

# Purple Copper Butterfly

## Targeted investigation

Walker Quarry, Wallerawang, NSW

October 2016



DRAFT VERSION 2



**Cover photographs:**

**Left:** Site 17, full sun at approximately 8,30 in the morning.

**Right:** A Blackthorn plant present within Site 17.

Report produced at the request of:

RW Corkery and Co Pty Ltd

on behalf of

Walker Quarries Pty Ltd

by

Lesryk Environmental Pty Ltd

PO Box 3001

Bundeena NSW 2230

Telephone: (02) 9523 2016

Mobile: 0408 25 8129

Email: [admin@lesryk.com.au](mailto:admin@lesryk.com.au)

[www.lesryk.com.au](http://www.lesryk.com.au)

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**Disclaimer**

This document has been prepared in accordance with the brief provided by RW Corkery and Co Pty Ltd ('the client'). This investigation has relied upon information collected during the course of field investigations, and as available in current known literature and data sources. All findings, conclusions or recommendations contained within this document are based upon the abovementioned circumstances. The study has been prepared for use by RW Corkery and Co Pty Ltd and their client, and no responsibility for its use by other parties is accepted by Lesryk Environmental Pty Ltd.

This report is prepared in accordance with both the 6<sup>th</sup> Edition of the Commonwealth of Australia (2002) Style Manual.

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### Glossary

Abbreviation	Definition
AMG	Australian Map Grid
ASL	Above Sea Level
°C	Degrees Celsius
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
GPS	Global Positioning System
LGA	Local Government Area
ha/mm/cm/m/km	Hectares, millimetres, centimetres, metres, kilometres,
ML 1633	Mining Lease #1633
NSW	New South Wales
NPWS	NSW National Parks and Wildlife Service
TSC Act	NSW <i>Threatened Species Conservation Act 1995</i>

## 1. Introduction

At the request of RW Corkery and Co Pty Ltd, on behalf of Walker Quarries Pty Ltd, a survey targeting the presence of the Purple Copper Butterfly<sup>1</sup> (*Paralucia spinifera*) has been undertaken. The investigation was conducted within the fenced limits of ML 1633 (Figure 1).



**Figure 1.** ML 1633. Blue line identifies boundary of the mining lease area.

ML 1633 is located to the south of the Great Western Highway, approximately 2.6 km south of the NSW township of Wallerawang. The city of Lithgow is located approximately 9.2 km to the south-east.

<sup>1</sup> This species also known as the Bathurst Copper Butterfly.

The objective of the targeted investigation was to:

- determine the presence and location of any Purple Copper Butterflies
- determine the presence and location of any Purple Copper Butterfly habitat (i.e. patches of Blackthorn [*Bursaria spinosa* subsp. *lasiophylla*])
- determine recommendations concerning the management of any suitable Blackthorn stands, including revegetation, so that it might remain as habitat for the Purple Copper Butterfly.

## 2. Purple Copper Butterfly

The Purple Copper Butterfly (also known as the Bathurst Copper Butterfly [NPWS 2001] but hereafter referred to as the Purple Copper Butterfly) is a threatened species that is listed under both the EPBC and TSC Acts. It is a species with a limited distribution, only being found in the Central Tablelands of NSW between Bathurst and Hartley (NPWS 2001). Within this area, this species is only known from 29 sites, these covering a total area of less than 30 ha (NPWS 2001).

The Purple Copper Butterfly is restricted to elevations above 900 m and feeds exclusively on a form of Blackthorn (NPWS 2001). This butterfly has a mutualistic relationship with a species of small ant, *Anonychomyrma itinerans*, this ant protecting the butterfly caterpillars from predation and hosting the pupae in their nests (NPWS 2001).

Throughout its distribution, the butterfly is known to emerge from pupation at different times of the year (NPWS 2001). 'At low elevation sites the species appears earlier in the season, whilst persisting later at higher elevation sites. The butterfly begins to emerge at some sites from early August and are on the wing until at least early November. For most sites there appears to be a peak of activity for a couple of weeks during September (NPWS 2001 p 12)'.

