespread dieback, erosion or excavations associated with the Quarry operations were recorded within monitoring plots as shown in site photographs (**Appendix A**).

#### 3.1.2 Floristic monitoring

Vegetation Integrity Scores (VIS) were calculated for each monitoring plot and are shown in **Table 3.1**. The VIS varied across the site from 62.5 to 81.1 in 2023, which was broadly similar to previous years. Changes from previous years are discussed in more detail in the section below.

All monitoring plots had high composition scores, ranging from 77.8 to 94.9, which are reflective of high species richness within the monitoring plots. Vegetation structure scores were much more variable between monitoring plots, ranging from 44.6 to 87.7. This broad range is reflective of a lower coverage of native grasses in some plots as compared to benchmarks (and previous years as discussed below). Vegetation function scores were also variable between plots, ranging from 53.6 to 85.7. The range in values for vegetation function were driven by differences in the number of large trees within each plot and the litter cover which was much less than the benchmark in every plot. Nonetheless, the values for vegetation function are still reflective of moderately intact vegetation.

The high VIS and generally high scores for composition and function indicate that retained vegetation within the Quarry site is generally in a relatively intact condition and has not been heavily impacted by ongoing operations at the Quarry.

**Table 3.1: VIS for floristic monitoring plots in 2023**

Monitoring plot	PCT	Composition score	Structure Score	Function Score	Vegetation Integrity Score
BAM01	732	85.1	67.9	85.7	<b>79.1</b>
BAM02	732	89.6	44.6	61	<b>62.5</b>
BAM03	732	94.9	87.7	64.4	<b>81.2</b>
BAM05	1093	81.7	61.5	71.5	<b>71.1</b>
BAM06	1093	93.9	57	78.3	<b>74.9</b>
BAM07	1093	77.8	59.1	53.6	<b>62.7</b>

### *Comparison with previous monitoring seasons*

A comparison of vegetation integrity scores, including component composition, structure and function scores, and species richness is presented in **Table 3.2** for those monitoring sites surveyed in 2020, 2021, 2022 and 2023. Data is not presented for BAM07 in 2020, as 2021 is the first year this plot was surveyed. No comparisons are presented against earlier monitoring seasons (prior to 2020) which employed a different monitoring method.

The VIS in 2023 was generally similar to all previous monitoring seasons at sites BAM01, BAM03, and BAM06. The VIS in 2023 at sites BAM02 and BAM05 increased moderately from 2022 but were still below the scores for these sites in 2020 and 2021. At site BAM07, the VIS in 2023 declined compared to both previous monitoring seasons (2021 and 2022).

For those sites where VIS scores have varied between seasons (BAM02, BAM05 and BAM07), the differences in VIS have been driven by differences in the component structure or function scores. At BAM02 the lower VIS scores in 2022 and 2023 compared to 2020 and 2021 were associated with a sharp decline in the cover of grass and grasslike species, most notably *Poa sieberiana* (Snow Grass) and *Microlaena stipoides* (Weeping Grass). No disturbance such as erosion or compaction was apparent at BAM02 which may explain the decline in cover of native grasses. In the absence of further observations indicating a multi-year trend, or evidence of disturbance, the most likely explanation for the difference is seasonal variation which may be influenced by weather and in particular rainfall. However, coverage of *P. sieberiana* and *M. stipoides* should be monitored carefully in subsequent years.

At BAM05 the lower VIS scores in 2022 and 2023 compared to 2020 and 2021 were associated with a sharp decline in the component structure score which is attributed to a decline in the cover of the canopy species (30% cover in 2020 and 2021, 15.2% in 2022 and 25% in 2023). At BAM07 the decline in VIS in 2023 was driven by a decline in the component function score which was a result of reduced litter cover (26 % in 2023 compared to 78% in 2022 and 2021) and a reduced number of large trees (one large trees was recorded in 2021 and 2022, but

none were recorded in 2023). As there is no evidence of tree dieback or other disturbance at BAM05 or BAM07, and no obvious alternative explanation for decreased canopy such as low rainfall, the observed differences are likely to be at least partially the result of different observers, rather than any recent change in amount of canopy coverage or loss of large trees.

