ATTACHMENT A
THREATENED SPECIES ASSESSMENT OF SIGNIFICANCE

TABLE OF CONTENTS

LIST OF TABLES

A1 INTRODUCTION

The purpose of this document is to assess whether the Vickery Extension Project (the Project) is likely to significantly affect threatened species, populations or ecological communities or their habitats listed under the New South Wales (NSW) *Biodiversity Conservation Act, 2016* (BC Act) in accordance with section 5A of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act).

Table A1 provides a list of threatened species or ecological communities which are assessed in this document in accordance with section 5A of the EP&A Act and the *Threatened Species Assessment Guidelines - the Assessment of Significance* (Department of Environment and Climate Change [DECC], 2007). No threatened populations listed under the BC Act are relevant to the Project and therefore none are assessed further.

A total of 11 threatened fauna species (comprising six birds, three bats and two mammals) listed under the BC Act and/or the *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) have been recorded[1] within the NSW Assessment Footprint during current and previous surveys (Table A1).

Table A1 also provides the approximate area of potential habitat within the NSW Assessment Footprint (in hectares [ha]) for each species based on the habitat preferences given in the *Archived BioMetric and Threatened Species Profiles Datasets* (Office of Environment and Heritage [OEH], 2017b]).

Tables referred to throughout this attachment are included in the attachment text, however, figures referred to throughout this attachment are included within the main text of the Biodiversity Assessment Report and Biodiversity Offset Strategy (herein referred to as the Main Text).

Table A1
Threatened Species and Communities Subject to the Assessments of Significance

Species	Conservation Status[1]		Credit Type	Approximate Area of Potential Habitat within BAR Footprint (ha)
	BC Act	EPBC Act		
Threatened Ecological Community				
Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	E	E	Ecosystem	0
Flora				
Finger Panic Grass (*Digitaria porrecta*)	E	-	Species	83.1[2]
Bluegrass (*Dichanthium setosum*)	V	V	Species	123.1[3]
Belson's Panic (*Homopholis belsonii*)	E	V	Species	3.6[4]
Winged Peppercress (*Lepidium monoplocoides*)	E	E	Species (Section 2.3.2.1 of the Main Text)	Seasonally moist areas.
Scant Pomaderris (*Pomaderris queenslandica*)	E	-	Species	73.2[5]
Tylophora linearis	V	E	Species	73.2[5]

[1] For two of these species (i.e. the Little Lorikeet and Eastern Bentwing-bat), only database records are located within the BAR Footprint (i.e. no previous survey records).

Table A1 (Continued)
Threatened Species and Communities Subject to the Assessments of Significance

Species	Conservation Status[1]		Credit Type	Approximate Area of Potential Habitat within BAR Footprint (ha)
	BC Act	EPBC Act		
Reptiles				
Pale-headed Snake (*Hoplocephalus bitorquatus*)	V	-	Species	73.2[5]
Birds				
Birds of Prey				
Square-tailed Kite (*Lophoictinia isura*)	V	-	Ecosystem (Table 7 of the Main Text)	77.8[#]
Spotted Harrier (*Circus assimilis*)	V	-	Ecosystem (Table 7 of the Main Text)	27.8[#6]
Little Eagle (*Hieraaetus morphnoides*)	V	-	Ecosystem (Table 7 of the Main Text)	77.8[#]
Grey Falcon (*Falco hypoleucos*)	E	-	Species (Table 4 of the Main Text)	4.6[#1, 7]
Black Falcon (*Falco subniger*)	V	-	Species - Not in credit calculator	4.6[#8]
Parrots				
Glossy Black-Cockatoo (*Calyptorhynchus lathami*)	V	-	Ecosystem (Table 7 of the Main Text)	0
Little Lorikeet (*Glossopsitta pusilla*)	V	-	Ecosystem (Table 7 of the Main Text)	77.8
Swift Parrot (*Lathamus discolor*)	E	CE*	Ecosystem (Table 7 of the Main Text)	74.2
Turquoise Parrot (*Neophema pulchella*)	V	-	Ecosystem (Table 7 of the Main Text)	77.8
Owls				
Masked Owl (*Tyto novaehollandiae*)	V	-	Ecosystem (Table 7 of the Main Text)	77.8[#]
Barking Owl (*Ninox connivens*)	V	-	Ecosystem (Table 7 of the Main Text)	
Woodland Birds				
Gilbert's Whistler (*Pachycephala inornata*)	V	-	Ecosystem – Not in credit calculator	
Brown Treecreeper (eastern subspecies) (*Climacteris picumnus* subsp. *victoriae*)	V	-	Ecosystem (Table 7 of the Main Text)	
Speckled Warbler (*Chthonicola sagittata*)	V	-	Ecosystem (Table 7 of the Main Text)	
Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis* subsp. *temporalis*)	V	-	Ecosystem (Table 7 of the Main Text)	
Varied Sittella (*Daphoenositta chrysoptera*)	V	-	Ecosystem (Table 7 of the Main Text)	77.8[#]
Diamond Firetail (*Stagonopleura guttata*)	V	-	Ecosystem (Table 7 of the Main Text)	
Dusky Woodswallow (*Artamus cyanopterus cyanopterus*)	V	-	Ecosystem – Not in credit calculator	
Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*)	V	-	Ecosystem (Table 7 of the Main Text)	

Table A1 (Continued)
Threatened Species and Communities Subject to the Assessments of Significance

Species	Conservation Status[1]		Credit Type	Approximate Area of Potential Habitat within BAR Footprint (ha)
	BC Act	EPBC Act		
Honeyeaters				
Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis* subsp. *gularis*)	V	-	Ecosystem (Table 7 of the Main Text)	77.8
Regent Honeyeater (*Anthochaera phrygia*)	CE	CE	Species (Table 6 of the Main Text)	48.1[10]
Painted Honeyeater (*Grantiella picta*)	V	V	Ecosystem (Table 7 of the Main Text)	77.8
Blue-billed Duck (*Oxyura australis*)	V	-	Ecosystem - not in Credit Calculator	0
Mammals				
Koala (*Phascolarctos cinereus*)	V	V	Species (Table 6 of the Main Text)	50.3[10]
Squirrel Glider (*Petaurus norfolcensis*)	V	-	Species (Table 6 of the Main Text)	74.7[10]
Hollow-roosting Bats				
Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)	V	-	Ecosystem (Table 7 of the Main Text)	
Eastern Freetail-bat (*Mormopterus norfolkensis*)	V	-	Ecosystem - not in Credit Calculator	
Corben's Long-eared Bat (*Nyctophilus corbeni*)	V	V	Ecosystem (Table 7 of the Main Text)	77.8[#]
Little Pied Bat (*Chalinolobus picatus*)	V	-	Ecosystem (Table 7 of the Main Text)	
Cave-roosting Bats				
Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)	V	-	Ecosystem or species – N/A	
Large-eared Pied Bat (*Chalinolobus dwyeri*)	V	V	Species (Table 4 of the Main Text)	77.8
Eastern Cave Bat (*Vespadelus troughtoni*)	V	-	Ecosystem or species – N/A	

Highlighted species – recorded in the NSW Assessment Footprint

V = Vulnerable; E = Endangered; CE = Critically Endangered.

* Listed as Endangered under the EPBC Act at the time of the controlled action decision (14 April 2016) and therefore assessed as 'Endangered' not 'Critically Endangered' (refer section 158A of the EPBC Act).

^ FloraSearch (2018) determined that there was limited, if any, habitat for the Glossy Black Cockatoo in the NSW Assessment Footprint.

This species may also use grassland habitat in the NSW Assessment Footprint from time to time.

1 Threatened species status under the BC Act and/or EPBC Act (current at July 2018).

2 The *Archived BioMetric and Threatened Species Profiles Datasets (OEH, 2017a)* recognises BVT NA185 (including associated secondary/derived grasslands) as potential habitat for this species.

3 The *Archived BioMetric and Threatened Species Profiles Datasets (OEH, 2017a)* recognises BVTs NA185 and NA349 (including associated secondary/derived grasslands) as potential habitat for this species.

4 The *Archived BioMetric and Threatened Species Profiles Datasets (OEH, 2017a)* recognises BVT NA185 as potential habitat for this species.

5 The *Archived BioMetric and Threatened Species Profiles Datasets (OEH, 2017a)* recognises BVTs NA324, NA349 and NA311 as potential habitat for this species.

6 The *Archived BioMetric and Threatened Species Profiles Datasets (OEH, 2017a)* recognises BVTs NA185, NA324 and NA193 as potential habitat for this species.

7 The *Archived BioMetric and Threatened Species Profiles Datasets (OEH, 2017a)* recognises BVTs NA185 and NA193 as potential habitat for this species.

8 Habitat requirements match those of the Grey Falcon.

9 The *Archived BioMetric and Threatened Species Profiles Datasets (OEH, 2017a)* recognises BVTs NA324, NA349, NA311 and NA193 as potential habitat for this species.

10 Refer to Section 2.3.4 of the main text for the justification regarding habitat area calculations for this species.

The Assessments of Significance in Section A2 also fulfil the requirements of the NSW *Framework for Biodiversity Assessment* (OEH, 2014a) for considering impacts on species and communities that require further consideration, namely the:

- *White Box - Yellow Box - Blakely's Red Gum Woodland Endangered Ecological Community* (Box-Gum Woodland EEC);
- Swift Parrot (*Lathamus discolor*);
- Regent Honeyeater (*Anthochaera phrygia*);
- Koala (*Phascolarctos cinereus*);
- Corben's Long eared Bat (*Nyctophilus corbeni*); and
- Large-eared Pied Bat (*Chalinolobus dwyeri*).

A2 EVALUATION OF POTENTIAL IMPACTS ON THREATENED SPECIES AND ECOLOGICAL COMMUNITIES

A2.1 THREATENED ECOLOGICAL COMMUNITIES

A2.1.1 Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes Bioregions

Introduction

The *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions* (Weeping Myall Woodland) is listed as 'Endangered' under the BC Act.

No Weeping Myall Woodland Endangered Ecological Community (EEC) has been mapped within the NSW Assessment Footprint , however, Niche (2013) mapped occurrences of this community in the approximate extent of the Approved Mine which were refined by FloraSearch (2018) (Figure 7).

As part of the Approved Mine, Whitehaven committed to design the Blue Vale Road realignment to avoid impacts on the Weeping Myall Woodland EEC, or offset the impact to the ecological community at a ratio of at least 1:5, 1 ha of clearance to 5 ha of offset (SSD-5000). The Weeping Myall Woodland EEC near the Blue Vale Road realignment has been specifically avoided as part of the Project.

Assessment of Significance

Questions (a) and (b) are not relevant to this species.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- ***(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or***
- ***(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

The Weeping Myall Woodland EEC which has been mapped outside of the NSW Assessment Footprint (Figure 7) is not likely to be impacted by the Project through indirect impacts such as fragmentation, edge effects, increases in dust or introduced flora and fauna. No Weeping Myall Woodland EEC would be cleared from within the NSW Assessment Footprint.

The Project would involve the same potential impacts from introduced flora and feral animals as the Approved Mine. Weeds and feral animals would be managed through prevention, control and monitoring measures. With the implementation of management measures, the potential indirect impacts to the Weeping Myall Woodland EEC associated with weeds and feral animals are expected to be minimal.

Weeping Myall Woodland EEC within the locality of the Project is not likely to be impacted by any changes in abiotic factors as a result of the Project. For example, the Project would include mitigation and management measures to minimise impacts to surface water within the locality (e.g. appropriately sized culverts would be installed where the road realignment crosses drainage lines).

The Project is unlikely to have an adverse effect on the extent of this ecological community such that its local occurrence would be placed at risk of extinction.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

No Weeping Myall Woodland EEC would be cleared within the NSW Assessment Footprint as a result of the Project. The Project would not result in further fragmentation.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

The Critical Habitat Register (OEH, 2016) does not list any critical habitat for this community.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No recovery plan has been developed for the Weeping Myall Woodland EEC, however recovery strategies for this community are listed on the threatened species profile (OEH, 2018). Given that no Weeping Myall Woodland occurs in the NSW Assessment Footprint, the Project would not be inconsistent with the recovery strategies listed for this community.

The Project would be consistent with the *Threat abatement plan for competition and land degradation by rabbits* (Department of the Environment and Energy [DEE], 2016) and the *threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs* (*Sus scrofa)* (DEE, 2017), given feral animal control strategies would be implemented for the Project to minimise the impacts from introduced fauna species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Project would result in *clearing of native vegetation*, which is a key threatening process applicable to Weeping Myall Woodland EEC. However, no native vegetation conforming to Weeping Myall Woodland EEC would be cleared in the NSW Assessment Footprint.

In addition, *invasion and establishment of exotic vines and scramblers* and *Invasion of native plant communities by exotic perennial grasses* are also key threatening processes applicable to the Weeping Myall Woodland EEC. Weed control measures would be implemented throughout the life of the Project.

Outcome

The Weeping Myall Woodland EEC is unlikely to be significantly impacted given no Weeping Myall Woodland EEC occurs within the NSW Assessment Footprint and indirect impacts to occurrences of this community would be appropriately managed and mitigated.

As part of the Local Biodiversity Enhancement Measures (LBEM) committed to by Whitehaven, grazing of native grasslands will be undertaken throughout the LBEM Area (Figure 27) (including the area surrounding the Blue Vale Road realignment) with the aim of maintaining 100% groundcover in grazing paddocks

A2.2 FLORA

A2.2.1 Winged Peppercress (*Lepidium monoplocoides*)

The Winged Peppercress is listed as 'Endangered' under the BC Act.

Introduction

The Winged Peppercress is widespread in the semi-arid western plains regions of NSW (OEH, 2018). It has been collected from widely scattered localities, with large numbers of historical records but few recent collections. There is a single collection from Broken Hill and only two collections since 1915, the most recent being 1950 (OEH, 2018). This species has also previously been recorded from Bourke, Cobar, Urana, Lake Cargelligo, Balranald, Wanganella and Deniliquin with more recent records from the Hay Plain, south-eastern Riverina, and from near Pooncarie (OEH, 2018).

The Winged Peppercress occurs on seasonally moist to waterlogged sites, on heavy fertile soils, with a mean annual rainfall of around 300-500 millimetres (mm). It is most commonly recorded in an open woodland dominated by *Allocasuarina luehmannii* (Bulloak) and/or eucalypts, particularly *Eucalyptus largiflorens* (Black Box) or *Eucalyptus populnea* (Poplar Box) (OEH, 2018). The field layer of the surrounding woodland is dominated by tussock grasses. This species flowers from late winter to spring (i.e. August to October) and is highly dependent on seasonal conditions.

The Winged Peppercress has been recorded by Niche (2013) at two locations outside the NSW Assessment Footprint, one of which is within the Approved Mine extent (Figure 7). These consist of one patch of approximately 20 metres (m) x 20 m containing approximately 50 plants located in the northern extent of the Western Emplacement (i.e. inside the Approved Mine extent), and one patch within an area of 50 m x 10 m containing approximately 418 individual plants located to the north-west of the Western Emplacement (i.e. outside the NSW Assessment Footprint) (Niche, 2013).

Targeted surveys for this species have been undertaken by FloraSearch and it has not been recorded within the NSW Assessment Footprint (FloraSearch, 2018).

In accordance with the Referral Decision for the Vickery Coal Project (EPBC 2012/6263), neither patch of the Winged Peppercress known to occur in the wider landscape would be adversely impacted. The larger Winged Peppercress patch is located on Whitehaven owned land within which grazing has been excluded. The area has also been fenced to avoid accidental disturbance (Figure 7). The smaller patch is located within the Approved Mine extent and would be translocated to the fenced protection area to the north of the Project mining area.

Assessment of Significance

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

No Winged Peppercress is known to occur within the NSW Assessment Footprint, despite multiple targeted surveys by Niche (2013) and FloraSearch (2018).

The Winged Peppercress has been recorded in the surrounding area (both within the Approved Mine extent and to the north of the NSW Assessment Footprint) and potential indirect impacts from the Project have been considered and would be mitigated (such as weeds and feral animals - assessed in Section 5.1.3 of the Main Text). Similarly, dust and inappropriate fire regimes are threats relevant to the Winged Peppercress, though these too would be mitigated.

The Project is unlikely to have an adverse impact on the lifecycle of the Winged Peppercress such that a viable population of the species is likely to be placed at risk of extinction because:

- no Winged Peppercress are known to occur within the NSW Assessment Footprint, despite targeted surveys by Niche (2013) and FloraSearch (2018); and
- the Winged Peppercress to the north of the NSW Assessment Footprint (Figure 7) would be managed in accordance with the EPBC Act Notification of Referral Decision (EPBC 2012/6263).

Questions (b) and (c) are not relevant to this species.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The Winged Peppercress has been recorded within the vicinity of the Project (i.e. outside the NSW Assessment Footprint) (Figure 7). Seasonally moist areas in the NSW Assessment Footprint could provide potential habitat for the Winged Peppercress within the NSW Assessment Footprint.

Multiple past and present surveys have not recorded the species in the NSW Assessment Footprint and as such no habitat known to be used by the species would be cleared as a result of the Project. While some potential habitat would be removed as a result of the Project, the nature of clearing would reduce the area of habitat rather than fragment or further isolate it.

The Winged Peppercress is known to use habitat in the wider landscape. The removal of potential habitat in the NSW Assessment Footprint is likely to have limited impact on this species, if at all, as significant areas of other known and potential habitat would continue to be available in the landscape.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The Critical Habitat Register (OEH, 2016) does not list any critical habitat for this species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

The Project involves the clearance of some Winged Peppercress potential habitat, as well as a commitment to offset native vegetation clearance in accordance with NSW Offset Policy (OEH, 2014b). The Project would not be inconsistent with the *National Recovery Plan for the Winged Peppercress (Lepidium monoplocoides)* (Mavromihalis, 2010) because it would result in a greater area of vegetation.

In addition, the Project would be consistent with the *Threat Abatement Plan for competition and land degradation by rabbits* (DEE, 2016) and the *Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (Sus scrofa)* (DEE, 2017), given feral animal control strategies would be implemented for the Project to minimise the impacts from introduced fauna species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Project would result in *clearing of native vegetation*, which is a key threatening process applicable to the Winged Peppercress. In addition, *invasion and establishment of exotic vines and scramblers* and *invasion of native plant communities by exotic perennial grasses* (e.g. Coolatai Grass [*Hyparrhenia hirta]* and African Lovegrass [*Eragrostis curvula*]) are also key threatening processes applicable to the Winged Peppercress. Weed control measures would be implemented throughout the life of the Project to manage these processes.

Outcome

The Project is unlikely to significantly impact the Winged Peppercress as:

- the Winged Peppercress has not been previously recorded within the NSW Assessment Footprint despite targeted surveys; and
- the Winged Peppercress is present outside the NSW Assessment Footprint (Figure 7) and potential indirect impacts on the known occurrence would be managed in accordance with the EPBC Act Notification of Referral Decision (EPBC 2012/6263).

A2.2.2 Scant Pomaderris (*Pomaderris queenslandica*)

The Scant Pomaderris is listed as 'Endangered' under the BC Act.

Introduction

The Scant Pomaderris is widely scattered but not common in north-east NSW (OEH, 2018). It is known from the NSW north coast, the New England Tablelands and North West Slopes as far south-west as Peak Hill. Populations are known in the Leard State Forest (OEH, 2018).

This species is most commonly found in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks (OEH, 2018).

The Scant Pomaderris has been recorded at two locations to the east of the NSW Assessment Footprint, adjacent to the Vickery State Forest (Figure 7). A single plant which was chewed down almost to ground level by grazers was located during the recent flora surveys by FloraSearch (2018).

The Project is not at the limit of this species' known distribution. The Scant Pomaderris has been recorded in the wider area, with the nearest records located within the Pilliga East State Forest, west of the NSW Assessment Footprint, and within the Deriah State Forest, to the north of the NSW Assessment Footprint (OEH, 2017a).

Assessment of Significance

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Approximately 73.2[2] ha of potential habitat for the Scant Pomaderris occurs within the NSW Assessment Footprint although much of this potential habitat has been subject to past disturbances (such as logging, fragmentation of habitat and livestock grazing). Targeted surveys for this species have been undertaken by FloraSearch (2018) and it has not been recorded within the NSW Assessment Footprint.

The Scant Pomaderris has been recorded in the surrounding area (within the Vickery State Forest) approximately 2.5 kilometres (km) east of the NSW Assessment Footprint and could potentially be disturbed by indirect impacts from the Project (such as weeds and feral animals - assessed in Section 5.1.3 of the Main Text). Similarly, dust and inappropriate fire regimes are threats relevant to the Scant Pomaderris, though these too would be mitigated. Other indirect impacts (e.g. sediment runoff, noise and vibration and artificial lighting) would not pose a threat to this species.

The Project is unlikely to have an adverse impact on the lifecycle of the Scant Pomaderris such that a viable population of the species is likely to be placed at risk of extinction because:

- this species has not been recorded within the NSW Assessment Footprint despite targeted surveys;
- much of the potential habitat to be cleared has been subject to past disturbances (such as logging, fragmentation of habitat and livestock grazing); and
- the known occurrence of the species in the surrounds is not likely to be indirectly impacted by the Project.

Questions (b) and (c) are not relevant to this species.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The Scant Pomaderris has been recorded within the vicinity of the Project (i.e. outside the NSW Assessment Footprint) (Figure 7).

The woodland/forests may provide potential habitat for the Scant Pomaderris within the NSW Assessment Footprint. Approximately 73.2 ha of the potential woodland/ forest habitat for the Scant Pomaderris would be removed in the NSW Assessment Footprint.

While clearing of potential habitat would occur as a result of the Project, the nature of clearing would reduce the area of habitat rather than fragment or further isolate it.

[2] The *Archived BioMetric and Threatened Species Profiles Datasets* (OEH, 2017a) recognises BVTs NA324, NA349 and NA311 as potential habitat for this species.

Removal of 73.2 ha of potential habitat is likely to have a limited impact on this species, since it is unable to survive in the existing farming regime. In addition, significant areas of other known and potential habitat would continue to be available in the landscape (e.g. the Vickery State Forest).

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The Critical Habitat Register (OEH, 2016) does not list any critical habitat for this species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No recovery plan has been developed for the Scant Pomaderris however recovery strategies for this species are listed on the threatened species profile (OEH, 2018). The Project involves the clearance of some potential habitat for the Scant Pomaderris as well as a commitment to offset native vegetation clearance in accordance with NSW Offset Policy (OEH, 2014b). The Project would not be inconsistent with the recovery strategies listed for this species because it would result in a greater area of potential habitat being managed and conserved in perpetuity.

The Project would be consistent with the *Threat Abatement Plan for competition and land degradation by rabbits* (DEE, 2016) and the *Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs* (*Sus scrofa)* (DEE, 2017), given feral animal control strategies would be implemented for the Project to minimise the impacts from introduced fauna species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Project would result in *clearing of native vegetation*, which is a key threatening process applicable to the Scant Pomaderris. The Scant Pomaderris has not been recorded within the NSW Assessment Footprint despite targeted surveys (FloraSearch, 2018).

In addition, *Invasion and establishment of exotic vines and scramblers* and *Invasion of native plant communities by exotic perennial grasses* are also key threatening processes applicable to the Scant Pomaderris. Weed control measures would be implemented throughout the life of the Project to manage these processes.

Outcome

The Project is unlikely to significantly impact the Scant Pomaderris as:

- the Scant Pomaderris has not been previously recorded within the NSW Assessment Footprint despite targeted surveys;
- much of the potential habitat to be cleared has been subject to past disturbances (such as logging, fragmentation of habitat and livestock grazing);
- the known occurrence of the species in the surrounds is not likely to be indirectly impacted by the Project; and
- the Scant Pomaderris and its habitat are present in the landscape outside the NSW Assessment Footprint.

A2.2.3 *Tylophora linearis*

Tylophora linearis is listed as 'Vulnerable' under the BC Act.

Introduction

This species is widespread on the Western Slopes of NSW between West Wyalong and the Queensland border (OEH, 2018). *Tylophora linearis* grows in dry scrub and open forest (OEH, 2018) and has been recorded from low-altitude sedimentary flats in dry woodlands of *Eucalyptus fibrosa, Eucalyptus sideroxylon, Eucalyptus albens, Callitris endlicheri, Callitris glaucophylla* and *Allocasuarina luehmannii* (OEH, 2018).

Tylophora linearis was recorded during the recent flora surveys undertaken by FloraSearch (2018) and Hunter Eco (2018) outside of the NSW Assessment Footprint. A colony of this small vine numbering in excess of 20 plants was found within the western boundary of Vickery State Forest and a second recording consisting of four individual plants was located to the west of the Vickery State Forest, between the NSW Assessment Footprint and the forest (Figure 7). This species is known to occur in a large number of government areas in NSW, including Barradine State Forest, Bibblewindi State Forest, Boonalla Aboriginal Reserve, Breeza State Forest, Euligal State Forest, Kerringle State Forest, Pilliga East State Forest, Pilliga National Park, Pilliga Nature Reserve, Pilliga State Conservation Area, Timallallie National Park, Trinkey State Conservation Area, Vickery State Forest and Leard State Forest (OEH, 2017a).

Targeted surveys for this species have been undertaken by FloraSearch and it has not been recorded within the NSW Assessment Footprint (FloraSearch, 2018).

Assessment of Significance

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Approximately 73.2 ha[3] of potential habitat for *Tylophora linearis* occurs within the NSW Assessment Footprint although much of this potential habitat has been subject to past disturbances (such as logging, fragmentation of habitat and livestock grazing). Targeted surveys for this species have been undertaken by FloraSearch (2018) and it has not been recorded within the potential habitat.

Tylophora linearis has been recorded in the surrounding area (within the Vickery State Forest and the adjoining Offset Area 7) and could potentially be disturbed by indirect impacts from the Project (such as weeds and feral animals - assessed in Section 5.1.3 of the Main Text). Similarly, dust and inappropriate fire regimes are threats relevant to *Tylophora linearis*, though these too would be mitigated. Other indirect impacts (e.g. sediment runoff, noise and vibration and artificial lighting) would not pose a threat to this species.

The Project is unlikely to have an adverse impact on the lifecycle of the *Tylophora linearis* such that a viable population of the species is likely to be placed at risk of extinction because:

- *Tylophora linearis* has not been recorded within the NSW Assessment Footprint despite targeted surveys;

[3] The *Archived BioMetric and Threatened Species Profiles Datasets* (OEH, 2017a) recognises BVTs NA324, NA349 and NA311 as potential habitat for this species.

- much of the potential habitat to be cleared has been subject to past disturbances (such as logging, fragmentation of habitat and livestock grazing); and
- *Tylophora linearis* and its habitat are commonly recorded in the landscape outside the NSW Assessment Footprint (after OEH, 2017b).

Questions (b) and (c) are not relevant to this species.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Tylophora linearis has been recorded within the vicinity of the Project (i.e. outside the NSW Assessment Footprint) (Figure 7).

The woodland/ forest habitat would provide potential habitat for *Tylophora linearis* within the NSW Assessment Footprint. Approximately 73.2 ha of the fragmented patches of woodland/open forest which provides potential habitat for this species would be removed in the NSW Assessment Footprint.

While potential habitat clearing would occur as a result of the Project, the nature of clearing would reduce the area of habitat rather than fragment it or further isolate habitat.

The removal of potential habitat in the NSW Assessment Footprint is likely to only have a limited impact on this species, if at all, owing to its likely removal from the NSW Assessment Footprint by past land uses. In addition, significant areas of other known and potential habitat would continue to be available in the surrounding landscape.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The Critical Habitat Register (OEH, 2016) does not list any critical habitat for this species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No recovery plan has been developed for *Tylophora linearis* however recovery strategies for this species are listed on the threatened species profile (OEH, 2018). The Project involves the clearance of some potential habitat for *Tylophora linearis* as well as a commitment to offset native vegetation clearance in accordance with NSW Offset Policy (OEH, 2014b). The Project would not be inconsistent with the recovery strategies listed for this species because it would result in a greater area of potential and known habitat being managed and conserved in perpetuity.

The Project would be consistent with the *Threat abatement plan for competition and land degradation by rabbits* (DEE, 2016) and the *Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs* (*Sus scrofa)* (DEE, 2017), given feral animal control strategies would be implemented for the Project to minimise the impacts from introduced fauna species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Project would result in *clearing of native vegetation*, which is a key threatening process applicable to *Tylophora linearis*. *Tylophora linearis* has not been previously recorded within the NSW Assessment Footprint despite targeted surveys.

In addition, *invasion and establishment of exotic vines and scramblers* and *Invasion of native plant communities by exotic perennial grasses* are also key threatening processes applicable to *Tylophora linearis*. Weed control measures would be implemented throughout the life of the Project to manage these processes.

Outcome

The Project is unlikely to significantly impact *Tylophora linearis* as:

- *Tylophora linearis* has not been previously recorded within the NSW Assessment Footprint despite targeted surveys;
- much of the potential habitat to be cleared has been subject to past disturbances (such as logging, fragmentation of habitat and livestock grazing); and
- *Tylophora linearis*, and its habitat, is present in the landscape outside the NSW Assessment Footprint (this species is known to occur in a large number of government areas in NSW, including Barradine State Forest, Bibblewindi State Forest, Boonalla Aboriginal Reserve, Breeza State Forest, Euligal State Forest, Kerringle State Forest, Pilliga East State Forest, Pilliga National Park, Pilliga Nature Reserve, Pilliga State Conservation Area, Timallallie National Park, Trinkey State Conservation Area, Vickery State Forest and Leard State Forest (OEH, 2017a).

A2.2.4 Other Flora Species

This section provides an assessment on the potential impacts on the following threatened flora species:

- Finger Panic Grass (*Digitaria porrecta*).
- Bluegrass (*Dichanthium setosum*).
- Belson's Panic (*Homopholis belsonii*).

Each of the above species is listed as 'Endangered' under the BC Act with the exception of Bluegrass which is listed as 'Vulnerable'.

Introduction

Table A2 outlines the species information and records for these threatened flora species. FloraSearch (2018) undertook targeted surveys for these threatened flora species in accordance with relevant survey guidelines. None of these species were identified in the NSW Assessment Footprint. One database record for the Belson's Panic is located within the Vickery State Forest, approximately 5 km east of the NSW Assessment Footprint (Figure 7) (Table A2).

Assessment of Significance

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Approximately 83.1 ha[4] of native vegetation which provides potential habitat for Finger Panic Grass, 123.1 ha[5] of native vegetation which provides potential habitat for Bluegrass and 3.6 ha[6] of native vegetation which provides potential habitat for Belson's Panic would be cleared in the NSW Assessment Footprint.

The Project is unlikely to have an adverse impact on the lifecycle of these species such that a viable local population is likely to be placed at risk of extinction because none of these species have been recorded within the NSW Assessment Footprint.

Consistent with the existing impact avoidance and mitigation measures to be undertaken for the Approved Mine, pre-clearance surveys would be undertaken for the Finger Panic Grass in the Approved Mine Footprint. If Finger Panic Grass was identified during pre-clearance surveys, appropriate management measures would be implemented, where practicable, to reduce the potential for significant impacts to this species (Table 31 of the Main Text).

[4] The *Archived BioMetric and Threatened Species Profiles Datasets* (OEH, 2017b) recognises BVTs NA185 as potential habitat for this species.

[5] The *Archived BioMetric and Threatened Species Profiles Datasets* (OEH, 2017b) recognises BVTs NA185 and NA349 as potential habitat for this species.

[6] The *Archived BioMetric and Threatened Species Profiles Datasets* (OEH, 2017b) recognises BVT NA185 as potential habitat for this species.

Table A2
Flora Species Predicted by the BioBanking Calculator – Species Information and Records

Species Name	Common Name	Conservation Status under the BC Act	Species Information	Records
Digitaria porrecta	Finger Panic Grass	E	In NSW, Finger Panic Grass is found on the North West Slopes and Plains, from near Moree south to Tambar Springs and from Tamworth to Coonabarabran within native grassland, woodlands or open forest with a grassy understorey, on richer soils (NSW Office of Environment and Heritage [OEH], 2018). Finger Panic Grass is most frequently associated with *Eucalyptus albens* and *Acacia pendula*. Common associated grasses and forbs in NSW sites include *Austrostipa aristiglumis, Enteropogon acicularis, Cyperus bifax, Hibiscus trionum* and *Neptunia gracilis (OEH, 2018)*. This species flowers in summer or late summer from mid-January to late February, with seeds maturing and falling from the plant soon after.	This species has not previously been recorded within the NSW Assessment Footprint or surrounds. This species has been recorded in the locality, with database records for this species approximately 15 km to the south-west and 15 km to the west of the Project (OEH, 2017b).
Dichanthium setosum	Bluegrass	V	Bluegrass occurs on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW. It occurs widely on private property, including in the Inverell, Guyra, Armidale and Glen Innes areas (OEH, 2018). This species is associated with heavy basaltic black soils and red-brown loams with clay subsoil (OEH, 2018). Often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture.	This species has not previously been recorded within the NSW Assessment Footprint or surrounds. The closest database records for this species occur approximately 35 km to the north of the Project near Mount Kaputar National Park (OEH, 2017b).
Homopholis belsonii	Belson's Panic	E	This species occurs on the northwest slopes and plains of NSW. Although habitat and ecology are poorly known, the species has been recorded in dry woodland (e.g. Belah) often on poor soils, although sometimes found in basalt-enriched sites north of Warialda and in alluvial clay soils (OEH, 2018).	This species has not previously been recorded within the NSW Assessment Footprint or surrounds. There is a recent record (2014) in Vickery State Forest in OEH (2017b). This record is isolated and well to the south of the core distribution of the species between Narrabri and the Queensland border. In addition, database records for this species occur within Moema State Forest, approximately 65 km north of the Project.

Questions (b) and (c) are not relevant to these species.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

None of these species have been recorded within the NSW Assessment Footprint and the likelihood of them occurring are low (Bluegrass) and moderate (Belson's Panic, Finger Panic Grass) (FloraSearch, 2018).

While potential habitat clearing would occur as a result of the Project, the nature of clearing would reduce the area of potential habitat rather than fragment it or further isolate habitat. As such, the associated potential impact would not result in additional fragmentation of the species' habitat on a local or regional scale.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The Critical Habitat Register (OEH, 2016) does not list any critical habitat for these species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No recovery plan has been developed for any of these species however recovery strategies are listed on the threatened species profiles (OEH, 2018). The Project involves the clearance of some potential habitat for these species as well as a commitment to offset native vegetation clearance in accordance with NSW Offset Policy (OEH, 2014b). The Project would not be inconsistent with the recovery strategies listed for these species because it would result in a greater area of potential habitat being managed and conserved in perpetuity.

The Project would be consistent with the *Threat Abatement Plan for competition and land degradation by rabbits* (DEE, 2016) and the *Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs* (*Sus scrofa)* (DEE, 2017), given feral animal control strategies would be implemented for the Project to minimise the impacts from introduced fauna species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Project would result in *clearing of native vegetation*, which is a key threatening process applicable to these species. Approximately 83.1 ha of native vegetation which provides potential habitat for Finger Panic Grass, 123.1 ha of native vegetation which provides potential habitat for Bluegrass and 3.6 ha of native vegetation which provides potential habitat for Belson's Panic would be cleared in the NSW Assessment Footprint.

In addition, *Invasion and establishment of exotic vines and scramblers* and *Invasion of native plant communities by exotic perennial grasses* are also key threatening processes applicable to these species. Weed control measures would be implemented throughout the life of the Project to manage these processes.

Outcome

The Project is unlikely to significantly impact the Finger Panic Grass, Bluegrass or Belson's Panic because:

- none of the of these species were identified in the NSW Assessment Footprint;
- much of the potential habitat to be cleared has been subject to past disturbances (such as logging, fragmentation of habitat and livestock grazing) that are likely to have eliminated their populations from the NSW Assessment Footprint; and
- potential habitat occurs more widely in the locality such that (were the species to be found) it is unlikely that they would be limited to the potential habitat in the NSW Assessment Footprint.

A2.3 FAUNA

A2.3.1 Pale-headed Snake (*Hoplocephalus bitorquatus*)

The Pale-headed Snake is listed as 'Vulnerable' under the BC Act.

Introduction

The Pale-headed Snake (*Hoplocephalus bitorquatus*) has a patchy distribution from north-east Queensland to north-east NSW (OEH, 2018). In NSW this species occurs from the coast to the western side of the Great Divide as far south as Tuggerah (OEH, 2018).

This species inhabits dry sclerophyll forests, woodlands, cypress woodland and is occasionally found in rainforest or moist eucalypt forest (Wilson and Swan, 2003; OEH, 2018). In drier environments, it appears to favour habitats close to riparian areas (OEH, 2018). The Pale-headed Snake is most commonly found in dry areas west of coastal ranges usually on floodplains or near watercourses (Wilson and Swan, 2003). This species shelters behind loose bark or in hollow trunks and limbs of standing timber (Wilson and Swan, 2003).

The main prey item for this species is tree frogs, although lizards and small mammals are also taken on occasion (OEH, 2018).

The Project is not at the limit of this species' known distribution. Pale-headed Snakes have been recorded in the wider area (OEH, 2017b), predominantly within highly vegetated areas (e.g. Pilliga East State Forest). The Pale-headed Snake has not been recorded within the NSW Assessment Footprint or immediate surrounds.

Assessment of Significance

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The primary potential adverse effect on the Pale-headed Snake associated with the Project is the clearance of potential habitat. A total of approximately 73.2 ha[7] of potential habitat for this species occurs in the NSW Assessment Footprint, based on a sum of individual patches of potential habitat. However, many patches of potential habitat are highly fragmented and are unlikely to provide suitable habitat as habitat fragmentation is a recognised threat to the species (OEH, 2018).

[7] The *Archived BioMetric and Threatened Species Profiles Datasets* (OEH, 2017a) recognises BVTs NA324, NA349 and NA311 as potential habitat for this species.

Despite no current records near the NSW Assessment Footprint, were this species to occur in the surrounding habitat, potential indirect impacts from the Project (such as noise, dust, artificial lighting – assessed in Section 5.1.3 of the Main Text) are unlikely to impact this species. This is because none of the potential indirect impacts are recognised threats to this species except for the potential of increased fire risks (OEH, 2018). All potential indirect impacts would be mitigated and bushfire management measures would minimise the risk of bushfire indirectly occurring as a result of the Project.

The change in cumulative impact on the Pale-headed Snake as a result of the potential habitat to be cleared for the Project (considering impacts from other surrounding developments [Section 5.1.4 of the Main Text]) is considered to be minimal because the native vegetation communities to be cleared (i.e. the potential habitat) are all more widely occurring in the surrounding landscape.

The Project is unlikely to have an adverse impact on the lifecycle of the Pale-headed Snake such that a viable population of the species is likely to be placed at risk of extinction because:

- the Pale-headed Snake has not been recorded within the NSW Assessment Footprint;
- were Pale-headed Snakes to be found in the habitat within the NSW Assessment Footprint, it is unlikely that the local population would be confined to the habitat present within the NSW Assessment Footprint; and
- much of the potential habitat to be cleared has been subject to past disturbances (such as logging, fragmentation of habitat and livestock grazing), which makes the habitat generally unsuitable for the Pale-headed Snake (OEH, 2018).

In addition to the above, suitably trained or qualified person(s) would be present during the felling of identified hollow bearing trees to provide assistance with the management of Pale-headed Snakes (were they to be found).

Questions (b) and (c) are not relevant to this species.

(d) In relation to the habitat of a threatened species, population or ecological community:

- ***(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;***
- ***(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and***
- ***(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

The Pale-headed Snake has not been previously recorded within the NSW Assessment Footprint. A total of approximately 73.2 ha of potential habitat for this species occurs in the NSW Assessment Footprint, based on a sum of individual patches of potential habitat. However, many patches of potential habitat are highly fragmented and may not be suitable since habitat fragmentation is a recognised threat to the species (OEH, 2018).

While potential habitat clearing would occur as a result of the Project, the nature of clearing would reduce the area of habitat rather than further fragment or isolate it. The Project rail spur would result in minor clearance of potential habitat for the Pale-headed Snake across the Namoi River, resulting in narrow interruptions of riparian corridors, which may inhibit movement of Pale-headed Snakes, were they to occur. The majority of remnant native vegetation within the NSW Assessment Footprint, however, comprises numerous small, isolated, more or less thinned patches, most of which have no continuous connecting corridors to larger regional remnants.

The Pale-headed Snake is known to use habitat in the wider Project locality and potential habitat does exist in the NSW Assessment Footprint. However, its removal is likely to have a limited impact on this species, if at all, as significant areas of other known and potential habitat would continue to be available in the landscape (e.g. the Vickery State Forest).

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The Critical Habitat Register (OEH, 2016) does not list any critical habitat for this species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No recovery plan has been developed for this species, however, recovery strategies are listed on the threatened species profile (OEH, 2018). The Project involves the clearance of some potential habitat for the Pale-headed Snake as well as a commitment to offset native vegetation clearance in accordance with NSW Offset Policy (OEH, 2014b). The Project would not be inconsistent with the recovery strategies listed for the Pale-headed Snake because it would result in a greater area of potential habitat being managed and conserved in perpetuity.

The Project would be consistent with the *NSW Fox Threat Abatement Plan 2010* (OEH, 2010), given feral animal control strategies would be implemented for the Project to minimise the impacts from introduced fauna species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Project would result in *Clearing of native vegetation*, *Removal of dead wood and dead trees*, *Loss of hollow-bearing trees* and *Bushrock Removal* which are all key threatening processes applicable to the Pale-headed Snake (OEH, 2018). Approximately 73.2 ha of woodland/open forest habitat (comprising numerous fragmented patches) which provides potential habitat for this species would be cleared in the NSW Assessment Footprint. The cleared land would be progressively rehabilitated over the life of the Project (with approximately 482 ha of woodland/forest on the post mine landforms associated with the NSW Assessment Footprint), and the vegetation loss would be offset, resulting in a net gain in habitat as a consequence of the Project.

Predation by the European red fox (*Vulpes vulpes)* and *Predation by the feral cat* (*Felis catus)* are also key threatening processes applicable to the Pale-headed Snake. Feral animal control strategies would be implemented to monitor and control feral animals (such as the Feral Cat and European Red Fox) and reduce the likelihood of these species increasing in abundance due to the Project.

Intense fires are another known threat to the Pale-headed Snake (OEH, 2018) are part of the key threatening process *High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition*. Bushfire management measures for the Project would include bushfire controls and emergency response, thus minimising the threat of bushfire.

Outcome

The Project is unlikely to significantly impact the Pale-headed Snake as:

- the Pale-headed Snake has not been recorded within the NSW Assessment Footprint;
- much of the potential habitat to be cleared has been subject to past disturbances (such as logging, fragmentation of habitat and livestock grazing), which makes the habitat generally unsuitable for the Pale-headed Snake (OEH, 2018); and
- the potential habitat that occurs in the NSW Assessment Footprint is a very minor component of the habitat available in the wider landscape.

In addition to the above, suitably trained or qualified person(s) would be present during the felling of identified hollow bearing trees to provide assistance with the management of Pale-headed Snakes (were they to be found).

A2.3.2 Birds of Prey

This section provides an assessment on the potential impacts on the following birds of prey which are known or likely to occur within the NSW Assessment Footprint:

- Square-tailed Kite (*Lophoictinia isura*).
- Spotted Harrier (*Circus assimilis*).
- Little Eagle (*Hieraaetus morphnoides*).
- Grey Falcon (*Falco hypoleucos*).
- Black Falcon (*Falco subniger*).

Each of the above species is listed as 'Vulnerable' under the BC Act, with the exception of the Grey Falcon which is listed as 'Endangered'.

Introduction

The Project is not at the limit of these species' known distribution, and only the Little Eagle (a database record from 2012 with an accuracy of 50 m) has been previously recorded within the NSW Assessment Footprint (Figure 9). Notwithstanding, potential habitat for this species occurs within the NSW Assessment Footprint (Table A3).

Assessment of Significance

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The primary potential adverse effect on these birds of prey associated with the Project is the clearance of known/potential habitat. The Project would result in the removal/modification of a portion of habitat resources for these species consisting of forest/woodland and grassland habitats. Breeding habitat for these birds of prey is relatively limited within the NSW Assessment Footprint, and more likely to occur on ridge tops or watercourses in the wider landscape.

All woodland and forest vegetation types in the NSW Assessment Footprint (sum of approximately 77.8 ha [comprising numerous fragmented patches]) and provide potential habitat for the Square-tailed Kite and Little Eagle. Furthermore, approximately 27.8 ha[8] of woodland/forest habitat would provide potential habitat for the Spotted Harrier, and approximately 4.6 ha[9] of woodland/forest habitat would provide potential habitat for the Grey Falcon and Black Falcon. These species may also utilise the native grasslands (approximately 502 ha) within the NSW Assessment Footprint from time to time.

[8] The *Archived BioMetric and Threatened Species Profiles Datasets* (OEH, 2017a) recognises BVTs NA185, NA324 and NA193 as potential habitat for this species.

[9] The *Archived BioMetric and Threatened Species Profiles Datasets* (OEH, 2017a) recognises BVTs NA185 and NA193 as potential habitat for this species.

Table A3
Birds of Prey – Species Information and Records

Species Name	Common Name	Conservation Status under the BC Act	Species Information	Records
Lophoictinia isura	Square-tailed Kite	V	The Square-tailed Kite favours timbered habitats including dry woodlands and open forests, with a particular preference for timbered watercourses (OEH, 2018). The Square-tailed Kite breeds from July to February (Pizzey and Knight, 1999; OEH, 2018). This species builds a large stick platform in a living tree, in open forest or woodland or near edges or openings in forest (NSW Scientific Committee, 2009). Square-tailed Kites may re-use nests in successive years (Lindsey, 1992). The diet of the Square-tailed Kite includes birds (including nestlings), reptiles and insects (OEH, 2018).	The Square-tailed Kite has not previously been recorded within the NSW Assessment Footprint. The Square-tailed Kite has been recorded on numerous occasions within the wider locality, of which the closest records occur within the Leard State Forest to the north of the NSW Assessment Footprint (OEH, 2017b).
Circus assimilis	Spotted Harrier	V	The Spotted Harrier inhabits grassy open woodland including *Acacia* and Mallee remnants, inland riparian woodland, grassland and shrub steppe (e.g. chenopods) (Marchant and Higgins, 1993; Aumann, 2001). The majority of its habitat is within native grassland, but it can also occur in agricultural land, in which it forages over open habitats including the edges of inland wetlands (OEH, 2018). The Spotted Harrier diet consists of small mammals, birds, reptiles, and occasionally insects (OEH, 2018)	The Spotted Harrier was recorded by Future Ecology (2018) adjacent to the NSW Assessment Footprint. The individual was seen flying into woodland habitat within the NSW Assessment Footprint. The Spotted Harrier has been recorded within the wider locality, including five database records within approximately 10 km of the Project. Three records are located adjacent the Leard State Forest and one is approximately 5 km north-east of the Vickery State Forest (OEH, 2017b).
Hieraaetus morphnoides	Little Eagle	V	The Little Eagle inhabits areas with high prey densities either within open eucalypt forest, woodland or open woodland (OEH, 2018). The Little Eagle consumes birds, reptiles and mammals, and sometimes eats large insects and carrion (Marchant and Higgins, 1993; Aumann, 2001; Debus *et al*., 2007). This species also uses Sheoak or Acacia woodlands and riparian woodlands of interior NSW (Marchant and Higgins, 1993; Aumann, 2001).	The Little Eagle has been recorded within, or surrounding the NSW Assessment Footprint on numerous occasions (Figures 8 and 9). The records include a combination of database records (OEH, 2017b; Birdlife, 2017) and two previous survey records (one in the scattered trees within the Approved Mine extent and another in the riparian vegetation along the Namoi River) (Cenwest, 2011).
Falco hypoleucos	Grey Falcon	E	The Grey Falcon inhabits shrubland, grassland and wooded watercourses of arid and semi-arid regions, and occasionally open woodlands near the coast (OEH, 2018). The Grey Falcon uses old nests of other birds of prey and ravens, usually high in a living eucalypt near water or a watercourse; peak egg-laying season is in late winter and early spring (OEH, 2018). Preys primarily on birds, but also reptiles and mammals (OEH, 2018).	The Grey Falcon has not previously been recorded within the NSW Assessment Footprint. The Grey Falcon has been recorded to the east of the Vickery State Forest (near the Kelvin Range), approximately 8 km east of the NSW Assessment Footprint (OEH, 2017b).
Falco subniger	Black Falcon	V	The Black Falcon inhabits woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses and agricultural land with scattered remnant trees (OEH, 2018). The Black Falcon is usually associated with streams or wetlands, visiting them in search of prey and often using standing dead trees as lookout posts (OEH, 2018).	The Black Falcon has not been recorded within the NSW Assessment Footprint. The Black Falcon has been recorded within the wider locality, including one record approximately 4 km north-west of the NSW Assessment Footprint, south of Boggabri (OEH, 2017b).

Despite there being no current records of these birds of prey (with exception of the Spotted Harrier and Little Eagle) near the NSW Assessment Footprint, were these species to occur in the surrounding habitat, potential indirect impacts from the Project (such as noise and dust – assessed in Section 5.1.3 of the Main Text) are considered unlikely to impact these species (including the Little Eagle). Most indirect impacts are not recognised threats to this group of birds (OEH, 2018) and would be mitigated as part of the Project. There are no known breeding sites nearby. Secondary poisoning from baiting feral animals is a threat to these birds (OEH, 2018; Olsen, *et al.*, 2012) and therefore the feral animal management programme would seek to minimise the risk of secondary poisoning, particularly as the Little Eagle is known to occur in the area and is likely to prey on Rabbits.

Niche (2013) assessed the potential impacts on the same birds of prey and concluded that the Approved Mine was unlikely to significantly impact them as the habitat to be removed contains limited breeding habitat and a relevantly small proportion of the foraging habitat present in the wider locality. The change in cumulative impact on these birds of prey as a result of the Project (considering impacts from other surrounding developments [Section 5.1.4 of the Main Text]) is considered to be minimal as these birds are wide-ranging, potential foraging habitat is abundant in the surrounding landscape and no breeding sites have been recorded in the NSW Assessment Footprint or immediate surrounds. Additionally, none of these birds of prey (except the Little Eagle) have been recorded within the habitat in the NSW Assessment Footprint.

The Project is unlikely to have an adverse impact on the lifecycle of any of these species such that a viable local population is likely to be placed at risk of extinction because:

- these species and their habitat are widespread in the landscape outside the NSW Assessment Footprint, as demonstrated by numerous records in the wider surrounds (Figure 8) (OEH, 2017b);
- these species are not known to use the habitat in the NSW Assessment Footprint for breeding;
- these species are unlikely to be displaced as they are sparsely distributed throughout western NSW and utilise large home ranges;
- these species are very mobile and not likely to be present during land clearance activities; and
- foraging habitat (and prey) is available in the wider landscape within the species' home range.

Consistent with the existing impact avoidance and mitigation measures to be undertaken for the Approved Mine, scattered trees (a total of 50 trees) would be planted annually within the LBEM area (for the life of the mine [25 years]) to improve foraging habitat for these threatened species.

Questions (b) and (c) are not relevant to these species.

(d) In relation to the habitat of a threatened species, population or ecological community:

- ***(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;***
- ***(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and***
- ***(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

The Little Eagle has been recorded within the woodland/forest habitat in the NSW Assessment Footprint and all woodland and forest vegetation types in the NSW Assessment Footprint (sum of approximately 77.8 ha [comprising numerous fragmented patches]) and native grasslands (approximately 502 ha) provide potential habitat for this species.

The Spotted Harrier has been recorded adjacent to the woodland/forest habitat in the NSW Assessment Footprint however only 27.8 ha of the woodland and forest vegetation types in the NSW Assessment Footprint provide potential habitat for this species (Table A1).

Although the other birds of prey have not previously been recorded within the NSW Assessment Footprint, some of the woodland/forest habitat and secondary/derived native grasslands would provide potential habitat for them within the NSW Assessment Footprint.

While clearing of potential habitat would occur as a result of the Project, the nature of the clearing would reduce the area of habitat rather than further fragment or isolate it. The Project rail spur would result in minor clearance of potential habitat across some nearby watercourses (e.g. Namoi River). Given the mobility and large home ranges of these species, the associated potential impact would not result in significant additional fragmentation of their habitat on a regional scale.

Birds of prey are wide ranging, such that the potential habitat in the NSW Assessment Footprint would constitute only a very small part of the area used for foraging. Accordingly, its removal is likely to have a very limited impact on these species, if at all.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The Critical Habitat Register (OEH, 2016) does not list any critical habitat for these species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No recovery plan has been developed for these species, however, recovery strategies are listed on the threatened species profiles (OEH, 2018). The Project involves the clearance of some potential habitat for these species as well as a commitment to offset native vegetation clearance in accordance with NSW Offset Policy (OEH, 2014b). The Project would not be inconsistent with the recovery strategies listed for these species because it would result in a greater area of potential habitat being managed and conserved in perpetuity.

The Project would be consistent with the *NSW Fox Threat Abatement Plan 2010* (OEH, 2010), given feral animal control strategies would be implemented for the Project to minimise the impacts from introduced fauna species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Project would result in *clearing of native vegetation* which is a key threatening process applicable to birds of prey. Approximately 77.8 ha of woodland/forest habitat (comprising numerous fragmented patches) would be cleared in the NSW Assessment Footprint. The cleared land would be progressively rehabilitated over the life of the Project (with approximately 482 ha of woodland/forest on the post mine landforms associated with the NSW Assessment Footprint), and the vegetation loss would be offset, resulting in a net gain in habitat as a consequence of the Project.

Predation by the European red fox (Vulpes vulpes), *Predation by the feral cat (Felis catus)*, *removal of dead wood and dead trees* and *Loss of hollow-bearing trees* are also key threatening processes applicable to these species. Feral animal control strategies would be implemented to monitor and control feral animals (such as the Feral Cat and European Red Fox) and reduce the likelihood of these species increasing in abundance due to the Project.

Intense fires are another known threat to birds of prey (OEH, 2018) and are part of the key threatening process *High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition*. Bushfire management measures for the Project would include bushfire controls and emergency response, thus minimising the threat of bushfire.

Outcome

The Project is unlikely to significantly impact the Square-tailed Kite, Spotted Harrier, Little Eagle, Grey Falcon or Black Falcon as:

- these species are not known to use the habitat in the NSW Assessment Footprint for breeding;
- they are unlikely to be displaced as they are sparsely distributed throughout western NSW and utilise large home ranges;
- these species are very mobile and not likely to be present during land clearance activities; and
- similar foraging habitat (and prey) occurs extensively in the wider landscape within the species home range.

In addition to the above, the offset requirement for clearance of habitat for these species has been calculated using the FBA (OEH, 2014a) and an offset would be provided in accordance with the NSW Offset Policy (OEH, 2014b).

A2.3.3 Parrots

This section provides an assessment on the potential impacts on the following parrots which are known or have the potential to occur within the NSW Assessment Footprint:

- Glossy Black-Cockatoo (*Calyptorhynchus lathami*).
- Little Lorikeet (*Glossopsitta pusilla*).
- Swift Parrot (*Lathamus discolor*).
- Turquoise Parrot (*Neophema pulchella*).

These species are all listed as 'Vulnerable' under the BC Act, with the exception of the Swift Parrot which is listed as 'Endangered'.

The Swift Parrot is specifically nominated in the Project SEARs as a protected matter relating to a controlling provision and therefore, within the assessment below, further consideration is given to the impacts on the Swift Parrot in accordance with the FBA (OEH, 2014a). Further consideration is given to the impacts on the Swift Parrot in Attachment B in relation to the EPBC Act.

Introduction

The Project is not at the limit of these species known distribution.

Assessment of Significance

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Project would result in the removal of a portion of potential foraging and breeding habitat resources for the Little Lorikeet, Swift Parrot and Turquoise Parrot. However, no breeding habitat for the Swift Parrot exists within the NSW Assessment Footprint as this species migrates to Tasmania to breed. Feeding resources for the Glossy Black-Cockatoo are extremely limited owing to very low densities of *Casuarina* and *Allocasuarina* species within the NSW Assessment Footprint.

All woodland and forest vegetation types in the NSW Assessment Footprint (sum of approximately 77.8 ha) provide potential habitat for these species, with the exception of the Swift Parrot and Glossy Black-Cockatoo. The NSW Assessment footprint contains approximately 74.2 ha of potential habitat for the Swift Parrot. The NSW Assessment Footprint contains extremely limited (if any) potential habitat for the Glossy Black-Cockatoo.

Individuals of the four parrot species are considered to have low potential to be affected by indirect impacts of the Project in areas in close proximity to the NSW Assessment Footprint (such as noise and feral animals - assessed in Section 5.1.3 of the Main Text). The potential indirect impacts associated with the Project would be mitigated.