Geology, soils and dominant vegetation canopy species vary between known Purple Copper Butterfly locations. Whilst this is the case, at each known site, the structure of the vegetation present is uniform, this being an open woodland or forest with a sparse understorey that is dominated by Blackthorn (NPWS 2001). This vegetation requires exposure to all-day sun. A commonality between known sites is their aspect and open nature, this permitting a high level of solar radiation.

Optimal 'flying conditions' for the Purple Copper Butterfly are documented as being sunny and warm days, low winds and surveys conducted between 10.00 am and 4.00 pm (GHD 2013).

Threats to the viability of the species primarily include clearing of native vegetation and habitat isolation, with spraying, grazing, fire and weeds also being contributing factors (NPWS 2001).

## 3. Site characteristics

ML 1633 covers an area of approximately 40 ha, with an expected quarrying area of around 20 ha. The site has an undulating topography and natural elevations that vary from 895 m to 970 m ASL. Aspects present include northerly and southerly.

ML 1633 is fenced, either by a six foot high wire mesh fence or 4 strand strainer wire and post configuration. The presence of this fencing was used to determine the extent of areas that required inspecting.

Beyond the areas disturbed by the site's quarrying activities, a eucalypt woodland is present. This woodland includes occurrences of exotic species, such as Radiata Pine (*Pinus radiata*) and Blackberry (*Rubus fruticosus aggregate*). It is acknowledged that, south of the quarrying area, the pines are being managed to permit their removal.

An unnamed drainage line is present within the southern portion of ML 1633. This flows in a south-easterly direction eventually discharging into the Coxs River. This drainage line supports banks and beds that are composed of soil and imbedded rock material. No aquatic vegetation is present, the creek being lined by the site's open woodland. At the time of the site inspection, this drainage line was flowing.

A high voltage transmission line, this including a cleared easement, is present within the eastern portion of ML 1633.

Lidsdale State Forest occurs to the south and west of ML 1633 (Figure 1), whilst Marrangaroo National Park is situated approximately 1.6 km to the east. Private, semi-rural land holdings are present to the north and north-east.

The site is located with the Lithgow City LGA.

#### 4. Survey methodology and field guides

Investigations of the woodland areas that occur beyond the quarries development footprint were undertaken by Deryk Engel (NSW Office of Environment and Heritage Scientific Licence #SL100484) on 26 and 27 September 2016. For reference, the weather conditions experienced during the site investigations are provided in Table 1.

**Table 1.** Weather conditions and survey times.

Date and Time		Time weather recorded	Conditions
26/09/16	12.00pm-4.00pm	12.00pm	clear skies, light winds <sup>2</sup> and mild temperatures (12°C)
		04.00pm	80% cloud cover, light winds and mild temperatures (12°C)
27/09/16	8.00am-12.00pm	08.30am	clear skies, strong winds and mild temperatures (12°C)

The areas that occur beyond the development footprint were traversed on foot. During these traverses, any occurrences of Blackthorn were located and mapped. Where stands of Blackthorn were found:

- The aspect of the stand and its exposure to solar radiation was determined.
- Visual inspections to observe any butterfly activity were carried out. This involved the researcher positioning themselves to observe the majority of the stand, the researcher remaining in place for 10 minutes per site. Where required, binoculars were used to determine the features of any butterflies observed.
- Random plants were selected and searched for butterfly caterpillars.
- Random plants were selected and searched for ants.
- Plants were inspected to determine age (large plants and seedlings present), health (any new shoots present) and any evidence of grazing (chewed leaves).

To assist with the location of Blackthorn occurrences, reference was made to those identified, and mapped by Wildthing Environmental Consultants (2002).

A net was used to collect any butterflies observed. The butterfly net supported a 1 m long handle, a 300 mm wide opening and 4 mm wide mesh. Any butterflies collected were keyed out in accordance with the field guide, Butterflies of Australia (Braby 2016).

<sup>2</sup> As per Beaufort wind scale

Any ants collected were compared to both the descriptions, and images, provided for *Anonychomyrma itinerans* on the AntWeb website (AntWeb 2016). To assist with this a stereomicroscope was used.

