ATTACHMENT A

COWAL GOLD OPERATIONS PROCESSING RATE MODIFICATION - FLORA AND FAUNA SURVEY REPORT

Cowal Gold Operations Processing Rate Modification - Flora and Fauna Survey Report

Prepared by AMBS Ecology & Heritage
for Evolution Mining (Cowal) Pty Limited

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Executive Summary

AMBS Ecology & Heritage Pty Ltd was commissioned by Evolution Mining (Cowal) Pty Limited (Evolution) to undertake flora and fauna surveys in study areas associated with both the Cowal Gold Operations (CGO) and a proposed mine processing rate modification (the Modification). The study area incorporated two sections: one immediately south, west and north of the current CGO lease area, incorporating a section of the western lake edge; and the other on the eastern side of Lake Cowal, consisting of a proposed pipeline corridor following existing tracks/road easements.

Flora and fauna surveys were undertaken between winter 2016 and spring 2017. Flora surveys included the collection of vegetation condition assessment data and targeted surveys for threatened species listed under the *Biodiversity Conservation Act 2016* (BC Act) and/or the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Full floristic data was used to verify previous vegetation mapping and subsequent reclassification into Biometric Vegetation Types (BVTs) using the Office of Environment and Heritage (OEH) *Archived Over-cleared Vegetation Types Data*.

The fauna surveys involved targeted searches for the Sloane's Froglet (*Crinia sloanei)*, deployment of remote cameras and hair tubes to survey for Spotted-tailed Quoll (*Dasyurus maculatus)*, and bird surveys targeting the Regent Honeyeater (*Anthochaera phrygia*) and the Swift Parrot (*Lathamus discolor*). Spring surveys involved a wider variety of techniques, including diurnal bird surveys, reptile surveys, nocturnal call playback, spotlighting, stag watching, harp trapping and Anabats. A greater survey effort focused on the Koala (*Phascolarctos cinereus*) and the Superb Parrot (*Polytelis swainsonii*).

Historically, the study area would have supported a mosaic of woodland communities comprising alluvial and floodplain transitional vegetation communities that reflect local soil and drainage patterns. Extensive clearing, primarily for the purposes of agriculture, has created a landscape now characterised by disturbed derived grasslands (used mainly for grazing and cropping) with scattered individual trees and woodland remnants.

The analysis of floristic data collected during this survey assigned six BVTs/PCTs to the study area:

- BVT LA212/PCT26 - Weeping Myall open woodland of the Riverina Bioregion and New South Wales (NSW) South Western Slopes Bioregion;
- BVT LA152/PCT82: Inland Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion;
- BVT LA191/PCT249: River Red Gum - Veined Swamp Wallaby Grass grassy tall woodland of depressions on floodplains and alluvial plains;
- BVT LA105/PCT55: Belah woodland on alluvial plains in central-north NSW;
- BVT LA144/PCT185: Dwyer's Red Gum - White Cypress Pine - Currawang shrubby woodland; and
- BVT LA138/PCT250: Derived tussock grasslands of the central western plains and lower slopes of NSW.

Four land use types were mapped that did not correspond to a BVT/Plant Community Type (PCT), including cropped land, plantings, cleared land and the lake bed (which was inundated with water at the time of the surveys).

Within the study area, the following Endangered Ecological Communities (EECs) listed under the BC Act and/or the EPBC Act were recorded:

- Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (BC Act) and Weeping Myall Woodlands (EPBC Act). These listings covered a combined area of 91 hectares (ha) and comprised BVT LA212, in low and moderate condition; and
- Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (BC Act) and Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (EPBC Act), which covered a combined area of 113 ha and comprised BVT LA152 in low and moderate condition.

No threatened plants listed under the BC Act or EPBC Act were recorded during the current surveys.

The fauna surveys recorded nine species listed as vulnerable under the BC Act, namely the Superb Parrot (*Polytelis swainsonii*), the White-fronted Chat (*Epthianura albifrons*), the Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*), the Black Falcon (*Falco subniger*), the Major Mitchell's Cockatoo (*Lophochroa leadbeateri*), the Yellow-bellied Sheath-tail Bat (*Saccolaimus flaviventris*), the Magpie Goose (*Anseranas semipalmata*), the Little Eagle (*Hieraaetus morphnoides*) and the White-bellied Sea-eagle (*Haliaeetus leucogaster*). The Superb Parrot is also listed as vulnerable under the EPBC Act. Two species listed as Migratory under the EPBC Act were detected within or near the study area: the Common Sandpiper (*Actitis hypoleucos*) and the Glossy Ibis (*Plegadis falcinellus*).

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1 Introduction

1.1 Background

AMBS Ecology & Heritage Pty Ltd (AMBS) was commissioned by Evolution Mining (Cowal) Pty Limited (Evolution) to undertake flora and fauna surveys in study areas associated with both the Cowal Gold Operations (CGO) and a proposed mine processing rate modification (the Modification). The results of the surveys are provided in this report.

1.2 Location of Study Area

The study area is located adjacent to Lake Cowal, within the Central West Slopes region of New South Wales (NSW) (Figure 1.1). The study area incorporates two sections; one occurs on the western side of Lake Cowal adjacent to the CGO within the Bland Shire local government area (LGA); and another occurs on the eastern side of Lake Cowal within the Forbes LGA.

The western section is located within Mining Lease (ML) 1535 and north of the ML, incorporating a section of the lake edge. The eastern section consists of a proposed pipeline corridor following existing tracks.

1.3 Regional Setting

Lake Cowal is located approximately 35 kilometres (km) north-east of West Wyalong and 53 km south-west of Forbes in Central NSW. The Lake itself forms part of an ephemeral inland wetland system of the Lachlan Catchment and, in 1992, was listed by the Australian Heritage Commission on the Register of the National Estate, Australian Directory of Important Wetlands (LCF 2017).

Lake Cowal is located within the Lower Slopes subregion of the NSW South Western Slopes Interim Biogeographic Regionalisation for Australia (IBRA) Region, an area characterised by the extensive foothills, isolated ranges and inland slopes of the Great Dividing Range (Thackway & Cresswell 1995, Environment Australia 2000). Previously administered by the Lachlan Catchment Management Authority, Lake Cowal now falls under the revised Riverina Local Land Services (LLS) division.

1.4 Climate

The closest Commonwealth Bureau of Meteorology (BoM) weather stations are the Wyalong Post Office (073054) and the West Wyalong Airport Automatic Weather Station (AWS) (050017), which are approximately 33 km south-west of the study area.

The area receives on average, 462.8 millimetres (mm) per annum, predominantly through winter, spring and summer (BoM 2018a). Monthly climate statistics indicate that, on an 18-year average between 1999 and 2017 although rainfall is generally spread throughout the year, the lowest rainfall occurs on average in autumn (April, 18.9 mm), with the highest rainfall occurring in spring (peaking in December, 53.6 mm) (BoM 2018a). These records vary slightly when taken from the West Wyalong Post Office, which averages 479.6 mm per annum (BoM 2018b). Rainfall from year to year may vary widely, as can be seen in Figure 1.2, where total rainfall in 2016 was 190.8 mm above the average and 2017 recorded a lower than average rainfall of 415.4 mm (BoM 2018b).

Averaged over an 18-year period, temperatures range between -5.6 degrees Celsius (°C) and 46.3°C (BoM 2018a). The warmest month is usually January (mean maximum 37°C, minimum 29°C) and the coolest is July (mean maximum 16°C, minimum 12.5°C) (West Wyalong Airport AWS).

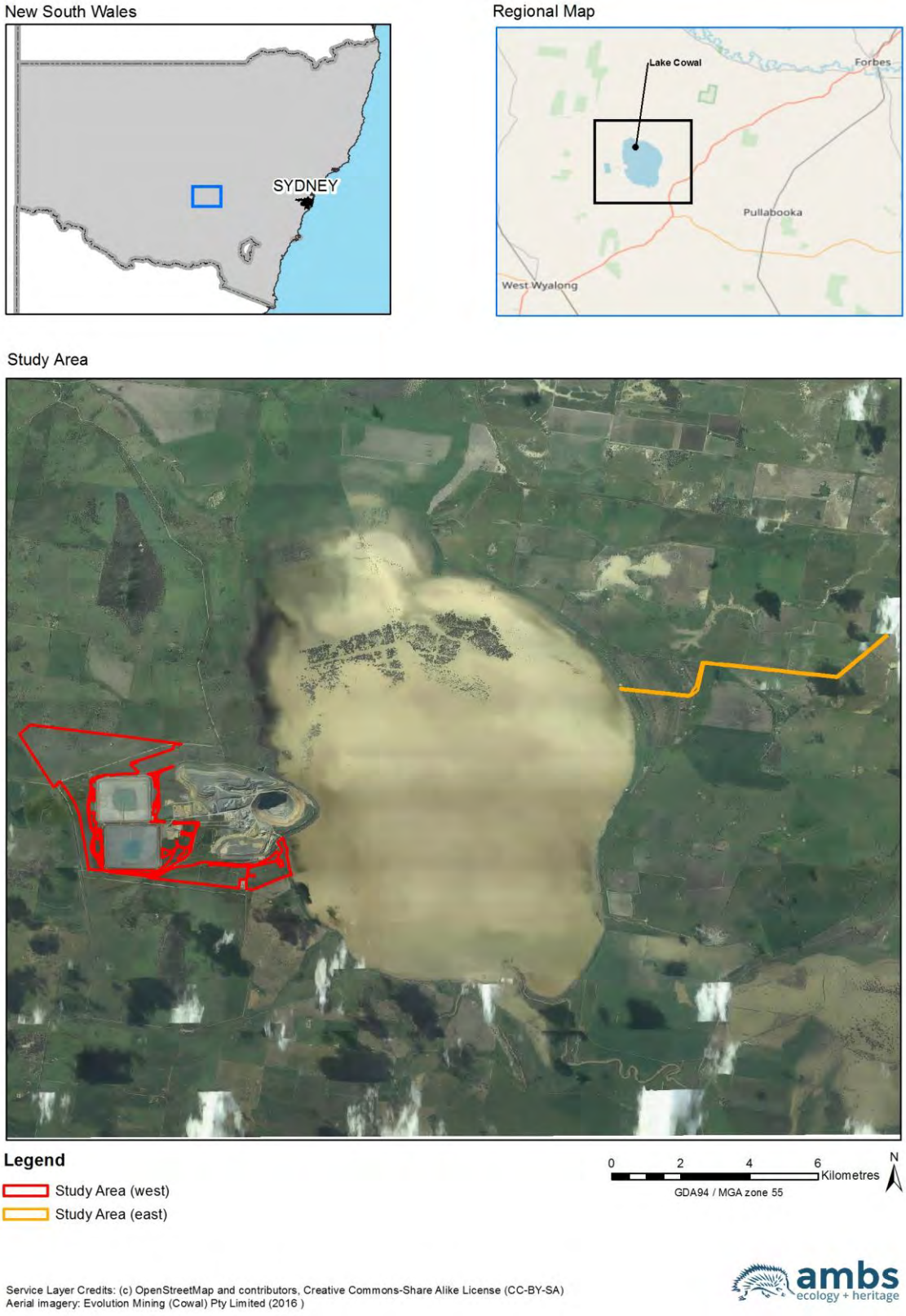

Figure 1.1 Location of the study area

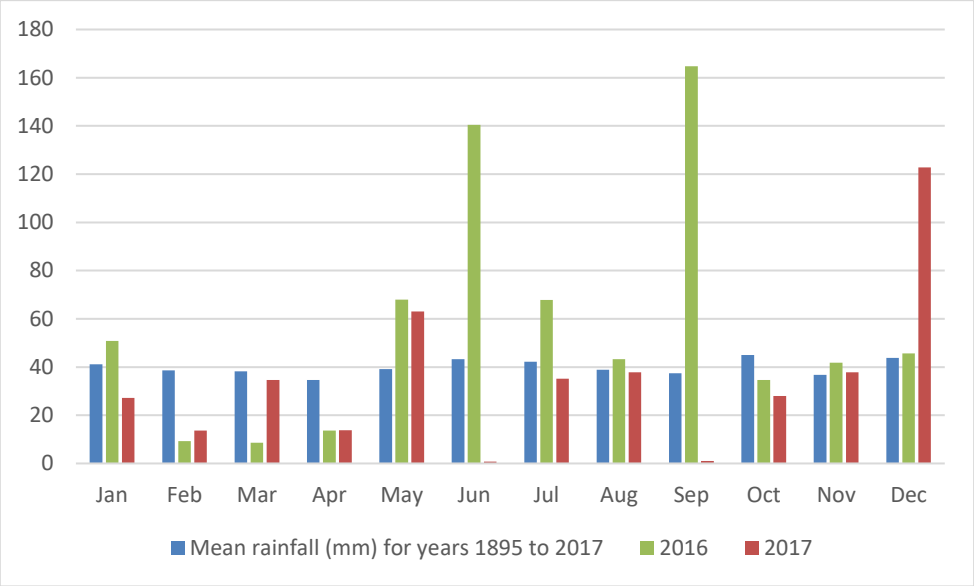

Figure 1.2 Rainfall for 2016 and 2017 compared to mean rainfall (BoM 2018b).

1.5 Landform and Hydrology

The study area is located in the alluvial fan of the Lachlan River known as the Jemalong Plains, part of the Riverina landform. Geologically, it lies on bedrock of the Lake Cowal Volcanic Complex, on the eastern margin of the Gilmore Fault Zone within the Lachlan Fold Belt of Central NSW (Miles & Brooker 1998).

The study area is adjacent to Lake Cowal. Lake Cowal is the largest inland freshwater lake in NSW, covering approximately 13,000 hectares (ha). When full, the lake measures approximately 21 km north-south and 9.5 km east-west. It is filled predominantly by Bland Creek from the south, however, it is also fed by the Lachlan River during flooding. Another lake, Nerang Cowal, lies to the immediate north of the study area and fills less frequently from the overflow from Lake Cowal. Historically, Lake Cowal contains at least some water around 50 per cent (%) of the time; however, prolonged dry periods of up to 30 years have occurred since the early 20th century (LCF 2017).

1.6 Land Use

The western portion of the study area incorporates a section within ML 1535, and a section outside of ML 1535 further to the north-west. The section of the study area which overlaps with ML 1535 supports a range of land uses associated with the CGO. Vegetated areas within the ML are not currently grazed by livestock. The section of the western study area outside ML 1535 has historically been used for grazing and/or cropping; however, the current land use is restricted to light grazing.

For most of its length, the study area on the eastern side of Lake Cowal is adjacent to road corridors, including Lake Road, Lows Road and Websters Road. A section of approximately 1.4 km, heading east from the edge of Lake Cowal, cuts through a cropped paddock adjacent to a narrow canal. In this section of the study area, the lake edge associated with the woodland fringe is currently grazed by cattle.

1.7 Vegetation

The study area falls within the NSW botanical division of Central Western Slopes, and incorporates mainly alluvial and floodplain transitional vegetation communities that are broadly classified by Keith (2006) as Floodplain Transition Woodlands, Western Slopes Grasslands, Riverine Plains Woodlands and Inland Floodplain Swamps. Historically, the study area would have supported a mosaic of woodland communities reflecting local soil and drainage patterns. Extensive clearing, primarily for the purposes of agriculture, has created a landscape now characterised by disturbed derived grasslands (used mainly for grazing and cropping) with scattered individual trees and woodland remnants. Hills and slopes with shallow rocky soils and poor grazing potential retain some remnant vegetation; however, these features are not present in the study area.

The vegetation of the study area and surrounds has been previously surveyed and mapped for the purposes of environmental assessments related to the CGO. Australian Museum Business Services (2012) characterised the following vegetation communities within some sections of the current study area:

- C1: Weeping Myall – Belah – Poplar Box Shrubland and Woodland;
- C2: Spear Grass – Windmill Grass Grassland and Low Open Grassy Woodland;
- C3: Inland Grey Box – Belah – Poplar Box Woodland;
- C8: River Red Gum Woodland and Forest;
- C4: Mugga Ironbark – Dwyer's Red Gum – White Cypress Pine Woodland; and
- C7: Sedgeland/Herbfield.

Portions of these vegetation communities were mapped as representing Threatened Ecological Communities (TECs).

Recent vegetation assessment for the Central West Lachlan Region (OEH 2015) maps the following plant community types (PCTs) as occurring in the vicinity of the study area:

- 76 Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions;
- 82 Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion;
- 185 Dwyers Red Gum - White Cypress Pine - Currawang low shrub-grass woodland of the Cobar Peneplain Bioregion;
- 250 Derived tussock grassland of the central western plains and lower slopes of NSW;
- 26 Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion;
- 249 River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW;
- 55 Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions;
- 53 Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains; and
- 45 Plains Grass grassland on alluvial mainly clay soils in the Riverina Bioregion and the NSW South Western Slopes Bioregion.

Large portions of the study area are mapped as "not native" vegetation.

1.8 Scope and Objectives

The objectives of the study were to undertake the following tasks within the study area:

- re-map previous vegetation mapping (Australian Museum Business Services 2012) to contemporary requirements (in accordance with the *Framework for Biodiversity Assessment NSW Biodiversity Offsets Policy for Major Projects* (FBA) (OEH 2014), which was released in 2014 [after the previous mapping]), including TECs;
- assign Biometric Vegetation Types (BVTs) and PCTs;
- collect biometric data in accordance with the FBA (OEH 2014);
- undertake targeted searches for potentially occurring threatened flora and fauna species under the then *NSW Biodiversity Conservation Act 2016* (BC Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), including threatened flora species previously recorded in or near the study area, e.g. *Pilularia novae-hollandiae* (Austral Pillwort);
- provide a description of any threatened species recorded and map their locations;
- provide a description and mapping of flora and fauna habitats and their condition;
- produce a list of flora species identified in the study area, including invasive species;
- produce a list of invasive fauna species present;
- provide lists of fauna species identified in the study area, including their abundance; and
- prepare a report documenting the survey methods and findings.

These tasks were previously undertaken for parts of the current study area, specifically the pipeline corridor and a small area to the west of Lake Cowal, during a separate study by AMBS (2017).

2 Methods

2.1 Literature and Database Review

A 'desktop' study of threatened species information and local reports was conducted prior to undertaking field surveys. This included:

- a review of the previous vegetation surveys and classification for the study area (Australian Museum Business Services 2012, OEH 2015, AMBS 2017);
- database searches for threatened plant records in the region, using the Department of the Environment and Energy (DEE) Protected Matters Search Tool (DEE 2017) and BioNET (OEH 2017a);
- database searches for threatened fauna records in the region, using the DEE Protected Matters Search Tool (DEE 2017), the Office of Environment and Heritage search of threatened species by Catchment Management Authority (CMA) region and subregion (OEH 2017b) and BioNET (OEH 2017a);
- a review of the ecology of target threatened flora and fauna species using information from the NSW Threatened Species Profile database (OEH 2017b), NSW Plant Information Network (PlantNet 2017), the Atlas of Living Australia (ALA 2017) and details from records in the Australasian Virtual Herbarium (AVH 2017); and
- a review of all other relevant documentation for the study area, particularly previous reports, such as those containing threatened species records (e.g. AMBS 2017, Remnant Enhancement Monitoring Reports by DnA Environmental 2008, 2009, 2010).

2.2 Flora

2.2.1 Overview

Three field surveys were undertaken between August and November 2017 (see Table 2.1). At some locations in the study area (the eastern side of Lake Cowal and south of the CGO mine site), data had already been collected as part of a 2016 assessment (13 plots) (AMBS 2017). The data from these locations has been incorporated into the results for this report.

Table 2.1 Flora surveys undertaken for the current report

Date	Purpose	Personnel
10 – 14 August	Target winter-flowering threatened plants; ground-truth previous vegetation maps and assign/confirm plant communities and threatened ecological community; assign plot vegetation zones.	Belinda Pellow; Tom O'Sullivan
17 – 23 September	Target spring-flowering threatened plants; confirm altered plant communities; collect data from allocated plots.	James Schlunke; Tom O'Sullivan
22 – 23 November	Target the threatened plant *Lepidium monoplocoides* (Winged Peppercress); collect data from allocated plots.	James Schlunke; James Rees

2.2.2 Plant Community Verification

In 15 locations identified prior to the August field survey, rapid assessment plots were used to collect data for preparation of a preliminary plant community map (Figures 3.1 and 3.2). Sites were chosen based on interpretation of aerial imagery and previous mapping. Data collected at each site included dominant species in each structural layer; surface features such as rock, litter, bryophytes and bare ground; level of disturbance; soil characteristics; land use; land cover; and factors that influence overall condition, such as native versus exotic cover.

The preliminary map was refined using full floristic data collected from 21 plots during the September field survey, and data collected from 13 plots within the study area in 2016 (Figures 3.1 and 3.2).

Plant communities were determined by examining previous vegetation maps for the study area and surrounds (Australian Museum Business Services 2012, OEH 2015, AMBS 2017) and comparing this mapping to data collected and observations made during the field surveys. Multivariate analyses of floristic data collected during the survey did not provide clarity on distinctions between plant communities or any historic pre-clearing information, as clearing, followed by many years of grazing, has resulted in a suite of native species becoming ubiquitous across the landscape. In addition, the dry period prior to surveys impacted the number of species recorded in each plot. Community descriptions were prepared using information collected from rapid assessment plots and from the FBA plot data (see Section 2.2.3).

The following information was used to prepare the plant community map:

- current aerial imagery of the study area to interpret variations in vegetation;
- recent mapping (OEH 2015) of the region to identify potential PCTs for the study area and surrounds;
- descriptions of potential PCTs, including species composition, structure and associated landforms;
- information on soil and associated vegetation from the soil landscape profiles (King 1998) for the area;
- data collected across the study area in 2012, 2016 and 2017 on species composition and vegetation structure;
- data collected on soil characteristics at selected sites across the study area; and
- final determination and listing advice for the two threatened communities; Box Gum Woodland and Myall Woodland, known to occur in the area (NSW Scientific Committee 2011a, 2011b, Threatened Species Scientific Committee 2010, Threatened Species Scientific Committee 2008).

Plant species identifications were checked against descriptions and distribution information provided by PlantNet (2017), to confirm that the species identified were known for the region and the habitat in which they were located.

2.2.3 FBA Vegetation Condition Data Collection

Plant community types identified in the preliminary plant community map were categorised according to the NSW FBA Offsets Policy for Major Projects (OEH 2014), which uses either Low or Moderate to Good condition states. All vegetation not conforming to the FBA definition of Low condition, as described below, is classified as being in Moderate to Good condition.

Vegetation in low condition:

a) woody native vegetation with:

- *native over-storey percent foliage cover less than 25% of the lower value of the over-storey percent foliage cover benchmark for that vegetation type, and*
  - *i. – less than 50% of groundcover vegetation is indigenous species, or*
  - *ii. – greater than 90% of groundcover vegetation is cleared.*

OR

b) native grassland, wetland or herbfield where:

- *less than 50% of groundcover vegetation is indigenous species, or*
- *more than 90% of groundcover vegetation is cleared.*

Vegetation zones were then designated using the plant community type and condition state. Under the FBA (OEH 2014) a set number of plots is required, depending on area and condition state (Table 2.2). The location of the surveyed plots is shown on Figure 3.1 and Figure 3.2.

FBA vegetation condition data collection consists of recording plant species composition data (Table 2.3), as well as a range of geophysical parameters, including habitat structure and species composition information.

Table 2.2 Minimum number of transects/plots required per zone area (Source: OEH 2014)

Vegetation zone area (ha)	Minimum number of transects/plots
0–4	1 transect/plot per 2 ha (or part thereof) or 1 transect/plot if vegetation is in low condition
> 4–20	3 transects/plots or 2 transects/plots if vegetation is in low condition
> 20–50	4 transects/plots or 3 transects/plots if vegetation is in low condition
> 50–100	5 transects/plots or 3 transects/plots if vegetation is in low condition
> 100–250	6 transects/plots or 4 transects/plots if vegetation is in low condition
> 250–1,000	7 transects/plots or 5 transects/plots if vegetation is in low condition. More transects/plots may be needed if the condition of the vegetation is variable across the zone
> 1,000	8 transects/plots or 5 transects/plots if vegetation is in low condition or in a homogenous landscape in the Western Division. More transects/plots may be needed if the condition of the vegetation is variable across the zone

Table 2.3 FBA vegetation condition data collected (Source: OEH 2014)

Attribute	Survey Requirement
Stratum and layer	Stratum and layer in which each species occurs
Growth form	Growth form for each recorded species
Species name	Scientific name and common name
Cover	A measure or estimate of the appropriate cover measure for each recorded species; recorded from 1–5% and then to the nearest 5%. If the cover of a species is less than 1% and the species is considered important, then the estimated cover is entered (e.g. 0.4)
Abundance rating	A relative measure of the number of individuals or shoots of a species within the plot. Use the following intervals; numbers above 20 are estimates only: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1,000 or specify a number greater than 1,000 if required

2.2.4 Threatened Plant Species Targeted Surveys

Targeted surveys were carried out to detect the occurrence of threatened plant species listed under the BC Act or EPBC Act. OEH (2017d) lists the following threatened plant species in the Lachlan CMA as associated with the BVTs in the study area:

- *Amphibromus fluitans* (Floating Swamp Wallaby-grass) (BC Act - Vulnerable, EPBC Act - Vulnerable)
- *Austrostipa metatoris* (A Speargrass) (BC Act - Vulnerable, EPBC Act - Vulnerable)
- *Austrostipa wakoolica* (A Speargrass) (BC Act - Endangered, EPBC Act - Endangered)
- *Cullen parvum* (Small Scurf-pea) (BC Act - Endangered)
- *Diuris tricolor* (Pine Donkey Orchid) (BC Act - Vulnerable)
- *Lepidium aschersonii* (Spiny Peppercress) (BC Act - Vulnerable, EPBC Act - Vulnerable)
- *Lepidium monoplocoides* (Winged Peppercress) (BC Act - Endangered, EPBC Act - Endangered)
- *Leptorhynchos orientalis* (Lanky Buttons) (BC Act - Endangered)
- *Monotaxis macrophylla* (Large-leafed Monotaxis) (BC Act - Endangered)
- *Philotheca ericifolia* (EPBC Act – Vulnerable)
- *Pilularia novae-hollandiae* (Austral Pillwort) (BC Act - Endangered)
- *Senecio garlandii* (Woolly Ragwort) (BC Act – Vulnerable)
- *Swainsona murrayana* (Slender Darling Pea) (BC Act - Vulnerable, EPBC Act - Vulnerable)
- *Swainsona plagiotropis* (Red Darling Pea) (BC Act - Vulnerable, EPBC Act - Vulnerable)
- *Swainsona sericea* (Silky Swainson-pea) (BC Act - Vulnerable)

Based on our desktop review of relevant databases and the broad habitat types available in the locality, several additional threatened plant species were considered to have the potential to occur in the study area. These species were:

- *Acacia ausfeldii* (Ausfeld's Wattle) (BC Act – Vulnerable)
- *Distichlis distichophylla* (Australian Saltgrass) (BC Act – Endangered)
- *Dysphania plantaginella* (BC Act – Endangered)
- *Eleocharis obicis* (Spike-Rush) (BC Act - Vulnerable, EPBC Act - Vulnerable)
- *Kippistia suaedifolia* (Fleshy Minuria) (BC Act – Endangered)
- *Wilsonia rotundifolia* (Round-leafed Wilsonia) (BC Act – Endangered)

Three threatened species have previously been recorded within the vicinity of the study area: *Pilularia novae-hollandiae* (Clements & Rodd, 1995; Bower, 1998, Bower, 2003, OEH, 2017a), *Wilsonia rotundifolia* (DNA 2008, DNA 2010, OEH 2017a) and *Austrostipa wakoolica* (A spear-grass) (OEH 2017a).

Survey timing occurred outside of the summer period as required for *Cullen parvum.* This species was targeted during December surveys by AMBS 2017.
Potential threatened flora species likely to occur within the study area have been included in Appendix D.

Surveys for threatened plants were undertaken across the entire study area; these included targeted parallel transects, surveys in and around each of the transects/plots, and random traverses (e.g. searches undertaken opportunistically when walking to and from survey site locations).

Parallel transects were used in locations that were considered to represent potential habitat for a threatened plant. Parallel transects involved observers walking in parallel straight lines approximately 10 metres (m) apart, consistent with the *NSW Guide to Surveying Threatened Plants* (OEH 2016). Areas that were targeted during the surveys included ephemerally wet areas and areas

of existing woodland. Ephemerally wet areas (gilgai depressions, roadside drainage lines, dams and lake edges) were searched for the presence of *Pilularia novae-hollandiae*, *Wilsonia rotundifolia, Dysphania plantaginella, Distichlis distichophylla, Lepidium monoplocoides* and *Eleocharis obicis*.

For each threatened flora species found, the following would be recorded:

- extent of each occurrence;
- population counts or population estimates; and
- detailed habitat description and condition.

2.2.5 Endangered Ecological Communities

Previous interpretation of the EPBC Act listing criteria and BC Act final determination criteria designated sections of the study area as conforming to TECs (Australian Museum Business Services 2012). The resulting Endangered Ecological Community (EEC) boundaries, as determined by Australian Museum Business Services (2012), were verified by the assessment of condition, structural characteristics, presence of characteristic species for the relevant TEC, and presence and species type of any canopy regeneration.

Vegetation was classified as TECs, based on criteria outlined in the relevant EPBC Act listing advice and BC Act final determinations. Determination of patches of vegetation that conformed to these criteria was based on interpretation of information from desktop assessment and field surveys, including soils, topography, patch size (ha), characteristic species, proximity to identified stands of the relevant EEC, degree of past disturbance, indications of past canopy using isolated canopy trees, and dead identifiable canopy trees or regenerating canopy species.

2.3 Fauna

2.3.1 Nomenclature

The nomenclature of all threatened species follows the Threatened Species Profiles provided by the OEH (OEH 2017b). For species not listed in NSW but listed federally under the EPBC Act 1999, the nomenclature follows that used on the EPBC threatened species list. For non-threatened species the following applies:

- Frog species nomenclature follows *Reptiles and Amphibians of Australia* (Cogger 2014);
- Reptile species nomenclature follows *A Complete Guide to Reptiles of Australia* (Wilson & Swan 2017);
- Mammal species nomenclature follows *Field Companion to the Mammals of Australia* (Van Dyck et al. 2013), with the exception of the free-tail bat genus *Mormopterus* which follows Reardon et al. (2014); and
- Bird species nomenclature follows the BirdLife Australia Working List v2.1. (BirdLife Australia 2017).

2.3.2 Threatened Fauna Database Records

Ninety-one threatened fauna species have been recorded within the Lachlan CMA (Appendix E). Threatened fauna species known or predicted to occur in the Lachlan CMA, that are associated with BVTs in the study area (OEH 2017d) and classified as “Species Credit” species or “Ecosystem and Species Credit” species, are listed in Table 2.4. Also listed are Threatened fauna under the EPBC Act that are known or considered likely to occur (Table 2.4). Particular survey techniques were also applied for several species listed as “Ecosystem Credit” species; these species are included in Table 2.4 for completeness.

Table 2.4: Threatened fauna within the Lachlan CMA associated with the BVTs in the study area

Common Name	Scientific Name	BC Act Status	EPBC Act Status	Class of Credit
Sloane's Froglet	*Crinia sloanei*	Vulnerable	-	Species
Pink-tailed Legless Lizard	*Aprasia parapulchella*	Vulnerable	Vulnerable	Species
Australasian Bittern	*Botaurus poiciloptilus*	Endangered	Endangered	Species
Grey Falcon	*Falco hypoleucos*	Endangered	-	Species
Black-breasted Buzzard	*Hamirostra melanosternon*	Vulnerable	-	Species
White-bellied Sea-eagle	*Haliaeetus leucogaster*	Vulnerable	-	Ecosystem and Species
Bush Stone-curlew	*Burhinus grallarius*	Endangered	-	Ecosystem
Australian Painted Snipe	*Rostratula australis*	Endangered	Endangered	Ecosystem
Bar-tailed Godwit	*Limosa lapponica*	-	Migratory	Ecosystem
Curlew Sandpiper	*Calidris ferruginea*	Endangered	Critically Endangered/ Migratory	Ecosystem
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	Vulnerable	-	Ecosystem
Swift Parrot	*Lathamus discolor*	Critically Endangered	Endangered	Ecosystem
Superb Parrot	*Polytelis swainsonii*	Vulnerable	Vulnerable	Ecosystem and Species
Barking Owl	*Ninox connivens*	Vulnerable	-	Ecosystem
White-browed Treecreeper population in Carrathool LGA south of the Lachlan River and Griffith LGA	*Climacteris affinis - endangered population*	Endangered	-	Species
Regent Honeyeater	*Anthochaera phrygia*	Critically Endangered	Critically Endangered	Species
Painted Honeyeater	*Grantiella picta*	Vulnerable	Vulnerable	Ecosystem
Spotted-tailed Quoll	*Dasyurus maculatus*	Vulnerable	Endangered	Ecosystem
Brush-tailed Phascogale	*Phascogale tapoatafa*	Vulnerable	-	Species
Koala	*Phascolarctos cinereus*	Vulnerable	Vulnerable	Species
Squirrel Glider	*Petaurus norfolcensis*	Vulnerable	-	Species
Grey-headed Flying-fox	*Pteropus poliocephalus*	Vulnerable	Vulnerable	Ecosystem and Species
Corben's Long-eared Bat	*Nyctophilus corbeni*	Vulnerable	Vulnerable	Ecosystem
Southern Myotis	*Myotis macropus*	Vulnerable	-	Ecosystem and Species

All the species listed in Table 2.4 were targeted during the surveys, with the exception of the Brush-tailed Phascogale (*Phascogale tapoatafa*). This species is not known or predicted to occur in the vicinity of Lake Cowal (OEH 2017b), and the habitats within the study area are not likely to be suitable.

2.3.3 Survey Methodology

Six field surveys were undertaken between August 2016 and October 2017. Survey timing and duration was designed to incorporate recommended targeted survey guidelines for threatened fauna species that could potentially occur in the study area (Table 2.6).

The winter survey was undertaken in three phases between:

- 9 to 12 August 2016;
- 4 to 7 July 2017; and
- 24 to 27 July 2017.

The spring and summer surveys were undertaken in three phases between:

- 17 to 22 October 2016;
- 29 November to 4 December 2016; and
- 22 to 28 October 2017.

Fauna surveys were undertaken by Chris Jackson, David James, George Madani, James Schlunke, Tom O'Sullivan, Ulrike Kloecker and Henry Cook. Anabat sequence files were identified by Narrawan Williams and hair samples were identified by Barbara Triggs of Dead Finish Ltd.

The survey effort applied to each method was determined by stratifying the study area into broad habitat types (BHTs) following the Keith Classifications assigned to PCTs previously identified in the study area. Six BHTs were attributed to the study area:

- Riverine Plains Woodland;
- Floodplain Transition Woodlands;
- North-west Floodplain Woodlands;
- Inland Riverine Woodlands;
- Inland Rocky Hill Woodlands; and
- Western Slopes Grassland.

The BHTs were further grouped, based on the likelihood of each habitat type to support threatened fauna species. Riverine Plains Woodland, Floodplain Transition Woodland, North-west Floodplain Woodlands, Inland Riverine Woodlands and Inland Rocky Hill Woodlands were grouped as one habitat type capable of supporting a similar array of threatened fauna, while Western Slopes Grassland was designated as the other.

Once the study area was stratified into BHTs, a sampling intensity was determined referring to relevant fauna survey guidelines, particularly the *NSW Threatened Biodiversity Survey Guidelines* (DEC 2004). For the Riverine Plains Woodland and Floodplain Transition Woodland group, the sampling stratification was 50 ha, while for the remaining broad habitat type it was 100 ha. The survey methods used to achieve the project objectives are described below. Survey location coordinates are shown in Appendix F.

Frog Surveys

Frog surveys were focused on detecting Sloane's Froglet (*Crinea sloanei*) following recommended guidelines (DECC 2009, DEC 2004). Surveys were undertaken at all potential habitat sites, including drainage lines, dams, flooded roadsides, gilgais and the edge of Lake Cowal. The targeted surveys utilised call play-back and spotlighting, and were undertaken only during the winter survey phases.

Frog surveys were carried out at 30 sites throughout the study area during the winter survey phases (Figure 2.1 and Figure 2.2). The surveys began with 5 minutes of call broadcast using a portable megaphone followed by 10 minutes of listening for frog calls. This process was repeated if the area of habitat was suitably large enough.

Spotlighting surveys were undertaken at all targeted frog survey sites (Figure 2.1 and Figure 2.2). Frog survey transects involved two people walking along linear habitat features for a period of at least 30 minutes, listening and actively searching for frogs. At more localised habitats such as dams, spotlighting surveys were undertaken until the entire edge of the water body had been surveyed.

All frog species observed and/or heard were recorded, and the numbers of each species within the immediate vicinity estimated. Most locations were surveyed twice, except where suitability for the target species was considered low.

Motion-Detecting Cameras

Twelve motion-detecting cameras were deployed within habitats that were potentially suitable for the Spotted-tailed Quoll (Figure 2.1 and Figure 2.2). The cameras focused on a bait chamber containing sardines that was placed approximately 2-3 m from the camera. Cameras were programmed to record three images each time they were triggered. The cameras were left out for 3 weeks (DSEWPaC 2011b). All species detected by the cameras were catalogued and included in the overall study species list.

Hair Tubes

Thirty-three hair tubes baited with sardines were deployed throughout the study area in habitats that were considered potentially suitable for the Spotted-tailed Quoll. They were left in-situ for a minimum of 14 nights (DEC 2004, DSEWPaC 2011b) (Figure 2.1 and Figure 2.2). Upon collection of the hair tubes, the samples with potential hair or scats were transferred to a notebook and covered with a sheet of non-stick paper for future identification.

Diurnal Bird Surveys

Following DEC survey guidelines, standard 20 minute, 2 ha diurnal bird surveys were undertaken at 33 sites within the study area (Figure 2.1 and Figure 2.2) during the spring survey period (DEC 2004). Surveys were undertaken within 3 hours of dawn and targeted both Riverine Woodland habitat types and Western Slope Grassland habitat types. The surveys targeted all bird species, including a variety of threatened woodland species.

Twenty-one hours was spent surveying for the Regent Honeyeater and the Swift Parrot, within potentially suitable habitats (Figure 2.1 and Figure 2.2). The survey effort included targeted diurnal bird surveys and targeted surveys at areas of Eucalyptus blossom or mistletoe blossom. Most potential habitats were surveyed at least twice over the course of 10 days during the two winter survey phases (DEWHA 2010a).

Targeted Superb Parrot surveys were completed within Inland Riverine Woodland BHT at the edge of Lake Cowal (Figure 2.1 and Figure 2.2). The habitat supports tree species such as *Eucalyptus camaldulensis,* many of which have a variety of hollows with entrances over 5 centimetres (cm) wide. Twelve hours of targeted surveys were undertaken in both 2016 and 2017, consistent with national survey guidelines (DEWHA 2010a).

Targeted migratory shore bird and wetland bird surveys were completed in the spring survey phase. Ten hours of shore bird and wetland bird surveys were undertaken, sometimes in conjunction with the Superb Parrot surveys, given that the potential habitats of both groups of birds were within the same locality (Figure 2.1 and Figure 2.2). The surveys involved meandering walks through potential habitats, noting all species that were present at the time (DEC 2004).

Glossy Black-Cockatoo Survey

Glossy Black-Cockatoo surveys involved supplementing area and opportunistic bird surveys (see above) with *Casuarina* seed cone surveys (DEWHA 2010a). Two sites within the study area supported low-density *Casuarina* cones on the ground. Each site was surveyed for 20 minutes for evidence of cones chewed by Glossy Black-Cockatoos, due to the very small extent of ground cover with cones.

Harp Trapping

Within the study area, harp trapping (DEC 2004, DEWHA 2010b) focused on Riverine Plain Woodland and Floodplain Transition Woodland habitats that could potentially support Corben's Long-eared Bat (*Nyctophilus corbeni*). In 2016, one harp trap was deployed within the study area for five survey nights. In 2017, five harp traps were deployed in potentially suitable habitats for a total of 22 survey nights (Figure 2.1 and Figure 2.2). At each harp trap site, the trap location was changed each morning after the bats had been collected. All captured bats were placed in a calico bag and stored in a cool dark place until nightfall, when they were released.