Table A4
Parrots – Species Information and Records

Species Name	Common Name	Conservation Status under the BC Act	Species Information	Records
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	The Glossy Black-Cockatoo inhabits open forest and woodlands of the coast and the Great Dividing Range in which stands of Sheoak species, particularly Black She-oak (*Allocasuarina littoralis*), Forest Oak (*A. torulosa*) or Drooping Sheoak (*A. verticillata*) occur (OEH, 2018). Not all apparently suitable habitat provides adequate food value to support the cockatoos (Crowley and Garnett, in press, in Garnett and Crowley, 2000; Crowley *et al*., 1999; Clout, 1989). This species is dependent on large hollow-bearing eucalypts for nest sites (OEH, 2018). Feeds almost exclusively on the seeds of several species of she-oak (*Casuarina* and *Allocasuarina* species) (OEH, 2018).). Even given a stable source of seeds, their high nutritional content and abundance, intake rates are low and cannot be accelerated if food supply is short (Garnett *et al.,* 2011). Individuals may spend up to 88 percent (%) of each day foraging and are rarely found foraging on species other than *Allocasuarina* or *Casuarina* species (Glossy Black Conservancy, 2010). This species generally forages in areas that have a high vegetation cover of Allocasuarina species and generally avoids open sites (Glossy Black Conservancy, 2010).	The Glossy Black-Cockatoo has not previously been recorded within the NSW Assessment Footprint. The nearest database record for this species is located to the north of the NSW Assessment Footprint, within the Leard State Forest (OEH, 2017b). Additional database records are prevalent to the west of the NSW Assessment Footprint within the Pilliga East State Forest and Pilliga Nature Reserve, with more than 30 records present (OEH, 2017b).
Glossopsitta pusilla	Little Lorikeet	V	Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees often chosen, including species like *Allocasuarina (OEH, 2018).*This species forages on nectar, pollen, fruits, berries and seeds (Morcombe, 2004). Forages primarily in the canopy of open *Eucalyptus* forest and woodland, yet also finds food in *Angophora, Melaleuca* and other tree species. (OEH, 2018).	Four database records and a previous survey record for this species are located outside the NSW Assessment Footprint. Two of the database records are located within the southern portion of the Vickery State Forest, with the third adjacent to the Namoi River within secondary/derived native grasslands to the south-west of the Project (Figure 9) in the same area as the previous survey record. Additional database records are prevalent within the wider locality, particularly within the Leard State Forest, Mount Kaputar National Park and Pilliga Nature Reserve (OEH, 2017b).

Table A4 (Continued)
Parrots – Species Information and Records

Species Name	Common Name	Conservation Status under the BC Act	Species Information	Records
Lathamus discolor	Swift Parrot	E	The Swift Parrot is dependent on flowering resources across a wide range of habitat in its wintering grounds in NSW (OEH, 2018). On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations (OEH, 2018). Following winter they return to Tasmania where they breed from September to January (OEH, 2018). The Swift Parrot feeds on winter flowering tree species such as Swamp Mahogany (*Eucalyptus robusta*), Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C. gummifera*), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*) (OEH, 2018). They also feed on lerp infested trees including Inland Grey Box (*E. microcarpa*), Grey Box (*E. moluccana*) and Blackbutt (*E. pilularis*) (OEH, 2018).	This species has not been recorded within the NSW Assessment Footprint or surrounds. There is only one database record for this species within approximately 50 km of the NSW Assessment Footprint (approximately 25 km south, near Gunnedah) (OEH, 2017b). Overall, records for this species are primarily located along the coast line, with scattered records through to central NSW (OEH, 2018).
Neophema pulchella	Turquoise Parrot	V	The Turquoise Parrot inhabits eucalypt woodland and Cypress Pine (*Callitris* spp.) open forests and woodlands with a grassy groundcover and open grassland (Morcombe, 2004; OEH, 2018). It also occurs where there is a low understorey of shrubs in natural and partially cleared areas up to 250 m from vegetation that has a canopy cover of 50% or more (Morcombe, 2004; OEH, 2018). This species commonly occurs on the edge of eucalypt woodlands that adjoin clearing, on timbered ridges and footslopes, and creeks in farmland (OEH, 2018).OEH, 2018 The Turquoise Parrot uses tree hollows less than 5 cm in diameter in living or dead trees, or hollow logs, fence posts or stumps that are less than 100 m from vegetation that has a canopy cover of more than 50% for nest sites from August to December (OEH, 2018). This species forages on seeds, grasses, herbaceous plants or shrubs found on the ground and may also consume flowers, nectar, fruits, leaves and scale insects (OEH, 2018).	The Turquoise Parrot has been recorded on a number of occasions surrounding the NSW Assessment Footprint (Figures 8 and 9). The records include three previous survey records within woodland habitat (Future Ecology, 2018; Cenwest, 2011), and four database records within the western portion of the Vickery State Forest (Figures 8 and 9). In the wider locality, Turquoise Parrot records are abundant, with approximately 20 records in the Leard State Forest and over 50 records within the Pilliga East State Forest and Pilliga Nature Reserve (OEH, 2017b).

Niche (2013) assessed the potential impacts on these species and concluded that the Approved Mine was unlikely to significantly impact them as the habitat to be removed (approximately 273 ha of woodland) represents a relatively small proportion of the habitat present in the wider locality. The change in cumulative impact on these parrots as a result of the Project (considering impacts from other surrounding developments [Section 5.1.4 of the Main Text]) is considered to be minimal because potential habitat is more abundant in the surrounding landscape. Additionally, the Swift Parrot and Glossy-black Cockatoo have not been recorded within the habitat in the NSW Assessment Footprint.

The Project is unlikely to have an adverse impact on the lifecycle of any of these species such that a viable local population is likely to be placed at risk of extinction because:

- the Swift Parrot does not breed in NSW and the NSW Assessment Footprint is located on the western edge of the species' range;
- the Swift Parrot would not be present during clearance of potential foraging habitat (clearing of hollow bearing trees will, where practicable, be restricted to late summer and autumn (Whitehaven, 2013) when the Swift Parrot would be in Tasmania);
- prime feeding habitat for the Glossy-black Cockatoo is not present in the NSW Assessment Footprint;
- the local population of Turquoise Parrot is more widespread in the landscape outside the NSW Assessment Footprint, as demonstrated by numerous records in the wider surrounds (OEH, 2017a) (Figure 8); and
- if used at any time, the potential habitat that occurs in the NSW Assessment Footprint for the Little Lorikeet is likely to be a very minor component of the available habitat in the region.

Questions (b) and (c) are not relevant to these species.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

All woodland and forest vegetation types in the NSW Assessment Footprint (sum of approximately 77.8 ha) provide potential habitat for the Little Lorikeet and Turquoise Parrot. Only approximately 74.2 ha of the NSW Assessment footprint provides potential habitat for the Swift Parrot.

Prime feeding habitat for the Glossy Black-Cockatoo is lacking in the NSW Assessment Footprint since there are no large patches of *Casuarina* or *Allocasuarina* species present. Isolated trees of *Casuarina cristata* would only provide transitory resources for individuals dispersing through the landscape.

While clearing of potential habitat would occur as a result of the Project, the nature of clearing would reduce the area of habitat rather than further fragment or isolate it.

Potential habitat for the Turquoise Parrot, Little Lorikeet and Swift Parrot does exist within the NSW Assessment Footprint. However, its removal is likely to have a limited impact on these species, given the following:

- Prime feeding habitat for the Glossy Black-Cockatoo is lacking in the NSW Assessment Footprint since there are no large patches of *Casuarina* or *Allocasuarina* species present. Isolated trees of *Casuarina cristata* would only provide transitory resources for individuals dispersing through the landscape.
- The Swift Parrot and Little Lorikeet are highly nomadic species that roam the landscape widely in search of flowering trees, their main source of food. They do not establish permanent sedentary populations, and therefore visits to the NSW Assessment Footprint would be opportunistic and transitory. The habitat on the NSW Assessment Footprint is a very small part of that available in the surrounding locality and wider region.
- Known and potential habitat for the Turquoise Parrots that occur adjacent to the NSW Assessment Footprint would continue to be available in the landscape (e.g. the Vickery State Forest, Pilliga Scrub, Mt. Kaputar complex and Boonalla State Conservation Area), such that the species would remain secure.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The Critical Habitat Register (OEH, 2016) does not list any critical habitat for these species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There are no recovery plans for the Glossy Black-Cockatoo, Little Lorikeet or Turquoise Parrot, however, recovery strategies for these species are listed on their threatened species profiles (OEH, 2018). The Project involves the clearance of some potential habitat for the Little Lorikeet, Turquoise Parrot and Swift Parrot as well as a commitment to offset native vegetation clearance in accordance with NSW Offset Policy (OEH, 2014b). The Project would not be inconsistent with the *National Recovery Plan for the Swift Parrot (Lathamus discolor)* (Saunders and Tzaros, 2011) or any recovery strategies identified for the Glossy Black-Cockatoo, Little Lorikeet or Turquoise Parrot because it would result in a greater area of potential habitat being managed and conserved in perpetuity.

In addition, the Project would be consistent with the *NSW Fox Threat Abatement Plan 2010* (OEH, 2010), given feral animal control strategies would be implemented for the Project to minimise the impacts from introduced fauna species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Project would result in *clearing of native vegetation*, *Removal of dead wood and dead trees*, *Loss of hollow-bearing trees* and *Bushrock Removal* which are all key threatening processes applicable to these species. Approximately 77.8 ha of potential breeding (excluding for the Swift Parrot and Glossy Black-Cockatoo) and foraging habitat (excluding the Glossy Black-Cockatoo) for these species would be cleared in the NSW Assessment Footprint.

The cleared land would be progressively rehabilitated over the life of the Project (with approximately 482 ha of woodland/forest on the post mine landforms associated with the NSW Assessment Footprint), and the vegetation loss would be offset, resulting in a net gain in habitat as a consequence of the Project.

Predation by the European red fox (Vulpes vulpes) and *Predation by the feral cat (Felis catus)* are also key threatening processes applicable to the Turquoise Parrot and Swift Parrot. Feral animal control strategies would be implemented to monitor and control feral animals (such as the Feral Cat and European Red Fox) and reduce the likelihood of these species increasing in abundance due to the Project.

Intense fires are another known threat to these species (OEH, 2018) and are part of the key threatening process *High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition*. Bushfire management measures for the Project would include bushfire controls and emergency response, thus minimising the threat of bushfire.

Outcome

The Project is unlikely to significantly impact the Glossy Black-Cockatoo, Little Lorikeet, Swift Parrot or Turquoise Parrot as:

- the Swift Parrot does not breed in NSW and the NSW Assessment Footprint is located on the western edge of the species range;
- the Swift Parrot would not be present during clearance of potential foraging habitat (clearing of hollow bearing trees will, where practicable, be restricted to late summer and autumn (Whitehaven, 2013) when the Swift Parrot would be in Tasmania);
- prime feeding habitat for the Glossy-black Cockatoo is not present in the NSW Assessment Footprint;
- the Turquoise Parrot that occur adjacent to the NSW Assessment Footprint are not likely to be restricted to this habitat, but rather part of a larger population, as demonstrated by numerous records in the wider surrounds (OEH, 2017b) (Figure 8); and
- if used at any time, the potential habitat that occurs in the NSW Assessment Footprint for the Little Lorikeet is likely to be a very minor component of the available habitat in the region.

In addition to the above, the offset liability for clearance of habitat for these species has been calculated using the FBA (OEH, 2014a) and an offset would be provided in accordance with NSW Offset Policy (OEH, 2014b).

In consideration of Section 9.2.5.2 of the FBA (OEH, 2014a), the Project would:

- not cause the extinction of the Swift Parrot from an IBRA subregion; and/or
- not significantly reduce the viability of the Swift Parrot.

A2.3.4 Owls

This section provides an assessment of the potential impacts on the following owls which may potentially occur within the NSW Assessment Footprint:

- Masked Owl (*Tyto novaehollandiae*).
- Barking Owl (*Ninox connivens*).

Both of the above species are listed as 'Vulnerable' under the BC Act.

Introduction

The Project is not at the limit of these species' known distribution, and neither species has been recorded within the NSW Assessment Footprint. Notwithstanding, potential habitat for each of these species occurs within the NSW Assessment Footprint (Table A5).

Assessment of Significance

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The primary potential adverse effect on these two owl species associated with the Project is the clearance of potential habitat. The Project would result in the removal of potential foraging, roosting and breeding habitat resources for these species consisting of forest/woodland habitat and native grasslands (Figure 7). Breeding habitat for these owl species is relatively limited within the NSW Assessment Footprint, as trees with hollows large enough to be used for breeding or roosting for these birds are uncommon (Niche, 2013; Future Ecology, 2018).

Despite no current records near the NSW Assessment Footprint, were these owls to occur in the surrounding habitat, potential indirect impacts from the Project (such as noise - assessed in Section 5.1.3 of the Main Text) are unlikely to impact these species. This is because most indirect impacts are not recognised threats to these species (OEH, 2018), there are no known breeding sites nearby and potential indirect impacts would be mitigated.

Niche (2013) assessed the potential impacts on the same threatened owls and concluded that the Approved Mine was unlikely to significantly impact them as the habitat to be removed (approximately 273 ha of woodland) represents poor quality habitat (moderately disturbed and supports low density of prey species) and a relatively small proportion of the habitat present in the wider locality. The change in cumulative impact on these owls as a result of the Project (considering impacts from other surrounding developments [Section 5.1.4 of the Main Text]) is considered to be minimal because potential habitat is more abundant in the surrounding landscape and no breeding sites have been recorded in the NSW Assessment Footprint or immediate surrounds. Additionally, neither of these owls has been recorded within the NSW Assessment Footprint.

Table A5
Owls – Species Information and Records

Species Name	Common Name	Conservation Status under the BC Act	Species Information	Records
Tyto novaehollandiae	Masked Owl	V	The Masked Owl inhabits dry eucalypt forests and woodlands from sea level to 1,100 m and is often active in the middle storey (Simpson and Day, 1999; OEH, 2018). The Masked Owl hunts over open woodland and farmland (Morcombe, 2004). Although this species is typically a forest owl, they often also hunt along roadsides or forest edges (OEH, 2018). Key habitat features for this species are: trees, crevices in cliffs or caves and sometimes buildings (OEH, 2018). The Masked Owl roosts and breeds in moist eucalypt forested gullies using large tree hollows or caves for nesting (OEH, 2018). This species depends on living or dead trees with hollows >40 cm in diameter, cliffs or caves for breeding habitat (OEH, 2018). It's diet typically consists of tree-dwelling and ground mammals, especially rats (OEH, 2018).	This species has not previously been recorded within the NSW Assessment Footprint or surrounds. Database records for the Masked Owl are widespread within the wider locality and are primarily located within vegetated areas (e.g. the Leard State Forest) (OEH, 2017b). The closest record is located approximately 10 km east of the NSW Assessment Footprint within the Kelvin Range (OEH, 2017b).
Ninox connivens	Barking Owl	V	The Barking Owl primarily inhabits open forest, including fragmented remnants and partly cleared farmland (OEH, 2018), avoiding high altitudes and dense, wet escarpment forests (Debus, 1997). The Barking Owl roosts in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as *Acacia* and *Casuarina*species (OEH, 2018). Breeding takes place in large hollows of old trees, however living eucalypts are preferred (OEH, 2018), which may be used year after year. They may also nest in rabbit burrows (Hollands, 1991 in Pizzey, Knight, 1999). This species hunts nocturnally for a variety of small to medium-sized mammals, birds, insects and vertebrates within woodland and forest habitats (NPWS, 2003). It requires very large permanent territories in most habitats due to sparse prey densities (OEH, 2018).	This species has not previously been recorded within the NSW Assessment Footprint or surrounds. Only two database records of this species occur within 10 km of the NSW Assessment Footprint, one at Boggabri, and one along the Namoi River to the north-west of the Project (OEH, 2017b). Additional database records are abundant within the wider locality, with the vast majority occurring within the Pilliga East and Pilliga West State Forests (OEH, 2017b).

The Project is unlikely to have an adverse impact on the lifecycle of either of these species such that a viable local population is likely to be placed at risk of extinction because:

- neither of these owls have been recorded in the NSW Assessment Footprint or immediate surrounds;
- no breeding sites for these owls have been recorded in the NSW Assessment Footprint or immediate surrounds (and are more likely to occur in habitat outside the NSW Assessment Footprint);
- the home range of these owls is large (covering forested and partly open country) and the population is unlikely to be restricted to the NSW Assessment Footprint or immediate surrounds; and
- the potential breeding habitat in the NSW Assessment Footprint is limited/not optimal for the Masked Owl (limited forests or forest gullies with old growth trees).

The Project would result in the removal of potential habitat for these species but is very unlikely to cause physical harm to individuals, given the highly mobile nature of each of these species.

Questions (b) and (c) are not relevant to these species.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Although these two species have not been previously recorded within the NSW Assessment Footprint, all woodland and forest (approximately 77.8 ha [comprising numerous fragmented patches]) and secondary/derived native grassland vegetation types (approximately 502 ha) in the NSW Assessment Footprint provide potential habitat, albeit marginal, for these species.

While clearing of potential habitat would occur as a result of the Project, the nature of the clearing would reduce the area of habitat rather than further fragment or isolate it. These species are very mobile, utilise large home ranges and are not dependant on vegetation corridors to move through the landscape.

Removal of potential habitat is likely to have a very limited impact on these species, if at all, as significant areas of other known and potential habitat would continue to be available in the landscape (e.g. the Vickery State Forest, Boonalla State Conservation Area, secondary/derived grasslands).

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The Critical Habitat Register (OEH, 2016) does not list any critical habitat for these species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

The Project involves the clearance of some potential habitat for the Barking Owl and Masked Owl as well as a commitment to offset native vegetation clearance in accordance with NSW Offset Policy (OEH, 2014b). The Project would not be inconsistent with the *Recovery Plan for the Barking Owl (Ninox connivens)* (NPWS, 2003), the *Approved NSW Recovery Plan for the Large Forest Owls: Powerful Owl (Ninox strenua), Sooty Owl (Tyto tenebricosa) and Masked Owl (Tyto novaehollandiae)* (DEC, 2006) or any recovery strategies listed for these species because it would result in a greater area of potential habitat being managed and conserved in perpetuity.

In addition, the Project would be consistent with the *NSW Fox Threat Abatement Plan 2010* (OEH, 2010), given feral animal control strategies would be implemented for the Project to minimise the impacts from introduced fauna species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Project would result in *clearing of native vegetation* which is a key threatening process applicable to these two owl species. Approximately 77.8 ha of woodland/ forest habitat (comprising numerous fragmented patches) would be cleared in the NSW Assessment Footprint along with approximately 502 ha of native grassland. The cleared land would be progressively rehabilitated over the life of the Project (with approximately 482 ha of woodland/forest on the post mine landforms associated with the NSW Assessment Footprint), and the vegetation loss would be offset, resulting in a net gain in habitat as a consequence of the Project.

Intense fires are another known threat to owl species (OEH, 2018) and are part of the key threatening process *High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition*. Bushfire management measures for the Project would include bushfire controls and emergency response, thus minimising the threat of bushfire.

Outcome

The Project is considered unlikely to significantly impact the Masked Owl or Barking Owl as:

- neither species has previously been recorded within the NSW Assessment Footprint;
- the potential breeding habitat in the NSW Assessment Footprint is limited/not optimal for the Masked Owl (limited forests or forest gullies with old growth trees); and
- both of these species, and their habitat, are widespread in the landscape outside the NSW Assessment Footprint.

In addition to the above, the offset requirement for clearance of habitat for these species has been calculated using the FBA (OEH, 2014a) and an offset would be provided in accordance with NSW Offset Policy (OEH, 2014b).

A2.3.5 Woodland Birds

This section provides an assessment on the potential impacts on the following woodland birds which are known or have the potential to occur within the NSW Assessment Footprint:

- Gilbert's Whistler (*Pachycephala inornata*).
- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*).
- Speckled Warbler (*Chthonicola sagittata*).
- Grey-crowned babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*).
- Varied Sittella (*Daphoenositta chrysoptera*).
- Diamond Firetail (*Stagonopleura guttata*).
- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*).
- Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*).

All of the above species are listed as 'Vulnerable' under the BC Act.

Introduction

The Project is not at the limit of these species' known distribution. The Speckled Warbler, Grey-crowned Babbler (eastern subspecies), Dusky Woodswallow and Diamond Firetail have been recorded within the NSW Assessment Footprint (Figures 8 and 9). The local population of these species is considered to be the individuals that occur in the NSW Assessment Footprint, as well as the individuals in the adjoining areas that are likely to use the habitats in the NSW Assessment Footprint. Noting, however, the individuals that occur in the NSW Assessment Footprint are not likely to be restricted to the habitat in the footprint but rather part of a larger population.

Although the remaining three species have not been recorded within the NSW Assessment Footprint, they have been recorded in the surrounding locality. Potential habitat for all eight species exists within the NSW Assessment Footprint, although its suitability varies among species (Table A6). The Varied Sittella, Gilbert's Whistler and Brown Treecreeper (eastern subspecies) have not been recorded in the NSW Assessment Footprint, most likely due to the woodlands lacking the structural diversity required by these species. The habitat is too open for Varied Sittella and Gilbert's Whistler and lacks the fallen logs and branches favoured by the Brown Treecreeper. However, the NSW Assessment Footprint does provide suitable potential habitat for the Diamond Firetail, Speckled Warbler, Hooded Robin (south-eastern form), Dusky Woodswallow and Grey-crowned Babbler (eastern subspecies) which have all been observed in similar habitat within, and surrounding, the NSW Assessment Footprint.

Table A6
Woodland Birds – Species Information and Records

Species Name	Common Name	Conservation Status under the BC Act	Species Information	Records
Pachycephala inornata	Gilbert's Whistler	V	The Gilbert's Whistler occurs in a range of habitats within NSW, though the shared feature appears to be a dense shrub layer (OEH, 2018). It is widely recorded in mallee shrublands, but also occurs in box-ironbark woodlands, Cypress Pine and Belah woodlands and River Red Gum forests. Within the mallee the species is often found in association with an understorey of spinifex and low shrubs including wattles, hakeas, sennas and hop-bushes (OEH, 2018). In woodland habitats, the understorey comprises dense patches of shrubs, particularly thickets of regrowth *Callitris* pine (OEH, 2018). Parasitic 'cherries' (*Exocarpos* species) appear to be an important habitat component in Belah and Red Gum communities, though in the latter case other dense shrubs, such as Lignum and wattles, are also used (OEH, 2018). The Gilbert's Whistler forages on or near the ground in shrub thickets and in tops of small trees. Its food consists mainly of spiders and insects such as caterpillars, beetles and ants, and occasionally, seeds and fruits are eaten (OEH, 2018).	The Gilbert's Whistler has not been recorded within the NSW Assessment Footprint. However, this species has been recorded within the Vickery State Forest and the Rocglen Coal Mine, outside the NSW Assessment Footprint. The species was recorded once by RPS (2010), and again more recently by Future Ecology (2018) (Figure 8). There are no other database records for this species within approximately 100 km of the NSW Assessment Footprint (OEH, 2017b). This species is much more widely recorded within central and south-western NSW (OEH, 2017b).
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	The Brown Treecreeper (eastern subspecies) inhabits eucalypt forests and woodlands, scrubs of the drier areas, river-edge trees and timbered paddocks (Morcombe, 2004). This species is often found on the ground in dry woodlands and forest clearings (Simpson and Day, 1999).Hollows in standing dead or live trees and tree stumps are essential for nesting (OEH, 2018). This species is insectivorous, and forages on tree trunks and on the ground for ants, beetles and larvae (Garnett *et al.,* 2011).	The Brown Treecreeper (eastern subspecies) has not been recorded within the NSW Assessment Footprint. However, this species has been previously recorded within the Vickery State Forest and in woodland habitat adjacent the Namoi River (Figures 8 and 9). Additional database records are widespread within the wider locality (Birdlife, 2017; OEH, 2017b) (Figure 8), particularly within the Vickery State Forest (approximately six records) and Leard State Forest (approximately 25 to 30 records).

Table A6 (Continued)
Woodland Birds – Species Information and Records

Species Name	Common Name	Conservation Status under the BC Act	Species Information	Records
Chthonicola sagittata	Speckled Warbler	V	The Speckled Warbler inhabits open forests and woodlands, and is typically found around waterfalls and where there is an abundance of stick and leaf debris (Thomas *et al.*, 2011). This species is also commonly found in open eucalypt woodlands with rocky gullies, ridges, tussock grass and sparse shrubbery (Morcombe, 2004). Key habitat features include: scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy (OEH, 2018). The Speckled Warbler builds its nest in ground litter (Simpson and Day, 1999). The Speckled Warbler typically breeds between August and January and builds a roughly rounded, domed nest of dry grass and strips of bark (OEH, 2018).OEH, 2018 The diet of the Speckled Warbler consists of seeds and insects, with most foraging taking place on the ground around tussocks and under bushes and trees with other small birds (Morcombe, 2004; OEH, 2018) OEH, 2018	The Speckled Warbler has been recorded on more than 15 occasions within and surrounding the NSW Assessment Footprint, within a range of habitat types (Future Ecology, 2018; Niche, 2013; RPS, 2010; Cenwest, 2011) (Figure 8). This includes records within the NSW Assessment Footprint, along the Namoi River and within the Vickery State Forest (outside the NSW Assessment Footprint) in both woodland and grassland habitat. Database records for this species are also prevalent throughout the wider locality and across NSW (OEH, 2017b).
Pomatostomus temporalis temporalis	Grey-crowned babbler (eastern subspecies)	V	The Grey-crowned Babbler (eastern subspecies) inhabits open forests and woodlands, including open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains (OEH, 2018). Nest are normally located in shrubs or sapling eucalypts, although they may be built in the outermost leaves of low branches of large eucalypts (OEH, 2018). The Grey-crown Babbler (eastern subspecies) prefers habitats with large trees, a scattered understorey of small trees and shrubs and an intact ground layer of grass and forbs (OEH, 2018). The Grey-crowned Babbler (eastern subspecies) feeds on invertebrates, such as beetle larvae, caterpillars and spiders taken from the ground or the trunks and foliage of the vegetation (Garnett and Crowley, 2000).	The Grey-crowned Babbler (eastern subspecies) has been recorded at more than 25 locations within and surrounding the NSW Assessment Footprint, within a range of habitat types (Figure 8) (Future Ecology, 2018; Cenwest, 2011; Niche, 2013; RPS, 2010). This includes records within the NSW Assessment Footprint, along the Namoi River and within the Vickery State Forest (outside the NSW Assessment Footprint) in both woodland and grassland habitat. Database records for this species are also prevalent throughout the wider locality and across NSW (OEH, 2017b) (Figure 8).

Table A6 (Continued)
Woodland Birds – Species Information and Records

Species Name	Common Name	Conservation Status under the BC Act	Species Information	Records
Daphoenositta chrysoptera	Varied Sittella	V	The Varied Sittella inhabits most wooded areas, such as sclerophyll forests, but is generally not found in dense rainforest (Thomas *et al.* 2011; Simpson and Day, 1999). It breeds co-operatively and when roosting all members of the group huddle together (Noske, 1998). Nests are constructed in vertical tree forks, usually on dead branches and are deep, open cups (Noske, 1998). The Varied Sittella forages for insects on the trunks and branches of tree trunks (Morcombe, 2004). This species tends to forage with its head down, with the males found on tree trunks and the main stems of trees and females found on finer tree branches and in the foliage of trees (Simpson and Day, 1999).	The Varied Sittella has not been recorded within the NSW Assessment Footprint. However, this species has previously been recorded at one location to the north of Vickery State Forest, outside the NSW Assessment Footprint, by RPS (2010) (Figure 9). There are also two database records of this species to the north of the Vickery State Forest (Figure 9). Database records for this species within the wider locality are primarily located within heavily vegetated areas (e.g. the Pilliga East State Forest) (OEH, 2017b). Outside the Namoi CMA, records are located in high densities along the east coast of NSW (OEH, 2017b).
Stagonopleura guttata	Diamond Firetail	V	The Diamond Firetail is generally found in the grassy groundcover underneath open forest; woodland, Mallee, Acacia scrub and timber belts along watercourses and roadsides (Morcombe, 2004; Simpson and Day, 1999). This species also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities (OEH, 2018). The Diamond Firetail prefers to construct its nest in Mistletoe, as Mistletoe provides a good structure for efficient nest building, a favourable microclimate and helps to conceal nests, which may reduce predation (Cooney and Watson, 2005). The Diamond Firetail forages exclusively on the ground (Morcombe, 2004). It feeds on ripe and partly-ripe grass and herb seeds and green leaves, and on insects (especially in the breeding season (OEH, 2018).	The Diamond Firetail has been recorded on seven occasions within and surrounding the NSW Assessment Footprint, within woodland habitat types, one of which was located within the Vickery State Forest (Future Ecology, 2018; Niche, 2013; RPS, 2010; Cenwest, 2011) (Figures 8 and 9). Two database records of this species occur within woodland to the north-east of the Vickery State Forest (Figure 8). Additional database records for this species are widespread within the wider locality and are primarily located within vegetated areas (e.g. the Leard State Forest and Kelvin Range) (OEH, 2017b).

Table A6 (Continued)
Woodland Birds – Species Information and Records

Species Name	Common Name	Conservation Status under the BC Act	Species Information	Records
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	The Dusky Woodswallow is widespread in eastern, southern and southwestern Australia (NSW Scientific Committee, 2016). In NSW it is widespread from the coast to inland, including the western slopes of the Great Dividing Range and farther west. It is sparsely scattered in, or largely absent from, much of the upper western region (NSW Scientific Committee, 2016). The Dusky Woodswallow is often reported in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. It has also been recorded in shrublands and heathlands and various modified habitats, including regenerating forests (NSW Scientific Committee, 2016). At sites where Dusky Woodswallows are recorded, the understorey is typically open with sparse eucalypt saplings, acacias and other shrubs (NSW Scientific Committee, 2016).	The Dusky Woodswallow has been recorded at three locations surrounding the NSW Assessment Footprint, within woodland habitat types (Figures 8 and 9) (Future Ecology, 2018; Niche, 2013; RPS, 2010; Cenwest, 2011). Four database records for this species are located within the Vickery State Forest (Figures 8 and 9a). Additional records are prevalent within the wider locality, particularly within the Pilliga East State Forest (OEH, 2017b).
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	The Hooded Robin (south-eastern form) inhabits a wide range of eucalypt, Mallee and Mulga woodlands; heath; dry forests; scrublands; and semi-cleared farmlands (Morcombe, 2004; Simpson and Day, 1999). This species prefers areas that are sparse to open woodlands with a ground layer of coarse tussock-grasses in which dense areas of shrubs, saplings or small trees occur (Priday, 2010). The Hooded Robin (south-eastern form) has been frequently recorded in box-gum and box-ironbark eucalypt and box-cypress pine (*Callitris*) woodlands (Priday, 2010). OEH, 2018The Hooded Robin (south-eastern form) is an insectivorous bird (Priday, 2010).	The Hooded Robin (south-eastern form) has been recorded at more than five locations surrounding the NSW Assessment Footprint (Figures 8 and 9). Most recently, Future Ecology (2018) recorded the Hooded Robin (south-eastern form) at three locations, within woodland habitat, within and adjacent to the NSW Assessment Footprint (Figures 8 and 9). Two database records for this species are located within the south-eastern corner of the Vickery State Forest (Figure 8). Additional records are prevalent within the wider locality, particularly within the Pilliga East State Forest (OEH, 2017b).

Assessment of Significance

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The primary potential adverse effect on these woodland bird species associated with the Project is the clearance of known and potential habitat. The Project would result in the removal/modification of a portion of potential foraging and breeding habitat resources for these species consisting of forest/woodland and grassland habitat (Figure 7). Breeding habitat for these species is limited to the forest/woodland habitat within the NSW Assessment Footprint, with the Brown Treecreeper (eastern subspecies) also requiring tree hollows to breed.

All woodland and forest vegetation types in the NSW Assessment Footprint (sum of approximately 77.8 ha) provide potential habitat for these species. In addition, the secondary/derived native grassland mapped within the NSW Assessment Footprint contains (in some parts) scattered paddock trees that are known to be used by the Speckled Warbler and Grey-crowned Babbler (eastern subspecies) (Figure 9). The Gilbert's Whistler, Brown Treecreeper (eastern subspecies), Varied Sittella, Diamond Firetail, Dusky Woodswallow and Hooded Robin (South-eastern form) may also forage in the secondary/derived native grassland.

Indirect impacts from the Project (such as noise - assessed in Section 5.1.3 of the Main Text) may affect individuals of these threatened woodland birds, particularly those which have been recorded in the surrounding area. Similarly, weeds, feral animals and inappropriate fire regimes are threats relevant to threatened woodland birds, though these too would be mitigated.

The Project is unlikely to have an adverse impact on the lifecycle of these species such that a viable local population is likely to be placed at risk of extinction because:

- much of the known and potential habitat to be cleared has been subject to past disturbances (such as logging, fragmentation of habitat and livestock grazing);
- similar (and better) potential habitat for these species is widespread in the landscape outside the NSW Assessment Footprint; and
- these species are widespread in the landscape outside the NSW Assessment Footprint, as demonstrated by numerous records in the wider surrounds (OEH, 2017b) (e.g. all these species have been recorded in Vickery State Forest and/or along the Namoi River).

Consistent with the existing impact avoidance and mitigation measures to be undertaken for the Approved Mine, scattered trees (a total of 50 trees) would be planted annually within the LBEM area (for the life of the mine [25 years]) to provide habitat for these threatened species.

Questions (b) and (c) are not relevant to these species.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The Gilbert's Whistler, Brown Treecreeper (eastern subspecies), Diamond Firetail, Speckled Warbler, Hooded Robin (south-eastern form), Dusky Woodswallow and Grey-crowned Babbler (eastern subspecies) have all recently been recorded within or surrounding the NSW Assessment Footprint by Future Ecology (2018) (Figure 9).

The woodland and forest vegetation types in the NSW Assessment Footprint (sum of approximately 77.8 ha) provide known habitat for three of these species (Diamond Firetail, Speckled Warbler, Dusky Woodswallow and Grey-crowned Babbler [eastern subspecies], likely habitat for the Hooded Robin and Dusky Woodswallow (south-eastern form) and minimal potential habitat for Gilbert's Whistler, the Brown Treecreeper (eastern subspecies) and the Varied Sittella. In addition, the secondary/derived native grassland mapped within the NSW Assessment Footprint contains (in some parts) scattered paddock trees that are known to be used by the Speckled Warbler and Grey-crowned Babbler (eastern subspecies) (Figure 9).

While clearing of potential habitat would occur as a result of the Project, the nature of clearing would reduce the area of habitat rather than further fragment or isolate it. The Project rail spur would result in minor clearance of potential habitat across the Namoi River. However, the majority of remnant native vegetation within the NSW Assessment Footprint comprises numerous small, isolated, more or less thinned patches, most of which have no continuous connecting corridors to larger regional remnants.

The removal of habitat for these species in the NSW Assessment Footprint would result in a very small reduction in the available habitat within the wider locality and region. Significant areas of similar and higher quality habitat would continue to be available in the landscape (e.g. the Vickery State Forest, Leard State Forest, the Kaputar complex, Pilliga Forests and Boonalla State Conservation Area). Similarly, the relative abundance of high quality natural habitats within the surrounding region means the change in cumulative impact on these woodland birds as a result of the Project (considering impacts from other surrounding developments [Section 5.1.4 of the Main Text]) is likely to be minimal.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The Critical Habitat Register (OEH, 2016) does not list any critical habitat for these species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is no existing recovery plan for these species, however, recovery strategies are listed on the threatened species profiles (OEH, 2018). The Project involves the clearance of some potential habitat for these species as well as a commitment to offset native vegetation clearance in accordance with NSW Offset Policy (OEH, 2014b).

The Project would not be inconsistent with the recovery strategies listed for these species because it would result in a greater area of potential habitat being managed and conserved in perpetuity.

The Project would be consistent with the *NSW Fox Threat Abatement Plan 2010* (OEH, 2010), given feral animal control strategies would be implemented for the Project to minimise the impacts from introduced fauna species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Project would result in *clearing of native vegetation*, *Removal of dead wood and dead trees* and *Loss of hollow-bearing trees* which are all key threatening processes applicable to these species. All woodland and forest vegetation types in the NSW Assessment Footprint (sum of approximately 77.8 ha [comprising numerous fragmented patches]) provide potential habitat for these species. The cleared land would be progressively rehabilitated over the life of the Project (with approximately 482 ha of woodland/forest on the post mine landforms associated with the NSW Assessment Footprint), and the vegetation loss would be offset, resulting in a net gain in habitat as a consequence of the Project.

Predation by the European red fox (Vulpes vulpes) and *Predation by the feral cat (Felis catus)* are also key threatening processes applicable to these species. Feral animal control strategies would be implemented to monitor and control feral animals (such as the Feral Cat and European Red Fox) and reduce the likelihood of these species increasing in abundance due to the Project.

Intense fires are another known threat to these species (OEH, 2018) and are part of the key threatening process *High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition*. Bushfire management measures for the Project would include bushfire controls and emergency response, thus minimising the threat of bushfire.

Outcome

The Project is unlikely to significantly impact these woodland birds as:

- much of the known and potential habitat to be cleared has been subject to past disturbances (such as logging, fragmentation of habitat and livestock grazing); and
- similar (and better) potential habitat for these species is widespread in the landscape outside the NSW Assessment Footprint; and
- these species are widespread in the landscape outside the NSW Assessment Footprint, as demonstrated by numerous records in the wider surrounds (OEH, 2017b) (e.g. all these species have been recorded in Vickery State Forest and/or along the Namoi River).

Consistent with the existing impact avoidance and mitigation measures to be undertaken for the Approved Mine, scattered trees (a total of 50 trees) would be planted annually within the LBEM area (for the life of the mine [25 years]) to provide habitat for threatened woodland birds, including the Grey-crowned Babbler (eastern subspecies), Hooded Robin (south-eastern form) and Speckled Warbler.

In addition to the above, the offset liability for clearance of habitat for these species has been calculated using the FBA (OEH, 2014a) and an offset would be provided in accordance with NSW Offset Policy (OEH, 2014b).

A2.3.6 Honeyeaters

This section provides an assessment on the potential impacts on the following honeyeaters which are known or have the potential to occur within the NSW Assessment Footprint:

- Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis gularis*).
- Regent Honeyeater (*Anthochaera phrygia*).
- Painted Honeyeater (*Grantiella picta*).

The Black-chinned Honeyeater (eastern subspecies) and Painted Honeyeater are listed as 'Vulnerable' under the BC Act, while the Regent Honeyeater is listed as 'Critically Endangered'.

The Regent Honeyeater is specifically nominated in the Project SEARs as a protected matter relating to a controlling provision and therefore, within the assessment below, further consideration is given to the impacts on the Regent Honeyeater in accordance with the FBA (OEH, 2014a). Further consideration is given to the impacts on the Regent Honeyeater in Attachment B in relation to the EPBC Act.

Introduction

The Project is not at the limit of these species' known distribution, and none of these species have previously been recorded within the NSW Assessment Footprint.

Potential habitat for each of these species occurs within the NSW Assessment Footprint (Table A7). One record of the Painted Honeyeater occurs within the NSW Assessment Footprint of the Project rail spur, and one record occurs adjacent the NSW Assessment Footprint (Figure 9). As shown on Figure 28, records for the Painted Honeyeater are widespread throughout the surrounding landscape, with the nearest database records located within the Leard State Forest. It is likely that the Painted Honeyeaters located within and near the NSW Assessment Footprint were recorded in River She-oaks which were observed along the Namoi River (FloraSearch, 2018) and are known to contain mistletoes. Mistletoes were very sparsely distributed within the remainder of the NSW Assessment Footprint (FloraSearch, 2018).

Assessment of Significance

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The primary potential adverse effect on these woodland bird species associated with the Project is the clearance of potential habitat. The Project would result in the removal of a portion of potential foraging and breeding habitat resources for these species consisting of forest/woodland habitat (Figure 7).

Approximately 48.1 ha[10] of woodland/ forest habitat (comprising numerous fragmented patches and 0.5 ha of scattered paddock trees) in the NSW Assessment Footprint provide potential habitat for the Regent Honeyeater (Figures 10 and 22), and all woodland and forest vegetation types in the NSW Assessment Footprint (sum of approximately 77.8 ha) provide potential habitat for the Black-chinned Honeyeater and Painted Honeyeater.

[10] Refer to Section 2.3.4 of the main text for the justification regarding habitat area calculations for this species.

Table A7
Honeyeaters – Species Information and Records

Species Name	Common Name	Conservation Status under the BC Act	Species Information	Records
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	In NSW, the Black-chinned Honeyeater (eastern subspecies) is mainly found in woodlands containing Box-Ironbark woodland associations and some Red Gum spp (Garnett *et al.,* 2011; OEH, 2018). The Black-chinned Honeyeater (eastern subspecies) inhabits forest, eucalypt woodland, paperbark forest and inland tree-lined watercourses (Morcombe, 2004). This species is reliant on flowering Ironbark Trees (Thomas *et al.,* 2011). The nest of this species is compact, suspended, cup-shaped and placed high in the crown of a tree, in the uppermost lateral branches, hidden by foliage (OEH, 2018). The Black-chinned Honeyeater (eastern subspecies) is a fairly specialised forager, probing between leaves for insects (Lollback *et al.,* 2008).	This species has not been recorded within the NSW Assessment Footprint or surrounds. There are only two database records of this species within approximately 25 km of the NSW Assessment Footprint, the nearest being within the Leard State Forest to the north (OEH, 2017b). Outside of the Project locality, database records are widespread across NSW (OEH, 2017b).
Anthochaera phrygia	Regent Honeyeater	CE	There are four known key breeding areas, three of them in NSW - Capertee Valley, Bundarra-Barraba and Hunter Valley regions (Figure 12) (DotE, 2016). The species breeds between July and January in Box-Ironbark and other temperate woodlands and riparian gallery forest dominated by River Sheoak (*Casuarina cunninghamiana*) (OEH, 2018). Regent Honeyeaters usually nest on horizontal branches or forks in tall mature eucalypts and Sheoaks and also nest in Mistletoe (OEH, 2018). The Regent Honeyeater is a generalist forager, although it feeds mainly on the nectar from a relatively small number of eucalypts that produce high volumes of nectar (OEH, 2018). It also feeds on arthropods, occasionally supplemented with fruit (Franklin *et al.,* 1988). Key eucalypt species include Mugga Ironbark (*Eucalyptus sideroxylon*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*), White Box (*E. albens*) and Swamp Mahogany (*E. robusta*) (OEH, 2018). When nectar is scarce lerp and honeydew comprise a large proportion of the diet (OEH, 2018).	This species has not been previously recorded within the NSW Assessment Footprint or surrounds. There is only one database record for this species within approximately 40 km of the NSW Assessment Footprint; approximately 7.5 km to the south-east (OEH, 2017b). Outside of the Project locality, database records are widespread across NSW (OEH, 2017b).

Table A7 (Continued)
Honeyeaters – Species Information and Records

Species Name	Common Name	Conservation Status under the BC Act	Species Information	Records
Grantiella picta	Painted Honeyeater	V	In NSW the greatest concentrations of the Painted Honeyeater, and almost all breeding, occurs on the inland slopes of the Great Dividing Range in NSW (OEH, 2018). This species inhabits Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests (OEH, 2018). It nests from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches (OEH, 2018). The Painted Honeyeater feeds on insects and nectar from Mistletoe or eucalypts (OEH, 2018). It is a specialist feeder on the fruits of Mistletoes growing on woodland eucalypts and acacias and prefers Mistletoes of the genus *Amyema* (OEH, 2018).	The Painted Honeyeater has been recorded at two locations. Two database records for this species are located within the Leard State Forest (OEH, 2017b). Outside of the Project locality, database records are widespread across NSW (OEH, 2017b).

Despite no current records near the NSW Assessment Footprint, were the Black-chinned Honeyeater (eastern subspecies) or Regent Honeyeater to use the surrounding habitat, potential indirect impacts from the Project (such as noise, dust, artificial lighting - assessed in Section 5.1.3 of the Main Text) are unlikely to impact these species as most indirect impacts are not recognised threats to this species (OEH, 2018), there are no known breeding sites nearby and potential indirect impacts would be mitigated. Individuals of the Painted Honeyeater which occur within and adjacent to the NSW Assessment Footprint associated with the Project rail spur could be disturbed by indirect impacts from the Project (such as noise - assessed in Section 5.1.3 of the Main Text) although indirect impacts would be mitigated.

In regard to the impacts from the Approved Mine, Niche (2013) assessed the potential impacts on the same threatened honeyeaters, and concluded that the Approved Mine was unlikely to significantly impact them as the Regent Honeyeater and Black-chinned Honeyeater (eastern subspecies) had a low likelihood of occurring near the Approved Mine and for the Painted Honeyeater, the habitat to be removed (approximately 273 ha of woodland) represents a relatively small proportion of the habitat present in the wider locality. The change in cumulative impact on these honeyeaters as a result of the Project (considering impacts from other surrounding developments [Section 5.1.4 of the Main Text]) is considered to be minimal as potential habitat is more abundant in the surrounding landscape and none of these threatened honeyeaters have been recorded using potential habitat in the NSW Assessment Footprint.

The Project is unlikely to have an adverse impact on the lifecycle of any of these species such that a viable local population is likely to be placed at risk of extinction because:

- none of these honeyeaters (with the exception of the Painted Honeyeater) have been recorded using potential habitat within the NSW Assessment Footprint, despite surveys (Niche, 2013; Future Ecology, 2018);
- the Regent and Painted Honeyeaters are highly nomadic species that may be transitory visitors, but would not form a local population;
- the lack of Black-chinned Honeyeater records on or close to the NSW Assessment Footprint, despite surveys, indicates this species is highly unlikely to have a resident local population there;
- the Project is not located in a key breeding area for the Regent Honeyeater (the closest of which is more than 40 km north-east of the NSW Assessment Footprint) (DotE, 2016) and this species is not typically recorded foraging in the surrounding landscape (Figure 12);
- the Painted Honeyeater is likely to persist in the habitat to the south of the NSW Assessment Footprint as potential indirect impacts would be mitigated.

The Project would result in the removal of potential habitat for these species but is very unlikely to cause physical harm to individuals, given the highly mobile nature of each of these species.

Consistent with the existing impact avoidance and mitigation measures to be undertaken for the Approved Mine, scattered trees (a total of 50 trees) would be planted annually within the LBEM area (for the life of the mine [25 years]) to provide habitat for these threatened species.

Questions (b) and (c) are not relevant to these species.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Remnant native vegetation within the NSW Assessment Footprint comprises numerous small, isolated, more or less thinned patches, most of which have no continuous connecting corridors to larger regional remnants. Although none of the three honeyeater species have been recorded within the NSW Assessment Footprint, approximately 48.1 ha of woodland/open forest habitat (comprising numerous fragmented patches and 0.5 ha of scattered paddock trees) provides potential habitat for the Regent Honeyeater (Figures 10 and 22), and all woodland and forest vegetation types (sum of approximately 77.8 ha) provide potential, albeit marginal, habitat for the Black-chinned Honeyeater and Painted Honeyeater.

While clearing of potential habitat would occur as a result of the Project, the nature of the clearing would reduce the area of habitat rather than further fragment or isolate it for these species.

The removal of habitat within the NSW Assessment Footprint is considered unlikely to have a significant impact on these species, if at all, as large areas of similar or better habitat would continue to be available in the landscape (e.g. the Vickery State Forest, the Kaputar complex, Pilliga forests, Boonalla State Conservation Area).

Similarly, the relative abundance of high quality natural habitats within the surrounding region means the change in cumulative impact on these woodland birds as a result of the Project (considering impacts from other surrounding developments [Section 5.1.4 of the Main Text]) is likely to be minimal.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The Critical Habitat Register (OEH, 2016) does not list any critical habitat for these species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

The Project involves the clearance of some potential habitat for the Regent Honeyeater as well as a commitment to offset native vegetation clearance in accordance with NSW Offset Policy (OEH, 2014b). The Project would not be inconsistent with the *National Recovery Plan for the Regent Honeyeater (Anthochaera phrygia)* (DotE, 2016) or any recovery strategies listed for this species because it would result in a greater area of potential habitat being managed and conserved in perpetuity.

The Project would be consistent with the *NSW Fox Threat Abatement Plan 2010* (OEH, 2010), given feral animal control strategies would be implemented for the Project to minimise the impacts from introduced fauna species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Project would result in *clearing of native vegetation* which is a key threatening process applicable to these species. Approximately 48.1 ha of potential breeding and foraging habitat for the Regent Honeyeater (Figures 10 and 22) and 77.8 ha of potential breeding and foraging habitat for the Black-chinned Honeyeater and Painted Honeyeater would be cleared in the NSW Assessment Footprint.

Intense fires are another known threat to these species (OEH, 2018) and are part of the key threatening process *High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition*. Bushfire management measures for the Project would include bushfire controls and emergency response, thus minimising the threat of bushfire.

Outcome

The Project is unlikely to significantly impact these honeyeaters as:

- none of these honeyeaters (with the exception of the Painted Honeyeater) have been recorded using potential habitat within the NSW Assessment Footprint, despite surveys (Niche, 2013 and Future Ecology, 2018);
- the habitat in the NSW Assessment Footprint is not very suitable for the Black-chinned Honeyeater, and while potentially providing transitory food supplies for the Regent and Painted Honeyeaters, is not likely to be critical to them owing to the existence of abundant similar or better habitat in the region;
- the Project is not located in a key breeding area for the Regent Honeyeater (the closest of which is more than 40 km north-east of the NSW Assessment Footprint) (DotE, 2016) and this species is not typically recorded foraging in the surrounding landscape (Figure 12);
- similar (and better) potential habitat for these species is widespread in the landscape outside the NSW Assessment Footprint; and
- the Painted Honeyeater is likely to persist in the habitat to the south of the NSW Assessment Footprint as potential indirect impacts would be mitigated.

In addition to the above, the offset liability for clearance of habitat for these species has been calculated using the FBA (OEH, 2014a) and an offset would be provided in accordance with NSW Offset Policy (OEH, 2014b).

In consideration of Section 9.2.5.2 of the FBA (OEH, 2014a), the Project would:

- not cause the extinction of the Regent Honeyeater from an IBRA subregion; and
- not significantly reduce the viability of the Regent Honeyeater.

A2.3.7 Blue-billed Duck (*Oxyura australis*)

The Blue-billed Duck is listed as 'Vulnerable' under the BC Act.

Introduction

The Blue-billed Duck is endemic to south-eastern and south-western Australia. It is widespread in NSW, but most common in the southern Murray-Darling Basin area (OEH, 2018). Birds disperse during the breeding season to deep swamps up to 300 km away (OEH, 2018).

The Project is not at the limit of this species' known distribution. Two previous survey records of the Blue-billed Duck are located outside the NSW Assessment Footprint, within man-made farm dams in the Approved Mine extent (Figure 9). There is only one other database record of this species within 100 km of the NSW Assessment Footprint, located near Gunnedah (OEH, 2017b).

The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation and is completely aquatic, swimming low in the water along the edge of dense cover (OEH, 2018). Blue-billed Ducks will feed by day far from the shore, particularly if dense cover is available in the central parts of the wetland (OEH, 2018). They feed on the bottom of swamps eating seeds, buds, stems, leaves, fruit and small aquatic insects such as the larvae of midges, caddisflies and dragonflies (OEH, 2018).

Assessment of Significance

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

No known/potential native habitat for the Blue-billed Duck occurs within the NSW Assessment Footprint, given that only small man-made farm dams occur. There are no large, deep naturally occurring waterbodies that could provide potential habitat for the Blue-billed Duck.

The Project is unlikely to have an adverse impact on the lifecycle of the Blue-billed Duck such that a viable local population of the species is likely to be placed at risk of extinction because:

- no naturally occurring habitat for this species would be removed by the Project;
- the nomadic life style of the Blue-billed Duck precludes the existence of a local population on the NSW Assessment Footprint; and
- small man-made farm dams occur in the NSW Assessment Footprint and are unlikely to be used by this species.

Questions (b) and (c) are not relevant to this species.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The Blue-billed Duck has been recorded adjacent to the NSW Assessment Footprint within the Approved Mine extent. There are small man-made farm dams within the NSW Assessment Footprint, however, no naturally occurring waterbodies would be removed in the NSW Assessment Footprint.

No known or potential native habitat for this species would be fragmented or further isolated by the Project.

The Blue-billed Duck is known to use habitat in the wider landscape. However, removal of the man-made farm dams within the NSW Assessment Footprint is likely to have a limited impact on this species, if at all, as significant areas of more suitable, native known and potential habitat would continue to be available in the landscape (e.g. Lake Keepit).

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The Critical Habitat Register (OEH, 2016) does not list any critical habitat for this species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No recovery plan has been developed for the Blue-billed Duck, however, recovery strategies for this species are listed on the threatened species profile (OEH, 2018). The Project involves the clearance of some potential man-made habitat for this species as well as a commitment to offset native vegetation clearance in accordance with NSW Offset Policy (OEH, 2014b). The Project would not be inconsistent with the recovery strategies listed for this species because it would result in a greater area of potential habitat being managed and conserved in perpetuity.

The Project would be consistent with the *NSW Fox Threat Abatement Plan 2010* (OEH, 2010), given feral animal control strategies would be implemented for the Project to minimise the impacts from introduced fauna species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Predation by the European red fox (Vulpes vulpes) and *Predation by the feral cat (Felis catus)* are key threatening processes applicable to the Blue-billed Duck. Feral animal control strategies would be implemented to monitor and control feral animals (such as the Feral Cat and European Red Fox) and reduce the likelihood of these species increasing in abundance due to the Project.

Outcome

The Project is unlikely to significantly impact the Blue-billed Duck as:

- no naturally occurring habitat for this species would be removed by the Project;
- the nomadic life style of the Blue-billed Duck precludes the existence of a local population on the NSW Assessment Footprint;
- small man-made farm dams within the NSW Assessment Footprint are unlikely to be utilised by the Blue-billed Duck;
- relatively large areas of more suitable, native and artificial habitat would remain outside the NSW Assessment Footprint; and
- Blue-billed Duck records and known habitat are widespread in the landscape outside the NSW Assessment Footprint (OEH, 2017b).

A2.3.8 Koala (*Phascolarctos cinereus*)

The Koala is listed as 'Vulnerable' under the BC Act.

The Koala is specifically nominated in the Project SEARs as a protected matter relating to a controlling provision and therefore, within the assessment below, further consideration is given to the impacts on the Koala in accordance with the FBA (OEH, 2014a). Further consideration is given to the impacts on the Koala in Attachment B in relation to the EPBC Act.

Introduction

The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia (OEH, 2018). In NSW their distribution mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range.

The Project is not at the limit of this species' known distribution. Koalas have been recorded in the locality, predominantly close to watercourses or along roadways (Figures 8 and 9). Furthermore, two recent recordings by Future Ecology (2018) are located within the surrounds of the NSW Assessment Footprint, one is located on the western side of the Namoi River across from the mining area, and the other is located on the eastern side of Deadmans Gully, near where it intersects the rail spur (Figures 13 and 23). Two previous survey records are also located in close proximity to the Namoi River, less than 1 km to the south-west of the NSW Assessment Footprint (Figure 13) (Kendall and Kendall, 2011).

One database record of the Koala is located within the immediate surrounds of the NSW Assessment Footprint (OEH, 2017b). The record (from 2011) is located approximately 350 m to the south-west of the NSW Assessment Footprint (with an accuracy of 500 m), within woodland habitat adjacent the Namoi River (OEH, 2017b).

In recent studies undertaken within the Gunnedah LGA, the local Koala population has been calculated as approximately 12,700 animals (Gunnedah Shire Council, 2015), this number being the result of population growth and an increase in the habitat occupancy rate over the last three to five Koala generations (Gunnedah Shire Council, 2015).

This species feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species (North West Ecological Services, 2016; OEH, 2018). The Project is located within the Western Slopes and Plains Koala Management Area, where the primary food tree species include River Red Gum (*E. camaldulensis*) and Coolabah (*E. coolabah*) (DECC, 2008). The primary, secondary and supplementary food species for the Koala in the Western Slopes and Plains Koala Management Area are listed in Table A8.

Table A8
Koala Food Trees of the Western Slopes and Plains Koala Management Area

Primary food tree species	
River Red Gum (*E. camaldulensis*)	Coolabah (*E. coolabah*)
Secondary food tree species	
Dirty Gum (*E. chloroclada*)	Blakely's Red Gum (*E. blakelyi*)
Bimble Box (*E. populnea*)	Apple-topped Box (*E. bridgesiana*)
Pilliga Box (*E. pilligaensis*)	Black Box (*E. largiflorens*)
Fuzzy Box (*E. conica*)	Mallee Red Gum (*E. nandewarica*)
Western Grey Box (*E. microcarpa*)	*E. vicina*
Yellow Box (*E. melliodora*)	*E. volcanica*
White Box (*E. albens*)	*E. polyanthemos*
Dwyer's Red Gum (*E. dwyeri*)	Orange Gum (*E. prava*)
Tumbledown Gum (*E. dealbata*)	
Stringybarks/supplementary species	
E. macrorhyncha	Narrow-leaved Stringybark (*E. sparsifolia*)

Source: DECC (2008).