All animals collected were released at their point of capture.

A known Purple Copper Butterfly reference site that is located adjacent to the Coxs River at Wallerawang, approximately 6 km north of Walkers Quarry, was inspected on 26 September 2016. This site was visited to determine the presence of any Purple Copper Butterfly, their attendant ants or caterpillars.

## 5. Limitations

No limitations due to site access were encountered. All portions of those areas that occur beyond the quarrying footprint could be easily accessed and traversed by foot.

The strong winds and mild temperatures experienced at the time of the field survey were considered to limit the detection of any flying butterflies. During the entire survey, the temperature did not appear to increase beyond the 12 degree mark.

Several of the sites where either Purple Copper Butterflies, or occurrences of Blackthorn, had previously been recorded (Wildthing Environmental Consultants 2002, Hunt 2009) have subsequently been cleared.

## 6. Results

### 6.1 Blackthorn habitat

With reference to Figure 2, it is noted that:

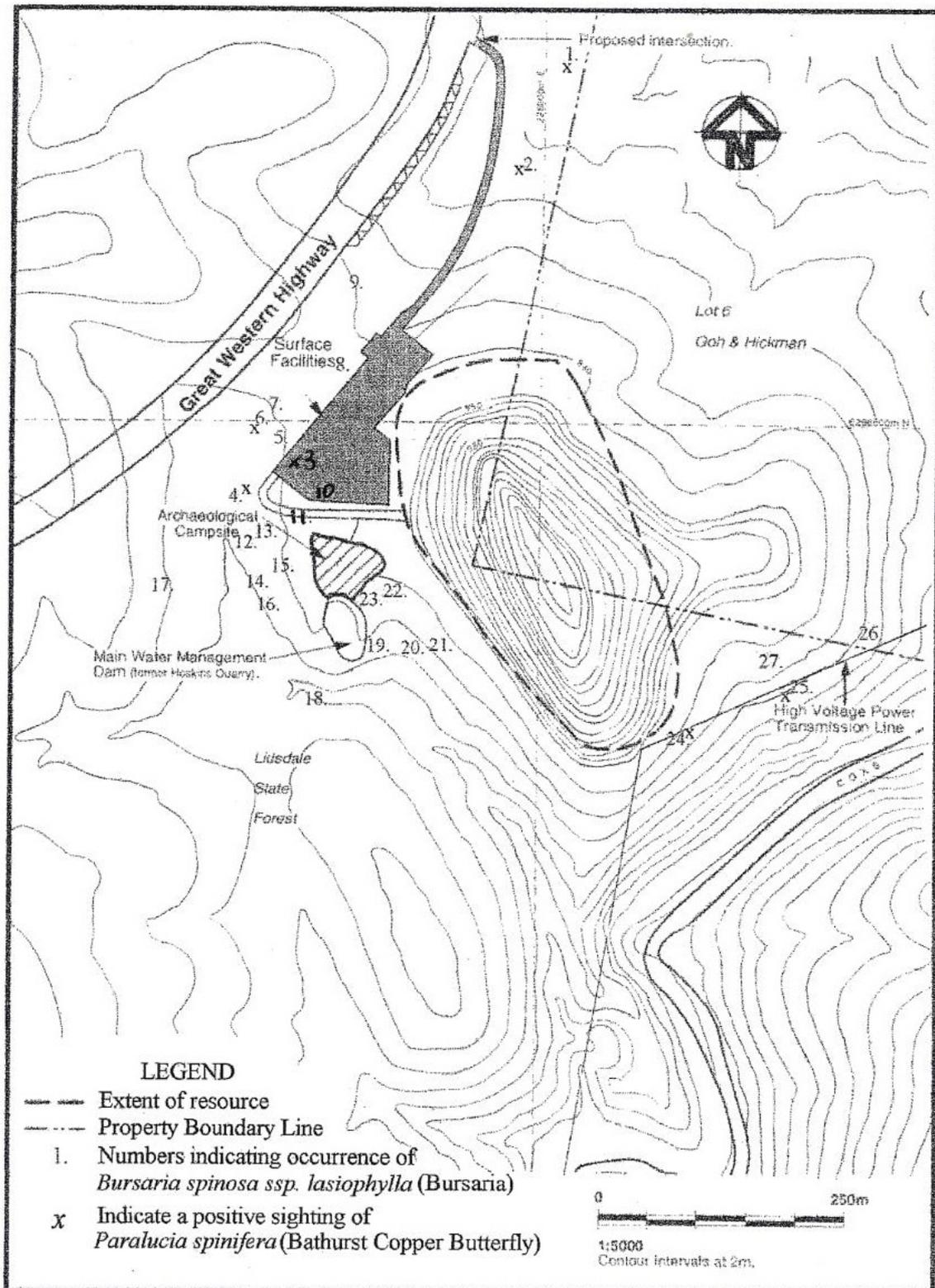
- Sites 1 and 2 appear to be north, and beyond the fenced limits, of the quarrying operation. These areas were not inspected.
- Sites 3 to 16 no longer exist, these portions of the quarry site being cleared and developed.
- Sites 22 and 23 no longer exist, these portions of the quarry site being cleared and developed.
- Sites 17 to 21 were relocated and mapped.
- Site 24 was relocated and mapped.
- Sites 25 to 27 occur north, and beyond the fenced limits, of the quarrying operation. These areas were not inspected.