Reptile Surveys

Reptile surveys focused on habitats that could be potentially suitable for the Pink-tailed Legless Lizard (*Aprasia parapulchella*). In the study area, potential Pink-tailed Legless Lizard habitat was found within the Inland Stony Hill and stony areas of the Western Slopes Grassland BHT. The survey activity included lifting rocks, loose timber, tin and other debris, and sifting through litter and loose soil (DEC 2004, DSEWPaC 2011a). All reptiles detected were recorded. The surveys were undertaken at eight locations within the study area (Figure 2.1 and Figure 2.2) for 5 people-hours.

Anabats

Anabat Express detectors were deployed at 15 locations within the study area (Figure 2.1 and Figure 2.2) (DEC 2004, DEWHA 2010b). All units were set to the automatic 'night only' recording mode. Anabat sequence files were analysed to species level where possible.

Spotlighting

In addition to surveying for frogs (see above) spotlighting was undertaken to survey for the Koala and the Squirrel Glider. The spotlighting effort focused on four sites with potential habitat for these species (Figure 2.1 and Figure 2.2). The survey was completed over the course of two nights during both 2016 and 2017, for a total of 6 person-hours, in accordance with relevant recommended survey techniques (DEC 2004, CoA 2014).

Using head-torches, two people meandered through potential habitat for the species, searching for eye-shine while listening for potential vocalisations. All species detected during each spotlighting survey were noted.

Koala SAT Survey

The Spot Assessment Technique (SAT) (Phillips & Callaghan 2011) was used to assess the potential occurrence of Koalas within the Inland Riverine Woodlands habitat on both sides of Lake Cowal. This habitat type stretches along the edge of the lake and, therefore, the radial SAT proposed in Philips and Callaghan was adapted to become a linear assessment of trees. A total of 30 trees were assessed within the study area (Figure 2.1 and Figure 2.2). At each tree, the ground surface within a 100 centimetre (cm) radius was checked for koala faecal pellets, initially by a cursory inspection without disturbing the ground surface, followed by raking the leaf litter for a more thorough inspection. Each tree was also inspected for potential koala scratches on the trunk and lower limbs.

Nocturnal Fauna Call Playback Surveys

Five nights of call playback surveys were undertaken at one site located within the Riverine Plain Woodlands habitat (Figure 2.1). The surveys were conducted in the early evening, targeting the Bush Stone-curlew, the Barking Owl and the Koala. Each call playback sequence took 45 minutes to complete. Calls were broadcast using a Chiayo Coach player. Each call playback session commenced with a 30 second call broadcast of the Bush Stone-curlew and 4.5 minutes of listening. This sequence was repeated three times and followed by a 5 minute spotlight search. The Barking Owl sequence consisted of 5 minutes call broadcast and 10 minute listening period, while the Koala sequence consisted of 5 minutues call broad cast and 5 minute listening period, in accordance with guideline recommendations (CoA 2014, DEC 2004, DEWHA 2010a, DSEWPaC 2011b).

Two stags within the Riverine Plain Woodlands habitat were also observed for 30 minutes before, and one hour after, sunset to determine whether they were being utilised by threatened arboreal mammal species or owl species.

2.3.4 Weather during Survey Period

Weather conditions during the survey period as reported from West Wyalong Airport (BoM 2018a) are displayed in Table 2.5.

Table 2.5 Weather conditions during survey period (West Wyalong Airport) (BoM 2018a)

Survey	Date	Temp. Min. [°C]	Temp. Max. [°C]	Rain [mm]
Winter Survey Phase 1	9/08/2016	1.7	16.7	-
	10/08/2016	8.5	17.5	0.1
	11/08/2016	4.3	13.3	-
	12/08/2016	-0.8	12.9	-
Spring Survey Phase 1	17/10/2016	10	17.7	16.8
	18/10/2016	6.9	21.5	-
	19/10/2016	5.4	17.2	-
	20/10/2016	3.1	21.6	-
	21/10/2016	5.3	26.2	-
	22/10/2016	7.5	16	1.2
Summer Survey	29/11/2016	9.7	32.4	-
	30/11/2016	1.7	34.8	-
	1/12/2016	12.5	33	-
	2/12/2016	15.3	31.3	-
	3/12/2016	12.8	36.1	-
	4/12/2016	14.7	35.6	-
Winter Survey Phase 2	4/7/2017	5.2	16.6	1.0
	5/7/2017	5.9	15.6	-
	6/7/2017	4.1	14.4	0.4

Survey	Date	Temp. Min. [°C]	Temp. Max. [°C]	Rain [mm]
	7/7/2017	2.9	16.5	-
Winter Survey Phase 3	24/7/2017	4.6	14.2	-
	25/7/2017	0.2	15.8	-
	26/7/2017	-1.1	16.4	-
	27/7/2017	1.6	12.7	-
Spring Survey Phase 2	22/10/2017	7.6	25.8	-
	23/10/2017	7.9	29.6	-
	24/10/2017	17.1	30.7	-
	25/10/2017	15.0	28.4	-
	26/10/2017	10.2	28.8	2.6
	27/10/2017	11.8	30.0	-

2.3.5 Survey Guidelines and Effort

A reconciliation of survey effort against relevant guidelines is provided in Table 2.6, pertaining to the threatened species that were conservatively considered to have potential to occur in the study area.

Table 2.6 Summary of survey guidelines for threatened species potentially found in the study area

Species	Method	Suggested Effort	Method Source	Relevant Survey Period	Applied Effort
Sloane's Froglet	Nocturnal Habitat Search	30 person-minutes on two separate nights (DEC, 2004); At least 200 m transect per water body or inundated area. Repeated on at least two nights (DECC, 2009).	DECC (2009), DEC (2004)	Autumn to spring (2016 and 2017)	Surveys conducted in winter. Point surveys at smaller water bodies included 30 person-minutes of listening and active searching for frogs. Conducted in 2017 and 2016. Three transect surveys (combined total of 4 km length) along linear habitat features, listening and actively searching for frogs in 2017. Six transect surveys (>3 km total length) along linear habitat features for at least 30 minutes in 2016. Locations with amphibian activity (most) were surveyed on two nights.
	Call Playback	At least one playback on each of two separate nights	DECC (2009), DEC (2004)	Mid-winter to early spring	Surveys conducted in winter. Five minutes of call broadcast at each survey site followed by 10 minutes of listening, on each of two separate nights at sites where habitat was suitable.
Pink-tailed Legless Lizard	Habitat Search	Active search of potential habitats performed for 30 person-minutes at each site on two separate days.	DEC (2004)	Spring and summer	Active searches of potential reptile habitat were performed for at least 30 person-minutes at five sites in the study area in Spring 2017. Three such active searches were completed in 2016.

Species	Method	Suggested Effort	Method Source	Relevant Survey Period	Applied Effort
Grey Falcon, Black-breasted Buzzard, Glossy Black-Cockatoo, Swift Parrot, Superb Parrot, White-browed Treecreeper, Regent Honeyeater, Painted Honeyeater.	Diurnal Bird Survey: area search	20 minute standard search within 3 hours of dawn. All birds observed or heard recorded.	DEC (2004)	Winter and spring	Standard searches were performed at 33 sites throughout 2016 and 2017. Several sites were surveyed multiple times.
Regent Honeyeater and Swift Parrot	Diurnal Bird Surveys: targeting flowering eucalypts	20 hours over 10 days targeting heavily-flowering eucalypts or large flocks of blossom feeders	DEWHA (2010a)	June and July	Limited flowering eucalypts or large flocks of blossom feeders present. 21 hours completed over the course of 10 days during the winter survey phases in 2017.
Superb Parrot	Area search	12 hours over 4 days in suitable habitat	DEWHA (2010a)	September to November	12 hours over 4 days in potential breeding habitats within study area during the spring survey phases in 2016 and 2017.
Australasian Bittern, White-bellied Sea-eagle, Australian Painted Snipe, Bar-tailed Godwit, Curlew Sandpiper.	Diurnal Bird Survey: targeting wetlands	10 hours of combined bird survey effort in suitable habitats	DEC (2004)	Spring	10 hours of bird surveys undertaken along the edge of Lake Cowal. Some surveys combined with Superb Parrot breeding habitat surveys
Glossy Black-Cockatoo	Searches for feeding signs	20 hours over 4 days	DEWHA (2010a)	All year	All *Casuarina* trees in study area surveyed due to the small extent of potential habitat.
Spotted-tailed Quoll	Motion cameras and hair tubes	Motion cameras deployed for 3 weeks. Hair tubes spaced 100 m and deployed for 14 nights.	DEC (2004) DSEWPaC (2011b)	May to August	12 cameras and 33 hair tubes deployed for 19-21 nights
Brush-tailed Phascogale, Koala, Squirrel Glider, Grey-headed Flying-fox, Barking Owl, Bush Stone-curlew	Spotlighting	2 x 1 hour and 1 km up to 200 hectares of stratification unit, on 2 separate nights	DEC (2004)	All year	Spotlighting for nocturnal species, including nocturnal birds was performed for 60 person-minutes per site, in suitable habitat on two separate nights in 2017 and 2016 (total effort 6 person hours).
Barking Owl, Koala, Bush Stone-curlew	Call playback	5 nights	DEC (2004)	All year	5 nights for each species.
Grey-headed Flying-fox	Habitat search	Not specified	DEWHA (2010b)	All year	31 field survey days within the study area, undertaking opportunistic searches for individuals and camps.

Species	Method	Suggested Effort	Method Source	Relevant Survey Period	Applied Effort
Species able to be identified by call (*Myotis macropus*)	Harp-trapping and/or Anabat detectors	Combination of traps and detectors for 4 trap/detector nights	DEC (2004)	Between October and March	Surveys conducted in late October. A combination of 22 harp trap nights and 22 Anabat detector nights in 2017. 4 harp trap nights and 8 Anabat detector nights within the study area in 2016.
Species difficult to be identified by call (*Nyctophilus*)	Harp trapping	20 trap nights over 5 nights for *Nyctophilus corbeni*	DEC (2004) DEWHA (2010b)	Between October and March	Surveys conducted in late October. Five harp traps moved through the only available habitat with some tree cover over five nights. Equates to 22 trap nights. 4 harp trap nights within the study area in 2016.

The following species, listed as migratory under the EPBC Act, were also surveyed for using the techniques outlined in Table 2.6: Fork-tailed Swift, White-throated Needletail, Yellow Wagtail, Satin Flycatcher, Rufous Fantail, Common Sandpiper, Sharp-tailed Sandpiper, Pectoral Sandpiper, Latham's Snipe, Bar-tailed Godwit, Osprey, Common Greenshank and Marsh Sandpiper.

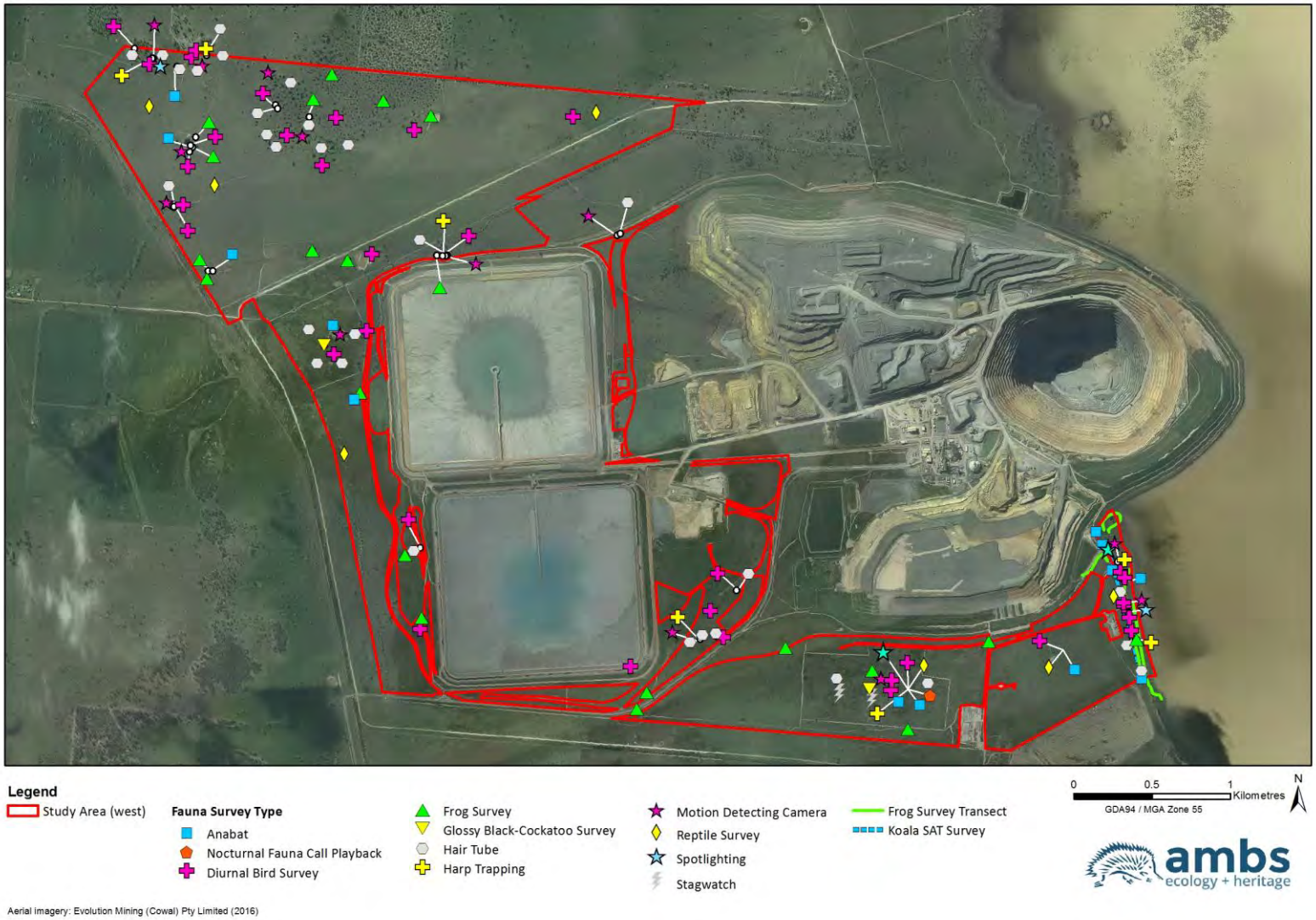

Figure 2.1 Fauna survey locations western study area

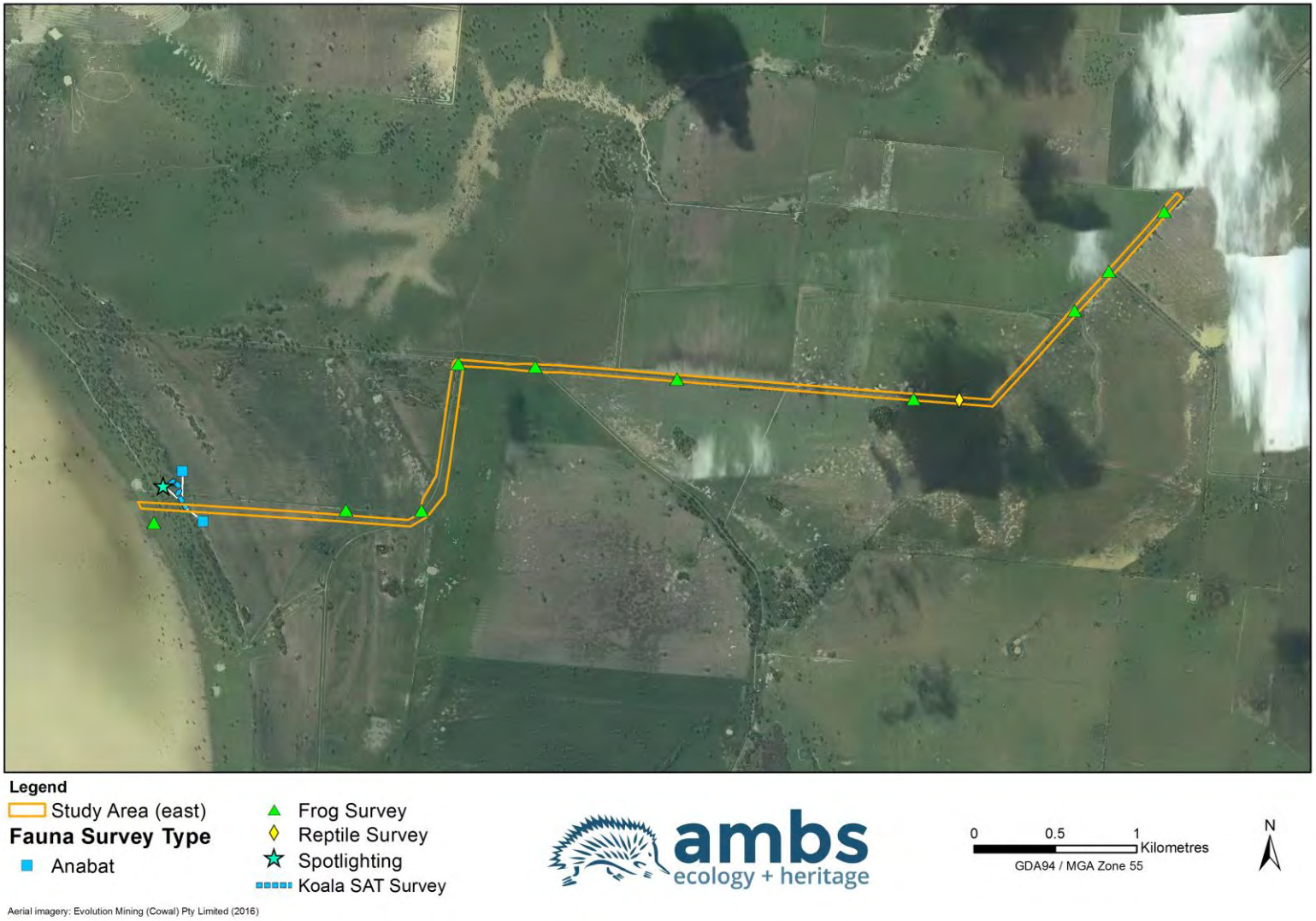

Figure 2.2 Fauna survey locations eastern study area

3 Results

3.1 Flora

3.1.1 Overview

Two hundred plant species, of which 137 were native and 63 exotic, were recorded in surveyed plots across the study area (Appendix A).

Plant community mapping across the study area was complicated by the long period of agricultural disturbance and the way in which vegetation in alluvial landscapes can vary from one plant assemblage to another with small changes in elevation. Prior to European settlement, these small changes in elevation would have created a mosaic pattern of plant communities in the original pre-cleared state. Further, climatic variation between survey years will influence the number and types of species recorded in highly disturbed locations. Exotic species will often dominate in wet years while many species of native and exotic plants will not flower during dry periods. Previous mapping has been reviewed to provide an updated vegetation map, and recent mapping of the Central West Lachlan region (OEH 2015): descriptions of PCTs are now available via the OEH *Archived Over-cleared Vegetation Types Data* (OEH 2017c). Some changes have been made to the mapping provided in 2012 (Australian Museum Business Services) as a result of the review.

3.1.2 Vegetation Mapping

Data from 41 full floristic plots surveyed across the study area in 2016 and 2017 were used to prepare the vegetation map (Figures 3.1 and 3.2) and plant community descriptions. Data from plots surveyed in 2012 were also used to assist in determining the location of plant community boundaries (Figure 3.1 and Figure 3.2).

Several key changes to plant community mapping occurred between the 2012 surveys (Australian Museum Business Services 2012) and this survey.

Previous habitat mapping within the study area attempted to identify individual gilgais and map them as their own plant community (Australian Museum Business Services 2012). The surveys conducted in 2017 identified additional gilgais that were not identified during previous mapping projects. As such, the approach to mapping individual gilgais was altered, and gilgais were instead described as a component of the plant communities within which they occurred (i.e. Belah woodland or Myall Woodland). Gilgais are not commonly associated with Grey Box Woodland.

A drainage channel, previously mapped as sedgeland/herbland (Australian Museum Business Services 2012), was not mapped as such for this report. The channel is ephemeral and was found to be severely eroded, probably from the high rainfall in 2016, and unlikely to support a sedge or herbland in the near future.

Other changes to plant community mapping are explained within the plant community descriptions. A list of the mapping units and areas is provided in Table 3.1.

Table 3.1 List of the mapping units and areas

BVT	PCT	Keith Class	Keith Formation	Mapping Name	Mapping Number	Plot Numbers	Total Area (ha)
LA212: Weeping Myall open woodland of the Riverina and NSW South Western Slopes Bioregions	026 Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Riverine Plain Woodlands	KF_CH11A - Semi-arid woodlands (Grassy sub-formation)	Weeping Myall Open Woodland (Semi Cleared in Moderate Condition) (LA212)	1a	LC26, LC27, LC21, LC22, LC23, LC14, LC55	48.50
LA212: Weeping Myall open woodland of the Riverina and NSW South Western Slopes Bioregions	026 Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Riverine Plain Woodlands	KF_CH11A - Semi-arid woodlands (Grassy sub-formation)	Weeping Myall Open Woodland (Semi Cleared in Low Condition) (LA212)	1b	LC28	2.00
LA212: Weeping Myall open woodland of the Riverina and NSW South Western Slopes Bioregions	026 Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Riverine Plain Woodlands	KF_CH11A - Semi-arid woodlands (Grassy sub-formation)	Weeping Myall Open Woodland (Derived Grassland in Low Condition) (LA212)	1c	LC29, LC33, LC32	41.00
LA152: Inland Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion	082 Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion	Floodplain Transition Woodlands	KF_CH3 Grassy Woodlands	Inland Grey Box - White Cypress Pine Woodland (Semi Cleared in Moderate Condition) (LA152)	2a	LC53, LC45, LC47	6.50
LA152: Inland Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion	082 Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion	Floodplain Transition Woodlands	KF_CH3 Grassy Woodlands	Inland Grey Box - White Cypress Pine Woodland (Derived Grassland in Low Condition) (LA152)	2b	LC41, LC42, LC51, LC52	108.50
LA191: River Red Gum - Veined Swamp Wallaby Grass grassy tall woodland of depressions on floodplains and alluvial plains	249 River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW	Inland Riverine Woodlands	KF_CH9 Forested Wetlands	River Red Gum Forest (Moderate Condition) (LA189)	3	LC08, LC09, LC56	6.50
LA105: Belah woodland on alluvial plains in central-north NSW	055 Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions	North-west Floodplain Woodlands	KF_CH11A Semi-arid woodlands (Grassy sub-formation)	Belah Woodland (Low Condition) (LA105)	4	LC37, LC38, LC39, LC48, LC49	76.50
LA144: Dwyer's Red Gum - White Cypress Pine - Currawang shrubby woodland	185 Dwyers Red Gum - White Cypress Pine - Currawang low	Inland Rocky Hill Woodlands	KF_CH11B Semi-arid Woodland	Dwyer's Red Gum - White Cypress Pine - Currawang	5	LC34, LC35, LC36,	5.00

BVT	PCT	Keith Class	Keith Formation	Mapping Name	Mapping Number	Plot Numbers	Total Area (ha)
mainly of the NSW South Western Slopes Bioregion	shrub-grass woodland of the Cobar Peneplain Bioregion		(Shrubby sub-formation)	Woodland (Moderate Condition) (LA144)			
LA138: Derived tussock grasslands of the central western plains and lower slopes of NSW	250 Derived tussock grassland of the central western plains and lower slopes of NSW	Western Slopes Grassland	KF_CH4 Grasslands*	Highly Modified Derived Grasslands (Moderate Condition) (LA138)	6a	LC50, LC44, LC17, LC54, LC20, LC05, LC16	148.00
LA138: Derived tussock grasslands of the central western plains and lower slopes of NSW	250 Derived tussock grassland of the central western plains and lower slopes of NSW	Western Slopes Grassland	KF_CH4 Grasslands*	Highly Modified Derived Grasslands (Low Condition) (LA138)	6b	LC40, LC43, LC46, LC15, LC19	279.00
Plantings	Plantings			Plantings	A		31.00
Lake Bed	Lake Bed			Lake Bed	B		6.50
Cropping	Cropping			Cropping	C		9.00
Cleared	Cleared			Cleared	D		13.00

* This Keith formation applies to vegetation that, in its pre-cleared state, was natural grassland dominated by large perennial tussock grasses and a lack of woody plants (Keith 2006). It is not intended to apply to derived native grasslands of woodland communities; however, no alternative for this BVT/PCT is available for this vegetation state.

3.1.3 Plant Community Description

BVT LA212 - Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion (including a derived grassland form)

Keith Formation: KF_CH11A - Semi-arid woodlands (Grassy sub-formation)
Keith Class: Riverine Plain Woodlands
Plant Community Type ID: PCT 26
Mapping Names:
Vegetation Community 1a Weeping Myall Open Woodland (Semi-Cleared in Moderate Condition)
Vegetation Community 1b Weeping Myall Open Woodland (Semi-Cleared in Low Condition)
Vegetation Community 1c Weeping Myall Open Woodland (Derived Grassland in Low Condition)

BC Act: All occurrences of this community conform to the Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions EEC listed under the BC Act.
EPBC Act: Larger occurrences of this community (>0.5 ha) with canopy dominated or co-dominated by *Acacia pendula* conform to the Weeping Myall Woodlands EEC listed under the EPBC Act.

Number of hectares: 91.50 ha comprised of:

- Map Number 1a – 48.50 ha;
- Map number 1b – 2.00 ha; and
- Map number 1c – 41.00 ha.

Three forms, which represent the condition and structure of this community, are shown on Figure 3.1 and listed in Table 3.1 (1a, 1b and 1c). In general, areas mapped as 1b or 1c are in low condition, have been cleared of most trees and generally have a remnant ground layer that is dominated by grasses (native and exotic) with some native forbs and exotic pasture species. In general, areas mapped as 1a are in moderate condition, have some tree canopy and a higher count of native species in the ground layer, although exotic species also occur. Soils are grey to brown clays and gilgais, which are typically associated with this community, were present.

An example of this community within the study area is shown on Plate 3.1.

Characteristic native species: *Carex inversa, Casuarina cristata, Oxalis perennans, Walwhalleya subxerophila, Einadia nutans* subsp. *nutans, Sclerolaena muricata* var. *semiglabra, Enteropogon acicularis, Acacia pendula, Atriplex semibaccata, Enchylaena tomentosa, Solanum esuriale, Asperula conferta, Marsilea drummondii.*

Plate 3.1 Example of LA212 - Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion in the study area with regenerating *Acacia pendula*.

BVT LA191: River Red Gum - Veined Swamp Wallaby Grass grassy tall woodland of depressions on floodplains and alluvial plain

Keith Formation: KF_CH9 Forested Wetlands
Keith Class: Inland Riverine Forests
Plant Community Type ID: PCT 249
Mapping Names: Vegetation Community 3 River Red Gum Forest (Moderate Condition) (LA191)

BC Act: N/A
EPBC Act: N/A

Number of hectares: 6.50

This BVT occurs on the fringes of Lake Cowal around the normal 'high water' mark, experiencing periodical flooding. In the study area, stands of this BVT closest to the lake feature a canopy of *Eucalyptus camaldulensis* (River Red Gum) and a sub-canopy of *Acacia stenophylla* (River Cooba). Areas further from the lake edge (particularly on the eastern side of the lake) also feature *Eucalyptus populnea* subsp. *bimbil* (Poplar Box or Bimble Box), *Eucalyptus microcarpa* (Inland Grey Box) and *Eucalyptus melliodora* (Yellow Box) above the normal highwater level. Where the BVT occurs in a relatively undisturbed state, it features a variable midstorey of *Duma florulenta* (Lignum) and other shrub species, such as *Glycyrrhiza acanthocarpa* (Native Liquorice), and an understorey of grasses, forbs and rushes. Where the community has been recently actively grazed on the eastern side of Lake Cowal, the mid- and under-storeys have been largely replaced by exotic annual and perennial pasture grasses and forbs, in particular *Avena fatua* and *Hypochaeris glabra* (Smooth Catsear). Soils are alluvial deposits consisting of deep grey clays.

An example of this community within the study area is shown on Plate 3.2.

Characteristic native species: *Acacia stenophylla*, *Diplachne parviflora*, *Ranunculus sessiliflorus* var. *pilifer*, *Atriplex semibaccata*, *Duma florulenta*, *Eclipta platyglossa*, *Einadia nutans* subsp. *nutans*, *Enchylaena tomentosa*, *Eucalyptus camaldulensis*.

Plate 3.2 Example of LA191 with *Eucalyptus camaldulensis* and *Eucalyptus populneus* subsp. *bimbil*

BVT LA152: Inland Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion (including a derived grassland form)

Keith Formation: KF_CH3 Grassy Woodlands
Keith Class: Floodplain Transition Woodlands
Plant Community Type ID: PCT 82
Mapping Names:
Vegetation Community 2a Inland Grey Box - White Cypress Pine Woodland (Semi-Cleared in Moderate Condition) (LA152)
Vegetation Community 2b Inland Grey Box - White Cypress Pine Woodland (Derived Grassland in Low Condition) (LA152)

BC Act: All occurrences of this community conform to Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC listed under the BC Act.
EPBC Act: Larger occurrences of this community (>0.5 ha) conform to Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC listed under the EPBC Act.

Number of hectares: 114.70 comprised of:

- 6.40 ha of mapping unit 2a; and
- 108.30 ha of mapping unit 2b.

Two forms, which represent the condition and structure of this community, are shown on Figure 3.1 and listed in Table 3.1 (2a and 2b). In general, areas mapped in low condition have been cleared of most trees and have a remnant ground layer that is dominated by grasses (native and exotic), with some native forbs and exotic pasture species. Most areas mapped as being in moderate condition have some tree canopy with a higher count of native species in the ground layer, although exotic species also occur. Soils are brown, clay loams with a silty to gravelly texture.

A portion of this PCT was previously mapped as LA212 - Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion. Interpretation of recent PCT descriptions and mapping by OEH (2017c), as well as the species recorded during this survey indicates that the vegetation in these locations is more suitably represented as LA152.

Examples of this community within the study area are shown on Plate 3.3 and 3.4.

Characteristic native species: *Eucalyptus microcarpa, Eucalyptus populnea* subsp. *bimbil* (Poplar Box or Bimble Box), *Acacia deanei*, *Allocasuarina luehmannii*, *Maireana enchylaenoides* (Wingless Bluebush), *Sclerolaena muricata* var. *semiglabra* (Black Rolypoly), *Austrostipa scabra, Austrostipa blackii, Einadia nutans* subsp*. nutans, Vittadinia cuneata, Vittadinia gracilis, Entolasia acicularis, Sida corrugata, Atriplex semibaccata, Rytidosperma articulata.*

Plate 3.3 Example of LA152 derived grassland with remnant *Eucalyptus microcarpa* (Grey box) over native tussock grass.

Plate 3.4 Example of LA152 semi cleared woodland with *Eucalyptus populnea* subsp. *bimbil* in the foreground and *Eucalyptus microcarpa* in the background.

BVT LA144: Dwyer's Red Gum - White Cypress Pine - Currawang shrubby woodland mainly of the NSW South Western Slopes Bioregion

Keith Formation: KF_CH11B - Semi-arid woodlands (Shrubby sub-formation)
Keith Class: Inland Rocky Hill Woodlands
Plant Community Types ID: PCT 185
Mapping Name:
Vegetation Community 5 Dwyer's Red Gum - White Cypress Pine - Currawang Woodland (Moderate Condition) (LA144)

BC Act: Not listed
EPBC Act: Not listed

Number of hectares: 5.00

LA144 was located on two small high points in the landscape. It has been heavily grazed in the past and shows signs of surface erosion due to the soil characteristics in this location (loamy sand).

An example of this community within the study area is shown on Plate 3.5.

Characteristic native species:
Eucalyptus sideroxylon, Eucalyptus dwyeri, Callitris glaucophylla, Aristida jerichoensis, Rytidosperma auriculatum, *Walwhalleya proluta, Austrostipa scabra, Vittadinia cuneata, Cheilanthes sieberi* and *Triptilodiscus pygmaeus.*

Plate 3.5 LA 144 with *Eucalyptus sideroxylon* in the background and regenerating *Callitris glaucophylla* over mainly native grasses.

BVT LA105: Belah woodland on alluvial plains in central-north NSW

Keith Formation: KF_CH11A - Semi-arid woodlands (Grassy sub-formation)
Keith Class: North-west Floodplain Woodlands
Plant Community Types ID: PCT55
Mapping Name: Vegetation Community 4 Belah Woodland (Low Condition) (LA105)

BC Act: Not listed
EPBC Act: Not listed

Number of hectares: 76.50

LA105 was located in two areas of the study area. At both locations the woodland had been cleared to varying degrees, with some regeneration of Belah occurring. Grazing has simplified the composition of the ground layer; however, native perennial grasses dominate with a high number of exotic herbs and grasses present.

Soils were brown to grey sandy or loamy clays with patches of red quartz gravel. Gilgais, which are typically associated with this community, were present.

LA105 was previously mapped as alternative BVTs, either a Grey Box plant community or a Myall plant community (Australian Museum Business Services 2012). With regard to areas previously assigned the Myall plant community, recent information from OEH (2015) suggests that the occurrence of *Acacia pendula* (Weeping Myall) as a midlayer species does not automatically indicate that this plant community is present. Species composition of LA105 includes *Acacia pendula* but it occurs sporadically as a midstorey species in this BVT, which is the case where it occurs in LA105 in the study area. Further, the presence of both gilgais and many Belah trees in an area previously mapped as Grey Box, suggests that this area is more suitably mapped as LA105. Gilgais are not commonly associated with Grey Box woodland, but are consistent with the description of LA105.

An example of this community within the study area is shown on Plate 3.6.

Characteristic native species: *Casuarina cristata* (Belah), *Geijera parviflora* (Wilga), *Alectryon oleifolius* (Western Rosewood), *Maireana microphylla, Sclerolaena microphylla, Rytidosperma setaceum, Enteropogon acicularis, Juncus aridicola, Walwhalleya proluta, Austrostipa blackii, Goodenia pinnatifida, Dichondra repens, Rhodanthe pygmaea, Pratia bicolor, Cheilanthes sieberi*.

Plate 3.6 LA105 showing an area with native tussock grasses and a remnant Belah.

BVT LA138 - Derived tussock grasslands of the central western plains and lower slopes of NSW

Keith Formation: Designated as KF_CH4 Grasslands – Western Slopes Grasslands*.
Keith Class: Designated as Western Slopes Grasslands.
Plant Community Type ID: PCT250
Mapping Names:
Vegetation Community 6a Highly Modified Derived Grasslands (Moderate Condition) (LA138)
Vegetation Community 6b Highly Modified Derived Grasslands (Low Condition) (LA138)

BC Act: Not listed
EPBC Act: Not listed

Number of hectares: 427.00 comprised of:

- 148.00 ha of mapping unit 6a; and,
- 279.00 ha of mapping unit 6b.

*The Keith formation KF_CH4 Grasslands – Western Slopes Grasslands applies to vegetation that, in its pre-cleared state, was natural grassland dominated by large perennial tussock grasses and a lack of woody plants (Keith 2006). It is not intended to apply to derived native grasslands of woodland community forms of LA152 or LA212. Distinguishing between the two potential Keith formations that might have occurred in the study area in the area mapped as LA138 is not possible, due to the current disturbed state of the derived grassland. Either the Keith Formations KF_CH3 Grassy Woodlands or KF_CH11A - Semi-arid woodlands (Grassy sub-formation) would have applied prior to clearing.

Two forms, which represent the condition of this community, are shown on Figure 3.1 and listed in Table 3.1 (6a and 6b). In general, areas mapped in low condition have been cleared of all trees and generally have a remnant ground layer that is dominated by grasses (native and exotic), with some native forbs and exotic pasture species. Most areas mapped as being in moderate condition may have some scattered remnant trees with a higher count of native species in the ground layer, although many exotic species also occur. Soils are clay to clay loams, and brown to red in colour.

This BVT occurs throughout the study area in habitats that may have previously supported both LA152 and LA212 (above) prior to clearing for agricultural purposes. This BVT is characterised by native perennial grasses *Enteropogon acicularis*, *Austrostipa blackii*, and *Walwhalleya subxerophila* (Gilgai Grass), native forbs such as *Oxalis perennans*, *Crassula sieberiana*, and *Salsola australis*, and low shrubs including *Maireana microphylla*, and *Sclerolaena muricata* var. *semiglabra*. The condition of this BVT varies across the study area, with some sites showing a (seasonal) high cover of exotic annual grasses, such as *Hordeum glaucum* (Northern Barley Grass), *Avena fatua* (Wild Oats), *Lolium perenne* (Perennial Ryegrass), *Vulpia muralis* (Fescue) and *Bromus molliformis* (Soft Brome), as well as exotic forbs such as *Arctotheca calendula* (Capeweed), *Medicago polymorpha* (Burr Medic), *Trifolium subterraneum* (Subterranean Clover) and *Trifolium glomeratum* (Clustered Clover). The high density of exotic species and the absence of native ground layer diversity has, in some instances, resulted in a condition classification of low.

An example of this community within the study area is shown on Plate 3.7.

Characteristic native species: *Enteropogon acicularis, Oxalis perennans, Walwhalleya subxerophila, Carex inversa, Atriplex semibaccata, Crassula sieberiana, Cheilanthes sieberi* subsp. *sieberi, Austrostipa blackii, Maireana enchylaenoides, Sclerolaena muricata* var. *semiglabra, Crassula decumbens* var. *decumbens, Salsola australis, Maireana microphylla.*

Plate 3.7 Example of LA138 a derived grassland community characterised by a mixed assemblage of perrenial native grasses and annual exotic herbs and grasses.

Other Map Units

Four other map units are shown on Figure 3.1, including the Lake Bed and Cleared Land. Plantings are areas in which trees have been replanted. Cropping land are areas where, in the past, crops have been grown.

3.1.4 FBA Vegetation Condition Data Collection

Condition classes were applied to each plant community type mapped in the study area, and the resulting vegetation zones are shown in Table 3.2. The number of FBA plots required, and the number completed in each zone are also shown in Table 3.2. Data was collected in each plot (Appendix C).

Table 3.2 Required number of FBA plots and number completed for each vegetation zone

Vegetation Zone	Area (ha)	Plots required	Plots Completed
Belah Woodland (Low Condition) (LA105)	76.50	3	5
Dwyer's Red Gum - White Cypress Pine - Currawang Woodland (Moderate Condition) (LA144)	5.00	3	3
Highly Modified Derived Grasslands (Low Condition) (LA138)	297.00	5	5
Highly Modified Derived Grasslands (Moderate Condition) (LA138)	153.00	6	7
Inland Grey Box - White Cypress Pine Woodland (Derived Grassland in Low Condition) (LA152)	108.50	4	4
Inland Grey Box - White Cypress Pine Woodland (Semi Cleared in Moderate Condition) (LA152)	6.50	3	3
River Red Gum Forest (Moderate Condition) (LA191)	6.50	3	3
Weeping Myall Open Woodland (Derived Grassland in Low Condition) (LA212)	41.00	3	3
Weeping Myall Open Woodland (Semi-Cleared in Low Condition) (LA212)	2.00	1	1
Weeping Myall Open Woodland (Semi-Cleared in Moderate Condition) (LA212)	48.50	4	7
Totals	744.50	**35**	**41**

3.1.5 Threatened Ecological Communities

Two TECs listed under the BC Act and/or the EPBC Act were confirmed as occurring in the study area:

1. Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes Bioregions (BC Act) and Weeping Myall Woodlands (EPBC Act); and
2. Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (BC Act) and Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (EPBC Act).

1. Myall Woodland

Myall Woodland typically occurs on red-brown earths and heavy textured grey and brown alluvial soils within a climatic belt receiving between 375 mm and 500 mm mean annual rainfall. The structure of the community varies from low woodland and low open woodland to low sparse woodland or open shrubland, depending on site quality and disturbance history. The tree layer grows to a height of about 10 m, and invariably includes *Acacia pendula* (Weeping Myall or Boree) as one of the dominant species, or the only tree species, present. The understorey includes an open layer of chenopod shrubs and other woody plant species, and an open to continuous groundcover of grasses and herbs. Within the study area, all patches of this TEC have been cleared for agricultural purposes. Clearing and regrowth is variable, resulting in semi-cleared woodland to derived native grassland forms in low or moderate condition.

Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes Bioregions (BC Act)

In the study area, semi-cleared or regeneration patches of this TEC, or areas with a high native species richness, met the criteria as described in the Final Determination (NSW Scientific Committee 2011a) for this community. Patches of the derived native grassland form that had low native ground layer richness and were small in size met criteria in the NSW final determination, due to the presence of canopy regeneration and their proximity to forms with higher species diversity and existing canopy species (Figures 3.3 and 3.4).

Weeping Myall Woodlands (EPBC Act)

Patches of this TEC, within the study area, were classified as meeting the criteria for EPBC Act listing because they met the following condition classes (Threatened Species Scientific Committee 2008):

- patches were greater than 0.5 ha in size;
- the tree canopy, where it occurred, was dominated by *Acacia pendula* (Weeping Myall), and had either two or more layers of regeneration Weeping Myall; or
- the tallest layer of living, dead or defoliated Myall trees was at least 4 m tall, and the vegetation cover overall contained more than 50% native species.

2. Inland Grey Box Woodland

Inland Grey Box Woodland occurs on fertile soils of the western slopes and plains of NSW. The community generally occurs where average rainfall is 375 - 800 mm. The characteristic tree species, *Eucalyptus microcarpa* (Inland Grey Box), is often found in association with *Eucalyptus populnea* subsp. *bimbil* (Bimble or Poplar Box), *Callitris glaucophylla* (White Cypress Pine), *Brachychiton populneus* (Kurrajong), and *Allocasuarina luehmannii* (Bulloak). Shrubs are typically sparse or absent, but may be locally common, especially in drier western portions of the community. A variable ground layer of grass and herbaceous species is present at most sites. At severely disturbed sites, the ground layer may be absent. The community generally occurs as an open woodland 15–25 m tall but, in some locations, the overstorey may be absent as a result of past clearing or thinning, leaving only an understorey. Within the study area, all patches of this TEC have been cleared for agricultural purposes. Clearing and regrowth is variable, resulting in semi-cleared woodland to derived native grassland forms in low or moderate condition.

Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (BC Act)

In the study area, semi-cleared or regenerated patches of this TEC, or areas with a high native species richness, met the criteria as described in the Final Determination (NSW Scientific Committee 2011b) for this community. Patches of the derived native grassland form that had low native ground layer richness and were small in size met criteria in the NSW final determination, due to the presence of canopy regeneration and their proximity to forms with higher species diversity and existing canopy species (Figures 3.3 and 3.4).

Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (EPBC Act)

Patches of this TEC within the study area were classified as meeting the criteria for EPBC Act listing because they met a combination of the following condition thresholds (Threatened Species Scientific Committee 2010):

- patches were greater than 0.5 ha in size;
- the canopy contained *Eucalyptus microcarpa* (Grey Box), at least 50% of the ground cover was made up of perennial native species and eight or more perennial native species were present in the mid- and ground-storey layers at any time of the year; or
- there was clear evidence that a derived grassland area formerly had a canopy of *Eucalyptus microcarpa,* at least 50% of the ground cover layer was comprised of perennial native species, and 12 or more native species were present in the ground layer.

The NSW Fisheries Scientific Committee has listed the EEC *Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Lachlan River*. This final recommendation includes all waterways and floodplains of the Lachlan River. The final recommendation names Lake Cowal and the lake bed as being part of this EEC (Fisheries Scientific Committee 2005). Based on its position in the landscape, the lake edge community "LA191: River Red Gum - Veined Swamp Wallaby Grass grassy tall woodland of depressions on floodplains and alluvial plain" may provide habitat for species listed under this EEC.

The total area of TECs in the study area is shown in Table 3.3. Figures 3.3 and 3.4 show the vegetation mapping for the study area, including those portions designated as representing TEC communities.

3.1.6 Threatened Plant Species

No threatened plant species were recorded in the study area. The study area has been cropped and/or grazed for decades and it is likely that any previous occurrences can no longer persist in the current conditions. Gilgai depressions associated with Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion and Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions can provide habitat for two ephemeral species *Pilularia novae-hollandiae* (Austral Pillwort) and *Lepidium monoplocoides* (Winged Peppercress). Targeted searches within these vegetation types did not locate either species, and they are unlikely to occur, given the disturbance of these areas in the past.

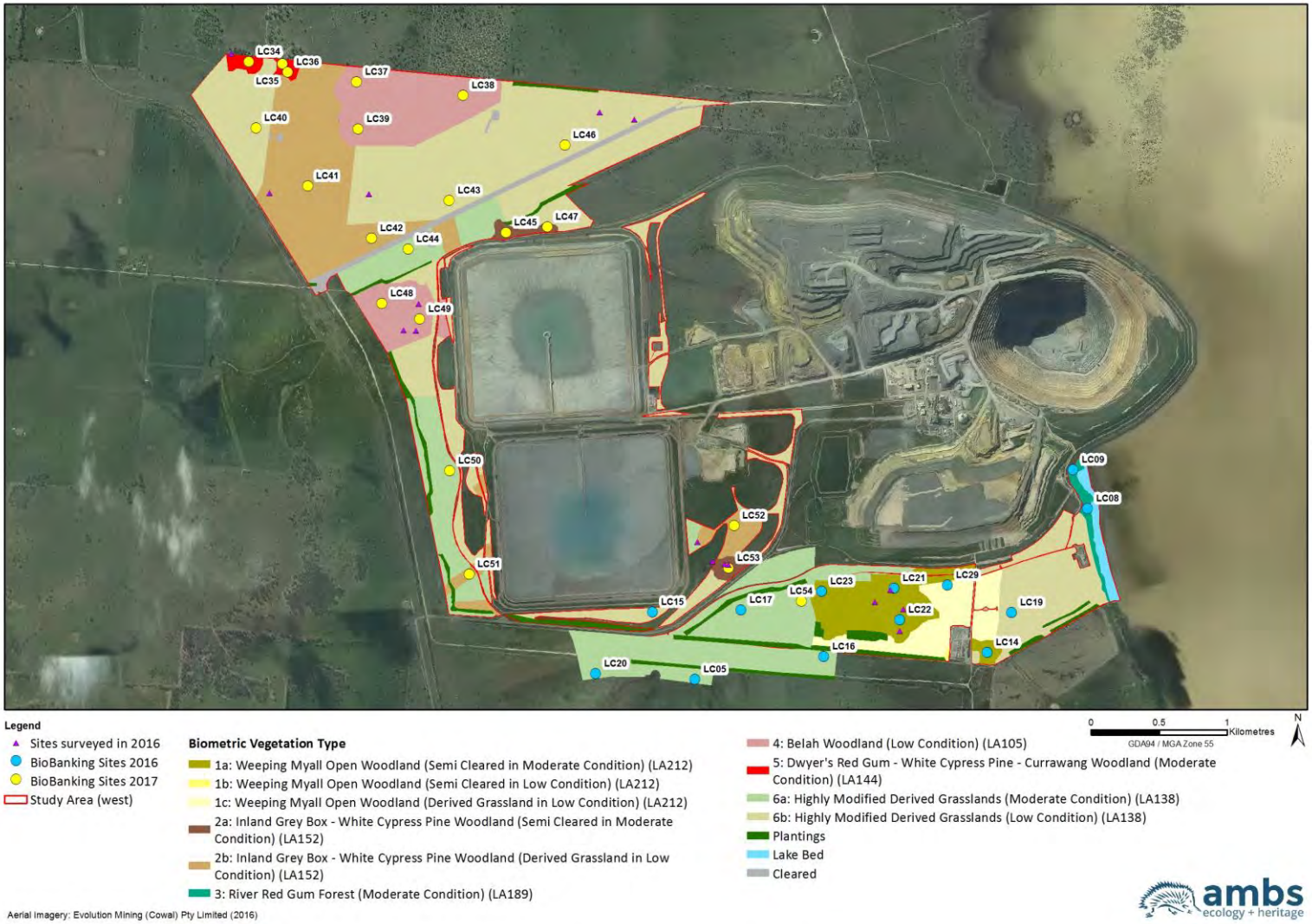

Figure 3.1 BVTs and location of surveyed plots across the western study area

Figure 3.2 BVTs and location of surveyed plots across the eastern study area

Table 3.3 Threatened Ecological Communities within the study area

BVT	PCT	TEC Status	Mapping Name *	Area (ha)
LA212: Weeping Myall open woodland of the Riverina and NSW South Western Slopes Bioregions	026 Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Weeping Myall Woodland EEC (BC Act)	Weeping Myall Open Woodland (Semi Cleared in Low Condition) (LA212) – 1b; and Weeping Myall Open Woodland (Derived Grassland in Low Condition) (LA212) – 1c	41.50
LA212: Weeping Myall open woodland of the Riverina and NSW South Western Slopes Bioregions	026 Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Weeping Myall Woodland EEC (BC Act and EPBC Act)	Weeping Myall Open Woodland (Semi Cleared in Moderate Condition) (LA212) – 1a; and Weeping Myall Open Woodland (Semi Cleared in Low Condition) (LA212) – 1b	50.00
LA152: Inland Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion (Benson 82)	082 Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion	Grey Box Woodland EEC (BC Act)	Inland Grey Box - White Cypress Pine Woodland (Derived Grassland in Low Condition) (LA152) -2b	101.00
LA152: Inland Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion (Benson 82)	082 Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion	Grey Box Woodland EEC (BC Act and EPBC Act)	Inland Grey Box - White Cypress Pine Woodland (Semi Cleared in Moderate Condition) (LA152) – 2a; and Inland Grey Box - White Cypress Pine Woodland (Derived Grassland in Low Condition) (LA152) – 2b	12.00

* All areas mapped using these names represent various forms of Threatened Ecological Communities.

Figure 3.3 Threatened Ecological Communities within the western study area

Figure 3.4 Threatened Ecological Communities within the eastern study area

3.2 Fauna

3.2.1 Fauna Habitat

Six BHTs were identified in the study area (Figures 3.5 and 3.6):

- Riverine Plain Woodlands;
- Inland Riverine Forests;
- North-west Floodplain Woodlands;
- Floodplain Transition Woodlands;
- Inland Rocky Hill Woodlands; and
- Western Slopes Grassland.

In general, the habitats of the study area were in poor condition, with small areas of habitat in moderate condition. All woodland habitats in the study area were highly fragmented, with poor connectivity and low floristic diversity. Exotic plant species were ubiquitous across the study area and regeneration of native species was isolated. Table 3.4 summarises the fauna attributes of each BHT detected on the study area.

Table 3.4 Summary of fauna habitat on the study area

Broad Habitat Type	Associated BVT	Fauna Habitat Description
Riverine Plain Woodlands	LA212: Weeping Myall open woodland of the Riverina and NSW South Western Slopes Bioregions	Riverine Plain Woodlands on the study area was dominated by very open Belah Woodland with remnant Myall shrubs. Small numbers of tree hollows were observed in this area which could be utilised by cavity-nesting parrot species, arboreal mammals and microbats. Scattered gilgais are present which could be suitable breeding habitat for Sloane's Frog when inundated.
Inland Riverine Forests	LA191: River Red Gum - Veined Swamp Wallaby Grass grassy tall woodland of depressions on floodplains and alluvial plains	Inland Riverine Forests was represented in a small linear strip along the edge of Lake Cowal. The habitat was dominated by old growth River Red Gums, most of which hosted several tree hollows. The habitat was in moderate condition. It would provide roosting and refugial habitat for a variety of migratory and wetland bird species, including the listed species detected during previous and current surveys and microbat species.
North-west Floodplain Woodlands	LA105: Belah woodland on alluvial plains in central-north NSW	North-west Floodplain Woodlands were present in larger fragments throughout the study area, and were dominated by areas of remnant Belah woodland. The Belah existed almost as a monoculture in some areas, resulting in low bird diversity in these habitats. Many remnant Belah trees hosted large hollows that would be suitable for arboreal mammals and cavity-nesting birds. In some areas of this BHT, dense areas of gilgais were present, which could provide breeding habitat for frogs during periods of inundation.
Floodplain Transition Woodlands	LA152: Inland Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion	Floodplain Transition Woodlands were mostly represented by large areas of regenerating White Cypress and Poplar Box. This BHT provides foraging habitat for a variety of bird species, including the Major Mitchell's Cockatoo.
Inland Rocky Hill Woodlands	LA144: Dwyer's Red Gum - White Cypress Pine - Currawang shrubby woodland	The Inland Rocky Hill BHT was represented by a small fragment of woodland in the far north of the study area. Many of the trees supported hollows that were suitable for nesting parrot species and roosting bat species.
Western Slopes Grassland	LA138: Derived tussock grasslands of the central western plains and lower slopes of NSW	The Western Slopes Grassland BHT was the most ubiquitous habitat type in the study area. The habitat showed signs of extensive historical grazing and was comprised of a variety of exotic and native grass species. Fauna diversity was low within these habitats, although three threatened species were recorded within the BHT.

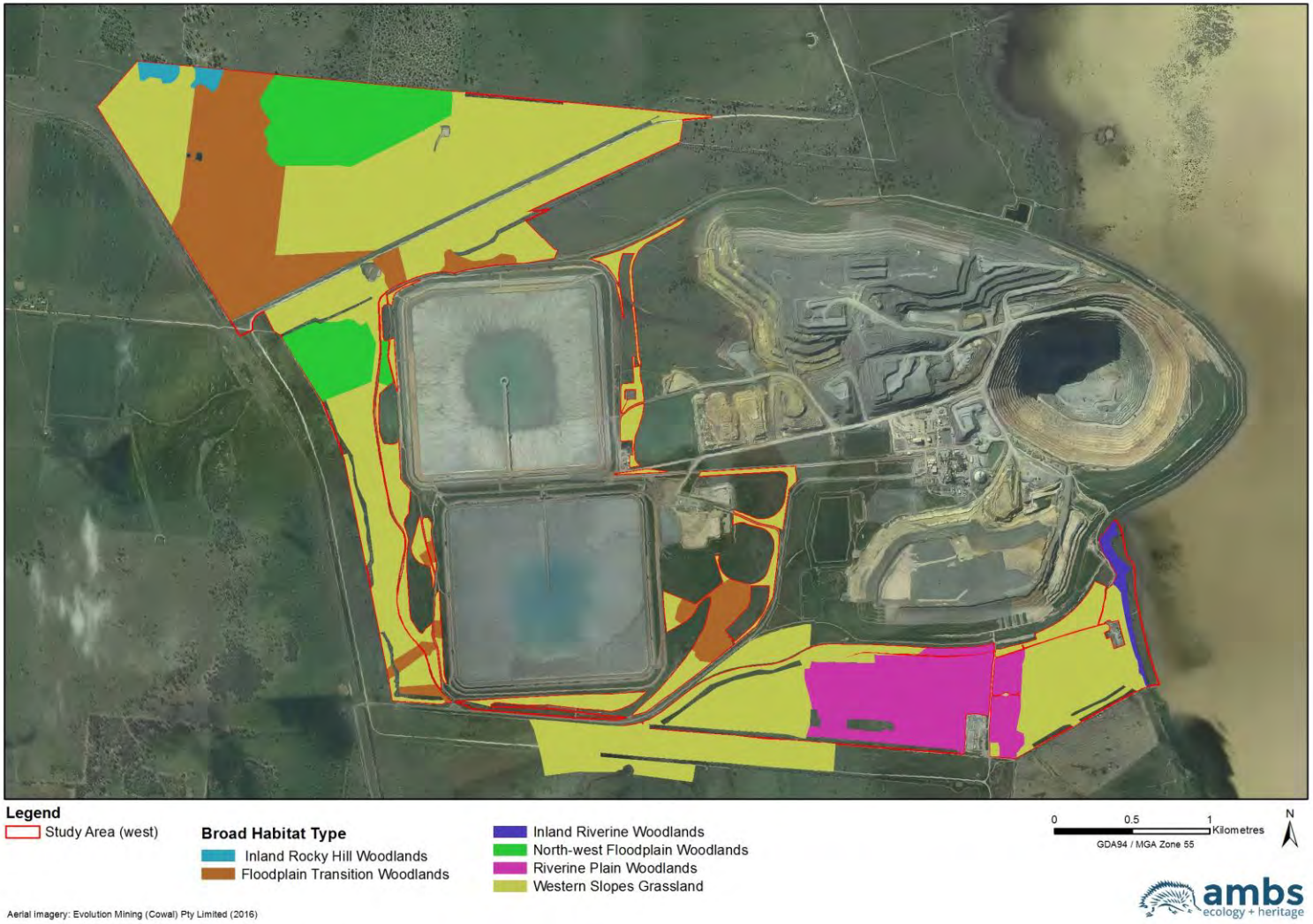

Figure 3.5 Broad habitat types within the western study area

Figure 3.6 Broad habitat types within the eastern study area

3.2.2 Species Recorded

One hundred and twenty-eight (128) species of vertebrate fauna were recorded in the study area during the survey, comprising five frogs, 14 reptiles, 86 birds and 23 mammals (Appendix B). Seven of the species were introduced, including:

- Red Fox (*Vulpes vulpes*);
- Feral Cat (*Felis catus*);
- Dog (*Canis lupus familiaris*);
- European Hare (*Lepus europaeus*);
- Cattle (*Bos taurus*);
- House Mouse (*Mus musculus*); and
- Common Starling (*Sturnus vulgaris*).

Eight of the fauna species recorded are listed as threatened on the schedules of the BC Act and one is listed as threatened under the EPBC Act (Table 3.5). An additional species listed under the BC Act, the Magpie Goose, was detected within 100 m of the study area, utilising habitats similar to those found in the study area (Table 3.5). Two species listed as migratory under the EPBC Act, the Glossy Ibis and Common Sandpiper, were incidentally recorded during the survey within 1 km of the study area (Table 3.5).

The locations of threatened species records are shown in Figure 3.7 and Figure 3.8. Additional details regarding the threatened species records are provided in Table 3.5.

Table 3.5 List of threatened and migratory fauna recorded in the study area

Common Name	Scientific Name	BC Act Status	EPBC Act Status	Records	Range of individuals observed within records
Magpie Goose*	*Anseranas semipalmat*	V	-	1	5
Glossy Ibis *	*Plegadis falcinellus*	-	M	2	5 - 8
Black Falcon	*Falco subniger*	V	-	1	1
White-fronted Chat	*Epthianura albifrons*	V	-	2	2
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V	-	45	1 - 8
Major Mitchell's Cockatoo	*Lophochroa leadbeateri*	V	-	1	1
Superb Parrot	*Polytelis swainsonii*	V	V	17	1 - 25
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	-	9	9
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	V	-	1	1
Common Sandpiper*	*Actitis hypoleucos*	-	M	1	1
Little Eagle	*Hieraaetus morphnoides*	V	-	1	1

Key: V = Vulnerable; M = Migratory; * = species was recorded nearby the study area;

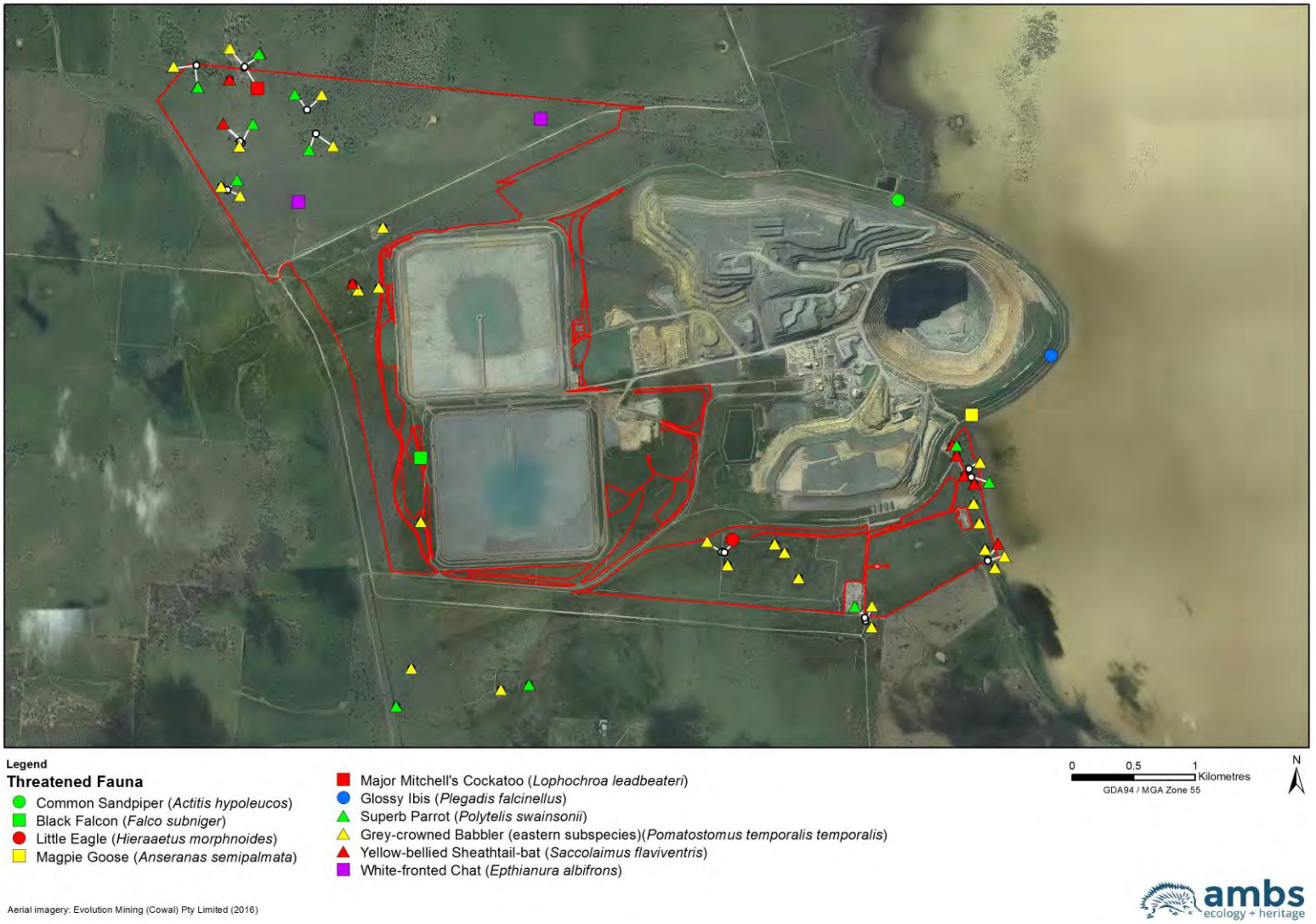

Figure 3.7 Threatened and migratory fauna recorded in the western study area

Figure 3.8 Threatened and migratory fauna recorded in the eastern study area

Species Credit Species

The Superb Parrot is the only species credit species, according to OEH (2017d), that was recorded or considered likely to occur in the study area in accordance with the FBA (OEH 2014). The Superb Parrot was recorded on 17 occasions during the surveys, 16 of which occurred during the winter survey phase. Two of these records were outside the study area by approximately 700 m. The majority of the winter records were collected in the Inland Rocky Hill BHT, with fewer in the Floodplain Transition Woodlands and North-west Floodplain Woodlands BHTs (Figures 3.9 and 3.10). These groups were observed foraging on Wilga (*Geijera parviflora*) flower and Broad-leafed Ironbark (*Eucalyptus sideroxylon*) seed. One record of the species was made during the spring survey phase in the Inland Riverine Forests BHT. The Inland Riverine Forests contain River Red Gum (*Eucalyptus camaldulensis*), with numerous hollows over 5 cm wide. As such, it should be considered as potential breeding habitat for the Superb Parrot.

Figure 3.9 Potential habitat for the Superb Parrot within the western study area

Figure 3.10 Potential habitat for the Superb Parrot within the eastern study area

4 Conclusion

The study area covers approximately 740 ha, the majority of which is utilised for mining, grazing and plantations. The flora and fauna surveys included targeted threatened species searches, confirmation of vegetation community mapping and identification of TECs. A range of fauna survey techniques were implemented, covering frogs, reptiles, mammals and birds.

The analysis of floristic data collected during this survey assigned six BVTs/PCTs to the study area:

- BVT LA212/PCT26: Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion;
- BVT LA152/PCT82: Inland Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion;
- BVT LA191/PCT249: River Red Gum - Veined Swamp Wallaby Grass grassy tall woodland of depressions on floodplains and alluvial plains;
- BVT LA105/PCT55: Belah woodland on alluvial plains in central-north NSW;
- BVT LA144/PCT185: Dwyer's Red Gum - White Cypress Pine - Currawang shrubby woodland; and
- BVT LA138/PCT250: Derived tussock grasslands of the central western plains and lower slopes of NSW.

Of these, BVT LA138 contributed the greatest proportion of the study area, being 427 ha or 57.5%. Four land use types were mapped that did not correspond to a BVT/PCT, these being Cropped land, Plantings, Cleared land and Lake bed.

In several cases, the BVT/PCT classifications and boundaries vary from previous mapping undertaken within the study area. These variations are a result of the interpretation of recently available mapping of the Central West Lachlan region (OEH 2015), descriptions of PCTs now available via the OEH *Archived Over-Cleared Vegetation Types Data* (OEH 2017c) and variations in species composition that reflect climatic conditions.

Within the study area, 204 ha conformed to EECs listed under the BC Act and/or the EPBC Act. These EECs were:

- Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (BC Act) and Weeping Myall Woodlands (EPBC Act). These listings covered a total area of 91 ha and comprised BVT LA212, in low and moderate condition; and
- Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (BC Act) and Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (EPBC Act), which covered a total area of 113 ha and comprised BVT LA152 in low and moderate condition.

No threatened plants were recorded during the current surveys. Nine fauna species listed as vulnerable under the BC Act were recorded, including the Superb Parrot, the White-fronted Chat, the Grey-crowned Babbler (eastern subspecies), the Black Falcon, the Major Mitchell's Cockatoo, the Yellow-bellied Sheath-tail-bat, the Magpie Goose, the Little Eagle (2016 only) and the White-bellied Sea-eagle (2016 only). The Superb Parrot is also listed as vulnerable under the EPBC Act. Two species listed as migratory under the EPBC Act were detected on or near the study area; the Common Sandpiper (2016 only) and the Glossy Ibis (2017 only).

Six broad habitat types based on Vegetation Classes were identified during the field surveys. Of these, Inland Riverine Forests are considered to be potential breeding habitat for the Superb Parrot.

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Appendix A: Flora species recorded

Native species recorded

Family	Scientific Name	Common Name
Fabaceae	*Acacia deanei*	Green Wattle
Fabaceae	*Acacia deanei* subsp. *deanei*	Deane's Wattle
Fabaceae	*Acacia oswaldii*	Miljee
Fabaceae	*Acacia pendula*	Boree
Fabaceae	*Acacia stenophylla*	River Cooba
Asteraceae	*Actinobole uliginosum*	Flannel Cudweed
Sapindaceae	*Alectryon oleifolius*	Western Rosewood
Casuarinaceae	*Allocasuarina luehmannii*	Bulloak
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed
Loranthaceae	*Amyema quandang* var. *quandang*	Grey Mistletoe
Poaceae	*Aristida behriana*	Bunch Wiregrass
Poaceae	*Aristida jerichoensis*	Jericho Wiregrass
Anthericaceae	*Arthropodium minus*	Small Vanilla Lily
Rubiaceae	*Asperula conferta*	Common Woodruff
Chenopodiaceae	*Atriplex semibaccata*	Creeping Saltbush
Poaceae	*Aira spp.*	A Hairgrass
Poaceae	*Austrostipa aristiglumis*	Plains Grass
Poaceae	*Austrostipa blackii*	
Poaceae	*Austrostipa nodosa*	A Speargrass
Poaceae	*Austrostipa scabra*	Speargrass
Poaceae	*Austrostipa spp.*	A Speargrass
Nyctaginaceae	*Boerhavia dominii*	Tarvine
Poaceae	*Bothriochloa decipiens* var. *decipiens*	Pitted Bluegrass
Asphodelaceae	*Bulbine semibarbata*	Wild Onion
Portulacaceae	*Calandrinia eremaea*	Small Purslane
Cupressaceae	*Callitris glaucophylla*	White Cypress Pine
Asteraceae	*Calotis anthemoides*	Cut-leaved Burr-daisy
Asteraceae	*Calotis hispidula*	Bogan Flea
Cyperaceae	*Carex inversa*	Knob Sedge
Casuarinaceae	*Casuarina cristata*	Belah
Adiantaceae	*Cheilanthes sieberi* subsp. *sieberi*	Rock Fern
Chenopodiaceae	*Chenopodium desertorum* subsp. *microphyllum*	
Poaceae	*Chloris truncata*	Windmill Grass
Convolvulaceae	*Convolvulus clementii*	Desert Bindweed
Convolvulaceae	*Convolvulus erubescens*	Pink Bindweed
Convolvulaceae	*Convolvulus graminetinus*	
Crassulaceae	*Crassula decumbens* var. *decumbens*	Spreading Stonecrop
Crassulaceae	*Crassula sieberiana*	Australian Stonecrop
Brassicaceae	*Cuphonotus humistratus*	Mother-of-misery
Poaceae	*Cynodon dactylon*	Common Couch
Apiaceae	*Daucus glochidiatus*	Native Carrot
Poaceae	*Dichanthium sericeum*	Queensland Bluegrass
Convolvulaceae	*Dichondra repens*	Kidney Weed
Poaceae	*Digitaria divaricatissima*	Umbrella Grass
Poaceae	*Diplachne parviflora*	Small-flowered Beetle Grass
Polygonaceae	*Duma florulenta*	Lignum
Chenopodiaceae	*Dysphania pumilio*	Small Crumbweed
Asteraceae	*Eclipta platyglossa*	Yellow Twin-heads
Chenopodiaceae	*Einadia nutans*	Climbing Saltbush
Chenopodiaceae	*Einadia nutans* subsp. *nutans*	Climbing Saltbush
Chenopodiaceae	*Einadia trigonos*	Fishweed
Cyperaceae	*Eleocharis pallens*	Pale Spike Sedge
Cyperaceae	*Eleocharis plana*	Flat Spike-sedge
Poaceae	*Elymus scaber*	Common Wheatgrass
Chenopodiaceae	*Enchylaena tomentosa*	Ruby Saltbush

Family	Scientific Name	Common Name
Poaceae	*Enteropogon acicularis*	Curly Windmill Grass
Onagraceae	*Epilobium billardierianum* subsp. *billardierianum*	
Myoporaceae	*Eremophila mitchellii*	Budda
Geraniaceae	*Erodium crinitum*	Blue Crowfoot
Myrtaceae	*Eucalyptus camaldulensis*	River Red Gum
Myrtaceae	*Eucalyptus dwyeri*	Dwyer's Red Gum
Myrtaceae	*Eucalyptus microcarpa*	Western Grey Box
Myrtaceae	*Eucalyptus populnea* subsp. *bimbil*	Bimble Box
Myrtaceae	*Eucalyptus sideroxylon*	Mugga Ironbark
Asteraceae	*Euchiton gymnocephalus*	Creeping Cudweed
Euphorbiaceae	*Euphorbia drummondii*	Caustic Weed
Rutaceae	*Geijera parviflora*	Wilga
Goodeniaceae	*Goodenia fascicularis*	Mallee Goodenia
Goodeniaceae	*Goodenia glabra*	Smooth Goodenia
Goodeniaceae	*Goodenia pinnatifida*	Scrambled Eggs
Haloragaceae	*Haloragis glauca* f. *glauca*	
Asteraceae	*Hyalosperma semisterile*	
Hypoxidaceae	*Hypoxis glabella* var. *glabella*	Tiny Star
Asteraceae	*Isoetopsis graminifolia*	Grass Cushion
Cyperaceae	*Isolepis congrua*	Slender Club-sedge
Juncaceae	*Juncus aridicola*	Tussock Rush
Juncaceae	*Juncus filicaulis*	
Juncaceae	*Juncus flavidus*	
Juncaceae	*Juncus subsecundus*	Finger Rush
Poaceae	*Lachnagrostis filiformis*	
Asteraceae	*Leiocarpa leptolepis*	Pale Plover-daisy
Asteraceae	*Leiocarpa panaetioides*	Woolly Buttons
Brassicaceae	*Lepidium pseudohyssopifolium*	Peppercress
Lomandraceae	*Lomandra multiflora* subsp. *multiflora*	Many-flowered Mat-rush
Lythraceae	*Lythrum hyssopifolia*	Hyssop Loosestrife
Chenopodiaceae	*Maireana enchylaenoides*	Wingless Fissure-weed
Chenopodiaceae	*Maireana humillima*	
Chenopodiaceae	*Maireana microphylla*	Small-leaf Bluebush
Chenopodiaceae	*Maireana* spp.	Cotton Bush, Bluebush, Fissure-weed
Marsileaceae	*Marsilea costulifera*	
Marsileaceae	*Marsilea drummondii*	Common Nardoo
Oxalidaceae	*Oxalis perennans*	
Poaceae	*Panicum effusum*	Hairy Panic
Poaceae	*Panicum laevinode*	Pepper Grass
Poaceae	*Paspalidium constrictum*	Knottybutt Grass
Poaceae	*Paspalum distichum*	Water Couch
Plantaginaceae	*Plantago debilis*	Shade Plantain
Lobeliaceae	*Pratia concolor*	Poison Pratia
Amaranthaceae	*Ptilotus nobilis*	Yellowtails
Amaranthaceae	*Ptilotus spathulatus* f. *spathulatus*	Pussy-tails
Ranunculaceae	*Ranunculus sessiliflorus* var. *pilulifer*	Common Buttercup
Chenopodiaceae	*Rhagodia spinescens*	Thorny Saltbush
Asteraceae	*Rhodanthe corymbiflora*	Small White Sunray
Asteraceae	*Rhodanthe pygmaea*	Pigmy Sunray
Polygonaceae	*Rumex brownii*	Swamp Dock
Polygonaceae	*Rumex tenax*	Shiny Dock
Poaceae	*Rytidosperma auriculatum*	Lobed Wallaby Grass
Poaceae	*Rytidosperma caespitosum*	Ringed Wallaby Grass
Poaceae	*Rytidosperma monticola*	Mountain Wallaby Grass
Poaceae	*Rytidosperma racemosum*	Wallaby Grass
Poaceae	*Rytidosperma setaceum*	Small-flowered Wallaby-grass
Poaceae	*Rytidosperma* spp.	
Chenopodiaceae	*Salsola australis*	
Chenopodiaceae	*Sclerolaena birchii*	Galvanized Burr
Chenopodiaceae	*Sclerolaena muricata* var. *semiglabra*	Black Rolypoly

Family	Scientific Name	Common Name
Asteraceae	*Senecio glossanthus*	Streaked Poverty Bush
Asteraceae	*Senecio quadridentatus*	Cotton Fireweed
Malvaceae	*Sida ammophila*	Sand Sida
Malvaceae	*Sida corrugata*	Corrugated Sida
Malvaceae	*Sida trichopoda*	High Sida
Solanaceae	*Solanum esuriale*	Quena
Poaceae	*Sporobolus caroli*	Fairy Grass
Poaceae	*Sporobolus mitchellii*	Rat's Tail Couch
Juncaginaceae	*Triglochin* spp.	
Asteraceae	*Triptilodiscus pygmaeus*	Common Sunray
Asteraceae	*Vittadinia cervicularis* var. *cervicularis*	A Fuzzweed
Asteraceae	*Vittadinia cuneata*	A Fuzzweed
Asteraceae	*Vittadinia gracilis*	Woolly New Holland Daisy
Asteraceae	*Vittadinia* spp.	Fuzzweed
Campanulaceae	*Wahlenbergia gracilenta*	Annual Bluebell
Campanulaceae	*Wahlenbergia luteola*	Bluebell
Campanulaceae	*Wahlenbergia stricta*	Tall Bluebell
Poaceae	*Walwhalleya proluta*	
Poaceae	*Walwhalleya subxerophila*	Gilgai Grass
Colchicaceae	*Wurmbea dioica* subsp. *dioica*	Early Nancy

Exotic species recorded

Family	*Scientific Name*	Common Name
Asteraceae	*Arctotheca calendula*	Capeweed
Asteraceae	*Aster subulatus*	Wild Aster
Poaceae	*Avena barbata*	Bearded Oats
Poaceae	*Avena fatua*	Wild Oats
Poaceae	*Bromus diandrus*	Great Brome
Poaceae	*Bromus hordeaceus*	Soft Brome
Poaceae	*Bromus molliformis*	Soft Brome
Poaceae	*Bromus rubens*	Red Brome
Asteraceae	*Carthamus lanatus*	Saffron Thistle
Asteraceae	*Centaurea melitensis*	Maltese Cockspur
Asteraceae	*Cichorium intybus*	Chicory
Asteraceae	*Cirsium vulgare*	Spear Thistle
Asteraceae	*Conyza* spp.	A Fleabane
Asteraceae	*Cotula bipinnata*	Ferny Cotula
Cucurbitaceae	*Cucumis myriocarpus* subsp. *leptodermis*	Paddy Melon
Boraginaceae	*Echium plantagineum*	Paterson's Curse
Poaceae	*Eragrostis* spp.	A Lovegrass
Geraniaceae	*Erodium cicutarium*	Common Crowfoot
Geraniaceae	*Erodium moschatum*	Musky Crowfoot
Asteraceae	*Gamochaeta* spp.	
Asteraceae	*Hedypnois rhagadioloides*	Cretan Weed
Asteraceae	*Helminthotheca echioides*	Ox-tongue
Poaceae	*Hordeum glaucum*	Northern Barley Grass
Poaceae	*Hordeum leporinum*	Barley Grass
Poaceae	*Hordeum marinum*	Sea Barley Grass
Asteraceae	*Hypochaeris glabra*	Smooth Catsear
Asteraceae	*Lactuca saligna*	Willow-leaved Lettuce
Asteraceae	*Lactuca serriola*	Prickly Lettuce
Brassicaceae	*Lepidium africanum*	Common Peppercress
Poaceae	*Lolium multiflorum*	Italian Ryegrass
Poaceae	*Lolium perenne*	Perennial Ryegrass
Poaceae	*Lolium rigidum*	Wimmera Ryegrass
Solanaceae	*Lycium ferocissimum*	African Boxthorn
Malvaceae	*Malva parviflora*	Small-flowered Mallow
Fabaceae	*Medicago minima*	Woolly Burr Medic

Family	*Scientific Name*	Common Name
Fabaceae	*Medicago polymorpha*	Burr Medic
Fabaceae	*Medicago truncatula*	Barrel Medic
Poaceae	*Paspalum dilatatum*	Paspalum
Caryophyllaceae	*Petrorhagia nanteuilii*	Proliferous Pink
Poaceae	*Phalaris paradoxa*	Paradoxa Grass
Polygonaceae	*Polygonum aviculare*	Wireweed
Iridaceae	*Romulea rosea var. australis*	Onion Grass
Polygonaceae	*Rumex conglomeratus*	Clustered Dock
Lamiaceae	*Salvia verbenaca*	Vervain
Asteraceae	*Scorzonera laciniata*	
Asteraceae	*Silybum marianum*	Variegated Thistle
Brassicaceae	*Sisymbrium erysimoides*	Smooth Mustard
Brassicaceae	*Sisymbrium irio*	London Rocket
Solanaceae	*Solanum* spp.	
Asteraceae	*Soliva stolonifera*	Jo-jo
Asteraceae	*Sonchus oleraceus*	Common Sowthistle
Caryophyllaceae	*Spergularia rubra*	Sandspurry
Asteraceae	*Taraxacum officinale*	Dandelion
Asteraceae	*Tolpis barbata*	Yellow Hawkweed
Fabaceae	*Trifolium angustifolium*	Narrow-leaved Clover
Fabaceae	*Trifolium arvense*	Haresfoot Clover
Fabaceae	*Trifolium glomeratum*	Clustered Clover
Fabaceae	*Trifolium hirtum*	Rose Clover
Fabaceae	*Trifolium subterraneum*	Subterranean Clover
Poaceae	*Vulpia bromoides*	Squirrel Tail Fesque
Poaceae	*Vulpia muralis*	Wall Fescue
Poaceae	*Vulpia myuros*	Rat's Tail Fescue
Asteraceae	*Xanthium spinosum*	Bathurst Burr