Across all monitoring sites, small fluctuations were observed in native species richness and exotic species richness in 2023 compared to previous seasons (**Table 3.3**). No consistent trend was identified across sites indicating an overall increase or decrease in native species richness. Decreases in native species richness beyond the range of previous seasons was observed at three sites (BAM01, BAM03 and BAM07) and increases beyond the previous range were observed at one site (BAM06; **Table 3.3**).

Across all monitoring sites, exotic species cover remained at a higher level within all monitoring plots within PCT 732 (BAM01, BAM02 and BAM03; **Table 3.4**). At individual monitoring sites the cover of exotic vegetation in 2023 declined sharply compared to previous seasons at two sites (BAM01 and BAM02). These declines were driven by large decreases in the cover of the exotic grass species *Anthoxanthum odoratum*\* (Sweet Vernal Grass) from 2021 to 2023, representing the reversal of the large increases in this species observed from 2021 to 2022. The decreased cover of *A. odoratum*\* from 2022 to 2023 is attributed to declining rainfall across this period, with the species generally occurring in moister habitats. However, the cover of this species should continue to be monitored and if vegetation integrity scores decline as a result of increased cover of this species, targeted control may be warranted. The cover of high threat exotic species, as defined under the BAM, remained relatively consistent and at low levels between 2020 and 2023 (**Table 3.4**).



**Table 3.2: VIS for floristic monitoring plots in 2020, 2021, 2022 and 2023**

Monitoring plot	Composition score				Structure Score				Function Score				Vegetation Integrity Score			
	2020	2021	2022	2023	2020	2021	2022	2023	2020	2021	2022	2023	2020	2021	2022	2023
BAM01	98	96.8	97.6	85.1	99.4	82.5	47.9	67.9	70.5	88	88.6	85.7	<b>88.2</b>	<b>88.9</b>	<b>74.5</b>	<b>79.1</b>
BAM02	81.5	92.5	80.7	89.6	88.8	88.9	27.3	44.6	64.3	84.9	86.8	61	<b>77.5</b>	<b>88.7</b>	<b>57.6</b>	<b>62.5</b>
BAM03	94.6	94.6	100	94.9	89.5	92	91.3	87.7	63.2	72.2	72.6	64.4	<b>81.2</b>	<b>85.6</b>	<b>87.2</b>	<b>81.2</b>
BAM05	84.1	90.4	88.6	81.7	75.2	72.6	45.2	61.5	63.3	72.8	74.7	71.5	<b>73.7</b>	<b>78.2</b>	<b>66.9</b>	<b>71.1</b>
BAM06	83.1	90.2	93.1	93.9	77.2	75	57.2	57	59.8	83.1	99.8	78.3	<b>72.7</b>	<b>82.5</b>	<b>81</b>	<b>74.9</b>
BAM07	n/a	91.9	91.6	77.8	n/a	66.9	59.4	59.1	n/a	72.5	73.8	53.6	n/a	<b>76.4</b>	<b>73.7</b>	<b>62.7</b>

**Table 3.3: Species richness within monitoring plots in 2020, 2021, 2022 and 2023**

FACTOR	BAM01				BAM02				BAM03				BAM05				BAM06				BAM07			
	2020*	2021	2022	2023	2020*	2021	2022	2023	2020*	2021	2022	2023	2020*	2021	2022	2023	2020*	2021	2022	2023	2020*	2021	2022	2023
No. native species	47	42	42	33	40	44	31	34	54	51	51	46	34	40	36	34	35	37	38	41	-	41	43	31
No. exotic species	14	11	10	7	14	13	13	9	5	4	4	7	3	3	4	3	3	5	5	4	-	6	7	6
Total species richness	61	53	52	40	54	57	44	43	59	55	55	53	37	43	40	37	38	42	43	45	-	47	50	37