For consistency, the numbering used by Wildthing Environmental Consultants (2002) will be adopted in this report.

It is acknowledged that, Sites 3 to 16, and 22 and 23, have been removed in accordance with the project's development consent and Mining Operation Plan.

It is noted that:

- Site 17 is located to the south of the ephemeral drainage line (Figure 3) (a central GPS position for this stand being Easting (E) 227721; Northing (N) 6296318).
- Site 18 is located east of 17, south of the ephemeral drainage line (E227888; N6296339) (Figure 3)
- Site 19 is located on the north side of the ephemeral drainage line, east of the 'old quarry' (E227949; N6296443) (Figure 3)
- Sites 20 and 21 are located on the north side of the ephemeral drainage line, approximately 50 m east of Site 19 (E228006; N6296445) (Figure 3)



Source Wildthing Environmental Consultants 2002

**Figure 2:** Previous locations of Blackthorn and positive observations of the Bathurst Copper Butterfly.

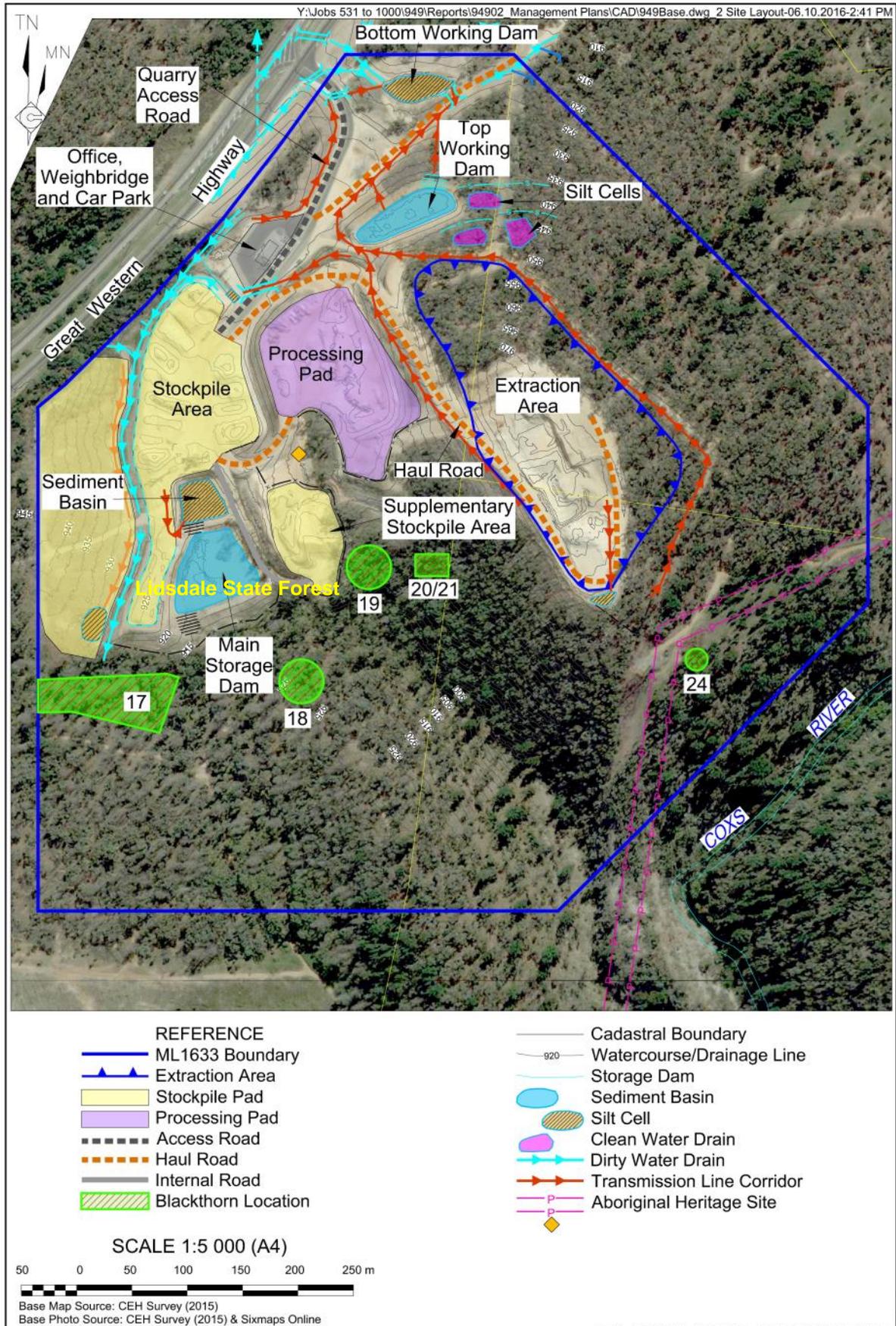


Figure 3: Sites where Blackthorn were located (September 2016).

- Site 24 is present within the high voltage transmission easement (E228245; N6296359) (Figure 3).

The Blackthorn stands are approximately:

- Site 17, this being the largest of the Blackthorn stands observed: 100 m x 30 m in size (0.3 ha)
- Site 18: 20 m x 20 m in size (0.04 ha)
- Site 19: 20 m x 20 m in size (0.04 ha)
- Sites 20/21: 30 m x 20 m in size (0.06 ha)
- Site 24: 20 m x 10 m in size (0.02 ha).