Appendix B: Fauna species recorded in the study area and surrounds

Class	Scientific Name	Common Name	No of times recorded	No individuals recorded
Amphibia	*Litoria caerulea*	Green Tree Frog	1	2
Amphibia	*Litoria peronii*	Peron's Tree Frog	4	111
Amphibia	*Limnodynastes dumerilii*	Eastern Banjo Frog	9	9
Amphibia	*Limnodynastes tasmaniensis*	Spotted Grass Frog	38	2384
Amphibia	*Neobatrachus sudelli*	Sudell's Frog	4	13
Amphibia	*Crinia parinsignifera*	Eastern Sign-bearing Froglet	45	855
Amphibia	*Crinia signifera*	Common Eastern Froglet	2	3
Amphibia	*Limnodynastes interioris*	Giant Banjo Frog	4	4
Amphibia	*Uperoleia rugosa*	Wrinkled Toadlet	5	13
Aves	*Haliaeetus leucogaster*	White-bellied Sea-Eagle #^	1	1
Aves	*Anas castanea*	Chestnut Teal	1	1
Aves	*Anas gracilis*	Grey Teal	8	33
Aves	*Anas rhynchotis*	Australasian Shoveler	2	2
Aves	*Anas superciliosa*	Pacific Black Duck	13	27
Aves	*Aythya australis*	Hardhead	2	2
Aves	*Biziura lobata*	Musk Duck	3	3
Aves	*Chenonetta jubata*	Australian Wood Duck	11	126
Aves	*Cygnus atratus*	Black Swan	1	1
Aves	*Dendrocygna eytoni*	Plumed Whistling-Duck	8	75
Aves	*Malacorhynchus membranaceus*	Pink-eared Duck	4	48
Aves	*Tadorna tadornoides*	Australian Shelduck	1	2
Aves	*Anseranas semipalmata*	Magpie Goose #^	1	5
Aves	*Aegotheles cristatus*	Australian Owlet-Nightjar	5	5
Aves	*Podargus strigoides*	Tawny Frogmouth	2	2
Aves	*Elseyornis melanops*	Black-fronted Dotterel	4	6
Aves	*Vanellus miles*	Masked Lapwing	12	12
Aves	*Himantopus himantopus*	Black-winged Stilt	4	17
Aves	*Chlidonias hybrida*	Whiskered Tern	2	55
Aves	*Chroicocephalus novaehollandiae*	Silver Gull	4	5
Aves	*Actitis hypoleucos*	Common Sandpiper #^	1	1
Aves	*Ardea alba*	Great Egret	5	6
Aves	*Ardea pacifica*	White-necked Heron	6	6
Aves	*Egretta novaehollandiae*	White-faced Heron	23	27
Aves	*Nycticorax caledonicus*	Nankeen Night Heron	8	8
Aves	*Platalea flavipes*	Yellow-billed Spoonbill	5	6
Aves	*Platalea regia*	Royal Spoonbill	5	6
Aves	*Plegadis falcinellus*	Glossy Ibis #	2	13
Aves	*Threskiornis spinicollis*	Straw-necked Ibis	4	66
Aves	*Ocyphaps lophotes*	Crested Pigeon	32	47
Aves	*Dacelo novaeguineae*	Laughing Kookaburra	3	3
Aves	*Todiramphus sanctus*	Sacred Kingfisher	4	5
Aves	*Chalcites basalis*	Horsfield's Bronze-Cuckoo	1	1
Aves	*Accipiter cirrocephalus*	Collared Sparrowhawk	1	1
Aves	*Aquila audax*	Wedge-tailed Eagle	1	1
Aves	*Elanus axillaris*	Black-shouldered Kite	20	28
Aves	*Haliastur sphenurus*	Whistling Kite	12	13
Aves	*Hieraaetus morphnoides*	Little Eagle #	1	1
Aves	*Milvus migrans*	Black Kite	2	2
Aves	*Falco berigora*	Brown Falcon	7	9
Aves	*Falco cenchroides*	Nankeen Kestrel	29	34
Aves	*Falco longipennis*	Australian Hobby	1	2
Aves	*Falco subniger*	Black Falcon#	1	1
Aves	*Coturnix ypsilophora*	Brown Quail	4	6

Class	Scientific Name	Common Name	No of times recorded	No individuals recorded
Aves	*Fulica atra*	Eurasian Coot	4	4
Aves	*Gallinula tenebrosa*	Dusky Moorhen	2	2
Aves	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill	10	14
Aves	*Acanthiza nana*	Yellow Thornbill	4	5
Aves	*Acanthiza uropygialis*	Chestnut-rumped Thornbill	2	2
Aves	*Aphelocephala leucopsis*	Southern Whiteface	1	4
Aves	*Gerygone fusca*	Western Gerygone	1	1
Aves	*Acrocephalus australis*	Australian Reed-warbler	2	2
Aves	*Mirafra javanica*	Horsfield's Bushlark	3	7
Aves	*Cracticus nigrogularis*	Pied Butcherbird	34	36
Aves	*Cracticus torquatus*	Grey Butcherbird	20	23
Aves	*Gymnorhina tibicen*	Australian Magpie	45	56
Aves	*Coracina maxima*	Ground Cuckoo-shrike	1	2
Aves	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	4	6
Aves	*Coracina papuensis*	White-bellied Cuckoo-shrike	1	1
Aves	*Cisticola exilis*	Golden-headed Cisticola	5	20
Aves	*Corcorax melanorhamphos*	White-winged Chough	5	19
Aves	*Struthidea cinerea*	Apostlebird	39	179
Aves	*Corvus coronoides*	Australian Raven	23	24
Aves	*Corvus mellori*	Little Raven	34	42
Aves	*Taeniopygia guttata*	Zebra Finch	2	4
Aves	*Grallina cyanoleuca*	Magpie-lark	1	2
Aves	*Hirundo ariel*	Fairy Martin	1	12
Aves	*Hirundo neoxena*	Welcome Swallow	20	23
Aves	*Hirundo nigricans*	Tree Martin	1	1
Aves	*Malurus lamberti*	Variegated Fairy-wren	4	9
Aves	*Malurus leucopterus*	White-winged Fairy-wren	1	3
Aves	*Cincloramphus cruralis*	Brown Songlark	3	3
Aves	*Cincloramphus mathewsi*	Rufous Songlark	2	2
Aves	*Megalurus gramineus*	Little Grassbird	2	2
Aves	*Acanthagenys rufogularis*	Spiny-cheeked Honeyeater	9	12
Aves	*Entomyzon cyanotis*	Blue-faced Honeyeater	7	10
Aves	*Epthianura albifrons*	White-fronted Chat #	2	4
Aves	*Lichenostomus penicillatus*	White-plumed Honeyeater	5	5
Aves	*Lichenostomus virescens*	Singing Honeyeater	1	1
Aves	*Manorina flavigula*	Yellow-throated Miner	1	1
Aves	*Manorina melanocephala*	Noisy Miner	69	126
Aves	*Philemon corniculatus*	Noisy Friarbird	1	1
Aves	*Plectorhyncha lanceolata*	Striped Honeyeater	16	19
Aves	*Grallina cyanoleuca*	Magpie-lark	34	40
Aves	*Anthus novaeseelandiae*	Australasian Pipit	1	1
Aves	*Pardalotus striatus*	Striated Pardalote	5	5
Aves	*Petroica goodenovii*	Red-capped Robin	3	3
Aves	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler (eastern subspecies) #	45	97
Aves	*Rhipidura albiscarpa*	Grey Fantail	4	4
Aves	*Rhipidura leucophrys*	Willie Wagtail	20	22
Aves	*Sturnus vulgaris*	Common Starling*	13	36
Aves	*Anhinga novaehollandiae*	Australasian Darter	4	5
Aves	*Ardea intermedia*	Intermediate Egret	1	1
Aves	*Pelecanus conspicillatus*	Australian Pelican	8	10
Aves	*Microcarbo melanoleucos*	Little Pied Cormorant	4	4
Aves	*Phalacrocorax carbo*	Great Cormorant	2	11
Aves	*Phalacrocorax sulcirostris*	Little Black Cormorant	2	9
Aves	*Phalacrocorax varius*	Pied Cormorant	3	3
Aves	*Threskiornis moluccus*	Australian White Ibis	1	5
Aves	*Podiceps cristatus*	Great Crested Grebe	2	4
Aves	*Poliocephalus poliocephalus*	Hoary-headed Grebe	4	4
Aves	*Tachybaptus novaehollandiae*	Australasian Grebe	7	9
Aves	*Cacatua sanguinea*	Little Corella	2	5

Class	Scientific Name	Common Name	No of times recorded	No individuals recorded
Aves	*Eolophus roseicapillus*	Galah	60	178
Aves	*Lophochroa leadbeateri*	Major Mitchell's Cockatoo #	1	2
Aves	*Nymphicus hollandicus*	Cockatiel	3	11
Aves	*Barnardius zonarius*	Australian Ringneck	22	29
Aves	*Northiella haematogaster*	Blue Bonnet	23	47
Aves	*Platycercus eximius*	Eastern Rosella	32	39
Aves	*Polytelis swainsonii*	Superb Parrot #	17	109
Aves	*Psephotus haematonotus*	Red-rumped Parrot	16	34
Aves	*Ninox novaeseelandiae*	Southern Boobook	3	3
Aves	*Tyto javanica*	Pacific Barn Owl	5	6
Aves	*Dromaius novaehollandiae*	Emu	23	197
Mammalia	*Bos taurus*	Cattle*	4	8
Mammalia	*Canis lupus familiaris*	Dog	1	1
Mammalia	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat #	9	9
Mammalia	*Austronomus australis*	White-striped Free-tailed Bat	16	17
Mammalia	*Mormopterus (Ozimops) petersi*	Inland Free-tailed Bat	15	15
Mammalia	*Mormopterus (Ozimops) planiceps*	South-eastern Free-tailed Bat	20	23
Mammalia	*Pteropus scapulatus*	Little Red Flying-fox	1	5
Mammalia	*Chalinolobus gouldii*	Gould's Wattled Bat	21	23
Mammalia	*Chalinolobus morio*	Chocolate Wattled Bat	7	7
Mammalia	*Nyctophilus geoffroyi*	Lesser Long-eared Bat	7	15
Mammalia	*Scotorepens balstoni*	Inland Broad-nosed Bat	15	15
Mammalia	*Scotorepens greyii*	Little Broad-nosed Bat	12	12
Mammalia	*Vespadelus vulturnus*	Little Forest Bat	25	32
Mammalia	*Antechinus flavipes*	Yellow-footed Antechinus	2	3
Mammalia	*Macropus giganteus*	Eastern Grey Kangaroo	44	71
Mammalia	*Macropus rufus*	Red Kangaroo	5	9
Mammalia	*Wallabia bicolor*	Swamp Wallaby	1	1
Mammalia	*Trichosurus vulpecula*	Common Brushtail Possum	31	87
Mammalia	*Vulpes vulpes*	Red Fox*	30	31
Mammalia	*Felis catus*	Cat*	13	13
Mammalia	*Lepus europaeus*	European Brown Hare*	8	14
Mammalia	*Tachyglossus aculeatus*	Short-beaked Echidna	6	19
Mammalia	*Mus musculus*	House Mouse*	7	8
Reptilia	*Pogona barbata*	Bearded Dragon	3	3
Reptilia	*Pogona vitticeps*	Central Bearded Dragon	1	1
Reptilia	*Diplodactylus vittatus*	Wood Gecko	1	1
Reptilia	*Notechis scutatus*	Tiger Snake	1	1
Reptilia	*Pseudechis guttatus*	Spotted Black Snake	1	1
Reptilia	*Suta suta*	Curl Snake	1	1
Reptilia	*Gehyra versicolor*	Variable Dtella	12	52
Reptilia	*Delma inornata*	Olive Delma	1	1
Reptilia	*Morelia spilota*	Carpet Python	1	1
Reptilia	*Cryptoblepharus australis*	Inland Snake-eyed Skink	2	5
Reptilia	*Ctenotus robustus*	Robust Ctenotus	4	6
Reptilia	*Lerista timida*	Timid Slider	3	8
Reptilia	*Menetia greyii*	Common Dwarf Skink	1	1
Reptilia	*Morethia boulengeri*	South-eastern Morethia Skink	5	15
Reptilia	*Tiliqua scincoides*	Eastern Blue-tongued Lizard	2	2
Reptilia	*Anilios bituberculatus*	Prong-snouted Blind Snake	2	2
Reptilia	*Chelodina longicollis*	Eastern Snake-necked Turtle	5	10

* Indicates introduced species or livestock
^ Indicates species recorded outside the study area
# Indicates threatened and/or migratory species under the New South Wales Threatened Species Conservation Act 1995 and/or Commonwealth Environment Protection and Biodiversity Conservation Act 1999
V = listed as 'Vulnerable' under the Biodiversity Conservation Act 2016 and/or Commonwealth Environment Protection and Biodiversity Conservation Act 1999
M = listed as 'Migratory' under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999

Appendix C: Biobanking plot data

Plot	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone	Survey Year
LC05	13	0	0	0	0	0	98	0	1	0	534954	6275542	55	2016
LC08	19	20	0	0	6	20	82	1	1	6	537928	6276628	55	2016
LC09	23	0	23.5	0	6	6	100	0	1	10	537826	6276919	55	2016
LC14	35	40	0	10	0	48	26	0	1	0	537127	6275619	55	2016
LC15	14	0	0	4	2	0	96	0	1	0	534698	6276066	55	2016
LC16	12	0	0	2	0	0	98	0	1	0	535909	6275658	55	2016
LC17	13	0	0	0	0	0	100	0	1	0	535305	6276034	55	2016
LC19	11	0	0	10	0	0	96	0	0	0	537308	6275900	55	2016
LC20	19	0	0	6	0	0	98	0	1	0	534230	6275681	55	2016
LC21	22	10	0	0	28	4	80	0	1	0	536471	6276137	55	2016
LC22	21	20.5	0	0	4	4	98	0	1	0	536496	6275893	55	2016
LC23	26	0	0	8	0	2	96	0	1	0	535921	6276131	55	2016
LC26	29	40	0	0	0	14	76	0	1	10	548070	6282044	55	2016
LC27	21	25	0	0	2	18	20	2	1	46	551124	6281708	55	2016
LC28	12	20	35	0	0	42	6	0	1	1	550176	6281812	55	2016
LC29	15	0	0	38	0	38	58	0	0	0	536846	6276177	55	2016
LC32	15	0	0	14	0	16	2	0	0	3	547912	6281379	55	2016
LC33	14	0	0	62	0	34	36	0	0	0	551451	6281799	55	2016
LC34	18	6	0	12	0	2	15	0	1	4	531948	6280312	55	2017
LC35	20	0	0	38	0	10	15	0	0	0	532191	6280283	55	2017
LC36	22	0	0	42	0	14	30	0	1	4	532227	6280217	55	2017
LC37	21	0	0	8	0	6	10	0	1	6	532728	6280117	55	2017
LC38	19	0	0	10	0	32	15	0	0	0	533504	6279974	55	2017
LC39	21	2	0	6	0	10	20	0	1	4	532719	6279771	55	2017
LC40	10	0	0	28	0	4	25	0	1	0	531970	6279822	55	2017
LC41	19	0	0	22	0	10	35	0	1	0	532326	6279377	55	2017
LC42	12	0	0	6	0	0	20	0	0	0	532772	6278965	55	2017
LC43	15	0	0	18	0	0	30	0	1	0	533356	6279209	55	2017
LC44	12	0	0	6	0	4	25	0	1	0	533034	6278868	55	2017
LC45	15	5	0	4	0	8	10	1	1	25	533759	6278949	55	2017
LC46	20	0	0	18	0	4	15	0	1	0	534228	6279564	55	2017
LC47	15	4	0	2	0	2	20	0	1	32	534064	6278973	55	2017
LC48	20	0	0	6	0	6	15	0	1	3	532820	6278483	55	2017

Plot	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone	Survey Year
LC49	18	0	0	6	0	2	15	0	1	0	533090	6278354	55	2017
LC50	11	0	0	6	0	0	35	0	1	0	533245	6277228	55	2017
LC51	25	0	0	16	0	0	15	0	1	4	533344	6276462	55	2017
LC52	9	0	0	10	0	0	20	0	1	0	535306	6276706	55	2017
LC53	18	0	1	2	0	10	10	1	1	13	535248	6276396	55	2017
LC54	14	0	0	8	0	0	15	0	1	0	535770	6276123	55	2017
LC55	23	25	5	16	4	0	4	1	0	10	552284	6282577	55	2017
LC56	13	8	0	92	0	0	1	6	0	10.5	546325	6281312	55	2017

Note: NPS = Native plant species, NOS = Native overstorey species, NMS = Native midstorey species, NGCG = Native ground cover grass, NGCS = Native ground cover shrub, NGCO = Native ground cover other, EPC = Exotic plant cover, NTH = Number tree hollows, OR = Overstorey regeneration, FL = Length of logs (metres).

Appendix D: Likelihood of threatened flora occurrence

Report generated using the OEH BioBanking Database tool for the Lachlan CMA.

Scientific Name	Common Name	General Type	Habitat Constraints	Potential Occurrence	Survey Technique
Acacia ausfeldii	Ausfeld's Wattle	Shrubs		Known for the region.	Transects in suitable habitat.
Acacia curranii	Curly-bark Wattle	Shrubs	Rocky slopes	Not known or predicted for the study area	No targeted surveys proposed.
Acacia meiantha		Shrubs		Not known or predicted for the study area.	No targeted surveys proposed.
Ammobium craspedioides	Yass Daisy	Herbs and Forbs		Not known or predicted for the study area.	No targeted surveys proposed.
Amphibromus fluitans	Floating Swamp Wallaby-grass	Herbs and Forbs	Periodically waterlogged sites (including table drains and farm dams)	Known for the region.	Transects in suitable habitat.
Austrostipa metatoris	A spear-grass	Herbs and Forbs		Not known or predicted for the study area.	No targeted surveys proposed.
Austrostipa wakoolica	A spear-grass	Herbs and Forbs		Habitat may be present.	Transects in suitable habitat.
Baloskion longipes	Dense Cord-rush	Herbs and Forbs		Not known or predicted for the study area.	No targeted surveys proposed.
Bossiaea fragrans		Shrubs		Not known or predicted for the study area.	No targeted surveys proposed.
Brachyscome papillosa	Mossgiel Daisy	Herbs and Forbs		Not known or predicted for the study area.	No targeted surveys proposed.
Budawangia gnidioides	Budawangs Cliff-heath	Shrubs		Not known or predicted for the study area.	No targeted surveys proposed.
Caladenia concolor	Crimson Spider Orchid	Orchids		Not known or predicted for the study area.	No targeted surveys proposed.
Caladenia tessellate	Thick Lip Spider Orchid	Orchids		Not known or predicted for the study area.	No targeted surveys proposed.
Carex klaphakei	Klaphake's Sedge	Herbs and Forbs	Swamps above 600 m in altitude	Not known or predicted for the study area.	No targeted surveys proposed.
Commersonia prostrata	Dwarf Kerrawang	Shrubs		Not known or predicted for the study area.	No targeted surveys proposed.
Cullen parvum	Small Scurf-pea	Herbs and Forbs		Not known or predicted for the study area.	No targeted surveys proposed.
Distichlis distichophylla	Australian Saltgrass	Herbs and Forbs	Salt marsh, saline areas or margins of these areas	Habitat may be present.	Transects in suitable habitat.
Diuris aequalis	Buttercup Doubletail	Orchids		Not known or predicted for the study area.	No targeted surveys proposed.
Diuris pedunculata	Small Snake Orchid	Orchids		Not known or predicted for the study area.	No targeted surveys proposed.
Diuris tricolor	Pine Donkey Orchid	Orchids		Known for the region; however, unlikely in disturbed/cleared areas.	No targeted surveys proposed.
Dodonaea sinuolata subsp. Acrodentata	A Hopbush	Shrubs	NA	Not known or predicted for the study area.	No targeted surveys proposed.
Dysphania plantaginella		Herbs and Forbs	Gypseous sandy soils	Habitat may be present.	Transects in suitable habitat.
Eleocharis obicis	Spike-Rush	Herbs and Forbs	Periodically waterlogged sites (including table drains and farm dams)	Known for the region.	Transects in suitable habitat.
Eucalyptus aggregata	Black Gum	Trees		Not known or predicted for the study area.	No targeted surveys proposed.
Eucalyptus canobolensis	Silver-Leaf Candlebark	Trees		Not known or predicted for the study area.	No targeted surveys proposed.
Eucalyptus mckieana	McKie's Stringybark	Trees		Not known or predicted for the study area.	No targeted surveys proposed.

Scientific Name	Common Name	General Type	Habitat Constraints	Potential Occurrence	Survey Technique
Eucalyptus robertsonii subsp. Hemisphaerica	Robertson's Peppermint	Trees		Not known or predicted for the study area.	No targeted surveys proposed.
Eucalyptus saxicola	Mt Canobolas Box	Trees		Not known or predicted for the study area.	No targeted surveys proposed.
Goodenia macbarronii	Narrow Goodenia	Herbs and Forbs	Seasonally wet/boggy sites (including table drains)	Not known or predicted for the study area.	No targeted surveys proposed.
Grevillea divaricata		Shrubs		Not known or predicted for the study area.	No targeted surveys proposed.
Grevillea iaspicula	Wee Jasper Grevillea	Shrubs		Not known or predicted for the study area.	No targeted surveys proposed.
Grevillea ilicifolia subsp. Ilicifolia	Holly-leaf Grevillea	Shrubs	Shrubby mallee communities	Not known or predicted for the study area.	No targeted surveys proposed.
Hibbertia puberula		Shrubs		Not known or predicted for the study area.	No targeted surveys proposed.
Homopholis belsonii	Belson's Panic	Herbs and Forbs		Not known or predicted for the study area.	No targeted surveys proposed.
Kippistia suaedifolia	Fleshy Minuria	Shrubs	Land containing gypsum-rich saline areas and surrounds	Known for the region.	Transects in suitable habitat.
Lepidium aschersonii	Spiny Peppercress	Herbs and Forbs	On ridges of gilgai clays	Known for the region.	Transects in suitable habitat.
Lepidium hyssopifolium	Aromatic Peppercress	Herbs and Forbs		Not known or predicted for the study area.	No targeted surveys proposed.
Lepidium monoplocoides	Winged Peppercress	Herbs and Forbs	Land containing seasonally damp or waterlogged sites	Known for the region.	Transects in suitable habitat.
Leptorhynchos orientalis	Lanky Buttons	Herbs and Forbs		Not known or predicted for the study area.	No targeted surveys proposed.
Leucochrysum albicans var. tricolor	Hoary Sunray	Herbs and Forbs		Not known or predicted for the study area.	No targeted surveys proposed.
Monotaxis macrophylla	Large-leafed Monotaxis	Herbs and Forbs		Not known or predicted for the study area.	No targeted surveys proposed.
Philotheca ericifolia		Shrubs		Not known or predicted for the study area.	No targeted surveys proposed.
Pilularia novae-hollandiae	Austral Pillwort	Ferns and Cycads	Periodically waterlogged sites (including table drains and farm dams)	Known for the region.	Transects in suitable habitat.
Pomaderris cocoparrana		Shrubs		Not known or predicted for the study area.	No targeted surveys proposed.
Senecio garlandii	Woolly Ragwort	Herbs and Forbs		Not known or predicted for the study area. Potential habitat not present.	No targeted surveys proposed.
Sida rohlenae	Shrub Sida	Herbs and Forbs		Not known or predicted for the study area.	No targeted surveys proposed.
Solanum karsense	Menindee Nightshade	Herbs and Forbs	Periodically flooded depressions with heavy soils	Not known or predicted for the study area.	No targeted surveys proposed.
Swainsona murrayana	Slender Darling Pea	Herbs and Forbs		Known for the region.	Transects in suitable habitat.
Swainsona plagiotropis	Red Darling Pea	Herbs and Forbs		Not known or predicted for the study area.	No targeted surveys proposed.
Swainsona recta	Small Purple-pea	Herbs and Forbs		Known for the region; however, unlikely in disturbed/cleared areas.	No targeted surveys proposed.
Swainsona sericea	Silky Swainson-pea	Herbs and Forbs		Known for the region.	Transects in suitable habitat.
Trachymene scapigera	Mountain Trachymene	Herbs and Forbs		Not known or predicted for the study area.	No targeted surveys proposed.
Tylophora linearis		Epiphytes and Climbers		Not known or predicted for the study area.	No targeted surveys proposed.
Veronica blakelyi		Shrubs		Not known or predicted for the study area.	No targeted surveys proposed.

Note: for months containing a “dash” (i.e. -), no data was available in the report generated using the OEH BioBanking Database tool for the Lachlan CMA.

Appendix E: Fauna desktop search results

Common Name	Scientific Name	Conservation Status		Previously recorded in locality			Recorded from Study Area or close surrounds	
		BC Act	EPBC Act	Lachlan CMA	EPBC Report[2]	Bionet[3]	Previous Surveys[4]	Current surveys[5]
Common Sandpiper	*Actitis hypoleucos*		M	✓	✓	✓		✓
Magpie Goose	*Anseranas semipalmata*	V		✓		✓	✓	✓
pRegent Honeyeater	*Anthochaera phrygia*	CE	CE, M	✓	✓	✓		
Pink-tailed Legless Lizard	*Aprasia parapulchella*	V	V	✓	✓			
Fork-tailed Swift	*Apus pacificus*		M		✓	✓		
Cattle Egret	*Ardea ibis*		M			✓		
Eastern Great Egret	*Ardea modesta*		M					
Australian Bustard	*Ardeotis australis*	E		✓				
Dusky Woodswallow	*Artamus cyanopterus*	V		✓		✓		
Australasian Bittern	*Botaurus poiciloptilus*	E	E	✓	✓	✓		
Bush Stone-curlew	*Burhinus grallarius*	E		✓		✓	✓	
Sharp-tailed Sandpiper	*Calidris acuminate*		M		✓	✓		
Curlew Sandpiper	*Calidris ferruginea*	E	CE, M	✓	✓	✓	✓	
Pectoral Sandpiper	*Calidris melanotos*		M		✓	✓		
Red-necked Stint	*Calidris ruficollis*		M			✓		
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V		✓				
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V		✓				
Eastern Pygmy-possum	*Cercartetus nanus*	V		✓				
Pied Honeyeater	*Certhionyx variegatus*	V		✓				
Little Pied Bat	*Chalinolobus picatus*	V		✓		✓	✓ (loc. unknown)	
Double-banded Plover	*Charadrius bicinctus*		M					
White-winged Black Tern	*Chlidonias leucopterus*		M			✓		
Speckled Warbler	*Chthonicola sagittate*	V		✓		✓		
Chestnut Quail-thrush	*Cinclosoma castanotum*	V		✓		✓		
Spotted Harrier	*Circus assimilis*	V		✓		✓		
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V		✓		✓		
Sloane's Froglet	*Crinia sloanei*	V		✓		✓		
Varied Sittella	*Daphoenositta chrysoptera*	V		✓		✓		
Spotted-tailed Quoll	*Dasyurus maculatus*	V	E	✓	✓			
Southern Scrub-robin	*Drymodes brunneopygia*	V		✓		✓		

Common Name	Scientific Name	Conservation Status		Previously recorded in locality			Recorded from Study Area or close surrounds	
		BC Act	EPBC Act	Lachlan CMA	EPBC Report[2]	Bionet[3]	Previous Surveys[4]	Current surveys[5]
White-fronted Chat	*Epthianura albifrons*	V		✓		✓		✓
Grey Falcon	*Falco hypoleucos*	E		✓		✓		
Black Falcon	*Falco subniger*	V		✓		✓		✓
Lathams's Snipe	*Gallinago hardwickii*		M		✓	✓		
Gull-billed Tern	*Gelochelidon nilotica*		M			✓		
Little Lorikeet	*Glossopsitta pusilla*	V		✓		✓		
Painted Honeyeater	*Grantiella picta*	V	V	✓	✓	✓		
Brolga	*Grus rubicunda*	V		✓		✓		
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	V		✓		✓		✓
Black-breasted Buzzard	*Hamirostra melanosternon*	V		✓		✓		
Little Eagle	*Hieraaetus morphnoides*	V		✓		✓	✓	✓
White-throated Needletail	*Hirundapus caudacutus*		M		✓	✓		
Caspian Tern	*Hydroprogne caspia*		M			✓		
Shy Heathwren	*Hylacola cautus*	V		✓		✓		
Swift Parrot	*Lathamus discolor*	CE	CE	✓	✓	✓		
Malleefowl	*Leipoa ocellate*	E	V, M	✓	✓	✓		
Bar-tailed Godwit	*Limosa lapponica*		M		✓	✓		
Black-tailed Godwit	*Limosa limosa*	V	M	✓		✓		
Green and Golden Bell Frog	*Litoria aurea*	E	V	✓				
Booroolong Frog	*Litoria booroolongensis*	E	E	✓				
Green-thighed Frog	*Litoria brevipalmata*	V		✓				
Yellow-spotted Tree Frog	*Litoria castanea*	CE	E	✓				
Southern Bell Frog	*Litoria raniformis*	E	V	✓				
Major Mitchell's Cockatoo	*Lophochroa leadbeateri*	V		✓		✓		✓
Square-tailed Kite	*Lophoictinia isura*	V		✓		✓	✓	
Bilby	*Macrotis lagotis*	Ex	V	✓				
Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	V		✓		✓		
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	V		✓		✓		
Stuttering Frog	*Mixophyes balbus*	E	V	✓				
Giant Barred Frog	*Mixophyes iteratus*	E	E	✓				
Yellow Wagtail	*Motacila flava*		M		✓			
Satin Flycatcher	*Myiagra cyanoleuca*		M		✓			
Southern Myotis	*Myotis Macropus*	V		✓				

Common Name	Scientific Name	Conservation Status		Previously recorded in locality			Recorded from Study Area or close surrounds	
		BC Act	EPBC Act	Lachlan CMA	EPBC Report[2]	Bionet[3]	Previous Surveys[4]	Current surveys[5]
Turquoise Parrot	*Neophema pulchella*	V		✓		✓		
Barking Owl	*Ninox connivens*	V		✓		✓	✓	
Eastern Curlew	*Numenius madagascariensis*		M / CE		✓			
Little Curlew	*Numenius minutus*		M					
Whimbrel	*Numenius phaeopus*		M			✓		
Corben's Long-eared Bat	*Nyctophilus corbeni*	V	V	✓	✓	✓		
Blue-billed Duck	*Oxyura australis*	V		✓		✓	✓ (loc unknown)	
Gilbert's Whistler	*Pachycephala inornata*	V		✓		✓		
Eastern Osprey	*Pandion cristatus*		M	✓		✓		
Squirrel Glider	*Petaurus norfolcensis*	V		✓		✓		
Scarlet Robin	*Petroica boodang*	V		✓		✓		
Flame Robin	*Petroica phoenicea*	V		✓		✓		
Night Parrot	*Pezoporus occidentalis*	PEx	E		✓			
Brush-tailed Phascogale	*Phascogale tapoatafa*	V		✓				
Koala	*Phascolarctos cinereus*	V	V	✓	✓			
Glossy Ibis	*Plegadis falcinellus*		M			✓		✓
Pacific Golden Plover	*Pluvialis fulva*		M			✓		
Superb Parrot	*Polytelis swainsonii*	V	V	✓	✓	✓	✓	✓
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V		✓		✓	✓	✓
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	V	✓	✓	✓		
Rufous Fantail	*Rhipidura rufifrons*		M		✓			
Australian Painted Snipe	*Rostratula australis*	E	E, M	✓	✓	✓		
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V		✓		✓		✓
Diamond Firetail	*Stagonopleura guttate*	V		✓		✓		
Freckled Duck	*Stictonetta naevosa*	V		✓		✓	✓	
Wood Sandpiper	*Tringa glareola*		M			✓		
Common Greenshank	*Tringa nebularia*		M		✓	✓		
Marsh Sandpiper	*Tringa stagnatilis*		M			✓		
Inland Forest Bat	*Vespadelus baverstocki*	V		✓			✓	
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V		✓				
Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	V		✓				
Eastern Freetail-bat	*Mormopterus norfolkensis*	V		✓				
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V		✓				

Notes:

EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*; BC Act = *Biodiversity Conservation Act 2016*

V = Vulnerable, E = Endangered, PEx = Presumed Extinct, Ex = Extinct, M = Migratory

[1] CMA subregion: Lower Slopes within the Lachlan CMA

[2] The report is based on an area within approximately 10 km of the study area.

[3] Only records that fell within 10 km of the study area boundary were included

[4] Surveys that are summarised in Resource Strategies (2013)

[5] Includes data from 2016 Surveys (AMBS, 2016)

Appendix F: Fauna survey location coordinates

Survey Period	Survey Type	Survey Site	Easting	Northing
2017	Targeted Bird Survey (SP and RH)	CWB01	533754	6278930
2017	Targeted Bird Survey (SP and RH)	CWB02	533216	6278480
2017	Targeted Bird Survey (SP and RH)	CWB03	533476	6277084
2017	Targeted Bird Survey (SP and RH)	CWB04	533446	6276567
2017	Targeted Bird Survey (SP and RH)	CWB05	535468	6276697
2017	Targeted Bird Survey (SP and RH)	CWB06	535369	6276400
2017	Targeted Bird Survey (SP and RH)	CWB07	537927	6276455
2017	Targeted Bird Survey (SP and RH)	CWB08	532233	6280318
2017	Targeted Bird Survey (SP and RH)	CWB09	531846	6280361
2017	Targeted Bird Survey (SP and RH)	CWB10	532175	6279710
2017	Targeted Bird Survey (SP and RH)	CWB11	532036	6279340
2017	Targeted Bird Survey (SP and RH)	CWB12	532780	6279751
2017	Targeted Bird Survey (SP and RH)	CWB13	536414	6276002
2017	Targeted Bird Survey (SP and RH)	CWB14	537927	6276454
2017	Targeted Bird Survey (SP and RH)	CWB15	532720	6279949
2017	Motion detecting camera	CWC01	534844	6278998
2017	Motion detecting camera	CWC02	533048	6278469
2017	Motion detecting camera	CWC03	535222	6276417
2017	Motion detecting camera	CWC04	532269	6280230
2017	Motion detecting camera	CWC05	531961	6280293
2017	Motion detecting camera	CWC08	531990	6279370
2017	Motion detecting camera	CWC09	532878	6279743
2017	Motion detecting camera	CWC10	536357	6276084
2017	Motion detecting camera	CWC11	537902	6276736
2017	Motion detecting camera	CWC12	532685	6280159
2017	Hair Tubes	CWHT01	534862	6279006
2017	Hair Tubes	CWHT02	533746	6278927
2017	Hair Tubes	CWHT03	533143	6278464
2017	Hair Tubes	CWHT04	532851	6278512
2017	Hair Tubes	CWHT05	532891	6278295
2017	Hair Tubes	CWHT06	533049	6278284
2017	Hair Tubes	CWHT07	533436	6277067
2017	Hair Tubes	CWHT08	535468	6276697
2017	Hair Tubes	CWHT09	535325	6276430
2017	Hair Tubes	CWHT10	535240	6276426
2017	Hair Tubes	CWHT11	535158	6276385
2017	Hair Tubes	CWHT12	532404	6280282
2017	Hair Tubes	CWHT13	532301	6280291
2017	Hair Tubes	CWHT14	532239	6280196
2017	Hair Tubes	CWHT15	532127	6280215
2017	Hair Tubes	CWHT16	532023	6280309
2017	Hair Tubes	CWHT18	531828	6280321
2017	Hair Tubes	CWHT20	532036	6279341

Survey Period	Survey Type	Survey Site	Easting	Northing
2017	Hair Tubes	CWHT22	532711	6279683
2017	Hair Tubes	CWHT23	532657	6279767
2017	Hair Tubes	CWHT24	532997	6279660
2017	Hair Tubes	CWHT25	532925	6279811
2017	Hair Tubes	CWHT26a	533169	6279669
2017	Hair Tubes	CWHT26b	536655	6276034
2017	Hair Tubes	CWHT27	536076	6276097
2017	Hair Tubes	CWHT28	537911	6276544
2017	Hair Tubes	CWHT30	537969	6276232
2017	Hair Tubes	CWHT31	538015	6276037
2017	Hair Tubes	CWHT32	532733	6279926
2017	Hair Tubes	CWHT33	532828	6280088
2017	Frog Survey	CWSF01	533687	6278936
2017	Frog Survey	CWSF02	533138	6278070
2017	Frog Survey	CWSF03	533377	6277043
2017	Frog Survey	CWSF04	534861	6276082
2017	Frog Survey	CWSF05	533120	6278936
2017	Frog Survey	CWSF06	532899	6279012
2017	Frog Survey	CWSF07	532199	6279775
2017	Frog Survey	CWSF07a	532177	6279713
2017	Frog Survey	CWSF08	533702	6279825
2017	Frog Survey	CWSF09	533405	6279937
2017	Frog Survey	CWSF10	533091	6280124
2017	Frog Survey	CWSF11	532928	6279863
2017	Frog Survey	CWSF12	532229	6278920
2017	Frog Survey	CWSF13XX	537996	6276235
2017	Frog Survey	CWSFXX	533458	6276638
2017	Frog Survey	CWSFXXX	532222	6278874
2017	Anabat	CSFA1	532108	6280232
2017	Anabat	CSFA2	532164	6279725
2017	Anabat	CSFA4	536460	6275923
2017	Anabat	CSFA3	532261	6278919
2017	Anabat	CSFA5	537938	6276614
2017	Anabat	CSFA6	533005	6278525
2017	Anabat	CSFA7	533129	6278063
2017	Diurnal Bird Census	CSFB01	532236	6280327
2017	Diurnal Bird Census	CSFB02	531933	6280253
2017	Diurnal Bird Census	CSFB03	532097	6279348
2017	Diurnal Bird Census	CSFB04	532154	6279685
2017	Diurnal Bird Census	CSFB05	533277	6278965
2017	Diurnal Bird Census	CSFB06	537918	6276668
2017	Diurnal Bird Census	CSFB07	537943	6276633
2017	Diurnal Bird Census	CSFB08	537964	6276294
2017	Diurnal Bird Census	CSFB09	537958	6276376
2017	Diurnal Bird Census	CSFB10	532993	6279548
2017	Diurnal Bird Census	CSFB11	533100	6279847
2017	Diurnal Bird Census	CSFB12	533593	6279739
2017	Diurnal Bird Census	CSFB13	535297	6276575
2017	Diurnal Bird Census	CSFB14	534770	6276250
2017	Diurnal Bird Census	CSFB15	534606	6279765
2017	Diurnal Bird Census	CSFB16	533001	6278345
2017	Diurnal Bird Census	CSFB17	536423	6276064
2017	Harp Trapping	CSFH1	532298	6280332
2017	Harp Trapping	CSFH2	531954	6280292
2017	Harp Trapping	CSFH3	537986	6276240
2017	Harp Trapping	CSFH4	537948	6276748
2017	Harp Trapping	CSFH5	533725	6278930
2017	Harp Trapping	CSFH6	535219	6276399
2017	Reptile Search	CSFHE1	532303	6279464
2017	Reptile Search	CSFHE2	532261	6278919
2017	Glossy Black-Cockatoo Survey	CSFGB01	536278	6276016

Survey Period	Survey Type	Survey Site	Easting	Northing
2017	Glossy Black-Cockatoo Survey	CSFGB02	532940	6278404
2017	Reptile Search	CSFHE4	531918	6279988
2017	Reptile Search	CSFHE3	533029	6277707
2017	Reptile Search	CSFHE5	534756	6279782
2017	Spotlighting	CSFS01	537949	6276412
2017	Spotlighting	CSFS02	532003	6280241
2016	Bird survey	FS00	537593	6276224
2016	Bird survey	FS01	536477	6275933
2016	Anabat	FS00	537480	6276159
2016	Anabat	FS00	537439	6276206
2016	Anabat	FS01	536468	6275860
2016	Anabat	FS01	536490	6275958
2016	Anabat	Lake East	546383	6281317
2016	Anabat	Lake East	546365	6281384
2016	Anabat	Lake Cowal_Log	537865	6276683
2016	Anabat	Lake Cowal_Water's edge	537810	6276850
2016	Anabat	Lake Cowal_Measuring station	537778	6276935
2016	Anabat	Lake_South	538012	6275985
2016	Harp trap	FS01	535914	6276003
2016	Harp trap	FS01	535917	6275983
2016	Harp trap	FS01	536037	6275940
2016	Harp trap	FS01	536042	6275884
2016	Harp trap	FS01	536131	6276122
2016	Harp trap	FS01	536161	6276121
2016	Harp trap	FS01	536205	6275928
2016	Harp trap	FS01	536179	6275985
2016	Harp trap	FS01	536158	6276133
2016	Harp trap	FS01	536175	6276112
2016	Harp trap	FS01	536291	6275959
2016	Harp trap	FS01	536236	6276001
2016	Harp trap	FS01	536452	6275847
2016	Harp trap	FS01	536474	6275966
2016	Harp trap	FS01	536363	6276186
2016	Harp trap	FS01	536363	6276109
2016	Harp trap	FS01	536494	6275886
2016	Harp trap	FS01	536489	6275926
2016	Harp trap	FS01	536496	6276101
2016	Harp trap	FS01	536420	6276144
2016	Stagwatch	FS01	536291	6275959
2016	Stagwatch	FS01	536088	6276003
2016	Spotlighting	Lake East	546357	6281358
2016	Spotlighting	Lake West	537850	6276818
2016	Reptile Search	FS00	537593	6276224
2016	Reptile Search	FS01	536477	6275933
2016	Reptile Search	Pipeline Corridor	551149	6281703
2016	Frog Survey-Point	SFP10	547360	6281248
2016	Frog Survey-Point	SFP12	548099	6282103
2016	Frog Survey-Point	SFP20	552857	6283162
2016	Frog Survey-Point	SFP17	552108	6282436
2016	Frog Survey-Point	SFP16	551885	6282209
2016	Frog Survey-Point	SFP15	550869	6281726
2016	Frog Survey-Point	SFP14	549431	6281932
2016	Frog Survey-Point	SFP19	552656	6282957
2016	Frog Survey-Point	SFP18	552468	6282781
2016	Frog Survey-Point	SFP13	548568	6282058
2016	Frog Survey-Point	SPF09	546184	6281241
2016	Frog Survey-Point	SFP11	547822	6281220
2016	Frog Survey-Point	SFP05	534792	6275978
2016	Frog Survey-Point	SFP03	536508	6275751
2016	Frog Survey-Point	SFP02	536301	6276135
2016	Frog Survey-Point	SFP01	537055	6276278

Survey Period	Survey Type	Survey Site	Easting	Northing
2016	Frog Survey-Point	SFP04	535762	6276311
2016	Frog Survey-Transect	SFT01 - Start	537828	6276940
2016	Frog Survey-Transect	SFT01 - Mid	537930	6277033
2016	Frog Survey-Transect	SFT01 - End	537868	6276919
2016	Frog Survey-Transect	SFT02 - Start	537670	6276659
2016	Frog Survey-Transect	SFT02 - Mid	537805	6276786
2016	Frog Survey-Transect	SFT02 - End	537850	6276739
2016	Frog Survey-Transect	SFT03 - Start	537973	6276691
2016	Frog Survey-Transect	SFT03 - End	538037	6275975
2016	Frog Survey-Transect	SFT04 - Start	537983	6276470
2016	Frog Survey-Transect	SFT04 - End	538037	6275975
2016	Frog Survey-Transect	SFT05 - Start	538037	6275975
2016	Frog Survey-Transect	SFT05 - End	538138	6275859
2016	Koala survey (approx.)	East - Start	537859	6276773
2016	Koala survey (approx.)	East - End	537995	6276078
2016	Koala survey (approx.)	West - Start	546319	6281486
2016	Koala survey (approx.)	West - End	546394	6281295

ATTACHMENT B

COWAL GOLD OPERATIONS PROCESSING RATE MODIFICATION – BIODIVERSITY OFFSET INVESTIGATION

Cowal Gold Operations Processing Rate Modification – Biodiversity Offset Investigation

Prepared by AMBS Ecology & Heritage
for Evolution Mining (Cowal) Pty Limited

Final Report

March 2018

AMBS Reference: 17463

AMBS Ecology & Heritage
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Recipient:	Bronwyn Flynn Evolution Mining (Cowal) Pty Limited PO Box 210 WEST WYALONG NSW 2671
Approved by:	Mark Semeniuk, Belinda Pellow

Executive Summary

AMBS Ecology & Heritage Pty Ltd (AMBS) was commissioned by Evolution Mining (Cowal) Pty Limited (Evolution) to undertake flora and fauna surveys in five study areas associated with both the Cowal Gold Operations (CGO) and a proposed mine processing rate modification. Three of the study areas required baseline surveys to determine their suitability as offset areas. Flora surveys had previously been undertaken in two of the study areas; however, additional floristic data collection was required to satisfy the BioBanking Assessment Methodology 2014 (BBAM). The results of the surveys are provided in this report.