**Table 3.4: Cover of exotic species and high threat exotic species within monitoring plots**

FACTOR	BAM01				BAM02				BAM03			
	2020	2021	2022	2023	2020	2021	2022	2023	2020	2021	2022	2023
Exotic species cover	35.5	62.8	61.1	10.9	23.2	37.2	54.7	11.4	10.8	15.3	41.3	10.9
High threat exotic cover	0.2	0.3	0	0.4	0.2	0.3	0.5	0.3	0	0	0.1	0.2
FACTOR	BAM05				BAM06				BAM07			
	2020	2021	2022	2023	2020	2021	2022	2023	2020	2021	2022	2023
Exotic species cover	2.1	2.2	2.7	2.4	5.1	5.5	6.2	5.4	n/a	1.1	3	0.9
High threat exotic cover	2	2	2.1	2	5	5.1	5.2	5	n/a	0	0.1	0.1

## 3.2 Purple Copper Butterfly

No PCBs were detected at the reference site during the survey period. This is potentially, in part, a result of the late timing of the PCB surveys.

No PCBs were observed within any of the monitoring sites at the Quarry. However, one butterfly species, Australian Painted Lady (*Vanessa kershawi*), was recorded in addition to a number of other arthropods including moths, spiders, beetles and bees.

No *Anonychomyrma itinerans*, or any other ant species, was observed on *Bursaria spinosa* subsp. *lasiophylla* during surveys at the quarry. One ant species was observed on adjacent vegetation, although was identified as a *Crematogaster* sp. and not the species *Anonychomyrma itinerans* with which PCB has a mutualistic relationship.

*Bursaria spinosa* subsp. *lasiophylla* within each of the monitoring sites was observed to be in a healthy condition with mature flowering and fruiting individuals and seedlings present. At all sites, *Bursaria spinosa* subsp. *lasiophylla* was observed with new growth shoots and several plants flowering vigorously. No obvious signs of grazing were apparent.

These monitoring results are largely consistent with monitoring results from 2016-2022, where no PCB or *Anonychomyrma itinerans* were recorded within the Quarry, although *Bursaria spinosa* subsp. *lasiophylla* remained in good health with new growth evident. While the definitive absence of PCB from the Quarry site in 2023 is difficult to determine, as targeted surveys did not coincide with the optimal time for detection of the species, the absence of *Anonychomyrma itinerans* suggests that PCB remain absent from the monitoring sites within the Quarry (noting that PCBs have not been detected within the Quarry during any of the last six years of monitoring).



## 4 Conclusions and recommendations

Consistent with the previous years' monitoring report, no large-scale disturbance to vegetation or soils which were attributable to the quarry operations were detected within the areas surrounding the Quarry operations. Observations of local flora made during the monitoring indicate that the vegetated areas of the Quarry continue to provide habitat for an array of native flora and fauna species. Based upon results from the 2023 monitoring period, no observable or significant trends in the occurrence of specific threatened species or quality / quantity of available habitat has been identified.

Several exotic flora species which have potential to invade native vegetation and outcompete native species were recorded within the Quarry including *Anthoxanthum odoratum*\* (Sweet Vernal Grass), *Hypericum perforatum*\* (St John's Wort), *Pinus radiata*\* (Radiata Pine) and *Rubus fruticosus* sp. agg.\* (Blackberry). These species should be targeted as part of weed control works within the Quarry.

As no PCB or attendant ants (*Anonychomyrma itinerans*) have been recorded within the Quarry during the last seven monitoring surveys dating back to 2016, with PCB last detected in the Quarry in September 2002, it is likely that the population of PCB which once occurred within the Quarry is either locally extinct or very small and difficult to detect.

## 5 References

NSW Department of Planning, Industry and Environment (DPIE) (2020). The NSW Biodiversity Assessment Method. State of NSW and DPIE.

Braby, M., (2016). *The complete field guide to butterflies of Australia*. 2nd ed. Victoria: CSIRO Publishing.

Umwelt (2021). Biodiversity Management Plan: Wallerawang Quarry. Unpublished report prepared for Walker Quarries, dated July 2020.