Of these five sites, Wildthing Environmental Consultants (2002) only observed Purple Copper Butterflies at Site 24.

As per Appendix 5 of the Purple Copper Butterfly Recovery Plan (NPWS 2001), assessment sheets have been produced for each of these sites (Appendix 1). Added to these sheets are descriptions of each site as per Appendix 2 of the Purple Copper Butterfly Recovery Plan (NPWS 2001).

Considering the requirement of a Purple Copper Butterfly site to a) be dominated by a Blackthorn understorey and b) be open and exposed to all-day sun, Sites 17, 18 and 24 would all meet these criteria. All of these sites have a north to north-east facing aspect and, at 8.30 am, the majority of Blackthorn plants present were exposed to full sun.

At Sites 17 and 18, treatment of the Radiata Pine has occurred; this opening up the tree canopy, whilst maintenance of the transmission easement has removed the tree canopy thereby exposing Site 24 to full sun.

Due to the proximity of Sites 17 and 18 (these being approximately 130 m apart) with rehabilitation, it would be possible to increase the area of habitat available to the Purple Copper Butterfly south of the ephemeral drainage line.

Sites 19 and 20 are located on the southern side of the quarry site, within a sheltered gully. Each of these sites are present mid-slope, approximately 50 m upslope of the ephemeral drainage line. Though present within an open woodland, neither site is considered to experience sufficient solar radiation.