The Koala spends most of its time in trees, but will descend and traverse open ground to move between trees (OEH, 2018). Their home range size varies with quality of habitat, ranging from less than 2 ha to several hundred hectares in size (OEH, 2018). This species is generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females and subordinate males on the periphery (OEH, 2018).

The following measures are proposed to manage the Project impact to the core koala habitat along the Namoi River:

- the Project rail spur has been sited such that impacts on mature vegetation would be minimal (i.e. it would cross the river at a location where the coverage of large tree is sparse);
- the Project rail spur crossing of the Namoi River would be constructed within a 40 m construction corridor length (the riparian zone is 1-2 trees wide at Site B [Future Ecology, 2018]);
- pre-clearance surveys and would be undertaken for the Koala to minimise impacts during clearance (Section 5.1.1 of the main text);
- construction of the spur is expected to be complete within a 12 month period;
- sediment controls, including up-catchment diversions and silt fences would be used to prevent sediment being carried into the Namoi River during construction;
- weeds would be managed at the Project rail spur crossing of the Namoi River during construction until native vegetation has re-established;
- following construction of the Project rail spur crossing, species characteristic of the River Red Gum Riparian Tall Woodland (NA 193) would be planted in the construction corridor along the river, including River Red Gum (*Eucalyptus camaldulensis*); and
- residual impacts on the River Red Gum Riparian Tall Woodland (NA 193) and the Koala from the Project would be offset (equating to 40 ecosystem credits for NA193 and approximately 1,308 credits for the Koala) (Section 5.8 of the main text).

Assessment of Significance

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The primary potential adverse effect on the Koala associated with the Project is the clearance of potential Koala habitat. River Red Gums (a primary koala food tree) are located within the NSW Assessment Footprint along the banks of the Namoi River, proposed to be traversed by the Project rail spur. Approximately 1 ha of River Red Gum Riparian Tall Woodland would be cleared as a result of the Project rail spur. FloraSearch (2018) also recorded White Box (*E. albens*), Poplar Box (*E. populnea*), Pilliga Box (*E. pilligaensis*), Yellow Box (*E. melliodora*) and Blakely's Red Gum (*E. blakelyi*), which are all secondary food trees for the Koala, in the NSW Assessment Footprint (Table A8).

The Project would remove approximately 50.3 ha[11] of woodland/open forest habitat (comprising numerous fragmented patches) within the NSW Assessment Footprint (the vast majority of which is only secondary Koala habitat), which would provide potential breeding and foraging habitat for the Koala, although no evidence of Koala breeding in the wider locality has been recorded (Figures 13 and 23). The small isolated patches of potential habitat shown on Figures 13 and 23 are less likely to be used by the species.

Individuals of Koala that occur in the surrounding habitat could potentially be disturbed by indirect impacts from the Project (such as noise - assessed in Section 5.1.3 of the Main Text). However, noise and other indirect impacts would be mitigated. Similarly, bushfire management measures would minimise the risk of bushfire indirectly impacting habitat which may be used by this species.

The change in cumulative impact on the Koala as a result of the Project (considering impacts from other surrounding developments [Section 5.1.4 of the Main Text]) is considered to be minimal as potential habitat is more abundant in the surrounding landscape (e.g. along the Namoi River and south towards Gunnedah) and this species has not been recorded using potential habitat in the NSW Assessment Footprint.

The Project is unlikely to have an adverse impact on the lifecycle of the Koala such that a viable population of the species is likely to be placed at risk of extinction because:

- only approximately 1 ha of primary Koala food trees occur in the NSW Assessment Footprint (after DECC, 2008);
- much of the known and potential habitat to be cleared has been subject to past disturbances (such as logging);
- similar (and better) potential habitat for this species is more widespread in the landscape outside the NSW Assessment Footprint (e.g. the riparian zone of the Namoi River and larger tributaries outside the NSW Assessment Footprint, Vickery State Forest and Boonalla State Conservation Area); and
- Koala records are widespread in the landscape outside the NSW Assessment Footprint, as demonstrated by numerous Koala records in the wider surrounds (particularly around Gunnedah, 25 km to the south of the NSW Assessment Footprint) (Figure 14).

[11] Refer to Section 2.3.4 of the main text for the justification regarding habitat area calculations for this species.

If a Koala is found during land clearance activities, it would be left to move away from the clearance area on its own accord. Therefore, while the Project would result in the removal of potential habitat for this species, it is very unlikely to cause physical harm to individuals of the species.

Questions (b) and (c) are not relevant to this species.

(d) In relation to the habitat of a threatened species, population or ecological community:

- ***(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;***
- ***(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and***
- ***(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

One record of the Koala has been recorded within the woodland/forest habitat inside the NSW Assessment Footprint. Approximately 50.3 ha of the woodland/forest that is potential Koala habitat would be removed in the NSW Assessment Footprint, the vast majority of which is only secondary Koala habitat.

Previous Koala records surrounding the NSW Assessment Footprint predominantly occur in close proximity to the Namoi River (and associated watercourses) (Figure 13 and 23). Although the Project would disturb the riparian habitat along the Namoi River, only approximately 1 ha of primary Koala food trees would be removed.

While clearing of potential habitat would occur as a result of the Project, the nature of clearing would reduce the area of habitat rather than further fragment or isolate it. The Project rail spur would result in the clearance of a narrow corridor (no more than 40 m across) in potential Koala habitat across the Namoi River (Figure 23). Despite this, the rail crossing would be elevated on piers at the river crossing, allowing any Koalas to cross underneath the rail without the risk of being struck. In addition, the associated potential impact would result in minimal additional fragmentation of the species habitat on a regional scale.

The removal of potential Koala habitat is likely to have a minimal impact on this species as larger areas of similar and better habitat would continue to be available in the landscape (e.g. the remaining riparian zone of the Namoi River and larger tributaries, Vickery State Forest and Boonalla State Conservation Area).

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The Critical Habitat Register (OEH, 2016) does not list any critical habitat for this species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

The Project involves the clearance of some potential breeding and foraging habitat for the Koala as well as a commitment to offset native vegetation clearance in accordance with NSW Offset Policy (OEH, 2014b). The Project would not be inconsistent with the *National Koala Conservation and Management Strategy 2009-2014* (Natural Resource Management Ministerial Council, 2009), the NSW State *Recovery Plan for the Koala (Phascolarctos cinereus)* (DECC, 2008) or any recovery strategies listed for this species because it would result in a greater area of potential habitat being managed and conserved in perpetuity.

In addition, the Project would be consistent with the *NSW Fox Threat Abatement Plan 2010* (OEH, 2010), given feral animal control strategies would be implemented for the Project to minimise the impacts from introduced fauna species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Project would result in *Clearing of native vegetation* which is a key threatening process applicable to the Koala. Approximately 50.3 ha of woodland/ forest Koala habitat (comprising numerous fragmented patches) would be cleared in the NSW Assessment Footprint, the vast majority of which is only secondary Koala habitat (Figures 13 and 23). The cleared land would be progressively rehabilitated over the life of the Project (with approximately 482 ha of woodland/forest on the post mine landforms associated with the NSW Assessment Footprint), and the vegetation loss would be offset, resulting in a net gain in habitat as a consequence of the Project.

Predation by the European red fox (Vulpes vulpes) and *Predation by the feral cat (Felis catus)* are also key threatening processes applicable to the Koala. Feral animal control strategies would be implemented to monitor and control feral animals (such as the Feral Cat and European Red Fox) and reduce the likelihood of these species increasing in abundance due to the Project.

Intense fires are another known threat to the Koala (OEH, 2018) and are part of the key threatening process *High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition*. Bushfire management measures for the Project would include bushfire controls and emergency response, thus minimising the threat of bushfire.

Outcome

The Project is unlikely to significantly impact the Koala as:

- only 1 ha of primary koala food trees occur in the NSW Assessment Footprint (after DECC, 2008);
- much of the known and potential habitat to be cleared has been subject to past disturbances (such as logging);
- similar (and better) potential habitat for these species is more widespread in the landscape outside the NSW Assessment Footprint (e.g. the riparian zone of the Namoi River and larger tributaries outside the NSW Assessment Footprint, Vickery State Forest and Boonalla State Conservation Area); and
- Koala records are widespread in the landscape outside the NSW Assessment Footprint, as demonstrated by numerous Koala records in the wider surrounds (particularly around Gunnedah, 25 km to the south of the NSW Assessment Footprint) (Figure 14).

In addition to the above, the offset requirement for clearance of habitat for this species has been calculated using the FBA (OEH, 2014a) and an offset would be provided in accordance with NSW Offset Policy (OEH, 2014b).

In consideration of Section 9.2.5.2 of the FBA (OEH, 2014a), the Project would:

- not cause the extinction of the Koala from an IBRA subregion; and
- not significantly reduce the viability of the Koala.

A2.3.9 Squirrel Glider (*Petaurus norfolcensis*)

The Squirrel Glider is listed as 'Vulnerable' under the BC Act.

Introduction

The Squirrel Glider (*Petaurus norfolcensis)* is widely, though sparsely, distributed in eastern Australia, from northern Queensland to western Victoria (OEH, 2018). Its range encompasses habitats on the drier inland slopes of the Great Dividing Range as well as coastal habitats in NSW and Queensland (Van Dyck and Strahan, 2008).

The Project is not at the limit of this species' known distribution. This species has been recorded within the NSW Assessment Footprint. Squirrel Glider records also exist within the immediate surrounds of the NSW Assessment Footprint, particularly adjacent the Namoi River (Cenwest, 2011; Future Ecology, 2018) and close to watercourses or within highly vegetated areas (e.g. Pilliga East State Forest).

The Squirrel Glider inhabits woodland and forest, with an overstorey including *Eucalyptus* spp., *Angophora* spp. or *Corymbia* spp. and a diverse shrubby understorey of *Acacia* spp. or *Banksia* spp. (Van Dyck and Strahan, 2008). Important habitat components for the Squirrel Glider include: availability of food; species of shrubs or trees that provide nectar in the winter; and hollow bearing trees for shelter (Smith and Murray, 2003; Van Dyck and Strahan, 2008).

The diet of the Squirrel Glider is very diverse and includes nectar, pollen, plant exudates (e.g. *Acacia* gum, *Eucalyptus* spp.), invertebrates and honeydew (a sugary coating on leaves produced by scale insects) (Van Dyck and Strahan, 2008). The Squirrel Glider's diet varies from place to place and from season to season depending on food availability (Van Dyck and Strahan, 2008).

Assessment of Significance

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The primary potential adverse effect on the Squirrel Glider associated with the Project is the clearance of potential Squirrel Glider habitat (some of which is connected to habitat known to be used by the species, namely the woodland south of Braymont Road). Approximately 74.7 ha[12] of woodland/ forest habitat (comprising numerous fragmented patches and 0.5 ha of scattered paddock trees (predominantly White Box) in secondary/derived native grassland) would provide potential habitat for this species (Figures 15 and 24). The small isolated patches of potential habitat shown on Figures 15 and 24 are less likely to be used by the species.

[12] Refer to Section 2.3.4 of the main text for the justification regarding habitat area calculations for this species.

All local occurrences of Squirrel Glider have been recorded near to the Namoi River (Figure 24) (Future Ecology, 2018). The three Squirrel Glider records within and adjacent to the NSW Assessment Footprint occur in scattered patches of woodland with Pilliga Box and Poplar Box (Vegetation Community 3) and the two Squirrel Glider records to the south of Braymont Road occur in the woodland with White Box (Vegetation Community 4) (Figure 24). The local occurrences of the Squirrel Glider have been recorded in habitat that is limited (highly cleared or fragmented). However, the habitats near the NSW Assessment Footprint in which the species has been found, are very similar to those within the NSW Assessment Footprint generally, suggesting the Squirrel Glider is also likely to occur within the NSW Assessment Footprint.

The riparian woodland which occurs along the Namoi River (a portion mapped by FloraSearch [2018] as NA193) represents potential habitat for the Squirrel Glider, and the species was recorded in the riparian woodland within and adjacent to the NSW Assessment Footprint associated with the Project rail spur (Future Ecology, 2018). The riparian woodland is continuous and loosely contiguous with the woodland south of Braymont Road (Figure 24), suggesting the local Squirrel Glider population encompasses the Namoi River riparian corridor, the woodlands south of Braymont Road and the occurrences south of the NSW Assessment Footprint. This distribution suggests that the loss of habitat due to the Project, while reducing potential Squirrel Glider habitat, is nevertheless unlikely to cause the extinction of a local population.

The nature of the disturbance to the riparian woodland along the Namoi River (i.e. a rail bridge) should also be considered. Studies have shown that Squirrel Gliders will attempt to run across roads/tracks that are wider than their gliding distance of generally 20 to 40 m, but up to 70 m (NSW Scientific Committee, 2008; van der Ree *et al.,* 2003). The Project rail spur would be constructed within a 40 m wide corridor and the Project rail spur would be constructed on a bridge.

Individuals of Squirrel Glider which occur in the surrounding habitat could be disturbed by indirect impacts from the Project (such as noise - assessed in Section 5.1.3 of the Main Text). However, noise and other impacts would be mitigated. Similarly, bushfire management measures would minimise the risk of bushfire indirectly impacting habitat which may be used by this species.

In regard to the impacts from the Approved Mine, Niche (2013) assessed the potential impacts on this species and concluded that the Approved Mine was unlikely to significantly impact this species as the potential habitat to be removed (approximately 273 ha of woodland) represented poor quality habitat for the local population of Squirrel Glider near the Namoi River.

The Project is unlikely to have an adverse impact on the lifecycle of the Squirrel Glider such that a viable local population of the species is likely to be placed at risk of extinction because:

- the Squirrel Glider has been recorded using habitat within the NSW Assessment Footprint;
- much of the habitat to be cleared in the NSW Assessment Footprint has been subject to past disturbances (such as logging); and
- the riparian woodland along the Namoi River which represents potential habitat for the Squirrel Glider and is continuous, suggesting the local population is extensive.

Questions (b) and (c) are not relevant to this species.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The Project would result in the clearance of approximately 74.7 ha of woodland/ forest habitat (comprising numerous fragmented patches and 0.5 ha of scattered paddock trees (predominately White Box) in secondary/derived native grassland) which provide potential habitat for the Squirrel Glider (Figures 15 and 24).

While clearing of potential habitat would occur as a result of the Project, the nature of clearing would reduce the area of habitat rather than further fragment or isolate it. Remnant native vegetation within the NSW Assessment Footprint comprises numerous small, isolated, more or less thinned patches, most of which have no continuous connecting corridors to larger regional remnants.

The removal of potential Squirrel Glider habitat in the NSW Assessment Footprint is likely to have a minimal impact on this species in the locality and surrounding region, if at all, as larger areas of similar and better habitat would continue to be available in the landscape (e.g. the Pilliga Forests and the Kaputar complex, among others) (Figure 16).

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The Critical Habitat Register (OEH, 2016) does not list any critical habitat for this species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No recovery plan has been developed for the Squirrel Glider, however, recovery strategies for this species are listed on its threatened species profile (OEH, 2018). The Project involves the clearance of some potential Squirrel Glider habitat as well as a commitment to offset native vegetation clearance in accordance with NSW Offset Policy (OEH, 2014b). The Project would not be inconsistent with the recovery strategies listed for this species because it would result in a greater area of potential habitat being managed and conserved in perpetuity.

The Project would be consistent with the *NSW Fox Threat Abatement Plan 2010* (OEH, 2010), given feral animal control strategies would be implemented for the Project to minimise the impacts from introduced fauna species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Project would result in *Clearing of native vegetation*, *Removal of dead wood and dead trees* and *Loss of hollow-bearing trees* which are all key threatening processes applicable to the Squirrel Glider. Approximately 74.7 ha of woodland/forest habitat (comprising numerous fragmented patches) and 0.5 ha of scattered paddock trees which provide potential habitat for this species would be cleared in the NSW Assessment Footprint.

Predation by the European red fox (Vulpes vulpes) and *Predation by the feral cat (Felis catus)* are also key threatening processes applicable to the Squirrel Glider. Feral animal control strategies would be implemented to monitor and control feral animals (such as the Feral Cat and European Red Fox) and reduce the likelihood of these species increasing in abundance due to the Project.

Inappropriate fire regimes are another known threat to the Squirrel Glider (OEH, 2018) and are part of the key threatening process *High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition*. Bushfire management measures for the Project would include bushfire controls and emergency response, thus minimising the threat of bushfire.

Outcome

The Project is unlikely to significantly impact the Squirrel Glider as:

- much of the known and potential habitat to be cleared has been subject to past disturbances (such as logging);
- similar (and better) potential habitat for this species is more widespread in the landscape outside the NSW Assessment Footprint (e.g. within the Leard State Forest and Pilliga Forests); and
- Squirrel Glider records are widespread in the landscape outside the NSW Assessment Footprint, as demonstrated by numerous Squirrel Gliders records in the wider surrounds (Figure 16).

A2.3.10 Hollow-roosting Bats

This section provides an assessment of the potential impacts on the following hollow-roosting bats which are known or likely to occur within the NSW Assessment Footprint:

- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*).
- Eastern Freetail-bat (*Mormopterus norfolkensis*).
- Corben's Long-eared Bat (*Nyctophilus corbeni*).
- Little Pied Bat (*Chalinolobus picatus*).

Each of the above species is listed as 'Vulnerable' under the BC Act.

The Corben's Long-eared Bat is specifically nominated in the Project SEARs as a protected matter relating to a controlling provision and therefore, within the assessment below, further consideration is given to the impacts on the Corben's Long-eared Bat in accordance with the FBA (OEH, 2014a).

Further consideration is also given to the impacts on the Corben's Long-eared Bat in Attachment B in relation to the EPBC Act.

Introduction

The Project is not at the limits of these species' known distributions. The Yellow-bellied Sheathtail-bat has been recorded within the NSW Assessment Footprint by Future Ecology (2018) and previously by Cenwest (2011). Calls of the Corben's Long-eared Bat were also possibly recorded within the NSW Assessment Footprint by Future Ecology (2018), however, the calls could not be distinguished from other non-threatened bat species. A single database record for the Eastern Freetail-bat exists within the NSW Assessment Footprint (OEH, 2017b). This record is from 2000 (i.e. it is 18 years old) and has an accuracy of 1,000 m, indicating that the exact location of the record may have been outside the NSW Assessment Footprint. The Little Pied Bat has been recorded in the surrounds, but not within the NSW Assessment Footprint. Potential habitat for each of these species occurs within the NSW Assessment Footprint (Table A9).

Assessment of Significance

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The primary adverse impact on these bat species associated with the Project is the clearance of known/potential habitat, including the removal of hollow-bearing trees (i.e. potential roosting habitat). For these hollow-roosting bat species, all land within the NSW Assessment Footprint would provide potential foraging resources, including woodland/forests, secondary/derived native grasslands and waterbodies. The woodland/forest habitats would potentially provide roosting habitat. All woodland and forest vegetation types in the NSW Assessment Footprint (approximately 77.8 ha) and secondary/derived native grasslands (approximately 502 ha) provide potential habitat for these species.

The NSW Assessment Footprint contains no caves, or cave-like structures, which could potentially provide additional secondary roost habitat for the Little Pied Bat.

Table A9
Hollow-roosting Bats – Species Information and Records

Species Name	Common Name	Conservation Status under the BC Act	Species Information	Records
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	The Yellow-bellied Sheathtail-bat lives in most habitats, including wet and dry sclerophyll forest, open woodland, Acacia shrubland, Mallee, grasslands and desert (Churchill, 2008). It roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows (OEH, 2018). In eucalypt forests the Yellow-bellied Sheathtail-bat feeds above the canopy, but will feed lower to the ground in Mallee or open habitats (Van Dyck and Strahan, 2008). This species predominately eats beetles, but also consumes grasshoppers, crickets, leafhoppers, shield bugs, wasps and a few flying ants (Churchill, 2008).	This species has been recorded throughout, and surrounding, the NSW Assessment Footprint (Figures 8 and 9). The records include a combination of database records (OEH, 2017b) and more than 10 previous survey records (Niche, 2013; Cenwest, 2011). Most recently this species was recorded at 10 of the 12 survey sites undertaken by Future Ecology (2018) during fauna surveys undertaken for the Project within both woodland and grassland habitat.
Mormopterus norfolkensis	Eastern Freetail-bat	V	The Eastern Freetail-bat is generally found in dry sclerophyll forest and woodland east of the Great Dividing Range (Churchill, 2008). This species prefers open spaces in woodland or forest and is generally more active in the upper slopes of forest areas rather than in riparian zones (Churchill, 2008). It roosts in tree hollows usually in large, mature trees, but will also roost under bark or in man-made structures (Churchill, 2008). The Eastern Freetail-bat forages predominantly on bugs, flies and beetles and prefers to catch prey in the spaces between trees (Churchill, 2008).	One database record for this species, dated March 2000, occurs within the NSW Assessment Footprint (Figures 8 and 9). Other than this individual record, there are no database records of this species within approximately 75 km of the NSW Assessment Footprint (OEH, 2017b).
Nyctophilus corbeni	Corben's Long-eared Bat	V	Inhabits a variety of vegetation types, including mallee, bulloke *Allocasuarina leuhmanni* and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland (OEH, 2018). OEH (2018) describes that the Pilliga Scrub region in NSW is the distinct stronghold for this species. This species inhabits dry woodlands and the River Red Gum communities of major watercourses (Van Dyck and Strahan, 2008). The species is quite flexible in its roost selection, but prefers tree hollows, exfoliating bark or dense foliage (Lunney *et al.*, 1988). The Corben's Long-eared Bat forages for large moths and beetles over water or in arid habitats (Hall and Richards, 1979; Richards, 1983).	This species has not been recorded within the NSW Assessment Footprint. The calls of *Nyctophilus corbeni* recorded with an Anabat detector cannot be distinguished from calls of other *Nyctophilus* sp. that are also potentially present in the area. Calls of *Nyctophilus* sp. (potentially the Corben's Long-eared Bat) were recorded in October 2015 surrounding the NSW Assessment Footprint (Future Ecology, 2018). Database records for the Corben's Long-eared Bat are widespread within the wider locality and are primarily located within vegetated areas (e.g. Pilliga East State Forest).
Chalinolobus picatus	Little Pied Bat	V	The Little Pied Bat inhabits dry open forest, open woodland, Mulga woodlands, chenopod shrublands, Callitris forest and Casuarina pauper woodlands (Churchill, 2008). This species roosts in trees, caves, abandoned mines and buildings (Churchill, 2008). In arid or semi-arid environments, the Little Pied Bat forages on insects and may occur near permanent or semi-permanent water (Duncan *et al*., 1999). Flexibility in foraging habitat is also known as this species is distributed in open areas in semi-arid and arid zones.	This species has not previously been recorded in the NSW Assessment Footprint. Two database records of this species are located in the south-eastern corner of the Vickery State Forest, outside the NSW Assessment Footprint (Figure 8). Other database records within the wider locality are primarily located within vegetated areas (e.g. Pilliga East State Forest).

It is unlikely that these hollow-roosting bats would be indirectly disturbed by most types of indirect impacts which may occur from the Project (such as noise and feral animals - assessed in Section 5.1.3 of the Main Text), although it is possible that these hollow-roosting bats could be disturbed indirectly if they were to be attracted to artificial lighting (assessed in Section 5.1.3 of the Main Text).

In regard to the impacts from the Approved Mine, Niche (2013) assessed the potential impacts on the same threatened hollow-dwelling bats and concluded that the Approved Mine was unlikely to significantly impact these species because of the habitat to be removed (approximately 273 ha of foraging and breeding) represents a relevantly small proportion of the habitat present in the wider locality. The change in cumulative impact on these species as a result of the Project (considering impacts from other surrounding developments [Section 5.1.4 of the Main Text]) is considered to be minimal as similar habitat is more abundant in the surrounding landscapes.

The Project is unlikely to have an adverse impact on the lifecycle of any of these species such that a viable local population is likely to be placed at risk of extinction because:

- much of the known and potential habitat to be cleared has been subject to past disturbances (such as logging);
- similar (and better) potential habitat for these species is more widespread in the landscape outside the NSW Assessment Footprint; and
- these species are widespread in the landscape outside the NSW Assessment Footprint, as demonstrated by numerous records in the wider surrounds (OEH, 2017b) (e.g. the Yellow-bellied Sheathtail-bat and Little Pied Bat have been recorded in Vickery State Forest and along the Namoi River).

Questions (b) and (c) are not relevant to these species.

(d) In relation to the habitat of a threatened species, population or ecological community:

- ***(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;***
- ***(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and***
- ***(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

All woodland and forest vegetation types in the NSW Assessment Footprint (sum of approximately 77.8 ha [comprising numerous fragmented patches]) and native grasslands (approximately 502 ha) provide potential habitat for these species.

The Project would reduce the area of foraging habitat for hollow-roosting bats rather than fragment it or isolate it due to the mobility of the species.

Removal of 579.8 ha of potential foraging and/or roosting habitat is likely to have a limited impact on these species, if at all, as significant areas of similar or better habitat would continue to be available in the locality and wider region (e.g. many remnant woodlots on farmland, the Namoi River riparian corridor and larger forest and woodland blocks including the Vickery State Forest and Boonalla State Conservation Area).

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The Critical Habitat Register (OEH, 2016) does not list any critical habitat for these species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No recovery plan has been developed for these bat species, however, recovery strategies for these species are listed on their threatened species profiles (OEH, 2018). The Project involves the clearance of some potential habitat for these species as well as a commitment to offset native vegetation clearance in accordance with NSW Offset Policy (OEH, 2014b). The Project would not be inconsistent with the recovery strategies listed for these species because it would result in a greater area of potential habitat being managed and conserved in perpetuity.

The Project would be consistent with the *NSW Fox Threat Abatement Plan 2010* (OEH, 2010), given feral animal control strategies would be implemented for the Project to minimise the impacts from introduced fauna species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Project would result in *clearing of native vegetation*, *Removal of dead wood and dead trees*, *Loss of hollow-bearing trees* and *Bushrock Removal* which are all key threatening processes applicable to these bat species. All woodland and forest vegetation types in the NSW Assessment Footprint (sum of approximately 77.8 ha) and native grasslands (approximately 502 ha) provide potential habitat for these species. The cleared land would be progressively rehabilitated over the life of the Project (with approximately 530 ha of woodland/forest on the post mine landforms associated with the NSW Assessment Footprint), and the vegetation loss would be offset, resulting in a net gain in habitat as a consequence of the Project.

Predation by the European red fox (Vulpes vulpes) and *Predation by the feral cat (Felis catus)* are also key threatening processes applicable to these bat species. Feral animal control strategies would be implemented to monitor and control feral animals (such as the Feral Cat and European Red Fox) and reduce the likelihood of these species increasing in abundance due to the Project.

Inappropriate fire regimes are another known threat to Corben's Long-eared Bat and the Little Pied Bat (OEH, 2018), and are part of the key threatening process *High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition*. Bushfire management measures for the Project would include bushfire controls and emergency response, thus minimising the threat of bushfire.

Outcome

The Project is unlikely to significantly impact these hollow-dwelling bats as:

- much of the known and potential habitat to be cleared has been subject to past disturbances (such as logging);

- similar (and better) potential habitat for these species is more widespread in the landscape outside the NSW Assessment Footprint; and
- these species are widespread in the landscape outside the NSW Assessment Footprint, as demonstrated by numerous records in the wider surrounds (OEH, 2017b) (e.g. the Yellow-bellied Sheathtail-bat and Little Pied Bat have been recorded in Vickery State Forest and along the Namoi River).

Measures that would be used to minimise potential impacts on hollow-dwelling bats during vegetation clearance include:

- clearing of hollow bearing trees would, where practicable, be restricted to late summer and autumn (Whitehaven, 2013); and
- suitably trained or qualified person(s) would be present during the felling of identified hollow bearing trees to provide assistance with the identification, and if necessary, rescue and care of any injured fauna.

In addition to the above, the offset liability for clearance of habitat for these species has been calculated using the FBA (OEH, 2014a) and an offset would be provided in accordance with NSW Offset Policy (OEH, 2014b).

In consideration of Section 9.2.5.2 of the FBA (OEH, 2014a), the Project would:

- not cause the extinction of the Corben's Long-eared Bat from an IBRA subregion; and
- not significantly reduce the viability of the Corben's Long-eared Bat.

A2.3.11 Cave-roosting Bats

This section provides an assessment on the potential impacts on the following cave-roosting bats which are known or likely to occur within the NSW Assessment Footprint:

- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*).
- Large-eared Pied Bat (*Chalinolobus dwyeri*).
- Eastern Cave Bat (*Vespadelus troughtoni*).

Each of the above species is listed as 'Vulnerable' under the BC Act.

The Large-eared Pied Bat is specifically nominated in the Project SEARs as a protected matter relating to a controlling provision and therefore, within the assessment below, further consideration is given to the impacts on the Large-eared Pied Bat in accordance with the FBA (OEH, 2014a). Further consideration is given to the impacts on the Large-eared Pied Bat in Attachment B in relation to the EPBC Act.

Introduction

The Project is not at the limits of these species' known distributions. The Eastern Bentwing-bat has been recorded within woodland habitat in the NSW Assessment Footprint and the Eastern Cave Bat has been recorded within vegetation which continues into the NSW Assessment Footprint (Future Ecology, 2018) (Figures 8 and 9). The Large-eared Pied Bat has not been recorded within the NSW Assessment Footprint or surrounds. Potential foraging habitat for all three of these species occurs within the NSW Assessment Footprint (Table A10). Caves and cave-like structures suitable the roosting of these species are absent.

The closest area of potentially suitable roosting habitat is located within the Boggabri Offset Area, approximately 5 km to the west of the Project rail spur, and approximately 15 km north-west of the Project mining area. The Project would not result in the removal of these caves, nor would any indirect impacts as a result of mining activities (i.e. noise, dust, vibration) adversely impact these caves (or any bats roosting within).

Table A10
Cave-roosting Bats – Species Information and Records

Species Name	Common Name	Conservation Status under the BC Act	Species Information	Records
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	The Eastern Bentwing-bat forms discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young (OEH, 2018). Maternity caves have specific temperature and humidity regimes (OEH, 2018). This species hunts in forested areas catching moths and other flying insects above the tree tops (OEH, 2018). At Richmond Range in NSW moths were found to be the dominant prey item with few flies, cockroaches and beetles (Churchill, 2008). They can forage long distances from the roost site and several marked females have travelled up to 65 km in one night (Churchill, 2008).	This species was recorded in woodland habitat within the NSW Assessment Footprint by Future Ecology (2018) (Figures 8 and 9). It was also potentially recorded by Niche (2013) within the Approved Mine extent (i.e. outside the NSW Assessment Footprint). Additional database records of this species occur within the wider surrounds. The closest of which is in the Leard State Forest, approximately 10 km north of the NSW Assessment Footprint.
Chalinolobus dwyeri	Large-eared Pied Bat	V	This species roosts in caves. The females give birth to one or two young during late November and early December and are suckled until late January (Van Dyck and Strahan, 2008). Females have been recorded raising young in maternity roosts from November through to January in roof domes in sandstone caves. They remain loyal to the same cave over many years (OEH, 2018). The combination of relatively short, broad wings and a low weight per unit area of wing is indicative of manoeuvrable flight (Van Dyck and Strahan, 2008). This species probably forages for small, flying insects below the forest canopy (OEH, 2018). Colony numbers are typically fewer than 10 individuals, although up to 80 have been recorded at some roosts (Van Dyck and Strahan, 2008).	This species has not been recorded within the NSW Assessment Footprint. Future Ecology (2018) possibly recorded a Large-eared Pied Bat, via bat recording devices outside the NSW Assessment Footprint, however, the calls could not be distinguished from other non-threatened bat species. The Large-eared Pied Bat has potentially been recorded within the woodland habitat adjoining the southern extent of the Vickery State Forest, outside the NSW Assessment Footprint by Niche (2013). Database records for this species are widespread within the wider locality and are primarily located within vegetated areas (e.g. Leard State Forest and Pilliga East State Forest).
Vespadelus troughtoni	Eastern Cave Bat	V	A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs and has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals (OEH, 2018). The capture of pregnant females indicates that births occur in NSW in mid to late November (Churchill, 2008). This species is known to forage over small areas (~30 ha) (Churchill, 2008). In NSW, maternity colonies of up to 500 females congregate during November (Van Dyck and Strahan, 2008).	The Eastern Cave Bat has been recorded by Future Ecology (2018) within vegetation which continues into the NSW Assessment Footprint. The nearest database records for this species are near Boggabri and the Leard State Forest, approximately 20 km north-west of the NSW Assessment Footprint (OEH, 2017b). Numerous other database records occur further to the west, within the Pilliga East State Forest and Pilliga Nature Reserve (OEH, 2017b).

In addition, suitable forging habitat for these species would be more prevalent in close proximity to these caves compared to within the NSW Assessment Footprint.

Assessment of Significance

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

These cave-roosting bats are unlikely to be indirectly impacted by the Project given the absence of adjacent breeding habitat (caves). It is possible, however, that these bats could be disturbed indirectly if they were attracted to artificial lighting used for the Project (assessed in Section 5.1.3 of the Main Text), but this is unlikely to result in permanent harm to individuals.

The change in cumulative impact on these species as a result of the Project (considering impacts from other surrounding developments [Section 5.1.4 of the Main Text]) is considered to be minimal given no roosting or breeding habitat would be removed in the NSW Assessment Footprint and the foraging habitat are all more widely occurring in the surrounding landscape.

The Project is unlikely to have an adverse impact on the lifecycle of any of these species such that a viable local population is likely to be placed at risk of extinction because:

- no roosts (caves) would be disturbed by the Project;
- cave-roosting bats would not be present in vegetation during land clearance activities;
- the local population of these species should be regarded as the occupants of a particular roost site rather than the occupants of a particular foraging area;
- similar foraging habitat for these species is more widespread in the landscape outside the NSW Assessment Footprint; and
- these species are widespread in the landscape outside the NSW Assessment Footprint, as demonstrated by numerous records in the wider surrounds (OEH, 2017b).

The Project would result in the removal of potential foraging habitat for these species but is very unlikely to cause physical harm to individuals, given the highly mobile nature of each of these species and the lack of roosting habitat on the NSW Assessment Footprint.

Questions (b) and (c) are not relevant to these species.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Potential foraging habitat for each of these species would be cleared in the NSW Assessment Footprint, consisting of 77.8 ha of woodland/forest habitat (comprising numerous fragmented patches). The Project would reduce the area of foraging habitat for cave-roosting bats rather than further fragmenting or isolating it due to the mobility of the species

The removal of known and potential foraging habitat is likely to have a limited impact on these species, if at all, as large areas of similar or better habitat would continue to be available in the wider region (e.g. the Vickery State Forest, Pilliga Forests, Kaputar complex and Boonalla State Conservation Area).

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The Critical Habitat Register (OEH, 2016) does not list any critical habitat for these species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No recovery plan has been developed for these bat species, however, recovery strategies for this species are listed on the threatened species profile (OEH, 2018). The Project involves the clearance of some potential habitat for these species as well as a commitment to offset native vegetation clearance in accordance with NSW Offset Policy (OEH, 2014b). The Project would not be inconsistent with the recovery strategies listed for these species because it would result in a greater area of potential habitat being managed and conserved in perpetuity.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Project would result in *clearing of native vegetation*, *Removal of dead wood and dead trees*, *Loss of hollow-bearing trees* and *Bushrock Removal* which are all key threatening processes applicable to these bat species. Approximately 77.8 ha of potential foraging habitat for these species would be cleared in the NSW Assessment Footprint. The cleared land would be progressively rehabilitated over the life of the Project (with approximately 482 ha of woodland/forest on the post mine landforms associated with the NSW Assessment Footprint), and the vegetation loss would be offset, resulting in a net gain in habitat as a consequence of the Project.

Innapropriate fire regimes are another known threat to these bat species (OEH, 2018) and are part of the key threatening process *High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition*. Bushfire management measures for the Project would include bushfire controls and emergency response, thus minimising the threat of bushfire.

Outcome

The Project is unlikely to significantly impact these cave-roosting bats as:

- no roosts (caves) would be disturbed by the Project;
- cave-roosting bats would not be present in vegetation during land clearance activities;

- similar foraging habitat for these species is more widespread in the landscape outside the NSW Assessment Footprint; and
- these species are widespread in the landscape outside the NSW Assessment Footprint, as demonstrated by numerous records in the wider surrounds (OEH, 2017b).

In addition to the above, the offset liability for clearance of habitat for these species has been calculated using the FBA (OEH, 2014a) and an offset would be provided in accordance with NSW Offset Policy (OEH, 2014b). In consideration of Section 9.2.5.2 of the FBA (OEH, 2014a), the Project would:

- not cause the extinction of the Large-eared Pied Bat from an IBRA subregion; and
- not significantly reduce the viability of the Large-eared Pied Bat.

A3 CONCLUSION

Assessments of Significance in accordance with section 5A of the EP&A Act were undertaken to evaluate the significance of impacts on threatened species and communities listed under the BC Act. It was concluded that the Project is not likely to have a significant impact on any threatened species or communities listed under the BC Act.

A4 REFERENCES

Aumann, T. (2001) Breeding biology of raptors in riparian environments in the south-west of the Northern Territory, Australia. *Emu,* **101,** 305-315.

Birdlife Australia (2017) *Birdlife Australia database search within the following area: -30.7, 150.2; -30.7, 150.4; -30.9, 150.2; -30.9, 150.4.* Data Received: November 2017.

Cenwest Environmental Services (2011), *Vickery Coal Project Baseline Fauna Survey*, Cenwest Environmental Services, Bathurst New South Wales, September 2011.

Churchill, S. (2008) *Australian Bats*. Second Edition. Allen & Unwin, Crows Nest, NSW, Australia.

Clout, M.N. (1989) Foraging Behaviour of Glossy Black-cockatoos. *Aust. Wildlife Res*., 16, 467-473.

Cooney, S.J.N. and Watson, D.M. (2005) Diamond Firetails (*Stagonopleura guttata*) Preferentially Nest in Mistletoe. *Emu*, 105, 315-322.

Crowley, G.M., Garnett, S.T. and Pedler, L.P. (1999) *Assessment of the Role of Captive Breeding and translocation in the Recovery of the South Australian Subspecies of the Glossy Black-Cockatoo (Calyptorhynchus lathami halmaturinus).* Birds Australia Report No. 5. Birds Australia, Melbourne.

Debus, S.J.S. (1997) The Barking Owl in New South Wales. *Australian Birds,* 30, 53-80.

Debus, S.J.S., Hatfield, T.S., Ley, A.J. and Rose, A.B. (2007) Breeding biology and diet of the Little Eagle *Hieraaetus morphnoides* in the New England region of New South Wales. *Australian Field Ornithology,* 24**,** 137-157.

Department of Environment and Climate Change (2007) *Threatened Species Assessment Guidelines – The Assessment of Significance.*

Department of Environment and Climate Change (2008) *NSW State Recovery Plan for the Koala.*

Department of Environment and Conservation (2006) *Approved NSW Recovery Plan for the Large Forest Owls: Powerful Owl (Ninox strenua), Sooty Owl (Tyto tenebricosa) and Masked Owl (Tyto novaehollandiae).*

Department of the Environment and Energy (2016) *Threat Abatement Plan for competition and land degradation by rabbits.*

Department of the Environment and Energy (2017) *Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (Sus scrofa)*(2017).

Department of the Environment (2016) *National Recovery Plan for the Regent Honeyeater (Anthochaera phrygia).* Duncan, A., Baker, G.B. and Montgomery, N. (1999) *The Action Plan for Australian Bats*. Environment Australia, Australia.

FloraSearch (2018) *Vickery Extension Project Baseline Flora Survey Report*. Report Prepared for Whitehaven Coal Limited.

Franklin, D.C., Menkhorst, P.W. and Robinson, J.L. (1988) Ecology of the Regent Honeyeater *Xanthomyza Phrygia. Emu,* 89(3), 140-154.

Future Ecology (2018) *Vickery Extension Project Baseline Fauna Survey Report*. Report Prepared for Whitehaven Coal Limited.

Garnett, S.T. and Crowley, G.M. (2000) *The Action Plan for Australian Birds*. Environment Australia, Australia.

Garnett, S.T., Szabo, J.K. and Dutson, G. (2011) *The Action Plan for Australian Birds 2010*. CSIRO Publishing, Australia.

Glossy Black Conservancy (2010) *Glossy Black-Cockatoo Conservation Guidelines for South-Eastern Queensland and Far North-Eastern New South Wales*.

Gunnedah Shire Council (2015) *Gunnedah Koala Strategy.*

Hall, L.S. and Richards, G.C. (1979) *The Bats of Eastern Australia.* Queensland Museum Booklet No. 12.

Hollands, D. (1991) *Birds of the Night Owls, Frogmouths and Nightjars of Australia*. Reed, Sydney.

Hunter Eco (2018) *Offset Areas 6, 7 and 8 Biobanking Assessment Report*. Prepared for Whitehaven Coal.

Kendall and Kendall (2011) *Vickery South Coal Project - Fauna Assessment Briefing Note.* Unpublished report prepared for R.W. Corkery & Co. Pty Limited.

Lindsey, T.R. (1992) *Encyclopaedia of Australian Animals: Birds*. The Australian Museum, Sydney.

Lollback, G.W., Ford, H.A. and Cairns, S.C. (2008) Is the uncommon Black-chinned Honeyeater a more specialised forager than the co-occurring and common Fuscous Honeyeater? *Emu,* 108, 125-132.

Lunney, D., Barker, J., Priddel, D. and O'Connel, M. (1988) Roost Selection by Gould's Long-eared Bat [sic] *Nyctophilus gouldi* Tones (Microchiroptera: Vespertilionidae) in a Logged Forest on the South Coast of New South Wales. *Australian Wildlife Research,* 15, 375-384.

Marchant, S. and Higgins, P.J. (Eds.) (1993) *Handbook of Australian, New Zealand and Antarctic Birds (HANZAB): Volume 2, Raptors to Lapwings*. Oxford University Press, Melbourne.

Mavromihalis, J. (2010) *National Recovery Plan for the Winged Peppercress (Lepidium monoplocoides).*

Morcombe, M. (2004) *Field Guide to Australian Birds*. Steve Parish Publishing Pty Ltd, Archerfield, Australia.

National Parks and Wildlife Service (2003) *Draft Recovery Plan for the Barking Owl Ninox connivens.* Draft for Public Comment. February 2003.Natural Resource Management Ministerial Council (2009) *National Koala Conservation and Management Strategy 2009-2014.*

New South Wales Scientific Commitee (2008) *Squirrel Glider Petaurus norfolcensis Review of Current Information in NSW August 2008*

New South Wales Scientific Commitee (2009) *Square-tailed Kite Lophoictinia isura Review of Current Information in NSW June 2009*

New South Wales Scientific Committee (2016) *Final Determination: Dusky Woodswallow Artamus cyanopterus cyanopterus*.

Niche Environment and Heritage (2013) *Vickery Coal Project Environmental Impact Statement. Appendix E: Ecological Assessment.* Whitehaven Coal, Sydney.

North West Ecological Services (2016) *Gunnedah Koala Conservation Plan for the Landcare and Community Groups*. Report prepared for North West Local Land Services.

Noske, R.A. (1998) Social Organisation and Nesting Biology of the Cooperatively-breeding Varied Sittella *Daphoenositta chrysoptera* in North-eastern New South Wales*. Emu,* 98, 85-96.

Office of Environment and Heritage (2010) *NSW Fox Threat Abatement Plan 2010.*

Office of Environment and Heritage (2014a) *Framework for biodiversity Assessment. NSW Biodiversity Offsets Policy for Major Projects.*

Office of Environment and Heritage (2014b) NSW *Biodiversity Offsets Policy for Major Projects.*

Office of Environment and Heritage (2016) *Critical Habitat Register*.

Office of Environment and Heritage (2017a) *Archived BioMetric and Threatened Species Profiles Datasets*.

Office of Environment and Heritage (2017b) *BioNet Atlas of NSW Wildlife – Database Records for The Following Area: -30.45, 150.64; -30.45, 149.89; -31.02, 149.89; 31.02, 150.64*

Office of Environment and Heritage (2018a) *Threatened Biodiversity Data Collection*.

Olsen, J., Debus. S., Judge. D., (2012) *Declining Little Eagles Hieraaetus morphnoides and increasing rabbit numbers near Canberra: is secondary poisoning by Pindone the problem?* Corella, 2013, 37(2): 33–35.

Pizzey, G. and Knight, F. (1999) *Field Guide to the Birds of Australia*. Harper Collins Publishers, Sydney, Australia.

Priday, S.D. (2010) Beyond the 'woody remnant' paradigm in conservation of woodland birds: habitat requirements of the Hooded Robin (*Melanodryas cucullata cucullata*). *Emu,* 110, 118-124.

Richards, G.C. (1983) *Greater Long Eared Bat.* In Strahan, R. (Ed.) (1983) *The Complete Book of Australian Mammals*. Angus and Robertson Publishers, Sydney.

RPS Harper Somers O'Sullivan (2010) *Flora and Fauna Assessment for Proposed Rocglen Coal Mine Extension Project.*

Saunders, P. and Tzaros, C. (2011) *National Recovery Plan for the Swift Parrot (Lathamus discolour).*

Simpson, K. and Day, N. (1999) *Field Guide to the Birds of Australia*. Sixth Edition, Penguin Books Australia Ltd, Camberwell, Victoria.

Smith, A.P. and Murray, M. (2003) Habitat requirements of the Squirrel Glider (*Petaurus norfolcensis*) and associated possums and gliders on the New South Wales central coast. *Wildlife Research,* 30, 291-3015.

Thomas, R., Thomas, S., Andrew, D. and McBride, A. (2011) *The Complete Guide to Finding the Birds of Australia.* Second Edition. CSIRO Publishing, Collingwood, Australia.

van der Ree, R., Bennett AF. and Gilmore DC. (2003) *Gap-crossing by gliding marsupials: thresholds for use of isolated woodland patches in an agricultural landscape.*

Van Dyck, S. and Strahan, R. (2008) *The Mammals of Australia.* Third Edition. Reed New Holland, Australia.

Whitehaven Coal Limited (2013) *Vickery Extension Project Environmental Impact Statement.*

Wilson, S. and Swan, G. (2003) *A Complete Guide to Reptiles of Australia*. Reed New Holland, Sydney.

ATTACHMENT B

MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

TABLE OF CONTENTS

LIST OF TABLES

B1 INTRODUCTION

The Vickery Coal Project (EPBC 2012/6263) was previously referred under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) in January 2012 and was determined to be not a controlled action if implemented in a particular manner (EPBC 2012/6263). The decision stipulated measures to be undertaken to avoid significant impacts on the Winged Peppercress (*Lepidium monoplocoides*), a listed threatened flora species.

On 12 February 2016, the Vickery Extension Project (the Project) was referred under the EPBC Act (EPBC 2016/7649). The referred Project does not include the components and operations of the Vickery Coal Project (EPBC 2012/6263).

On 14 April 2016, a delegate of the Commonwealth Minister for the Environment declared the Project to be a controlled action for the purpose of the EPBC Act due to potential adverse impacts on the following controlling provisions under Part 3 of the EPBC Act:

- sections 18 and 18A of the EPBC Act (listed threatened species and communities); and
- sections 24D and 24E of the EPBC Act (a water resource, in relation to coal seam gas development and large coal mining development).

The Project is to be assessed under the assessment bilateral agreement with New South Wales (NSW). Accordingly, this document provides an assessment on the relevant EPBC Act listed threatened species and communities. Tables referred to throughout this attachment are included in the attachment text, however, figures referred to throughout this attachment are included within the main text of the Biodiversity Assessment Report and Biodiversity Offset Strategy (herein referred to as the Main Text).

The Commonwealth Department of the Environment's (DotE) comments in the Secretary's Environmental Assessment Requirements (SEARs) for the Environmental Impact Statement (EIS) relevant to threatened species and communities listed under the EPBC Act have been considered as outlined in Table B1. A full reconciliation of the DotE's comments in the SEARs is provided in the EIS.

Table B1
EPBC Act Assessment Requirements (Supplementary SEARs) – Reference Summary

Assessment Requirement[1]		Reference
The EIS must address the following issues:		
General Requirements		
6.	*an assessment of the relevant impacts of the action on (i) threatened species and communities and (ii) water resources; including:*	
	– *a description and detailed assessment of the nature and extent of the likely direct, indirect and consequential impacts, including short term and long term relevant impacts;*	Section B3 Section 5.5 of the Main Text
	– *a statement whether any relevant impacts are likely to be known, unpredictable or irreversible;*	Section B3
	– *analysis of the significance of the relevant impacts;*	Section B3
	– *a comparative description of the impacts of alternatives, if any, on the threatened species and communities.*	Sections B3 and B4 Sections 5.1 and 5.5 of the Main Text
7.	*Information on proposed avoidance and mitigation measures to manage the relevant impacts of the action including:*	
	– *a description of the proposed avoidance and mitigation measures to deal with the relevant impacts of the action;*	Section B4 Table B15
	– *assessment of the expected or predicted effectiveness of the mitigation measures;*	
	– *the cost of the mitigation measures;*	
	– *a description of the outcomes that the avoidance and mitigation measures will achieve; and*	
	– *a description of the offsets proposed to address the residual adverse significant impacts and how these offsets will be established.*	Section B5 Section 6 of the Main Text
Key Issues – Biodiversity		
8.	*The EIS must address the following issues in relation to Biodiversity including separate:*	
	– *identification of each EPBC Act listed threatened species and community likely to be significantly impacted by the development. Provide evidence why other EPBC Act listed threatened species and communities likely to be located in the project area or in the vicinity will not be significantly impacted in accordance with the Matters of National Environmental Significance - Significant Impact Guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999 (Significant Impact Guidelines).*	Sections B2 and B3
9.	*For each of the relevant EPBC Act listed threatened species and communities likely to be significantly impacted by the development the EIS must provide a separate:*	
	– *description of the habitat and habits (including identification and mapping of suitable breeding habitat, suitable foraging habitat, important populations and habitat critical for survival), with consideration of, and reference to, any relevant Commonwealth guidelines and policy statements including listing advice, conservation advice and recovery plans, threat abatement plans and wildlife conservation plans; and*	Sections B2 and B3 Figures 7, 10, 13, 15, 20 ,22 ,23 and 24

Table B1 (Continued)
EPBC Act Assessment Requirements (Supplementary SEARs) – Reference Summary

	Assessment Requirement[1]	Reference
	– *details of the scope, timing and methodology for studies or surveys used and how they are consistent with (or justification for divergence from) published Australian Government guidelines and policy statements.*	Section B2 and Attachments C and D to the Main Text
	– *description of the impacts of the action having regard to the full national extent of the species or community's range.*	Section B3
	[Note: the relevant guidelines and policy statements for each species and community are available from the Department of the Environment Species Profiles and Threats Database.http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl]	Section B2
10.	*For each of the relevant EPBC Act listed threatened species and communities likely to be significantly impacted by the development the EIS must provide a separate:* – *identification of significant residual adverse impacts likely to occur after the proposed activities to avoid and mitigate all impacts are taken into account.*	Sections B3 and B4
	– *details of how the current published NSW Framework for Biodiversity Assessment (FBA) has been applied in accordance with the objects of the EPBC Act to offset significant residual adverse impacts;*	Section B5 Section 6.2.4 of the Main Text
	– *details of the offset package to compensate for significant residual impacts including details of the credit profiles required to offset the development in accordance with the FBA and/or mapping and descriptions of the extent and condition of the relevant habitat and/or threatened communities occurring on proposed offset sites.*	Section B5 Sections 5.8 and 6.2.4 of the Main Text
	[Note: For the purposes of approval under the EPBC Act, it is a requirement that offsets directly contribute to the ongoing viability of the specific protected matter impacted by a proposed action i.e. 'like for like'. In applying the FBA, residual impacts on EPBC Act listed threatened ecological communities must be offset with Plant Community Type(s) (PCT) that are ascribed to the specific EPBC listed ecological community. PCTs from a different vegetation class will not generally be acceptable as offsets for EPBC listed communities.]	Section B5 Section 6.2.4 of the Main Text
11.	*Any significant residual impacts not addressed by the FBA may need to be addressed in accordance with the Environment Protection and Biodiversity Conservation Act 1999 Environmental Offset Policy. http://www.environment.gov.au/epbc/publications/epbc-act-environmental-offsets-policy.* *[Note if the EPBC Act Environmental Offset Policy is used to calculate proposed offsets for a threatened species or community you may wish to seek further advice from the Department of Planning and Environment.]*	Section B5 Section 6.2.4 of the Main Text
Attachment A		
	The Department of the Environment's Environment Reporting Tool (ERT) identifies that 20 listed threatened species and 5 listed ecological communities may occur within 5 km of the proposed action. Based on the information in the referral documentation, the location of the action, species records and likely habitat present in the area, the Department of the Environment considers that there are likely to be significant impacts to: – *Regent Honeyeater (Anthochaera phrygia) - Critically Endangered*	Section B2 Section B3.5
	– *Swift Parrot (Lathamus discolor) - Endangered*	Section B3.6
	– *Koala (Phascolarctos cinereus) - Vulnerable*	Section B3.8

Table B1 (Continued)
EPBC Act Assessment Requirements (Supplementary SEARs) – Reference Summary

	Assessment Requirement[1]	Reference
	The Department of the Environment considers there is some risk that there may be significant impacts on the matters listed below. In the circumstance that the proponent considers that these species and communities are not likely to be significantly impacted, this must be supported by evidential-based information and in accordance with the Matters of National Environmental Significance: Significant Impact Guidelines 1.1 (Dept of the Environment, 2013).	
	– *Corben's Long-eared Bat (Nyctophilus corbeni) – Vulnerable*	Section B3.9
	– *Large-eared Pied Bat, Large Pied Bat (Chalinolobus dwyeri) – Vulnerable*	Section B3.10
	– *Murray Cod (Maccullochella peelii) – Vulnerable*	Not assessed in this report – refer to Eco Logical Australia (2018)

[1] World Heritage properties, National Heritage places, wetlands of international importance (listed under the Ramsar Convention), migratory species protected under international agreements, Commonwealth marine areas, the Great Barrier Reef Marine Park and nuclear actions (including uranium mines) are not applicable to the action, as described in the EPBC Act Referral for the action and controlled action decision (EPBC 2016/7649).

B2 RELEVANT THREATENED SPECIES AND COMMUNITIES

Table B2 provides a list of threatened species and communities listed under the EPBC Act which are known from the wider locality from various sources (e.g. DEE, 2017a) as well as an evaluation as to whether the species/community or its habitat could be potentially impacted by the Project.

It is noted that the Project is not located within an 'Important Bird Area' as defined by Dutson *et al,* (2009). The closest 'Important Bird Area' is associated with the Pilliga, approximately 30 kilometres (km) west of the Project.

Table B2
Threatened Species Listed Under the EPBC Act

Common Name	Scientific Name	Conservation Status[1]	Is the Species or its Habitat Potentially Impacted by the Action?
Ecological Communities			
Weeping Myall Woodland		E	This community is not located within the Commonwealth Assessment Footprint.
Flora			
Ooline	*Cadellia pentastylis*	V	The Project is unlikely to impact this species given the absence of records in proximity to the Commonwealth Assessment Footprint and lack of preferred habitat.
-	*Euphrasia arguta*	CE	The Project is unlikely to impact this species given the absence of records in proximity to the Commonwealth Assessment Footprint and lack of preferred habitat.
Bluegrass	*Dichanthium setosum*	V	The Project is unlikely to impact this species given the absence of records in proximity to the Commonwealth Assessment Footprint and lack of preferred habitat.
Belson's Panic	*Homopholis belsonii*	V	Targeted searches did not identify the species within the Commonwealth Assessment Footprint. Potential habitat for this species may be impacted by the Project.
Winged Peppercress	*Lepidium monoplocoides*	E	Targeted searches did not identify the species within the Commonwealth Assessment Footprint. Potential habitat for this species may be impacted by the Project.
-	*Philotheca ericifolia*	V	The Project is unlikely to impact this species given the absence of records in proximity to the Commonwealth Assessment Footprint and lack of preferred habitat.
-	*Prasophyllum sp.* Wybong *(C. Phelps ORG 5269)*	CE	The Project is unlikely to impact this species given the absence of records in proximity to the Commonwealth Assessment Footprint and lack of preferred habitat.
Tarengo Leek Orchid	*Prasophyllum petilum*	E	The Project is unlikely to impact this species given the absence of records in proximity to the Commonwealth Assessment Footprint and lack of preferred habitat.
Slender Darling Pea	*Swainsona murrayana*	V	The Project is unlikely to impact this species given the absence of records in proximity to the Commonwealth Assessment Footprint and lack of preferred habitat.