Flora and fauna surveys were undertaken between November 2017 and January 2018. Flora surveys included the collection of floristic and structural data from BBAM plots to verify the plant communities present. On-site observations of the plant communities present were also made and vegetation data was collected at a number of strategically located Rapid Data Points (RDPs). The data collected at each RDP, and aerial photo interpretation, were used to verify New South Wales (NSW) Office of Environment and Heritage (OEH) regional mapping (OEH 2015), assign plant community types (PCTs) and confirm threatened ecological communities (TECs). PCTs were based on descriptions provided in the OEH NSW Vegetation Information System (OEH 2018a). Confirmation of TECs was undertaken by utilising information in the relevant NSW Final Determinations and Commonwealth Listing Advices.

Fauna surveys were undertaken concurrently with the flora surveys, and involved searching and listening for the Superb Parrot during all survey work. Opportunistic observations of other threatened fauna were also recorded.

The analysis of data collected during this survey assigned eight Biometric Vegetation Types (BVTs)/Plant Community Types (PCTs) to the study areas:

- BVT LA212/PCT26: Weeping Myall open woodland of the Riverina and NSW South Western Slopes Bioregions;
- BVT LA152/PCT82: Inland Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion;
- BVT LA191/PCT249: River Red Gum - Veined Swamp Wallaby Grass grassy tall woodland of depressions on floodplains and alluvial plains;
- BVT LA105/PCT55: Belah woodland on alluvial plains in central-north NSW;
- BVT LA198/PCT53: Shallow freshwater mixed marsh sedgeland of northern-western NSW floodplains;
- BVT LA148/PCT176: Green Mallee - White Cypress Pine woodland on gravelly rises of central NSW;
- BVT LA175/PCT56: Poplar Box - Belah woodland on clay-loam soils of the alluvial plains of north-central NSW; and
- BVT LA138/PCT250: Derived tussock grasslands of the central western plains and lower slopes of NSW.

Two land use types were mapped that did not correspond to a BVT/PCT: “non-native” and “cultivated”.

Within the study area, the following Endangered Ecological Communities (EECs) listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) and/or the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were recorded:

- Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (BC Act)

covering 26.6 hectares (ha), and Weeping Myall Woodlands (EPBC Act) covering 3.9 ha. These listings comprised BVT LA212 in moderate condition; and

- Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (BC Act) and Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (EPBC Act), which covered a combined area of 165.9 ha and comprised BVT LA152 in low condition.

Two plant species were collected that may be listed as threatened species, pending confirmation by the National Herbarium of NSW:

- *Austrostipa wakoolica* (A Speargrass) (BC Act - Endangered, EPBC Act - Endangered). A specimen of this grass was collected in Study area 2.
- *Tylophora linearis* (BC Act - Vulnerable, EPBC Act - Endangered). One specimen of this species was collected in Study area 3.

Four species of threatened fauna were recorded during the surveys:

- Superb Parrot (*Polytelis swainsonii*) (BC Act – Vulnerable, EBPC Act – Vulnerable). Recorded in Study areas 1a, 1b and 3.
- Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*) (BC Act – Vulnerable). Recorded in Study areas 1, 2 and 3.
- Painted Honeyeater (*Grantiella picta*) (BC Act – Vulnerable, EPBC Act – Vulnerable). Recorded in Study area 1a.
- Black Falcon (*Falco subniger*) (BC Act – Vulnerable). Recorded in Study area 2.

Potential foraging and breeding habitat for the Superb Parrot was recorded within the study areas.

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1 Introduction

1.1 Background

AMBS Ecology & Heritage Pty Ltd (AMBS) was commissioned by Evolution Mining (Cowal) Pty Limited (Evolution) to undertake flora and fauna surveys in five study areas associated with the Cowal Gold Operations (CGO) and a proposed mine processing rate modification to the CGO. Three of the study areas required baseline surveys to determine their suitability as offset areas. Flora surveys had previously been undertaken in two of the study areas but additional floristic data collection was required to satisfy the BioBanking Assessment Methodology 2014 (BBAM) (OEH 2014). The results of the surveys are provided in this report.

1.2 Location of Study Areas

The study areas are located in the vicinity of Lake Cowal, within the Central West Slopes region of New South Wales (NSW) (Figure 1.1). The study areas incorporate five sections, all of which occur on the western side of Lake Cowal in the vicinity of the CGO within the Bland Shire local government area (LGA). Study areas 1a and 1b lie to the north of Mining Lease (ML) 1535, incorporating a section of the lake edge. Study areas 2 and 3 are north of ML 1535, while Study areas 4 and 5 are to the south.

1.3 Regional Setting

Lake Cowal is located approximately 38 kilometres (km) north-east of West Wyalong and 53 km south-west of Forbes in Central NSW. The Lake itself forms part of an ephemeral inland wetland system of the Lachlan Catchment and, in 1992, was listed on the Register of the National Estate, Australian Directory of Important Wetlands by the Australian Heritage Commission (LCF 2017).

Lake Cowal is located within the Lower Slopes subregion of the NSW South Western Slopes Interim Biogeographic Regionalisation for Australia (IBRA) Region, an area characterised by the extensive foothills, isolated ranges and inland slopes of the Great Dividing Range (Thackway & Cresswell 1995, Environment Australia 2000). Previously administered by the Lachlan Catchment Management Authority, Lake Cowal now falls under the revised Riverina Local Land Services (LLS) division.

1.4 Climate

The closest Commonwealth Bureau of Meteorology (BoM) weather stations are the Wyalong Post Office (073054) and the West Wyalong Airport Automatic Weather Station (AWS) (050017), which are approximately 33 km south-west of the study areas.

The area receives, on average, 462.8 millimetres (mm) per annum, predominantly throughout winter, spring and summer (West Wyalong AWS) (BoM 2018a). Monthly climate statistics indicate that on an 18-year average between 1999 and 2017, although rainfall is generally spread throughout the year, the lowest rainfall occurs, on average, in autumn (April 18.9 mm), with the highest rainfall occurring in spring (peaking in December, 53.6 mm) (BoM 2018a). These records vary slightly when taken from the West Wyalong Post Office, which shows an average rainfall of 479.6 mm per annum (BoM 2018b). Rainfall may vary widely from year to year, as can be seen in Figure 1.2, where the total rainfall in 2016 was 190.8 mm above the average and 2017 recorded a lower than average rainfall of 415.4mm (BoM, 2018b).

Averaged over an 18-year period, temperatures range between -5.6 degrees Celsius (°C) and 46.3°C (BoM 2018a). The warmest month is usually January (mean maximum 37°C, mean minimum 29°C) and the coolest is July (mean maximum 16°C, mean minimum 12.5°C) (West Wyalong Airport AWS).

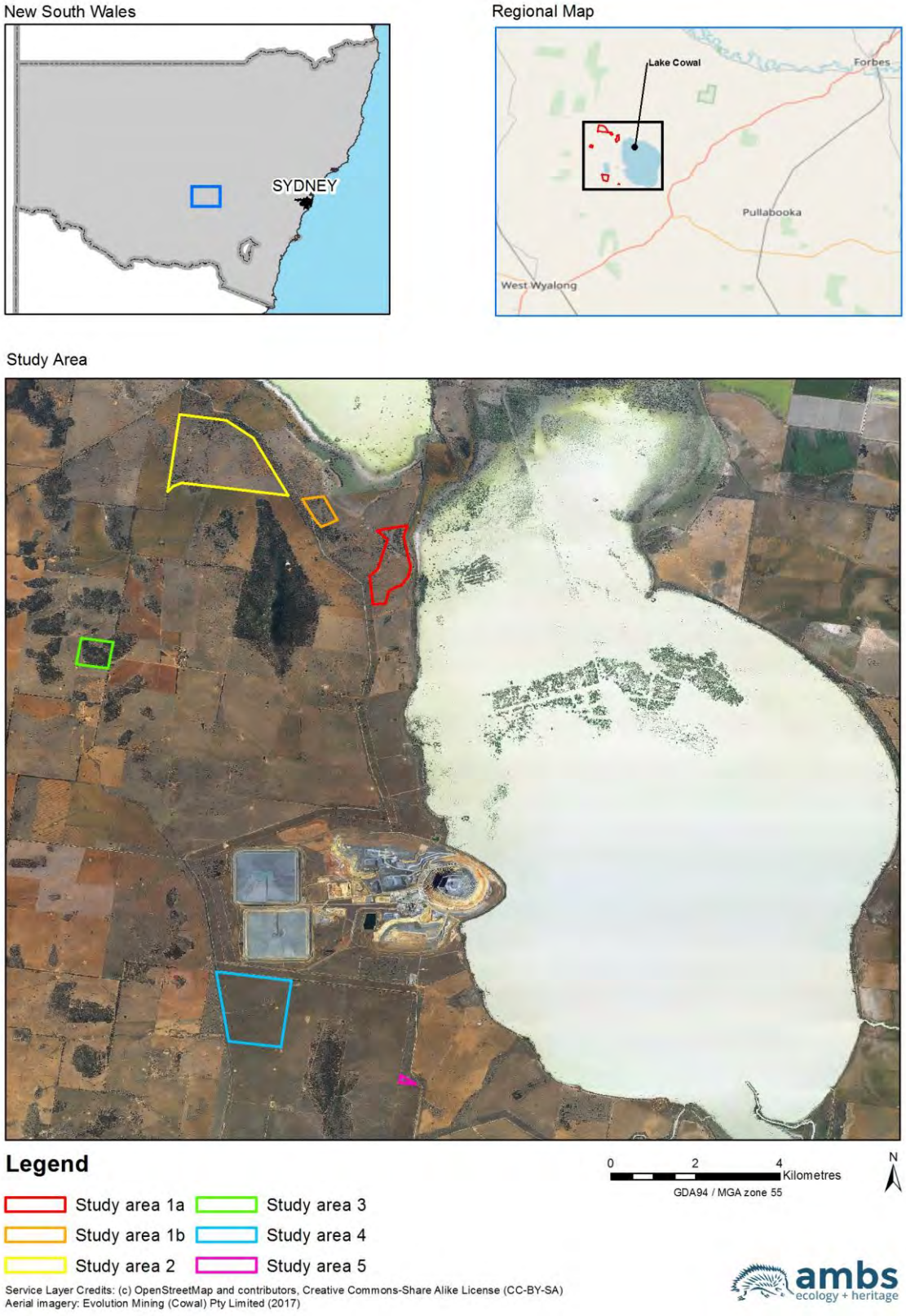

Figure 1.1 Location of the study areas

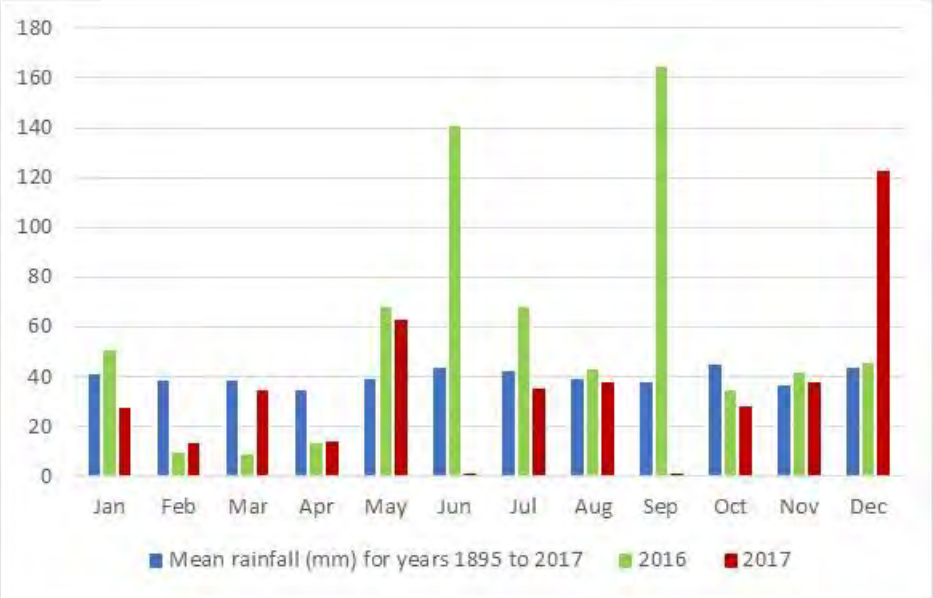

Figure 1.2 Rainfall for 2016 and 2017 compared to mean rainfall.

1.5 Landform and Hydrology

The study areas are located in the alluvial fan of the Lachlan River known as the Jemalong Plains, which is part of the Riverina landform. Geologically, it lies on bedrock of the Lake Cowal Volcanic Complex, on the eastern margin of the Gilmore Fault Zone within the Lachlan Fold Belt of Central NSW (Miles & Brooker 1998).

The study areas are adjacent to Lake Cowal. Lake Cowal is the largest inland freshwater lake in NSW, covering approximately 13,000 hectares (ha). When full, the lake measures approximately 21 km north-south and 9.5 km east-west. It is filled predominantly by Bland Creek from the south; however, it is also fed by the Lachlan River during flooding. Another lake, Nerang Cowal, lies to the immediate north of the study areas and fills less frequently from the overflow from Lake Cowal. Historically, Lake Cowal contains at least some water around 50 per cent (%) of the time; however, prolonged dry periods of up to 30 years have occurred since the early 20th century (LCF 2017).

1.6 Land Use

Study areas 1a, 1b, 2 and 3 occur to the north of the CGO. Study area 1 has been subject to historical clearing, and some sections appear to have been lightly cultivated. Study area 2 appears to have been subject to stump removal, with many log piles observed (mostly *Callitris* sp.) throughout much of the area. With the exception of the grassland fringe, the majority of Study area 3 does not appear to have been historically cleared. All three areas are subject to grazing, the heaviest of which was observed in Study areas 1a, 1b and 2. Study areas 4 and 5 occur to the south of the CGO, in the vicinity of Mining Lease 1535. Both areas have been subject to historical clearing; however, the current land use is restricted to light grazing.

1.7 Vegetation

The study areas fall within the NSW botanical division of the Central Western Slopes, and incorporate mainly alluvial and floodplain transitional vegetation communities that are broadly classified by Keith (2006) as Floodplain Transition Woodlands, Western Slopes Grasslands, Riverine Plains Woodlands and Inland Floodplain Swamps. Historically, the study areas would have supported a mosaic of woodland communities reflecting local soil and drainage patterns. Extensive clearing, primarily for the purposes of agriculture, has created a landscape now characterised by disturbed derived grasslands (used mainly for grazing and cropping), with scattered individual trees and woodland remnants. Hills and slopes with shallow rocky soils and poor grazing potential, retain some remnant vegetation.

The vegetation within Study areas 4 and 5 has previously been surveyed and mapped for the purposes of environmental assessments related to the CGO. AMBS (2018) characterised the following vegetation communities within Study area 4:

- 53 Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains
- 82 Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion
- 250 Derived tussock grassland of the central western plains and lower slopes of NSW

Study area 5 has previously been mapped as containing Plant Community Type (PCT) 26, Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion (Australian Museum Business Services 2012).

Recent vegetation assessment for the Central West Lachlan Region (OEH 2015) mapped the following PCTs as occurring within Study areas 1a, 1b, 2 and 3:

- 26 Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion
- 70 White Cypress Pine woodland on sandy loams in central NSW wheatbelt
- 76 Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions
- 80 Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion
- 176 Green Mallee - White Cypress Pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain Bioregion
- 185 Dwyers Red Gum - White Cypress Pine - Currawang shrubby woodland mainly in the NSW South Western Slopes Bioregion
- 217 Mugga Ironbark - Western Grey Box - cypress pine tall woodland on footslopes of low hills in the NSW South Western Slopes Bioregion
- 248 Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW
- 249 River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW
- 250 Derived tussock grassland of the central western plains and lower slopes of NSW

Portions of the study areas are mapped as “non-native” vegetation.

1.8 Scope and Objectives

The objectives of the study were to undertake the following tasks within the study areas:

- provide a vegetation map for native vegetation extent within the study areas, including cleared areas;
- assign Biometric Vegetation Types (BVTs) and Plant Community Types (PCTs);
- collect biometric data in accordance with the BBAM (OEH 2014);
- map any threatened ecological communities (TECs) within the study areas;
- vegetation condition assessment, including mapping vegetation zones and survey effort;
- undertake opportunistic searches for potentially occurring threatened flora species under the then NSW *Biodiversity Conservation Act 2016* (BC Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- undertake surveys for the Superb Parrot (*Polytelis swainsonii*);
- provide a description of any threatened species recorded and map their locations;
- produce a list of flora species identified in the study area including invasive species;
- prepare a report documenting the survey methods and findings.

2 Methods

2.1 Literature and Database Review

A 'desktop' study of ecological information and local reports was conducted prior to undertaking field surveys. This primarily included a review of the previous vegetation surveys and classification for the study areas (Australian Museum Business Services 2012; OEH 2015; AMBS 2018).

2.2 Flora

2.2.1 Overview

Five field surveys were undertaken during September 2016, November 2017 and January 2018 (Table 2.1).

For Study areas 1 to 3, the primary tasks included ground-truthing regional vegetation mapping (OEH 2015), assigning/confirming plant communities and TECs, and assigning plots (full floristic, BBAM [2014], rapid, observation) and vegetation zones.

For Study areas 4 and 5, vegetation mapping had previously been undertaken by Australian Museum Business Services (2012), and refined by AMBS (2018). A number of BBAM (2014) plots were required to satisfy the minimum plot requirements of the BBAM.

Table 2.1 Flora surveys undertaken for the current report

Date	Purpose	Personnel
13-17 September 2016	Flora surveys in Study area 4. Undertake BBAM plots.	James Schlunke, Ryan Sims
29 November to 2 December 2017	Survey focused on Study areas 1a and 1b. Brief inspection of Study areas 2, 3 and 5. Ground-truth OEH Regional mapping and undertake BBAM plots.	James Schlunke; Tom O'Sullivan
4-8 December 2017	Survey focused on Study areas 2 and 3. Ground-truth OEH Regional mapping and undertake BBAM plots.	Dan Clarke; James Rees
8-11 December 2017	Survey focused on Study areas 4 and 5, brief survey in Study areas 1a and 1b. Undertake BBAM plots.	Tom O'Sullivan; Ruby Stephens
17-20 January 2018	Survey focused on Study areas 1a, 1b, 2, 3 and 5. Undertake final BBAM plots. Verify previously unsurveyed vegetation in additional locations with Rapid Assessment Plots.	Dan Clarke; James Rees

2.2.2 Plant Community Verification

Floristic and structural data from 51 BBAM plots was used to verify the plant communities present. On-site observations of the plant communities present were also made and vegetation data were collected at a number of strategically located Rapid Data Points (RDPs). The data collected at each RDP, and aerial photo interpretation, were used to verify the OEH regional mapping (OEH 2015), assign PCTs and confirm TECs. PCTs were based on descriptions provided in the OEH NSW Vegetation Information System (OEH 2018a). Confirmation of TECs was undertaken by comparing information in the relevant NSW Final Determinations (NSW Scientific Committee 2011a, 2011b) and Commonwealth Listing Advices (Threatened Species Scientific Committee 2008, 2010) with data on community structure, species composition, topography and soil types collected during the field surveys.

The assignment of BVTs was undertaken using PCT descriptions. Collected floristic data was used to select the closest-fit PCT, and its equivalent BVT was assigned to the map unit. A best-fit approach was used in selecting a PCT when a description that fully matched the floristic data collected could not be found. PCT descriptions are for structurally intact PCTs. In cleared or semi-cleared locations, where much of the original vegetation has been removed, assignment of a best-fit PCT is based on remnant canopy species, remnant shrubs and/or the composition of the ground layer, soil and landscape features.

The following information sources were used to prepare the plant community map:

- current aerial imagery of the study area was used to interpret variations in vegetation;
- recent mapping (OEH 2015) of the region to identify potential PCTs for the study area and surrounds;
- descriptions of potential PCTs, including species composition, structure and associated landforms;
- data collected across the study area in 2012, 2016, 2017 and 2018 on species composition and vegetation structure; and
- final determination and listing advice for the two threatened communities, Grey Box Woodland and Myall Woodland, known to occur in the area.

Plant species identifications were checked against descriptions and distribution information provided by PlantNet (2018), to confirm that the species identified were known for the region and the habitat in which they were located.

2.2.3 BBAM Vegetation Condition Data Collection

PCTs identified in the preliminary plant community map were categorised according to the BBAM (OEH 2014), which uses either Low or Moderate to Good condition states. All vegetation not conforming to the BBAM definition of Low condition, as described below, is classified as being in Moderate to Good condition.

Vegetation in low condition:

a) woody native vegetation with:

- *native over-storey percent foliage cover less than 25% of the lower value of the over-storey percent foliage cover benchmark for that vegetation type, and*
  - *i. – less than 50% of groundcover vegetation is indigenous species, or*
  - *ii. – greater than 90% of groundcover vegetation is cleared.*

OR

b) native grassland, wetland or herbfield where:

- *less than 50% of groundcover vegetation is indigenous species, or*
- *more than 90% of groundcover vegetation is cleared.*

Vegetation zones were then designated using the PCT and condition state. Under the BBAM (OEH 2014) a set number of plots are required, depending on area and condition state (Table 2.2). The location of the surveyed plots is shown on Figures 3.1 and 3.2.

BBAM vegetation condition data collection consists of recording plant species composition data (Table 2.3), as well as a range of geophysical parameters, including habitat structure and species composition information.

Table 2.2 Minimum number of transects/plots required per zone area (Source: OEH 2014)

Vegetation zone area (ha)	Minimum number of transects/plots
0–4	1 transect/plot per 2 ha (or part thereof) or 1 transect/plot if vegetation is in low condition
> 4–20	3 transects/plots or 2 transects/plots if vegetation is in low condition
> 20–50	4 transects/plots or 3 transects/plots if vegetation is in low condition
> 50–100	5 transects/plots or 3 transects/plots if vegetation is in low condition
> 100–250	6 transects/plots or 4 transects/plots if vegetation is in low condition
> 250–1,000	7 transects/plots or 5 transects/plots if vegetation is in low condition. More transects/plots may be needed if the condition of the vegetation is variable across the zone
> 1,000	8 transects/plots or 5 transects/plots if vegetation is in low condition or in a homogenous landscape in the Western Division. More transects/plots may be needed if the condition of the vegetation is variable across the zone

Table 2.3 BBAM vegetation condition data collected (Source: OEH 2014)

Attribute	Survey Requirement
Stratum and layer	Stratum and layer in which each species occurs
Growth form	Growth form for each recorded species
Species name	Scientific name and common name
Cover	A measure or estimate of the appropriate cover measure for each recorded species, recorded from 1–5% and then to the nearest 5%. If the cover of a species is less than 1% and the species is considered important, then the estimated cover is entered (e.g. 0.4)
Abundance rating	A relative measure of the number of individuals or shoots of a species within the plot. Use the following intervals; numbers above 20 are estimates only: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1,000 or specify a number greater than 1,000 if required

2.2.4 Threatened Plant Species Surveys

Opportunistic searches for threatened plant species listed under the BC Act or EPBC Act were undertaken during the surveys. For each threatened flora species found, the following was recorded:

- extent of each occurrence;
- population counts or population estimates; and
- detailed habitat description and condition.

2.2.5 Endangered Ecological Communities

Previous interpretation of the EPBC Act listing criteria and BC Act final determination criteria designated sections of the study area as conforming to TECs (Australian Museum Business Services 2012; AMBS 2018). The resulting Endangered Ecological Community (EEC) boundaries, as determined by Australian Museum Business Services (2012) and/or AMBS (2018), were verified by the assessment of condition, structural characteristics, presence of characteristic species for the relevant TEC, and presence and species type of any canopy regeneration.

Vegetation was classified as TECs based on criteria outlined in the relevant EPBC Act listing advice and BC Act final determinations. Determination of patches of vegetation that conformed to these criteria was based on interpretation of information from desktop assessment and field surveys, including soils, topography, patch size (ha), characteristic species, proximity to identified stands of the relevant EEC, degree of past disturbance, indications of past canopy using isolated canopy trees, and dead identifiable canopy trees or regenerating canopy species.

2.3 Superb Parrot Surveys and Habitat

Surveys for the Superb Parrot (*Polytelis swainsonii*) were guided primarily by the *Survey Guidelines for Australia's threatened birds* (DEWHA 2010). Surveys were undertaken over the course of 12 days while concurrently undertaking flora survey plots, rapid assessment plots, BBAM plots and from vehicles while traversing between sites (Figures 3.1 to 3.4). The species was recorded from observation or call identification.

Data was also collected during the surveys regarding habitat features relevant for the Superb Parrot. This included data collected from floristic and BBAM plots, as well as opportunistic observations of features outside these specific locations. A review of threatened species profiles within the OEH BioNet (OEH 2018b) database was undertaken to identify which BVTs are recognised as potential habitat for the species. A determination of which BVTs were likely or unlikely to support habitat for the Superb Parrot was made based on the data collected and while traversing the study area, and in conjunction with known habitat preferences from relevant literature and information sources.

2.4 Weather Conditions

Weather conditions during the survey period as reported from West Wyalong Airport (BoM 2018a) are displayed in Table 2.4.

Table 2.4 Weather conditions during the survey periods

Survey Period	Date	Temp Min [C]	Temp Max [C]	Rain [mm]
September 2016	13/09/2016	7.1	16.8	0.0
	14/09/2016	11.5	16.4	1.8
	15/09/2016	6.5	16.3	-
	16/09/2016	10.0	17.9	0.6
	17/09/2016	6.1	20.1	0.0
December 2017	4/12/2017	12.3	22.4	0.0
	5/12/2017	13.1	21.7	0.0
	6/12/2017	13.3	27.0	4.6
	7/12/2017	13.1	32.5	0.0
	8/12/2017	13.6	23.8	0.2
	9/12/2017	10.9	26.5	0.0
	10/12/2017	12.9	30.7	0.0
	11/12/2017	16.3	33.0	0.0
January 2018	17/01/2018	14.6	32.4	0.0
	18/01/2018	12.6	37.4	0.0
	19/01/2018	15.0	40.4	0.0
	20/01/2018	18.9	42.1	0.0

3 Results

3.1 Flora

3.1.1 Plant Community Description

A total of 236 plant species, of which 166 were native and 70 exotic, were recorded in surveyed plots across the study areas (Appendix A). Native species were used to determine the most likely plant communities in the study areas. A list of the plant communities described is provided in Table 3.1 and a map of each will be found within Figures 3.1 to 3.4.

Table 3.1 List of the mapping units and areas

BVT	PCT	Keith Class	Keith Formation	Mapping Name	Mapping Number	Plot Numbers	Total Area (ha)
LA212: Weeping Myall open woodland of the Riverina and NSW South Western Slopes Bioregions	026 Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Riverine Plain Woodlands	KF_CH11A Semi-arid woodlands (Grassy sub-formation)	Weeping Myall Open Woodland (Derived Grassland in Moderate Condition) (LA212)	1d	CO10, CO41, CO42 CO46, CO47, CO51	26.6
LA152: Inland Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion	082 Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion	Floodplain Transition Woodlands	KF_CH3 Grassy Woodlands	Inland Grey Box - White Cypress Pine Woodland (Derived Grassland in Low Condition) (LA152)	2b	CO36, CO52, CO54, CO56	165.9
LA191: River Red Gum - Veined Swamp Wallaby Grass grassy tall woodland of depressions on floodplains and alluvial plains	249 River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW	Inland Riverine Woodlands	KF_CH9 Forested Wetlands	River Red Gum Forest (Moderate Condition) (LA191)	3a	CO04, CO06, CO49	13.9
LA191: River Red Gum - Veined Swamp Wallaby Grass grassy tall woodland of depressions on floodplains and alluvial plains	249 River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW	Inland Riverine Woodlands	KF_CH9 Forested Wetlands	River Red Gum Forest (Derived Grassland in Moderate Condition) (LA191)	3b	CO05, CO11, CO50	6.4
LA105: Belah woodland on alluvial plains in central-north NSW	055 Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions	North-west Floodplain Woodlands	KF_CH11A Semi-arid woodlands (Grassy sub-formation)	Belah Woodland (Semi cleared Moderate Condition) (LA105)	4a	CO01, CO02, C003, CO07, CO12, CO35	41.2
LA105: Belah woodland on alluvial plains in central-north NSW	055 Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions	North-west Floodplain Woodlands	KF_CH11A Semi-arid woodlands (Grassy sub-formation)	Belah Woodland (Derived Grassland Moderate Condition) (LA105)	4c	CO08, CO09, CO13, CO48	47.0
LA198 - Shallow freshwater mixed marsh sedgeland of northern-western NSW floodplains	53 Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains	Inland Floodplain Swamps	KF_CH8 Freshwater Wetlands	Shallow freshwater mixed marsh sedgeland (Moderate Condition) (LA198)	7	CO37, CO53, CO55	6.8

BVT	PCT	Keith Class	Keith Formation	Mapping Name	Mapping Number	Plot Numbers	Total Area (ha)
LA148 Green Mallee - White Cypress Pine woodland on gravelly rises of central NSW	176 Green Mallee - White Cypress Pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain Bioregion	Inland Rocky Hill Woodlands	KF_CH11B Semi-arid Woodland (Shrubby sub-formation)	Green Mallee - White Cypress Pine Woodland (Moderate Condition) (LA148)	8	CO10, CO17, CO18, CO19, CO20, CO21	30.5
LA175 Poplar Box - Belah woodland on clay-loam soils of the alluvial plains of north-central NSW	56 Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW	Floodplain Transition Woodlands	KF_CH3 Grasslands	Poplar Box - Belah Woodland (Semi Cleared in Moderate Condition) (LA175)	9a	CO14, CO15, CO23, CO24, CO26, CO30, CO31, CO33, CO34	136.1
LA175 Poplar Box - Belah woodland on clay-loam soils of the alluvial plains of north-central NSW	56 Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW	Floodplain Transition Woodlands	KF_CH3 Grasslands	Poplar Box - Belah Woodland (Derived Grassland in Moderate Condition) (LA175)	9b	CO25, CO27, CO28, CO29, CO32	82.2
LA138: Derived tussock grasslands of the central western plains and lower slopes of NSW	250 Derived tussock grassland of the central western plains and lower slopes of NSW	Western Slopes Grassland	KF_CH4 Grasslands*	Highly Modified Derived Grasslands (Low Condition) (LA138)	6b	CO38, CO39, CO40, CO43, CO44, CO45, CO57	38.4
Non-native	Non-native			Non-native			50.7
Cultivated	Cultivated			Cultivated			1.3

* This Keith formation applies to vegetation that in its pre-cleared state was natural grassland dominated by large perennial tussock grasses and a lack of woody plants (Keith 2006). It is not intended to apply to derived native grasslands of woodland communities; however, no alternative for this BVT/PCT is available for this vegetation state.