## **6.2 Butterflies detected**

No Purple Copper Butterflies were observed during the field inspection. The only butterfly collected was an Australian Painted Lady (*Vanessa kershawi*), this being a common and widespread species (Braby 2016). This species was caught immediately south of the main storage dam.

At Site 24, a number of butterflies were observed, all appearing to exhibit similar features to the Australian Painted Lady. Though targeted, no butterflies were captured at this Site. This site is relatively sheltered from those westerly winds experienced at the time of the field investigation, this considered to have increased the butterfly activity observed.

No butterflies were observed at Sites 17, 18, 20 or 21.

Though targeted, no Purple Copper Butterflies, caterpillars or attendant ants were observed at the reference site.

### 6.3 Ants detected

At Site 20 an ant was collected from a Blackthorn plant. The ant was deceased, having been caught in a spider's web. The ant was approximately 8 mm long. Use of a stereomicroscope confirmed that the ant's features were not consistent with those of *Anonychomyrma itinerans*. The proximity of the eye to the antenna, and the shape of the rear part of the collected ant's thorax (its propodeum and petiole), were different to the images provided for *Anonychomyrma itinerans*.

A smaller ant was observed on a Blackthorn plant at Site 17. Efforts to collect this individual were unsuccessful.

## 7. Recommendations

To increase the habitat value of those areas that occur beyond the quarrying operation for the Purple Copper Butterfly, the following recommendations are presented:

- 1) Continual monitoring of Radiata Pine, particularly south of the ephemeral drainage line near Sites 17 and 18, with any individuals being treated/removed.
  - a. Inspections for, and removal of, any Radiata Pine seedlings should be undertaken biannually for the first year and annually each year after that.
- 2) Clearly highlight on site existing limits/approximate locations of Sites 17 and 18. Denoting these area would:
  - a. Minimise any indirect impact due to inadvertently entering these sites
  - b. Assist with future on-going monitoring as the patch size, this detecting any increase or decrease in the size of the stand.
- 3) Restriction of vehicle and machinery movement in (near to) Sites 17 and 18 thereby minimizing disturbance of any Blackthorn plants (and potential Purple Copper Butterfly habitat).
- 4) Management of the area between Sites 17 and 18, this to include the treatment of exotic species and the planting of Blackthorn plants, thereby increasing the extent of potential Purple Copper Butterfly habitat.
- 5) Management of Sites 17 and 18 through the planting of Blackthorn seedlings. These should be located within those gaps present between mature plants as the Purple Copper Butterfly larvae will not traverse open ground to reach host plants. Closely spaced Blackthorn with intertwining branchlets offer the best habitat for grazing larvae (NPWS 2001).
- 6) Weeding/treatment of exotic species such as Blackberry. Removal of exotic species would reduce competition pressures exerted on those native plants present.
- 7) Ongoing monitoring of Sites 17, 18 and 24 during climatic conditions suitable for the detection of the Purple Copper Butterfly.
  - a. Monitoring should be undertaken:
    - i. Annually
    - ii. Between early September and Mid-November
    - iii. Between 10.00 am and 4.00 pm
    - iv. On warm days when winds are low.

- b. Monitoring should include:
  - i. Ten minutes of direct observation undertaken at each Site to note any butterfly activity
  - ii. Establishment of a 10 m long transect through each Site along which the spacing of individuals, and number of Blackthorn plants present, should be determined
  - iii. Identification of the size of each stand and consideration if the stand has increased or decreased.
  - iv. Condition of stand (i.e. any seedlings or new growth on mature plants visible)
  - v. Presence of any weeds
  - vi. Evidence of grazing by caterpillars
  - vii. Presence of any butterflies, caterpillars or ants.
    - 1. Should butterflies, ants or caterpillars be observed/collected, the methods used to identify the species employed in this report should be adopted.
- 8) To permit qualitative ongoing comparisons to be made, monitoring of Sites 17, 18 and 24 should result in the completion of Site description records and assessment sheets as per Appendix 1.
- 9) Should Blackthorn be included in any site rehabilitation works, this should only be planted in areas where it was originally recorded (as per Wildthing Environmental Consultants 2002),. Some areas within the quarry were found to be suitable for this plant, but its presence was not detected during either the current, or previous investigations. Reasons for Blackthorn not having established in these area are unknown. Rehabilitation should aim at producing a Blackthorn 'patch' whose:
  - a. canopy is intertwined
  - b. canopy is exposed to a high level of solar radiation
  - c. canopy is overtopped by an open woodland.