Table B2 (Continued)
Threatened Species Listed Under the EPBC Act

Common Name	Scientific Name	Conservation Status[1]	Is the Species or its Habitat Potentially Impacted by the Action?
Austral Toadflax	*Thesium australe*	V	The Project is unlikely to impact this species given the absence of records in proximity to the Vickery Extension Project (EPBC 2016/7649) Footprint and lack of preferred habitat.
-	*Tylophora linearis*	E	Targeted searches did not identify the species within the Commonwealth Assessment Footprint. Potential habitat for this species may be impacted by the Project.
Amphibians			
Booroolong Frog	*Litoria booroolongensis*	E	The Project is unlikely to impact this species given the absence of records in proximity to the Commonwealth Assessment Footprint and lack of preferred habitat.
Reptiles			
Border Thick-tailed Gecko	*Underwoodisaurus sphyrurus*	V	The Project is unlikely to impact this species given the absence of records in proximity to the Commonwealth Assessment Footprint.
Pink-tailed Legless Lizard	*Aprasia parapulchella*	V	The Project is unlikely to impact this species given the absence of records in proximity to the Commonwealth Assessment Footprint.
Birds			
Malleefowl	*Leipoa ocellata*	V	The Project is unlikely to impact this species given the absence of records in proximity to the Commonwealth Assessment Footprint and lack of preferred habitat.
Australian Painted Snipe	*Rostratula australis*	E	The Project is unlikely to impact this species given the absence of records in proximity to the Commonwealth Assessment Footprint and lack of preferred habitat.
Swift Parrot	*Lathamus discolor*	CE*	Potential habitat for this species would be impacted.
Regent Honeyeater	*Anthochaera phrygia*	CE	Potential habitat for this species would be impacted.
Painted Honeyeater	*Grantiella picta*	V	Potential habitat for this species would be impacted.
Mammals			
Koala	*Phascolarctos cinereus*	V	Potential habitat for this species would be impacted.
Brush-tailed Rock-wallaby	*Petrogale penicillata*	V	The Project is unlikely to impact this species given the absence of records in proximity to the Commonwealth Assessment Footprint and lack of preferred habitat.
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	The Project is unlikely to impact this species given the absence of records in proximity to the Commonwealth Assessment Footprint.
Corben's Long-eared Bat	*Nyctophilus corbeni*	V	Potential habitat for this species would be impacted.
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	Potential habitat for this species would be impacted.

Highlighted species – relevant to the Commonwealth Assessment Footprint

[1] Threatened species status under the EPBC Act (current as at July 2018).

V = Vulnerable; E = Endangered; CE = Critically Endangered.

* Listed as Endangered under the EPBC Act at the time of the controlled action decision (14 April 2016) and therefore assessed as 'Endangered' not 'Critically Endangered' (refer section 158A of the EPBC Act).

The DotE comments in the SEARs for the EIS indicate that DotE (now Department of the Environment and Energy [DEE]) considers that there are likely to be significant impacts to:

- Regent Honeyeater (*Anthochaera phrygia*);
- Swift Parrot (*Lathamus discolour*); and
- Koala (*Phascolarctos cinereus*).

DotE (now DEE) also indicate that there is some risk that there may be significant impacts on:

- Corben's Long-eared Bat (*Nyctophilus corbeni*);
- Large-eared Pied Bat, Large Pied Bat (*Chalinolobus dwyeri*); and
- Murray cod (*Maccullochella peelii*).

The DotE comments in the SEARs for the EIS indicate that DotE (now DEE) considers that there are not likely to be significant impacts to:

- Box-Gum Woodland CEEC;
- Weeping Myall Woodland EEC;
- Winged Peppercress (*Lepidium monoplocoides*); and
- Painted Honeyeater (*Grantiella picta*).

The EPBC Act Referral lodged in February 2016 described the extent of proposed disturbance as 1,371 hectares (ha), however further refinements have been made to the Project. The EPBC Act Referral lodged in February 2016 presented two Rail Spur Investigation Corridors (Northern Rail Investigation Corridor and Western Rail Investigation Corridor). In 2018, Whitehaven notified DEE of a variation to the Action, to include the construction and operation of a Project rail loop and rail spur to connect the Project to the Werris Creek Mungindi Railway (herein referred to as the Project rail spur). The Project rail spur, and associated laydown areas, are proposed to be constructed in predominantly disturbed land (with minimal threatened species habitat) (Figure 20). The current extent of the proposed disturbance assessed under the EPBC Act is 984.4 ha (Table 36 main text).

The potential impacts of the Project on these Matters of National Environmental Significance are assessed in Section B3 in accordance with DotE (2013) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance* with the exception of the Murray Cod. The potential impacts from the Project on the Murray Cod are assessed in the *Vickery Extension Project Aquatic Ecology Assessment* (Eco Logical Australia, 2018).

Targeted Surveys

The species identified in Table B2 as unlikely to be affected by the action (and therefore not assessed in Section B3) all have a very low likelihood of occurring within the area of the Commonwealth Assessment Footprint which was not surveyed by FloraSearch (2018) or Future Ecology (2018) (with the exception of Bluegrass – discussed further below). This is due to the fact that no database records for any of these species occur within approximately 20 km of this area and none of them have been identified in the previous surveys undertaken within the Project locality (Section 2.3 of the Main Text).

The following best practice survey guidelines published by the Commonwealth Government were applied by Future Ecology (2018) during the fauna surveys:

- *Survey Guidelines for Australia's Threatened Reptiles* (Department of Sustainability, Environment, Water, Population and Communities, 2011a);
- *Survey Guidelines for Australia's Threatened Bats* (Department of Environment, Water, Heritage and the Arts [DEWHA], 2010a);
- *Survey Guidelines for Australia's Threatened Birds* (DEWHA, 2010b);
- *Survey Guidelines for Australia's Threatened Mammals* (Department of Sustainability, Environment, Water, Population and Communities, 2011b); and
- *Survey Guidelines for Australia's Threatened Frogs* (DEWHA, 2010c).

Targeted flora and fauna surveys were conducted by FloraSearch (2018) and Future Ecology (2018) for those threatened species listed in Table B2. For the nine threatened flora and fauna species which may be potentially impacted by the Project, Table B3 demonstrates how the surveys are consistent with the best practice survey guidelines published by the Commonwealth Government.

The fauna surveys for the Project did not occur within a season likely to detect the Swift Parrot. However, since this species is migratory a site survey could not rule out the potential for this species to use the potential habitat in the Commonwealth Assessment Footprint in any year. Therefore, the assessment considers that the Swift Parrot uses the habitat in the Commonwealth Assessment Footprint.

Relevant Plan/Agreements

Various plans/agreements have been considered including:

- *National Recovery Plan for the Swift Parrot (Lathamus discolor)* (Birds Australia, 2011).
- *EPBC Act Referral Guidelines for the Vulnerable Koala (combined populations of Queenland, New South Wales and the Australian Capital Territory*) (DotE, 2014).
- *Threat Abatement Plan for Competition and Land Degradation by Rabbits* (DEE, 2016).
- *Threat Abatement Plan for Predation by the European Red Fox* (DEWHA, 2008).
- *Threat Abatement Advice for Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs (Sus scrofa)* (2017) (DEE, 2017b).
- *National Recovery Plan for the Large-eared Pied Bat Chalinolobus dwyeri* (Department of Environment and Resource Management, 2011).
- *National Recovery Plan for the Regent Honeyeater (Anthochaera phrygia)* (DotE, 2016).
- *Approved Conservation Advice on Homopholis belsonii* (Threatened Species Scientific Committee, 2008a).
- *Commonwealth Conservation Advice on Tylophora linearis* (Threatened Species Scientific Committee, 2008b).
- *National Recovery Plan for the Winged Peppercress Lepidium monoplocoides* (Mavromihalis, 2010).
- *Commonwealth Listing Advice on Ten Species of Bats* (Threatened Species Scientific Committee, 2001).
- *Conservation Advice on Lathamus discolor (Swift Parrot)* (Threatened Species Scientific Committee, 2016).
- *Australia's Threatened Species Strategy* (DotE, 2015a).

- *Approved Conservation Advice on Phascolarctos cinereus (Combined Population in Queensland, New South Wales and the Australian Capital Territory (*Department of Sustainability, Environment, Water, Population and Communities, 2012).
- *Listing Advice for Phascolarctos cinereus (Koala)* (Threatened Species Scientific Committee, 2012a).
- *Threat Abatement Plan for Predation by Feral Cats* (DotE, 2015b).
- *Commonwealth Listing Advice on Chalinolobus dwyeri (Large-eared Pied Bat)* (Threatened Species Scientific Committee, 2012b).
- *Conservation Advice for Anthochaera phrygia (Regent Honeyeater)* (Threatened Species Scientific Committee, 2015a).
- *Commonwealth Listing Advice on Weeping Myall Woodlands* (Threatened Species Scientific Committee, 2009).
- *EPBC Act Policy Statement 3.17: Weeping Myall Woodlands* (DEWHA, 2009).
- *Conservation Advice for Grantiella picta (Painted Honeyeater)* (Threatened Species Scientific Committee, 2015b).
- *Conservation Advice for Nyctophilus corbeni (South-eastern Long-eared Bat)* (Threatened Species Scientific Committee, 2015c).
- *National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland* (Department of Environment, Climate Change and Water, 2010).
- *Commonwealth Listing Advice on White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* (Threatened Species Scientific Committee, 2006).
- *Approved Recovery Plan for the Koala (Phascolarctos cinereus) (Department of Environment and Climate Change [DECC], 2008).*

The Project is not inconsistent with any relevant recovery plans, conservation advice or agreements.

Table B3
Relevant Threatened Species and Communities Survey Effort

Common Name	Scientific Name	Conservation Status[1]	Survey Guideline Requirements	Survey Techniques Undertaken by Future Ecology	Survey Guidelines Met
Flora					
Belson's Panic	*Homopholis belsonii*	V	No species specific survey methodology defined.	FloraSearch undertook the following sampling techniques during appropriate survey timing for each species: 1. Detailed quadrat sampling (floristics and vegetation condition) in accordance with the NSW Framework for Biodiversity Assessment. 2. Random meander and targeted threatened species searches in suitable habitat. 3. Determination of the extent of occurrences and estimation of population sizes of any threatened species, if found.	N/A
Winged Peppercress	*Lepidium monoplocoides*	E			N/A
-	*Tylophora linearis*	E			N/A
Birds					
Regent Honeyeater	*Anthochaera Phrygia*	CE	Area searches or transect surveys (DEWHA, 2010b). Targeted searches of woodland patches with heavily flowering trees may be useful (DEWHA, 2010b).	Habitat assessments (to identify suitable foraging locations) and diurnal bird surveys were undertaken. Targeted searches were not undertaken as no areas of heavily flowering eucalypts were located within the study area.	✓
Painted Honeyeater	*Grantiella picta*	V	No species specific requirement defined.	Diurnal bird surveys were undertaken along with habitat assessments.	N/A
Mammals					
Koala	*Phascolarctos cinereus*	V	Diurnal (daytime) searching, nocturnal spotlighting, call playback and remote sensor activated cameras (DotE, 2014).	Diurnal habitat assessments (including searches for signs of activity such as scratches and scats), nocturnal spotlighting, call playback and camera trapping were undertaken. Specific Koala scat searches were undertaken using the spot technique.	✓
Corben's Long-eared Bat	*Nyctophilus corbeni*	V	Bat detection devices and harp trapping (DEWHA, 2010a).	Bat detection devices were used in conjunction with harp trapping.	✓
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	Bat detection devices and harp trapping/mist netting (DEWHA, 2010a).	Bat detection devices were used in conjunction with harp trapping.	✓

[1] Threatened fauna species status under the EPBC Act (current as at July 2018).

V = Vulnerable; E = Endangered; CE = Critically Endangered.

B3 IMPACTS ON THREATENED SPECIES AND COMMUNITIES LISTED UNDER THE EPBC ACT

A description of all relevant impacts of the Project (construction, operation and decommissioning) on flora and fauna are described in Section 5 of the Main Text. Cumulative impacts are described in Section 5.1.4 of the Main Text.

This section provides a detailed analysis of the nature and extent of the likely direct, indirect and consequential impacts relevant to specific protected matters, including likely short-term and long-term impacts. The assessments are in accordance with DotE (2013) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance*.

The impacts of the Project on protected matters are known or predictable. The majority of Commonwealth Assessment Footprint would be rehabilitated and revegetated (as described in Section 5.1.5 of the Main Text) with the exception of the final void. Final voids were approved as part of the existing Vickery Coal Project (the Approved Mine) and a single final void is proposed as part of the Project (Figure 34). As described in Section 5.1.3 of the Main Text, the final void has been designed to reduce the surface catchment to a minimum through the progressive placement of waste rock within the footprint of the open cut void and the use of up-catchment diversions and contour drains around their perimeter.

B3.1 WEEPING MYALL WOODLAND EEC

The Weeping Myall Woodlands occurs on the inland alluvial plains west of the Great Dividing Range in NSW and Queensland, with one small outlying patch in northern Victoria. It occurs in the Riverina, NSW South Western Slopes, Darling Riverine Plains, Brigalow Belt South, Brigalow Belt North, Murray-Darling Depression, Nandewar and Cobar Peneplain IBRA Bioregions (Department of the Environment and Energy [DEE], 2018).

During the survey undertaken by FloraSearch (2018), Weeping Myall Low Shrubland was mapped outside the Commonwealth Assessment Footprint (Figure 17). These patches of Weeping Myall Woodland EEC are highly fragmented, thinned and heavily grazed (FloraSearch, 2018). The patches are considered to be in *moderate* condition.

As part of the Approved Mine, Whitehaven committed to design the Blue Vale Road realignment to avoid impacts on the Weeping Myall Woodland EEC, or offset the impact to the ecological community at a ratio of at least 1:5, 1 ha of clearance to 5 ha of offset (SSD-5000). The Weeping Myall Woodland EEC near the Blue Vale Road realignment has been specifically avoided as part of the Project.

Table B4 provides an assessment of adverse impacts on Weeping Myall Woodland EEC in accordance with DotE's (2013) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance*.

Table B4
Likelihood of a Significant Adverse Impact on Weeping Myall Woodland EEC

EPBC Act Assessment Criteria[1] Is the action likely to:	Assessment
Reduce the extent of an ecological community?	Weeping Myall Woodland EEC is not located within the Commonwealth Assessment Footprint (Figure 17). As part of the Approved Mine, Whitehaven committed to design the Blue Vale Road realignment to avoid impacts on the Weeping Myall Woodland EEC, or offset the impact to the Weeping Myall Woodland at a ratio of at least 1:5, 1 ha of clearance to 5 ha of offset (SSD-5000). The Weeping Myall Woodland EEC near the Blue Vale Road realignment has been specifically avoided as part of the Project. The Weeping Myall Woodland EEC which has been mapped outside of the Commonwealth Assessment Footprint (Figure 17) is not likely to be impacted by the Project through indirect impacts such as fragmentation, edge effects, increases in dust or introduced flora and fauna.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines?	Weeping Myall Woodland EEC outside the Commonwealth Assessment Footprint and immediate surrounds occurs in small fragments (i.e. four small patches along Stratford Creek) (Figure 17). This fragmentation is a consequence of early land clearing practices for agricultural development. The Project would not result in further fragmentation of this community.
Adversely affect habitat critical to the survival of an ecological community?	No habitat critical to the survival of this community occurs within the Commonwealth Assessment Footprint.
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns?	The Project would not significantly impact abiotic factors (e.g. surface water flow regimes or soil nutrients) necessary for the community's survival. Nor would it significantly impact any abiotic factors critical to the survival of the Weeping Myall Woodland EEC in the landscape.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting?	As outlined in Table 31 of the Main Text, bushfire management is an existing measure that would be adopted for the Commonwealth Assessment Footprint, including, clearing restrictions, controlled grazing, restricted vehicle movements, fire breaks, the use of diesel vehicles, prohibition of smoking in fire prone areas and rapid response to any outbreak of fire. The Project would also not increase the frequency or intensity of grazing in this area. There would be no modification to the Weeping Myall Woodland EEC that would cause substantial change in the species composition, including causing a decline or loss of functionally important species.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: - assisting invasive species, that are harmful to the listed ecological community, to become established, or - causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or	The Project would not cause a substantial reduction in the quality or integrity of this ecological community given construction would occur over a short time period with management of weeds, minimisation of disturbed areas and erosion and sediment control. As part of the Local Biodiversity Enhancement Measures committed to by Whitehaven, grazing of native grasslands will be undertaken throughout the (including the area surrounding the Blue Vale Road realignment) with the aim of maintaining 100% groundcover in grazing paddocks. There is a low likelihood of weeds spreading into adjoining native vegetation as a result of the Project because, as outlined in Section 5.1.3 of the Main Text, the control of noxious and environmental weeds and control of feral pests are existing measures that would be adopted for the Commonwealth Assessment Footprint (including mine rehabilitation) and wider area.
Interfere with the recovery of an ecological community?	Remnants of Weeping Myall Woodland EEC on the Commonwealth Assessment Footprint and in its immediate surrounds have been fragmented and considerably reduced in size historically by agricultural land uses. The Project would not interfere with the recovery potential of this community as it has been avoided by the Project.

[1] As defined by the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DotE, 2013).

In conclusion, The Weeping Myall Woodland EEC is unlikely to be significantly impacted by the Project given:

- no Weeping Myall Woodland EEC is located within the Commonwealth Assessment Footprint (Figure 17); and
- the Weeping Myall Woodland EEC which has been mapped outside of the Commonwealth Assessment Footprint (Figure 17) is not likely to be indirectly impacted by the Project.

B3.2 BELSON'S PANIC (*HOMOPHOLIS BELSONLII*)

Belson's Panic is listed as 'Vulnerable' under the EPBC Act, and has not been recorded within the Commonwealth Assessment Footprint.

The distributional range of Belson's Panic lies within the southern Brigalow Belt Queensland, namely the Darling Downs area west of Toowoomba, near Oakey, Jondaryan, Bowenville, Dalby, Acland, Sabine, Quinalow, Goombungee, Gurulmundi and Millmerran, and further west between Miles and Roma. The species is also found on the northwest slopes and plains of NSW, north of Warialda between Wee Waa, Goondiwindi and Glen Innes (DEE, 2018).

Targeted surveys for this species have been undertaken by FloraSearch (2018) and it has not been recorded within the Commonwealth Assessment Footprint. The species has been previously recorded within the Vickery State Forest, approximately 5 km east of the Commonwealth Assessment Footprint (Figure 7).

Table B5 provides an assessment of adverse impacts on Belson's Panic (*Homopholis belsonii*) in accordance with DotE's (2013) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance*.

Table B5
Likelihood of a Significant Adverse Impact on Belson's Panic

EPBC Act Assessment Criteria[1] Is the action likely to:	Assessment
Lead to a long-term decrease in the size of an important population of a species?	The Project would not lead to a long-term decrease in the size of a population of Belson's Panic given: ■ it has not been identified in the highly disturbed habitats within the Commonwealth Assessment Footprint; and ■ the potential habitat in the Commonwealth Assessment Footprint occurs widely in the wider locality such that (were the Belson's Panic to be found) it is unlikely that it would be limited to the potential habitat in the Commonwealth Assessment Footprint.
Reduce the area of occupancy of an important population?	This species has not been recorded within the Commonwealth Assessment Footprint despite targeted surveys. The Belson's Panic population within the Vickery State Forest (Figure 7) potentially meets the definition of an important population according to DotE (2013) as it is within the limit of the species' known range (OEH, 2018). However, the known occurrences of Belson's Panic within the Vickery State Forest are located approximately 5 km east of the Project and would not be disturbed by the Project. As such, the Project would not reduce the area of occupancy of this species.
Fragment an existing important population into two or more populations?	This species has not been recorded within the Commonwealth Assessment Footprint despite targeted surveys. While potential habitat clearing would occur as a result of the Project, the nature of clearing would reduce the area of potential habitat rather than fragment or further isolate it. As such, the associated potential impact would not result in additional fragmentation of the species on a local or regional scale.
Adversely affect habitat critical to the survival of a species?	No habitat critical to the survival of Belson's Panic has been mapped within the Commonwealth Assessment Footprint or immediate surrounds.
Disrupt the breeding cycle of an important population?	Belson's Panic has not been located within the Commonwealth Assessment Footprint despite targeted surveys. The nearby Belson's Panic population appears to be restricted to the Vickery State Forest which would not be disturbed by the Project (Figure 7).

Table B5
Likelihood of a Significant Adverse Impact on Belson's Panic

EPBC Act Assessment Criteria[1] Is the action likely to:	Assessment
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The Project would not impact on the habitat of the species to the extent that the species would be likely to decline, given: ■ it has not been identified in the Commonwealth Assessment Footprint; and ■ the potential habitat in the Commonwealth Assessment Footprint occurs widely in the locality and beyond such that (were the Belson's Panic to be found) it is unlikely that it would be limited to the potential habitat in the Commonwealth Assessment Footprint.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	There is a low likelihood of weeds spreading into adjoining native vegetation as a result of the Project because, as outlined in Section 5.1.3 of the Main Text, the control of noxious and environmental weeds (e.g. Coolatai Grass [*Hyparrhenia hirta*]) and control of feral pests are existing measures that would be adopted for the Commonwealth Assessment Footprint (including mine rehabilitation) and wider area.
Introduce disease that may cause the species to decline?	No known diseases potentially spread by soil movement or mining equipment that might adversely affect Belson's Panic have been identified.
Interfere substantially with the recovery of the species?	The Project is not considered likely to have a negative impact on Belson's Panic numbers, or to significantly reduce available resources in the immediate landscape. Thus the Project would not substantially interfere with the recovery of the species.

[1] As defined by the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DotE, 2013).

In conclusion, Belson's Panic is unlikely to be significantly impacted by the Project given:

- this species has not been recorded in the localised nature of the Commonwealth Assessment Footprint despite targeted surveys;
- the localised nature of the Commonwealth Assessment Footprint disturbance of potential habitat compared to the wider distribution of the species and its potential habitat; and
- the greater extent of potential habitat in the locality.

Mitigation measures for this species are provided in Section B4.

B3.3 WINGED PEPPERCRESS (*LEPIDIUM MONOPLOCOIDES*)

The Winged Peppercress is listed as 'Endangered' under the EPBC Act, and has not been recorded within the Commonwealth Assessment Footprint.

The Winged Peppercress is widespread in the semi-arid western plains regions of NSW (OEH, 2018). It has been collected from widely scattered localities, with large numbers of historical records but few recent collections. This species has been recorded from Broken Hill, Bourke, Cobar, Urana, Lake Cargelligo, Balranald, Wanganella and Deniliquin with more recent records from the Hay Plain, south-eastern Riverina, and from near Pooncarie (OEH, 2018).

Two populations of Winged Peppercress have previously been identified outside the Commonwealth Assessment Footprint as follows (Figure 17):

- 20 metres (m) x 20 m containing approximately 50 plants located in the northern extent of the Western Emplacement (i.e. inside the Approved Mine extent); and
- 50 m x 10 m containing approximately 418 individual plants located to the north-west of the Western Emplacement (i.e. outside the Vickery Extension Project [EPBC 2016/7649] Footprint).

Targeted surveys for this species have been undertaken by FloraSearch (2018) and it has not been recorded within the Commonwealth Assessment Footprint.

Table B6 provides an assessment of adverse impacts on Winged Peppercress in accordance with DotE (2013) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance*.

Table B6
Likelihood of a Significant Adverse Impact on Winged Peppercress

EPBC Act Assessment Criteria[1] Is the action likely to:	Assessment
Lead to a long-term decrease in the size of a population of a species?	In accordance with the referral decision for the Project, neither patch of the Winged Peppercress known to occur in the wider landscape would be adversely impacted. The larger Winged Peppercress patch is located on Whitehaven owned land from which grazing has been excluded. The area has also been fenced to avoid accidental disturbance. The smaller patch is located within the Approved Mine extent and would be translocated to the fenced protection area to the north of the Project mining area. The Project is unlikely to result in a long-term decrease in the size of the Winged Peppercress population given no Winged Peppercress are known to occur within the Commonwealth Assessment Footprint, despite targeted surveys by Niche (2013) and FloraSearch (2018).
Reduce the area of occupancy of the species?	This species has not been recorded within the Commonwealth Assessment Footprint despite targeted surveys. Any Winged Peppercress located outside the Commonwealth Assessment Footprint (Figure 17), would not be disturbed by the Project. As such, the Project would not reduce the area of occupancy of this species.
Fragment an existing population into two or more populations?	This species has not been recorded within the Commonwealth Assessment Footprint despite targeted surveys. Any Winged Peppercress located outside the Commonwealth Assessment Footprint (Figure 17), would not be cleared by the Project. As such, the Project would not fragment an existing population into two or more populations.
Adversely affect habitat critical to the survival of a species?	No habitat critical to the survival of the Winged Peppercress would be removed by the Project.
Disrupt the breeding cycle of a population?	The Winged Peppercress has not been located within the Commonwealth Assessment Footprint despite targeted surveys. The Winged Peppercress populations north of the Project (Figure 17) would be fenced to avoid accidental disturbance (including disruption to the species' breeding cycle).
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The Project would have no impact on the habitat of the species to the extent that the species would be likely to decline, given: ■ no Winged Peppercress are known to occur within the Commonwealth Assessment Footprint, despite targeted surveys by Niche (2013) and FloraSearch (2018); and ■ the Winged Peppercress to the north of the Commonwealth Assessment Footprint (Figure 17) would be managed in accordance with the EPBC Act Notification of Referral Decision (EPBC 2012/6263).
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?	There is a low likelihood of weeds spreading into adjoining native vegetation as a result of the Project because, as outlined in Section 5.1.3 of the Main Text, the control of noxious and environmental weeds (e.g. Coolatai Grass [*Hyparrhenia hirta*]) and control of feral pests are existing measures that would be adopted for the Commonwealth Assessment Footprint (including mine rehabilitation) and wider area.
Introduce disease that may cause the species to decline?	No diseases potentially spread by soil movement or mining equipment are known to adversely affect the Winged Peppercress.
Interfere with the recovery of the species?	The *National Recovery Plan for the Winged Peppercress Lepidium monoplocoides* (Mavromihalis, 2010) lists recovery actions for this species. The Project is not inconsistent with the actions listed in this plan.

[1] As defined by the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DotE, 2013).

In conclusion, the Winged Peppercress is unlikely to be significantly impacted by the Project given:

- no Winged Peppercress are known to occur within the Commonwealth Assessment Footprint, despite targeted surveys by Niche (2013) and FloraSearch (2018); and
- the Winged Peppercress to the north of the Commonwealth Assessment Footprint (Figure 17) would be managed in accordance with the EPBC Act Notification of Referral Decision (EPBC 2012/6263).

Mitigation measures for this species are provided in Section B4.

B3.4 *TYLOPHORA LINEARIS*

Tylophora linearis is listed as 'Endangered' under the EPBC Act, and has not been recorded within the Commonwealth Assessment Footprint.

Tylophora linearis is a small vine generally twining around the stems of tall grasses, shrubs or young trees. The species occurs in several bioregions, botanical divisions and Local Land Service areas. This species is known to occur in a large number of government areas in NSW, including Barradine State Forest, Bibblewindi State Forest, Boonalla Aboriginal Reserve, Breeza State Forest, Euligal State Forest, Kerringle State Forest, Pilliga East State Forest, Pilliga National Park, Pilliga Nature Reserve, Pilliga State Conservation Area, Timallallie National Park, Trinkey State Conservation Area, Vickery State Forest and Leard State Forest (OEH, 2017).

Targeted surveys for this species have been undertaken by FloraSearch (2018) and it has not been recorded within the Commonwealth Assessment Footprint.

Tylophora linearis was recorded during the recent flora surveys undertaken by FloraSearch (2018) and Hunter Eco (2018) outside of the Commonwealth Assessment Footprint. A group of 20 plants was found within the western boundary of Vickery State Forest and a second group consisting of four individual plants was located to the west of the Vickery State Forest, between the Commonwealth Assessment Footprint and the forest (Figure 17).

Table B7 provides an assessment of adverse impacts on *Tylophora linearis* in accordance with DotE's (2013) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance*.

Table B7
Likelihood of a Significant Adverse Impact on *Tylophora linearis*

EPBC Act Assessment Criteria[1] Is the action likely to:	Assessment
Lead to a long-term decrease in the size of a population of a species?	The Project would not lead to a long-term decrease in the size of a population of *Tylophora linearis* given: ■ *Tylophora linearis* has not been recorded within the Commonwealth Assessment Footprint despite targeted surveys. ■ *Tylophora linearis* and its habitat is widespread in the landscape outside the Commonwealth Assessment Footprint (after OEH, 2017).
Reduce the area of occupancy of the species?	This species has not been recorded within the Commonwealth Assessment Footprint despite targeted surveys. *Tylophora linearis* located within and to the west of the Vickery State Forest (Figure 17) would not be disturbed by the Project. As such, the Project would not reduce the area of occupancy of this species.

Table B7 (Continued)
Likelihood of a Significant Adverse Impact on *Tylophora linearis*

EPBC Act Assessment Criteria[1] Is the action likely to:	Assessment
Fragment an existing population into two or more populations?	This species has not been recorded within the Commonwealth Assessment Footprint despite targeted surveys. *Tylophora linearis* located within and to the west of the Vickery State Forest (Figure 17) would not be disturbed by the Project and is not considered to comprise an important population. While clearing of potential habitat would occur as a result of the Project, the nature of clearing would reduce the area of habitat rather than fragment it or further isolate habitat.
Adversely affect habitat critical to the survival of a species?	No habitat critical for the survival of *Tylophora linearis* would be removed by the Project.
Disrupt the breeding cycle of a population?	*Tylophora linearis* has not been located within the Commonwealth Assessment Footprint despite targeted surveys. The nearby *Tylophora linearis* populations in, and adjacent to, the Vickery State Forest would not be disturbed by the Project (Figure 17).
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The Project would have no impact on the habitat of the species to the extent that the species would be likely to decline given: ■ *Tylophora linearis* has not been recorded within the Commonwealth Assessment Footprint despite targeted surveys. ■ *Tylophora linearis* and its habitat is widespread in the landscape outside the Commonwealth Assessment Footprint (after OEH, 2017).
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?	There is a low likelihood of weeds spreading into adjoining native vegetation as a result of the Project because, as outlined in Section 5.1.3 of the Main Text, the control of noxious and environmental weeds (e.g. Coolatai Grass [*Hyparrhenia hirta*]) and control of feral pests are existing measures that would be adopted for the Commonwealth Assessment Footprint (including mine rehabilitation) and wider area.
Introduce disease that may cause the species to decline?	No diseases potentially spread by soil movement or mining equipment are known to adversely affect *Tylophora linearis*.
Interfere with the recovery of the species?	The Project is unlikely to have a negative impact on *Tylophora linearis* numbers, or significantly reduce available resources in the immediate landscape. Thus the Project would not interfere with the recovery of the species.

[1] As defined by the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DotE, 2013).

In conclusion, *Tylophora linearis* is unlikely to be significantly impacted by the Project given:

- *Tylophora linearis* has not been recorded within the Commonwealth Assessment Footprint despite targeted surveys.
- *Tylophora linearis* and its habitat is commonly recorded in the landscape outside the Commonwealth Assessment Footprint (after OEH, 2017). The majority of records occur in the central western region, with records from Goonoo, Pillaga West, Pillaga East, Bibblewindi, Cumbil and Eura State Forests, Coolbaggie Nature Reserve, Goobang National Park and Beni State Conservation Area. It has also been recorded in Hiawatha State Forest near West Wyalong in the south and there are old records as far north as Crow Mountain near Barraba and near Glenmorgan in the western Darling Downs (OEH, 2018).

Mitigation measures for this species are provided in Section B4.

B3.5 REGENT HONEYEATER (*ANTHOCHAERA PHRYGIA*)

The Regent Honeyeater is listed as 'Critically Endangered' under the EPBC Act and has been identified as one of 12 birds for priority conservation under *Australia's Threatened Species Strategy* (DotE, 2015a).

These birds are itinerant, generally following the flowering of a variety of eucalypts and other species, with their main food source being nectar, supplemented by various insects and arthropods. Distribution is patchy across eastern NSW and inland, to northern Victoria. The species is not at the limit of its range in or near the Commonwealth Assessment Footprint. In NSW there are three main breeding areas, being Capertee Valley, the Bundarra-Barraba and Hunter Valley regions (DotE, 2016).

The Regent Honeyeater is a nomadic species that roam widely in search of abundant sources of nectar. In consequence, the Commonwealth Assessment Footprint may provide temporary food sources for transiting Regent Honeyeaters when eucalypts, particularly White Box and Yellow Box, are flowering. However, this species does not form permanent local populations, but essentially comprise a single population across its entire range. Although a site may be used intermittently by the Regent Honeyeater, habitat on the site may still be important to the species during its period of use, given the complex patterns of movement undertaken by the species.

The Regent Honeyeater has not been recorded within the Commonwealth Assessment Footprint. A single database record for this species occurs approximately 7.5 km to the south-east of the Commonwealth Assessment Footprint (OEH, 2017) (Figure 11). There are no known breeding sites within the Commonwealth Assessment Footprint. The closest known breeding area for this species is approximately 40 km north-east of the Project in the Bundarra-Barraba regions (DotE, 2016) (Figure 12).

Habitat critical to the survival of the Regent Honeyeater is defined by the *National Recovery Plan for the Regent Honeyeater (Anthochaera phrygia)* (DotE, 2016) as:

- *any breeding or foraging habitat in areas where the species is likely to occur (as defined by the distribution map provided in Figure 12); and*
- *any newly discovered breeding or foraging locations.*

The Project is not associated with 'habitat critical to the survival' of the Regent Honeyeater.

The Project is located in an area where the species 'may occur' according to the *National Recovery Plan for the Regent Honeyeater (Anthochaera phrygia)* (DotE, 2016) (Figure 12) (i.e. it is not within a breeding area). In addition, there is no evidence to demonstrate that the potential habitat within the Project area provides connectivity for movement between any important population areas (i.e. critical habitat) for the Regent Honeyeater.

Table B8 provides an assessment of adverse impacts on the Regent Honeyeater (*Anthochaera phrygia*) in accordance with DotE's (2013) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance*.

Table B8
Likelihood of a Significant Adverse Impact on the Regent Honeyeater

EPBC Act Assessment Criteria[1] Is the action likely to:	Assessment
Lead to a long-term decrease in the size of a population of a species?	The Project would result in the removal of approximately 75.2 ha of potential foraging habitat for the Regent Honeyeater from within the Commonwealth Assessment Footprint. The Project is unlikely to lead to a long-term decrease in the size of an important population of this species given: ■ it has not been recorded using potential foraging habitat within the Commonwealth Assessment Footprint, despite surveys (Niche, 2013; Future Ecology, 2018); ■ much of the potential foraging habitat to be cleared has been subject to past disturbances (such as logging, fragmentation of habitat, and livestock grazing); ■ the Project is not located in a key breeding area for this species (the closest of which is more than 40 km north-east of the Vickery Extension Project [EPBC 2016/7649] Footprint) (DotE, 2016) and this species is not typically recorded foraging in the surrounding landscape (Figure 12); and ■ similar (and better) potential habitat for these species is widespread in the landscape outside the Commonwealth Assessment Footprint. Despite no current records near the Commonwealth Assessment Footprint, were the Regent Honeyeater to use the surrounding habitat, potential indirect impacts from the Project (such as vegetation dieback as a result of potential groundwater drawdown, noise, dust, artificial lighting) (assessed in Sections 5.1.2 and 5.1.3 of the Main Text) are unlikely to impact this species as there are no known breeding sites nearby and potential indirect impacts would be mitigated. The change in cumulative impact on the Regent Honeyeater as a result of the Project (considering impacts from other surrounding developments [Section 5.1.4 of the Main Text]) is considered to be minimal as potential habitat is more abundant in the surrounding landscape this species has not been recorded using potential habitat in the Commonwealth Assessment Footprint. Therefore, removal/modification of these areas of habitat would have negligible impact on resources for this bird and would not lead to a decrease in the size of a population.
Reduce the area of occupancy the species?	It is probable that Regent Honeyeater recorded in the wider landscape dispersed from the Bundarra-Barraba region breeding population, approximately 40 km to the north-east of the Commonwealth Assessment Footprint. This species' distribution is widespread across NSW and the Project is not located at the extent of the species range. As such, the Project would not reduce the area of occupancy of this population.
Fragment an existing population into two or more populations?	While potential habitat clearing would occur as a result of the Project, the nature of clearing would reduce the area of habitat rather than fragment or further isolate it. Given the highly mobile and dispersive nature of this species, the loss of the vegetation within the Commonwealth Assessment Footprint would not fragment the wider Regent Honeyeater population. In addition, consistent with the existing impact avoidance and mitigation measures to be undertaken for the Approved Mine, scattered trees (a total of 50 trees) would be planted annually within the Local Biodiversity Enhancement Measures (LBEM) area (for the life of the mine [25 years]) to provide potential habitat for the Regent Honeyeater.
Adversely affect habitat critical to the survival of a species?	The *National Recovery Plan for the Regent Honeyeater (Anthochaera phrygia)* (DotE, 2016) defines critical habitat for the species as "Any 'breeding areas' or regions where the species is 'likely' to occur" and "Any newly discovered 'breeding' or foraging locations that extend the 'likely' range of the regent honeyeater". Despite the modification/removal of a small area of potential habitat within the Commonwealth Assessment Footprint (Figures 10 and 22), the Project is not considered to have a significant impact on critical habitat for the Regent Honeyeater, as an abundance of similar vegetation occurs within the surrounding Vickery State Forest and Pilliga Nature Reserve, and would not be impacted by the Project.
Disrupt the breeding cycle of a population?	There is no record of breeding in the Commonwealth Assessment Footprint, with a key breeding area in the Bundarra-Barraba region, approximately 40 km north-east of the Project (DotE, 2016). The Project would not disrupt the breeding cycle of the wider Regent Honeyeater population.

Table B8 (Continued)
Likelihood of a Significant Adverse Impact on the Regent Honeyeater

EPBC Act Assessment Criteria[1] Is the action likely to:	Assessment
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The potential foraging habitat to be removed/modified as a result of the Project (Figures 10 and 22) is expected to have a negligible impact on resources for this bird and would not lead the species declining given: ■ it has not been recorded using potential foraging habitat within the Commonwealth Assessment Footprint, despite surveys (Niche, 2013; Future Ecology, 2018); ■ much of the potential foraging habitat to be cleared has been subject to past disturbances (such as logging, fragmentation of habitat and livestock grazing); ■ the Project is not located in a key breeding area for this species (the closest of which is more than 40 km north-east of the Vickery Extension Project [EPBC 2016/7649] Footprint) (DotE, 2016) and this species is not typically recorded foraging in the surrounding landscape (Figure 12); and ■ similar (and better) potential habitat for these species is widespread in the landscape outside the Commonwealth Assessment Footprint.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?	The NSW Scientific Committee has determined that Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners (*Manorina melanocephala*) constitutes a key threatening process. Noisy Miners are found along eastern Australia and inland and inhabit fragmented, sparsely vegetated habitat. Increased clearing has resulted in increased numbers of this highly territorial and aggressive bird. The Scientific Committee determination lists the Regent Honeyeater as being driven away from normally suitable habitat by Noisy Miners. Recent bird surveys in and around the Commonwealth Assessment Footprint (Future Ecology, 2018) show that while Noisy Miners are present, there is also good representation of birds such as honeyeaters and thornbills. The Project would not result in habitat fragmentation or clearing that would result in an increase in the Noisy Miner population. Feral pests that are already present in the Commonwealth Assessment Footprint are likely to displace into adjoining areas during construction, however, the number of feral pests that would be displaced would be reduced by controlling feral pests in the Commonwealth Assessment Footprint. The control of feral pests is an existing measure that would be adopted for the Commonwealth Assessment Footprint (including mine rehabilitation) and wider area.
Introduce disease that may cause the species to decline?	There are no known diseases potentially spread by soil movement or mining equipment that would affect the Regent Honeyeater. *Phytophthora cinnamomi* is a disease which may affect (dieback) habitat for the species elsewhere in NSW. Climatic conditions on the Liverpool Plains are not conducive to *P. cinnamomi*, which is most commonly found in warm, moist conditions of coastal forests, but may also occur at higher elevations (OEH, 2018).
Interfere with the recovery of the species?	The Project involves the clearance of some potential habitat for the Regent Honeyeater. However, as Whitehaven would offset the vegetation clearance, the Project would not be inconsistent the *National Recovery Plan for the Regent Honeyeater (Anthochaera phrygia)* (DotE, 2016) or *Australia's Threatened Species Strategy* (DotE, 2015a). The Project is unlikely to have a negative impact on Regent Honeyeater numbers, or significantly reduce available resources in the immediate landscape. Thus the Project would not interfere with the recovery of the species.

[1] As defined by the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DotE, 2013).

In conclusion, the Regent Honeyeater is unlikely to be significantly impacted by the Project given:

- it has not been recorded using potential habitat within the Commonwealth Assessment Footprint, despite surveys (Niche, 2013; Future Ecology, 2018);
- much of the potential habitat to be cleared has been subject to past disturbances (such as logging, fragmentation of habitat and livestock grazing);
- the Project is not located in a key breeding area for this species (the closest of which is more than 40 km north-east of the Vickery Extension Project [EPBC 2016/7649] Footprint) (DotE, 2016) and this species is not typically recorded foraging in the surrounding landscape (Figure 12); and
- similar (and better) potential habitat for these species is widespread in the landscape outside the Commonwealth Assessment Footprint.

It is noted the Project is located in an area where the species 'may occur' according to the *National Recovery Plan for the Regent Honeyeater (Anthochaera phrygia)* (DotE, 2016) (Figure 12) (i.e. it is not within a breeding area or area where the species is 'likely to occur').

Mitigation measures for this species are provided in Section B4. Impacts on this species habitat would be offset as described in Section B5.

B3.6 SWIFT PARROT (*LATHAMUS DISCOLOR*)

The Swift Parrot is listed as 'Critically Endangered'[1] under the EPBC Act.

This bird breeds in Tasmania and migrates to the Australian mainland for autumn and winter. In NSW, the Swift Parrot mostly occurs on the coast and the south-west slopes. This species forages on flowering eucalypts and lerp infestations (OEH, 2018).

There are no records of the Swift Parrot from within the Commonwealth Assessment Footprint or surrounds. The Commonwealth Assessment Footprint provides potential foraging habitat for this species, however no breeding habitat for this species exists within the Commonwealth Assessment Footprint as this species migrates to Tasmania to breed.

There are several flowering eucalypt species used by the Swift Parrot (OEH, 2018) that are abundant in the area. More broadly, ecological data provided in the Swift Parrot's species profile in the NSW Atlas of NSW Wildlife (OEH, 2018) indicates that the Swift Parrot could use a large number of vegetation communities occurring within the Commonwealth Assessment Footprint.

Table B9 provides an assessment of adverse impacts on the Swift Parrot (*Lathamus discolor*) in accordance with DotE's (2013) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance*.

[1] Listed as Endangered under the EPBC Act at the time of the controlled action decision (14 April 2016) and therefore assessed under the Federal Office Policy as 'Endangered' not 'Critically Endangered' (refer Section 158A of the EPBC Act).

Table B9
Likelihood of a Significant Adverse Impact on the Swift Parrot

EPBC Act Assessment Criteria[1] Is the action likely to:	Assessment
Lead to a long-term decrease in the size of a population of a species?	The Project would result in the removal/modification of approximately 104.7 (Table 29 of the Main Text) ha of potential habitat for the Swift Parrot. Considering the above, it is possible that members of the Swift Parrot population could occur within the Commonwealth Assessment Footprint, given the occurrence of potential habitat resources within the footprint and records of the species within the wider locality. However, the removal/modification of a portion of habitat for this species is unlikely to lead to a long-term decrease in the size of the Swift Parrot population given: ■ This species, and its habitat, is widespread in the landscape outside the Commonwealth Assessment Footprint. ■ The Swift Parrot is a highly nomadic species that roams the landscape widely in search of flowering trees, their main source of food. The habitat on the Commonwealth Assessment Footprint is a very small part of that available in the surrounding locality and wider region. If the Swift Parrot opportunistically forage in the habitat surrounding the Commonwealth Assessment Footprint it is not likely to be impacted by indirect impacts (such as noise and feral animals) given its migratory nature.
Lead to a long-term decrease in the size of a population of a species? (Cont.)	The change in cumulative impact on this species as a result of the Project (considering impacts from other surrounding developments [Section 5.1.4 of the Main Text]) is considered to be minimal because potential habitat is more abundant in the surrounding landscape. Additionally, the Swift Parrot has not been recorded within the habitat in the Commonwealth Assessment Footprint. Therefore, removal/modification of these areas of habitat would have negligible impact on resources for this bird and would not lead to a decrease in the size of the population.
Reduce the area of occupancy of a species?	The Swift Parrot breeds during summer within Tasmania and migrates in autumn and winter to mainland Australia as far north as the Queensland border. The Project would not reduce the area of occupancy of the species.
Fragment an existing important population into two or more populations?	Given the highly migratory and dispersive nature of this species, the loss of the vegetation within the Commonwealth Assessment Footprint would not fragment the wider Swift Parrot population. In addition, consistent with the existing impact avoidance and mitigation measures to be undertaken for the Approved Mine, scattered trees (a total of 50 trees) would be planted annually within the LBEM area (for the life of the mine [25 years]) to provide potential habitat for the Swift Parrot.
Adversely affect habitat critical to the survival of a species?	As records across this bird's distribution indicate, along with its nomadic habit following nectar resources in particular, there is a broad geographic range of available habitat. The only habitat critical to the survival of the species would be that in known breeding areas. Such habitat does not occur in or near the Commonwealth Assessment Footprint, as breeding is restricted to Tasmania.
Disrupt the breeding cycle of a population?	There is no record of breeding in the Commonwealth Assessment Footprint, as breeding for this species is limited to Tasmania. The Project would not disrupt the breeding cycle of the Swift Parrot population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The potential habitat which would be removed/modified as a result of the Project is expected to have a negligible impact on resources for this bird and would not lead to the species declining, given: ■ This species, and its potential foraging habitat, is widely distributed in the landscape outside the Commonwealth Assessment Footprint. ■ The Swift Parrot is a highly nomadic species that roams the landscape widely in search of flowering trees, their main source of food. The habitat on the Commonwealth Assessment Footprint is a very small part of that available in the surrounding locality and wider region.

Table B9 (Continued)
Likelihood of a Significant Adverse Impact on the Swift Parrot

EPBC Act Assessment Criteria[1] Is the action likely to:	Assessment
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?	The NSW Scientific Committee has determined that aggressive exclusion of birds from known foraging sites by abundant Noisy Miners constitutes a threat to the Swift Parrot. Noisy Miners are found along eastern Australia and inland and inhabit fragmented, sparsely vegetated habitat. Increased clearing has resulted in increased numbers of this highly territorial and aggressive bird. Recent bird surveys in and around the Commonwealth Assessment Footprint (Future Ecology, 2018) show that while Noisy Miners are present, there is also good representation of birds such as honeyeaters and thornbills. The Project would not result in habitat fragmentation or clearing that would result in an increase in the Noisy Miner populations. Feral pests that are already present in the Commonwealth Assessment Footprint are likely to displace into adjoining areas during construction, however, the number of feral pests that would be displaced would be reduced by controlling feral pests in the Commonwealth Assessment Footprint. The control of feral pests is an existing measure that would be adopted for the Commonwealth Assessment Footprint (including mine rehabilitation) and wider area.
Introduce disease that may cause the species to decline?	Beak and feather disease is an infectious disease affecting parrots, caused by the beak and feather disease circovirus. The beak and feather disease virus can be introduced to endangered populations of parrots via the movements of common species carrying the disease. Lesions suggestive of the virus have been reported in the Swift Parrot (DEE, 2018). The Project is not likely to introduce beak and feather disease to the Swift Parrot population.
Interfere with the recovery of the species?	The Project is unlikely to have a negative impact on Swift Parrot numbers, or significantly reduce available resources in the immediate landscape. Recovery actions for the Swift Parrot are listed in the *National Recovery Plan for the Swift Parrot (Lathamus discolor)* (Saunders & Tzaros, 2011). The Project is not inconsistent with the actions listed in this plan. Thus the Project would not interfere with the recovery of the species.

In conclusion, the Swift Parrot unlikely to be significantly impacted by the Project given:

- the localised nature of the potential habitat in the Commonwealth Assessment Footprint compared to the wider distribution of the species;
- this species does not breed in NSW;
- the Swift Parrot is a highly nomadic species that roams the landscape widely in search of flowering trees, their main source of food, and the habitat on the Commonwealth Assessment Footprint is a very small part of that available in the surrounding locality and wider region; and
- the greater extent of habitat in the locality.

Mitigation measures for this species are provided in Section B4. Impacts on this species habitat would be offset as described in Section B5.

B3.7 PAINTED HONEYEATER (*GRANTIELLA PICTA*)

The Painted Honeyeater is listed as 'Vulnerable' under the EPBC Act.

In NSW the greatest concentrations of the Painted Honeyeater, and almost all breeding, occurs on the inland slopes of the Great Dividing Range in NSW (OEH, 2018). This species inhabits Boree/Weeping Myall, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests (OEH, 2018).

The Painted Honeyeater is a specialist feeder on the fruits of Mistletoes growing on woodland eucalypts and acacias and prefers Mistletoes of the genus *Amyema* (OEH, 2018). Insects and nectar from mistletoe or eucalypts are occasionally eaten (OEH, 2018). Consequently, the Commonwealth Assessment Footprint may provide temporary food sources for transiting Painted Honeyeaters when eucalypts are flowering.

The Painted Honeyeater has been recorded at two locations less than 1.5 km south-west of the Commonwealth Assessment Footprint (Figure 8), one of which was within the Commonwealth Assessment Footprint. As shown on Figure 28, records for the Painted Honeyeater are widespread throughout the surrounding landscape, with the nearest database records located within the Leard State Forest. It is likely that the Painted Honeyeaters located in and near the Commonwealth Assessment Footprint were recorded in River She-oaks which were observed along the Namoi River (FloraSearch, 2018) and are known to contain mistletoes. Mistletoes were very sparsely distributed within the remainder of the Commonwealth Assessment Footprint (FloraSearch, 2018).

Table B10 provides an assessment of adverse impacts on the Painted Honeyeater (*Grantiella picta*) in accordance with DotE's (2013) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance*.

Table B10
Likelihood of a Significant Adverse Impact on the Painted Honeyeater

EPBC Act Assessment Criteria[1] Is the action likely to:	Assessment
Lead to a long-term decrease in the size of an important population of a species?	The Project would result in the removal/modification of approximately 111.4 ha of potential foraging habitat for the Painted Honeyeater. The Project is unlikely to lead to a long-term decrease in the size of an important population of this species given: ■ Mistletoes were very sparsely distributed within the remainder of the Commonwealth Assessment Footprint (FloraSearch, 2018).; ■ much of the potential habitat to be cleared has been subject to past disturbances (such as logging, fragmentation of habitat, and livestock grazing); ■ similar (and better) potential habitat for these species is widespread in the landscape outside the Commonwealth Assessment Footprint; and ■ the Painted Honeyeater is likely to persist in the habitat to the south of the Commonwealth Assessment Footprint as potential indirect impacts would be mitigated.
Lead to a long-term decrease in the size of an important population of a species? (cont)	The change in cumulative impact on the Painted Honeyeater as a result of the Project (considering impacts from other surrounding developments [Section 5.1.4 of the Main Text]) is considered to be minimal as potential habitat is more abundant in the surrounding landscape this species has not been recorded using potential habitat in the Commonwealth Assessment Footprint. Therefore, removal/modification of these areas of habitat would have negligible impact on resources for this bird and would not lead to a decrease in the size of the population.
Reduce the area of occupancy of an important population?	Given the species has not been recorded within the Commonwealth Assessment Footprint, and the Project is not located at the extent of the species range, an important population of Painted Honeyeaters is not present within the Commonwealth Assessment Footprint. The Painted Honeyeater is likely to persist in the habitat to the south of the Commonwealth Assessment Footprint as potential indirect impacts would be mitigated. As such, the Project would not reduce the area of occupancy of a population.
Fragment an existing important population into two or more populations?	Given the highly mobile and dispersive nature of this species, the loss of the vegetation within the Commonwealth Assessment Footprint would not fragment the wider Painted Honeyeater population. In addition, consistent with the existing impact avoidance and mitigation measures to be undertaken for the Approved Mine, scattered trees (a total of 50 trees) would be planted annually within the LBEM area (for the life of the mine [25 years]) to provide potential habitat for the Painted Honeyeater.

Table B10 (Continued)
Likelihood of a Significant Adverse Impact on the Painted Honeyeater

EPBC Act Assessment Criteria[1] Is the action likely to:	Assessment
Adversely affect habitat critical to the survival of a species?	As records across this bird's distribution indicate (Figure 28), along with its nomadic nature following feeding resources in particular, there is a broad geographic range of available habitat. No habitat critical for the survival of this species would be removed by the Project given the scarcity of primary feeding resources (mistletoes) within the Commonwealth Assessment Footprint.
Disrupt the breeding cycle of an important population?	It is likely that the Painted Honeyeaters located near the Commonwealth Assessment Footprint were recorded in River She-oaks which were observed along the Namoi River (FloraSearch, 2018) and are known to contain mistletoes which this species use for breeding. Mistletoes were very sparsely distributed within the remainder of the Commonwealth Assessment Footprint (FloraSearch, 2018). There is no evidence of Painted Honeyeater breeding within the Commonwealth Assessment Footprint. The Project would not disrupt the breeding cycle of the wider Painted Honeyeater population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The habitat which would be removed/modified as a result of the Project is expected to have a negligible impact on resources for this bird and would not lead to the species declining, given: ■ it has not been recorded using potential habitat within the Commonwealth Assessment Footprint, despite surveys (Niche, 2013; Future Ecology, 2018); ■ much of the potential habitat to be cleared has been subject to past disturbances (such as logging, fragmentation of habitat and livestock grazing); ■ similar (and better) potential habitat for these species is widespread in the landscape outside the Commonwealth Assessment Footprint; and ■ the Painted Honeyeater is likely to persist in the habitat to the south of the Commonwealth Assessment Footprint as potential indirect impacts would be mitigated.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	The NSW Scientific Committee has determined that aggressive exclusion of birds from known foraging sites by abundant Noisy Miners constitutes a threat to the Painted Honeyeater. Noisy Miners are found along eastern Australia and inland and inhabit fragmented, sparsely vegetated habitat. Increased clearing has resulted in increased numbers of this highly territorial and aggressive bird. Recent bird surveys in and around the Commonwealth Assessment Footprint (Future Ecology, 2018) show that while Noisy Miners are present, there is also good representation of birds such as honeyeaters and thornbills. This indicates that Noisy Miners in and around the Commonwealth Assessment Footprint do not dominate. The Project would not result in habitat fragmentation or clearing that would result in an increase in the Noisy Miner populations. Feral animals would continue to be managed through weed prevention, control and monitoring measures. With the implementation of management measures, the potential impacts to native flora and fauna associated with feral animals is likely to be low.
Introduce disease that may cause the species to decline?	There are no known diseases potentially spread by soil movement or mining equipment that would affect the Painted Honeyeater.
Interfere substantially with the recovery of the species?	The Project is unlikely to have a negative impact on Painted Honeyeater numbers, or significantly reduce available resources in the immediate landscape. Thus the Project would not interfere with the recovery of the species.

[1] As defined by the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DotE, 2013).

In conclusion, the Painted Honeyeater unlikely to be significantly impacted by the Project given:

- much of the potential habitat to be cleared has been subject to past disturbances (such as logging, fragmentation of habitat and livestock grazing);
- it is likely that the Painted Honeyeaters located near the Commonwealth Assessment Footprint were recorded in River She-oaks which were observed along the Namoi River (FloraSearch, 2018) and are known to contain mistletoes, while mistletoes were very scarcely recorded throughout the remainder of the Commonwealth Assessment Footprint (FloraSearch, 2018);

- similar (and better) potential habitat for these species is widespread in the landscape outside the Commonwealth Assessment Footprint; and
- the Painted Honeyeater is likely to persist in the habitat to the south of the Commonwealth Assessment Footprint as potential indirect impacts would be mitigated.

Mitigation measures for this species are provided in Section B4.

B3.8 KOALA (*PHASCOLARCTOS CINEREUS*)

The Koala is listed as 'Vulnerable' under the EPBC Act.

Koalas are widespread across most of NSW, and eastern and southern Australia. The animal browses on eucalypt leaves, with known species preferences. Preferred feed trees are listed in the NSW Koala Approved Recovery Plan (DECC, 2008) and include *Eucalyptus camaldulensis, Eucalyptus blakelyi*, *Eucalyptus melliodora* and *Eucalyptus albens*, all of which occur in the Commonwealth Assessment Footprint (FloraSearch, 2018).