## Appendix A Floristic monitoring data

### *Site photos*



**BAM01 - Start**





**BAM02 – Start**





**BAM03 – Start**





**BAM05 – Start**





**BAM06 – Start**





**BAM07 - Start**

*Plot data*

Plot	Composition					
	Tree (TG)	Shrub (SG)	Grass & grasslike (GG)	Forb (FG)	Fern (EG)	Other (OG)
BAM01	5	11	8	21	0	1
BAM02	3	4	12	13	0	2
BAM03	5	11	8	21	0	1
BAM05	2	7	12	12	0	1
BAM06	3	8	10	17	1	2
BAM07	3	5	5	16	0	2

Plot	Structure					
	Tree (TG)	Shrub (SG)	Grass & grasslike (GG)	Forb (FG)	Fern (EG)	Other (OG)
BAM01	32	4.1	16.3	2.5	0	0.4
BAM02	21	1	10.3	1.9	0	0.2
BAM03	25.3	3.4	25.7	3.7	0	0.1
BAM05	25	1.5	21.3	1.6	0	0.1
BAM06	26.6	2.6	13.5	3	0.1	0.4
BAM07	30	1	13.2	2.6	0	0.3

Plot	Function									
	Large trees	HBT	Litter (%)	Logs (m)	Tree 5-10 cm	Tree 10-20 cm	Tree 20-30 cm	Tree 30-50 cm	Tree <5 cm	HTE
BAM01	3	0	7	68	1	1	1	1	1	0.4
BAM02	1	0	9	58	1	1	1	1	1	0.3
BAM03	1	0	16	54	1	1	1	1	1	0.2
BAM05	1	0	52	68	1	1	1	1	1	2
BAM06	2	0	39	38	1	1	1	1	1	5
BAM07	0	0	26	71	1	1	1	1	1	0.1



## Appendix B Flora list

Family	Species	Growth Form	BAM01	BAM02	BAM03	BAM05	BAM06	BAM07
Acanthaceae	<i>Brunoniella australis</i>	Forb (FG)					0.1	
Anthericaceae	<i>Laxmannia gracilis</i>	Forb (FG)				0.1	0.2	0.2
Apiaceae	<i>Hydrocotyle laxiflora</i>	Forb (FG)		0.1	0.2		0.1	0.1
Asphodelaceae	<i>Tricoryne elatior</i>	Forb (FG)				0.1	0.1	
Asteraceae	<i>Brachyscome sieberi</i>	Forb (FG)			0.2			0.1
	<i>Brachyscome</i> sp.	Forb (FG)					0.1	
	<i>Cassinia laevis</i>	Shrub (SG)	0.2	0.1	0.1	0.2	0.6	0.3
	<i>Chrysocephalum apiculatum</i>	Forb (FG)					0.2	
	<i>Chrysocephalum semipapposum</i>	Forb (FG)			0.1			0.1
	<i>Cirsium vulgare</i> *	Exotic	0.1	0.2				
	<i>Conyza</i> sp.*	Exotic			0.1			
	<i>Euchiton involucratus</i>	Forb (FG)	0.2					
	<i>Gamochaeta calviceps</i> *	Exotic						0.2
	<i>Hypochaeris glabra</i> *	Exotic	0.3	0.3	0.2	0.2	0.1	0.2
	<i>Leontodon saxatilis</i> *	Exotic			0.1			0.1
<i>Ozothamnus diosmifolius</i>	Shrub (SG)	0.1			0.2	0.2	0.1	

Family	Species	Growth Form	BAM01	BAM02	BAM03	BAM05	BAM06	BAM07
	<i>Senecio hispidulus</i>	Forb (FG)	0.1	0.1	0.1			
	<i>Senecio prenanthoides</i>	Forb (FG)	0.1		0.1			
	<i>Senecio quadridentatus</i>	Forb (FG)	0.3	0.2	0.1			0.1
	<i>Taraxacum officinale</i> *	Exotic	0.1					
	<i>Xerochrysum bracteatum</i>	Forb (FG)			0.2	0.2		0.1
	<i>Xerochrysum viscosum</i>	Forb (FG)		0.1				
Boraginaceae	<i>Cynoglossum australe</i>	Forb (FG)	0.1	0.1		0.1		
Campanulaceae	<i>Wahlenbergia stricta</i>	Forb (FG)				0.1		0.1
Caryophyllaceae	<i>Stellaria pungens</i>	Forb (FG)	0.1					
Clusiaceae	<i>Hypericum gramineum</i>	Forb (FG)			0.1	0.1	0.1	0.1
	<i>Hypericum perforatum</i> *	High Threat Exotic	0.1	0.1				0.1
Convolvulaceae	<i>Dichondra repens</i>	Forb (FG)	0.1	0.1	0.2			
Cyperaceae	<i>Carex inversa</i>	Grass & grasslike (GG)		0.1				
	<i>Cyperus gracilis</i>	Grass & grasslike (GG)		0.1				
	<i>Lepidosperma gunnii</i>	Grass & grasslike (GG)			0.2	0.2	5	
Dilleniaceae	<i>Hibbertia obtusifolia</i>	Shrub (SG)					0.3	0.2
Ericaceae	<i>Acrotriche serrulata</i>	Shrub (SG)			0.2			