## 8. References

Antweb 2016 *Anonychomyrma itinerans*, accessed September 2016, <<https://www.antweb.org/>>

Braby, M. F. 2016 *The complete field guide to butterflies of Australia*, 2<sup>nd</sup> Edition. CSIRO Publishing, Victoria

Hunt, A. 2009 *Site visits by Alan Hunt for Wallerawang Quarry, Great Western Highway*. Letter prepared for Walkers Quarry by A.Hunt, Little Hartley, NSW

Mjadwesch, R. and Nally, S. 2008 Emergency relocation of a Purple Copper Butterfly Colony during roadworks: Successes and lessons learned. *Ecological Management and Restoration* Vol 9, No 2 pp 100 - 109

National Parks and Wildlife Service 2001 *Approved recovery plan, Bathurst Copper Butterfly (*Paralucia spinifera*) Recovery Plan*. National Parks and Wildlife Service, Hurstville, NSW

GHD Pty Ltd 2013 *Great Western Highway (Forty Bends Upgrade) Purple copper Butterfly Management Plan*. Report prepared for the Roads and Maritime Services by GHD Pty Ltd, Sydney

Wildthing Environmental Consultants 2002 *Paralucia spinifera (Bathurst Copper Butterfly) survey for the proposed Wallerawang quarry near Wallerawang, NSW*. Report prepared for Pacrim Environmental Pty Ltd by Wildthing Environmental Consultants, Salt Ash, NSW

## Appendix 1: Site description records and assessment sheets

<b>Site:</b>	17	<b>Elevation:</b>	~922 m ASL
<b>AMG Easting</b>	227721	<b>Northing</b>	6296318
<b>Zone</b>	56		
<b>Date:</b>	27/09/16	<b>Time: (period)</b>	08.30-09.30
<b>Owner/Manager:</b>	Walkers Quarry		
<b>Weather:</b>	clear skies, strong winds and mild temperatures (12°C)		
<b>Site aspect:</b>	North facing slope, ~10°		
<b>Size of stand:</b>	100 m by 30 m		
<b>Butterfly:</b>	None observed. Other species of butterfly present in locality.		
<b>Blackthorn:</b>	Number plants present:	> 200 individuals	
	Shrub height:	0.1 m to 1.5 m	
	Mature plants present:	Yes	
	Seedlings present:	Yes	
	Any new plant growth:	Yes	
	Evidence of grazing:	Yes	
<b>Ants:</b>	One ant observed on a Blackthorn. Species unknown		
<b>Insects:</b>	European Honey Bees ( <i>Apis mellifera</i> ), Beetle (species unknown)		
<b>Weeds:</b>	Blackberry (along creek bank) and exotic pines (treated)		
<b>Actions required:</b>	Clearly identify location of site Restrict access to site Monitor presence of exotic pines Ensure quarrying activities do not affect this site		
<b>Photograph</b>			

<b>Site:</b>	18	<b>Elevation:</b>	~917 m ASL
<b>AMG Easting</b>	227888	<b>Northing</b>	6296339
<b>Zone</b>	56		
<b>Date:</b>	26/09/16	<b>Time: (period)</b>	14.00-14.40
<b>Owner/Manager:</b>	Walkers Quarry		
<b>Weather:</b>	clear skies, light winds and mild temperatures (12°C)		
<b>Site aspect:</b>	North facing slope, ~5°		
<b>Size of stand:</b>	20 m by 20 m		
<b>Butterfly:</b>	None observed. Other species of butterfly present in locality.		
<b>Blackthorn:</b>	Number plants present:	~ 25 individuals	
	Shrub height:	0.15 m to 1 m	
	Mature plants present:	Yes	
	Seedlings present:	Yes	
	Any new plant growth:	Yes	
	Evidence of grazing:	Yes	
<b>Ants:</b>	None observed		
<b>Insects:</b>	None observed		
<b>Weeds:</b>	Blackberry (along creek bank) and exotic pines (treated)		
<b>Actions required:</b>	Clearly identify location of site Restrict access to site Monitor presence of exotic pines Ensure quarrying activities do not affect this site		
<b>Photograph</b>			