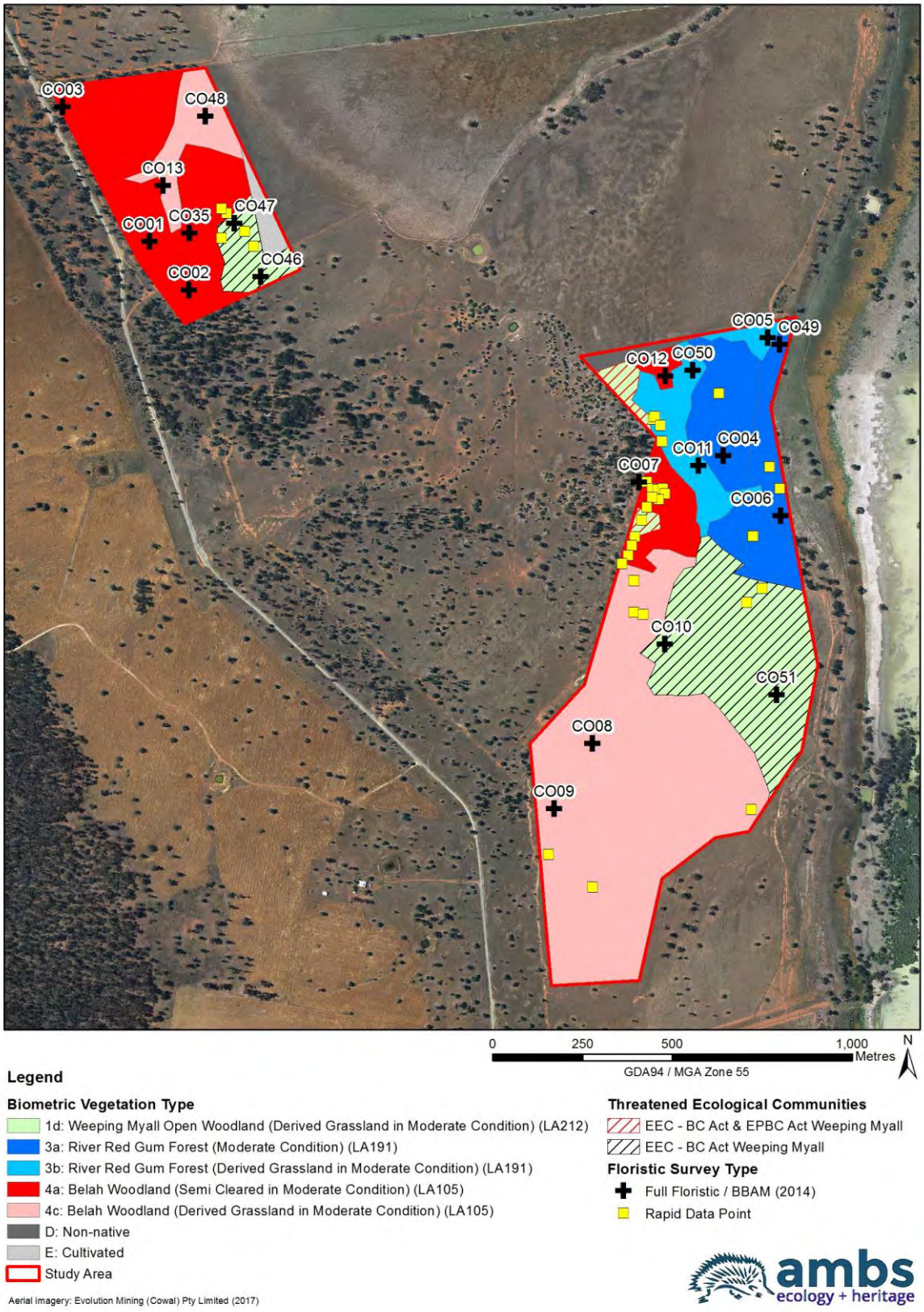

Figure 3.1 BVTs and location of surveyed plots across Study area 1a-1b

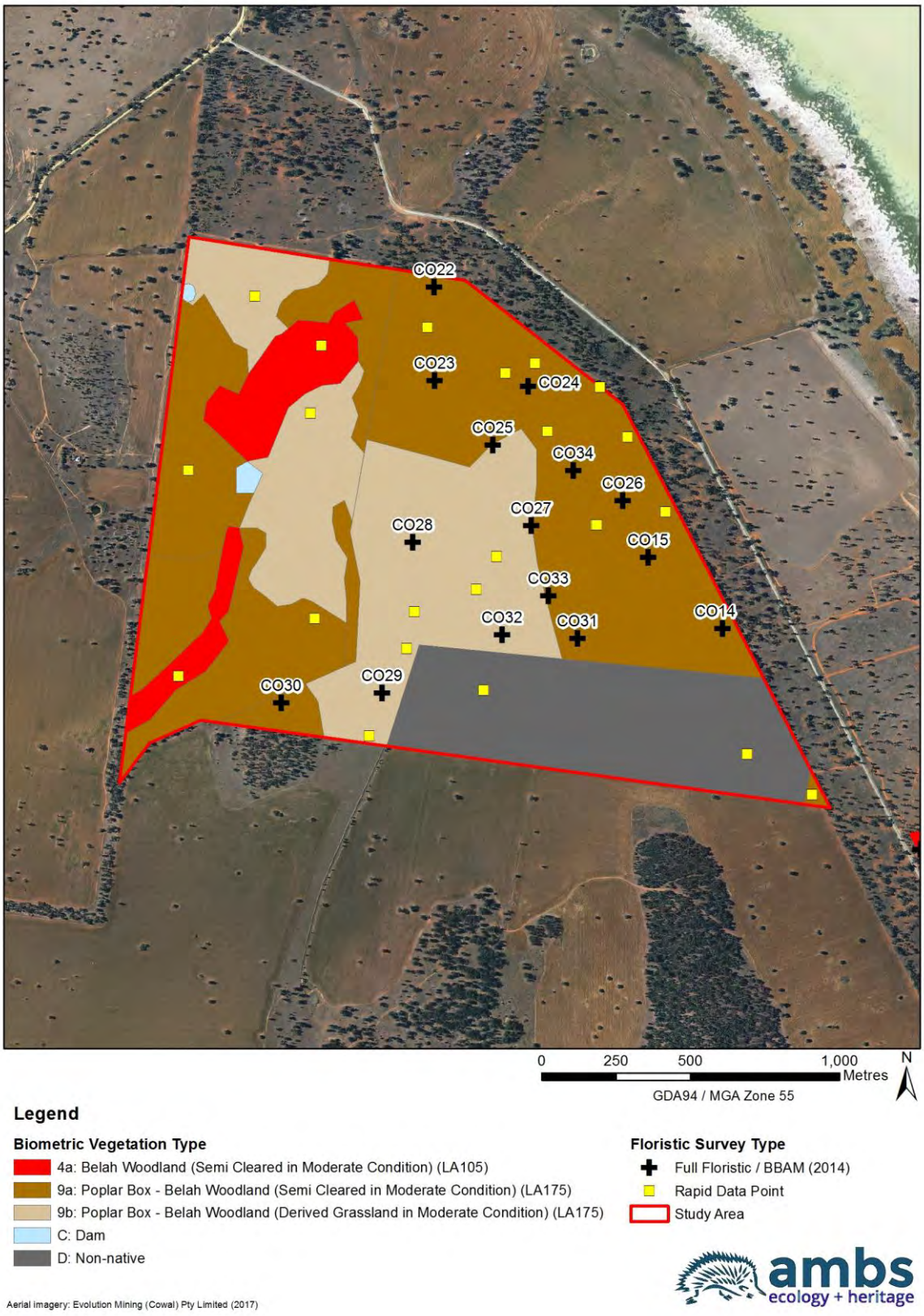

Figure 3.2 BVTs and location of surveyed plots across Study area 2

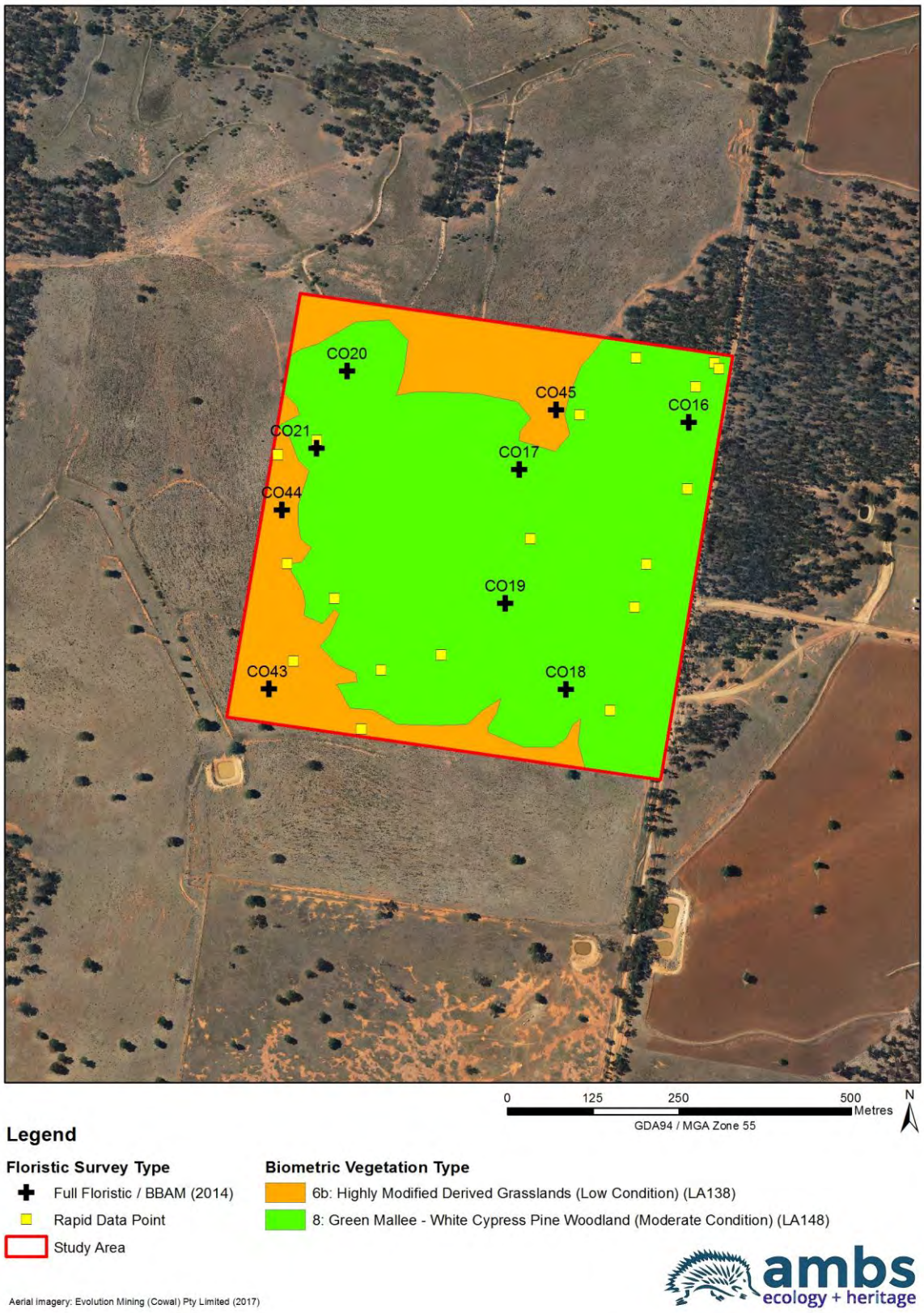

Figure 3.3 BVTs and location of surveyed plots across Study area 3

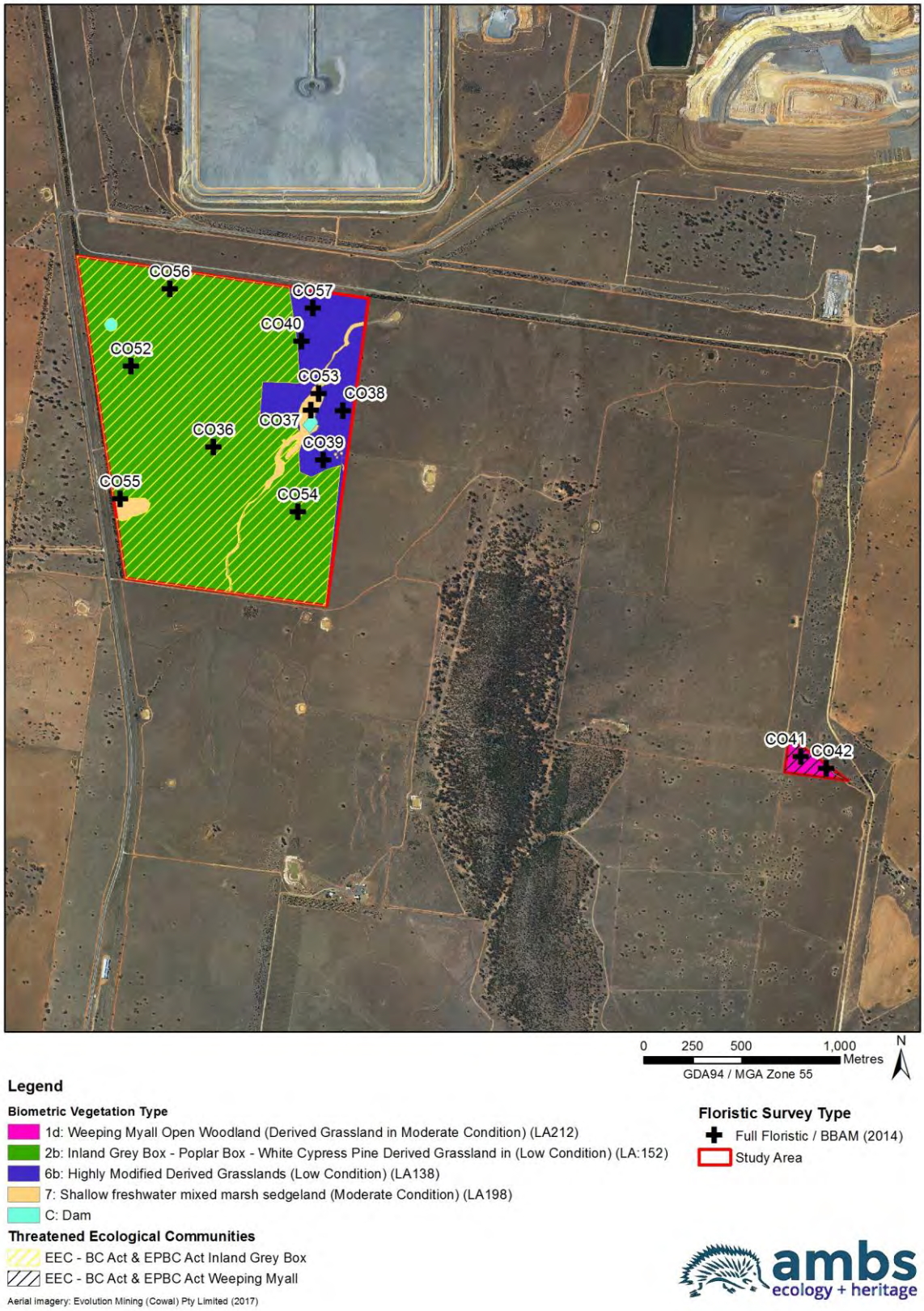

Figure 3.4 BVTs and location of surveyed plots across Study areas 4 and 5

BVT LA212 - Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion (including a derived grassland form)

Keith Formation: KF_CH11A - Semi-arid woodlands (Grassy sub-formation)
Keith Class: Riverine Plain Woodlands
Plant Community Type ID: PCT 26
Mapping Names:
Vegetation Community 1d Weeping Myall Open Woodland (Derived Grassland in Moderate Condition)

BC Act: All occurrences of this community conform to the Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions EEC listed under the BC Act.

Number of hectares: 26.6 ha

Examples of this community within the study area are shown on Plates 3.1 and 3.2. In general, areas have been cleared of most trees but have a remnant ground layer that is dominated by grasses, native forbs and exotic pasture species.

Characteristic native species: *Geijera parviflora, Abrophyllum anomalum, Acacia pendula Casuarina cristata, Oxalis perennans, Einadia nutans* subsp. *nutans, Sclerolaena muricata* var. *semiglabra, Carex inversa, Atriplex semibaccata, Enchylaena tomentosa, Convolvulus erubescens, Sida corrogata, Solanum esuriale, Asperula conferta, Marsilea drummondii, Enteropogon acicularis, Chloris truncate, Walwhalleya subxerophila.*

Plate 3.1 BVT LA212 (Derived Grassland) at plot CO41

Plate 3.2 BVT LA212 (Derived Grassland) at plot CO07

BVT LA191: River Red Gum - Veined Swamp Wallaby Grass grassy tall woodland of depressions on floodplains and alluvial plains

Keith Formation: KF_CH9 Forested Wetlands
Keith Class: Inland Riverine Forests
Plant Community Type ID: PCT 249
Mapping Names:
Vegetation Community 3a River Red Gum Forest (Moderate Condition) (LA191)
Vegetation Community 3b River Red Gum Forest (Derived Grassland in Moderate Condition) (LA191)

BC Act: Not listed
EPBC Act: Not listed

Number of hectares: 20.3 ha comprised of:

- Map Number 3a – 13.9 ha; and
- Map number 3b – 6.4ha

This BVT occurs on the fringes of Lake Cowal around the normal 'high water' mark, and experiences periodic flooding. Examples of this community within the study area are shown on Plates 3.3 and 3.4. In the study area, stands of this BVT closest to the lake feature a canopy of *Eucalyptus camaldulensis* (River Red Gum) and a sub-canopy of *Acacia stenophylla* (River Cooba). Areas further from the lake edge (particularly on the eastern side of the lake) also feature *Eucalyptus populnea* subsp. *bimbil* (Poplar Box or Bimble Box), *Eucalyptus microcarpa* (Inland Grey Box) and *Eucalyptus melliodora* (Yellow Box) above the normal high-water level. Where the BVT occurs in a relatively undisturbed state, it features a variable mid-storey of *Duma florulenta* (Lignum) and other shrub species, such as *Glycyrrhiza acanthocarpa* (Native Liquorice), and an under-storey of grasses, forbs and rushes. Where the community has been cleared the mid- and under-storey contain native herbs and grasses, as well as exotic annual and perennial pasture grasses and forbs.

Frequently recorded native species: *Alternanthera denticulata, Austrostipa scabra* subsp. *falcata, Acacia stenophylla*, *Pseudognaphalium luteoalbum, Dysphania pumilio*, *Duma florulenta*, *Wahlenbergia gracilenta*, *Juncus filicaulis*, *Einadia nutans* subsp. *nutans*, *Sporobolus mitchellii, Marsilea drummondii, Glycyrrhiza acanthocarpa*, *Eleocharis spp., Eucalyptus camaldulensis, Eucalyptus populnea* subsp. *bimbil*.

Plate 3.3 BVT LA191 at plot CO04

Plate 3.4 BVT LA191 (Derived Grassland) at plot CO11

BVT LA152: Inland Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion (including a derived grassland form)

Keith Formation: KF_CH3 Grassy Woodlands
Keith Class: Floodplain Transition Woodlands
Plant Community Type ID: PCT 82
Mapping Names:
Vegetation Community 2b Inland Grey Box - White Cypress Pine Woodland (Derived Grassland in Low Condition) (LA152)

BC Act: All occurrences of this community conform to Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC listed under the BC Act.
EPBC Act: All occurrences of this community conform to Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC listed under the EPBC Act.

Number of hectares: 165.9 ha

An example of this community within the study area is shown on Plate 3.5. In general, the area has been cleared of most trees and has a remnant ground layer that is dominated by grasses (native and exotic) with some native forbs and exotic pasture species. Most areas mapped as being in low condition have a high cover of exotic species in the ground layer, although native species also occur.

Frequently recorded native species: *Eucalyptus microcarpa, Eucalyptus populnea* subsp. *bimbil*, *Maireana enchylaenoides*, *Sclerolaena muricata* var. *semiglabra*, *Maireana microphylla*, *Austrostipa scabra, Austrostipa blackii, Einadia nutans* subsp. *nutans, Vittadinia cuneata, Enteropogon acicularis, Sida corrugata, Rytidosperma caespitosa.*

Plate 3.5 BVT LA152 (Derived Grassland) at plot CO36

BVT LA105: Belah woodland on alluvial plains in central-north NSW

Keith Formation: KF_CH11A - Semi-arid woodlands (Grassy sub-formation)
Keith Class: North-west Floodplain Woodlands
Plant Community Types ID: PCT55
Mapping Name:
Vegetation Community 4a Belah Woodland (Moderate Condition) (LA105)
Vegetation Community 4c Belah Woodland (Derived Grassland Moderate Condition) (LA105)

BC Act: Not listed
EPBC Act: Not listed

Number of hectares: 88.2 ha comprised of:

- Map Number 4a – 41.2 ha; and
- Map number 4c – 47.0 ha

Examples of this community within the study area are shown on Plates 3.6 and 3.7. The Belah woodland has been cleared to varying degrees where it occurs in the study area. In some locations regeneration of Belah is occurring; in others a derived grassland form is represented. Grazing has simplified the composition of the ground layer; however, native grasses and forbs usually dominate, with a high number of exotic herbs and grasses present. Gilgais, which are typically associated with this community, were present.

Frequently recorded native species: *Casuarina cristata*, *Geijera parviflora*, *Alectryon oleifolius, Sclerolaena muricata* subsp. *semiglabra, Rytidosperma setaceum, Enteropogon acicularis, Atriplex semibaccata*, *Solanum esuriale*, *Sporobolus mitchellii*, *Salsola australis*, *Sida corrugata*.

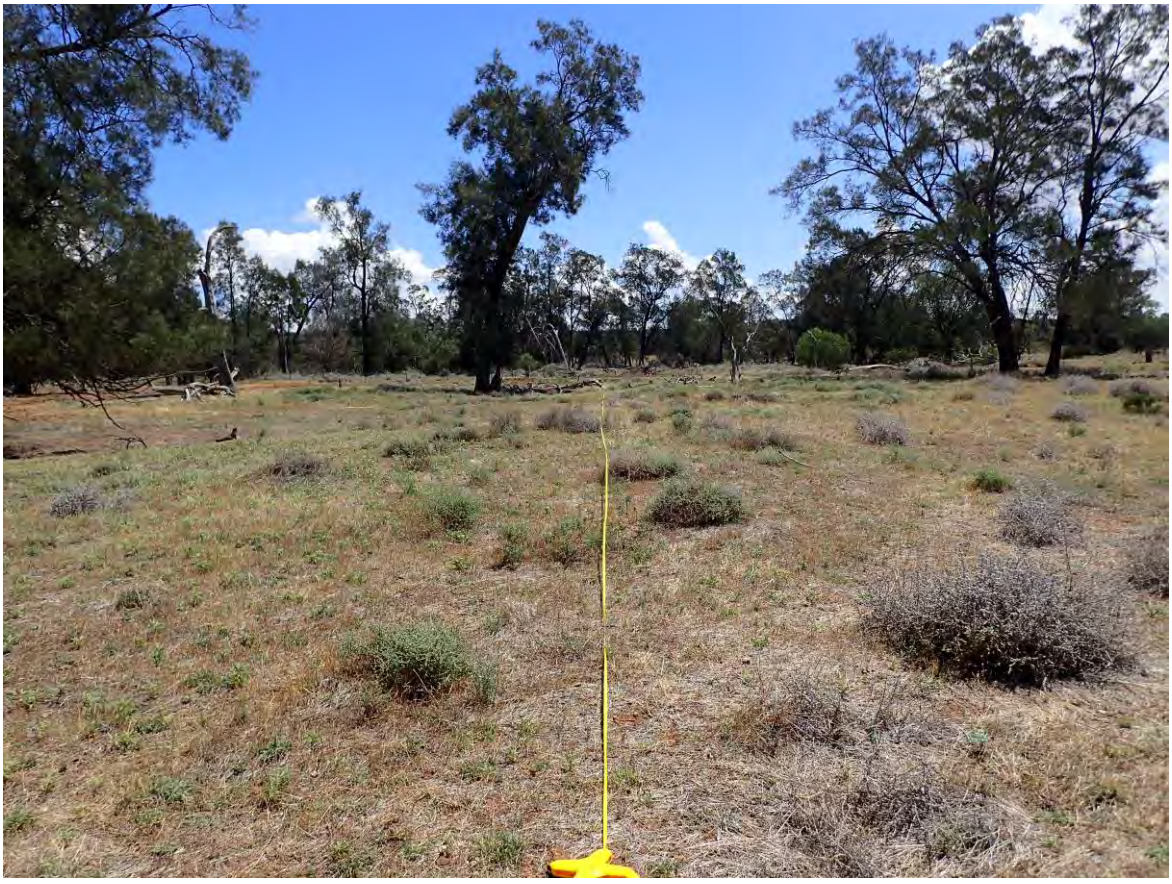

Plate 3.6 BVT LA105 at plot CO03

Plate 3.7 BVT LA105 (Derived Grassland) at plot CO09

BVT LA198 - Shallow freshwater mixed marsh sedgeland of northern-western NSW floodplains

Keith Formation: KF_CH8 Freshwater Wetlands
Keith Class: Inland Floodplain Swamps
Plant Community Type ID: PCT53
Mapping Names:
Vegetation Community 7 Shallow freshwater mixed marsh sedgeland (Moderate Condition) (LA198)

BC Act: Not listed
EPBC Act: Not listed

Number of hectares: 6.8 ha

An example of this community within the study area is shown on Plate 3.8. This community occurs in ephemerally wet low-lying drainage lines and artificial drainage channels. The assemblage of species varied between the two plots; however, a range of rushes and sedges are abundant in at least one site, including *Juncus usitatus*, *Juncus flavidus*, *Eleocharis plana*, and *Carex inversa*, in addition to water-tolerant and semi-aquatic forbs such as *Epilobium billardierianum* subsp. *billardierianum*, *Ranunculus sessiliflorus* var. *pilifer, Marsilea costulifera* and *Pratia concolor*. Many of the examples of this community mapped in the study area retained standing water at the time of survey. Small depressions (gilgais) within BVT LA212 may also support this plant assemblage.

These areas of seasonal inundation are susceptible to frequent disturbance and can support a high cover of exotic species during high rainfall periods, primarily annual grasses such as *Avena fatua* (Wild Oats) and *Hordeum glaucum.* Despite this, the vegetation mapped as BVT LA198 is classed as being in a moderate condition state, as species composition is highly varied, as evidenced by the benchmark ranges in Table 2.2.

Frequently recorded native species: *Carex inversa, Pratia concolor*, *Juncus usitatus, Enteropogon acicularis, Epilobium billardierianum* subsp. *billardierianum, Oxalis perennans, Ranunculus sessiliflorus* var. *pilifer.*

Plate 3.8 BVT LA198 at plot CO37

BVT LA148 Green Mallee - White Cypress Pine woodland on gravelly rises of central NSW

Keith Formation: KF_CH11B Semi-arid Woodland (Shrubby sub-formation)
Keith Class: Inland Rocky Hill Woodlands
Plant Community Type ID: PCT176
Mapping Names:
Vegetation Community 8 Green Mallee - White Cypress Pine Woodland (Moderate Condition) (LA148)

BC Act: Not listed
EPBC Act: Not listed

Number of hectares: 30.5 ha

Green Mallee White Cypress Pine woodland occurs on gravelly red and yellow sandy loam or sandy clay loam soils derived from mainly sedimentary substrates including sandstone and conglomerate.

In the study area it is a tall mallee woodland often dominated by *Eucalyptus viridis* (Green Mallee) and *Callitris glaucophylla* (White Cypress Pine), with *Eucalyptus sideroxylon and Eucalyptus dwyeri.* Examples of this community within the study area are shown on Plates 3.9 and 3.10.

Frequently recorded native species: *Eucalyptus viridis*, *Callitris glaucophylla*, *Eucalyptus sideroxylon*, *Eucalyptus dwyeri*, *Acacia doratoxylon*, *Austrostipa scabra*, *Rytidosperma setaceum*, *Rytidosperma erianthum*, *Calotis cuneifolia*, *Stuartina hamata*, *Carex inversa*.

Plate 3.9 BVT LA148 within Study area 3

Plate 3.10 BVT LA148 at plot CO18

BVT LA175 Poplar Box - Belah woodland on clay-loam soils of the alluvial plains of north-central NSW

Keith Formation: KF_CH3 Grasslands
Keith Class: Floodplain Transition Woodlands
Plant Community Type ID: PCT56
Mapping Names:
Vegetation Community 9a Poplar Box - Belah Woodland (Semi Cleared in Moderate Condition) (LA175)
Vegetation Community 9b Poplar Box - Belah Woodland (Derived Grassland in Moderate Condition) (LA175)

BC Act: Not listed
EPBC Act: Not listed

Number of hectares: 218.3 ha

- Map Number 9a – 136.1 ha; and
- Map number 9b – 82.2 ha.

Generally, occurs on pink to brown loamy sand or light clay in the transition zone between floodplains and the peneplains in the central and northern plains of the NSW. In its uncleared state it is generally a tall to mid-high woodland dominated by *Eucalyptus populnea* subsp. *bimbil* (Poplar or Bimble Box) and *Casuarina cristata* (Belah), often with the small tree *Alectryon oleifolius* (Western Rosewood). Examples of this community within the study area are shown on Plates 3.11 and 3.12.

Frequently recorded native species: *Eucalyptus populnea* subsp. *bimbil*, *Casuarina cristata*, *Alectryon oleifolius*, *Walwhalleya subxerophila*, *Rytidosperma setaceum*, *Rytidosperma caespitosum*, *Enteropogon acicularis, Aristida behriana*, *Austrostipa nitida*, *Sida corrugata*, *Chloris truncata*, *Cheilanthes sieberi.*

Plate 3.11 BVT LA175 (Derived Grassland) at plot CO26

Plate 3.12 BVT LA175 at plot CO28

BVT LA138 - Derived tussock grasslands of the central western plains and lower slopes of NSW

Keith Formation: Designated in the VIS as KF_CH4 Grasslands – Western Slopes Grasslands*.
Keith Class: Designated in the VIS as Western Slopes Grasslands.
Plant Community Type ID: PCT250
Mapping Names:
Vegetation Community 6b Highly Modified Derived Grasslands (Low Condition) (LA138)

BC Act: Not listed
EPBC Act: Not listed

Number of hectares: 38.4 ha

*The Keith formation KF_CH4 Grasslands – Western Slopes Grasslands applies to vegetation that, in its pre-cleared state, was natural grassland dominated by large perennial tussock grasses and a lack of woody plants (Keith 2006). It is not intended to apply to derived native grasslands of woodland community forms of LA152 or LA212. Distinguishing between the two potential Keith formations that might have occurred in the study area, in the area mapped as LA138, is not possible due to the current disturbed state of the derived grassland. Either the Keith Formations KF_CH3 Grassy Woodlands or KF_CH11A Semi-arid woodlands (Grassy sub-formation) would have applied prior to clearing.

An example of this community within the study area is shown on Plate 3.13. In general, areas mapped in low condition have been cleared of all trees and generally have a remnant ground layer that is dominated by grasses (native and exotic), with some native forbs and exotic pasture species. Soils are clay to clay loams, and brown to red in colour.

This BVT is characterised by native perennial grasses *Enteropogon acicularis*, *Austrostipa blackii*, and *Walwhalleya subxerophila* (Gilgai Grass), native forbs such as *Oxalis perennans*, *Crassula sieberiana*, and *Salsola australis*, and low shrubs including *Maireana microphylla*, and *Sclerolaena muricata* var. *semiglabra*. The condition of this BVT varies across the study area, with some sites showing a (seasonal) high cover of exotic annual grasses such as *Hordeum glaucum* (Northern Barley Grass), *Avena fatua* (Wild Oats), *Lolium perenne* (Perennial Ryegrass), *Vulpia muralis* (Fescue) and *Bromus molliformis* (Soft Brome), as well as exotic forbs such as *Arctotheca calendula* (Capeweed), *Medicago polymorpha* (Burr Medic), *Trifolium subterraneum* (Subterranean Clover) and *Trifolium glomeratum* (Clustered Clover). The high density of exotic species and the absence of native ground layer diversity has resulted in a condition classification of low.

Characteristic native species: *Enteropogon acicularis, Chloris truncata, Walwhalleya subxerophila, Carex inversa, Austrostipa blackii, Austrostipa scabra, Dichanthium sericeum, Oxalis perennans, Maireana enchylaenoides, Sclerolaena muricata* var. *semiglabra, Atriplex semibaccata, Crassula sieberiana, Cheilanthes sieberi* subsp. *sieberi, Crassula decumbens* var. *decumbens, Salsola australis, Maireana microphylla.*

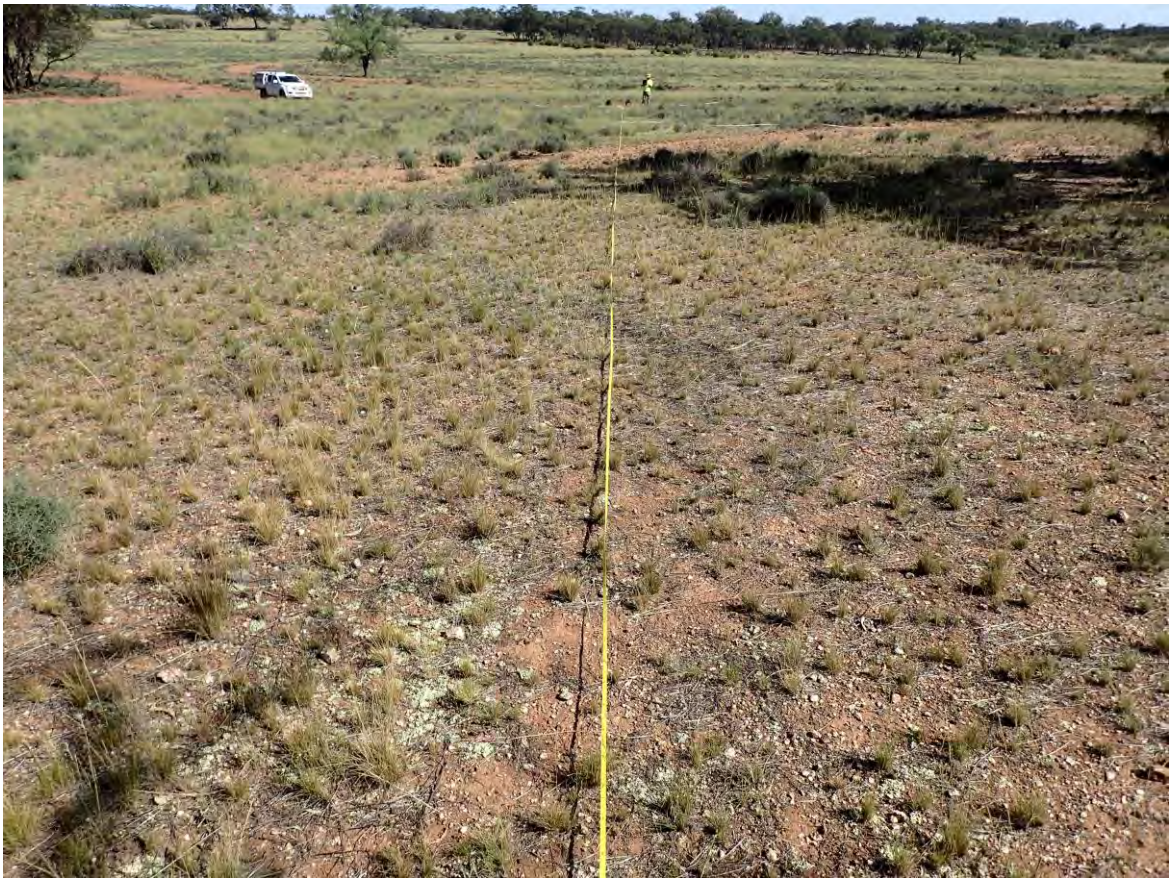

Plate 3.13 BVT LA138 at plot CO45

3.1.2 BBAM Vegetation Condition Data Collection

Condition classes were applied to each PCT mapped in the study areas, and the resulting vegetation zones are shown in Table 3.2. The number of BBAM plots completed in each zone are shown in Table 3.2. Data collected in each plot are summarised in Appendix B.

Table 3.2 Required number of BBAM plots and number completed for each vegetation zone

Vegetation Zone	Area (ha)	BBAM (2014) plots
Study area 1a and 1b		
Weeping Myall Open Woodland (Derived Grassland in Moderate Condition) (LA212)	23.7	4
Belah Woodland (Semi Cleared in Moderate Condition) (LA105)	22.9	6
Belah Woodland (Derived Grassland in Moderate Condition) (LA105)	47.0	4
River Red Gum Forest (Moderate Condition) (LA191)	13.9	3
River Red Gum Forest (Derived Grassland in Moderate Condition) (LA191)	6.4	3
Cultivated	1.3	-
Study area 2		
Poplar Box - Belah Woodland (Semi Cleared in Moderate Condition) (LA175)	136.1	10
Poplar Box - Belah Woodland (Derived Grassland in Moderate Condition) (LA175)	82.2	5
Belah Woodland (Semi Cleared in Moderate Condition) (LA105)*	18.3	0*
Non-native	50.7	-
Study area 3		
Green Mallee - White Cypress Pine Woodland (Moderate Condition) (LA148)	30.5	6
Highly Modified Derived Grasslands (Low Condition) (LA138)	9.3	3
Study area 4		
Shallow freshwater mixed marsh sedgeland (Moderate Condition) (LA198)	6.8	3
Highly Modified Derived Grasslands (Low Condition) (LA138)	29.1	4
Inland Grey Box - White Cypress Pine Woodland (Derived Grassland in Low Condition) (LA152)	165.9	4
Dam	0.7	-
Study area 5		
Weeping Myall Open Woodland (Derived Grassland in Moderate Condition) (LA212)	2.9	2

Note: * no BBAM (2014) plots were undertaken in community LA105 within Study area 2, due to limited field survey time in a location in which the BVT/PCTs had not been verified in previous inspections.

3.1.3 Threatened Ecological Communities

Two TECs listed under the EP Act and/or the BC Act were confirmed as occurring in the study areas:

1. Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes Bioregions (BC Act) and Weeping Myall Woodlands (EPBC Act);
2. Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (BC Act) and Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (EPBC Act).

1. Myall Woodland

Myall Woodland typically occurs on red-brown earths and heavy textured grey and brown alluvial soils within a climatic belt receiving between 375 mm and 500 mm mean annual rainfall. The structure of the community varies from low woodland and low open woodland to low sparse woodland or open shrubland, depending on site quality and disturbance history. The tree layer grows up to a height of about 10 metres (m) and invariably includes *Acacia pendula* (Weeping Myall or Boree) as one of the dominant species or the only tree species present. The under-storey includes an open layer of chenopod shrubs and other woody plant species and an open to continuous groundcover of grasses and herbs. Within the study areas, all patches of this TEC have been cleared for agricultural purposes. Clearing has resulted in a derived native grassland form of this EEC moderate condition.

Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (BC Act)

In the study areas, cleared or regeneration patches of this TEC, or areas with high native species richness, met the criteria as described in the Final Determination (NSW Scientific Committee 2011a) for this community. Patches of the derived native grassland form that had low native ground layer richness and were small in size met criteria in the NSW Final Determination, due to the presence of canopy regeneration and their proximity to forms with higher species diversity and existing canopy species (Figures 3.1 and 3.4).

Weeping Myall Woodlands (EPBC Act)

Patches of this TEC within the study areas were classified as meeting the criteria for EPBC Act listing because they met the following condition classes (Threatened Species Scientific Committee 2008):

- patches were greater than 0.5 ha in size;
- the tree canopy, where it occurred, was dominated by *Acacia pendula* (Weeping Myall) and had either two or more layers of regenerating Weeping Myall; or
- the tallest layer of living, dead or defoliated Myall trees was at least 4 m tall, and the vegetation cover overall comprised more than 50% native species.

2. Inland Grey Box Woodland

Inland Grey Box Woodland occurs on fertile soils of the western slopes and plains of NSW. The community generally occurs where average rainfall is 375-800 mm. The characteristic tree species, *Eucalyptus microcarpa* (Inland Grey Box), is often found in association with *Eucalyptus populnea* subsp. *bimbil* (Bimble or Poplar Box), *Callitris glaucophylla* (White Cypress Pine), *Brachychiton populneus* (Kurrajong), and *Allocasuarina luehmannii* (Bulloak). Shrubs are typically sparse or absent, but may be locally common, especially in drier western portions of the community. A variable ground layer of grass and herbaceous species is present at most sites. At severely disturbed sites the ground layer may be absent. The community generally occurs as an open woodland 15–25 m tall, but in some locations the over-storey may be absent as a result of past clearing or thinning, leaving only an under-storey. Within the study areas, all patches of this TEC have been cleared for agricultural purposes. Clearing is variable, resulting in semi-cleared woodland to derived native grassland forms in low or moderate condition.

Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (BC Act)

In the study areas, semi-cleared or regenerated patches of this TEC, or areas with high native species richness, met the criteria as described in the Final Determination (NSW Scientific Committee 2011b) for this community. Patches of the derived native grassland form that had low native ground layer richness and were small in size met criteria in the NSW Final Determination, due to the presence of canopy regeneration and their proximity to forms with higher species diversity and existing canopy species (Figure 3.4).

Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (EPBC Act)

Patches of this TEC within the study areas were classified as meeting the criteria for EPBC Act listing because they met a combination of the following condition thresholds (Threatened Species Scientific Committee 2010):

- patches were greater than 0.5 ha in size;
- the canopy contained *Eucalyptus microcarpa* (Grey Box), at least 50% of the ground cover was made up of perennial native species and eight or more perennial native species were present in the mid- and ground-storey layers at any time of the year; or
- there was clear evidence that a derived grassland area formerly had a canopy of *Eucalyptus microcarpa,* at least 50% of the ground cover layer was comprised of perennial native species, and 12 or more native species were present in the ground layer.

Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Lachlan River

The NSW Fisheries Scientific Committee has listed the EEC *'Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Lachlan River*'. This final recommendation includes all waterways and floodplains of the Lachlan River, and names Lake Cowal and the lake bed as being part of this EEC (Fisheries Scientific Committee 2005). Based on its position in the landscape, the lake edge community "LA191: River Red Gum - Veined Swamp Wallaby Grass grassy tall woodland of depressions on floodplains and alluvial plain" may provide habitat for species listed under this EEC.

The total area of TECs in the study area is shown in Table 3.3. Figures 3.1 and 3.4 show the vegetation mapping for the study area, including those portions designated as representing TEC communities.

Table 3.3 Total area of TECs in the study areas

BVT	PCT	TEC Status	Mapping Name *	Area (ha)
LA212: Weeping Myall open woodland of the Riverina and NSW South Western Slopes Bioregions	026 Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Weeping Myall Woodland EEC (BC Act and EPBC Act)	Weeping Myall Open Woodland (Derived Grassland in Moderate Condition) (LA212) – 1d	26.6 ha (BC Act) 3.9 ha (EPBC Act)
LA152: Inland Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion (Benson 82)	082 Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion	Grey Box Woodland EEC (BC Act and EPBC Act)	Inland Grey Box - White Cypress Pine Woodland (Derived Grassland in Low Condition) (LA152) – 2b	165.9 ha

3.1.4 Threatened Plant Species

Two threatened plant species were collected and their identification has been confirmed by the National Herbarium of NSW.

- *Austrostipa wakoolica* (A Speargrass) (BC Act - Endangered, EPBC Act - Endangered). One specimen was collected in Study area 2 (533799E 6288233N; GDA94 Zone 55).
- *Tylophora linearis* (BC Act - Vulnerable, EPBC Act - Endangered). One specimen of this species was collected in Study area 3; searches of the surrounds did not locate further specimens (530458E 6283723N; GDA94 Zone 55).

3.2 Fauna

3.2.1 Threatened Fauna Records

A total of four threatened fauna species were recorded during the surveys (Appendix C); all four are listed as threatened under the BC Act and/or EPBC Act (Table 3.4). No threatened fauna were recorded in Study area 5 during the surveys. The locations of threatened fauna records are shown in Figure 3.5).

Table 3.4: Threatened fauna recorded in the study area.