Family	Species	Growth Form	BAM01	BAM02	BAM03	BAM05	BAM06	BAM07
	<i>Brachyloma daphnoides</i>	Shrub (SG)	0.2		0.5			
	<i>Leucopogon virgatus</i>	Shrub (SG)				0.1		
	<i>Lissanthe strigosa</i>	Shrub (SG)		0.6	0.3	0.2		
Fabaceae (Faboideae)	<i>Bossiaea buxifolia</i>	Shrub (SG)			0.2		0.1	
	<i>Desmodium varians</i>	Other (OG)		0.1				
	<i>Dillwynia phyllicoides</i>	Shrub (SG)			0.2	0.5	0.6	0.3
	<i>Glycine clandestina</i>	Other (OG)	0.1	0.1	0.1			
	<i>Gompholobium huegelii</i>	Shrub (SG)			0.1			
	<i>Hardenbergia violacea</i>	Other (OG)				0.1	0.3	0.2
	<i>Hovea heterophylla</i>	Forb (FG)			0.1		0.1	
	<i>Mirbelia platylobioides</i>	Shrub (SG)			0.2		0.5	
Fabaceae (Mimosoideae)	<i>Acacia dealbata</i>	Tree (TG)	4	1	0.2			
	<i>Acacia floribunda</i>	Shrub (SG)			0.5			
Gentianaceae	<i>Centaurium erythraea</i> *	Exotic		0.1	0.1		0.1	0.1
Geraniaceae	<i>Geranium solanderi</i>	Forb (FG)	0.2	0.3				
Goodeniaceae	<i>Goodenia bellidifolia</i>	Forb (FG)				0.2	0.1	0.2
	<i>Goodenia hederacea</i>	Forb (FG)			0.3	0.2	0.3	0.2



Family	Species	Growth Form	BAM01	BAM02	BAM03	BAM05	BAM06	BAM07
Haloragaceae	<i>Gonocarpus tetragynus</i>	Forb (FG)			0.3	0.1	0.4	0.3
Iridaceae	<i>Patersonia sericea</i>	Forb (FG)					0.5	
Juncaceae	<i>Juncus homalocaulis</i>	Grass & grasslike (GG)		0.1				
	<i>Juncus</i> sp.	Grass & grasslike (GG)		0.1				
Lamiaceae	<i>Ajuga australis</i>	Forb (FG)			0.2			
Lauraceae	<i>Cassytha glabella</i>	Other (OG)					0.1	0.1
Loganiaceae	<i>Mitrasacme</i> sp.	Forb (FG)				0.2		
Lomandraceae	<i>Lomandra filiformis</i>	Grass & grasslike (GG)	0.3	0.6	0.3	0.1	0.3	0.2
	<i>Lomandra longifolia</i>	Grass & grasslike (GG)		0.2		10	2	5
	<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	Grass & grasslike (GG)		0.3	0.2			
Myrtaceae	<i>Eucalyptus bridgesiana</i>	Tree (TG)	10					
	<i>Eucalyptus dalrympleana</i>	Tree (TG)	15					
	<i>Eucalyptus dives</i>	Tree (TG)	1	5	15		1	20
	<i>Eucalyptus mannifera</i>	Tree (TG)	2		5	5	0.6	5
	<i>Eucalyptus rossii</i>	Tree (TG)			0.1	20	25	5
	<i>Eucalyptus rubida</i>	Tree (TG)		15	5			
	<i>Leptospermum parvifolium</i>	Shrub (SG)				0.1		