<b>Site:</b>	19	<b>Elevation:</b>	~915 m ASL
<b>AMG Easting</b>	227949	<b>Northing</b>	6296443
<b>Zone</b>	56		
<b>Date:</b>	26/09/16	<b>Time: (period)</b>	13.00-13.40
<b>Owner/Manager:</b>	Walkers Quarry		
<b>Weather:</b>	clear skies, light winds and mild temperatures (12°C)		
<b>Site aspect:</b>	East facing slope, ~30°		
<b>Size of stand:</b>	20 m by 20 m		
<b>Butterfly:</b>	None observed		
<b>Blackthorn:</b>	Number plants present:	~ 60 individuals	
	Shrub height:	0.3 m to 0.5 m	
	Mature plants present:	Yes	
	Seedlings present:	Yes	
	Any new plant growth:	Yes	
	Evidence of grazing:	No	
<b>Ants:</b>	None observed		
<b>Insects:</b>	European Honey Bees ( <i>Apis mellifera</i> )		
<b>Weeds:</b>	None observed		
<b>Actions required:</b>	Clearly identify location of site Restrict access to site Ensure quarrying activities do not affect this site		
<b>Photograph</b>			

<b>Site:</b>	20 / 21	<b>Elevation:</b>	~910 m ASL
<b>AMG Easting</b>	228006	<b>Northing</b>	6296445
<b>Zone</b>	56		
<b>Date:</b>	26/09/16	<b>Time: (period)</b>	15.00-16.00
<b>Owner/Manager:</b>	Walkers Quarry		
<b>Weather:</b>	80% cloud cover, light winds and mild temperatures (12°C)		
<b>Site aspect:</b>	South facing slope, ~30°		
<b>Size of stand:</b>	30 m by 20 m		
<b>Butterfly:</b>	None observed		
<b>Blackthorn:</b>	Number plants present:	~ 15 / 100 m <sup>2</sup>	
	Shrub height:	0.2 m to 1 m	
	Mature plants present:	Yes	
	Seedlings present:	Yes	
	Any new plant growth:	Yes	
	Evidence of grazing:	Yes	
<b>Ants:</b>	Yes but not <i>Anonychomyrma itinerans</i>		
<b>Insects:</b>	Beetles present on plants (species unknown)		
<b>Weeds:</b>	None observed		
<b>Actions required:</b>	Clearly identify location of site Restrict access to site Ensure quarrying activities do not affect this site		
<b>Photograph</b>			

<b>Site:</b>	24	<b>Elevation:</b>	~955 m ASL
<b>AMG Easting</b>	228245	<b>Northing</b>	6296359
<b>Zone</b>	56		
<b>Date:</b>	27/09/16	<b>Time: (period)</b>	10.00-11.00
<b>Owner/Manager:</b>	Walkers Quarry		
<b>Weather:</b>	clear skies, strong winds and mild temperatures (12°C)		
<b>Site aspect:</b>	North-east facing slope, ~20°		
<b>Size of stand:</b>	20 m by 10 m		
<b>Butterfly:</b>	None observed. Other species of butterfly present.		
<b>Blackthorn:</b>	Number plants present:	20 individuals / 100 m <sup>2</sup>	
	Shrub height:	0.1 m to 1.5 m	
	Mature plants present:	Yes	
	Seedlings present:	Yes	
	Any new plant growth:	Yes	
	Evidence of grazing:	Yes	
<b>Ants:</b>	None observed		
<b>Insects:</b>	European Honey Bees ( <i>Apis mellifera</i> ), Grasshopper (species unknown)		
<b>Weeds:</b>	None observed		
<b>Actions required:</b>	Clearly identify location of site Restrict access to site Monitor presence of exotic pines Ensure quarrying activities do not affect this site		
<b>Photograph</b>			