Two recent recordings by Future Ecology (2018) are located within and surrounding the Commonwealth Assessment Footprint, one is located on the western side of the Namoi River across from the mining area, one is located on the eastern side of Deadmans Gully across from the Project rail spur, and the other is located to approximately 3 km west of the Project mining area (Figures 13 and 23). Two previous survey records are also located in close proximity to the Namoi River, to the south-west of the Commonwealth Assessment Footprint (Figure 13) (Kendall and Kendall, 2011).

Critical Habitat under the EPBC Act

In late 2013, the DotE released the *EPBC Act Referral Guidelines for the Vulnerable Koala (Combined Populations of Queensland, New South Wales and the Australian Capital Territory)* (EPBC Act Referral Guidelines for the Koala) (DotE, 2014). The EPBC Act Referral Guidelines (DotE, 2014) for the Koala provides a habitat assessment tool for determining habitat critical to the survival of the Koala and the likelihood of a significant impact on this species.

Table B11 provides an appraisal of the habitat within the Commonwealth Assessment Footprint. Based on the rating system provided in the EPBC Act Referral Guidelines for the Koala (DotE, 2014), the majority of the habitat within the Commonwealth Assessment Footprint does not meet the definition of critical habitat for the Koala for the purpose of the EPBC Act. A small area (1 ha) of riparian vegetation located along the Namoi River that would be cleared by the Project rail spur would be critical habitat for the Koala as per the EPBC Act Referral Guidelines for the Koala (DotE, 2014) (Table B11).

Table B11
Koala Habitat Appraisal

Attribute*	Score*	Habitat Appraisal
Koala occurrence	+1-2	There is evidence of one or more Koalas within 2 km of the edge of the Project mining area within the last 10 years generating a score of 1 for the Project mining area. There is also evidence of one or more Koalas located in the riparian habitat which continues into the Project rail spur area within the last 5 years generating a score of 2 for the riparian habitat within the Project rail spur.
Vegetation composition	+2	The woodland habitat shown on Figures 13 and 23 provides habitat for the Koala based on the occurrence of recognised food trees for the Koala in the Western Slopes and Plains Koala Management Area (DECC, 2008). This attribute is rated 2 as the woodland within the Commonwealth Assessment Footprint has two or more known Koala food tree species in the canopy.
Habitat connectivity	+0-2	The majority of the potential Koala habitat within the Commonwealth Assessment Footprint does not form part of a contiguous landscape as it is bound by large areas of previously cleared land. These areas generate a score of 0. A small area (1 ha) of potential Koala habitat that would be cleared by the Project rail spur located along the Namoi River is part of a contiguous landscape ≥ 1,000 ha. This area generates a score of 2.
Key existing threats	+1	Anecdotal evidence from a landowner in the vicinity of the Commonwealth Assessment Footprint suggests that there is infrequent Koala mortality from domestic dog attacks in the wider surrounds. Although, there is little or no evidence of Koala mortality from vehicle strike in the locality, the Project is located in an area where vehicle strike is likely to pose an existing threat to the local Koala population Given the above, the Project would generate a score of 1.
Recovery value	0	Habitat is unlikely to be important for achieving the interim recovery objectives for the inland habitat which are described in DotE (2014) as: • *Protect and conserve the quality and extent of habitat refuges for the persistence of the species during droughts and periods of extreme heat, especially in riparian environments and other areas with reliable soil moisture and fertility.* • *Maintain the quality, extent and connectivity of large areas of koala habitat surrounding habitat refuges.*
Total	**4-7**	**(Note: a score of 5 or more indicated critical habitat).**

* DotE (2014).

The following measures are proposed to manage the Project impact to the critical koala habitat along the Namoi River:

- the Project rail spur has been sited such that impacts on mature vegetation would be minimal (i.e. it would cross the river at a location where the coverage of large trees is sparse).
- the Project rail spur crossing of the Namoi River would be constructed within a 40 m construction corridor length (the riparian zone is 1-2 trees wide at Site B [Future Ecology, 2018]);
- pre-clearance surveys and would be undertaken for the Koala to minimise impacts during clearance (Section 5.1.1 of the Main Text);
- construction of the spur is expected to be complete within a 12 month period;
- sediment controls, including up-catchment diversions and silt fences would be used to prevent sediment being carried into the Namoi River during construction;
- weeds would be managed at the Project rail spur crossing of the Namoi River during construction until native vegetation has re-established;

- following construction of the Project rail spur crossing, species characteristic of the River Red Gum Riparian Tall Woodland (NA 193) would be planted in the construction corridor along the river, including River Red Gum (*Eucalyptus camaldulensis*); and
- residual impacts on the River Red Gum Riparian Tall Woodland (NA 193) and the Koala from the Project would be offset (equating to 40 ecosystem credits for NA193 and approximately 1,308 credits for the Koala (Section 5.8 of the Main Text).

Table B12 provides an assessment of adverse impacts on the Koala (*Phascolarctos cinereus*) in accordance with DotE's (2013) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance* and considering the assessment guidelines.

Table B12
Likelihood of a Significant Adverse Impact on the Koala

EPBC Act Assessment Criteria[1] Is the action likely to:	Assessment
Lead to a long-term decrease in the size of an important population of a species?	The Project would result in the removal/modification of approximately 80.9 ha of potential habitat resources for the Koala (Figures 13 and 23) and may disrupt foraging and shelter for the Koala. The removal/modification of a portion of habitat for the Koala is unlikely to lead to a long-term decrease in the size of an important population of Koala given: ■ much of the known and potential habitat to be cleared has been subject to past disturbances (such as logging); ■ similar (and better) potential habitat for this species is more widespread in the landscape outside the Commonwealth Assessment Footprint; and ■ Koala records are widespread in the landscape outside the Commonwealth Assessment Footprint, as demonstrated by numerous Koala records in the wider surrounds (Figure 14). A number of measures would be implemented for the Project to minimise potential impacts on flora and fauna which would be relevant to occurrences of this species within the Commonwealth Assessment Footprint and adjacent park and reserve areas including progressive site rehabilitation, vegetation clearance protocol as well as weed and feral animal management.
	The change in cumulative impact on the Koala as a result of the Project (considering impacts from other surrounding developments [Section 5.1.4 of the Main Text]) is considered to be minimal as potential habitat is more abundant in the surrounding landscape and this species has not been recorded using potential habitat in the Commonwealth Assessment Footprint.
Reduce the area of occupancy of an important population?	Given that only one Koala has been recorded within the Commonwealth Assessment Footprint, and the Project is not located at the extent of the species range, an important population of Koala is not present within the Commonwealth Assessment Footprint. There is no evidence of Koala breeding within the locality. The Project would not reduce the area of occupancy of a population.
Fragment an existing important population into two or more populations?	While potential habitat clearing would occur as a result of the Project, the nature of clearing would reduce the area of habitat rather than fragment it or further isolate habitat. The Project rail spur would result in clearance of potential Koala habitat along the Namoi River. This species is known to move across open paddocks/grasslands to locate suitable food resources. Given the mobile nature of the species, the loss of the vegetation within the Commonwealth Assessment Footprint would not fragment the wider Koala population. Consistent with the existing impact avoidance and mitigation measures to be undertaken for the Approved Mine, scattered trees (a total of 50 trees) would be planted annually within the LBEM area (for the life of the mine [25 years]) to provide habitat for the Koala.
Adversely affect habitat critical to the survival of a species?	Table B11 provides an appraisal of the habitat within the Commonwealth Assessment Footprint. Based on the rating system provided in the EPBC Act Referral Guidelines for the Koala (DotE, 2014), the habitat in the Commonwealth Assessment Footprint has been assessed as critical habitat for the Koala for the purpose of the EPBC Act. However, this assessment needs to be viewed against the reality that the Koala has not been recorded within the Commonwealth Assessment Footprint despite Future Ecology (2018) having conducted surveys in accordance with the Spot Assessment Technique methodology. The habitat is not critical for the survival of the species as such habitat is widespread in the wider landscape, and often not used by the Koala.

Table B12 (Continued)
Likelihood of a Significant Adverse Impact on the Koala

EPBC Act Assessment Criteria[1] Is the action likely to:	Assessment
Disrupt the breeding cycle of an important population?	Given the species has not been recorded within the Commonwealth Assessment Footprint, and the Project is not located at the extent of the species range, an important population of Koala is not present within the Commonwealth Assessment Footprint. There is no evidence of Koala breeding within the locality. The Project would not disrupt the breeding cycle of the wider Koala population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The habitat which would be removed/modified as a result of the Project (Figures 13 and 23) is expected to have a negligible impact on resources for this species and would not lead the species declining given: ■ much of the known and potential habitat to be cleared has been subject to past disturbances (such as logging); ■ similar (and better) potential habitat for these species is more widespread in the landscape outside the Commonwealth Assessment Footprint; ■ Koala records and known Koala habitat are widespread in the landscape outside the Commonwealth Assessment Footprint, as demonstrated by numerous Koala records in the wider surrounds (Figure 14); and ■ Some potential habitat would be removed in the Commonwealth Assessment Footprint (approximately 80.9 ha) (Figures 13 and 23), however, the area of habitat that would remain outside the Commonwealth Assessment Footprint is relatively large and would still provide habitat for Koalas.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	Bell Miners (*Manorina melanophrys*) and the European Red Fox (*Vulpes vulpes*) are considered threats to the Koala (DECC, 2008). The Bell Miner was not recorded during the recent surveys by Future Ecology (2018), however, surveys did record the European Red Fox. Feral pests that are already present in the Commonwealth Assessment Footprint are likely to displace into adjoining areas during construction, however, the number of feral pests that would be displaced would be reduced by controlling feral pests in the Commonwealth Assessment Footprint. The control of feral pests is an existing measure that would be adopted for the Commonwealth Assessment Footprint (including mine rehabilitation) and wider area. With the implementation of management measures, the potential impacts to Koala associated with feral animals is likely to be low. The Project is not inconsistent with the *Threat Abatement Plan for Predation by the European Red Fox* (DEWHA, 2008).
Introduce disease that may cause the species to decline?	Koalas in NSW carry the pathogens *Chlamydia* spp. However, clinical signs of this infection, chlamydiosis, are expressed when animals are exposed to environmental stresses such as loss of habitat, harassment by predators, nutritional stress or overcrowding. Reduced fertility as a result of chlamydiosis is thought to naturally regulate populations to prevent them from exceeding the carrying capacity of their habitat, thus preventing overbrowsing (DECC, 2008). However, some of the more harmful strains of Chlamydia are not natural infections of koalas, but recently derived from cows and sheep (DECC, 2008). Therefore, Chlamydial disease should still be considered a threat to Koala populations in spite of the popular belief that the long-term survival of koalas is not threatened by Chlamydia. The Project is not likely to increase the existing risk of Chlamydial infections into the NSW Koala population, nor is it likely to exacerbate the existing Chlamydial disease of any local Koala populations (should they occur).
Interfere substantially with the recovery of the species?	Given the above, the Project is unlikely to have a negative impact on Koala numbers, or significantly reduce available resources in the immediate landscape. Recovery actions for the Koala are listed in the *Recovery Plan for the Koala (Phascolarctos cinereus)* (DECC, 2008). The Project is not inconsistent with the actions listed in this plan. Thus the Project would not interfere with the recovery of the species.

[1] As defined by the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DotE, 2013).

In conclusion, the Koala is unlikely to be significantly impacted by the Project given:

- only 1 ha of primary koala food trees occur in the Commonwealth Assessment Footprint (after DECC, 2008);
- much of the known and potential habitat to be cleared has been subject to past disturbances (such as logging);
- similar (and better) potential habitat for this species is more widespread in the landscape outside the Commonwealth Assessment Footprint (e.g. the riparian zone of the Namoi River and larger tributaries outside the Commonwealth Assessment Footprint, Vickery State Forest and Boonalla State Conservation Area); and
- Koala records are widespread in the landscape outside the Commonwealth Assessment Footprint, as demonstrated by numerous Koala records in the wider surrounds (Figure 14).

Mitigation measures for this species are provided in Section B4. Impacts on this species habitat would be offset as described in Section B5.

B3.9 CORBEN'S LONG-EARED BAT (*NYCTOPHILUS CORBENI*)

Corben's Long-eared Bat is listed as 'Vulnerable' under the EPBC Act.

This bat is widespread across central western NSW, inhabiting a variety of woodland vegetation and roosting in tree hollows, exfoliating bark or dense foliage (Lunney *et al.,* 1988). It hunts non-flying prey such as caterpillars and beetles (OEH, 2018).

There are no confirmed records of this species in the locality. The calls of *Nyctophilus corbeni* recorded with an Anabat detector cannot be distinguished from calls of other *Nyctophilus* sp. that are also potentially present in the area. Calls of *Nyctophilus* sp. (potentially the Corben's Long-eared Bat) were recorded by Future Ecology (2018) within the surrounds of the Commonwealth Assessment Footprint, however, no roosts have been identified. Database records for the Corben's Long-eared Bat are widespread within the wider locality and are primarily located within vegetated areas (e.g. Pilliga East State Forest).

Table B13 provides an assessment of adverse impacts on Corben's Long-eared Bat (*Nyctophilus corbeni*) in accordance with DotE's (2013) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance*.

Table B13
Likelihood of a Significant Adverse Impact on the Corben's Long-eared Bat

EPBC Act Assessment Criteria[1] Is the action likely to:	Assessment
Lead to a long-term decrease in the size of an important population of a species?	The Project would result in the removal/modification of approximately 77.8 ha of potential habitat for the Corben's Long-eared Bat. The Project is unlikely to lead to a long-term decrease in the size of an important population of Corben's Long-eared Bat given: ■ much of the known and potential habitat to be cleared has been subject to past disturbances (such as logging) resulting in a reduction of hollow-bearing trees; ■ similar (and better) potential habitat for these species is more widespread in the landscape outside the Commonwealth Assessment Footprint; and ■ this species is widespread in the landscape outside the Commonwealth Assessment Footprint, as demonstrated by numerous records in the wider surrounds (Figure 29). In regard to the impacts from the Approved Mine, Niche (2013) assessed the potential impacts on the same threatened hollow-dwelling bats and concluded that the Approved Mine was unlikely to significantly impact these species because of the habitat to be removed (approximately 273 ha of foraging and breeding) represents a relevantly small proportion of the habitat present in the wider locality. The change in cumulative impact on these species as a result of the Project (considering impacts from other surrounding developments [Section 5.1.4 of the Main Text]) is considered to be minimal as similar habitat is more abundant in the surrounding landscapes. Therefore, removal/modification of these areas of habitat would have negligible impact on resources for this species and would not lead to a decrease in the size of the population.
Reduce the area of occupancy of an important population?	Given the species has not been confirmed within the Commonwealth Assessment Footprint, and the Project is not located at the extent of the species range, an important population of Corben's Long-eared Bat is not present within the Commonwealth Assessment Footprint. There is no evidence of Corben's Long-eared Bat breeding within the Commonwealth Assessment Footprint and no roosts have been identified (Future Ecology, 2018). The Project would not reduce the area of occupancy of a population.
Fragment an existing important population into two or more populations?	Given the highly mobile and dispersive nature of this species, the loss of the vegetation within the Commonwealth Assessment Footprint would not fragment the wider Corben's Long-eared Bat population.
Adversely affect habitat critical to the survival of a species?	No critical habitat for Corben's Long-eared Bat has been mapped within the Commonwealth Assessment Footprint or immediate surrounds.
Disrupt the breeding cycle of an important population?	There is no evidence of Corben's Long-eared Bat breeding within the Commonwealth Assessment Footprint. The Project would not disrupt the breeding cycle of the wider Corben's Long-eared Bat population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The potential habitat which would be removed/modified as a result of the Project is expected to have a negligible impact on resources for this species and would not lead the species declining, given: ■ much of the known and potential habitat to be cleared has been subject to past disturbances (such as logging); ■ similar (and better) potential habitat for these species is more widespread in the landscape outside the Commonwealth Assessment Footprint; and ■ this species is widespread in the landscape outside the Commonwealth Assessment Footprint, as demonstrated by numerous records in the wider surrounds (Figure 29).

Table B13 (Continued)
Likelihood of a Significant Adverse Impact on the Corben's Long-eared Bat

EPBC Act Assessment Criteria[1] Is the action likely to:	Assessment
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	The impact of feral predation is unknown but has been documented as a threat for bat species closely related to Corben's Long-eared Bat (DEE, 2018). Bats have been recorded being evicted from tree hollows by feral species, including the Common Starling (*Sturnus vulgaris*) (DEE, 2018). Recent bird surveys in and around the Commonwealth Assessment Footprint show that while Common Starlings are present, there is also good representation of native bird and tree-dwelling mammal species (including other hollow-dwelling bats). This indicates that Common Starlings in and around the Commonwealth Assessment Footprint do not dominate tree hollows. The Project would not result in habitat fragmentation or clearing that would result in an increase in the Common Starling populations. Feral pests that are already present in the Commonwealth Assessment Footprint are likely to displace into adjoining areas during construction, however, the number of feral pests that would be displaced would be reduced by controlling feral pests in the Commonwealth Assessment Footprint. The control of feral pests is an existing measure that would be adopted for the Commonwealth Assessment Footprint (including mine rehabilitation) and wider area.
Introduce disease that may cause the species to decline?	There are no known diseases potentially spread by soil movement or mining equipment that would affect Corben's Long-eared Bat.
Interfere substantially with the recovery of the species?	The Project is unlikely to have a negative impact on Corben's Long-eared Bat numbers, or significantly reduce available resources in the immediate landscape. Thus the Project would not interfere with the recovery of the species.

[1] As defined by the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DotE, 2013).

In conclusion, the Corben's Long-eared Bat is unlikely to be significantly impacted by the Project given:

- much of the known and potential habitat to be cleared has been subject to past disturbances (such as logging) resulting in a reduction of hollow-bearing trees;
- similar (and better) potential habitat for these species is more widespread in the landscape outside the Commonwealth Assessment Footprint; and
- this species is widespread in the landscape outside the Commonwealth Assessment Footprint, as demonstrated by numerous records in the wider surrounds (Figure 29).

Mitigation measures for this species are provided in Section B4.

B3.10 LARGE-EARED PIED BAT (*CHALINOLOBUS DWYERI*)

The Large-eared Pied Bat is listed as 'Vulnerable' under the EPBC Act.

This is an insectivorous bat assumed to forage below the Forest canopy. It roosts in caves, crevices, in the roofs of culverts and rock shelters. Found from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes (OEH, 2018). There are over 1,000 records for this bat from across NSW with over half concentrated in the area from the Hunter Valley south to Nowra (OEH, 2017a). The species in the locality of the Commonwealth Assessment Footprint is not at the limits of its range.

Future Ecology (2018) possibly recorded a Large-eared Pied Bat, via bat recording devices, outside the Commonwealth Assessment Footprint. However, the calls could not be distinguished from other non-threatened bat species. The Large-eared Pied Bat has possibly been recorded within the Commonwealth Assessment Footprint to the south of the Vickery State Forest by Niche (2013). Database records for this species are widespread within the wider locality and are primarily located within vegetated areas (e.g. Pilliga East State Forest).

Table B14 provides an assessment of adverse impacts on the Large-eared Pied Bat (*Chalinolobus dwyeri*) in accordance with DotE's (2013) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance*.

Table B14
Likelihood of a Significant Adverse Impact on the Large-eared Pied Bat

EPBC Act Assessment Criteria[1] Is the action likely to:	Assessment
Lead to a long-term decrease in the size of an important population of a species?	The Project would result in the removal/modification of approximately 77.8 ha of potential habitat for the Large-eared Pied Bat. Considering the above, it is possible that local populations of this species could use the Commonwealth Assessment Footprint as part of a foraging range, given the occurrence of potential habitat resources and records of the species within the footprint. The Project is unlikely to lead to a long-term decrease in the size of an important population of this species given: ■ no roosts (caves) would be disturbed by the Project; ■ cave-roosting bats would not be present in vegetation during land clearance activities; ■ similar foraging habitat for these species is more widespread in the landscape outside the Commonwealth Assessment Footprint; and ■ this species is widespread in the landscape outside the Commonwealth Assessment Footprint, as demonstrated by numerous records in the wider surrounds (Figure 30) (e.g. Large-eared Pied Bat has been recorded along the Namoi River). The change in cumulative impact on these species as a result of the Project (considering impacts from other surrounding developments [Section 5.1.4 of the Main Text]) is considered to be minimal given no roosting or breeding habitat would be removed in the Commonwealth Assessment Footprint and the foraging habitat are all more widely occurring in the surrounding landscape. Therefore, removal/modification of these areas of potential habitat would have negligible impact on resources for this species and would not lead to a decrease in the size of the population.
Reduce the area of occupancy of an important population?	Given the species has not been confirmed within the Commonwealth Assessment Footprint, and the Project is not located at the extent of the species range, an important population of Large-eared Pied Bat is not present within the Commonwealth Assessment Footprint. There is no breeding habitat (i.e. caves) for the Large-eared Pied Bat within the Commonwealth Assessment Footprint. The closest area of potentially suitable roosting habitat is located within the Boggabri Offset Area approximately 5 km to the west of the Project rail spur, and approximately 15 km north-west of the Project mining area. The Project would not result in the removal of these caves, nor would any indirect impacts as a result of mining activities (i.e. noise, dust, vibration) adversely impact these caves (or any bats roosting within). In addition, suitable forging habitat for the Large-eared Pied Bat would be more prevalent in close proximity to these caves compared to within the Commonwealth Assessment Footprint. The Project would not reduce the area of occupancy of a population.
Fragment an existing important population into two or more populations?	Given the highly mobile and dispersive nature of this species, the loss of the vegetation within the Commonwealth Assessment Footprint would not fragment the wider Large-eared Pied Bat population.
Adversely affect habitat critical to the survival of a species?	No critical habitat for Large-eared Pied Bat has been mapped within the Commonwealth Assessment Footprint or immediate surrounds.
Disrupt the breeding cycle of an important population?	There is no breeding habitat for the Large-eared Pied Bat within the Commonwealth Assessment Footprint. The Project would not disrupt the breeding cycle of the wider Large-eared Pied Bat population.

Table B14 (Continued)
Likelihood of a Significant Adverse Impact on the Large-eared Pied Bat

EPBC Act Assessment Criteria[1] Is the action likely to:	Assessment
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The habitat which would be removed/modified as a result of the Project is expected to have a negligible impact on resources for this species and would not lead the species declining, given: ■ no roosts (caves) would be disturbed by the Project; ■ cave-roosting bats would not be present in vegetation during land clearance activities; ■ similar foraging habitat for these species is more widespread in the landscape outside the Commonwealth Assessment Footprint; and ■ this species is widespread in the landscape outside the Commonwealth Assessment Footprint, as demonstrated by numerous records in the wider surrounds (Figure 30) (e.g. Large-eared Pied Bat has been recorded along the Namoi River).
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	The European Red Fox poses a potential predatory threat to the Large-eared Pied Bat (DEE, 2018). The Project would involve the same potential impacts from feral animals as the Approved Mine. Feral pests that are already present in the Commonwealth Assessment Footprint are likely to displace into adjoining areas during construction, however, the number of feral pests that would be displaced would be reduced by controlling feral pests in the Commonwealth Assessment Footprint. The control of feral pests is an existing measure that would be adopted for the Commonwealth Assessment Footprint (including mine rehabilitation) and wider area. The Project is not inconsistent with the *Threat Abatement Plan for Predation by the European Red Fox* (DEWHA, 2008).
Introduce disease that may cause the species to decline?	There are no known diseases potentially spread by soil movement or mining equipment that would affect Large-eared Pied Bat.
Interfere substantially with the recovery of the species?	The Project is unlikely to have a negative impact on Large-eared Pied Bat numbers, or significantly reduce available resources in the immediate landscape. The *National Recovery Plan for the Large-eared Pied Bat Chalinolobus dwyeri* (Department of Environment and Resource Management, 2011) lists recovery actions for this species. The Project is not inconsistent with the actions listed in this plan. Thus the Project would not interfere with the recovery of the species.

[1] As defined by the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DotE, 2013).

In conclusion, the Large-eared Pied Bat is unlikely to be significantly impacted by the Project given:

- the localised nature of the habitat in the Commonwealth Assessment Footprint compared to the wider distribution of the species;
- the absence of breeding habitat in the Commonwealth Assessment Footprint; and
- the greater extent of habitat in the locality known to be used by the species.

Mitigation measures for this species are provided in Section B4.

B4 IMPACT AVOIDANCE AND MITIGATION

Despite targeted surveys, no threatened flora species listed under the EPBC Act have been recorded within the Commonwealth Assessment Footprint. The occurrences of the threatened flora species in the wider locality would all be avoided by the Project.

Table B15 provides a consolidated list of avoidance and mitigation measures proposed to be undertaken to minimise the impacts of the Project on the Swift Parrot, Regent Honeyeater, Painted Honeyeater, Koala, Corben's Long-eared Bat and Large-eared Pied Bat, including:

- a description of proposed avoidance and mitigation measures to deal with relevant impacts of the Project;
- assessment of the expected or predicted effectiveness of the mitigation measures;
- a description of the outcomes that the avoidance and mitigation measures are likely to achieve; and
- statutory or policy basis for the proposed mitigation measures.

The management and mitigation measures proposed as part of the Project are considered consistent with current best practice in the mining industry. The majority of these matters have substantial evidence of success over a long period of time (e.g. weed and erosion management measures).

Whitehaven is the proponent for the Project and would be responsible for undertaking and funding the management measures.

Table B15
Protected Matters and Mitigation Measures

Common Name	Conservation Status under the EPBC Act[1]	List of Avoidance and Mitigation Measures	Description	Predicted Effectiveness	Outcome	Statutory Or Policy Basis
Swift Parrot	CE*	■ Planting of 50 trees per annum for the life of the mine (25 years)	A total of 50 trees per annum for the life of the mine (25 years) will be planted (from hiko) throughout the LBEM Area to provide habitat for threatened species.	There is a high likelihood that this measure would provide potential foraging habitat for this species over the long-term.	Additional foraging habitat in the LBEM area in the medium to long-term.	*National Recovery Plan for the Swift Parrot (Lathamus discolor)* (Saunders & Tzaros, 2011) *Commonwealth Listing Advice on Lathamus discolour (Swift Parrot)* (Threatened Species Scientific Committee, 2016)
		■ vegetation clearance protocol	Provides for the avoidance of impacts on individuals of this species as they would not be present at the time of clearance.	There is a high likelihood that this measure would effectively minimise direct impacts to this species.	Swift Parrots would not be on site at the time of clearance.	
Regent Honeyeater	CE	■ Planting of 50 trees per annum for the life of the mine (25 years)	A total of 50 trees per annum for the life of the mine (25 years) will be planted (from hiko) throughout the LBEM Area to provide habitat for threatened species.	There is a high likelihood that this measure would provide potential foraging habitat for this species over the long-term.	Additional foraging habitat in the LBEM area in the medium to long-term.	*National Recovery Plan for the Regent Honeyeater (Anthochaera phrygia)* (DotE, 2016) *Approved Conservation Advice for Anthochaera phrygia (Regent Honeyeater)* (Threatened Species Scientific Committee, 2015a)
		■ vegetation clearance protocol	Provides for the avoidance of impacts on individuals of this species which may be present at the time of clearance.	There is a moderate to high likelihood that this measure would effectively minimise direct impacts to this species.	Impacts to Regent Honeyeaters on site at the time of clearance (were they to occur) would be minimised.	
Painted Honeyeater	V	■ vegetation clearance protocol	Provides for the avoidance of impacts on individuals of this species which may be present at the time of clearance.	There is a moderate to high likelihood that this measure would effectively minimise direct impacts to this species.	Impacts to Painted Honeyeaters on site at the time of clearance (were they to occur) would be minimised.	*Approved Conservation Advice for Grantiella picta (Painted Honeyeater)* (Threatened Species Scientific Committee, 2015b) *Threat Abatement Plan for Predation by the European Red Fox* (DEWHA, 2008) *Threat Abatement Plan for Predation by Feral Cats* (DotE, 2015b)
		■ feral pest control	Provides for the avoidance of impacts from nest predation or competition to the Painted Honeyeater.	There is a high likelihood that this measure would effectively mitigate potential impacts as a result of feral animals.	Impacts from exotic fauna (e.g. nest predation and competition) to the Painted Honeyeater (were they to occur) would be minimised.	

Table B15 (Continued)
Protected Matters and Mitigation Measures

Common Name	Conservation Status under the EPBC Act[1]	List of Avoidance and Mitigation Measures	Description	Predicted Effectiveness	Outcome	Statutory Or Policy Basis
Koala	V	■ vegetation clearance protocol	Provides for the avoidance of impacts on individuals of this species which may be present at the time of clearance.	There is a moderate to high likelihood that this measure would effectively minimise direct impacts to this species.	Impacts to Koalas on site at the time of clearance (were they to occur) would be minimised.	*EPBC Act Referral Guidelines for the Vulnerable Koala* (DotE, 2014) *Listing Advice for Phascolarctos cinereus (Koala)* (Threatened Species Scientific Committee, 2012a)
		■ feral pest control	Provides for the avoidance of impacts from predation or competition to the Koala.	There is a high likelihood that this measure would effectively mitigate potential impacts as a result of feral animals.	Impacts from exotic fauna (e.g. predation and competition) to the Koala (were they to occur) would be minimised.	
Corben's Long-eared Bat (cont)	V	■ vegetation clearance protocol	Provides for the avoidance of impacts on individuals of this species which may be present at the time of clearance.	There is a moderate to high likelihood that this measure would effectively minimise direct impacts to this species.	Impacts to Corben's Long-eared Bats on site at the time of clearance (were they to occur) would be avoided.	*Commonwealth Listing Advice on Ten Species of Bats* (Threatened Species Scientific Committee, 2001) *Approved Conservation Advice for Nyctophilus corbeni (south-eastern long-eared bat)* (Threatened Species Scientific Committee, 2015c)
		■ feral pest control	Provides for the avoidance of impacts from predation or competition to Corben's Long-eared Bat.	There is a high likelihood that this measure would effectively mitigate potential impacts as a result of feral animals.	Impacts from exotic fauna (e.g. predation and competition) to Corben's Long-eared Bat (were they to occur) would be minimised.	
Large-eared Pied Bat	V	■ Planting of 50 trees per annum for the life of the mine (25 years)	A total of 50 trees per annum for the life of the mine (25 years) will be planted (from hiko) throughout the LBEM Area to provide habitat for threatened species.	There is a high likelihood that this measure would provide potential foraging habitat for this species over the long-term.	Additional foraging habitat in the LBEM area in the medium to long-term.	*Commonwealth Listing Advice on Ten Species of Bats* (Threatened Species Scientific Committee, 2001) *Commonwealth Listing Advice on Chalinolobus dwyeri (Large-eared Pied Bat)* (Threatened Species Scientific Committee, 2012b)

[1] Threatened fauna species status under the EPBC Act (current at July 2018).

V = Vulnerable; E = Endangered; CE = Critically Endangered.

* Listed as Endangered under the EPBC Act at the time of the controlled action decision (14 April 2016) and therefore assessed as 'Endangered' not 'Critically Endangered' (refer section 158A of the EPBC Act).

B5 COMMONWEALTH OFFSET PACKAGE

The bilateral agreement made under section 45 of the EPBC Act between the Commonwealth of Australia and the State of NSW relating to environmental assessment (the NSW Assessment Bilateral Agreement – dated 26 February 2015), enables the Commonwealth Minister for the Environment to rely on assessment processes of the State of NSW in assessing actions referred under the EPBC Act.

The Commonwealth Assessment Footprint includes:

- Commonwealth Assessment Footprint for the Mining area, which comprises two parts:
  - the NSW BAR Footprint for the Mining area; and
  - an additional portion of the Approved Mine which was not previously referred under the EPBC Act.
- The Project rail spur

Table 50 of the main text summarises the potential habitat clearance for the Swift Parrot, Regent Honeyeater and Koala, Project offset requirements for these species and proposed method of meeting the offset requirements. Table 50 of the main text shows how the offset requirements could be satisfied through a combination of:

- creating new credits by establishing proposed offset areas 6, 7 and 8;
- creating new credits by establishing a proposed offset area at the Mount Somner property; and
- satisfying the residual credit requirement through additional credits acquired, retired, converted to the fund or supplementary measures (the latter two methods capped at 10% for MNES).

As stated in Section 6.2.2.5 of the main text, much greater area of habitat would be conserved in perpetuity as a result of the Project than the area of habitat would be disturbed by the Project. For example, the Project would conserve in the order of 510 ha of habitat for the Regent Honeyeater (~1:10.84 disturbance to offset ratio), 231.4 ha of habitat for the Squirrel Glider (~1:3 ratio) and 184 ha of habitat for the Koala (~1:3.65 ratio) (Table 38).

The BAR Footprint does not include an additional portion of the Approved Mine which was not previously referred under the EPBC Act (the difference is approximately 208.6 ha, comprising 30.6 ha of woodland/forest). However, the woodland/forest within this portion of the Commonwealth Assessment Footprint was covered by the Approved Mine (SSD-5000) and therefore subject to the existing biodiversity offset strategy described in Section 6.1 of the main text. It is reasonable that the existing biodiversity offset strategy applies to this portion of the Commonwealth Assessment Footprint because:

- the existing biodiversity offset strategy was provided for the same disturbance footprint;
- the existing biodiversity offset strategy was not relevant to the previously referred Vickery Coal Project (EPBC 2012/6263) (outside of the Commonwealth Assessment Footprint) as it was determined to be not a Controlled Action if implemented in a particular manner; and
- the existing biodiversity offset strategy provides for the enhancement and conservation of habitat for the threatened fauna relevant to the Project.

B6 CONCLUSION

Although the Project was declared a controlled action, this assessment provides more detailed information than available at the time the Project was referred to the Commonwealth government. This assessment describes how the removal of limited potential habitat would not significantly impact any threatened species or communities listed under the EPBC Act (Table B16).

Table B16
Assessment Summary

Common Name	Scientific Name	Conservation Status[1]	Assessment Summary
Ecological Communities			
Weeping Myall Woodland		E	The Weeping Myall Woodland EEC is unlikely to be significantly impacted by the Project given: ■ no Weeping Myall Woodland EEC is located within the Commonwealth Assessment Footprint (Figure 17); and ■ the Weeping Myall Woodland EEC which has been mapped outside of the Commonwealth Assessment Footprint (Figure 17) is not likely to be indirectly impacted by the Project.
Flora			
Belson's Panic	*Homopholis belsonii*	V	Belson's Panic is unlikely to be significantly impacted by the Project given: ■ this species has not been recorded in the Commonwealth Assessment Footprint despite targeted surveys; ■ the localised nature of the Commonwealth Assessment Footprint disturbance of potential habitat compared to the wider distribution of the species and its potential habitat; and ■ the greater extent of potential habitat in the locality.
Winged Peppercress	*Lepidium monoplocoides*	E	Winged Peppercress is unlikely to be significantly impacted by the Project given: ■ No Winged Peppercress are known to occur within the Commonwealth Assessment Footprint, despite targeted surveys by Niche (2013) and FloraSearch (2018); and ■ The Winged Peppercress to the north of the Commonwealth Assessment Footprint (Figure 17) would be managed in accordance with the EPBC Act Notification of Referral Decision (EPBC 2012/6263).
-	*Tylophora linearis*	E	*Tylophora linearis* is unlikely to be significantly impacted by the Project given: ■ *Tylophora linearis* has not been recorded within the Commonwealth Assessment Footprint despite targeted surveys; and ■ *Tylophora linearis* and its habitat are commonly recorded in the landscape outside the Commonwealth Assessment Footprint (after OEH, 2017).
Birds			
Regent Honeyeater	*Anthochaera phrygia*	CE	The Regent Honeyeater is unlikely to be significantly impacted by the Project given: ■ it has not been recorded using potential habitat within the Commonwealth Assessment Footprint, despite surveys (Niche, 2013; Future Ecology, 2018); ■ much of the potential habitat to be cleared has been subject to past disturbances (such as logging, fragmentation of habitat and livestock grazing); ■ the Project is not located in a key breeding area for this species (the closest of which is more than 40 km north-east of the Vickery Extension Project [EPBC 2016/7649] Footprint) (DotE, 2016) and this species is not typically recorded foraging in the surrounding landscape (Figure 12); and ■ similar (and better) potential habitat for these species is widespread in the landscape outside the Commonwealth Assessment Footprint.

Table B16 (Continued)
Assessment Summary

Common Name	Scientific Name	Conservation Status[1]	Assessment Summary
Birds (Continued)			
Swift Parrot	*Lathamus discolor*	CE*	The Swift Parrot unlikely to be significantly impacted by the Project given: ■ the localised nature of the potential habitat in the Commonwealth Assessment Footprint compared to the wider distribution of the species; ■ this species does not breed in NSW; ■ the Swift Parrot is a highly nomadic species that roams the landscape widely in search of flowering trees, their main source of food. The habitat on the Commonwealth Assessment Footprint is a very small part of that available in the surrounding locality and wider region; and ■ the greater extent of habitat in the locality.
Painted Honeyeater	*Grantiella picta*	V	The Painted Honeyeater unlikely to be significantly impacted by the Project given: ■ much of the potential habitat to be cleared has been subject to past disturbances (such as logging, fragmentation of habitat and livestock grazing); ■ it is likely that the Painted Honeyeaters located near the Commonwealth Assessment Footprint were recorded in River She-oaks which were observed along the Namoi River (FloraSearch, 2018) and are known to contain mistletoes, while mistletoes were very scarily recorded throughout the remainder of the Commonwealth Assessment Footprint (FloraSearch, 2018); ■ similar (and better) potential habitat for these species is widespread in the landscape outside the Commonwealth Assessment Footprint; and ■ the Painted Honeyeater is likely to persist in the habitat to the south of the Commonwealth Assessment Footprint as potential indirect impacts would be mitigated.
Mammals			
Koala	*Phascolarctos cinereus*	V	The Koala is unlikely to be significantly impacted by the Project given: ■ only 1 ha of primary koala food trees occur in the Commonwealth Assessment Footprint (after DECC, 2008); ■ much of the known and potential habitat to be cleared has been subject to past disturbances (such as logging); ■ similar (and better) potential habitat for this species is more widespread in the landscape outside the Commonwealth Assessment Footprint (e.g. the riparian zone of the Namoi River and larger tributaries outside the Commonwealth Assessment Footprint, Vickery State Forest and Boonalla State Conservation Area); and ■ Koala records are widespread in the landscape outside the Commonwealth Assessment Footprint, as demonstrated by numerous Koala records in the wider surrounds (Figure 14).
Corben's Long-eared Bat	*Nyctophilus corbeni*	V	The Corben's Long-eared Bat is unlikely to be significantly impacted by the Project given: ■ much of the known and potential habitat to be cleared has been subject to past disturbances (such as logging); ■ similar (and better) potential habitat for these species is more widespread in the landscape outside the Commonwealth Assessment Footprint; and ■ this species is widespread in the landscape outside the Commonwealth Assessment Footprint, as demonstrated by numerous records in the wider surrounds (Figure 29).

Table B16 (Continued)
Assessment Summary

Common Name	Scientific Name	Conservation Status[1]	Assessment Summary
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	The Large-eared Pied Bat is unlikely to be significantly impacted by the Project given: ■ the localised nature of the habitat in the Commonwealth Assessment Footprint compared to the wider distribution of the species; ■ the absence of breeding habitat in the Commonwealth Assessment Footprint; and ■ the greater extent of habitat in the locality known to be used by the species.

[1] Threatened fauna species status under the EPBC Act (current as at July 2018).

V = Vulnerable; E = Endangered; CE = Critically Endangered.

* Listed as Endangered under the EPBC Act at the time of the controlled action decision (14 April 2016) and therefore assessed as 'Endangered' not 'Critically Endangered' (refer section 158A of the EPBC Act).

The Project is not inconsistent with any relevant recovery plans, conservation advice or agreements.

The impacts of the Project at a local scale would be minimal. Therefore, there would be no additional cumulative impacts compared to previous proposed disturbance from other agricultural and industrial activities, especially when considering the avoidance and mitigation measures and the positive benefits of the proposed Biodiversity Offset Strategy (Section 6.2 of the Main Text).

Impacts on protected matters would be localised and negligible on a regional, state and national scale. The Project is unlikely to have a significant negative impact on the conservation status, condition or trend of any Matter of National Significance at a local or regional scale.

B6 REFERENCES

Department of Environment and Climate Change (2008) *Approved Recovery Plan for the Koala (Phascolarctos cinereus)*.

Department of Environment, Climate Change and Water (2010) *National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland*.

Department of Environment and Resource Management (2011) *National Recovery Plan For the Large-eared Pied Bat Chalinolobus dwyeri.*
Website: http://www.environment.gov.au/resource/national-recovery-plan-large-eared-pied-bat-chalinolobus-dwyeri

Department of the Environment (2013) *Matters of National Environmental Significance Significant Impact Guidelines 1.1.*
Website: https://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf

Department of the Environment (2014) *EPBC Act Referral Guidelines for the Vulnerable Koala*.
Website: http://www.environment.gov.au/biodiversity/threatened/publications/epbc-act-referral-guidelines-vulnerable-koala

Department of the Environment (2015a) *Australia's Threatened Species Strategy*.

Department of the Environment (2015b) *Threat Abatement Plan for Predation by Feral Cats*.

Department of the Environment (2016) *National Recovery Plan for the Regent Honeyeater (Anthochaera phrygia).*

Department of the Environment and Energy (2016) *Threat Abatement Plan for Competition and Land Degradation by Rabbits*.

Department of the Environment and Energy (2017a) *Protected Matters search for the following area: -32.21, 149.71; -32.20, 150.03; -32.47, 150.04; -32.48, 149.72.* Data received: August 2017.

Department of the Environment and Energy (2017b) *Threat Abatement Plan for Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs (Sus scrofa*).

Department of the Environment and Energy (2018) *Species Profiles and Threats Database.*

Department of the Environment, Water, Heritage and the Arts (2008) *Threat Abatement Plan for Predation by the European Red Fox.*

Department of the Environment, Water, Heritage and the Arts (2009) *EPBC Act Policy Statement 3.17: Weeping Myall Woodlands.*

Department of the Environment, Water, Heritage and the Arts (2010a) *Survey Guidelines for Australia's Threatened Bats.*

Department of the Environment, Water, Heritage and the Arts (2010b) *Survey Guidelines for Australia's Threatened Birds.*

Department of the Environment, Water, Heritage and the Arts (2010c) *Survey Guidelines for Australia's Threatened Frogs.*

Department of Sustainability, Environment, Water, Population and Communities (2011a) *Survey Guidelines for Australia's Threatened Reptiles.*

Department of Sustainability, Environment, Water, Population and Communities (2011b) *Survey Guidelines for Australia's Threatened Mammals.*

Department of Sustainability, Environment, Water, Population and Communities (2012) *Approved Conservation Advice for* Phascolarctos cinereus *(combined populations in Queensland, New South Wales and the Australian Capital Territory)*. Dutson, G., Garnett, S., and Gole, C. (2009). *Australia's important bird areas: key sites for bird conservation*.

Eco Logical Australia (2018) *Vickery Extension Project Aquatic Ecology Assessment*. Report prepared for Whitehaven Coal Limited.

FloraSearch (2018) *Vickery Extension Project Baseline Flora Survey Report*. Report Prepared for Whitehaven Coal Limited.

Future Ecology (2018) *Vickery Extension Project Baseline Fauna Survey Report*. Report Prepared for Whitehaven Coal Limited.

Hunter Eco (2018) *Offset Areas 6, 7 and 8 Biobanking Assessment Report*. Prepared for Whitehaven Coal.

Kendall and Kendall (2011) *Vickery South Coal Project - Fauna Assessment Briefing Note.* Unpublished report prepared for R.W. Corkery & Co. Pty Limited.

Lunney, D., Barker, J., Priddel, D. and O'Connel, M. (1988) *Roost Selection by Gould's Long-eared Bat* [sic] *Nyctophilus gouldi Tones (Microchiroptera: Vespertilionidae) in a Logged Forest on the South Coast of New South Wales*. *Australian Wildlife Research,* 15, 375-384.

Mavromihalis (2010) *National Recovery Plan for the Winged Peppercress Lepidium monoplocoides*.

Niche Environment and Heritage (2013) *Vickery Coal Project Environmental Impact Statement. Appendix E: Ecological Assessment.* Whitehaven Coal, Sydney.

Office of Environment and Heritage (2017) *BioNet Atlas of NSW Wildlife – Database Records for the Following Area: -30.45, 150.64; -30.45, 149.89; -31.02, 149.89; 31.02, 150.64*

Office of Environment and Heritage (2018) *Threatened Biodiversity Data Collection*.

Saunders, D.L. & C.L. Tzaros (2011). *National Recovery Plan for the Swift Parrot* (Lathamus discolor). Birds Australia, Melbourne.

Threatened Species Scientific Committee (2001) *Commonwealth Listing Advice on Ten Species of Bats*.

Threatened Species Scientific Committee (2006) *Commonwealth Listing Advice on White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland.*

Threatened Species Scientific Committee (2008a) *Approved Conservation Advice on Homopholis belsonii*.

Threatened Species Scientific Committee (2008b) *Approved Conservation Advice on Tylophora linearis.*

Threatened Species Scientific Committee (2009) *Commonwealth Listing Advice on Weeping Myall Woodlands*.

Threatened Species Scientific Committee (2012a) *Listing Advice for Phascolarctos cinereus (Koala).*

Threatened Species Scientific Committee (2012b) *Commonwealth Listing Advice on Chalinolobus dwyeri (Large-eared Pied Bat).*

Threatened Species Scientific Committee (2015a) *Approved Conservation Advice for Anthochaera phrygia (Regent Honeyeater)*.

Threatened Species Scientific Committee (2015b) *Approved Conservation Advice for Grantiella picta (Painted Honeyeater)*.

Threatened Species Scientific Committee (2015c) *Approved Conservation advice for Nyctophilus corbeni (south-eastern long-eared bat).*

Threatened Species Scientific Committee (2015d) *Approved Conservation advice for Nyctophilus corbeni (south-eastern long-eared bat).*

Threatened Species Scientific Committee (2016) *Commonwealth Listing Advice on Lathamus discolor (Swift Parrot).*

ATTACHMENT C
VICKERY EXTENSION PROJECT BASELINE FLORA REPORT

FLORASEARCH

VICKERY EXTENSION PROJECT
BASELINE FLORA REPORT

Prepared for Whitehaven Coal Limited

by C.C. Bower
Principal Consultant Botanist

July 2018

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF APPENDICES

EXECUTIVE SUMMARY

FloraSearch has been commissioned by Whitehaven Coal Limited (Whitehaven) to undertake a baseline flora survey as part of the preparation of an Environmental Impact Statement for the proposed Vickery Extension Project located 25 kilometres north of Gunnedah, New South Wales (NSW).

The objectives of this report are to:

- review existing flora information and mapping relevant to the study area;
- sample the natural vegetation on the study area using *Framework for Biodiversity Assessment* (FBA) survey guidelines;
- determine and map the BioMetric Vegetation Types (BVTs) present within the study area;
- compile a plant species list for each vegetation community;
- using relevant government databases and the FBA decision support system, develop a list of threatened plant species, populations, ecological communities or critical habitat, listed in the Schedules of the NSW *Biodiversity Conservation Act, 2016* (BC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act*, *1999* (EPBC Act) that could potentially occur in the study area; and
- conduct and report on targeted searches for potentially occurring threatened plant species, populations, communities and critical habitat, and map any occurrences.

Methods

- The flora survey was undertaken to provide the data required for a Biodiversity Assessment Report and Biodiversity Offset Strategy under the FBA. Accordingly, the methods closely follow those outlined in FBA.
- Field surveys for this report were undertaken over 13 days in November 2015, 9 days in February 2016, 2 days in March 2016, 2 days in December 2016, 1 day in April 2017 and 2 days in August 2017.

Findings

- The study area was found to support remnants of seven naturally occurring vegetation communities, and secondary/derived native grasslands.
- A total of 374 flora species was identified by the FBA quadrats, standard floristic plots, rapid assessment spot samples, random meanders and general movement around the study area. Of these, 271 (72.5 percent [%]) are native to the natural communities of the study area and 103 (27.5%) are introduced.

- The plant families with the highest numbers of species (Appendix A) were the Grasses, Poaceae (79 taxa); Daisies, Asteraceae (47 taxa); Chenopods, Chenopodiaceae (19 species); Pea-flowers, subfamily Faboideae (20 species); Sidas and Lantern Bushes, Malvaceae (11 species) and the Eucalypts, Myrtaceae (11 species). In all, some 70 plant families and sub-families were represented.

- The highest proportions of introduced species, 52%, were found in River Red Gum riparian woodland (Community 8), which is a highly disturbed, fertile environment favourable to many introduced species. The remaining communities all hosted similar levels of introduced species (22.7 to 32.2%).

- All native vegetation surveyed was in moderate to good condition according to the BioBanking definition of condition. However, during the field surveys it was considered that the vegetation condition across the study area is poor to moderate with the exception of one community in good condition (White Box - Silver-leaved Ironbark Shrubby Open Forest).

- No threatened flora species listed in the schedules of the BC Act, or the EPBC Act, was identified within the study area by the surveys. However, two threatened flora species, Scant Pomaderris, *Pomaderris queenslandica* and a vine, *Tylophora linearis*, were found just to the east of the study area.

- No listed endangered populations or critical habitat occur on the study area.

- One BVT identified on the study area by the current survey, Weeping Myall Woodland, is equivalent to Threatened Ecological Communities listed under the BC Act and the EPBC Act, as follows:

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

  - *Weeping Myall Woodlands* EEC (EPBC Act).

1 INTRODUCTION

The former Vickery Coal Mine and former Canyon Coal Mine are located approximately 25 kilometres (km) north of Gunnedah, in New South Wales (NSW) (Figure 1). Open cut and underground mining activities were conducted at the Vickery Coal Mine between 1986 and 1998. Open cut mining activities at the former Canyon Coal Mine ceased in 2009. The former Vickery and Canyon Coal Mines have been rehabilitated following closure.

The approved Vickery Coal Project (herein referred to as the Approved Mine) is an approved, but yet to be constructed, project involving the development of an open cut coal mine and associated infrastructure, and would facilitate a run-of-mine (ROM) coal production rate of up to approximately 4.5 million tonnes per annum (Mtpa) for a period of 30 years.

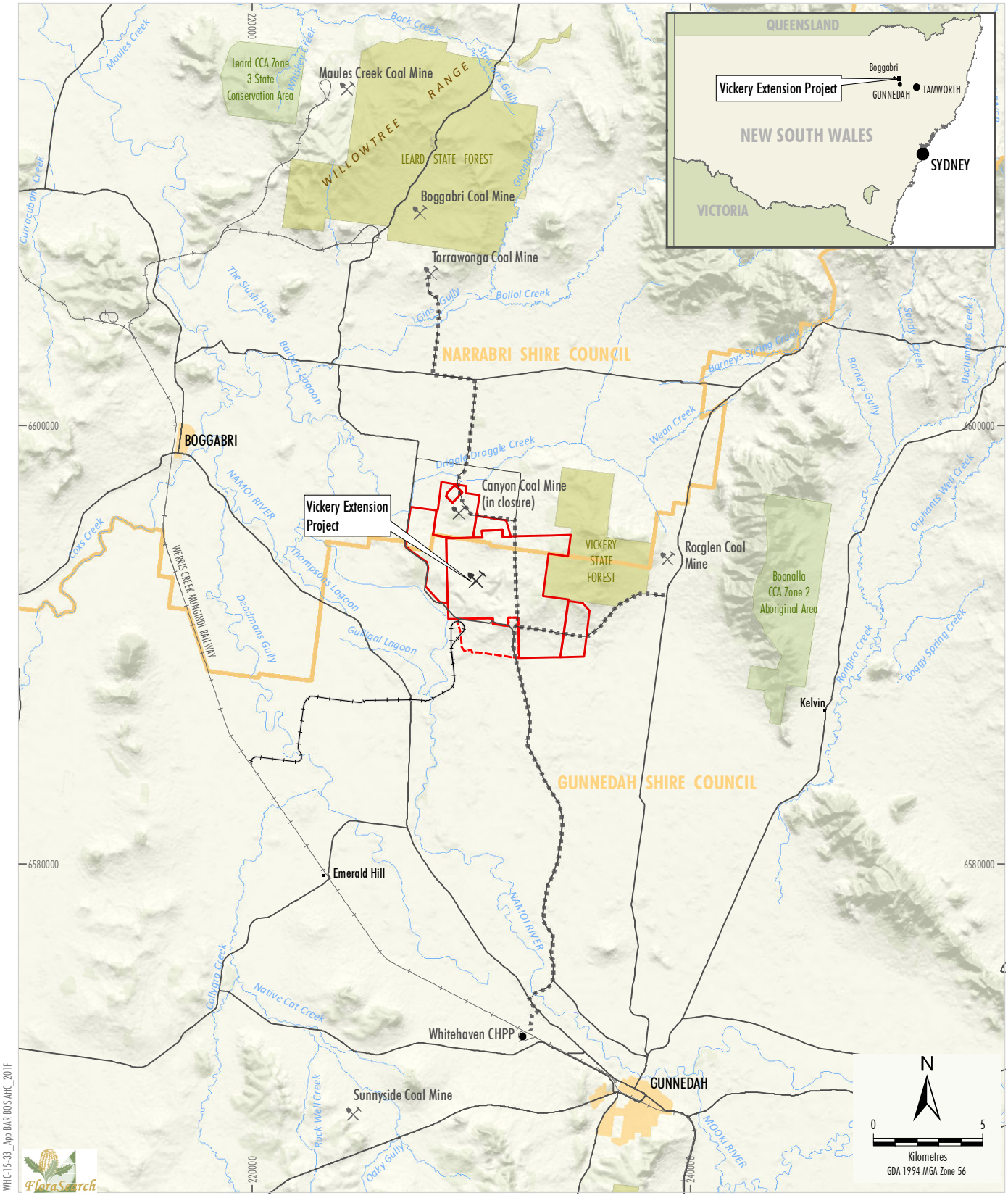
Whitehaven is seeking a new Development Consent for extension of open cut mining operations at the Approved Mine (herein referred to as the Vickery Extension Project [the Project]). This would include a physical extension to the Approved Mine footprint to gain access to additional ROM coal reserves, an increase in the footprint of waste rock emplacement areas, an increase in the approved ROM coal mining rate and construction and operation of a Project Coal Handling and Preparation Plant (CHPP), train load-out facility and rail spur (Figure 2). This infrastructure will be used for the handling, processing and transport of coal from the Project, as well as other Whitehaven mines.

The Project involves mining the coal reserves associated with the Approved Mine, as well as accessing additional coal reserves within the Project area. ROM coal would be mined by open cut methods at a rate up to approximately 10 Mtpa, over a mine life of approximately 25 years.

Figure 2 illustrates the general arrangement of the Project. A detailed description of the Project is provided in Section 2 in the Main Report of the Environmental Impact Statement (EIS).

This assessment forms part of an EIS which has been prepared to accompany a Development Application made for the Project in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act).

The Project Description and Preliminary Environmental Assessment lodged in January 2016 presented two Rail Spur Investigation Corridors (Northern Rail Investigation Corridor and Western Rail Investigation Corridor). In January 2017, Whitehaven notified the Department of the Environment and Energy (DEE) of a variation to the Action, to include the construction and operation of a Project rail loop and rail spur to connect the Project to the Werris Creek Mungindi Railway.