Common Name	Scientific Name	BC Act	EPBC Act	Study area			
				1a-1b	2	3	4
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V	-	✓	✓	✓	✓
Superb Parrot	*Polytelis swainsonii*	V	V	✓		✓	✓
Painted Honeyeater	*Grantiella picta*	V	V	✓			
Black Falcon	*Falco subniger*	V	-		✓		

3.2.2 Species Credit Species

The Superb Parrot was recorded relatively frequently during surveys outside the breeding season in September 2016 and January 2018, within Study areas 1a-1b, 3 and 4.

The species was recorded twice in Study area 4 during September 2016; on one occasion three birds were observed perched in a tree, and on the other occasion nine birds were observed flying overhead. During January 2018, Superb Parrots were recorded once in Study area 1a (five individuals were recorded flying through the River Red Gum habitat) and once in Study area 1b (one individual was heard within the Weeping Myall habitat). In addition, during January 2018 four sightings of the species were recorded in Study area 3. Flocks of up to seven individuals were observed flying in various directions, in open spaces and alighting in Green Mallee habitat patches. One pair was observed foraging on the ground in Study area 3.

OEH (2018b) classifies the following BVTs that occur in the study areas as potential habitat for the species:

- Weeping Myall open woodland of the Riverina and NSW South Western Slopes Bioregions (LA212);
- Inland Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion (LA152);
- River Red Gum - Veined Swamp Wallaby Grass grassy tall woodland of depressions on floodplains and alluvial plains (LA191);
- Poplar Box - Belah woodland on clay-loam soils of the alluvial plains of north-central NSW (LA175); and
- Derived tussock grasslands of the central western plains and lower slopes of NSW (LA138).

The surveys confirmed that the BVTs listed above present potential habitat for the species within the study areas. In addition, our surveys determined "Green Mallee - White Cypress Pine woodland on gravelly rises of central NSW (LA148)" also provides foraging habitat, with numerous sightings of the species throughout Study area 3.

Due to the number and diversity of tree hollows within the River Red Gum Forest, this area provides potential breeding habitat for the species, although no individuals were recorded here during the breeding season. The extent of potential habitat is shown in Figure 3.6.

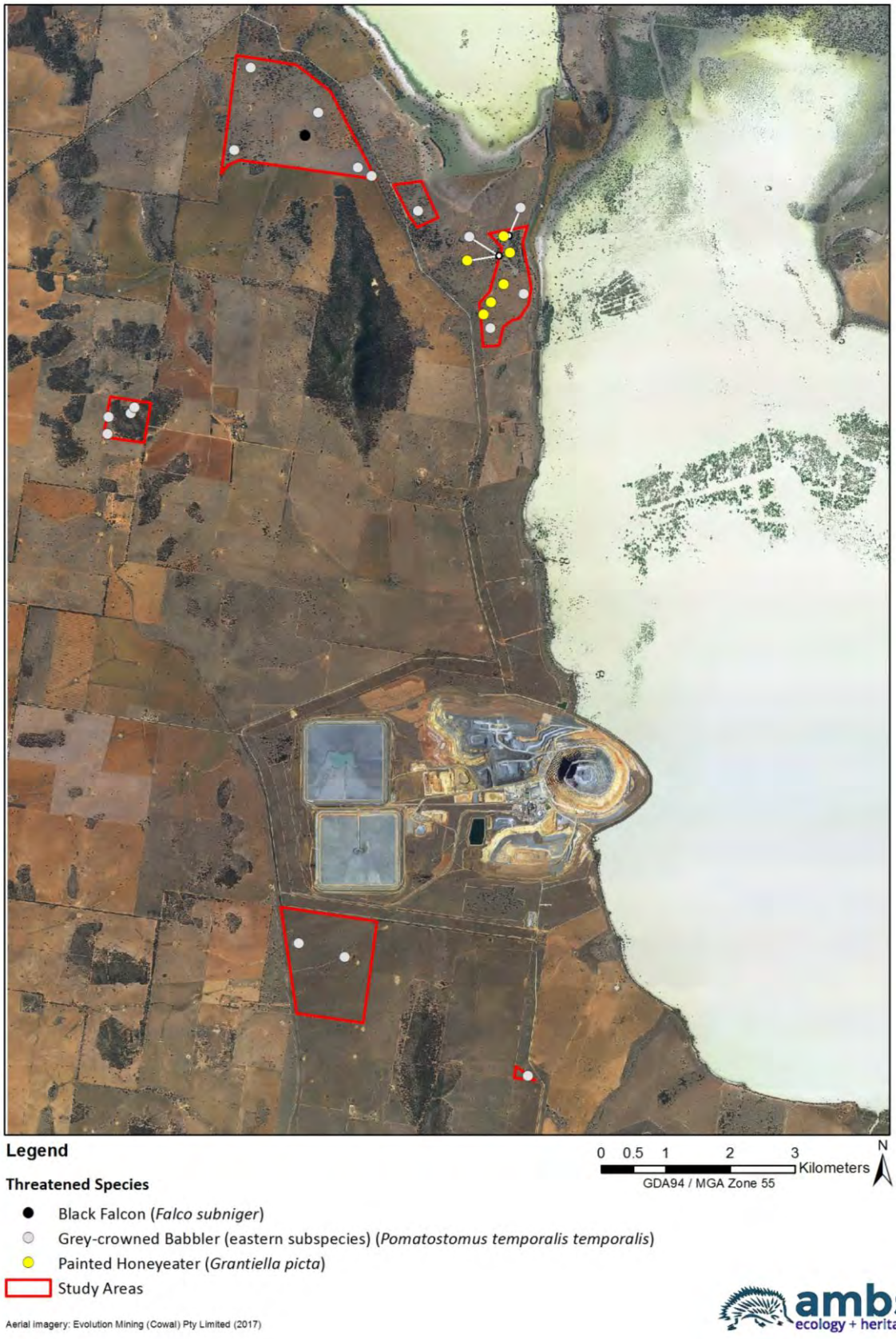

Figure 3.5 Threatened fauna recorded during the surveys

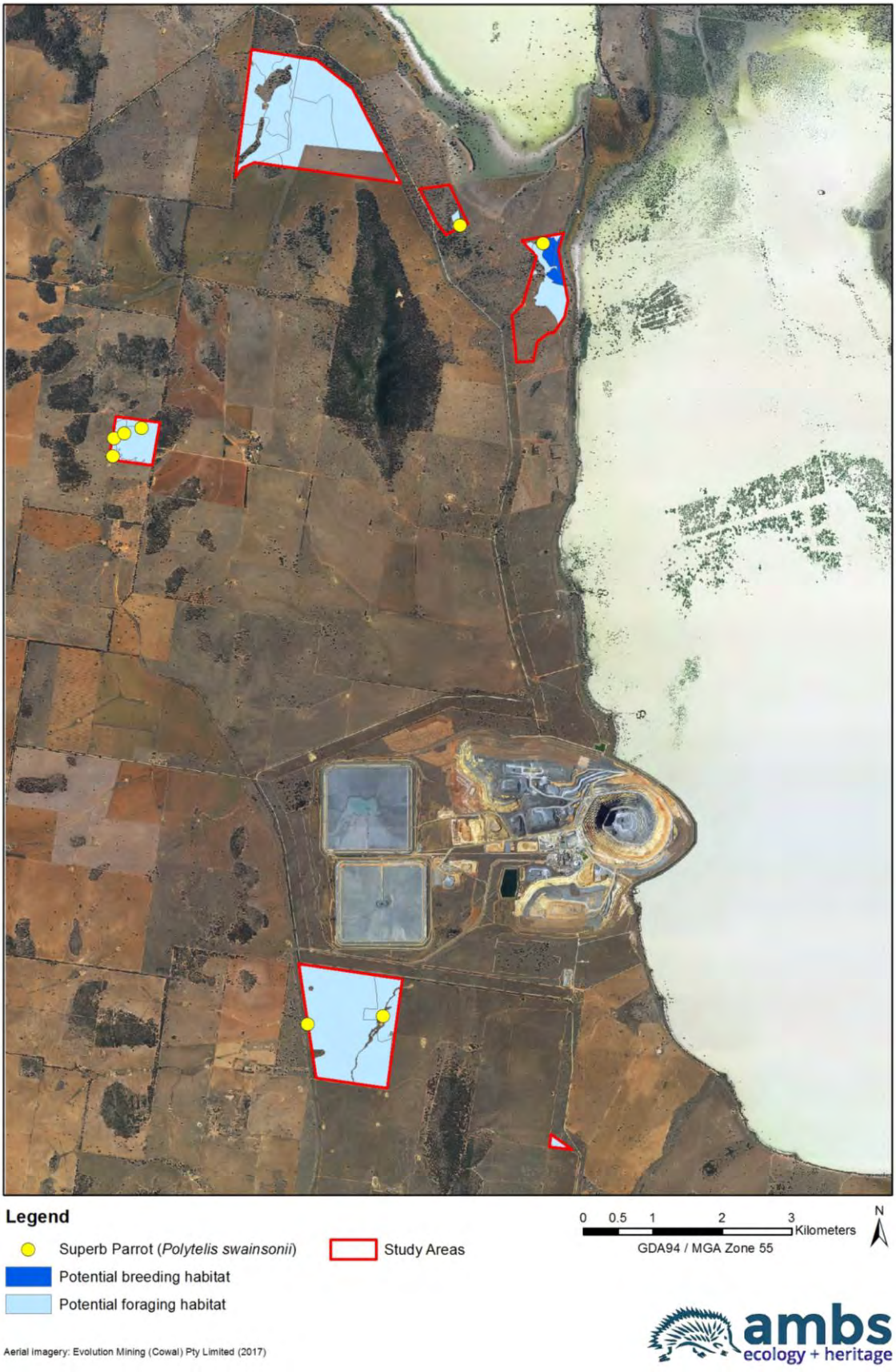

Figure 3.6 Superb Parrot records and habitat within the study areas

4 Conclusion

The current study included five areas located to the west of Lake Cowal. The flora and fauna surveys were undertaken within the five study areas, including confirmation of vegetation community mapping, identification of TECs, collection of BBAM (2014) data, opportunistic threatened flora surveys, and surveys for the Superb Parrot.

The surveys and analysis of data assigned eight BVTs/PCTs to the study areas:

- BVT LA212/PCT26: Weeping Myall open woodland of the Riverina and NSW South Western Slopes Bioregions;
- BVT LA152/PCT82: Inland Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion;
- BVT LA191/PCT249: River Red Gum - Veined Swamp Wallaby Grass grassy tall woodland of depressions on floodplains and alluvial plains;
- BVT LA105/PCT55: Belah woodland on alluvial plains in central-north NSW;
- BVT LA198/PCT53: Shallow freshwater mixed marsh sedgeland of northern-western NSW floodplains;
- BVT LA148/PCT176: Green Mallee - White Cypress Pine woodland on gravelly rises of central NSW;
- BVT LA175/PCT56: Poplar Box - Belah woodland on clay-loam soils of the alluvial plains of north-central NSW; and
- BVT LA138/PCT250: Derived tussock grasslands of the central western plains and lower slopes of NSW.

Within the study area, the following EECs listed under the BC Act and/or the EPBC Act were recorded:

- Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (BC Act) covering 26.6 ha and Weeping Myall Woodlands (EPBC Act) covering 3.9 ha. These listings comprised BVT LA212 in moderate condition; and
- Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (BC Act) and Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (EPBC Act), which covered a cumulative area of 165.9 ha and comprised BVT LA152 in low condition.

Two plant species were collected that may be listed as threatened species pending confirmation by the National Herbarium of NSW:

- *Austrostipa wakoolica* (A Speargrass) (BC Act - Endangered, EPBC Act - Endangered). A specimen of this grass may have been collected in Study area 2.
- *Tylophora linearis* (BC Act - Vulnerable, EPBC Act - Endangered). One specimen of this species was collected in Study area 3.

The surveys recorded four species listed as vulnerable under the BC Act (the Grey-crowned Babbler, the Painted Honeyeater, the Superb Parrot and the Black Falcon). The Superb Parrot and the Painted Honeyeater are also listed as vulnerable under the EPBC Act.

Potential foraging and breeding habitat for the Superb Parrot was recorded within the study areas.

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Appendix A: Flora species recorded

Family	*Scientific Name*	Common Name	Exotic
Poaceae	*Austrostipa aristiglumis*	Plains Grass	
Fabaceae	*Acacia deanei subsp. deanei*	Deane's Wattle	
Fabaceae	*Acacia doratoxylon*	Currawang	
Fabaceae	*Acacia lanigera*	Woolly Wattle	
Fabaceae	*Acacia pendula*	Boree	
Poaceae	*Aira caryophyllea*	Silvery Hairgrass	*
Sapindaceae	*Alectryon oleifolius*	Western Rosewood	
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed	
Amaranthaceae	*Alternanthera nana*	Hairy Joyweed	
Poaceae	*Amphibromus macrorhinus*	Long-nosed Swamp Wallaby Grass	
Poaceae	*Amphibromus nervosus*	Swamp Wallaby Grass	
Anthericaceae	*Anthericaceae indeterminate*		
Capparaceae	*Apophyllum anomalum*	Warrior Bush	
Asteraceae	*Arctotheca calendula*	Capeweed	*
Poaceae	*Aristida behriana*	Bunch Wiregrass	
Poaceae	*Aristida jerichoensis var. jerichoensis*	Jericho Wiregrass	
Rubiaceae	*Asperula conferta*	Common Woodruff	
Asteraceae	*Aster subulatus*	Wild Aster	*
Chenopodiaceae	*Atriplex eardleyae*	Small Saltbush	
Chenopodiaceae	*Atriplex semibaccata*	Creeping Saltbush	
Chenopodiaceae	*Atriplex spinibractea*	Spiny-fruit Saltbush	
Poaceae	*Austrostipa blackii*		
Poaceae	*Austrostipa densiflora*	Foxtail Speargrass	
Poaceae	*Austrostipa nitida*		
Poaceae	*Austrostipa scabra*	Speargrass	
Poaceae	*Austrostipa wakoolica*	A spear-grass	
Poaceae	*Avena barbata*	Bearded Oats	*
Poaceae	*Avena fatua*	Common Wild Oat	*
Poaceae	*Avena sativa*	Oats	*
Nyctaginaceae	*Boerhavia dominii*	Tarvine	
Poaceae	*Bothriochloa decipiens var. decipiens*	Pitted Bluegrass	
Poaceae	*Bothriochloa macra*	Red Grass	
Poaceae	*Bromus brevis*		*
Poaceae	*Bromus hordeaceus*	Soft Brome	*
Poaceae	*Bromus molliformis*	Soft Brome	*
Poaceae	*Bromus rubens*	Red Brome	*
Asphodelaceae	*Bulbine semibarbata*	Wild Onion	
Cupressaceae	*Callitris glaucophylla*	White Cypress Pine	
Asteraceae	*Calotis cuneifolia*	Purple Burr-Daisy	
Asteraceae	*Calotis hispidula*	Bogan Flea	
Cyperaceae	*Carex inversa*	Knob Sedge	
Asteraceae	*Carthamus lanatus*	Saffron Thistle	*
Casuarinaceae	*Casuarina cristata*	Belah	
Asteraceae	*Centaurea melitensis*	Maltese Cockspur	*
Asteraceae	*Centipeda cunninghamii*	Common Sneezeweed	
Asteraceae	*Centipeda minima subsp. minima*	Spreading Sneezeweed	
Euphorbiaceae	*Chamaesyce dallachyana*		
Euphorbiaceae	*Chamaesyce drummondii*	Caustic Weed	
Adiantaceae	*Cheilanthes sieberi subsp. sieberi*	Rock Fern	

Family	*Scientific Name*	Common Name	Exotic
Chenopodiaceae	*Chenopodium desertorum*	Desert Goosefoot	
Poaceae	*Chloris divaricata var. divaricata*	Slender Chloris	
Poaceae	*Chloris truncata*	Windmill Grass	
Asteraceae	*Chondrilla juncea*	Skeleton Weed	*
Asteraceae	*Cirsium vulgare*	Spear Thistle	*
Cucurbitaceae	*Citrullus lanatus var. lanatus*	Wild Melon	*
Convolvulaceae	*Convolvulus erubescens*	Pink Bindweed	
Asteraceae	*Conyza bonariensis*	Flaxleaf Fleabane	*
Asteraceae	*Conyza sumatrensis*	Tall Fleabane	*
Asteraceae	*Cotula bipinnata*	Ferny Cotula	*
Crassulaceae	*Crassula decumbens var. decumbens*		
Crassulaceae	*Crassula sieberiana*	Australian Stonecrop	
Cucurbitaceae	*Cucumis myriocarpus subsp. leptodermis*	Paddy Melon	*
Poaceae	*Cynodon dactylon*	Common Couch	
Cyperaceae	*Cyperus difformis*		
Cyperaceae	*Cyperus gracilis*	Slender Flat-sedge	
Cyperaceae	*Cyperus gymnocaulos*		
Fabaceae	*Desmodium varians*	Slender Tick-trefoil	
Poaceae	*Dichanthium spp.*		
Convolvulaceae	*Dichondra repens*	Kidney Weed	
Poaceae	*Digitaria divaricatissima*	Umbrella Grass	
Chenopodiaceae	*Dysphania pumilio*	Small Crumbweed	
Boraginaceae	*Echium plantagineum*	Patterson's Curse	*
Asteraceae	*Eclipta platyglossa*	Yellow Twin-heads	
Poaceae	*Ehrharta longiflora*	Annual Veldtgrass	*
Chenopodiaceae	*Einadia hastata*	Berry Saltbush	
Chenopodiaceae	*Einadia nutans subsp. linifolia*	Climbing Saltbush	
Chenopodiaceae	*Einadia nutans subsp. nutans*	Climbing Saltbush	
Chenopodiaceae	*Einadia polygonoides*	Knotweed Goosefoot	
Chenopodiaceae	*Einadia trigonos*	Fishweed	
Cyperaceae	*Eleocharis plana*	Flat Spike-sedge	
Poaceae	*Elymus scaber*	Common Wheatgrass	
Chenopodiaceae	*Enchylaena tomentosa*	Ruby Saltbush	
Poaceae	*Enteropogon acicularis*	Curly Windmill Grass	
Onagraceae	*Epilobium billardierianum*		
Poaceae	*Eragrostis cilianensis*	Stinkgrass	*
Poaceae	*Eragrostis elongata*	Clustered Lovegrass	
Poaceae	*Eragrostis lacunaria*	Purple Lovegrass	
Poaceae	*Eragrostis parviflora*	Weeping Lovegrass	
Myoporaceae	*Eremophila mitchellii*	Budda	
Poaceae	*Eriochloa pseudoacrotricha*	Early Spring Grass	
Geraniaceae	*Erodium botrys*	Long Storksbill	*
Geraniaceae	*Erodium cicutarium*	Common Crowfoot	*
Geraniaceae	*Erodium crinitum*	Blue Crowfoot	
Geraniaceae	*Erodium moschatum*	Musky Crowfoot	*
Myrtaceae	*Eucalyptus camaldulensis*	River Red Gum	
Myrtaceae	*Eucalyptus dwyeri*	Dwyer's Red Gum	
Myrtaceae	*Eucalyptus microcarpa*	Western Grey Box	
Myrtaceae	*Eucalyptus populnea subsp. bimbil*	Bimble Box	
Myrtaceae	*Eucalyptus sideroxylon*	Mugga Ironbark	
Myrtaceae	*Eucalyptus viridis*	Green Mallee	
Asteraceae	*Euchiton sphaericus*		

Family	*Scientific Name*	Common Name	Exotic
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-sedge	
Asteraceae	*Gamochaeta spp.*		*
Rutaceae	*Geijera parviflora*	Wilga	
Fabaceae	*Glycine clandestina*	Twining glycine	
Fabaceae	*Glycine tabacina*	Variable Glycine	
Fabaceae	*Glycyrrhiza acanthocarpa*	Native Liquorice	
Haloragaceae	*Gonocarpus elatus*	A Raspwort	
Goodeniaceae	*Goodenia cycloptera*		
Goodeniaceae	*Goodenia fascicularis*	Mallee Goodenia	
Goodeniaceae	*Goodenia glabra*	Smooth Goodenia	
Goodeniaceae	*Goodenia pinnatifida*		
Proteaceae	*Hakea tephrosperma*	Hooked Needlewood	
Asteraceae	*Hedypnois rhagadioloides*	Cretan Weed	*
Boraginaceae	*Heliotropium amplexicaule*	Blue Heliotrope	*
Boraginaceae	*Heliotropium europaeum*	Potato Weed	*
Poaceae	*Hordeum glaucum*		*
Poaceae	*Hordeum leporinum*	Barley Grass	*
Apiaceae	*Hydrocotyle laxiflora*	Stinking Pennywort	
Clusiaceae	*Hypericum perforatum*	St. Johns Wort	*
Asteraceae	*Hypochaeris glabra*	Smooth Catsear	*
Asteraceae	*Hypochaeris microcephala*	White Flatweed	*
Asteraceae	*Hypochaeris radicata*	Catsear	*
Juncaceae	*Juncus aridicola*	Tussock Rush	
Juncaceae	*Juncus australis*	Rush	
Juncaceae	*Juncus filicaulis*		
Juncaceae	*Juncus flavidus*		
Juncaceae	*Juncus radula*		
Juncaceae	*Juncus subglaucus*		
Juncaceae	*Juncus subsecundus*	Finger Rush	
Juncaceae	*Juncus usitatus*		
Juncaceae	*Juncus vaginatus*		
Poaceae	*Lachnagrostis filiformis*		
Asteraceae	*Lactuca saligna*	Willow-leaved Lettuce	*
Asteraceae	*Lactuca serriola*	Prickly Lettuce	*
Brassicaceae	*Lepidium africanum*	Common Peppercress	*
Poaceae	*Lolium perenne*	Perennial Ryegrass	*
Poaceae	*Lolium rigidum*	Wimmera Ryegrass	*
Lomandraceae	*Lomandra filiformis subsp. coriacea*	Wattle Matt-rush	
Solanaceae	*Lycium ferocissimum*	African Boxthorn	*
Chenopodiaceae	*Maireana brevifolia*		
Chenopodiaceae	*Maireana decalvans*	Black Cotton Bush	
Chenopodiaceae	*Maireana enchylaenoides*	Wingless Fissure-weed	
Chenopodiaceae	*Maireana humillima*		
Chenopodiaceae	*Maireana microphylla*	Small-leaf Bluebush	
Malvaceae	*Malva parviflora*	Small-flowered Mallow	*
Lamiaceae	*Marrubium vulgare*	White Horehound	*
Marsileaceae	*Marsilea drummondii*	Common Nardoo	
Fabaceae	*Medicago minima*	Woolly Burr Medic	*
Fabaceae	*Medicago polymorpha*	Burr Medic	*
Fabaceae	*Medicago truncatula*	Barrel Medic	*

Family	*Scientific Name*	Common Name	Exotic
Poaceae	*Microlaena stipoides subsp. stipoides*	Weeping Grass	
Phrymaceae	*Mimulus gracilis*	Slender Monkey-flower	
Myoporaceae	*Myoporum platycarpum subsp. platycarpum*		
Asteraceae	*Onopordum acanthium*	Scotch Thistle	*
Oxalidaceae	*Oxalis exilis*		
Oxalidaceae	*Oxalis perennans*		
Poaceae	*Panicum effusum*	Hairy Panic	
Poaceae	*Panicum queenslandicum*	Yadbila Grass	
Apocynaceae	*Parsonsia straminea*	Common Silkpod	
Poaceae	*Paspalidium constrictum*	Knottybutt Grass	
Poaceae	*Paspalidium gracile*	Slender Panic	
Poaceae	*Paspalidium jubiflorum*	Warrego Grass	
Poaceae	*Paspalum dilatatum*	Paspalum	*
Caryophyllaceae	*Petrorhagia nanteuilii*		*
Poaceae	*Phalaris paradoxa*	Paradoxa Grass	*
Verbenaceae	*Phyla canescens*	Lippia	*
Plantaginaceae	*Plantago debilis*	Shade Plantain	
Poaceae	*Poaceae indeterminate*	Grasses	*
Polygonaceae	*Polygonum aviculare*	Wireweed	*
Polygonaceae	*Polygonum plebeium*	Small Knotweed	
Portulacaceae	*Portulaca oleracea*	Pigweed	
Lobeliaceae	*Pratia concolor*	Poison Pratia	
Martyniaceae	*Proboscidea louisianica*	Purple-flowered Devil's Claw	*
Asteraceae	*Pseudognaphalium luteoalbum*	Jersey Cudweed	
Amaranthaceae	*Ptilotus exaltatus var. exaltatus*	Tall Mulla Mulla	
Amaranthaceae	*Ptilotus sessilifolius var. sessilifolius*		
Chenopodiaceae	*Rhagodia spinescens*	Thorny Saltbush	
Asteraceae	*Rhodanthe floribunda*	Common White Sunray	
Polygonaceae	*Rumex brownii*	Swamp Dock	
Polygonaceae	*Rumex conglomeratus*	Clustered Dock	*
Polygonaceae	*Rumex dumosus*	Wiry Dock	
Polygonaceae	*Rumex tenax*	Shiny Dock	
Poaceae	*Rytidosperma auriculatum*	Lobed Wallaby Grass	
Poaceae	*Rytidosperma bipartitum*	Wallaby Grass	
Poaceae	*Rytidosperma caespitosum*	Ringed Wallaby Grass	
Poaceae	*Rytidosperma duttonianum*		
Poaceae	*Rytidosperma erianthum*	Wallaby Grass	
Poaceae	*Rytidosperma fulvum*	Wallaby Grass	
Poaceae	*Rytidosperma monticola*		
Poaceae	*Rytidosperma setaceum*	Small-flowered Wallaby-grass	
Chenopodiaceae	*Salsola australis*		
Chenopodiaceae	*Sclerolaena birchii*	Galvanized Burr	
Chenopodiaceae	*Sclerolaena diacantha*	Grey Copperburr	
Chenopodiaceae	*Sclerolaena muricata*	Black Rolypoly	
Asteraceae	*Senecio quadridentatus*	Cotton Fireweed	
Malvaceae	*Sida corrugata*	Corrugated Sida	
Malvaceae	*Sida cunninghamii*	Ridge Sida	
Malvaceae	*Sida trichopoda*	High Sida	

Family	*Scientific Name*	Common Name	Exotic
Brassicaceae	*Sisymbrium erysimoides*	Smooth Mustard	*
Brassicaceae	*Sisymbrium irio*	London Rocket	*
Solanaceae	*Solanum esuriale*	Quena	
Solanaceae	*Solanum nigrum*	Black-berry Nightshade	*
Asteraceae	*Sonchus oleraceus*	Common Sowthistle	*
Caryophyllaceae	*Spergularia rubra*	Sandspurry	*
Poaceae	*Sporobolus caroli*	Fairy Grass	
Poaceae	*Sporobolus mitchellii*	Rat's Tail Couch	
Asteraceae	*Stuartina hamata*	Hooked Cudweed	
Poaceae	*Tragus australianus*	Small Burrgrass	
Zygophyllaceae	*Tribulus micrococcus*	Spineless Caltrop	
Fabaceae	*Trifolium angustifolium*	Narrow-leaved Clover	*
Fabaceae	*Trifolium arvense*	Haresfoot Clover	*
Fabaceae	*Trifolium glomeratum*	Clustered Clover	*
Fabaceae	*Trifolium tomentosum*	Woolly Clover	*
Apocynaceae	*Tylophora linearis*		
Urticaceae	*Urtica urens*	Small Nettle	*
Scrophulariaceae	*Verbascum virgatum*	Twiggy Mullein	*
Verbenaceae	*Verbena gaudichaudii*	Verbena	
Asteraceae	*Vittadinia cervicularis*		
Asteraceae	*Vittadinia cuneata*	A Fuzzweed	
Asteraceae	*Vittadinia gracilis*	Woolly New Holland Daisy	
Asteraceae	*Vittadinia pterochaeta*	Rough Fuzzweed	
Asteraceae	*Vittadinia pustulata*		
Poaceae	*Vulpia muralis*	Wall Fescue	*
Poaceae	*Vulpia myuros*	Rat's Tail Fescue	*
Campanulaceae	*Wahlenbergia communis*	Tufted Bluebell	
Campanulaceae	*Wahlenbergia fluminalis*	River Bluebell	
Campanulaceae	*Wahlenbergia gracilenta*	Annual Bluebell	
Campanulaceae	*Wahlenbergia gracilis*	Sprawling Bluebell	
Campanulaceae	*Wahlenbergia luteola*	Bluebell	
Campanulaceae	*Wahlenbergia stricta*	Tall Bluebell	
Poaceae	*Walwhalleya subxerophila*	Gilgai Grass	
Asteraceae	*Xanthium spinosum*	Bathurst Burr	*
Asteraceae	*Xerochrysum bracteatum*	Golden Everlasting	
Aizoaceae	*Zaleya galericulata subsp. australis*		

Appendix B: BioBanking plot data

NPS = Native Plant Species Richness NOS = Native Over-Storey (%) NMS (%) = Native Mid-Storey NGCG = Native Ground Cover Grass NGCS = Native Ground Cover Shrubs NGCO = Native Ground Cover Other EPC =Exotic Plant Cover NTH = No. trees with Hollow OR = Over-Storey Regeneration FL= Length of Logs.

Plot	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Zone	Easting	Northing	Survey Year
CO01	21	12	1	2	10	4	24	1	1	45	55	535041	6286688	2017
CO02	30	1	0	4	4	18	34	1	1	34	55	535151	6286553	2017
CO03	34	8	0	26	0	10	32	0	1	11	55	534799	6287063	2017
CO04	20	11	0	4	0	12	14	3	1	47	55	536638	6286092	2017
CO05	16	3	0	32	0	8	48	1	0.33	22	55	536761	6286420	2017
CO06	24	25	0	4	0	14	8	2	1	53	55	536797	6285925	2017
CO07	39	3	0	22	12	14	14	0	1	44	55	536403	6286019	2017
CO08	30	0	7	16	10	2	54	1	0.66	22	55	536274	6285292	2017
CO09	32	9	0	26	6	10	54	1	0.66	4	55	536167	6285110	2017
CO10	35	0	0	30	0	4	46	0	0.5	0	55	536475	6285568	2017
CO11	19	0	0	8	0	58	0	0	0.33	0	55	536569	6286065	2017
CO12	19	7	0	4	0	42	4	1	1	4	55	536476	6286314	2017
CO13	19	0	0	8	0	16	76	0	0.66	0	55	535079	6286844	2017
CO14	23	19	0	16	0	10	0	4	0.5	1	55	534133	6287804	2017
CO15	19	3	0	24	0	12	20	3	0.5	3	55	533884	6288043	2017
CO16	23	8.2	0.5	36	0	4	0	14	1	47	55	530955	6283649	2017
CO17	16	9.5	1.5	12	0	0	0	12	1	60	55	530708	6283580	2017
CO18	20	5.9	1.5	12	0	0	0	9	1	94	55	530776	6283260	2017
CO19	18	5.4	0	10	0	0	0	6	1	42	55	530688	6283385	2017
CO20	26	9.8	0	16	0	20	0	3	1	57	55	530458	6283723	2017
CO21	22	6.7	0.5	18	0	0	0	2	1	66	55	530413	6283611	2017
CO22	34	8.7	0.4	36	2	16	4	1	0.5	13	55	533165	6288950	2017
CO23	29	15	0	38	6	20	4	0	05	12	55	533167	6288636	2017
CO24	23	10	0	46	0	6	8	0	0.5	13	55	533480	6288617	2017
CO25	22	0	0	42	0	6	8	0	1	5	55	533362	6288420	2017
CO26	26	4.5	0	24	0	20	6	1	0.5	5	55	533799	6288233	2017
CO27	23	0	0	24	0	24	12	0	0	0	55	533492	6288150	2017
CO28	23	0	0	58	0	4	0	0	0	9	55	533094	6288093	2017
CO29	23	0.5	0	28	2	2	26	4	0	31	55	532991	6287587	2017
CO30	25	6	0	36	2	10	0	1	0.5	36	55	532651	6287555	2017

Plot	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Zone	Easting	Northing	Survey Year
CO31	27	2.7	0	44	0	2	2	0	0.5	23	55	533646	6287770	2017
CO32	18	0	0	56	0	2	4	0	0	0	55	533394	6287783	2017
CO33	30	7.5	0	42	0	4	10	1	0.5	58	55	533549	6287913	2017
CO34	26	3.5	0	20	0	18	10	0	0.5	57	55	533632	6288335	2017
CO35	22	22.3	0	0	18	12	42	4	1	30	55	535153	6286711	2017
CO36	22	3	1	32	2	12	76	1	1	0	55	533722	6274973	2017
CO37	8	0	0	14	0	8	68	0	1	0	55	534220	6275161	2017
CO38	32	0	0	28	0	12	52	0	1	25	55	534383	6275157	2017
CO39	31	0	0	34	2	16	86	0	1	0	55	534283	6274906	2017
CO40	33	0	0	44	0	10	60	0	1	0	55	534173	6275513	2017
CO41	33	13	0	14	8	10	58	0	0.75	0	55	536721	6273392	2017
CO42	32	11	0	8	0	32	4	0	0.75	16	55	536851	6273332	2018
CO43	19	0	0	4	8	8	54	0	0	0	55	530344	6283261	2018
CO44	20	0	0	32	20	4	4	0	0	0	55	530363	6283521	2018
CO45	27	0	0	42	2	4	0	0	0	0	55	530762	6283667	2018
CO46	28	0	0	30	0	22	0	1	0.5	28	55	535351	6286590	2018
CO47	19	0	0	26	0	48	12	0	0.5	0	55	535277	6286739	2018
CO48	25	17.7	0	18	0	32	14	1	0.66	12	55	535197	6287037	2018
CO49	18	33.5	0	0	0	8	0	11	1	140	55	536795	6286401	2018
CO50	15	0	0	2	0	86	0	0	0.33	3	55	536552	6286330	2018
CO51	21	0	0	44	2	6	2	0	0.5	0	55	536785	6285428	2018
CO52	11	0	0	2	0	2	96	0	1	0	55	533300	6275386	2016
CO53	12	0	0	0	0	4	90	0	1	5	55	534244	6275198	2016
CO54	14	0	0	0	2	8	98	0	1	0	55	534145	6274592	2016
CO55	11	0	0	2	0	16	94	0	1	0	55	533257	6274661	2016
CO56	17	0	0	16	0	0	90	0	1	0	55	533499	6275726	2016
CO57	20	0	0	6	0	0	98	0	1	0	55	534230	6275681	2016

Appendix C: Fauna species recorded

Class	Family	Common Name	Scientific Name
FROGS	Hylidae	Peron's Tree Frog	*Litoria peronii*
	Limnodynastidae	Spotted Grass Frog	*Limnodynastes tasmaniensis*
BIRDS	Acanthizidae	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*
		Southern Whiteface	*Aphelocephala leucopsis*
	Accipitridae	Whistling Kite	*Haliastur sphenurus*
	Aegothelidae	Australian Owlet-nightjar	*Aegotheles cristatus*
	Alcedinidae	Laughing Kookaburra	*Dacelo novaeguineae*
		Sacred Kingfisher	*Todiramphus sanctus*
	Anatidae	Australian Wood Duck	*Chenonetta jubata*
	Ardeidae	White-faced Heron	*Egretta novaehollandiae*
	Artamidae	Masked Woodswallow	*Artamus personatus*
		White-browed Woodswallow	*Artamus superciliosus*
		Pied Butcherbird	*Cracticus nigrogularis*
		Grey Butcherbird	*Cracticus torquatus*
		Australian Magpie	*Gymnorhina tibicen*
	Cacatuidae	Galah	*Eolophus roseicapillus*
		Cockatiel	*Nymphicus hollandicus*
	Campephagidae	Ground Cuckoo-shrike	*Coracina maxima*
		Black-faced Cuckoo-shrike	*Coracina novaehollandiae*
	Charadriidae	Banded Lapwing	*Vanellus tricolor*
	Columbidae	Crested Pigeon	*Ocyphaps lophotes*
		Common Bronzewing	*Phaps chalcoptera*
	Corcoracidae	White-winged Chough	*Corcorax melanorhamphos*
		Apostlebird	*Struthidea cinerea*
	Corvidae	Australian Raven	*Corvus coronoides*
		Little Raven	*Corvus mellori*
	Falconidae	Brown Falcon	*Falco berigora*
		Nankeen Kestrel	*Falco cenchroides*
		Black Falcon *	*Falco subniger*
	Hirundinidae	Welcome Swallow	*Hirundo neoxena*
	Megaluridae	Brown Songlark	*Cincloramphus cruralis*
		Rufous Songlark	*Cincloramphus mathewsi*
	Meliphagidae	Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*
		Painted Honeyeater *	*Grantiella picta*
		Noisy Miner	*Manorina melanocephala*
	Meropidae	Rainbow Bee-eater	*Merops ornatus*
	Monarchidae	Magpie-lark	*Grallina cyanoleuca*
	Motacillidae	Australian Pipit	*Anthus novaeseelandiae*
	Nectariniidae	Mistletoebird	*Dicaeum hirundinaceum*
	Oriolidae	Olive-backed Oriole	*Oriolus sagittatus*
	Pelecanidae	Australian Pelican	*Pelecanus conspicillatus*
	Pomatostomidae	Grey-crowned Babbler (eastern subspecies) *	*Pomatostomus temporalis temporalis*
	Psittacidae	Australian Ringneck	*Barnardius zonarius*
		Blue Bonnet	*Northiella haematogaster*
		Eastern Rosella	*Platycercus eximius*
		Red-rumped Parrot	*Psephotus haematonotus*
		Superb Parrot *	*Polytelis swainsonii*
	Rhipiduridae	Willie Wagtail	*Rhipidura leucophrys*
	Threskiornithidae	Australian White Ibis	*Threskiornis moluccus*
		Straw-necked Ibis	*Threskiornis spinicollis*
MAMMALS	Tachyglossidae	Short-beaked Echidna	*Tachyglossus aculeatus*
REPTILES	Agamidae	Bearded Dragon	*Pogona barbata*
	Scincidae	Copper-tailed Skink	*Ctenotus taeniolatus*
	Varanidae	Lace Monitor	*Varanus varius*

Note: * = threatened species under the BC Act and/or EPBC Act.