Family	Species	Growth Form	BAM01	BAM02	BAM03	BAM05	BAM06	BAM07
Onagraceae	<i>Epilobium hirtigerum</i>	Forb (FG)		0.1				
Orchidaceae	<i>Dipodium roseum</i>	Forb (FG)			0.1			0.1
	<i>Dipodium variegatum</i>	Forb (FG)						0.1
Oxalidaceae	<i>Oxalis perennans</i>	Forb (FG)	0.1	0.2			0.1	
Phormiaceae	<i>Dianella revoluta</i>	Forb (FG)	0.3	0.2	0.3	0.1	0.1	0.5
Phyllanthaceae	<i>Poranthera microphylla</i>	Forb (FG)				0.1	0.1	0.1
Pinaceae	<i>Pinus radiata</i> *	High Threat Exotic		0.1	0.2	2	5	
Pittosporaceae	<i>Bursaria spinosa</i>	Shrub (SG)	3	0.2	1			
Plantaginaceae	<i>Plantago gaudichaudii</i>	Forb (FG)	0.1		0.3			
	<i>Plantago lanceolata</i> *	Exotic	0.2	0.3	0.2			
	<i>Veronica calycina</i>	Forb (FG)	0.2	0.1				
	<i>Veronica plebeia</i>	Forb (FG)			0.1		0.2	0.2
Poaceae	<i>Anthoxanthum odoratum</i> *	Exotic	10	10	10	0.2	0.2	0.2
	<i>Aristida ramosa</i>	Grass & grasslike (GG)				0.3		
	<i>Aristida vagans</i>	Grass & grasslike (GG)				0.5		
	<i>Austrostipa</i> spp.	Grass & grasslike (GG)					1	1
	<i>Dichelachne micrantha</i>	Grass & grasslike (GG)		1	2	0.5	0.5	

Family	Species	Growth Form	BAM01	BAM02	BAM03	BAM05	BAM06	BAM07
	<i>Echinopogon caespitosus</i>	Grass & grasslike (GG)	1	0.5	5	0.5	0.6	
	<i>Microlaena stipoides</i>	Grass & grasslike (GG)	5		4	0.1	0.4	
	<i>Poa sieberiana</i>	Grass & grasslike (GG)	10	5	10	5	3	5
	<i>Rytidosperma monticola</i>	Grass & grasslike (GG)		0.3		0.1	0.2	
	<i>Rytidosperma pallidum</i>	Grass & grasslike (GG)		2	4	2	0.5	2
	<i>Sorghum leiocladum</i>	Grass & grasslike (GG)				2		
Polygonaceae	<i>Rumex brownii</i>	Forb (FG)	0.1					
Primulaceae	<i>Lysimachia arvensis</i> *	Exotic		0.2				
Proteaceae	<i>Hakea dactyloides</i>	Shrub (SG)					0.2	
	<i>Persoonia linearis</i>	Shrub (SG)			0.1	0.2	0.1	0.1
Pteridaceae	<i>Cheilanthes sieberi</i>	Fern (EG)					0.1	
Ranunculaceae	<i>Clematis aristata</i>	Other (OG)	0.3					
Rosaceae	<i>Acaena novae-zelandiae</i>	Forb (FG)	0.2	0.2				
	<i>Acaena ovina</i>	Forb (FG)	0.2		0.2			
	<i>Rosa rubiginosa</i> *	High Threat Exotic	0.1					
	<i>Rubus fruticosus sp. agg.</i> *	High Threat Exotic	0.2	0.1				
	<i>Rubus parvifolius</i>	Shrub (SG)	0.3					

Family	Species	Growth Form	BAM01	BAM02	BAM03	BAM05	BAM06	BAM07
Rubiaceae	<i>Opercularia diphylla</i>	Forb (FG)			0.1		0.2	
Solanaceae	<i>Solanum opacum</i>	Forb (FG)		0.1				
Stylidiaceae	<i>Stylidium graminifolium</i>	Forb (FG)			0.1			
Violaceae	<i>Melicytus dentatus</i>	Shrub (SG)	0.3	0.1				
	<i>Viola betonicifolia</i>	Forb (FG)	0.1		0.3			