WHC-15-33_App BAR BOS AHC_201F

LEGEND

- Mining Tenement Boundary (ML and CL)
- Mining Lease Application (MLA)
- Local Government Boundary
- State Forest
- State Conservation Area, Aboriginal Area
- Major Road
- Railway
- Approved Road Transport Route
- Indicative Rail Spur Alignment

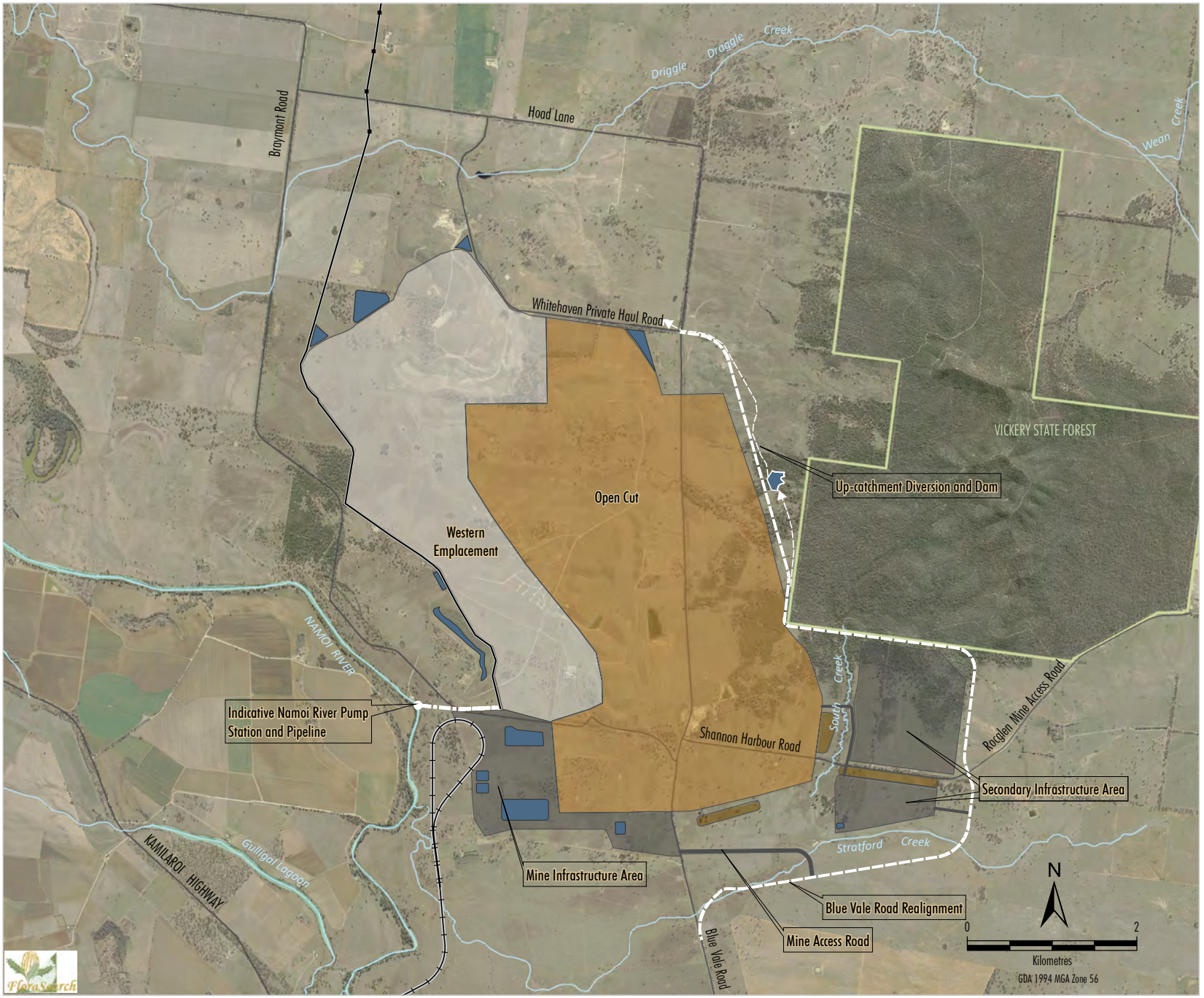
Source: LPMA - Topographic Base (2010); Department of Industry (2015)

WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Project Location

Figure 1



LEGEND

State Forest

Project Components

- Indicative Extent of Open Cut
- Indicative Extent of Out of Pit Waste Rock Emplacement
- Indicative Extent of Infrastructure Area
- Indicative Extent of Soil Stockpile
- Indicative Extent of Water Storage
- Indicative Mine Access Road Alignment
- Indicative Namoi River Pump Station and Pipeline
- Indicative Road Realignment
- Indicative Up-catchment Diversion and Dam Location
- Indicative Rail Spur Alignment
- Indicative Location of Groundwater Bores and Pipeline

Source: Orthophoto - Department of Land and Property Information, Aerial Photography (July 2011); Department of Industry (2015); Essential Energy (2015)

WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Project General Arrangement - Project Mining Area

Figure 2

1.1 REPORT OBJECTIVES

The objectives of this report are to:

- review existing flora information and mapping relevant to the study area;
- sample the natural vegetation on the study area using FBA survey guidelines (OEH, 2014a);
- determine and map the BioMetric Vegetation Types (BVTs) (OEH, 2017a) present within the study area;
- compile a plant species list for each vegetation community;
- using relevant government databases and the FBA decision support system, develop a list of threatened plant species, populations, ecological communities or critical habitat, listed in the Schedules of the NSW *Biodiversity Conservation Act, 1995* (BC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act*, *1999* (EPBC Act) that could potentially occur in the study area; and
- conduct and report on targeted searches for potentially occurring threatened plant species, populations, communities and critical habitat, and map any occurrences.

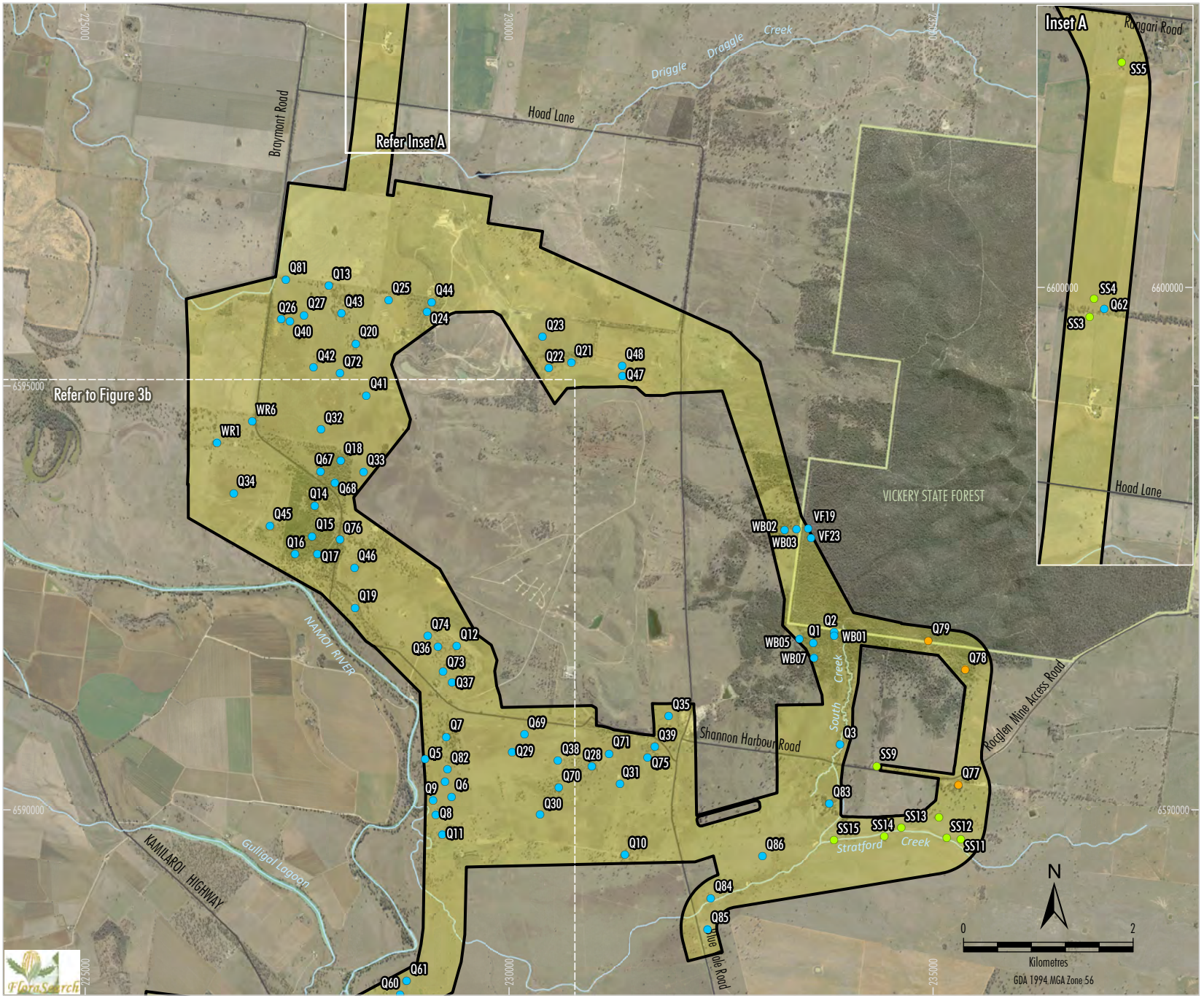
1.2 STUDY AREA

The study area for the flora survey in this report is shown on Figures 3a and 3b and comprises lands around the former Canyon and Vickery Coal Mines. It includes the south western corner of Vickery State Forest and parts of several former agricultural properties (Figures 3a and 3b). Braymont, Blue Vale and Shannon Harbour Roads traverse the study area.

1.3 REGIONAL SETTING

The study area occurs within the Gunnedah Basin geological formation on the NSW North West Slopes and Plains. The Gunnedah Basin developed in a trough between the Lachlan Fold Belt to the west and the New England Fold Belt on the eastern side of the Mooki Thrust (Pratt, 1998), approximately 6 km east of the study area. The Gunnedah Basin lies within the Namoi River catchment that is bounded by the Liverpool Range to the south, the Great Dividing Range to the east, the Nandewar Range to the north and the Pilliga Scrub to the west.

Most of the lower lying areas of the Namoi Valley comprise Quaternary alluviums from which the native vegetation has been almost completely cleared for agriculture.



LEGEND

- State Forest
- Study Area
- FBA Plot
- Spot Sample
- Floristic Plot

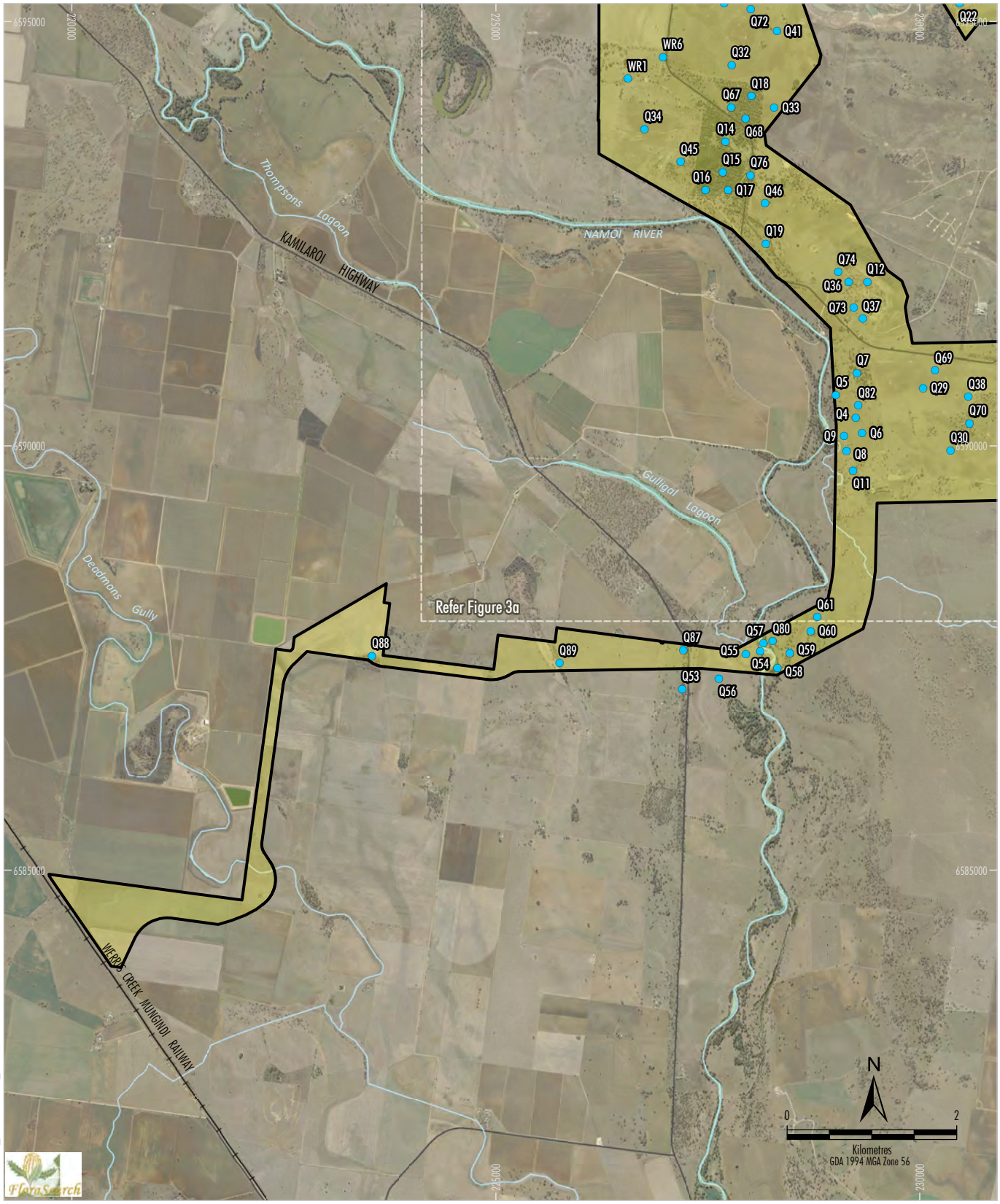
Source: Orthophoto - Department of Land and Property Information, Aerial Photography (July 2011)

WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Study Area and Survey Effort
Project Mining Area

Figure 3a



WHC-15-33_App BAR BOS AHC_204F

LEGEND

Study Area

FBA Plot

WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Study Area and Survey Effort
Indicative Rail Spur Investigation Corridor

Source: Orthophoto - Department of Land and Property Information, Aerial Photography (July 2011)

Figure 3b

Within the Gunnedah Basin native vegetation persists on the steep terrain of small inselbergs, such as Mount Binalong and Goonbri Mountain that respectively comprise remnants of former Jurassic and Tertiary volcanic landscapes. Native vegetation also remains on the poorer soils of Early Permian sediments, such as the Maules Creek, Goonbri and Leard Formations of the Leard and Vickery State Forests.

North of Boggabri, significant naturally vegetated areas occur on rugged outcrops of the Early Permian Boggabri Volcanics that underlie the sedimentary formations (e.g. Leard State Conservation Area). On the eastern side of the Mooki Thrust, rugged ranges comprising Carboniferous sediments and tuffs also support native vegetation (e.g. Boonalla Community Conservation Area).

1.4 DESCRIPTION OF THE STUDY AREA AND SURROUNDS

1.4.1 TOPOGRAPHY AND DRAINAGE

The dominant topographic feature in the study area is an approximately east-west oriented ridge system that extends west from Vickery State Forest through the centre of the study area before terminating at the floodplains on the Namoi River to the west of Braymont Road.

The Namoi River is the major watercourse in the study area. It passes close to the south-western side of the proposed mine disturbance areas (Figure 2) and is crossed by the Project rail spur approximately 4 km south-west of the Project mining area. Minor watercourses in the study area form interrupted channel networks (Speight, 2009) on the flatter terrain to the north (Driggle Draggle Creek) and south (Stratford Creek) of the central ridge system (Figure 3a). The Project rail spur descends onto the Namoi River floodplain just within the western boundary of the Study Area for the Project and remains on the floodplain for its whole length.

Altitudes in the study area around the Project range from 248 metres (m) Australian Height Datum (AHD) to the west of Braymont Road to 333 m AHD in Vickery State Forest. The terrain on the agricultural properties around the central ridge system is flat to undulating. By contrast, the area within and near Vickery State Forest has steeper, more dissected terrain.

1.4.2 GEOLOGY AND SOILS

The Project is situated mainly on Early Permian age coal measures of the Maules Creek Formation, which, in addition to coal, largely comprise conglomerates, with lesser amounts of sandstone, siltstone and claystone (Pratt, 1998). The Project rail spur and areas fringing the Project are on flatter terrain comprising quaternary alluvial sediments and active floodplains. Infilling of the Namoi Valley with alluvial deposits (Namoi Sediments) to form a broad flat valley floor is thought to have begun in the Pliocene (<5.3 million years ago [Ma]) and has continued to the present (Pratt, 1998). The low slope of the valley floor and the lack of topographical relief suggest the Namoi Valley may have been dammed intermittently during this period at Cox's Gap, 8 km north of Boggabri, forming a large lake (Pratt, 1998). The surface layer of the Namoi Sediments, known as the Curlewis Member or Narrabri Formation, is Pleistocene in age (<1.8 Ma), and comprises brown clays becoming darker near the surface, with limited channel sand and gravel deposits (Pratt, 1998).

Three Soil Landscapes, Blue Vale, Brentry and Top Rock, are derived from Maules Creek Formation geology in the study area (OEH, 2012a). The Driggle Draggle Soil Landscape of the stagnant alluvial plains flanks the edges of the Project mining area on the north and south sides. The Project rail spur traverses active alluvial soils of the Burburgate Soil Landscape on both sides of the Namoi River and a small area of the Collygra Creek Soil Landscape where it joins the Werris Creek Mungindi Railway. The six Soil Landscapes are described briefly below.

Blue Vale Soil Landscape

The Blue Vale Soil Landscape occupies the higher parts of the central ridge through the study area. It is a residual soil landscape with soils developed in situ from the parent rock. Accordingly, the soils contain significant levels of gravel and stones derived from the breakdown of the original conglomerate rock. This landscape is dominated by Chromosols (Red-brown Earths and Non-calcic Brown Soils). Crests on conglomerate tend to have Bleached Red Chromosols (Non-calcic Brown Soils), sideslopes are generally dominated by Vertic Brown Chromosols (Red-brown Earths) with Brown Sodosols (Solodic Soils) occurring on lower slopes (OEH, 2012a). Fertility is moderate, soils may be shallow and low water availability may occur (OEH, 2012a).

Top Rock Soil Landscape

The Top Rock Soil Landscape occupies a landscape position on footslopes below the Blue Vale Soil Landscape. Top Rock is a colluvial Soil Landscape with soils derived primarily by the downslope transfer of material from higher in the landscape. Soils are dominated by hard duplex soils with highly variable gravel content and degrees of sodicity. Upper and mid footslopes are generally dominated by very deep, moderately well-drained Red and Black Sodosols (Solonetz) and some Bleached Red Chromosols (Red-brown Earths), whilst mid to lower footslopes are dominated by deep to very deep, imperfectly to poorly drained Black and Brown Sodosols (Solodic Soils and Solonetz) (OEH, 2012a). Soils have moderate fertility, may be locally shallow, may experience local salinity problems and may waterlog seasonally.

Brentry Soil Landscape

The Brentry Soil Landscape is a transferral soil landscape that occurs on lower footslopes below the Top Rock Soil Landscape. It is prone to waterlogging, poor drainage and high watertables. Soils vary according to local sediment source. Some footslopes are dominated by very deep gravelly imperfectly drained loamy Grey Chromosols (Solodic Soils), with others by giant moderately well drained loamy Brown Sodosols (Red-brown Earths/Solodic Soils). The plain elements of the landscape are dominated by giant very poorly drained Brown Vertosols (Brown Clays) and imperfectly to poorly drained deep to giant loamy Brown Sodosols (Solodic Soils and Solodized Solonetz) (OEH, 2012a). Soils are of moderate fertility.

Driggle Draggle Soil Landscape

The Driggle Draggle Soil Landscape occupies extensive flat quaternary stagnant alluvial plains. The sediments forming the alluvium are considered to be extremely old and weathered, giving rise to poorer soils than most of the other alluvial landscapes in the region (OEH, 2012a). Vertosols tend to dominate, including giant imperfectly drained Gypsic Brown Vertosols (Brown Clays), giant poorly drained Brown Vertosols (Brown Clays), and giant very poorly drained Grey Vertosols (Grey Clays).

Also present are some giant, poorly drained clay loamy Grey Chromosols (Solodic Soils) and very deep, poorly drained silty Brown Sodosols (Solodic Soils), whilst some low rises exhibiting ancient abandoned fluvial features have very deep, imperfectly drained Eutrophic Brown Dermosols (Brown Clays) (OEH, 2012a). Soils have low fertility and are subject to waterlogging, surface flooding and poor drainage.

Burburgate Soil Landscape

The Burburgate Soil Landscape occurs on extensive, broad, level stagnant alluvial plains and floodplains of the Namoi River. The soils experience localised poor drainage, localised permanently high watertables, localised permanent waterlogging, widespread seasonal waterlogging and widespread flood hazard (OEH, 2012a). The soils are complex alluvium derived from the range of geologies in the Liverpool Plains catchment. Sorting of materials by floodwaters has led to surface lithologies ranging from fine sands to clays and gravels. Extensive flat plain areas are dominated by giant, poorly drained Vertic Eutrophic Brown Chromosols (Red-brown Earths) or giant, moderately well-drained Endocalcareous Self-Mulching Brown Vertosols (Brown Clays) or giant, imperfectly drained Self-Mulching Red Vertosols (Red Clays). Oxbow beds, locally extensive backswamps and broad flood channels are dominated by giant, poorly drained Endocalcareous Self-Mulching Grey of Black Vertosols (Grey Clays and Black Earths). Small areas of high floodplain (very seldom flooded) often have giant, imperfectly drained Vertic Brown Chromosols (Solodic Soils). Inset floodplains (most frequently inundated) along the Namoi River tend to be dominated by giant imperfectly drained Melanic Eutrophic Black Dermosols (Chernozems). Soils are of high fertility suitable for cropping and irrigation.

Collygra Creek Soil Landscape

Similar to the Burburgate Soil Landscape, the Collygra Creek Soil Landscape occupies level floodplains, stagnant alluvial plains, but also gently inclined drainage plains and alluvial fans (OEH, 2012a). Soils are derived from mixed sandstone and basalt alluvium of the Curlewis Hills. The soils include Giant, well-drained Red Vertosols (Red Clays) which dominate the upper catchment; the lower catchment is dominated by giant, imperfectly to poorly drained Black Vertosols (Black Earths), with giant, poorly drained Grey Vertosols (Grey Clays) where drainage is impeded. Giant, moderately well-drained Red and Brown Sodosols (Red-brown Earths/Solodic Soils) occur close to upslope boundary.

1.4.3 CLIMATE

The study area lies within the eastern sub humid region of Australia which has a hot summer and no dry season (Sahukar *et al*., 2003).

1.4.4 LAND USE

The study area was part of the tribal lands of the Kamilaroi Aboriginal people who inhabited the Liverpool Plains (Sahukar *et al*., 2003). The European history of the valley began in 1835 with the establishment of a sheep run called Namoi Hut at the confluence of the Namoi River and Cox's Creek (Heritage Management Consultants, 2011).

The fertile soils of the Namoi Valley support a diverse range of agricultural industries including winter and summer cropping, and cattle, sheep and pig production (Gunnedah Shire Council, 2016). Wheat is the most widely grown cereal crop followed by sorghum, barley, maize and sunflowers. Cotton is a significant summer crop. Other important crops include oats, canola, soybeans, mung beans, chickpeas and safflower (Gunnedah Shire Council, 2016). On the study area, agricultural pursuits including cropping and grazing have been the dominant forms of land use since white settlement of the area. Logging of Ironbark and White Cypress Pine has occurred episodically in Vickery State Forest and on privately owned land.

Open cut and underground coal mining, for both domestic and export markets, is also prominent on the Liverpool Plains. The Tarrawonga, Boggabri and Maules Creek Coal Mines operate to the north of the study area (Figure 1).

Further, open cut and underground mining activities were previously conducted in the study area. Three areas associated with former open cuts and associated waste rock emplacements (i.e. the Red Hill Pit and Greenwood/Shannon Hill Pit) are located within the Project Area. In addition, part of the final void associated with the former Canyon Coal Mine (mining ceased in 2009) occurs in the north-west portion of the study area.

1.5 BOTANICAL/BIOGEOGRAPHIC REGIONS

The study area lies in the southern part of the North West Slopes Botanical Division (Anderson, 1968; Harden, 1990-2002). It is also in the Liverpool Plains subregion of the Brigalow Belt South Bioregion as defined originally by Thackway and Cresswell (1995). This bioregion extends from Dubbo in NSW to the central coast of Queensland and occupies 22.6 million ha, with 5.3 million ha in NSW. The study area lies close to the eastern boundary of the Brigalow Belt South Bioregion with the Nandewar Bioregion. Consequently, the vegetation of the study area can be expected to have similarities with that of the nearby parts of the Nandewar Bioregion. The study area also occurs within the North West Local Land Services area.

1.6 PREVIOUS VEGETATION STUDIES

1.6.1 REGIONAL SURVEYS

The Western Regional Assessments

The vegetation in the Brigalow Belt South and Nandewar Bioregions was comprehensively surveyed (the Western Regional Assessments) by the NSW Government between 1999 and 2004 to inform conservation decisions enshrined in the *Brigalow and Nandewar Community Conservation Area Act, 2005*.

The assessments also provided scientific information on which to base Forest Agreements, as well as providing information for use by other regional planning organisations such as Regional Vegetation Management Committees and Catchment Management Boards (Beckers and Binns, 2000). These studies generated a large number of reports, the most relevant of which are:

- *Brigalow Belt South - Stage 1. Vegetation Survey and Mapping* (Beckers and Binns, 2000).
- *Brigalow Belt South - Stage 2. Targeted Flora Survey and Mapping* (National Parks and Wildlife Service [NPWS], 2002a).
- *Brigalow Belt South - Stage 2. Joint Vegetation Mapping Project* (NSW Department of Infrastructure, Planning and Natural Resources, 2004).
- *NSW Western Regional Assessments, Nandewar. Biodiversity Surrogates - Vegetation* (Wall, 2004).

NSW Vegetation Classification and Assessment: Plant communities of the Brigalow Belt South (BBS), Nandewar (NAN) & West New England Tablelands (NET) Bioregions (Benson et al., 2010.)

A comprehensive synthesis of all previous vegetation studies in the Brigalow Belt South and Nandewar Bioregions, in conjunction with new survey work, comprised the fourth paper in the NSW Vegetation Classification and Assessment (NSWVCA) series (Benson *et al*., 2010).

This classification endeavoured to identify, describe and assess the conservation status of vegetation communities at the 'plant association' level defined by Beadle and Costin (1952). By applying a common approach to vegetation classification across the whole state, the NSWVCA aimed to develop a consistent state-wide categorisation of communities. The NSWVCA recognised a total of 235 plant communities in the Brigalow Belt South Bioregion (Benson *et al.,* 2010). The detailed vegetation descriptions allow vegetation on the study area to be matched to the appropriate NSWVCA community.

NSW Vegetation Information System (OEH, 2017a).

The NSW Vegetation Information System (VIS) was established for use with OEH decision support systems, including BioBanking and the FBA (OEH, 2014a). The VIS Classification contains the NSW Master Plant Community Type Classification (PCT) that has been established as the NSW standard community level vegetation classification for use in site based planning processes and standardised vegetation mapping. The PCT classification has been constructed by integrating two existing vegetation classification databases: the NSW VCA database developed by the Royal Botanic Gardens and Domain Trust (RBGDT); and the BioMetric Vegetation Types Database that is used in Property Vegetation Planning and BioBanking assessment processes. BVTs are used as the standard classification in this report.

Border Rivers Gwydir/Namoi Regional Native Vegetation Mapping (OEH, 2015)

This report relies heavily on the output of recent regional vegetation survey work and mapping in the Namoi catchment conducted by OEH in 2012 (OEH, 2015). The *Border Rivers Gwydir/Namoi Regional Native Vegetation Mapping* (BRGN) project re-analysed data from over 9,000 existing full floristic plot samples. Over 6,000 new rapid assessment vegetation samples were undertaken to fill gaps in coverage. The analysis assigned the full floristic field plots to 268 PCTs. Mapping was undertaken by spectral analysis of satellite imagery and modelling. This study significantly increased the number of vegetation communities recognised in the Namoi catchment and introduced new community naming. Table 1 lists the vegetation communities identified by Niche Environment and Heritage (2013a) at the Approved Mine and their equivalence to the BVTs identified in the BRGN project in the vicinity of the study area.

Table 1.
Vegetation Communities Previously Identified Within the Study Area and Immediate Surrounds

Landscape Position	Formation	Class	Niche Environment and Heritage (2013a)		BVT (This study)	
			BVT (OEH, 2012b)	Community Name	No. (OEH, 2017a)	Community Name
Hills and ridges	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	-	Not recorded	NA311	Narrow-leaved Ironbark – Black Cypress Pine – White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion
	Dry Sclerophyll Forests (Shrub/grass sub-formation)	North West Slopes Dry Sclerophyll Woodlands	NA232	Silver leaved Ironbark – White Box – White Cypress Pine	NA349	Silver-leaved Ironbark – White Cypress Pine shrubby open forest of the Brigalow Belt South Bioregion and the Nandewar Bioregion
			NA225	White Box – White Cypress Pine		
			NA226	White Box Grassy Woodland		
Lower slopes	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Pilliga Outwash Dry Sclerophyll Forests	-	Not recorded	NA324	Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion
Valley floor	Semi-arid Woodlands (Grassy sub-formation)	Riverine Plain Woodlands	NA219	Weeping Myall Low Shrubland	NA219	Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion
		Brigalow Clay Plain Woodlands	NA185	Poplar Box Grassy Woodland	NA185	Poplar Box – Yellow Box – Western Grey Box grassy woodland on cracking clay soils, mainly in the Liverpool Plains, Brigalow Belt South Bioregion
			NA181	Plains Grass – Blue Grass Secondary/Derived Native Pasture	-	[Treated in this report as secondary/derived native grassland from NA185 and NA193]
Wetland	Freshwater Wetlands	Inland Floodplain Swamps	NA201	Mixed Marsh Sedgeland	NA201	Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains
Riparian	Forested Wetlands	Inland Riverine Forests	NA193	River Red Gum Riverine Woodland	NA193	River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and the Brigalow Belt South Bioregion

1.6.2 LOCAL SURVEYS

Several vegetation surveys have been conducted on and near the study area for previous development applications, including the *Continuation of the Boggabri Coal Mine* (Hansen Bailey, 2010), the *Tarrawonga Coal Project* (FloraSearch, 2011) and the *Vickery Coal Project* (Niche Environment and Heritage, 2013a). Other reports relevant to this study include surveys of offset areas on or near this study area (Niche Environment and Heritage, 2013b, 2014). These surveys employed standard methodology in accordance with *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (Department of Environment and Conservation (DEC), 2004). They identified vegetation communities, listed flora species, identified threatened flora and provide background information for this study.

1.7 THREATENED SPECIES, POPULATIONS, ECOLOGICAL COMMUNITIES AND CRITICAL HABITAT

Lists of threatened species, populations, ecological communities and critical habitat that are known, or have potential to occur in the study area were derived by consulting the following sources:

- BioNet website incorporating searches of the databases of the Atlas of NSW Wildlife, RBGDT, Forests NSW and the Australian Museum (BioNet, 2017).
- Protected Matters Search Tool (Commonwealth Department of the Environment and Energy, 2017a).
- Schedules of the BC Act and the EPBC Act.
- Preliminary and Final Determinations of the NSW Scientific Committee.
- Regional vegetation studies referred to above (Section 1.6).
- Feedback from the OEH BioBanking credit calculator.
- Report of previous flora survey conducted on the study area and surrounds (Niche Environment and Heritage, 2013a).

Database searches were conducted within a 40 × 40 km square centred on the study area. The databases were accessed in November 2015, March 2016 and January 2017.

1.7.1 THREATENED FLORA SPECIES

Table 2 lists 15 threatened flora species listed in the Schedules of the BC Act and the EPBC Act that were returned by the database searches and are considered possible occurrences within the study area or surrounds. Table 2 assesses the likelihood of each threatened species occurring on the study area by comparing their known distributions and habitats with those present within the study area. Based on these considerations, eight of these species were considered to have some likelihood of occurring on the study area prior to the surveys and therefore were specifically targeted during the surveys for this study. Three species, Ooline, *Cadellia pentastylis*; a Bluegrass, *Dichanthium setosum* and Slender Darling-pea, *Swainsona murrayana*, were considered to have a low chance of occurring prior to the surveys, while five species, Finger Panic Grass, *Digitaria porrecta*; Belson's Panic, *Panicum belsonii*; Winged Peppercress, *Lepidium monoplocoides*; Scant Pomaderris, *Pomaderris queenslandica* and *Tylophora linearis* were considered to have a moderate or high chance of being present prior to the surveys.

The threatened species selected for targeted searches comprise a tree, a shrub, a small vine, a herb and three grasses. The presence of the tree and vine can be detected at any time of the year and in any seasonal conditions. However, detection of the grasses and the herb depends on flowering time, seasonal conditions and grazing pressure. Species of the herb and grasses may not be detectable in very dry conditions or where there is heavy grazing by livestock. All potentially occurring species were targeted at an appropriate time of year.

1.7.2 THREATENED POPULATIONS

Twenty-nine endangered populations are currently listed in Schedule 1 of the BC Act (as at December 2016). None of the populations potentially occur on the study area.

Table 2.
Threatened Flora Species with Potential to Occur on the Study Area Based on Database and Literature Searches

Scientific Name	Common Name	Conservation Status[1]		Distribution	Habitat	Likelihood of Occurrence
		BC Act	EPBC Act			
Cadellia pentastylis	Ooline	V	V	Occurs along the western edge of the North West Slopes from north of Gunnedah to west of Tenterfield (OEH, 2017b). Also occurs in Queensland. The natural range of Ooline is from 24°S to 30°S in the 500 to 750 mm per annum rainfall belt. There are no records close to the study area (BioNet, 2016).	There appears to be a strong correlation between the presence of Ooline and low- to medium-nutrient soils of sandy clay or clayey consistencies, with a typical soil profile having a sandy loam surface layer, grading from a light clay to a medium clay with depth (OEH, 2017b).	Low
Cyperus conicus	-	E	-	Recorded from the Pilliga to Narrabri area and around Yetman (OEH, 2017b).	Recorded from *Callitris* forest in the Pilliga area, growing in sandy soil. Sandy soil is absent from the study area (OEH, 2017b).	Nil
Dichanthium setosum	A Bluegrass	V	V	Bluegrass occurs on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW. It occurs widely on private property, including in the Inverell, Guyra, Armidale and Glen Innes areas (OEH, 2017b). Not recorded close to the study area. This species was highlighted as a potential occurrence only by the OEH BioBanking credit calculator.	Associated with heavy basaltic black soils and red-brown loams with clay subsoil (OEH, 2017b). Often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture.	Low
Digitaria porrecta	Finger Panic Grass	E	-	In NSW, Finger Panic Grass is found on the North West Slopes and Plains, from near Moree south to Tambar Springs and from Tamworth to Coonabarabran. It largely occurs on private land and roadsides (OEH, 2017b). There are numerous recent records along roadsides in the Boggabri area (BioNet, 2016).	Native grassland, woodlands or open forest with a grassy understorey, on richer soils (OEH, 2017b). The most frequently recorded associated tree species are *Eucalyptus albens* and *Acacia pendula*. Common associated grasses and forbs include *Austrostipa aristiglumis, Enteropogon acicularis, Cyperus bifax, Hibiscus trionum* and *Neptunia gracilis*. Most of these species occur on the study area.	Moderate

Table 2. (Continued)
Threatened Flora Species with Potential to Occur on the Study Area Based on Database and Literature Searches

Scientific Name	Common Name	Conservation Status[1]		Distribution	Habitat	Likelihood of Occurrence
		BC Act	EPBC Act			
Euphrasia arguta	-	CE	CE	*Euphrasia arguta* was rediscovered in the Nundle area of the NSW north western slopes and tablelands in 2008. Prior to this, it had not been collected for 100 years. Historically, it was recorded from a few places between Sydney, Bathurst and Walcha. Additional recent records are from the Hastings River and Barrington Tops (OEH, 2017b).	Recorded habitats vary from grassy meadows near rivers to open forest with shrubs and grasses in the understorey (OEH, 2017b). It appears to require a small amount of disturbance to survive. Sites in the study area are likely to have endured too much disturbance historically for this species to still be present, if it ever was.	Nil
Homopholis belsonii	Belson's Panic	E	V	Occurs on the northwest slopes and plains of NSW. There is a recent record (2014) in Vickery State Forest in BioNet (2016). This record is isolated and well to the south of the core distribution of the species between Narrabri and the Queensland border.	Although habitat and ecology are poorly known, the species has been recorded in dry woodland (e.g. Belah) often on poor soils, although sometimes found in basalt-enriched sites north of Warialda and in alluvial clay soils (OEH, 2017b).	Moderate
Lepidium monoplocoides	Winged Peppercress	E	E	Widespread in the semi-arid western plains regions of NSW. Collected from widely scattered localities, with large numbers of historical records but relatively few recent collections (OEH, 2017b). Recorded at the Approved Mine by Niche Environment and Heritage (2013a).	Occurs on seasonally moist to waterlogged sites, on heavy fertile soils, with a mean annual rainfall of around 300-500 mm (OEH, 2017b). Predominant vegetation is usually open woodland dominated by *Allocasuarina luehmannii* (Bulloak) and/or eucalypts, particularly *Eucalyptus largiflorens* (Black Box) or *Eucalyptus populnea* (Poplar Box).	High
Philotheca ericifolia	-	-	V	Known from the upper Hunter Valley and Pilliga to Peak Hill districts of NSW (OEH, 2017b). The records are scattered over a range of over 400 km between West Wyalong and the Pilliga Scrub.	Grows chiefly in dry sclerophyll forest and heath on damp sandy flats and gullies (OEH, 2017b). It has been collected from heath, open woodland, dry sandy creek beds, rocky ridges and cliff tops. Suitable sandy habitats are absent from the study area.	Nil

Table 2. (Continued)
Threatened Flora Species with Potential to Occur on the Study Area Based on Database and Literature Searches

Scientific Name	Common Name	Conservation Status[1]		Distribution	Habitat	Likelihood of Occurrence
		BC Act	EPBC Act			
Euphrasia arguta	-	CE	CE	*Euphrasia arguta* was rediscovered in the Nundle area of the NSW north western slopes and tablelands in 2008. Prior to this, it had not been collected for 100 years. Historically, it was recorded from a few places between Sydney, Bathurst and Walcha. Additional recent records are from the Hastings River and Barrington Tops (OEH, 2017b).	Recorded habitats vary from grassy meadows near rivers to open forest with shrubs and grasses in the understorey (OEH, 2017b). It appears to require a small amount of disturbance to survive. Sites in the study area are likely to have endured too much disturbance historically for this species to still be present, if it ever was.	Nil
Polygala linariifolia	Native Milkwort	E	-	Occurs from central northern to north-eastern NSW in an arc from the Pilliga Scrub through Inverell to Casino. There are no recorded occurrences on the Liverpool Plains (OEH, 2017b).	Sandy soils in dry eucalypt forest and woodland with a sparse understorey. Has been recorded in the Pilliga area in Fuzzy Box woodland, White Cypress Pine-Bulloak - Ironbark woodland, Rough-barked Apple riparian forb-grass open forest, and Ironbark - Brown Bloodwood shrubby woodland. Sandy soils are lacking on the study area (OEH, 2017b).	Nil
Pomaderris queenslandica	Scant Pomaderris	E	-	Widely scattered but not common in north-east NSW (OEH, 2017b). It is known from the NSW north coast, the New England Tablelands and North West Slopes as far south west as Peak Hill. Populations are known in Leard State Forest.	Moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks (OEH, 2017b).	Moderate
Prasophyllum petilum	Tarengo Leek Orchid	E	E	Known from six sites on the NSW central and southern tablelands and upper Hunter Valley; Boorowa, Captains Flat, Ilford, Delegate, Wybong and a newly recognised population approximately 10 km south east of Muswellbrook. It also occurs at Hall in the Australian Capital Territory (OEH, 2017b). There are no known populations on the NSW north west slopes or northern tablelands.	Grows in open sites in Natural Temperate Grassland, in grassy woodland in association with River Tussock, *Poa labillardieri*; Black Gum, *Eucalyptus aggregata* and Teatrees, *Leptospermum* spp., and in Kangaroo Grass under Box-Gum Woodland. Highly susceptible to grazing, being retained only in little-grazed travelling stock reserves and in cemeteries (OEH, 2017b). Suitable lightly grazed grassy areas are absent from the study area.	Nil
Prasophyllum sp. Wybong (C. Phelps ORG 5269)	A Leek Orchid	-	CE	This taxon is now regarded as synonymous with *Prasophyllum petilum* (see above) (DoEE, 2017b).	–	Nil

Table 2. (Continued)
Threatened Flora Species with Potential to Occur on the Study Area Based on Database and Literature Searches

Scientific Name	Common Name	Conservation Status[1]		Distribution	Habitat	Likelihood of Occurrence
		BC Act	EPBC Act			
Swainsona murrayana	Slender Darling-pea	V	V	Found throughout inland NSW, it has been recorded in the Jerilderie and Deniliquin areas of the southern riverine plain, the Hay plain as far north as Willandra National Park, near Broken Hill and in various localities between Dubbo and Moree (OEH, 2017b).	The species has been collected from clay-based soils, ranging from grey, red and brown cracking clays to red-brown earths and loams (OEH, 2017b). Grows in a variety of vegetation types including bladder saltbush, black box and grassland communities on level plains, floodplains and depressions and is often found with *Maireana* species. Plants have been found in remnant native grasslands or grassy woodlands that have been intermittently grazed or cultivated.	Low
Thesium australe	Austral Toadflax	V	V	Austral Toadflax has a disjunct distribution on the NSW tablelands; there are many records for the northern and southern tablelands, but none for the central tablelands or Hunter Valley (BioNet, 2016).	It is largely confined to grasslands, grassy woodlands or sub-alpine grassy heathlands (OEH, 2017b). Austral Toad-flax is usually hemiparasitic on Kangaroo Grass, but may associate less frequently with *Poa* spp. It is highly unlikely to occur on the study area where Kangaroo Grass is very uncommon.	Nil
Tylophora linearis	-	V	E	This species is widespread on the Western Slopes of NSW between West Wyalong and the Queensland border (OEH, 2017b). It has been found abundantly recently in the Pilliga Scrub and in and near Leard State Forest north of the study area. There is also a record in Kelvin State Forest to the east of the study area (BioNet, 2016).	Grows in dry scrub and open forest. Recorded from low-altitude sedimentary flats in dry woodlands of *Eucalyptus fibrosa, Eucalyptus sideroxylon, Eucalyptus albens, Callitris endlicheri, Callitris glaucophylla* and *Allocasuarina luehmannii* (OEH, 2017b). Suitable habitats may occur on the study area.	High

[1] Threatened flora species conservation status under the BC Act and/or EPBC Act (current at July 2018).
E – Endangered; CE – Critically Endangered; V – Vulnerable.

1.7.3 THREATENED ECOLOGICAL COMMUNITIES

Nine threatened ecological communities (TEC) listed under the BC Act and six TECs listed under the EPBC Act were returned by the BioNet Atlas of NSW Wildlife and Commonwealth Protected Matters Search Tool (Table 3). Many of these communities have not been recorded in the vicinity of the study area (Niche Environment and Heritage, 2013a) or in the surrounding region (Hansen Bailey, 2010; FloraSearch, 2011; OEH, 2015). The eleven TECs are listed in Table 3 with discussion of their distribution and habitats to determine their likelihood of occurring on the study area.

Three TECs listed in the Schedules of the EPBC Act were considered to have potential to occur on the study area (Table 3), *viz.:*

- *Natural Grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland* Critically Endangered Ecological Community (CEEC);
- *Weeping Myall Woodlands* Endangered Ecological Community (EEC); and
- *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC*.*

Three TECs listed in the Schedules of the BC Act were considered potential occurrences within the study area prior to the surveys (Table 3), *viz.:*

- *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray Darling Depression, Riverina and NSW South Western Slopes bioregions* EEC*;*[1]
- *Native Vegetation on Cracking Clay Soils of the Liverpool Plains* EEC[2]*;* and
- *White Box Yellow Box Blakely's Red Gum Woodland* EEC[3]*.*

Each of the BC Act TECs is equivalent to one of the three EBPC Act listed TECs so that, in effect, there are three potential threatened vegetation types, each listed at both the State and Commonwealth levels.

1.7.4 CRITICAL HABITAT

No Critical Habitat for flora has been declared on or near the study area under the BC Act (OEH, 2017c) or the EPBC Act (DoEE, 2017c).

[1] This community is equivalent to the *Weeping Myall Woodlands* EEC listed under the EPBC Act.

[2] This community is equivalent to the *Natural Grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland* CEEC listed under the EPBC Act.

[3] This community is equivalent to the *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC listed under the EPBC Act.

Table 3.
Threatened Ecological Communities with Potential to Occur on the Study Area Based on Database and Literature Searches

Community Name	Conservation Status[1]		Dominant Species	Distribution and Habitats	Likelihood of Occurrence
	BC Act	EPBC Act			
Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions (BC Act). Brigalow (Acacia harpophylla dominant and co-dominant) (EPBC Act).	E	E	*Acacia harpophylla – Casuarina cristata – Eucalyptus populnea* subsp. *bimbil* [*Acacia harpophylla and Casuarina cristata* are absent or rare on the study area].	Mainly between Narrabri and the Queensland border with a further concentration north east of Bourke (BioNet, 2016). A small stand occurs on the Rocglen Coal Mine east of Vickery State Forest.	Nil
Coolibah-Black Box Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain and Mulga Lands Bioregion (BC Act). Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions (EPBC Act).	E	E	*Eucalyptus coolabah - Eucalyptus largiflorens - Acacia stenophylla - Acacia salicina – C. cristata* [The first 3 species are absent from the study area and the last 2 are rare].	Occurs on grey self-mulching clays of periodically waterlogged floodplains, swamp margins, ephemeral wetlands and stream levees (OEH, 2017b). Confined to areas west of Narrabri and Moree (Australia's Virtual Herbarium, 2016).	Nil
Fuzzy Box Woodland on Alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions (BC Act).	E	-	*Eucalyptus conica - Eucalyptus microcarpa - Eucalyptus melliodora* [The first two species, which define this community, are absent from the study area].	Occurs on brown loam or clay, alluvial or colluvial soils on prior streams and abandoned channels or slight depressions on undulating plains or flats of the western slopes (OEH, 2017b). Appears to favour lighter clay soils than occur on the study area.	Nil
Howell Shrublands in the New England Tableland and Nandewar Bioregions (BC Act).	E	-	*Babingtonia densifolia - Homoranthus prolixus* [Species not present on the study area].	Confined to areas of extensive granite outcropping (OEH, 2017b). Scattered patches found between Inverell and Manilla on the New England Tablelands and North West Slopes of NSW. Habitat is not present on the study area.	Nil

Table 3. (Continued)
Threatened Ecological Communities with Potential to Occur on the Study Area Based on Database and Literature Searches

Community Name	Conservation Status[1]		Dominant Species	Potential Habitats	Likelihood of Occurrence
	BC Act	EPBC Act			
Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (BC Act). Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (EPBC Act).	E	E	*E. microcarpa ± E. populnea* subsp. *bimbil ± Callitris glaucophylla ± Brachychiton populneus ± Allocasuarina luehmannii ± E. melliodora* [Inland Grey Box, the defining species in this community, is absent or very rare on the study area.]	Very widespread on the NSW inland slopes and plains from the Victorian to Queensland borders (OEH, 2017b). Occurs largely on Tertiary and Quaternary Red Brown Earths of alluvial origin. The ecological role of Inland Grey Box appears to be occupied by *Eucalyptus pilligaensis* on the study area.	Nil
Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (BC Act). Weeping Myall Woodlands (EPBC Act).	E	E	*Acacia pendula* [This community has been recorded previously on and near the study area.]	Scattered across the eastern parts of the alluvial plains of the Murray-Darling river system (OEH, 2017b). Typically occurs on red-brown earths and heavy textured grey and brown alluvial soils within a climatic belt receiving between 375 and 500 mm mean annual rainfall.	High
Native Vegetation on Cracking Clay Soils of the Liverpool Plains (BC Act). Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland (EPBC Act).	E	CE	*Austrostipa aristiglumis - Dichanthium sericeum Panicum queenslandicum*.	Occurs on the highly fertile cracking clay soils of the Liverpool Plains (OEH, 2017b). On the study area potential habitat is limited to the Burburgate Soil Landscape on the Rail Spur Investigation Corridor, west of the Namoi River.	Medium
New England Peppermint (Eucalyptus nova-anglica) Woodland on Basalts and Sediments in the New England Tableland Bioregion (BC Act). New England Peppermint (Eucalyptus nova-anglica) Grassy Woodlands (EPBC Act).	CE	CE	*Eucalyptus nova-anglica – Eucalyptus dalrympleana* subsp. *heptantha* [Neither of these species occur on or near the study area].	Confined to the New England Tablelands (OEH, 2017b).	Nil

Table 3. (Continued)
Threatened Ecological Communities with Potential to Occur on the Study Area Based on Database and Literature Searches

Community Name	Conservation Status[1]		Dominant Species	Potential Habitats	Likelihood of Occurrence
	BC Act	EPBC Act			
Semi-evergreen Vine Thicket in the Brigalow Belt South and Nandewar Bioregions (BC Act). Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (EPBC Act).	E	E	*Cassine australis* var. *angustifolia* - *Geijera parvifolia* - *Notelaea microcarpa* var. *microcarpa* - *Ehretia membranifolia*. [While all but the first species have been recorded on or near the study area, they do not form a distinct ecological community.]	This community often occurs on rocky hills in deep loamy, high nutrient soils derived from basalt or other volcanic rocks, in areas which are sheltered from frequent fire (OEH, 2017b). Rocky hills and igneous geology are absent from the study area.	Nil
Carbeen Open Forest Community in the Darling Riverine Plans and Brigalow Belt South Bioregions (BC Act).	E	-	*Corymbia tessellaris* - *Callitris glaucophylla* [*Corymbia tessellaris* has not been recorded on or near the Study Area. The nearest records are north and north west of Narrabri.]	Carbeen Open Forest occurs on siliceous sands, earthy sands and clayey sands and is a distinctive plant community on the riverine plains of the Meehi, Gwydir, MacIntyre and Barwon Rivers (OEH, 2017b). It has not been recorded on the Liverpool Plains.	Nil
White Box Yellow Box Blakely's Red Gum Woodland (BC Act). White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act).	E	CE	*Eucalyptus albens* - *E. melliodora* - *Eucalyptus blakelyi* [This community has been recorded in the previous surveys of the study area (Niche Environment and Heritage, 2013a) and was mapped in the former travelling stock reserve by OEH (2015).]	Remnants generally occur on fertile lower parts of the landscape where resources such as water and nutrients are abundant (OEH, 2017b). The understorey in intact sites is characterised by native grasses and a high diversity of herbs. Shrubs are generally sparse or absent, though they may be locally common.	High*

* Note: Following the surveys this is considered not to be present (Section 3.7).

[1] Threatened flora species conservation status under the BC Act and/or EPBC Act (current at January 2017).

E – Endangered; CE – Critically Endangered.

2 METHODS

This flora survey was undertaken to provide the data required for a Biodiversity Assessment Report and Biodiversity Offset Strategy under the FBA (OEH, 2014a). Accordingly, the methods closely follow those outlined in Section 5 of the FBA.

2.1 STRATIFYING NATIVE VEGETATION

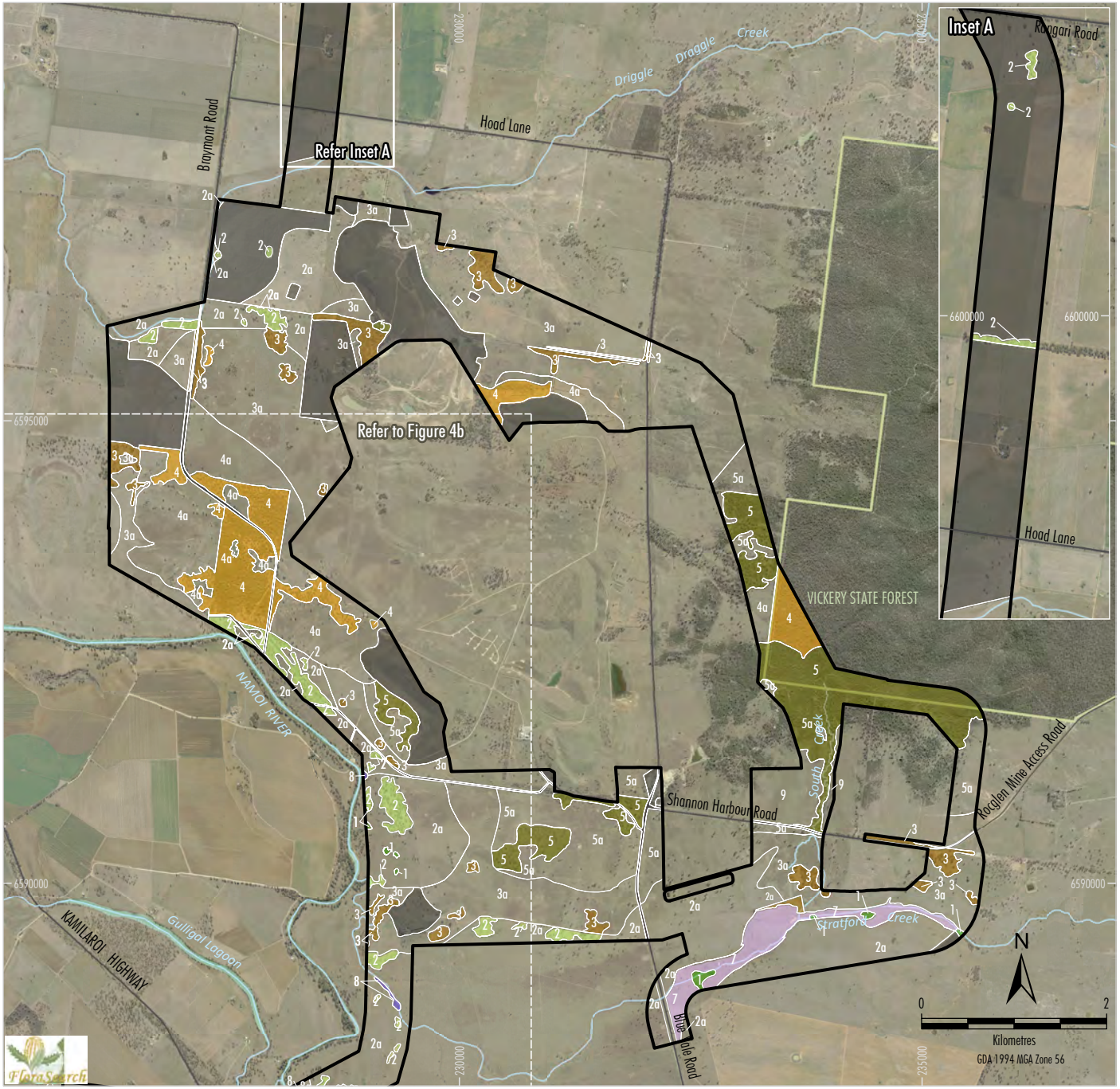
Two sources of existing data were used to determine the BVTs present in the study area:

1. Preliminary mapping of study area vegetation was conducted for the Approved Mine and surrounds in 2012 (Niche Environment and Heritage, 2013a). This mapping was based on the vegetation classification concepts available at the time for the Namoi Catchment Management Authority (now North West Local Land Services) area and documented in the then BVTs Database (OEH, 2012b).

2. BRGN mapping published by OEH (2015). This revision resulted in the recognition of a larger number of BVTs in the region than previously mapped and required a review of the BVTs recognised in the study area by Niche Environment and Heritage (2013a). The additional BVTs were described in the former VIS Classification Database. This database has recently been revised as the BioNet Vegetation Classification System and no longer includes BVTs (OEH, 2017a).

A preliminary site visit was made to the study area over three days from 6 to 8 November 2015. The purpose of this visit was to review the existing site mapping, and parts of the study area that had not been mapped previously. Field mapping was conducted by recording the dominant overstorey and midstorey flora species at all remnant vegetation patches across the study area. Where large changes to overstorey and midstorey floristic composition occurred within a patch, the boundary between the two vegetation types was recorded, either by hand drawing on a high resolution air photo, or by walking the boundary and recording the track in a hand held GPS unit (Garmin GPSMAP64s). The floristic information was then matched to potentially occurring BVTs identified in the former VIS Classification Database (OEH, 2017a). The most important aid for selecting the appropriate BVTs was the BRGN vegetation mapping (OEH, 2015). This mapping indicates the BVTs that have been identified in the region, in and around the study area by OEH (2015).

Following the preliminary field visit, the revised vegetation mapping was digitised in a GIS system and areas calculated for each vegetation zone identified (Figures 4a and 4b). These areas were used to determine the number of survey plots required in each zone according to Table 3 in the FBA (OEH, 2014a). The vegetation zones and sampling intensity are given in Table 4. Other sampling conducted is summarised in Table 5.



LEGEND

State Forest

Study Area

Vegetation Communities

Semi-arid Woodlands (Grassy Sub-formation)

1 Weeping Myall Woodland (NA219)#

2 Poplar Box Woodland on Alluvial Clay Soils (NA185)

2a Poplar Box Woodland on Alluvial Clay Soils (Secondary/derived grassland) (NA185)

Dry Sclerophyll Forests (Shrub/Grass Sub-formation)

3 Pilliga Box – Poplar Box Shrubby Woodland (NA324)

3a Pilliga Box – Poplar Box Shrubby Woodland (Secondary/derived grassland) (NA324)

4 White Box – Silver-leaved Ironbark Shrubby Open Forest (NA349)

4a White Box – Silver-leaved Ironbark Shrubby Open Forest (Secondary/derived grassland) (NA349)

Dry Sclerophyll Forests (Shrubby Sub-formation)

5 Narrow-leaved Ironbark – White Box Shrubby Forest (NA311)

5a Narrow-leaved Ironbark – White Box Shrubby Forest (Secondary/derived grassland) (NA311)

Freshwater Wetlands

7 Mixed Marsh Sedgeland (NA201)

Forested Wetlands

8 River Red Gum Riparian Tall Woodland (NA193)

8a River Red Gum Riparian Tall Woodland (Secondary/derived grassland) (NA193)

Cleared Land

9 Exotic Dominant Grasslands

DL Disturbed Land

Listed as the Weeping Myall Woodland EEC

Note: Vegetation community 6 is not present in this figure.