ATTACHMENT C
THREATENED SPECIES DATABASE RESULTS

Table C1
Threatened Fauna Species Database Results

Scientific Name	Common Name	Conservation Status[1]			Database Records				Australian Museum Business Services (2013)[6]	AMBS (2018)[9]	Recorded During Surveys at the CGO or Surrounds Prior to 2007[7]	Recorded During Surveys at the CGO or Surrounds from Jan 2007 to March 2013[8]	Recorded During Surveys at the CGO or Surrounds from Jan 2013 to Nov 2016[10]
		BC Act	EPBC Act	FM Act	NSW BioNet	Atlas of Living Australia	Birdlife Australia	Protected Matters Search					
Flora													
Austrostipa metatoris		V	V	-	-	-	-	●	-	-	-	-	-
Austrostipa wakoolica		E	E	-	●	●	-	●	-	-	-	-	●
Diuris tricolor		V	-	-	-	●	-	-	-	-	-	-	-
Lepidium aschersonii	Spiny Peppercress	V	V	-	-	●	-	●	-	-	-	-	-
Philotheca ericifolia		-	V	-	-	-	-	●	-	-	-	-	-
Pilularia novae-hollandiae	Austral Pillwort	E	-	-	●	-	-	-	-	-	●	-	-
Swainsona murrayana	Slender Darling-pea	V	V	-	-	-	-	●	-	-	-	-	-
Swainsona sericea	Silky Swainson-pea	V	-	-	●	●	-	-	-	-	-	-	-
Tylophora linearis		V	E	-	-	●	-	●	-	-	-	-	-
Fish													
Galaxias rostratus	Flathead Galaxias	-	CE	CE	-	-	-	●	-	-	-	-	-
Maccullochella peelii peelii	Murray Cod	-	V	-	-	-	-	●	-	-	●	-	-
Macquaria australasica	Macquarie Perch	-	E	E	-	-	-	●	-	-	●	-	-
Bidyanus bidyanus	Silver Perch	-	CE	V	-	-	-	-	-	-	●	-	-
Amphibians													
Crinia sloanei	Sloane's Froglet	V	-	-	●	●	-	-	-	-	A, B	-	-
Neobatrachus pictus	Painted Burrowing Frog	E	-	-	-	-	-	-	-	-	A	-	-
Litoria raniformis	Southern Bell Frog	E	V	-	●	-	-	-	-	-	-	-	-
Reptiles													
Aprasia parapulchella	Pink-tailed Worm-lizard	V	V	-	-	-	-	●	-	-	-	-	-
Leipoa ocellata	Malleefowl	E	V	-	●	●	-	●	-	-	-	-	-
Anseranas semipalmata	Magpie Goose	V	-	-	●	●	●	-	●	-	A, C, D, G, H	-	H

Table C1 (Continued)
Threatened Fauna Species Database Results

Scientific Name	Common Name	Conservation Status[1]			Database Records				Australian Museum Business Services (2013)[6]	AMBS (2018)[9]	Recorded During Surveys at the CGO or Surrounds Prior to 2007[7]	Recorded During Surveys at the CGO or Surrounds from Jan 2007 to March 2013[8]	Recorded During Surveys at the CGO or Surrounds from Jan 2013 to Nov 2016[10]
		BC Act	EPBC Act	FM Act	NSW BioNet	Atlas of Living Australia	Birdlife Australia	Protected Matters Search					
Stictonetta naevosa	Freckled Duck	V	-	-	●	●	●	-	●	-	A, C, D, I	C	B, C, G, H
Oxyura australis	Blue-billed Duck	V	-	-	●	●	●	-	●	-	A, C, D	B	-
Botaurus poiciloptilus	Australasian Bittern	E	E	-	●	●	-	●	●	-	A	-	-
Falco hypoleucos	Grey Falcon	E	-	-	●	●	●	-	-	-	-	-	-
Falco subniger	Black Falcon	V	-	-	●	●	-	-	-	●	A	-	-
Pandion cristatus	Eastern Osprey	V	-	-	●	-	-	-	-	-	-	-	-
Lophoictinia isura	Square-tailed Kite	V	-	-	●	●	-	-	-	-	-	-	-
Hamirostra melanosternon	Black-breasted Buzzard	V	-	-	●	-	-	-	-	-	-	-	-
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	-	●	-	●	-	-	-	-	B, C	-
Circus assimilis	Spotted Harrier	V	-	-	●	●	●	-	-	-	A	-	-
Hieraaetus morphnoides	Little Eagle	V	-	-	●	●	●	-	-	-	A, I, K[#], L, M[#], N, O[#], P	-	-
Ardeotis australis	Australian Bustard	E	-	-	-	●	-	-	-	-	-	-	-
Grus rubicunda	Brolga	V	-	-	●	●	-	-	●	-	A, C	-	-
Burhinus grallarius	Bush Stone-curlew	E	-	-	●	●	-	-	-	-	-	-	-
Rostratula australis	Australian Painted Snipe	E	E	-	●	●	●	●	-	-	A	-	-
Pedionomus torquatus	Plains-wanderer	E	CE	-	-	●	-	-	-	-	-	-	-
Limosa limosa	Black-tailed Godwit	V	-	-	●	-	-	-	-	-	A	-	-
Numenius madagascariensis	Eastern Curlew	-	CE	-	-	-	-	●	-	-	-	-	-
Calidris ferruginea	Curlew Sandpiper	E	CE	-	●	●		●	●	-	-		
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	-	●	●	●	-	-	-	I	-	-
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	-	-	●	●	-	-	-	-	-	-	-
Glossopsitta pusilla	Little Lorikeet	V	-	-	●	-	-	-	-	-	-	-	-

Table C1 (Continued)
Threatened Fauna Species Database Results

Scientific Name	Common Name	Conservation Status[1]			Database Records				Australian Museum Business Services (2013)[6]	AMBS (2018)[9]	Recorded During Surveys at the CGO or Surrounds Prior to 2007[7]	Recorded During Surveys at the CGO or Surrounds from Jan 2007 to March 2013[8]	Recorded During Surveys at the CGO or Surrounds from Jan 2013 to Nov 2016[10]
		BC Act	EPBC Act	FM Act	NSW BioNet	Atlas of Living Australia	Birdlife Australia	Protected Matters Search					
Neophema pulchella	Turquoise Parrot	V	-	-	●	●	-	-	-	-	I, Q	-	-
Lathamus discolor	Swift Parrot	E	CE	-	●	●	-	●	-	●	-	-	-
Pezoporus occidentalis	Night Parrot	PE	E	-	-	-	-	●	-	-	-	-	-
Polytelis swainsonii	Superb Parrot	V	V	-	●	●	●	●	-	-	I, R	B	-
Ninox connivens	Barking Owl	V	-	-	●	●	●	-	-	-	A, S	-	-
Hirundapus caudacutus	White-throated Needletail	-	M	-	●	●	-	●	-	-	-	-	-
Apus pacificus	Fork-tailed Swift	-	M	-	●	●	-	●	-	-	-	-	-
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-	-	●	●	-	-	-	-	A, B[+], I	-	-
Hylacola cautus	Shy Heathwren	V	-	-	●	-	-	-	-	-	-	-	-
Chthonicola sagittata	Speckled Warbler	V	-	-	●	●	-	-	-	-	-	-	-
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-	-	●	-	-	-	-	-	-	-	-
Anthochaera phrygia	Regent Honeyeater	CE	CE	-	●	●	-	●	-	-	-	-	-
Grantiella picta	Painted Honeyeater	V	V	-	●	●	-	●	-	-	A, I	-	-
Certhionyx variegatus	Pied Honeyeater	V	-	-		●	-	-	-	-	-	-	-
Epthianura albifrons	White-fronted Chat	V	-	-	●	●	●	-	-		A, I	-	-
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	-	-	●	-	-	-	-	-	Q, T	-	-
Petroica phoenicea	Flame Robin	V	-	-	●	●	-	-	-	-	-	-	-
Petroica boodang	Scarlet Robin	V	-	-	●	●	-	-	-	-	-	-	-
Drymodes brunneopygia	Southern Scrub-robin	V	-	-	●	●	-	-	-	-	-	-	-
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-	-	●	-	●	-	-	●	A, B, G, H, I, L, M, N, P, T, U, V, W	B, C	-
Cinclosoma castanotum	Chestnut Quail-thrush	V	-	-	●	●	-	-	-	-	-	-	-

Table C1 (Continued)
Threatened Fauna Species Database Results

Scientific Name	Common Name	Conservation Status[1]			Database Records				Australian Museum Business Services (2013)[6]	AMBS (2018)[9]	Recorded During Surveys at the CGO or Surrounds Prior to 2007[7]	Recorded During Surveys at the CGO or Surrounds from Jan 2007 to March 2013[8]	Recorded During Surveys at the CGO or Surrounds from Jan 2013 to Nov 2016[10]
		BC Act	EPBC Act	FM Act	NSW BioNet	Atlas of Living Australia	Birdlife Australia	Protected Matters Search					
Daphoenositta chrysoptera	Varied Sittella	V	-	-	●	●	●	-	-	-	B+	-	-
Pachycephala inornata	Gilbert's Whistler	V	-	-	●	●	-	-	-	-	B+		
Stagonopleura guttata	Diamond Firetail	V	-	-	●	●	●	-	-	-	I	-	-
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	-	●	●	-	-	-	-	-	-	-
Mammals													
Dasyurus maculatus	Spotted-tailed Quoll	V	E	-	-	●	-	●	-	-	-	-	-
Phascolarctos cinereus	Koala	V	V	-	-	-	-	●	-	-	-	-	-
Petaurus norfolcensis	Squirrel Glider	V	-	-	●	●	-	-	-	-	-	-	-
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	-	-	-	-	-	-	-	-	-	-
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	-	●	●	-	●	-	-	-	-	-
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	-	●	●	-	-	-	-	W, X	-	-
Nyctophilus corbeni	Corben's Long-eared Bat	V	V	-	●	●	-	●	-	-	-	-	-
Chalinolobus picatus	Little Pied Bat	V	-	-	●	●	-	-	-	-	B+	-	-
Myotis macropus	Southern Myotis	V	-	-	-	●	-	-	-	-	-	-	-
Vespadelus baverstocki	Inland Forest Bat	V	-	-	-	-	-	-	-	-	Y	-	-
Vespadelus troughtoni	Eastern Cave Bat	V	-	-	-	-	-	-	-	-	B+	-	-

Notes:

+ Species with restricted distributions in the Wamboyne Mountain/'Coniston' area.

Nests located.

1 Threatened species status under the NSW *Biodiversity Conservation Act, 2016,* Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* and/or NSW *Fisheries Management Act, 1994* (current as of March 2018). CE = Critically Endangered, E = Endangered, V = Vulnerable.

2 Office of the Environment and Heritage (2017b) *Atlas of New South Wales Atlas Wildlife database search for the following area: -33.4584 147.1777,-33.4584 147.6107,-33.8206 147.6107, -33.8206 147.1777.* Website Accessed: September 2017.

3 Atlas of Living Australia (2017) *Atlas of Living Australia Website*. Database search within the following area: -33.4584 147.1777,-33.4584 147.6107,-33.8206 147.6107, -33.8206 147.1777. Website Accessed: September 2017.

4 Birdlife Australia (2017) *Birdlife Australia database search within the following area: -33.4584 147.1777,-33.4584 147.6107,-33.8206 147.6107, -33.8206 147.1777.*

Data received September 2017.

[5] Department of the Environment and Energy (2017) *Protected Matters search for the following area: -33.4584 147.1777,-33.4584 147.6107,-33.8206 147.6107, -33.8206 147.1777.*

Data received September 2017.

[6] Australian Museum Business Services (2013) *Lake Cowal Waterbird Monitoring (1989 to 2012) Compilation Report.*

[7] Previous survey results recorded from the CGO and surrounds prior to 2007 have been sourced from the following:

A = Vestjens, W.J.M (1977) *Status, Habitats and Food of Vertebrates at Lake Cowal, NSW*. Division of Wildlife Research Technical Memorandum No. 12. CSIRO, Canberra.

B = Gunninah Consultants (1995) *Fauna Species List for Lake Cowal.* Appendix 6 in NSR Environmental Consultants (1995) *Lake Cowal Gold Project Environmental Impact Statement – Volume 2 Fauna Impact Statement & Flora and Fauna Studies.*

C = Lane, B.R. (1990) *West Wyalong Prospect: Waterbird Investigation Data Report.* In Gunninah Consultants (1995) *Fauna Species List for Lake Cowal.* Appendix 6 in NSR Environmental Consultants (1995) *Lake Cowal Gold Project Environmental Impact Statement – Volume 2 Fauna Impact Statement & Flora and Fauna Studies.*

D = Lawler, W. (1989) Waterbird breeding at Lake Cowal, New South Wales. *Australian Birds* 23(2): 32-35. In Gunninah Consultants (1995) *Fauna Species List for Lake Cowal.* Appendix 6 in NSR Environmental Consultants (1995) *Lake Cowal Gold Project Environmental Impact Statement – Volume 2 Fauna Impact Statement & Flora and Fauna Studies.*

G = Barrick (2005c) *Cowal Gold Project – Vegetation Clearance Protocol Report – Perimeter Waste Emplacement.* September 2005. VCP-R018-B.

H = Barrick (2006a) *Cowal Gold Project – Vegetation Clearance Protocol Report – Magazine Laydown Area, Low Grade Ore Stockpile and Northern and Southern Tailings Storage Facilities Perimeter Fence Easement.* September 2006. VCP-R028-C.

I = Mount King Ecological Surveys (1997) *Temora to Cowal Gold Project Electricity Transmission Line Fauna Assessment.* Attachment D5-A of Appendix D Resource Strategies (1997) *Environmental Impact Statement Proposed 132kV Electricity Transmission Line from Temora to the Cowal Gold Project.* In North Limited (1998) *Cowal Gold Project Environmental Impact Statement.*

K = Barrick (2005d) *Cowal Gold Project – Vegetation Clearance Protocol Report – Soil Stockpile 1*. September 2005. VCP-R006-C.

L = Barrick (2005e) *Cowal Gold Project – Vegetation Clearance Protocol Report – Internal Mine Access Road*. September 2005. VCP-R012-B.

M = Barrick (2005f) *Cowal Gold Project – Vegetation Clearance Protocol Report – Processing Plant.* September 2005. VCP-R013-C.

N = Barrick (2005g) *Cowal Gold Project – Vegetation Clearance Protocol Report – Cowal West Borrow Pit (Northern Waste Emplacement).* September 2005. VCP-R020-B.

O = Barrick (2005h) *Cowal Gold Project – Vegetation Clearance Protocol Report – Contained Water Storage D2.* September 2005. VCP-R022-B.

P = Barrick (2006c) *Cowal Gold Project – Vegetation Clearance Protocol Report – Northern Waste Emplacement*. September 2006. VCP-NWE-C.

Q = Barrick (2005i) *Vegetation Clearing Protocol: Summary of Species located on the ETL and MLA, 31st October –2nd November 2005.*

R = Barrick (2005j) *Cowal Gold Project – Vegetation Clearance Protocol Report – Soil Stockpile 2*. September 2005. VCP-R007-B.

S = Barrick (2005k) *Vegetation Clearing Protocol: Summary of Species located on the MLA and Access Road, V Jan 10th – 14th 2005.*

T = Barrick (2005l) *Cowal Gold Project – Vegetation Clearance Protocol Report – Access Road (Blow Clear Road)*. September 2005. VCP-AR-Blow-A Clear Road.

U = Barrick (2003) *Cowal Gold Project Implementation of the Threatened Species Management Protocol.*

V = Barrick (2005m) *Vegetation Clearing Protocol: Summary of Species located on the ETL and MLA, July 6th – 7th 2005;* Barrick (2005n) *Vegetation Clearing Protocol: Summary of Species located on the MLA, July 6th – 7th 2005*; Barrick (2005o) *Vegetation Clearing Protocol: Summary of Species located on the MLA, June 14th – June 17th 2005;* Barrick (2005p) *Vegetation Clearing Protocol: Summary of Species located on the MLA, Lake Cowal Gold July 22nd – 23rd 2005;* Barrick (2005q) *Vegetation Clearing Protocol: Summary of Species located on the Mine Site September 28th – 30th 2005;* Barrick (2005r) *Vegetation Clearing Protocol: Summary of Species located on the ETL, MLA and Access Road, Jan 17th – 21st 2005;* Barrick (2005s) *Vegetation Clearing Protocol: Summary of Species located on the ETL and MLA, Jan 31st – 4th Feb 2005;* Barrick (2006d) *Vegetation Clearing Protocol: Summary of Species located on the MLA, 9-10th January 2006;* Barrick Australia Limited (2005t) *Cowal Gold Project – Vegetation Clearance Protocol Report – Cowal West Borrow Pit (Extension)*; Barrick Australia Limited (2005u) *Cowal Gold Project – Vegetation Clearance Protocol Reports – Low Grade Ore Stockpile*; Barrick Australia Limited (2005v) *Cowal Gold Project – Vegetation Clearance Protocol Report – Borefield Pipeline*; Barrick Australia Limited (2005w) *Cowal Gold Project – Vegetation Clearance Protocol Report – Northern Tailings Storage Facility*; Barrick Australia Limited (2005x) *Cowal Gold Project – Vegetation Clearance Protocol Report – Up-Catchment Diversion System*; Barrick Australia Limited (2005y) *Cowal Gold Project – Vegetation Clearance Protocol Report – Permanent Catchment Divide*; Barrick Australia Limited (2005z) *Cowal Gold Project – Vegetation Clearance Protocol Report – Soil Stockpile 3*; Barrick Australia Limited (2005zi) *Cowal Gold Project – Vegetation Clearance Protocol Report – Soil Stockpile 4*; Barrick Australia Limited (2005zii) *Cowal Gold Project – Vegetation Clearance Protocol Report – Open Pit*; Barrick Australia Limited (2005ziii) *Cowal Gold Project – Vegetation Clearance Protocol Report – Haul Road (Processing Plant to Tailings Storage Facilities)*; Barrick Australia Limited (2005ziv) *Cowal Gold Project – Vegetation Clearance Protocol Report – Southern Tailings Storage Facility*; Barrick Australia Limited (2005zv) *Cowal Gold Project 2003-2004 Annual Environmental Management Report.*

W = Barrick (2005zvi) *Cowal Gold Project – Vegetation Clearance Protocol Report – Access Road (Wamboyne Road)*. September 2005. VCP-AR-Wamboyne Road-A.

X = Greg Richards and Associates (1997) *Results of a Bat Fauna Survey to Target Threatened Species*. Attachment A7 of Resource Strategies Pty Ltd, CSIRO Wildlife and Ecology, Goldney, D. and Greg Richards and Associates (1997) *Cowal Gold Project Species Impact Statement.* In North Limited (1998) *Cowal Gold Project Environmental Impact Statement.*

Y = Donato Environmental Services (2006) *Seasonal Wildlife Use Patterns of the Cowal Gold Mine Tailings Facility.*

[8] Fauna species recorded within ML 1535 from January 2007 to April 2013 sourced from the following:

B = Barrick pers. comm. (2011).

C = Barrick (2007a) *Cowal Gold Project 2005-2006 Annual Environmental Management Report.*

D = Barrick (2010) *Cowal Gold Project 2008-2009 Annual Environmental Management Report.*

E = Kerle, A. (2013) *Cowal Gold Mine and Surrounds Fauna Report.*

G = Barrick (2007c) *Cowal Gold Project – Vegetation Clearance Protocol Report – Soil Stockpile 6. August 2007*. VCP-SS6-C.

H = Barrick (2009a) *Cowal Gold Project – Vegetation Clearance Protocol Report – Northern Waste Emplacement Area.* November 2009. VCP-NSE-A.

I = Barrick, pers. comm. (2010).

K = Barrick (2008c) *Cowal Gold Project – Vegetation Clearance Protocol Report – Southern Waste Emplacement (Campaign 2).* August 2008. VCP-SWE(C2)-B.

L = Barrick (2008d) *Fauna Observations within ML 1535 from 28 April 2005 to 27 February 2008;* Barrick (2007d) *Lake Cowal Observation Data Sheet 5-8 February 2007;* Barrick (2008e) *Implementing Tree Clearance Protocol, Southern Waste Dump Barrick Gold Lake Cowal, 18th - 21st February 2008;* Western Research Institute (2008) *Cowal Gold Mine E42 Modification Fauna Assessment;* Barrick Australia Limited (2007e) *Cowal Gold Project – Vegetation Clearance Protocol Report – Magazine Area*; Barrick Australia Limited (2007cf) *Cowal Gold Project – Vegetation Clearance Protocol Report – Northern Waste Emplacement – Southern Section*; Barrick Australia Limited (2009b) *Cowal Gold Project 2007-2008 Annual Environmental Management Report.*

M = Donato Environmental Services (2010a) *Seasonal Wildlife Use Patterns of the Cowal Gold Project Tailings Storage Facility: 1 October 2009 to 31 March 2010.*

N = Donato Environmental Services (2011a) *Seasonal Wildlife Use Patterns of the Cowal Gold Mine tailings storage facility: 1 April to 30 September 2010*.

O = Donato Environmental Services (2011b) *Seasonal Wildlife Use Patterns of the Cowal Gold Mine tailings storage facility: 1 October 2010 to 31 March 2011*.

P = Donato Environmental Services (2010b) *Seasonal Wildlife Use Patterns of the Cowal Gold Mine Tailings Storage Facility: 1 April 2009 to 30 September 2009.*

Q = Donato Environmental Services (2012a) *Seasonal Wildlife Use Patterns of the Cowal Gold Mine tailings storage facility: 1 April 2011 to 30 September 2011*.

R = Donato Environmental Services (2012b) *Seasonal Wildlife Use Patterns of the Cowal Gold Mine tailings storage facility: 1 October 2011 to 31 March 2012*.

S = Donato Environmental Services (2013) *Seasonal Wildlife Use Patterns of the Cowal Gold Mine tailings storage facility: 1 April to 30 September 2012*.

T = Donato Environmental Services (2008a) *Seasonal Wildlife Use Patterns of the Cowal Gold Mine Tailings Facility: April to September 2008.*

U = Donato Environmental Services (2008b) *Seasonal Wildlife Use Patterns of the Cowal Gold Mine Tailings Facility: October 2007 to March 2008.*

V = Donato Environmental Services (2009) *Seasonal Wildlife Use Patterns of the Cowal Gold Project Tailings Storage Facility: 1 October 2008 to 30 March 2009.*

W = Gell, P and Peake, P. (2010). Lake Cowal Waterbird Monitoring Survey. Progress Report – October 2010. Prepared for Barrick Gold Corporation.

X = Gell, P and Peake, P. (2011a). Lake Cowal Waterbird Monitoring Survey. Progress Report – January 2011. Prepared for Barrick Gold Corporation.

Y = Gell, P and Peake, P. (2011b). Lake Cowal Waterbird Monitoring Survey. Progress Report – October 2011. Prepared for Barrick Gold Corporation.

Z = Gell, P and Peake, P. (2012). Lake Cowal Waterbird Monitoring Survey. Progress Report – January 2012. Prepared for Barrick Gold Corporation.

[9] AMBS Ecology & Heritage (2018) Cowal Gold Operations Processing Rate Modification - Flora and Fauna Survey Report. Prepared for Evolution Mining (Cowal) Pty Limited.

[10] Previous survey results recorded from the CGO and surrounds between 2013 and 2016 have been sourced from the following:

A = Gell, P and Peake, P. (2013a) *Lake Cowal Waterbird Monitoring Survey Progress Report January 2013.* The University of Ballarat, Centre for Environmental Management. Report Prepared for Barrick Gold Corporation.

B = Gell, P and Peake, P. (2013b) *Lake Cowal Waterbird Monitoring Survey Progress Report August 2013.* The University of Ballarat, Centre for Environmental Management. Report Prepared for Barrick Gold Corporation.

C = Gell, P and Peake, P. (2013c) *Lake Cowal Waterbird Monitoring Survey Progress Report October 2013.* The University of Ballarat, Centre for Environmental Management. Report Prepared for Barrick Gold Corporation.

D = Gell, P and Peake, P. (2014a) Lake Cowal Waterbird Monitoring Survey Progress Report January 2014. Federation University Australia, Centre for Environmental Management. Report Prepared for Barrick Gold Corporation.

E = Gell, P and Peake, P. (2014b) Lake Cowal Waterbird Monitoring Survey Progress Report August 2014. Federation University Australia, Centre for Environmental Management. Report Prepared for Barrick Gold Corporation.

F = Gell, P and Peake, P. (2014c) Lake Cowal Waterbird Monitoring Survey Progress Report October 2014. Federation University Australia, Centre for Environmental Management. Report Prepared for Barrick Gold Corporation.

G = Gell, P. (2016a) *Lake Cowal Waterbird Monitoring Survey Progress Report August 2016.* Federation University Australia, Water Research Network. Report Prepared for Evolution Mining Limited.

H = Gell, P. (2016b) *Lake Cowal Waterbird Monitoring Survey Progress Report November 2016*. Federation University Australia, Water Research Network. Report Prepared for Evolution Mining Limited.

ATTACHMENT D

CREDIT REPORT FOR THE BAR FOOTPRINT ASSOCIATED WITH THE MINE SITE

Biodiversity credit report

This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 6/02/2018 Time: 5:26:39PM Calculator version: v4.0

Major Project details

Proposal ID:	0056/2018/4737MP
Proposal name:	Cowal Gold Mod 14 - Mine Site
Proposal address:	Cowal Gold Operations Lake Cowal Road Lake Cowal NSW 2671
Proponent name:	Evolution Mining (Cowal)
Proponent address:	Cowal Gold Operations Lake Cowal Road Lake Cowal NSW 2671
Proponent phone:	0269754749
Assessor name:	James Gleeson
Assessor address:	PO Box 1842 BRISBANE NSW 4064
Assessor phone:	07 3871 3144
Assessor accreditation:	0056

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.	16.50	193.05
Derived tussock grassland of the central western plains and lower slopes of NSW	234.00	2,532.36
Dwyer's Red Gum - White Cypress Pine - Currawang shrubby woodland mainly in the NSW South Western Slopes Bioregion	1.00	18.00
Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion	30.00	815.18
Total	281.50	3,559

Credit profiles

1. Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion, (LA152)

Number of ecosystem credits created	254
IBRA sub-region	Lower Slopes - Lachlan

Offset options - Plant Community types	Offset options - IBRA sub-regions
Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion, (LA152) Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion, (LA153) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, (LA154) Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW, (LA162) Mixed Eucalypt woodlands of floodplains in the southern-eastern Cobar Peneplain Bioregion, (LA163) Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW, (LA175) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)., (LA178) Riverine Western Grey Box grassy woodland of the semi-arid (warm) climate zone, (LA194) Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion, (LA195)	Lower Slopes - Lachlan and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion, (LA152)

Number of ecosystem credits created	562
IBRA sub-region	Lower Slopes - Lachlan

Offset options - Plant Community types	Offset options - IBRA sub-regions
Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion, (LA152) Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion, (LA153) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, (LA154) Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW, (LA162) Mixed Eucalypt woodlands of floodplains in the southern-eastern Cobar Peneplain Bioregion, (LA163) Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW, (LA175) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)., (LA178) Riverine Western Grey Box grassy woodland of the semi-arid (warm) climate zone, (LA194) Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion, (LA195)	Lower Slopes - Lachlan and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

3. Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions., (LA105)

Number of ecosystem credits created	193
IBRA sub-region	Lower Slopes - Lachlan

Offset options - Plant Community types	Offset options - IBRA sub-regions
Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions., (LA105)	Lower Slopes - Lachlan and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

4. Dwyer's Red Gum - White Cypress Pine - Currawang shrubby woodland mainly in the NSW South Western Slopes Bioregion, (LA144)

Number of ecosystem credits created	18
IBRA sub-region	Lower Slopes - Lachlan

Offset options - Plant Community types	Offset options - IBRA sub-regions

Dwyer's Red Gum - White Cypress Pine - Currawang shrubby woodland mainly in the NSW South Western Slopes Bioregion, (LA144) Gum Coolabah woodland on sedimentary substrates mainly in the Cobar Peneplain Bioregion, (LA204) White Cypress Pine - Mulga low woodland on siliceous rocky ranges mainly of the Cobar Peneplain Bioregion, (LA220) Blue Mallee - Bull Mallee - Green Mallee very tall mallee shrubland of the West Wyalong region, NSW South Western Slopes Bioregion, (LA122) Broombush - Green Mallee - Blue Mallee very tall shrubland on stony rises in the NSW South Western Slopes Bioregion, (LA126) Dwyer's Red Gum - Black Cypress Pine - Currawang shrubby low woodland on rocky hills mainly in the NSW South Western Slopes Bioregion, (LA141) Dwyer's Red Gum - Currawang grassy low woodland of the central western plains of NSW, (LA142) Dwyer's Red Gum - White Cypress Pine - Currawang low shrub-grass woodland of the Cobar Peneplain Bioregion, (LA143) Green Mallee tall mallee woodland on rises in the Pilliga - Goonoo regions, southern Brigalow Belt South Bioregion, (LA147) Green Mallee - White Cypress Pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain Bioregion, (LA148) Grey Mallee - White Cypress Pine woodland on rocky hills of the eastern Cobar Peneplain Bioregion, (LA149) Red Stringybark - Dwyer's Red Gum - Black Cypress Pine woodland on siliceous ranges in the Lockhart to Griffith regions NSW South Western Slopes Bioregion and Cobar Peneplain Bioregion, (LA181) Ridge mallee woodland on hills of meta-sediments and volcanics, eastern Cobar Peneplain Bioregion, (LA184) She oak - Fringe Myrtle heathland on rocky ranges in the NSW South Western Slopes Bioregion, (LA200) Currawang very tall shrubland on siliceous rocky ridges and cliffs mainly in the NSW South Western Slopes Bioregion, (LA237) Mugga Ironbark -Tumbledown Red Gum - Red Box - Black Cypress Pine open forest on shallow stony soils on hills in the NSW South Western Slopes Bioregion, (LA249) Tumbledown Red Gum - White Cypress Pine hill woodland in the southern part of the NSW South Western Slopes Bioregion, (LA270) Red Ironbark - Black Cypress Pine shrubby woodland of the NSW South Western Slopes Bioregion, (LA253) Red Ironbark - Red Stringybark - Tumbledown Gum heath low woodland on ridges, central NSW South Western Slopes, (LA254) Tumbledown Red Gum - Black Cypress Pine - Red Stringybark woodland on rocky hills in the NSW central western slopes, (LA269) Tick Bush - Drooping She Oak tall shrubland on granite hills of the NSW central western slopes, (LA267)	Lower Slopes - Lachlan and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

5. Derived tussock grassland of the central western plains and lower slopes of NSW, (LA138)

Number of ecosystem credits created	679
IBRA sub-region	Lower Slopes - Lachlan

Offset options - Plant Community types	Offset options - IBRA sub-regions
Derived tussock grassland of the central western plains and lower slopes of NSW, (LA138) Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bi, (LA244) Derived grassland of the NSW South Western Slopes, (LA238)	Lower Slopes - Lachlan and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

6. Derived tussock grassland of the central western plains and lower slopes of NSW, (LA138)

Number of ecosystem credits created	1,853
IBRA sub-region	Lower Slopes - Lachlan

Offset options - Plant Community types	Offset options - IBRA sub-regions
Derived tussock grassland of the central western plains and lower slopes of NSW, (LA138) Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bi, (LA244) Derived grassland of the NSW South Western Slopes, (LA238)	Lower Slopes - Lachlan and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Summary of species credits required

ATTACHMENT E

CREDIT REPORT FOR THE BAR FOOTPRINT ASSOCIATED WITH THE PIPELINE DUPLICATION

Biodiversity credit report

This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 6/02/2018 Time: 5:22:18PM Calculator version: v4.0

Major Project details

Proposal ID:	0056/2018/4738MP
Proposal name:	Cowal Gold Mod 14 - Pipeline
Proposal address:	Cowal Gold Operations Lake Cowal Road Lake Cowal NSW 2671
Proponent name:	Evolution Mining (Cowal)
Proponent address:	Cowal Gold Operations Lake Cowal Road Lake Cowal NSW 2671
Proponent phone:	0269754749
Assessor name:	James Gleeson
Assessor address:	PO Box 1842 BRISBANE NSW 4064
Assessor phone:	07 3871 3144
Assessor accreditation:	0056

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Derived tussock grassland of the central western plains and lower slopes of NSW	0.30	0.00
River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW	0.40	19.00
Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	4.50	109.39
Total	5.20	128

Credit profiles

1. Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion, (LA212)

Number of ecosystem credits created	51
IBRA sub-region	Upper Slopes - Lachlan

Offset options - Plant Community types	Offset options - IBRA sub-regions
Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion, (LA212)	Upper Slopes - Lachlan and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion, (LA212)

Number of ecosystem credits created	58
IBRA sub-region	Upper Slopes - Lachlan

Offset options - Plant Community types	Offset options - IBRA sub-regions
Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion, (LA212)	Upper Slopes - Lachlan and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

3. Derived tussock grassland of the central western plains and lower slopes of NSW, (LA138)

Number of ecosystem credits created	0
IBRA sub-region	Upper Slopes - Lachlan

Offset options - Plant Community types	Offset options - IBRA sub-regions
Derived tussock grassland of the central western plains and lower slopes of NSW, (LA138) Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bi, (LA244) Derived grassland of the NSW South Western Slopes, (LA238)	Upper Slopes - Lachlan and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

4. River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW, (LA191)

Number of ecosystem credits created	19
IBRA sub-region	Upper Slopes - Lachlan

Offset options - Plant Community types	Offset options - IBRA sub-regions
River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW, (LA191) River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion, (LA263)	Upper Slopes - Lachlan and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Summary of species credits required

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Superb Parrot	Polytelis swainsonii	0.40	7

ATTACHMENT F1 TO F4
CREDIT REPORT FOR THE PROPOSED OFFSET AREAS

BioBanking credit report

This report identifies the number and type of credits required at a BIOBANK SITE

Date of report: 8/02/2018 Time: 4:25:29PM Calculator version: v4.0

Biobank details

Proposal ID:	0056/2018/4740B
Proposal name:	Cowal Gold Mod 14 - Offsets 3 and 4
Proposal address:	2283 Lake Road Lake Cowal NSW 2671
Proponent name:	Evolution Mining (Cowal)
Proponent address:	Cowal Gold Operations Lake Cowal Road Lake Cowal NSW 2671
Proponent phone:	0269754749
Assessor name:	James Gleeson
Assessor address:	PO Box 1842 BRISBANE NSW 4064
Assessor phone:	07 3871 3144
Assessor accreditation:	0056

Additional information required for approval:

- ☐ Use of local benchmark
- ☐ Expert report...
- ☐ Request for additional gain in site value

Ecosystem credits summary

Plant Community type	Area (ha)	Credits created
Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.	69.70	1,045.00
River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW	19.50	295.00
Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	23.00	406.00
Total	112.20	1,746

Credit profiles

1. Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion, (LA212)

Number of ecosystem credits created	406
IBRA sub-region	Lower Slopes - Lachlan

2. Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions., (LA105)

Number of ecosystem credits created	1,045
IBRA sub-region	Lower Slopes - Lachlan

3. River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW, (LA191)

Number of ecosystem credits created	295
IBRA sub-region	Lower Slopes - Lachlan

Species credits summary

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.	Exclude commercial apiaries
Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.	Exclude miscellaneous feral species
Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.	Feral and/or over-abundant native herbivore control
Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.	Fox control
River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW	Control of feral pigs
River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW	Exclude commercial apiaries
River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW	Exclude miscellaneous feral species
River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW	Feral and/or over-abundant native herbivore control
River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW	Fox control
River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW	Maintain or re-introduce natural flow regimes
River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW	Slashing
Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Exclude commercial apiaries
Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Feral and/or over-abundant native herbivore control
Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Fox control

BioBanking credit report

This report identifies the number and type of credits required at a BIOBANK SITE

Date of report: 6/02/2018 Time: 5:28:56PM Calculator version: v4.0

Biobank details

Proposal ID:	0056/2018/4741B
Proposal name:	Cowal Gold Mod 14 - Offset 5
Proposal address:	2283 Lake Road Lake Cowal NSW 2671
Proponent name:	Evolution Mining (Cowal)
Proponent address:	Cowal Gold Operations Lake Cowal Road Lake Cowal NSW 2671
Proponent phone:	0269754749
Assessor name:	James Gleeson
Assessor address:	PO Box 1842 BRISBANE NSW 4064
Assessor phone:	07 3871 3144
Assessor accreditation:	0056

Additional information required for approval:

- ☐ Use of local benchmark
- ☐ Expert report...
- ☐ Request for additional gain in site value

Ecosystem credits summary

Plant Community type	Area (ha)	Credits created
Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW	157.00	1,694.00
Total	157.00	1,694

Credit profiles

1. Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW, (LA175)

Number of ecosystem credits created	1,694
IBRA sub-region	Upper Slopes - Lachlan

Species credits summary

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW	Exclude commercial apiaries
Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW	Exclude miscellaneous feral species
Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW	Feral and/or over-abundant native herbivore control
Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW	Fox control

BioBanking credit report

This report identifies the number and type of credits required at a BIOBANK SITE

Date of report: 6/02/2018 Time: 5:29:53PM Calculator version: v4.0

Biobank details

Proposal ID:	0056/2018/4742B
Proposal name:	Cowal Gold Mod 14 - Offset 6
Proposal address:	935 Buttenshaws Lane Lake Cowal NSW 2671
Proponent name:	Evolution Mining (Cowal)
Proponent address:	Cowal Gold Operations Lake Cowal Road Lake Cowal NSW 2671
Proponent phone:	0269754749
Assessor name:	James Gleeson
Assessor address:	PO Box 1842 BRISBANE NSW 4064
Assessor phone:	07 3871 3144
Assessor accreditation:	0056

Additional information required for approval:

- ☐ Use of local benchmark
  - Derived tussock grassland of the central western plains and lower slopes of NSW
- ☐ Expert report...
- ☐ Request for additional gain in site value

Ecosystem credits summary

Plant Community type	Area (ha)	Credits created
Derived tussock grassland of the central western plains and lower slopes of NSW	9.00	50.00
Green Mallee - White Cypress Pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain Bioregion	30.50	300.00
Total	39.50	350

Credit profiles

1. Green Mallee - White Cypress Pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain Bioregion, (LA148)

Number of ecosystem credits created	300
IBRA sub-region	Upper Slopes - Lachlan

2. Derived tussock grassland of the central western plains and lower slopes of NSW, (LA138)

Number of ecosystem credits created	50
IBRA sub-region	Upper Slopes - Lachlan

Species credits summary

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Green Mallee - White Cypress Pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain Bioregion	Exclude commercial apiaries
Green Mallee - White Cypress Pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain Bioregion	Feral and/or over-abundant native herbivore control
Green Mallee - White Cypress Pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain Bioregion	Fox control

BioBanking credit report

This report identifies the number and type of credits required at a BIOBANK SITE

Date of report: 6/02/2018 Time: 5:31:06PM Calculator version: v4.0

Biobank details

Proposal ID:	0056/2018/4743B
Proposal name:	Cowal Gold Mod 14 - Offset 7
Proposal address:	419 Uncle Bills Road Lake Cowal NSW 2671
Proponent name:	Evolution Mining (Cowal)
Proponent address:	Cowal Gold Operations Lake Cowal Road Lake Cowal NSW 2671
Proponent phone:	0269754749
Assessor name:	James Gleeson
Assessor address:	PO Box 1842 BRISBANE NSW 4064
Assessor phone:	07 3871 3144
Assessor accreditation:	0056

Additional information required for approval:

- ☐ Use of local benchmark
  - Derived tussock grassland of the central western plains and lower slopes of NSW
- ☐ Expert report...
- ☐ Request for additional gain in site value

Ecosystem credits summary

Plant Community type	Area (ha)	Credits created
Derived tussock grassland of the central western plains and lower slopes of NSW	29.00	241.00
Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains	6.80	76.00
Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion	165.50	2,084.00
Total	201.30	2,401

Credit profiles

1. Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion, (LA152)

Number of ecosystem credits created	2,084
IBRA sub-region	Upper Slopes - Lachlan

2. Derived tussock grassland of the central western plains and lower slopes of NSW, (LA138)

Number of ecosystem credits created	241
IBRA sub-region	Upper Slopes - Lachlan

3. Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains, (LA198)

Number of ecosystem credits created	76
IBRA sub-region	Upper Slopes - Lachlan

Species credits summary

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains	Control exotic pest fish species (within dams)
Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains	Control of feral pigs
Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains	Exclude miscellaneous feral species
Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains	Feral and/or over-abundant native herbivore control
Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains	Fox control
Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains	Maintain or re-introduce natural flow regimes

ATTACHMENT G
PEER REVIEW LETTER

HUNTER ECO

Evolution Mining (Cowal) Pty Limited
PO Box 210
West Wyalong NSW 2671

Attn: Bronwyn Flynn

19 March 2018

Dear Bronwyn

Peer Review of the Biodiversity Assessment Report and Biodiversity Offset Strategy (BARBOS) for the Processing Rate Modification at Cowal Gold Mine

Cowal Gold has asked me to review the Biodiversity Assessment Report and Offset Strategy (BARBOS) developed for the Cowal Gold Operations Processing rate Modification by Resource Strategies Pty Ltd. This letter briefly outlines the outcomes of my review.

I am an Accredited BioBanking Assessor (#0011) and have a detailed understanding of the requirements of the NSW *Framework for Biodiversity Assessment* (FBA), *Biodiversity Offsets Policy for Major Projects* and *Biodiversity Conservation Act, 2016* (BC Act). I have also conducted floristic surveys in south western NSW.

In reviewing the Cowal Gold Operations Processing rate Modification BARBOS I aimed to ensure that it met both FBA and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) guidelines requirements.

Overall I found the final Cowal Gold Operations Processing Rate Modification BARBOS to be consistent with the field data collection and reporting requirements of the FBA. Specifically some corrections and clarification suggestions were made and these have been incorporated to my satisfaction. I consider that the BARBOS meets the requirements of the FBA and EPBC Act guidelines.

Yours Sincerely
HUNTER ECO

Colin Driscoll

Dr Colin Driscoll
Environmental Biologist

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