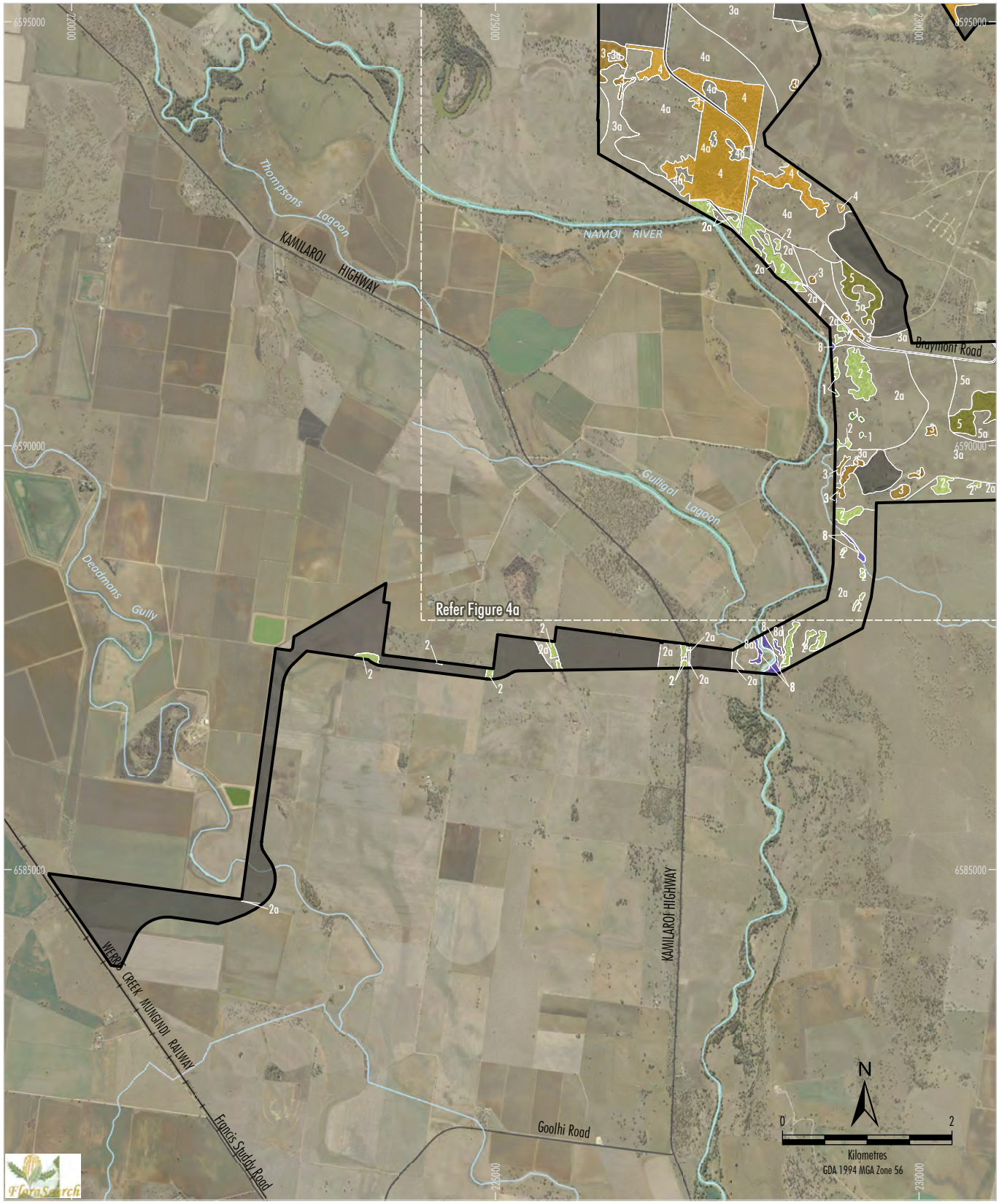
Source: Orthophoto - Department of Land and Property Information, Aerial Photography (July 2011)

WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Vegetation Communities
Project Mining Area

Figure 4a



WHC-15-33_App BAR BOS AnC_206H

LEGEND

State Forest

Study Area

Vegetation Communities

Semi-arid Woodlands (Grassy Sub-formation)

1 Weeping Myall Woodland (NA219)#

2 Poplar Box Woodland on Alluvial Clay Soils (NA185)

2a Poplar Box Woodland on Alluvial Clay Soils (Secondary/derived grassland) (NA185)

Dry Sclerophyll Forests (Shrub/Grass Sub-formation)

3 Pilliga Box – Poplar Box Shrubby Woodland (NA324)

3a Pilliga Box – Poplar Box Shrubby Woodland (Secondary/derived grassland) (NA324)

Dry Sclerophyll Forests (Shrub/Grass Sub-formation)

4 White Box – Silver-leaved Ironbark Shrubby Open Forest (NA349)

4a White Box – Silver-leaved Ironbark Shrubby Open Forest (Secondary/derived grassland) (NA349)

Forested Wetlands

8 River Red Gum Riparian Tall Woodland (NA193)

8a River Red Gum Riparian Tall Woodland (Secondary/derived grassland) (NA193)

Cleared Land

DL Disturbed Land

Listed as the Weeping Myall Woodland EEC

* Provisional vegetation mapping west of the Kamilaroi Highway based on airphoto interpretation

Note: Vegetation communities 1, 5, 6 and 7 are not present on this figure

Source: Orthophoto - Department of Land and Property Information, Aerial Photography (July 2011)

WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Vegetation Communities
Indicative Rail Spur Investigation Corridor

Figure 4b

Table 4.
FBA Sampling Effort on the Study Area Stratified by Vegetation Zone

Vegetation Community[1]	BVT No.	BVT Name (this study)	FBA Quadrat Numbers	Total
1	NA219	Weeping Myall Woodland	4, 5, 6	3
2	NA185	Poplar Box Woodland on Alluvial Clay Soils	7, 10, 13, 19, 59, 60, 62, 87, 88, 89	10
2a		Poplar Box Woodland on Alluvial Clay Soils (Secondary/Derived Grassland)	8, 9, 61, 69, 81, 82	6
3	NA324	Pilliga Box – Poplar Box Shrubby Woodland	11, 20, 24, 43, 83, WR1	6
3a		Pilliga Box – Poplar Box Shrubby Woodland (Secondary/Derived Grassland)	27, 29, 30, 41, 42, 72	6
4	NA349	White Box – Silver-leaved Ironbark Shrubby Open Forest	14, 15, 16, 17, 18, 21, 22, 26, 67, 68, 76, VF19, VF23, WR6	14
4a		White Box – Silver-leaved Ironbark Shrubby Open Forest (Secondary/Derived Grassland)	23, 32, 33, 34, 40, 45, 46, 47, 48	9
5	NA311	Narrow-leaved Ironbark – White Box Shrubby Forest	1, 2, 3, 12, 28, 36, 37, 39, 44, 70, WB1, WB2, WB3, WB5, WB7	15
5a		Narrow-leaved Ironbark – White Box Shrubby Forest (Secondary/Derived Grassland)	31, 35, 38, 71, 73, 74, 75	7
7	NA201	Mixed Marsh Sedgeland	84, 85, 86	3
8	NA193	River Red Gum Riparian Tall Woodland	54, 57, 58	3
8a		River Red Gum Riparian Tall Woodland (Secondary/Derived Grassland)	55, 80	2
9	-	Exotic Dominated Grassland	-	0
DL	-	Disturbed Land	25	1
Total				85

[1] Vegetation community 6 was not accessed by this study.

Table 5.
Other Sampling Conducted by Vegetation Zone

Community Number[1]	Zone Number	BVT No.	BVT Name (this study)	Blue Vale Road Realignment	Northern Access Road
1	1	NA219	Weeping Myall Woodland	SS11[2], SS12, SS14, SS15	
2	2	NA185	Poplar Box Woodland on Alluvial Clay Soils		
2a	3		Poplar Box Woodland on Alluvial Clay Soils (Secondary/Derived Grassland)		
3	4	NA324	Pilliga Box – Poplar Box Shrubby Woodland	Q77[3], SS9	
3a	5		Pilliga Box – Poplar Box Shrubby Woodland (Secondary/Derived Grassland)		
4	6	NA349	White Box – Silver-leaved Ironbark Shrubby Open Forest		
4a	7		White Box – Silver-leaved Ironbark Shrubby Open Forest (Secondary/Derived Grassland)		
5	8	NA311	Narrow-leaved Ironbark – White Box Shrubby Forest	Q78, Q79	
5a	9		Narrow-leaved Ironbark – White Box Shrubby Forest (Secondary/Derived Grassland)		
7	-	NA201	Mixed Marsh Sedgeland	SS13	
8	10	NA193	River Red Gum Riparian Tall Woodland	-	
8a	11		River Red Gum Riparian Tall Woodland (Secondary/Derived Grassland)	-	
9	-	-	Exotic Dominated Grassland	-	
DL		-	Disturbed Land		SS3, SS4, SS5
			Totals	10	3

[1] Vegetation community 6 was not accessed by this study.

[2] Spot Sample.

[3] Floristic 20 × 20 m quadrat only.

[4] FBA quadrat outside study area for detailed shrub cover measurements.

2.2 VEGETATION SAMPLING

A total of 88, 20 × 20 m (0.04 hectare [ha]) flora quadrat sites were sampled over the study area (Tables 4 and 5). Quadrat sampling occurred in November 2015 (15 days), February 2016 (9 days), March 2016 (2 days), December 2016 (2 days), April 2017 (1 day) and August 2017 (2 days). Of these, 85 were FBA quadrats (Table 4) and three were floristic quadrats conducted on the proposed Blue Vale Road realignment in March 2016 to verify new vegetation mapping of that area (Table 5). The locations of sample sites are given on Figures 3a and 3b. On all 20 × 20 m plots the data collected was that outlined in Table 1 of the FBA (OEH, 2014a). All flora species on each plot were recorded. For each species the following data were collected;

- the vegetation stratum in which species occurred;
- the growth form;
- scientific and common names;
- an estimate of canopy cover for each species from 1-5%, then in 5% intervals; and

- counts of numbers of individuals up to 20, and estimates in tens to 100, and hundreds above 100, or 1000s if required.

Other details recorded for each site included its Global Positioning System (GPS) position, landform, physiography, surface soil characteristics, disturbance, vegetation structural formation and general comments.

2.2.1 RAPID ASSESSMENT SPOT SAMPLING

Rapid assessment spot samples were conducted in highly disturbed habitats to provide data on areas excluded from FBA assessment owing to their low condition. Eight rapid assessment spot samples were conducted (Table 5, Figures 3a and 3b). Spot samples listed all vascular plant species within a 15 m radius of the central point at which a GPS reading was taken. The dominant tree species, if present, were noted to allow classification of the site according to community. Brief notes were made on site characteristics, the condition of the vegetation and any disturbance.

2.2.2 RANDOM MEANDERS

Random meanders were used to search for threatened flora species (DEC, 2004). 'Random meander' describes the nature of a search which is a randomly directed walk through habitat, considered likely to support populations of a targeted species. The random meanders in this survey were targeted to the known habitats described in fact sheets and profiles of threatened species published on the websites of the OEH (2017b) and the DoEE (2017b), as well as on the website of the RBGDT (2016). The habitat requirements of these species are given in Table 2. Surveys were timed to coincide with periods when ephemeral species, e.g. orchids and grasses, would be flowering.

The species targeted are the seven considered to have some likelihood of occurring in the study area (as assessed in Table 2). Random meanders of approximately 30 minutes duration were conducted by a team of two people walking approximately 10 m apart from each quadrat site[4].

2.2.3 SPECIES LISTING

All observed plant species were recorded, whether identified on formal sample sites or not. Some less common plants were only observed opportunistically during random meanders or whilst moving between sample sites. Where plants could not be confidently identified in the field, a sample was taken for later examination. This included samples belonging to groups containing threatened species, particularly the grass genera *Digitaria* and *Dichanthium* to check for *Digitaria porrecta* and *Dichanthium setosum*, respectively. Also heavily sampled were groups that are difficult to identify without examination under a microscope, e.g. grasses in the genera *Paspalidium*, *Rytidosperma*, *Austrostipa* and *Aristida*, and daisies such as *Vittadinia* and *Brachyscome*. Samples were preserved in a plant press and identified later using a binocular microscope and flora keys. The principal reference was *Flora of New South Wales* (Harden, 1990-2002), and is used as the basis for nomenclature in this report along with any updates on the PlantNet web site of the RBGDT.

[4] Note that the threatened species searches for this survey were conducted at the appropriate times to detect each species as specified in the 'site survey details' page of the BioBanking Credit Calculator. New guidelines for surveying threatened plants have been published by OEH (2016) and became available in March 2016, after the threatened flora surveys for this report had been completed.

2.3 SITE VALUE (VEGETATION CONDITION ASSESSMENT)

The condition of the vegetation in the study area was measured using the ten site attributes in Table 2 of the FBA (OEH, 2014a). The ten attributes allow the condition of vegetation to be assessed in a repeatable fashion for comparison with established benchmarks for each of the vegetation classes defined by Keith (2004).

89 of the 20 × 20 m flora survey plots were extended to 50 × 20 m for site value measurements (Figures 3a and 3b). The ten condition parameters were measured in each plot, as per the methodology below:

- Native plant species diversity: - the number of native plant species in the 20 × 20 m subplot.
- Native overstorey cover: - mean percent cover of ground by the foliage of the uppermost vegetation layer; trees or tall shrubs (>1 m) at 10 points along a 50 m transect along the long axis of the plot.
- Native midstorey cover: - mean percent cover of ground by the foliage of the middle vegetation layer; tall shrubs (>1 m), low trees and regeneration at 10 points along a 50 m transect along the long axis of the plot.
- Native groundcover – grasses: - presence or absence of native grasses at 50 points 1 m apart on a 50 m transect along the long axis of the plot.
- Native groundcover – shrubs: - mean percent cover of ground by the foliage of low shrubs (>1 m) and regeneration at 10 points along a 50 m transect along the long axis of the plot.
- Native groundcover – other: - Presence or absence of native herbs and other groundcover species at 50 points 1m apart on a 50 m transect along the long axis of the plot.
- Exotic plant cover: - Presence or absence of exotic grasses at 50 points 1 m apart on a 50 m transect along the long axis of the plot.
- Number of trees with hollows: - All living and dead standing trees with their centres in the 50 × 20 quadrat were examined for hollows capable of harbouring wildlife. Hollows are defined as tree holes > 5 cm diameter, having depth, and > 1 m above the ground.
- Regeneration: - The proportion of overstorey trees species on the 50 × 20 m quadrat that are regenerating.
- Total length of fallen logs: - The length of fallen logs > 10 cm diameter and > 0.5 m long was totalled for the whole 50 × 20 m quadrat.

2.4 SHRUB COVER MEASUREMENT

Accurate estimates of shrub canopy cover were required to verify the status of vegetation as grassy or shrubby in accordance with the Commonwealth guideline, which uses a shrub cover of 30% to separate grassy (<30% shrub cover) White Box Woodlands from shrubby (>30% shrub cover) White Box Woodlands (Department of Environment and Heritage, 2006). A variation of the 'line intercept method' (Hnatiuk *et al*., 2009) was adopted for this purpose.

Shrub canopy cover was measured on the same 50 m long transect that was used for the vegetation condition measurements outlined above (Section 2.3). A straight three metre long stick was held vertically above the tape. The points on the tape were recorded at which the leading and trailing edges of a shrub's canopy were encountered. The two values were later subtracted to give the length of the canopy over the tape. The lengths of all shrub canopies along the tape were summed to give the total cover over 50 m, which was then converted to a percentage.

To ensure the selection of transect locations was not biased, the following procedure was used;

- In relatively uniform habitat comprising the vegetation type to be assessed in Vickery State Forest, a 50 × 100 m grid was drawn in a GIS system on a georeferenced aerial photo. There were 36 points of intersection on the grid representing potential origins for transects. A random number generator was used to select 10 points for establishing a transect location (and FBA quadrat sites).

- Large areas of uniform habitat are not present on the former farmland in the study area. Transect site selection on farmland was governed by the presence of remnant woodland containing White Box trees close to the control sites in Vickery State Forest. Bias was avoided by establishing a point of origin on one side of the FBA 20 × 50 m quadrat and measuring shrub canopy cover on the other side 20 m away.

- At each selected location, the transect was conducted in a northerly direction from the point of origin to avoid directional bias.

- Statistical comparisons of shrub canopy cover between BVT NA349 in Vickery State Forest and on adjacent former farmland were conducted using the Mann-Whitney U Test for non-parametric data in Winstat for Excel (Fitch, 2009).

3 RESULTS AND DISCUSSION

3.1 IDENTIFICATION OF BIOMETRIC VEGETATION TYPES

The vegetation types in the study area were matched to BVTs described in the former OEH web-based VIS with considerable help from the recent BRGN Catchments vegetation mapping (OEH, 2015). Two problems were encountered in using these resources, the second of which is to be expected when extrapolating large regional scale satellite-based vegetation mapping to small local areas;

- Many fields in the VIS system are yet to be fully populated with information. The rather rudimentary information that exists for many BVTs, for example, distribution information is often lacking, and can make it difficult to select the correct BVT among several with similar dominant species.

- The BRGN vegetation mapping is unreliable at the scale required for environmental assessment, which is not unexpected. While there are large areas of agreement between the results of this field survey and the BRGN mapping, there are also significant areas of disagreement. Key areas of difference are outlined below. Nevertheless, the main value of the BRGN mapping for this study has been to highlight the BVTs that have been identified by the regional study as occurring on the northern Liverpool Plains, thereby complementing the VIS system.

The dominant BVTs mapped by the BRGN study for the northern Liverpool Plains correspond to the dominant vegetation types in the study area, except that the distributions shown by the BRGN mapping differ considerably from the actual distributions on the ground. However, there are also several communities identified by BRGN that do not occur on the study area or surrounds and have been misidentified by the mapping process.

Dominant BVTs identified by BRGN that correspond to vegetation types observed on the study area are:

- NA311 – *Narrow-leaved Ironbark – cypress pine – White Box shrubby forest in the Brigalow Belt South Bioregion and Nandewar Bioregion*. This community is given a very large distribution in Vickery State Forest and smaller occurrences in the study area by BRGN. The distribution in both areas is larger than mapped and the study area distribution is considerably different.

- NA349 - *Silver-leaved Ironbark – White Cypress Pine shrubby open forest of the Brigalow Belt South Bioregion and the Nandewar Bioregion*. This vegetation type is also mapped prominently in Vickery State Forest and on the study area by the BRGN study. There is more of this BVT on the study area, particularly in the west of the Project mining area, than shown by BRGN.

- NA185 - *Poplar Box – Yellow Box – Western Grey Box grassy woodland on cracking clay soils, mainly in the Liverpool Plains, Brigalow Belt South Bioregion*. The BRGN mapping identifies this community as prominent on the stagnant alluvial plains to the north and south of the Project mining area. However, it also shows BVT NA185 as occurring on large areas of Maules Creek Formation geology where BVTs NA349 and NA311 actually occur. In addition, an area of NA185 near the Namoi River is incorrectly mapped by the BRGN study as River Red Gum Woodland (NA193).

- NA324 - *Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion*. This vegetation community is used in this study to represent vegetation dominated by Pilliga Box and Poplar Box that occurs on the footslopes of Maules Creek Formation geology and above the stagnant alluvial floodplain where BVT NA185 dominates. NA185 is characterised by Poplar Box and Yellow Box on cracking clay soils with or without Pilliga Box. NA324 is strongly represented immediately to the north east of the study area by the BRGN mapping. This study found that small remnants also occur within the study area.

- NA219 - *Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion*. Mapping of this community by the BRGN study is largely accurate.

Vegetation types mapped for the study area that have been misidentified by the BRGN study are:

- NA397 – *White Box – White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion*. The BRGN study identifies this community in the former travelling stock reserve south of Braymont Road. This is understandable since the reserve supports a considerable density of White Cypress Pine regrowth with scattered remnant White Box trees. However, the reserve also has significant remnant Silver-leaved Ironbark trees and is considered simply to be another area of NA349. This vegetation extends to the north of Braymont Road, which BRGN maps incorrectly as communities NA311 and NA185.

- NA199 – *Mock Olive – Wilga – Peach Bush – Carissa semi-evergreen vine thicket (dry rainforest) mainly on basalt soils in the Brigalow Belt South Bioregion*. The BRGN methodology identified a very small area in the former travelling stock reserve as semi-evergreen vine thicket. However, the actual vegetation at this location comprises scattered individuals of Wild Orange, *Capparis mitchellii* and Wilga, *Geijera parviflora*, in semi-cleared NA349. The Wild Orange and Wilga comprise a diffuse understorey below a mainly White Box and White Cypress Pine canopy.

- NA146 - *Western Grey Box - cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion*. The BRGN study maps this vegetation along Shannon Harbour Road and nearby. Western Grey Box is a rare tree in the study area; the dominant trees along Shannon Harbour Road are Pilliga Box belonging to BVT NA324 [*Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion*].

A summary list of vegetation communities identified in the study area is provided in Table 6.

Table 6
Vegetation Communities Identified in the Study Area

No.	Vegetation Community	BVT	PCT	
Semi-arid Woodlands (Grassy Sub-formation)				
1	Weeping Myall Woodland[1]	NA219	27	Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion
2	Poplar Box Woodland on Alluvial Clay Soils	NA185	101	Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion
2a	Poplar Box Woodland on Alluvial Clay Soils (secondary/derived grassland)			
Dry Sclerophyll Forests (Shrub/Grass Sub-formation)				
3	Pilliga Box – Poplar Box Shrubby Woodland	NA324	397	Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion
3a	Pilliga Box – Poplar Box Shrubby Woodland (secondary/derived grassland)			
4	White Box – Silver-leaved Ironbark Shrubby Open Forest	NA349	594	Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion
4a	White Box – Silver-leaved Ironbark Shrubby Open Forest (secondary/derived grassland)			
Dry Sclerophyll Forests (Shrubby Sub-formation)				
5	Narrow-leaved Ironbark – White Box Shrubby Forest	NA311	459	Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion
5a	Narrow-leaved Ironbark – White Box Shrubby Forest (secondary/derived grassland)			
Freshwater Wetlands				
7	Mixed Marsh Sedgeland	NA201	53	Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains
Forested Wetlands				
8	River Red Gum Riparian Tall Woodland	NA193	78	River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion
8a	River Red Gum Riparian Tall Woodland (secondary/derived grassland)			

Note: There is no community #6 in the study area.
[1] Weeping Myall Woodland EEC

3.2 VEGETATION COMMUNITY DESCRIPTIONS

Tables 7 to 14 provide descriptions of eight vegetation communities identified in the study area using sample data collected in this survey (Appendix A).

Semi-arid Woodlands (Grassy Sub-formation)

Semi-arid Woodlands (Grassy Sub-formation) are represented in the study area by Vegetation Communities 1 and 2 (Tables 7 and 8).

Table 7.
Vegetation Community 1. Weeping Myall Woodland

No. of Samples:	3 quadrats, 4 spot samples.
Landscape Position:	Weeping Myall Woodland is confined to low lying poorly drained areas along drainage depressions on the stagnant alluvial plain south of the Project mining area (Figure 4a; Plate 1).
General comments:	Remnants of Weeping Myall Woodland on the study area are highly fragmented, thinned and heavily grazed. The understorey has been greatly modified and simplified compared to the natural condition. There is evidence of herbicide damage to the trees in some places where African Boxthorn has been controlled.
Dominant and Characteristic Species:	
Trees:	Tall trees are absent from the community on the study area.
Low Trees:	Weeping Myall, *Acacia pendula*, is the dominant species, generally forming pure stands.
Shrubs:	The dominant native low shrub is Black Rolypoly, *Sclerolaena muricata*. Grey Mistletoe, *Amyema quandang*, was abundant on some Weeping Myall trees.
Vines / Creepers:	Vines are absent. The only creepers recorded were two Bindweed species, *Convolvulus graminetinus* and *C. angustissimus*.
Ground Covers:	The ground vegetation layer has relatively low diversity. The most common native ground cover species include the herbs Slender-fruited Saltbush, *Atriplex leptocarpa*; Climbing Saltbush, *Einadia nutans* subsp. *nutans*; Berry Saltbush, *Einadia hastata*; Tarvine, *Boerhavia dominii*; Quena, *Solanum esuriale*; Narrow-leaf Sida, *Sida trichopoda*; a Wood-sorrel, *Oxalis perennans*; Silky Goodenia, *Goodenia fascicularis*; Sago-weed, *Plantago cunninghamii* and Sensitive Plant, *Neptunia gracilis*. The most common native grasses are Curly Windmill Grass, *Enteropogon acicularis*; a Wallaby Grass, *Rytidosperma fulvum* and Plains Grass, *Austrostipa aristiglumis*.
Introduced Species:	Introduced species are common, and in some cases, abundant. These include the shrub African Boxthorn, *Lycium ferocissimum*. Common introduced herbs and grasses are *Sida spinosa*, maltese Cockspur, *Centaurea melitensis*; Cretan Weed, *Hedypnois rhagodioloides* subsp. *cretica*; Lippia, *Phyla nodiflora*; African Peppercress, *Lepidium africanum*; Turnip Weed, *Rapistrum rugosum*; London Rocket, *Sisymbrium irio* and Common Sowthistle, *Sonchus oleraceus*.
Equivalent BVT:	Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion (NA219) (OEH, 2017a).
Equivalent NSW TEC:	Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions EEC (BC Act).
Equivalent Commonwealth TEC:	Weeping Myall Woodlands EEC (EPBC Act).

Plate 1. Weeping Myall Woodland (Quadrat 5)

Plate 2. Poplar Box Woodland on Alluvial Clay Soils (Quadrat 10)

Plate 3. Poplar Box Woodland on Alluvial Clay Soils (Quadrat 19)

Table 8.
Vegetation Community 2. Poplar Box Woodland on Alluvial Clay Soils

No. of Samples:	10 quadrats.
Landscape Position:	Poplar Box Woodland on alluvial clay soils is confined to flat terrain on the fringes of the Project mining area (Figures 4a and 4b; Plates 2 and 3).
General comments:	Remnants of alluvial Poplar Box Woodland are highly fragmented and heavily grazed. They occur on areas of deep highly leached soils more or less prone to waterlogging. In most cases, the former midstorey has been removed historically, the understorey has been greatly modified by grazing and may carry high levels of exotic species in some remnants.
Dominant and Characteristic Species:	
Trees:	The most characteristic trees are Poplar Box, *Eucalyptus populnea*, and Yellow Box, *Eucalyptus melliodora*. Narrow-leaved Grey Box, *Eucalyptus pilligaensis*, is a common associate and may sometimes dominate. Blakely's Red Gum, *Eucalyptus blakelyi*, occurs occasionally.
Low Trees:	Miljee, *Acacia oswaldii*, is an occasional isolated low tree or large shrub.
Shrubs:	The dominant native low shrub is Black Rolypoly, *Sclerolaena muricata*, which may occur in large numbers, while Small-leaf Bluebush, *Maireana microphylla* and Galvanised Burr, *Sclerolaena birchii*, occur sporadically.
Vines / Creepers:	Native Jasmine, *Jasminum suavissimum*, was recorded on one plot. The only creepers observed were low numbers of Blushing Bindweed, *Convolvulus angustissimus* and Variable Glycine, *Glycine tabacina*.
Ground Covers:	The ground vegetation layer was similar in composition to Community 1 which may occur nearby in the landscape. The most common native ground cover species include the herbs Nardoo, *Marsilea drummondii*; Native Wandering Jew, *Commelina cyanea*; Climbing Saltbush, *Einadia nutans* subsp. *linifolia*; Berry Saltbush, *Einadia hastata*; Kidney Weed, *Dichondra repens*; Caustic Weed, *Chamaesyce drummondii*; Corrugated Sida, *Sida corrugata*; a Wood-sorrel, *Oxalis perennans*; Swamp Dock, *Rumex brownii*; Amulla, *Eremophila debilis* and Quena, *Solanum esuriale*. The most common native grasses and sedges are Knob Sedge, *Carex inversa*; Pale Spike-sedge, *Eleocharis pallens*; Plains Grass, *Austrostipa aristiglumis*; Slender Bamboo Grass, *Austrostipa verticillata*; Curly Windmill Grass, *Enteropogon acicularis*; Slender Panic, *Paspalidium gracile* and Warrego Grass, *Paspalidium jubiflorum*.
Introduced Species:	Introduced species are frequent, but do not dominate the ground cover. These include the shrub African Boxthorn, *Lycium ferocissimum*. Common introduced herbs and grasses are *Sida spinosa*, Lippia, *Phyla nodiflora*; Burr Medic, *Medicago polymorpha*; Clustered Clover, *Trifolium glomeratum*; Dead Nettle, *Lamium amplexicaule*; Cat-head, *Tribulus terrestris*; African Peppercress, *Lepidium africanum*; Turnip Weed, *Rapistrum rugosum*; London Rocket, *Sisymbrium irio*; Common Sowthistle, *Sonchus oleraceus*; Prairie Grass, *Bromus catharticus*; Barley Grass, *Hordeum leporinum* and Wimmera Ryegrass, *Lolium rigidum*.
Equivalent BVT:	Poplar Box – Yellow Box – Western Grey Box grassy woodland on cracking clay soils, mainly in the Liverpool Plains, Brigalow Belt South Bioregion (NA185) (OEH, 2017a).
Equivalent NSW TEC:	N/A
Equivalent Commonwealth TEC:	N/A

Dry Sclerophyll Forests (Shrub/Grass Sub-formation)

Dry Sclerophyll Forests (Shrub/Grass Sub-formation) are represented in the study area by Vegetation Communities 3 and 4 (Tables 9 and 10).

Table 9.
Vegetation Community 3. Pilliga Box – Poplar Box Shrubby Woodland

No. of Samples:	7 quadrats
Landscape Position:	Pilliga Box – Poplar Box Shrubby Woodland occurs on gently sloping lower footslopes and rises above the stagnant alluvial floodplains and on drier parts of the floodplains themselves (Figure 4a; Plate 4).
General comments:	Soils tend to have moderate to high gravel contents. A diversity of shrubs is present in areas with low levels of grazing, such as roadsides or around farm buildings. However, most sites in grazing paddocks have few, if any shrubs present.
Dominant and Characteristic Species:	
Trees:	The dominant tree is Poplar Box, *Eucalyptus populnea*, often in association with Pilliga Box, *Eucalyptus pilligaensis*, which can also occur in large monospecific stands. White Cypress Pine, *Callitris glaucophylla*, also often occurs in this community.
Low Trees:	Low trees may include Wilga, *Geijera parviflora*; Western Rosewood, *Alectryon oleifolius* subsp. *elongatus*; Bulloak, *Allocasuarina luehmannii* and Wild Orange, *Capparis mitchellii*.
Shrubs:	Shrubs recorded were Western Silver Wattle, *Acacia decora*; Western Boobialla, *Myoporum montanum*; Black Rolypoly, *Sclerolaena muricata*; Galvanised Burr, *Sclerolaena birchii* and Small-leaf Bluebush, *Maireana microphylla*.
Vines / Creepers:	Vines were not recorded. Two species of twiners / creepers were identified; Variable Glycine, *Glycine tabacina* and Blushing Bindweed, *Convolvulus angustissimus*.
Ground Covers:	A diverse ground cover of native herbs and grasses is often present. Common native herbaceous ground covers included; Yellow Buttons, *Chrysocephalum apiculatum*; Berry Saltbush, *Einadia hastata*; Climbing Saltbush, *Einadia nutans* subsp. *linifolia*; *Einadia polygonoides*; Tarvine, *Boerhavia dominii*; Ridge Sida, *Sida cunninghamii*; Corrugated Sida, *Sida corrugata*; Blue Trumpet, *Brunoniella australis*; Leek Lily, *Bulbine semibarbata*; Sago-weed, *Plantago cunninghamii*; Kidney Weed, *Dichondra repens*; Wingless Fissure-weed, *Maireana enchylaenoides*; Winter Apple, *Eremophila debilis*; Pigweed, *Portulaca oleracea*; Pink Tongues, *Rostellularia adscendens* and Small Vanilla-lily, *Arthropodium minus*. Grasses and sedges mainly comprised; Wattle Matrush, *Lomandra filiformis* subsp. *flavior*; Slender Flat-sedge, *Cyperus gracilis*; Purple Wiregrass, *Aristida ramosa*; Speargrass, *Austrostipa scabra*; Bamboo Grass, *Austrostipa verticillata*; Curly Windmill Grass, *Enteropogon acicularis*; Bottlewashers, *Enneapogon nigricans* and *Paspalidium gracile*.
Introduced Species:	Introduced species of shrubs and ground covers may be present, but are not usually dominant. Shrubs may include; European Olive, *Olea europaea* subsp. *cuspidata* and African Boxthorn, *Lycium ferocissimum*, the latter may form a dense layer below the tree canopy. Common introduced ground covers include London Rocket, *Sisymbrium irio*; Hedge Mustard, *Sisymbrium orientale*; African Peppercress, *Lepidium africanum*; Wimmera Ryegrass, *Lolium rigidum* and Common Sowthistle, *Sonchus oleraceus*.
Equivalent BVT:	Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion (NA324) (OEH, 2017a).
Equivalent NSW TEC:	N/A
Equivalent Commonwealth TEC:	N/A

Plate 4. Pilliga Box - Poplar Box Shrubby Woodland (Quadrat 24)

Plate 5. White Box - Silver-leaved Ironbark Shrubby Open Forest (Quadrat 17)

Plate 6. White Box - Silver-leaved Ironbark Shrubby Open Forest (Quadrat 76)

Table 10.
Vegetation Community 4. White Box – Silver-leaved Ironbark Shrubby Open Forest

No. of Samples:	14 quadrats.
Landscape Position:	White Box – Silver-leaved Ironbark Shrubby Open Forest occurs on the upper slopes and mid slopes of landscapes associated with Maules Creek Formation geology. The soils are moderately fertile and well drained. This community is prominent in the former travelling stock reserve and its immediate surrounds, and Vickery State Forest (Figure 4a; Plates 5 and 6).
General comments:	Soils tend to be stony with high gravel contents. A diversity of shrubs is present in areas with low levels of grazing, such as in Vickery State Forest. However, most sites that have experienced heavy grazing historically have few, if any, shrubs present, including the former travelling stock reserve. This community tends to regenerate to dense stands of White Cypress Pine, *Callitris glaucophylla*, after clearing of the overstorey eucalypts. Reductions in grazing over much of the study area following earlier mining activity have allowed vigorous regrowth of White Cypress Pine to occur. The dominant and characteristic species listed below exclude quadrats conducted in Vickery State Forest. The contrast between Vickery State Forest and the neighbouring properties is discussed in detail below.
Dominant and Characteristic Species:	
Trees:	The dominant trees are White Box, *Eucalyptus albens*, Silver-leaved Ironbark, *Eucalyptus melanophloia* and White Cypress Pine, *Callitris glaucophylla*.
Low Trees:	Low trees include small numbers of Wild Orange, *Capparis mitchellii*; Wilga, *Geijera parviflora*; Western Rosewood, *Alectryon oleifolius* subsp. *elongatus* and Western Boobialla, *Myoporum montanum.*
Shrubs:	Shrubs included low numbers of Western Silver Wattle, *Acacia decora*; Galvanised Burr, *Sclerolaena birchii* and Small-leaf Bluebush, *Maireana microphylla*.
Vines / Creepers:	Vines were uncommon and included Doubah, *Marsdenia australis* and Rough Silkpod, *Parsonsia lanceolata*. Twiners / creepers included occasional Blushing Bindweed, *Convolvulus angustissimus*; abundant Variable Glycine, *Glycine tabacina* and occasional Love Creeper, *Glycine clandestina*.
Ground Covers:	The ground cover of native herbs and grasses may be diverse, but is often suppressed by dense canopies of regenerating White Cypress Pine. Common native herbaceous ground covers included; Bristly Cloak Fern, *Cheilanthes distans*; Blue Trumpet, *Brunoniella australis*; Pink Tongues, *Rostellularia adscendens*; Yellow Buttons, *Chrysocephalum apiculatum*; Cobbler's Tack, *Glossocardia bidens*; a Fuzzweed, *Vittadinia cervicularis* var. *subcervicularis*; Golden Everlasting, *Xerochrysum bracteatum*; Tufted Bluebell, *Wahlenbergia communis*; Red Berry Saltbush, *Einadia hastata*; Knotweed Goosefoot, *Einadia polygonoides*; Wingless Bluebush, *Maireana enchylaenoides*; Kidney Weed, *Dichondra repens*; *Evolvulus alsinoides* var. *decumbens*; Large Tick-trefoil, *Desmodium brachypodum*; Slender Tick-trefoil, *Desmodium varians*; Forest Goodenia, *Goodenia hederacea*; Ridge Sida, *Sida cunninghamii*; Corrugated Sida, *Sida corrugata*; Tarvine, *Boerhavia dominii*; an Oxalis, *Oxalis perennans*; Sago-weed, *Plantago cunninghamii*; Winter Apple, *Eremophila debilis*; Western Stackhousia, *Stackhousia muricata*; Yellow Rush-lily, *Tricoryne elatior* and Small Vanilla-lily, *Arthropodium minus*. Grasses and sedges mainly comprised; Many-flowered Matrush, *Lomandra mulriflora*; Slender Flat-sedge, *Cyperus gracilis*; Knob Sedge, *Carex inversa*; *Aristida calycina* var. *calycina*; Purple Wiregrass, *Aristida personata*; Purple Wiregrass, *Aristida ramosa*; Speargrass, *Austrostipa scabra*; Slender Bamboo Grass, *Austrostipa verticillata*; Plump Windmill Grass, *Chloris ventricosa*; Cotton Panic Grass, *Digitaria brownii*; Slender Bottle-washers, *Enneapogon gracilis*; Slender Panic, *Paspalidium gracile* and a Wallaby Grass, *Rytidosperma racemosum* var. *obtusatum*.
Introduced Species:	Introduced species generally form only a minor component of this community. Shrubs include only a few African Boxthorn, *Lycium ferocissimum*. Common introduced ground covers include Maltese Cockspur, *Centaurea melitensis*; African Peppercress, *Lepidium africanum*; London Rocket, *Sisymbrium irio*; Indian Hedge Mustard, *Sisymbrium orientale*; Four-leaved Allseed, *Polycarpon tetraphyllum*; Haresfoot Clover, *Trifolium arvense*; Clustered Clover, *Trifolium glomeratum*; *Sida spinosa* and Lesser Snapdragon, *Misopates orontium*.
Equivalent BVT:	Silver-leaved Ironbark – White Cypress Pine shrubby open forest of the Brigalow Belt South Bioregion and the Nandewar Bioregion (NA349) (OEH, 2017a).
Equivalent NSW TEC:	N/A
Equivalent Commonwealth TEC:	N/A

Dry Sclerophyll Forests (Shrubby Sub-formation)

Dry Sclerophyll Forests (Shrubby Sub-formation) is represented in the study area by Vegetation Community 5 (Table 11).

Table 11.
Vegetation Community 5. Narrow-leaved Ironbark – White Box Shrubby Forest

No. of Samples:	17 quadrats.
Landscape Position:	Narrow-leaved Ironbark – White Box Shrubby Forest occurs on the upper slopes and high ridges of landscapes associated with Maules Creek Formation geology. The soils are moderately fertile, but tend to be shallower and drier than those supporting Community 5. This community is prominent on the higher parts of the study area and in Vickery State Forest (Figure 4a; Plates 7 and 8).
General comments:	Soils tend to be stony with high gravel contents. A diversity of shrubs is present in areas with low levels of grazing, such as Vickery State Forest. However, most sites that have experienced heavy grazing historically have few, if any, shrubs present.
Dominant and Characteristic Species:	
Trees:	The dominant trees are Narrow-leaved Ironbark, *Eucalyptus crebra*; White Box, *Eucalyptus albens* and White Cypress Pine, *Callitris glaucophylla* with occasional Silver-leaved Ironbark, *Eucalyptus melanophloia*.
Low Trees:	Low trees included only small numbers of Wilga, *Geijera parviflora*.
Shrubs:	Shrubs included sometimes high numbers of Galvanised Burr, *Sclerolaena birchii*; small numbers of Small-leaf Bluebush, *Maireana microphylla*; occasional Sticky Hopbush, *Dodonaea viscosa* subsp. *angustifolia* and *Dodonaea sinuolata*.
Vines / Creepers:	Vines were not recorded. Twiners / creepers included only Variable Glycine, *Glycine tabacina*.
Ground Covers:	The ground cover of native herbs and grasses is less diverse than Community 5. Common native herbaceous ground covers included; Blue Trumpet, *Brunoniella australis*; Golden Everlasting, *Xerochrysum bracteatum*; Tufted Bluebell, *Wahlenbergia communis*; Red Berry Saltbush, *Einadia hastata*; Caustic Weed, *Chamaesyce drummondii*; Large Tick-trefoil, *Desmodium brachypodum*; Slender Tick-trefoil, *Desmodium varians*; *Oncinocalyx betchei*; Ridge Sida, *Sida cunninghamii*; Corrugated Sida, *Sida corrugata*; Tarvine, *Boerhavia dominii*; Swamp Dock, *Rumex brownii*; *Solanum parvifolium* subsp. *parvifolium*; Yellow Vine, *Tribulus micrococcus*; Small Vanilla Lily, *Arthropodium minus* and Nodding Chocolate Lily, *Dichopogon fimbriatus*. Grasses and sedges mainly comprised; Slender Flat-sedge, *Cyperus gracilis*; Knob Sedge, *Carex inversa*; Purple Wiregrass, *Aristida ramosa*; Speargrass, *Austrostipa scabra*; Slender Bamboo Grass, *Austrostipa verticillata*; Slender Bottle-washers, *Enneapogon gracilis*; Curly Windmill Grass, *Enteropogon acicularis* and a Wallaby Grass, *Rytidosperma racemosum* var. *obtusatum*.
Introduced Species:	Introduced species generally form only a minor component of this community. Shrubs include only a few African Boxthorn, *Lycium ferocissimum*. Common introduced ground covers include Maltese Cockspur, *Centaurea melitensis*; Smooth Catsear, *Hypochaeris glabra*; Patterson's Curse, *Echium plantagineum*; African Peppercress, *Lepidium africanum*; London Rocket, *Sisymbrium irio*; Indian Hedge Mustard, *Sisymbrium orientale*; Proliferous Pink, *Petrorhagia nanteuillii*; Four-leaved Allseed, *Polycarpon tetraphyllum*; Woolly Burr Medic, *Medicago minima*; Haresfoot Clover, *Trifolium arvense*; Clustered Clover, *Trifolium glomeratum*; *Sida spinosa*; Scarlet Pimpernel, *Anagallis arvensis*; Lesser Snapdragon, *Misopates orontium*; Wimmera Ryegrass, *Lolium rigidum* and *Vulpia* species.
Equivalent BVT:	Narrow-leaved Ironbark – Black Cypress Pine – White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion (NA311) (OEH, 2017a).
Equivalent NSW TEC:	N/A
Equivalent Commonwealth TEC:	N/A

Plate 7. Narrow-leaved Ironbark - White Box Shrubby Forest (Qudarat 12)

Plate 8. Narrow-leaved Ironbark - White Box Shrubby Forest (Quadrat 37)

Plate 9. River Red Gum Riparian Tall Woodland (south of Study Area)

Freshwater Wetlands

Freshwater Wetlands are represented in the study area by Vegetation Community 7 (Table 12).

Table 12.
Vegetation Community 7. Mixed Marsh Sedgeland

No. of Samples:	3 quadrats, 1 spot sample.
Landscape Position:	Mixed marsh sedgeland occurs along Stratford Creek south of Shannon Harbour Road on the proposed route of the Blue Vale Road realignment. Stratford Creek is a non-incised drainage depression that may temporarily fill with water after major rainfall events. (Figure 4a).
General comments:	Remnants of Weeping Myall Woodland occur along the length of Stratford Creek extending above it for up to 30 m on either side. The lowest parts of the depression support a variety of semi-aquatic plants including sedges, rushes and other moisture dependent flora. On either side of the sedgeland are flanking strips of tall grassland dominated by Plains Grass, *Austrostipa aristiglumis*. The sedgeland, flanking grassland and Weeping Myall Woodland occur on farmland heavily grazed by sheep or cattle.
Dominant and Characteristic Species:	
Trees:	Tall trees were absent, although it is likely that the original overstorey vegetation included emergent Poplar Box, *Eucalyptus populnea* and Pilliga Box, *Eucalyptus pilligaensis*, which still occur in the surrounds and represent Community 2.
Low Trees:	Low trees comprised remnant patches of Weeping Myall, *Acacia pendula*.
Shrubs:	Shrubs included only occasional Black Rolypoly, *Sclerolaena muricata* and Galvanised Burr, *Sclerolaena birchii*.
Vines / Creepers:	Vines and twiners or creepers were absent.
Ground Covers:	The ground cover comprised a suite of aquatic and semi-aquatic species of low diversity. The most common native sedges and rushes included; dense swards of Pale Spike-sedge, *Eleocharis pallens*, Flat Spike-sedge, *Eleocharis plana*; Tiny Spike-sedge, *Eleocharis pusilla*. Herbs included Hairy Joyweed, *Alternanthera nana*; Rough Burr-daisy, *Calotis scabiosifolia*; Carrot Weed, *Cotula australis*; *Eclipta platyglossa*; Mat Spurge, *Euphorbia dallachyana*; Hairy Carpet-weed, *Glinus lotoides*; Small Crumbweed, *Dysphania pumilio*; Native Sensitive Plant, *Neptunia gracilis*; *Goodenia fascicularis*; Creeping Oxalis, *Oxalis perennans*; Slender Monkey-flower, *Mimulus gracilis*; Pigweed, *Portulaca oleracea* and Common Nardoo, *Marsilea drummondii*. Grasses mainly comprised Plains Grass, *Austrostipa aristiglumis*; Curly Windmill Grass, *Enteropogon acicularis*; *Lachnagrostis filiformis*; Native Millet, *Panicum decompositum*; A Wallby Grass, *Rytidosperma fulvum* and Fairy Grass, *Sporobolus caroli*.
Introduced Species:	Introduced species were occasional in this community. The main introduced ground covers were Cretan Weed, *Hedynois rhagodioloides* subsp. *cretica*; White Flatweed, *Hypochaeris microcephala* var. *albiflora*; Common Sowthistle, *Sonchus oleraceus*; Turnip Weed, *Rapistrum rugosum;* Sandspurrey, *Spergularia rubra*; Burr Medic, *Medicago polymorpha*; *Sida spinosa*; and Bathurst Burr, *Xanthium spinosum*.
Equivalent BVT:	Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains (NA201) (OEH, 2017a).
Equivalent NSW TEC:	N/A
Equivalent Commonwealth TEC:	N/A

Forested Wetlands

Forested Wetlands are represented in the study area by Vegetation Community 8 (Table 13).

Table 13.
Vegetation Community 8. River Red Gum Riparian Tall Woodland

No. of Samples:	3 quadrats.
Landscape Position:	River Red Gum Riparian Tall Woodland occurs in the riparian zone of the Namoi River and some of its smaller tributaries on the study area. It also occurs on the active flood terraces above the river (Figures 4a and 4b; Plate 9).
General comments:	The soils are highly fertile but may be prone to waterlogging. Shrubs are scarce, but sedges, rushes and other moisture dependent flora are common. The riparian zone is confined to farmland on private property and is heavily grazed. The high moisture status and fertility of the soils promote high cover and diversity of exotic species.
Dominant and Characteristic Species:	
Trees:	The dominant trees are River Red Gum, *Eucalyptus camaldulensis*, often associated with River Sheoak, *Casuarina cunninghamiana*.
Low Trees:	Low trees were absent from the plots and surrounds.
Shrubs:	Shrubs included only occasional Smooth Senna, *Senna barclayana* and Weeping Pittosporum, *Pittosporum angustifolium*.
Vines / Creepers:	Vines and twiners or creepers were not recorded.
Ground Covers:	The ground cover comprised a suite of semi-aquatic and moisture loving species of low diversity. The most common native herbaceous ground covers included; Climbing Saltbush, *Einadia nutans*; Native Wandering Jew, *Commelina cyanea*; Tarvine, *Boerhavia dominii*; Creeping Oxalis, *Oxalis perennans*; Swamp Dock, *Rumex brownii* and Stinging Nettle, *Urtica incisa*. Grasses mainly comprised; Couch, *Cynodon dactylon*; Awnless Barnyard Grass, *Echinochloa colona*; Early Spring Grass, *Eriochloa pseudoacrotricha* and Warrego Grass, *Paspalidium jubiflorum*.
Introduced Species:	Introduced species were common in this community. Shrubs included only Velvet Mesquite, *Prosopis velutina*. Common introduced ground covers were Hemlock, *Conium maculatum*; Common Sowthistle, *Sonchus oleraceus*; Nettle-leaf Goosefoot, *Chenopodium murale*; *Sida spinosa*; Common Thornapple, *Datura stramonium*; Madeira Winter, *Solanum pseudocapsicum*; Lippia, *Phyla nodiflora*; Cat-head, *Tribulus terrestris*; Nutgrass, *Cyperus rotundus* and Prairie Grass, *Bromus catharticus*.
Equivalent BVT:	River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and the Brigalow Belt South Bioregion (NA193) (OEH, 2017a).
Equivalent NSW TEC:	N/A
Equivalent Commonwealth TEC:	N/A

Secondary/Derived Native Grasslands

Table 14.
Secondary/Derived Native Grasslands

No. of Samples:	30 quadrats
Landscape Position:	Throughout the study area, principally on lower slopes and flat terrain (Figures 4a and 4b; Plates 10, 11 and 12).
General comments:	Secondary/derived native grasslands are grasslands that have developed after clearing of the original vegetation (Keith, 2004; Benson, 1996). In some parts of the study area, the native grasslands comprise native grassland species that have recolonised previously cultivated land (e.g. via windblown or animal carried seed) and are regarded as secondary grasslands. In other parts of the study area, native grasslands remain after removal of the original overstorey and midstorey vegetation and are regarded as derived grasslands. The secondary/derived native grasslands of a particular PCT in the study area are all in a similar condition (i.e. it was not practicable to classify them into separate vegetation zones based on condition).
Dominant and Characteristic Species:	
Trees:	By definition, trees are absent from secondary/derived native grasslands.
Low Trees:	By definition, low trees are absent from secondary/derived native grasslands.
Shrubs:	Native shrubs included only occasional Galvanised Burr, *Sclerolaena birchii*; Small-leaf Bluebush, *Maireana microphylla*; and on flatter terrain, Black Rolypoly, *Sclerolaena muricata*.
Vines / Creepers:	Vines were not recorded. Twiners / creepers included mainly Blushing Bindweed, *Convolvulus angustissimus* and the Glycine species Variable Glycine, *Glycine tabacina* and Silky Glycine, *G. canescens*, although none was common.
Ground Covers:	The most widespread ground covers included Poison Rock Fern, *Cheilanthes sieberi*; Yellow Burr Daisy, *Calotis lappulacea*; the Fuzzweeds, *Vittadinia muelleri* and *V. pustulata*; Golden Everlasting, *Xerochrysum bracteatum*; Tufted Bluebell, *Wahlenbergia communis*; the Climbing Saltbushes, *Einadia nutans* subsp. *nutans* and *E. nutans* subsp. *linifolia*; Kidney Weed, *Dichondra repens*; Caustic Weed, *Chamaesyce drummondii*; Spike Centaury, *Schenkia australis*; Corrugated Sida, *Sida corrugata*; Hairy Sida, *Sida trichopoda*; Tarvine, *Boerhavia dominii*; an Oxalis, *Oxalis perennans*; Swamp Dock, *Rumex brownii*; Portulaca, *Portulaca oleracea*; Quena, *Solanum esuriale*; *Verbena gaudichaudii* and Yellow Vine, *Tribulus micrococcus*. Grasses and sedges mainly comprised Knob Sedge, *Carex inversa*; the Purple Wiregrasses, *Aristida personata* and *A. ramosa*; Plains Grass, *Austrostipa aristiglumis*, on lower lying areas; Speargrass, *Austrostipa scabra*; Slender Bamboo Grass, *Austrostipa verticillata*; Red Grass, *Bothriochloa decipiens*; Couch, *Cynodon dactylon*; Windmill Grass, *Chloris truncata*; Queensland Bluegrass, *Dichanthium sericeum*; Cotton Panic Grass, *Digitaria brownii*; Umbrella Grass, *Digitaria divaricatissima*; the Bottle-washers, *Enneapogon gracilis* and *E. nigricans*; Awnless Barnyard Grass, *Echinochloa colona*; Curly Windmill Grass, *Enteropogon acicularis*; a Lovegrass, *Eragrostis alveiformis*; Early Spring Grass, *Eriochloa pseudoacrotricha* and Fairy Grass, *Sporobolus caroli*.
Introduced Species:	Introduced species may be abundant in secondary/derived native grasslands and include African Peppercress, *Lepidium africanum*; Saffron Thistle, *Carthamus lanatus*; Maltese Cockspur, *Centaurea melitensis*; Cretan Weed, *Hedypnois rhagodioloides* subsp. *cretica*; Smooth Catsear, *Hypochaeris glabra*; Proliferous Pink, *Petrorhagia nanteuillii*; Woolly Burr Medic, *Medicago minima*; Haresfoot Clover, *Trifolium arvense*; Hop Clover, *Trifolium campestre*; Clustered Clover, *Trifolium glomeratum*; Lesser Snapdragon, *Misopates orontium*; *Sida spinosa*; Cat-head, *Tribulus terrestris*; Soft Brome, *Bromus molliformis*; Wimmera Ryegrass, *Lolium rigidum* and *Vulpia* species.
Equivalent BVT:	N/A
Equivalent NSW TEC:	N/A
Equivalent Commonwealth TEC:	N/A

Plate 10. Grassland Community 2a (north of Study Area)

Plate 11. Grassland and White Cypress Pine Regeneration Community 5a (Quadrat 23)

Plate 12. Grassland Community 7a (Quadrat 74)

3.3 FLORA SPECIES

A total of 374 flora species were identified by the FBA quadrats, standard floristic plots, rapid assessment spot samples, random meanders and general movement around the study area (Appendix A, Table 15). Of these, 271 (72.5%) are native to the natural communities of the study area and 103 (27.5%) are introduced. The numbers of species found in each community generally varied according to the sampling intensity (Table 15). The largest number of native species was found in Communities 2, 4 and 5, with 99, 127 and 140 species, respectively. These were also the most widespread and hence most heavily sampled communities.

The plant families with the highest numbers of species (Appendix A) were the Grasses, Poaceae (79 taxa); Daisies, Asteraceae (47 taxa); Chenopods, Chenopodiaceae (19 species); Pea-flowers, subfamily Faboideae (20 species); Sidas and Lantern Bushes, Malvaceae (11 species) and the Eucalypts, Myrtaceae (11 species). In all, some 70 plant families and sub-families were represented.

Table 15.
Numbers and Percentages of Native and Introduced Vascular Plant Species Identified in the Vegetation Communities within the Study Area

Community	Number of Samples[1]	Total Plant Species	Number of Native Species	% of Native Species	Number of Introduced Species	% Introduced Species
1	7	61	43	70.5	18	29.5
2	10	146	99	67.8	47	32.2
2a	6	79	59	74.7	20	25.3
3	8	112	83	74.1	29	25.9
3a	6	87	67	77.0	20	23.0
4	14	165	127	77.0	38	23.0
4a	9	111	77	69.4	34	30.6
5	17	181	140	77.3	41	22.7
5a	7	89	68	76.4	21	23.6
7	4	69	49	71.0	20	29.0
8	3	50	24	48.0	26	52.0
8a	2	33	25	75.8	8	24.2
Total	93	374	271	72.5	103	27.5

[1] Includes FBA quadrats, standard floristic quadrats and spot samples across the whole study area.

[2] Additional species observed on disturbed land, random meanders and opportunistically.

3.4 PRIORITY WEEDS

103 species (27.5%) recorded in the survey are introduced (Table 15). The highest proportions of introduced species, 52%, were found in River Red Gum riparian woodland (Community 8), which is a highly disturbed, fertile environment favourable to many introduced species. The remaining communities all hosted similar levels of introduced species (22.7 to 32.2%) (Table 15).

Three introduced species recorded in this survey (Table 16) are listed as priority weeds under the NSW *Biosecurity Act 2015* for the North West Region (North West Local Land Services, 2017). African Boxthorn was often abundant below eucalypt canopies in remnant woodlots on the stagnant alluvial plains surrounding the Project mining area. The remaining noxious weeds were encountered infrequently.

Table 16.
Priority Weeds Recorded on the Study Area

Scientific Name	Common Name	Strategic Response
Prosopis velutina	Velvet Mesquite	**Prohibition on dealings** The plant must not be imported into the State or sold **Regional Recommended Measure** The plant or parts of the plant are not traded, carried, grown or released into the environment
Opuntia aurantiaca	Tiger pear	**Prohibition on dealings** The plant must not be imported into the State or sold.
Lycium ferocissimum	African boxthorn	**Prohibition on dealings** The plant must not be imported into the State or sold.

3.5 THREATENED FLORA SPECIES

Two threatened flora species were detected by the surveys reported here:

- Scant Pomaderris, *Pomaderris queenslandica*. A single plant chewed down almost to ground level by grazers was found just outside the boundary of Vickery State Forest (Figure 5); and
- *Tylophora linearis*. A colony of this small vine numbering in excess of 20 plants was found within the western boundary of Vickery State Forest (Figure 5).

However, neither species was located on the study area itself (Figure 5). Both are likely to be more widely distributed within Vickery State Forest.

3.6 THREATENED POPULATIONS AND CRITICAL HABITAT

No threatened populations or critical habitat were identified on the study area.

3.7 THREATENED ECOLOGICAL COMMUNITIES

One BVT identified on the study area by the current survey, Weeping Myall Woodland (Vegetation Community 1 [NA219]), is equivalent to TECs listed under the BC Act and the EPBC Act, as follows:

- *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions* EEC (BC Act); and
- *Weeping Myall Woodlands* EEC (EPBC Act).

However, two additional TECs, Semi-evergreen Vine Thicket and Box – Gum Woodland, listed under both the BC Act and the EPBC Act were previously predicted in the study area by the BRGN study, both in the former travelling stock reserve. Small patches of Box-Gum Woodland EEC/CEEC were also identified elsewhere on the study area by Niche Environment and Heritage (2013a).

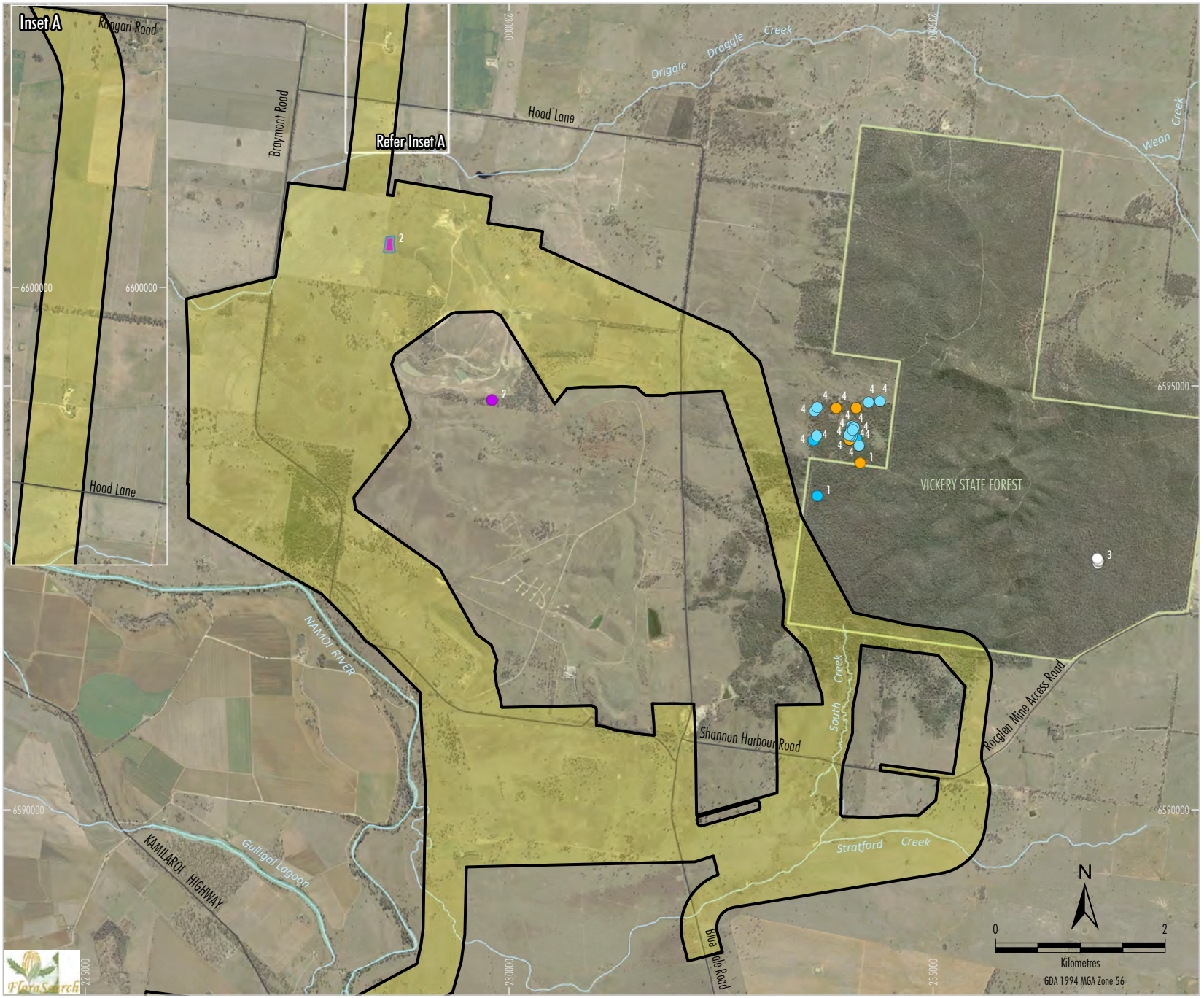
Semi-evergreen Vine Thicket is listed as:

- *Semi-evergreen Vine Thicket in the Brigalow Belt South and Nandewar Bioregions* EEC (BC Act); and
- *Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions* EEC (EPBC Act).

Box – Gum Woodland is listed as:

- *White Box Yellow Box Blakely's Red Gum Woodland* EEC (BC Act); and
- *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC (EPBC Act).

The following sections justify why the Semi-evergreen Vine Thicket EEC and Box – Gum Woodland EEC/CEEC are not present in the study area.



LEGEND

- State Forest
- Study Area
- Belson's Panic (*Homopholis belsonii*)
- Scant Pomaderris (*Pomaderris queenslandica*)
- *Tylophora linearis*
- Winged Peppercress (*Lepidium monoplocoides*)
- Winged Peppercress Protection Area

Reference: 1 FloraSearch (2018)
2 Niche (2013)
3 OEH (2018)
4 Hunter Eco (2018)

Source: Orthophoto - Department of Land and Property Information, Aerial Photography (July 2011)

WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Threatened Flora Records
Project Mining Area

Figure 5

Semi-Evergreen Vine Thicket

The BRGN regional vegetation mapping (OEH, 2015) predicted the presence of a small patch of Semi-evergreen Vine Thicket in the centre north of the former travelling stock reserve approximately 100 m south of Braymont Road. This area was specifically investigated on 30 March 2016 and an FBA quadrat (Q14) was conducted within the area on 19 November 2015.

The identification guidelines for Semi-evergreen Vine Thicket (Department of Environment, Climate Change and Water (DECCW), 2010) state:

> *'Semi-evergreen Vine Thicket is a low, dense form of dry rainforest or 'scrub' made up of vines, some shrub species and tree species that are related to coastal subtropical rainforest trees. Some of the trees are either regularly deciduous or sporadically shed their leaves in response to prevailing weather conditions. Taller eucalypts and cypress pines from surrounding woodland vegetation often emerge above the rainforest tree layer. Semi-evergreen Vine Thicket occurs on deep, loamy high-nutrient soils derived from basalt or other volcanic rocks, on sites that are relatively protected from fire and that have an annual average rainfall of around 750 mm'.*

Table 17 applies identification guidelines for Semi-evergreen Vine Thicket to the putative patch on the study area. From the analysis in Table 16 it is clear that the putative Semi-evergreen Vine Thicket patch on the study area is not Semi-evergreen Vine Thicket and is not part of the TEC.

Table 17.
Conformance of Study Area Vegetation with Identification Guidelines for Semi-evergreen Vine Thicket (DECCW, 2010)

Criterion	Question	Conforms?	Comment
1	Is the site in the Brigalow Belt South or Nandewar Bioregions in NSW?	✓	
2	Is the vegetation a low dry rainforest or 'scrub' with vines present?	X	The vegetation is open woodland with scattered low trees of Wild Orange and Wilga. Vines are absent.
3	Is the site on deep, loamy soils derived from basalt or other volcanic rocks?	X	The soils are derived from coarse-grained sedimentary rocks of the Maules Creek Formation.
4	Does the rainforest tree layer contain Red Olive Plum, Wilga, Native Olive or Peach Bush, often under a layer of White Box, Silver-leaved Ironbark, Belah, Kurrajong and/or White Cypress Pine?	X	The community does not form a closed rainforest layer. Red Olive Plum and Native Olive are absent. Wilga, Wild Orange and one Peach Bush comprise the scattered non-sclerophyllous layer. White Box and White Cypress Pine are present.
5	Are there any characteristic plant species present?	✓	Out of nine characteristic tree species, only two are present, Wilga, *Geijera parviflora*, and a single Peach Bush, *Ehretia membranifolia*. Of the ten characteristic shrubs, none are present. The ground layer was not investigated.

Box-Gum Woodland

The NSW and Commonwealth guidelines for identification of the Box-Gum Woodland TEC are similar, but differ in detail.

BC Act

There are five criteria for determining whether the Box-Gum Woodland EEC exists at a site under the BC Act (NPWS, 2002b):

1. Whether the site is within the area defined in the Determination.
2. Whether the characteristic trees of the site are (or are likely to have been) White Box, Yellow Box or Blakely's Red Gum.
3. Whether the site is mainly grassy.
4. Whether any of the listed characteristic species occur (including as part of the seedbank in the soil).
5. If the site is degraded, whether there is potential for assisted natural regeneration of the overstorey or understorey.

The Final Determination of the NSW Scientific Committee (2002) indicates Box-Gum Woodland includes vegetation where '*grass and herbaceous species generally characterise the ground layer…. Shrubs are generally sparse or absent, though they may be locally common.*' 'Locally common' is not defined in the Final Determination, however, the Identification Guidelines suggest that the intent of the Final Determination '*is that shrubs may be dominant over parts of an EEC site*' (NPWS, 2002b). However, the Identification Guidelines note that:

> *'shrubby woodlands, which generally occur in upper or midslope situations on shallower soils, are not part of the EEC. Such woodlands are more prevalent on hillsides of the North Western slopes (Nandewar and Brigalow Belt South bioregions). Where shrubby woodlands dominated by White Box, Yellow Box or Blakely's Red Gum intergrades (sic) with the Box-Gum Woodland the more shrub-free sections of the community should be regarded as Box-Gum Woodland.'*

The NSW guidelines are general, avoid nominating quantitative criteria and are consequently open to interpretation.

EPBC Act

The Commonwealth identification guidelines for the Box-Gum Woodland CEEC include the first four NSW general criteria but also include the following quantitative criteria;

1. Patches must have at least 5 trees no more than 75m apart, or are areas with a predominantly native ground cover. Patches are assessed at a minimum of 0.1ha or 50 × 20m.

2. Whether the patch has a predominantly native understorey: This is defined as 'at least 50 percent of the perennial vegetation cover in the ground layer'.

3. Whether the patch has less than 30 percent shrub cover.

4. To qualify as CEEC the 0.1 ha sample site must be placed in the best part of the site and contain 12 or more non-grass native understorey species, at least one of which must be an 'important' species. A list of native species found in Box-Gum Woodland CEEC is available from the DotE website with the 'important' species annotated.

5. Even if patches do not meet the preceding understorey requirement, they can be accepted as Box-Gum Woodland CEEC if the patch is more than 2 ha in size and either averages more than 20 trees per ha, or has natural regeneration of the overstorey eucalypts.

Box-Gum Woodland on the Study Area

The Environmental Assessment of the Approved Mine (Niche Environment and Heritage, 2013a) concluded that vegetation consistent with the Box-Gum Woodland TEC occurs in the study area. In addition, the BRGN project's vegetation modelling (OEH, 2015) predicted that Box-Gum Woodland occurs in the former travelling stock reserve.

Niche Environment and Heritage (2013a) identified small areas of BVT NA226 (*White Box Grassy Woodland of the Nandewar and Brigalow Belt South Bioregions*) in the study area, which is part of the Box-Gum Woodland TEC (OEH, 2017a). These areas would have been identified as Box-Gum Woodland based on the dominant presence of White Box, *Eucalyptus albens*, in the tree canopy, a lack of understorey shrubs and a predominance of native grasses in the ground layer.

By contrast, the BRGN mapping identifies a large area of BVT NA397 (*White Box – White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion*), which is also considered to be part of the Box-Gum Woodland TEC (OEH, 2017a).

Interestingly, the above two studies identified the presence of the Box-Gum Woodland TEC on different parts of the study area. Niche Environment and Heritage (2013a) identified it in two small areas; one north west of the junction of the Braymont and Blue Vale Roads and the other along a gully known as South Creek, north of Shannon Harbour Road. By contrast, the BRGN study mapped the TEC in the former travelling stock reserve south of Braymont Road.

It is considered that none of these occurrences actually represent the Box-Gum Woodland TEC for the following reasons, which are explored in more detail below;

- BVTs NA226 and NA397 do not occur on the study area.
- The relative lack of shrubs in the study area is a secondary condition resulting from past land use.

Absence of NA226 and NA397

Areas thought to represent NA226 by Niche Environment and Heritage (2013a) both conform to NA311 (*Narrow-leaved Ironbark – cypress pine – White Box shrubby forest in the Brigalow Belt South Bioregion and Nandewar Bioregion*). Narrow-leaved ironbark is a prominent tree within and adjacent to both areas nominated as Box-Gum Woodland TEC by Niche Environment and Heritage (2013a). NA226 does not have Narrow-leaved Ironbark as a characteristic species (OEH, 2017a)[5]. NA311 has been identified as a dominant vegetation type on Maules Creek Formation sedimentary geology (OEH, 2015), which dominates the study area including the parts nominated as NA226 by Niche Environment and Heritage (2013a). The presence of remnants of NA311 on sites nominated as Box-Gum Woodland by Niche Environment and Heritage (2013a) is relevant because in its undisturbed state, NA311 has a prominent shrub layer which is inconsistent with it being part of the Box-Gum Woodland TEC. The relative lack of shrubs throughout the formerly farmed parts of the Project mining area is likely to be a secondary or derived condition and is discussed further below.

Similarly, the dominant and characteristic species of NA397 do not match those present in the former travelling stock reserve where it was mapped by the BRGN study. The characteristic tall tree species given for NA397 in the VIS database (OEH, 2017a) are White Box, *Eucalyptus albens*; Blakely's Red Gum, *Eucalyptus blakelyi* and Rough-barked Apple, *Angophora floribunda*. The dominant species in the former travelling stock reserve are White Box and Silver-leaved Ironbark(*Eucalyptus melanophloia)*, supporting the existence of NA349 (*Silver-leaved Ironbark – White Cypress Pine shrubby open forest of the Brigalow Belt South Bioregion and the Nandewar Bioregion*) within the former reserve. Like NA311, NA349 is a dominant vegetation type on Maules Creek Formation sedimentary geology (OEH, 2015) and is also a shrubby community in its undisturbed state (OEH, 2017a). Niche Environment and Heritage (2013a) also mapped Silver-leaved Ironbark and White Box in the former travelling stock reserve. The lack of shrubs within remnants of this community on the study area is considered to be a product of past management (tree thinning and shrub removal) and prevention of regeneration by livestock grazing. The next section demonstrates the impact of farming and grazing on shrub cover in remnants of NA311/NA349 dominated by White Box.

Reduction of Shrub Cover Due to Past Land Use

Prior to mining, the land on the study area had been farmed for several generations. An effect of this has been the loss of the shrub layer over most of the farmed landscape. Shrubs persist on some roadsides, but are absent from the paddocks, including woodlots of remnant native trees, where grubbing out by farmers and grazing by livestock has eliminated the shrubs. Accordingly, it can be difficult to determine the nature of the original vegetation on farmland. In the case of the study area, relatively undisturbed examples of some of the main vegetation types can still be found in Vickery State Forest which occurs on Maules Creek Formation geology. NA311 and NA349 are dominant BVTs in Vickery State Forest (OEH, 2015), which extend onto parts of the study area on the same geological substrate.

[5] It should be noted that NA311 was not available for consideration by Niche Environment and Heritage (2013a) since the BRGN study post-dates theirs and NA311 was not in the 2012 version of the BVTs Database (OEH, 2012b)]. NA311 is not considered to be part of the Box-Gum Woodland TEC (OEH, 2017a).

There is a stark contrast between the diversity and cover of shrubs in Vickery State Forest with that in remnant woodland patches on closely adjoining former farmland. To measure this, shrub canopy cover was accurately determined on randomly placed 50 m transects using the 'line intercept method' (Hnatiuk *et al*., 2009) (Section 2.4). Eight transects were conducted within Vickery State Forest and 7 transects on adjoining former farmland. All transects were in vegetation dominated by White Box trees. The locations are labelled VF (Vickery Forest) and WB (White Box) on Figure 3a.

The mean percentage of shrub canopy cover within Vickery State Forest was 42.4 versus 4.6 on the adjoining former farmland (Table 18). Since the cover variances are heterogeneous (F=13.77, P=0.005), the data were compared using the non-parametric Mann-Whitney U Test, which showed the mean ranks of the two sets of data are significantly different (Z=-3.135, P=0.0017). Accordingly, it is clear that shrub canopy cover is significantly reduced in remnant native vegetation on the former farmland compared to Vickery State Forest (SF). These differences can be seen in Plates 13 to 20.

These data add weight to the conclusion that the native vegetation formerly covering those parts of the study area on Maules Creek Formation geology had predominantly shrubby rather than grassy understoreys. Further evidence for this can be seen in the road reserve along Braymont Road beside the former travelling stock reserve at quadrat site 76 (Plate 6) (Figure 3a) which retains a prominent shrub layer.

Overall, the results of this vegetation survey in combination with those of the BRGN survey (OEH, 2015) show that the original White Box dominated communities of the Project mining area belong to vegetation types that are predominantly shrubby in their undisturbed states. The current lack of shrubs is considered to be a product of past land management practices and long term livestock grazing, and is a secondary or derived condition. It is concluded that the Box-Gum Woodland TEC is absent from the study area.

Quadrat WB2

Quadrat VF2

Quadrat WB4

Quadrat VF8

Near Quadrat WB6

Quadrat VF19

Quadrat WB7

Plates 13 to 16. Grazed White Box - White Cypress Pine Woodland on farmland.

Quadrat VF21

Plates 17 to 20. Ungrazed Shrubby White Box - White Cypress Pine Woodland (Vickery State Forest).

Table 18.
Shrub Canopy Cover in White Box Dominated Vegetation in Vickery State Forest Versus Closely Adjoining Former Farmland

	No. of Replicates	Mean Canopy Cover (%)	Range (%)	Standard Error
Vickery State Forest	8	42.4	12.7 – 74.4	7.5
Former farmland	7	4.6	0.0 – 14.8	2.2

South Creek/Box-Gum Woodland EEC Management Area

Approximately 5.6 ha of Box-Gum Woodland EEC was mapped by Niche (2013) along South Creek. The EIS for the Approved Mine stated that this area of Box-Gum Woodland EEC will be fenced to exclude grazing livestock, thereby promoting regeneration of the Box-Gum Woodland EEC. The more recent flora surveys conducted for this report indicated that the Box-Gum Woodland EEC is not present.

This area was assigned to the Box-Gum Woodland EEC by Niche (2013), apparently based on the presence of White Box and Blakely's Red Gum trees which are characteristic species of the EEC. In addition, Niche (2013) designated nearby vegetation remnants as White Box - White Cypress Pine Woodland. The more recent surveys have shown the presence of a large representation of Narrow-leaved Ironbark in the surrounds of South Creek, such that a more appropriate BVT for this vegetation is Narrow-leaved Ironbark - cypress pine - White Box shrubby open forest (NA311), which is not part of the Box - Gum Woodland EEC.

Native Vegetation on Cracking Clay Soils of the Liverpool Plains

The BRGN regional vegetation mapping (OEH, 2015b) predicted the presence of Native Vegetation on Cracking Clay Soils of the Liverpool Plains along the Project rail spur.

The vegetation is considered more likely to comprise mainly exotic dominated cleared lands with small areas of remnant Poplar Box Woodland on Alluvial Clay Soils (NA185) and secondary/derived native grasslands associated with the latter. This is because all surrounding uncultivated and relatively undisturbed areas supporting predominantly native vegetation cover comprise woodlands rather than grasslands. Native grasslands generally occur on abandoned cultivation paddocks and inter-paddock areas that have been colonised mainly by the wind-blown grass species.

Based on the above and air photo interpretation it was determined that the Native Vegetation on Cracking Clay Soils of the Liverpool Plains is not present within the Study area.

3.8 CONDITION OF THE VEGETATION

The condition of the native vegetation in the study area is influenced by a number of factors including land clearing, cropping, grazing, predominantly by cattle, and the weather.

Land clearing

Much of the study area has been cleared of most of its original tree and shrub cover historically. These areas now support secondary/derived native grassland vegetation types. However, some cleared areas on alluvial plains are dominated by chenopod shrubs such as Black Rolypoly, *Sclerolaena muricata*, and depressions and drainage lines on alluvial plains may be dominated by native rushes and sedges. Cleared and semi-cleared hilly areas on soils derived from the Maule's Creek Formation may develop dense regrowth stands of White Cypress Pine, especially where livestock grazing has been reduced since the advent of mining. In addition to areas that have lost all of their tree cover, remnant woodlots within the study area have undergone various degrees of tree thinning historically reducing canopy connectivity.

The more arable parts of the study area have been cropped intensively for summer and winter crops for many decades. The cropped lands are almost completely devoid of native flora species and are considered to be in low condition in this report. They are mapped as Disturbed Land in Figures 4a and 4b.

Grazing

The study area has been grazed intensively by domestic stock and feral animals, mainly rabbits, for over 160 years. Grazing is based on naturally occurring native fodder species, mainly grasses, which dominate the pastures in summer and autumn. Various introduced weeds may become prominent in winter and spring and may dominate pastures in some areas. Grazing and active management by landholders has effectively eliminated the native shrub layer from current and former farmland on the study area. It has also prevented regeneration of the overstorey trees with tree seedlings being eaten by stock as soon as they emerge.

Weather

The results of flora surveys, particularly in the inland, are strongly influenced by the weather conditions leading up to the survey and the time of the year it is conducted. The timing of this survey in late spring and summer is considered to be optimal for the detection of native flora species that germinate in winter and flower in spring and summer.

BioMetric data on the condition of each vegetation community and their associated secondary/derived native grasslands are summarised and compared with community benchmarks below (Tables 17 to 22).

Vegetation Community 1 – *Weeping Myall Woodland*

Three FBA quadrats (Figure 3a, Appendix B) were conducted within remnant woodlots of Weeping Myall (Table 19) just south of the Project mining area. All three sites are within the same paddock used for cattle grazing.

Mean native plant species richness, native overstorey cover, native groundcover (shrubs), number of trees with hollows and total length of fallen logs were within or close to the benchmarks indicating the vegetation was in good condition with respect to these parameters.

Native groundcover (other) exceeded the upper benchmark by over five times owing to high cover of the chenopods Climbing Saltbush and Black Rolypoly. These unusually high levels may reflect the impacts of high nutrient levels due to cattle camping and/or favourable seasonal conditions. Conversely, native midstorey cover and native groundcover (grasses) were lower than the benchmarks, presumably reflecting the effects of heavy cattle grazing. Overall, this community is considered to be in moderate condition.

Table 19.
Vegetation Condition Data – *Weeping Myall Woodland*

Condition Category	No. of replicates	Recorded Values			Benchmarks[1]	
		Lower	Upper	Average	Lower	Upper
Native plant species richness (number of species)	3	18	25	21.3	20	-
Native overstorey cover (%)	3	10	18	14.8	6	25
Native midstorey cover (%)	3	0	0	0	0	5
Native groundcover – grasses (%)	3	2	14	9.3	20	30
Native groundcover – shrubs (%)	3	0	0	0	0	0
Native groundcover – other (%)	3	14	40	28	3	5
Exotic plant cover (%)	3	4	6	5.3	-	-
Number of trees with hollows	3	0	2	0.7	1	-
Regeneration (proportion of tree species)	3	0	1	0.3	-	-
Total length of fallen logs (m)	3	0	22	14	15	-

[1] Benchmark data is for the *Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion* (NA219) (OEH, 2017a).

Vegetation Community 2 – *Poplar Box Woodland on Alluvial Clay Soils*

Ten FBA quadrats (Figures 3a and 3b, Appendix B) were conducted within remnant woodlots of Poplar Box Woodland on Alluvial Clay Soils and six in secondary/derived native grasslands associated with this community (Table 20, Figures 4a and 4b). Most of the sites were on farmland used for cattle grazing.

In the remnant woodlots, mean native plant species richness, native overstorey cover and total length of fallen logs were within the benchmarks indicating the vegetation was in good condition with respect to these parameters. Native groundcover (shrubs), native groundcover (other) and number of trees with hollows greatly exceeded their upper benchmarks. The first two parameters were due to high cover of chenopods; Berry Saltbush, Climbing Saltbush and Black Rolypoly. These unusually high levels may reflect the impacts of high nutrient levels from cattle camping below the trees and/or favourable seasonal conditions. Conversely, native midstorey cover and native groundcover (grasses) were lower than the benchmark, presumably reflecting the effects of heavy cattle grazing. Overall, remnants of this community are considered to be in moderate condition.

The secondary/derived native grassland plots showed similar trends to the woodlot areas except for native groundcover (grasses) which was a little above benchmark, probably reflecting good seasonal conditions, and parameters dependent on the absence of trees. Accordingly, native overstorey cover, number of trees with hollows and length of fallen logs were zero or very close to zero (Table 20). Plot data for this community that has been used for the Biodiversity Assessment Report and Biodiversity Offset Strategy (Resource Strategies, 2018) is included in Appendix B.

Table 20.
Vegetation Condition Data – *Poplar Box Woodland on Alluvial Clay Soils*

Vegetation type	No. of replicates	Recorded Values			Benchmarks[1]	
		Lower	Upper	Average	Lower	Upper
Native plant species richness (number of species)						
Woodland	9	13	36	24.3	20	-
Secondary/Derived Native Grasslands	6	13	28	20.8		
Native overstorey cover (%)						
Woodland	9	14	35	22.2	6	25
Secondary/Derived Native Grasslands	6	0	0	0		
Native midstorey cover (%)						
Woodland	9	0	0	0	0	5
Secondary/Derived Native Grasslands	6	0	0	0		
Native groundcover – grasses (%)						
Woodland	9	4	44	14.8	20	30
Secondary/Derived Native Grasslands	6	24	54	29.3		
Native groundcover – shrubs (%)						
Woodland	9	0	12	2.9	0	0
Secondary/Derived Native Grasslands	6	0	36	12.7		
Native groundcover – other (%)						
Woodland	9	6	52	27.8	3	5
Secondary/Derived Native Grasslands	6	4	42	18.0		
Exotic plant cover (%)						
Woodland	9	0	70	17.9	-	-
Secondary/Derived Native Grasslands	6	0	8	1.0		
Number of trees with hollows						
Woodland	9	0	8	3	1	-
Secondary/Derived Native Grasslands	6	0	6	1		
Regeneration (proportion of tree species)						
Woodland	9	0	1	0.7	-	-
Secondary/Derived Native Grasslands	6	0	1.0	0.2		

Table 20 (Continued).
Vegetation Condition Data – *Poplar Box Woodland on Alluvial Clay Soils*

Vegetation type	No. of replicates	Recorded Values			Benchmarks[1]	
		Lower	Upper	Average	Lower	Upper
Total length of fallen logs (m)						
Woodland	9	4	91	36.2	15	-
Secondary/Derived Native Grasslands	6	0	2	0.5		

[1] Benchmark data is for the *Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion* (NA185) (OEH, 2017a).

Vegetation Community 3 – *Pilliga Box – Poplar Box Shrubby Woodland*

Six FBA quadrats (Figure 3a, Appendix B) were conducted within remnant woodlots of Pilliga Box – Poplar Box Shrubby Woodland and six in secondary/derived native grasslands associated with this community (Table 21, Figure 4a). Most of the sites are within the Project mining area and currently used for cattle grazing.

In the remnant woodlots, mean native plant species richness, native groundcover (shrubs) and numbers of trees with hollows were within or just above the benchmarks indicating the vegetation was in good condition with respect to these parameters. Native groundcover (other) greatly exceeded its upper benchmark owing to high cover of various native groundcover herbs (Appendix A). These unusually high levels may reflect the impacts of high nutrient levels due to cattle camping and/or favourable seasonal conditions. Conversely, native overstorey cover, native groundcover (grasses), native midstorey cover and total length of fallen logs were below the benchmarks. This is likely due to the effects of tree thinning in the case of overstorey cover, heavy cattle grazing for the low grass cover and complete lack of midstorey cover, and log removal by farmers for the lack of fallen timber. Overall, remnants of this community are considered to be in moderate condition. Plot data for this community which has been used for the Biodiversity Assessment Report and Biodiversity Offset Strategy is included in Appendix B.

The secondary/derived native grassland plots were below community benchmarks for all but native groundcover (grasses) and native groundcover (other). The high groundcover values perhaps reflect the good seasonal conditions prevailing at the time of the survey (Table 21).

Table 21.
Vegetation Condition Data – *Pilliga Box – Poplar Box Shrubby Woodland*

Vegetation type	No. of replicates	Recorded Values			Benchmarks[1]	
		Lower	Upper	Average	Lower	Upper
Native plant species richness (number of species)						
Woodland	7	21	42	33.3	30	-
Secondary/Derived Native Grasslands	8	22	31	27.3		
Native overstorey cover (%)						
Woodland	7	7.5	39	22.6	25	40
Secondary/Derived Native Grasslands	8	0	14	1.8		
Native midstorey cover (%)						
Woodland	7	0	3	0.5	6	25
Secondary/Derived Native Grasslands	8	0	0	0		
Native groundcover – grasses (%)						
Woodland	7	4	38	20	20	30
Secondary/Derived Native Grasslands	8	30	62	44.5		
Native groundcover – shrubs (%)						
Woodland	7	0	12	4.0	3	10
Secondary/Derived Native Grasslands	8	0	6	2.0		
Native groundcover – other (%)						
Woodland	7	6	32	17.1	3	5
Secondary/Derived Native Grasslands	8	2	16	7.3		
Exotic plant cover (%)						
Woodland	7	0	22	3.7	-	-
Secondary/Derived Native Grasslands	8	0	20	6.3		
Number of trees with hollows						
Woodland	7	0	6	2.1	2	-
Secondary/Derived Native Grasslands	8	0	0	0		

Table 21 (Continued).
Vegetation Condition Data – *Pilliga Box – Poplar Box Shrubby Woodland*

Vegetation type	No. of replicates	Recorded Values			Benchmarks[1]	
		Lower	Upper	Average	Lower	Upper
Regeneration (proportion of tree species)						
Woodland	7	0	1	0.9	-	-
Secondary/Derived Native Grasslands	8	0	0	0		
Total length of fallen logs (m)						
Woodland	7	1	45	13.1	20	-
Secondary/Derived Native Grasslands	8	0	0	0		

[1] Benchmark data is for the *Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion* (NA324) (OEH, 2017a).

Vegetation Community 4 – *White Box – Silver-leaved Ironbark Shrubby Open Forest*

Twelve FBA quadrats (Figures 3a and 3b) were conducted within remnant woodlots of White Box – Silver-leaved Ironbark Shrubby Open Forest and nine in secondary/derived native grasslands associated with this community (Table 22, Figures 4a and 4b). Most of the sites are within the Project mining area and few, if any, are currently used for cattle grazing. However some, but not all, of the secondary/derived native grasslands are in grazed paddocks.

In the remnant woodlots, mean native plant species richness greatly exceeded the benchmark on all quadrats (Table 22) indicating these ungrazed patches harbour high plant species diversity. Native overstorey cover, native groundcover (grasses), numbers of trees with hollows and total length of fallen logs were within or just above the benchmarks indicating the vegetation was in good condition with respect to these parameters. Native groundcover (other) greatly exceeded its upper benchmark owing to high cover of various native groundcover herbs (Appendix A), perhaps owing to reasonably good seasonal conditions, since increased nutrient levels due to the recent presence of livestock is unlikely to be a factor in this community. Conversely, native midstorey cover and native groundcover (shrubs) were below the benchmarks. This may be due to the carryover effects of past clearing and heavy livestock grazing. Overall, remnants of this community are considered to be in good condition.

The secondary/derived native grassland plots are in poorer condition than the remnant woodland areas. Mean native plant species richness is just lower than the benchmark. As would be expected, native overstorey cover, native midstorey cover, native groundcover (shrubs), number of trees with hollows and length of fallen logs were all zero or close to zero in the secondary/derived native grassland (Table 22). However, native groundcover (grasses) greatly exceeded the upper benchmark reflecting high grass cover levels in ungrazed paddocks. Plot data for this community which has been used for the Biodiversity Assessment Report and Biodiversity Offset Strategy is included in Appendix B.

Vegetation Community 5 – *Narrow-leaved Ironbark – White Box Shrubby Forest*

Ten FBA quadrats (Figure 3a) were conducted within remnant woodlots of Narrow-leaved Ironbark – White Box Shrubby Forest and seven in secondary/derived native grasslands associated with this community (Table 23, Figure 4a). All of the sites are within the Project mining area and most are currently used for cattle grazing, as are many of the secondary/derived native grasslands.

Mean native plant species richness and native groundcover (grasses) were within the benchmarks indicating the vegetation was in good condition with respect to these parameters. Native groundcover (other) greatly exceeded its upper benchmark owing to high cover of various native groundcover herbs (Appendix A), owing to good seasonal conditions. Conversely, native overstorey cover, native midstorey cover, native groundcover (shrubs), numbers of trees with hollows and total length of fallen logs were below the benchmarks. This reflects the highly disturbed nature of remnants of this community on farmland subject to heavy tree thinning and livestock grazing (Plates 7 and 8). Overall, remnants of this community are considered to be in poor condition on the Project mining area.

Table 22.
Vegetation Condition Data – *White Box – Silver-Leaved Ironbark Shrubby Open Forest*

Vegetation type	No. of replicates	Recorded Values			Benchmarks[1]	
		Lower	Upper	Average	Lower	Upper
Native plant species richness (number of species)						
Woodland	12	14	57	39.1	26	-
Secondary/Derived Native Grasslands	8	13	30	24.1		
Native overstorey cover (%)						
Woodland	12	6	34	18.7	6	25
Secondary/Derived Native Grasslands	8	0	14	1.6		
Native midstorey cover (%)						
Woodland	12	0	12	4	6	25
Secondary/Derived Native Grasslands	8	0	0	0		
Native groundcover – grasses (%)						
Woodland	12	6	42	25.8	20	30
Secondary/Derived Native Grasslands	8	32	60	43.5		
Native groundcover – shrubs (%)						
Woodland	12	0	14	1.7	3	10
Secondary/Derived Native Grasslands	8	0	4	0.8		

Table 22 (Continued).
Vegetation Condition Data – *White Box – Silver-Leaved Ironbark Shrubby Open Forest*

Vegetation type	No. of replicates	Recorded Values			Benchmarks[1]	
		Lower	Upper	Average	Lower	Upper
Native groundcover – other (%)						
Woodland	12	6	46	26.2	3	5
Secondary/Derived Native Grasslands	8	0	22	6.3		
Exotic plant cover (%)						
Woodland	12	0	12	3	-	-
Secondary/Derived Native Grasslands	8	0	32	13		
Number of trees with hollows						
Woodland	12	0	8	2.6	1	-
Secondary/Derived Native Grasslands	8	0	0	0		
Regeneration (proportion of tree species)						
Woodland	12	1	1	1	-	-
Secondary/Derived Native Grasslands	8	0	0	0		
Total length of fallen logs (m)						
Woodland	12	0	44	16.1	15	-
Secondary/Derived Native Grasslands	8	0	0	0		

[1] Benchmark data is for the *White Box - White Cypress Pine shrubby open forest of the Nandewar Bioregion and Brigalow Belt South Bioregion* (NA225) (OEH, 2017a).

Table 23.
Vegetation Condition Data – *Narrow-leaved Ironbark – White Box Shrubby Forest*

Vegetation type	No. of replicates	Recorded Values			Benchmarks[1]	
		Lower	Upper	Average	Lower	Upper
Native plant species richness (number of species)						
Woodland	9	18	38	30.8	30	-
Secondary/Derived Native Grasslands	7	22	31	27.4		
Native overstorey cover (%)						
Woodland	9	5	29.5	16.9	25	40
Secondary/Derived Native Grasslands	7	0	0	0		

Table 23 (Continued)
Vegetation Condition Data – *Narrow-leaved Ironbark – White Box Shrubby Forest*

Vegetation type	No. of replicates	Recorded Values			Benchmarks[1]	
		Lower	Upper	Average	Lower	Upper
Native midstorey cover (%)						
Woodland	9	0	18.5	3.7	6	25
Secondary/Derived Native Grasslands	7	0	0	0		
Native groundcover – grasses (%)						
Woodland	9	12	36	24.9	20	30
Secondary/Derived Native Grasslands	7	18	64	42.3		
Native groundcover – shrubs (%)						
Woodland	9	0	4	1.3	3	10
Secondary/Derived Native Grasslands	7	0	6	0.9		
Native groundcover – other (%)						
Woodland	9	4	44	16.4	3	5
Secondary/Derived Native Grasslands	7	4	26	11.1		
Exotic plant cover (%)						
Woodland	9	0	28	4.7	-	-
Secondary/Derived Native Grasslands	7	0	22	6.3		
Number of trees with hollows						
Woodland	9	0	3	1	2	-
Secondary/Derived Native Grasslands	7	0	0	0		
Regeneration (proportion of tree species)						
Woodland	9	1	1	1	-	-
Secondary/Derived Native Grasslands	7	0	0	0		
Total length of fallen logs (m)						
Woodland	9	2	27	9.4	20	-
Secondary/Derived Native Grasslands	7	0	0	0		

[1] Benchmark data is for the *Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion* (NA311) (OEH, 2017a).

The secondary/derived native grassland plots are in even poorer condition than the remnant woodland areas. Mean native plant species richness is just lower than the community benchmark. As would be expected, native overstorey cover, native midstorey cover, native groundcover (shrubs), number of trees with hollows and length of fallen logs were all zero, or close to it, in the secondary/derived native grassland (Table 23). However, native groundcover (grasses) and native groundcover (other) greatly exceeded the upper benchmark reflecting high cover levels in good seasonal conditions and a lack of grazing in some paddocks. Plot data for this community that has been used for the Biodiversity Assessment Report and Biodiversity Offset Strategy is included in Appendix B.

Vegetation Community 7 – *Mixed Marsh Sedgeland*

Three FBA quadrats (Figure 3a) were conducted within the riparian zone of Stratford Creek which becomes swampy in wet seasons and supports a sedge or wet grassland dominated community (Table 24). All the sites are associated with the Bluevale Road realignment and occur in paddocks currently used for cattle grazing.

Mean native plant species richness, native midstorey cover and native groundcover (other) are within or close to benchmarks indicating the vegetation is in good condition with respect to these paramenters. The sedgeland nature of the vegetation is reflected in the lack of tree cover, lack of tree hollows and absence of fallen logs. However, native groundcover (grasses) and native groundcover (shrubs) greatly exceed their benchmark values, reflecting high levels of groundcover chenopods and grasses, possibly reflecting good seasonal conditions. Plot data for this community that has been used for the Biodiversity Assessment Report and Biodiversity Offset Strategy is included in Appendix B. This community is considered to be in moderate condition.

Table 24.
Vegetation Condition Data – *Mixed Marsh Sedgeland*

Vegetation type	No. of replicates	Recorded Values			Benchmarks[1]	
		Lower	Upper	Average	Lower	Upper
Native plant species richness (number of species)						
Sedgeland	3	13	25	17.3	18	-
Native overstorey cover (%)						
Sedgeland	3	0	0	0	1	40
Native midstorey cover (%)						
Sedgeland	3	0	0	0	0	0
Native groundcover – grasses (%)						
Sedgeland	3	0	42	25.3	5	10
Native groundcover – shrubs (%)						
Sedgeland	3	0	16	7.3	0	0
Native groundcover – other (%)						
Sedgeland	3	2	82	30.7	35	40

Table 24 (Continued).
Vegetation Condition Data – *Mixed Marsh Sedgeland*

Vegetation type	No. of replicates	Recorded Values			Benchmarks[1]	
		Lower	Upper	Average	Lower	Upper
Exotic plant cover (%)						
Sedgeland	3	0	52	19.3	-	-
Number of trees with hollows						
Sedgeland	3	0	0	0	0	-
Regeneration (proportion of tree species)						
Sedgeland	3	0	0	0	-	-
Total length of fallen logs (m)						
Sedgeland	3	0	0	0	0	-

[1] Benchmark data is for the *Shallow freshwater mixed marsh sedgeland of northern-western NSW floodplains (Benson 53)* (NA201) (OEH, 2008).

Vegetation Community 8 – *River Red Gum Riparian Tall Woodland*

Three FBA quadrats (Figures 3a and 3b, Appendix B) were conducted within remnant woodlots of River Red Gum Riparian Tall Woodland and two in secondary/derived native grasslands associated with this community (Table 25, Figures 4a and 4b). All the sites are on farmland near the Namoi River on the proposed Project rail spur.

For the remnant woodland areas, the mean native overstorey cover, native groundcover (grasses), native groundcover (shrubs), native groundcover (other) and total length of fallen logs were within or close to the benchmarks indicating the vegetation is in good condition with respect to these parameters. Conversely, native plant species richness, native midstorey cover and number of trees with hollows were below the benchmarks. The low plant species richness and midstorey cover may reflect high levels of grazing in this community and high competition from introduced groundcover species favoured by the highly fertile alluvial soils. Overall, remnants of this community on the study area are considered to be in moderate condition.

The secondary/derived native grassland plots are in poorer condition than the remnant woodland areas (Table 25). Mean native plant species richness is lower than the benchmark and similar to the woodlot areas. As would be expected, native overstorey cover, native midstorey cover, native groundcover (shrubs), number of trees with hollows and length of fallen logs were all zero in the secondary/derived native grassland (Table 25). However, native groundcover (grasses) and native groundcover (other) were within or close to the benchmark. Plot data for this community which has been used for the Biodiversity Assessment Report and Biodiversity Offset Strategy is included in Appendix B.

Vegetation Condition - Discussion

Vegetation condition varied from poor (Community 5) to good (Community 4) with remnants of all other communities rated as being in moderate condition.

Most communities retained benchmark or better levels of plant species richness and Community 4 supported particularly high levels of flora diversity. Similarly, most communities had native overstorey cover and groundcover (grasses) within or just below benchmarks. Other parameters were more inconsistent between communities, sometimes meeting benchmarks, or were well below benchmark in others; e.g. native groundcover (shrubs), number of trees with hollows and length of fallen logs.

Table 25.
Vegetation Condition Data – *River Red Gum Riparian Tall Woodland*

Vegetation type	No. of replicates	Recorded Values			Benchmarks[1]	
		Lower	Upper	Average	Lower	Upper
Native plant species richness (number of species)						
Woodland	3	13	19	16.5	28	-
Secondary/Derived Native Grasslands	2	13	13	13		
Native overstorey cover (%)						
Woodland	3	0	42	35.3	25	40
Secondary/Derived Native Grasslands	2	0	0	0		
Native midstorey cover (%)						
Woodland	3	0	0	0	3	25
Secondary/Derived Native Grasslands	2	0	0	0		
Native groundcover – grasses (%)						
Woodland	3	14	28	21	20	30
Secondary/Derived Native Grasslands	2	24	24	24		
Native groundcover – shrubs (%)						
Woodland	3	0	2	0.7	0	0
Secondary/Derived Native Grasslands	2	0	0	0		
Native groundcover – other (%)						
Woodland	3	0	12	8	3	5
Secondary/Derived Native Grasslands	2	8	8	8		
Exotic plant cover (%)						
Woodland	3	2	20	10	-	-
Secondary/Derived Native Grasslands	2	40	40	40		
Number of trees with hollows						
Woodland	3	1	2	1	2	-
Secondary/Derived Native Grasslands	2	0	0	0		
Regeneration (proportion of tree species)						
Woodland	3	0	1	0.5	-	-
Secondary/Derived Native Grasslands	2	0	0	0		
Total length of fallen logs (m)						
Woodland	3	22	40	22.5	20	-
Secondary/Derived Native Grasslands	2	3	3	3		

[1] Benchmark data is for the *River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion* (NA193) (OEH, 2017a).

One parameter, native midstorey cover, was consistently below benchmark across communities. The lack of midstorey likely reflects agricultural management practices and high livestock grazing pressures. These factors have also eliminated eucalypt regeneration across the study area.

Exotic plant cover was consistently low in all communities except for Community 8a (30% cover), Community 7 (19% cover) and to a lesser extent secondary/derived native grasslands associated with Community 4 (14% cover).

A surprising result was the high exceedance of benchmarks across all communities for native groundcover (other). This is considered most likely to be the result of good seasonal conditions at the times of the surveys, which resulted in prolific growth of some native herbaceous groundcovers.

3.9 STATE ENVIRONMENTAL PLANNING POLICY 44

NSW *State Environmental Planning Policy No 44 – Koala Habitat Protection* (SEPP 44) aims to protect habitat utilised by the Koala, *Phascolarctos cinereus*. Of the SEPP 44 preferred feed trees, River Red Gum (*E. camaldulensis*), White Box (*E. albens*) and Poplar Box (*E. populnea*) are present in the study area in the following communities:

- Vegetation Community 2 - Poplar Box Woodland on Alluvial Clay Soils (NA185);
- Vegetation Community 3 - Pilliga Box – Poplar Box Shrubby Woodland (NA324);
- Vegetation Community 4 - White Box – Silver-leaved Ironbark Shrubby Open Forest (NA349);
- Vegetation Community 5 - Narrow-leaved Ironbark – White Box Shrubby Forest (NA311); and
- Vegetation Community 8 - River Red Gum Riparian Tall Woodland (NA193).

Potential Koala habitat is defined by SEPP 44 as an area of native vegetation greater than one hectare in size in which listed Koala feed tree species occupy more than 15 percent of the total number of trees in the upper or lower strata of the tree component.

All occurrences of Vegetation Communities 3 and 8 are considered to be potential habitat for the Koala. All occurrences of Vegetation Communities 2, 4 and 5 are considered to be potential habitat for the Koala, with exception of:

- occurrences of Vegetation Community 2 in the study area north of Hoad Lane and near Quadrat 27.
- occurrences of Vegetation Community 4 near Quadrat 22.
- occurrences of Vegetation Community 5 near Quadrats 39 and 12.

Habitat mapping for the Koala (based on the above) is provided in the Project Biodiversity Assessment Report and Biodiversity Offset Strategy (being prepared separately by Resource Strategies [2018]).

3.10 VEGETATION WITH REGENT HONEYEATER HABITAT

Potenital habitat for the Regent Honeyater is present in the following communities:

- Vegetation Community 2 - Poplar Box Woodland on Alluvial Clay Soils (NA185);
- Vegetation Community 4 - White Box – Silver-leaved Ironbark Shrubby Open Forest (NA349);
- Vegetation Community 5 - Narrow-leaved Ironbark – White Box Shrubby Forest (NA311); and

Vegetation Community 5 Narrow-leaved Ironbark – White Box Shrubby Forest (NA311) has been identified as potential habitat for the Regent Honeyeater based on the presence of White Box trees. Two patches of this BVT were identified as not containing any White Box, namely the occurrences of Vegetation Community 5 near Quadrats 39 and 12.

Vegetation Community 2 Poplar Box Woodland on Alluvial Clay Soils (NA185) has been identified as potential habitat for the Regent Honeyeater based on the presence of Yellow Box trees. Only a subset of the Poplar Box Woodland on Alluvial Clay Soils within the BAR Footprint associated with the Project mining area contains Yellow Box (i.e. those occurences near the Namoi River).

Habitat mapping for the Regent Honeyeater (based on the above) is provided in the Project Biodiversity Assessment Report and Biodiversity Offset Strategy (being prepared separately by Resource Strategies [2018]).

4 CONCLUSIONS

- The study area was found to support remnants of seven naturally occurring vegetation communities and secondary/derived native grasslands associated with them.

- A total of 315 flora species was identified by the FBA quadrats, standard floristic plots, rapid assessment spot samples, random meanders and general movement around the study area. Of these, 235 (74.6%) are native to the natural communities of the study area and 80 (25.4%) are introduced.

- The plant families with the highest numbers of species (Appendix A) were the Grasses, Poaceae (70 taxa); Daisies, Asteraceae (35 taxa); Chenopods, Chenopodiaceae (17 species); the Pea-flowers, subfamily Faboideae (16 species); the Sidas and Lantern Bushes, Malvaceae (12 species) and the Eucalypts, Myrtaceae (10 species). In all, some 62 plant families and sub-families were represented.

- The highest proportions of introduced species, 53.3 and 40.8 percent were found in River Red Gum riparian woodland and the secondary/derived native grasslands associated with it, respectively.

- All native vegetation surveyed was in moderate to good condition according to the Biobanking definition of condition, however, the vegetation condition varied from poor (Narrow-leaved Ironbark - White Box Shrubby Forest) to good (White Box - Silver-leaved Ironbark Shrubby Open Forest) with remnants of all other communities rated as being in poor to moderate or moderate condition.

- No threatened flora species listed in the schedules of the BC Act, or the EPBC Act, was identified within the study area by the surveys. However, two threatened flora species, Scant Pomaderris, *Pomaderris queenslandica* and a vine, *Tylophora linearis*, were found just to the east of the study area.

- No listed endangered populations or critical habitat occur in the study area.

- One Biometric Vegetation Type (BVT) identified in the study area by the current survey, Weeping Myall Woodland, is equivalent to Threatened Ecological Communities (TECs) listed under the BC Act and the EPBC Act, as follows:

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

    - *Weeping Myall Woodlands* Endangered Ecological Community (EEC) (EPBC Act).

5 REFERENCES

Anderson RH (1968). *The Trees of New South Wales*. Fourth Edition. New South Wales Department of Agriculture, Sydney.

Australia's Virtual Herbarium (2016). Website: http://avh.chah.org.au/. Council of Heads of Australasian Herbaria.

Beadle NCW and Costin AB (1952). Ecological classification and nomenclature. *Proceedings of the Linnaean Society of New South Wales.* 67: 61-82.

Beckers D and Binns D (2000). *Vegetation Survey and Mapping (Stage 1). Western Regional Assessments.* Project No. WRA13. NSW Resource and Conservation Assessment Council. Sydney

Benson JS (1996). *What is a Native Grassland?* National Herbarium of New South Wales.

Benson JS Richards PG Walker S and Allen CB (2010). NSW Vegetation Classification and Assessment: Plant communities of the BBS, NAN & West NET Bioregions. Version 3 of the NSWVCA database. *Cunninghamia*. 11: 457-579.

BioNet (2017). *NSW BioNet – the website for the NSW Atlas of Wildlife.*

Department of Environment and Conservation (2004). *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities.* Working Draft.

Department of Environment and Heritage (2006). *White box - Yellow box - Blakely's red gum grassy woodlands and derived native grasslands*. EPBC Act Policy Statement 3.5.

Department of Environment, Climate Change and Water (2010). *Semi-evergreen Vine Thicket in the Brigalow Belt South and Nandewar bioregions.* NSW Department of Environment, Climate Change and Water, Sydney.

Department of Infrastructure, Planning and Natural Resources (2004). *Joint Vegetation Mapping Project. NSW Western Regional Assessments (Stage 2)*. Project No. WRA 24. Prepared for the NSW Resource and Conservation Assessment Council. Sydney.

Department of Primary Industries (2017). *Noxious Weed Declarations*.

Department of the Environment and Energy (2017a). *EPBC Act Protected Matters Search Tool*.

Department of the Environment and Energy (2017b). *Species Profile and Threats Database*. Website: http://www.environment.gov.au/biodiversity/threatened/species/pubs/4325-conservation-advice.pdf.
Accessed: March 2016, January 2017.

Department of the Environment and Energy (2017c). *Register of Critical Habitat*.

Fitch R (2009). *WinSTAT for Excel. Version 2009.1.* R. Fitch Software.

FloraSearch (2011). *Tarrawonga Coal Project Environmental Assessment. Appendix F: Flora Assessment.* Report to Tarrawonga Coal Pty. Ltd.

Gunnedah Shire Council (2016). *Gunnedah Shire - Agriculture.* Website: http://www.gunnedah.nsw.gov.au/index.php/business-industry/agriculture Accessed: March 2016.

Hansen Bailey Pty. Ltd. (2010). *Continuation of the Boggabri Coal Mine - Biodiversity Impact Assessment.* Report to Boggabri Coal Pty. Ltd.

Harden GJ (Ed.) (1990 - 2002). *Flora of New South Wales*, Volumes 1 to 4 and revisions. University of New South Wales Press, Sydney.

Heritage Management Consultants (2011). *Tarrawonga Coal Project. Non-Aboriginal Heritage Assessment.* Report to Tarrawonga Coal Pty. Ltd.

Hnatiuk RJ Thackway R and Walker J (2009). *Vegetation.* Pages 73 to 120 in *Australian Soil and Land Survey Handbook*. *Third Edition.* The National Committee on Soil and Terrain. CSIRO Publishing, Collingwood.

Keith DA (2004). *Ocean Shores to Desert Dunes. The Native Vegetation of New South Wales and the ACT.* Department of Environment and Conservation, Sydney.

National Parks and Wildlife Service (2002a). *Targeted Flora Survey and Mapping*. *NSW Western Regional Assessments*. Project No. WRA 16. Prepared for the Resource and Conservation Assessment Council. Sydney.

National Parks and Wildlife Service (2002b). *White Box Yellow Box Blakely's Red Gum Woodland (Box-Gum Woodland).* Identification Guidelines for Endangered Ecological Communities.

Niche Environment and Heritage (2013a). *Vickery Coal Project Environmental Impact Statement. Appendix E: Ecological Assessment.* Whitehaven Coal, Sydney.

Niche Environment and Heritage (2013b). *Vegetation mapping of four parcels of land for Whitehaven Coal Ltd.* Report to Whitehaven Coal Ltd.

Niche Environment and Heritage (2014). *Boggabri Coal Mine - Biodiversity Offsets Audit*. Report to Boggabri Coal Pty. Ltd.

North West Local Land Services (2017). *North West Regional Strategic Weed Management Plan 2017-2022.* State of New South Wales

NSW Scientific Committee (2002). *White box yellow box Blakely's red gum woodland – endangered ecological community listing.* Final determination. NSW National Parks and Wildlife Service. Hurstville.

Office of Environment and Heritage (2012a). *Soil and Land Resources of the Liverpool Plains Catchment.* DVD-R. NSW Office of Environment and Heritage, Sydney.

Office of Environment and Heritage (2012b). *BioMetric Vegetation Types Database.* Excel Spreadsheet. Now incorporated in OEH (2017a).

Office of Environment and Heritage (2014a). *Framework for Biodiversity Assessment.* NSW Office of Environment and Heritage, Sydney.

Office of Environment and Heritage (2014b). *NSW Biodiversity Offsets Policy for Major Projects*. NSW Office of Environment and Heritage, Sydney.

Office of Environment and Heritage (2015). *Border Rivers Gwydir / Namoi Regional Native Vegetation Mapping. Technical Notes*. NSW Office of Environment and Heritage, Sydney.

Office of Environment and Heritage (2016). *NSW Guide to Surveying Threatened Plants.* Office of Environment and Heritage, Sydney.

Office of Environment and Heritage (2017a). *Vegetation Information System - Classification 2.1*. Website: http://www.environment.nsw.gov.au/NSWVCA20PRapp/LoginPR.aspx?

Office of Environment and Heritage (2017b). *Threatened Species Profiles*.

Office of Environment and Heritage (2017c). *Critical habitat register.*

Pratt W (1998). *The Gunnedah Coalfield*. Geological Survey Report No. GS1998/505. New South Wales Department of Mineral Resources.

Resource Strategies (2018). *Biodiversity Assesment Report and Biodiversity Offset Strategy*. Vickery Extention Project. Appendix F.

Royal Botanic Gardens and Domain Trust (2016). *PlantNET: NSW Flora Online.*

Sahukar R Gallery C Smart J and Mitchell P (2003). *The Bioregions of New South Wales – Their biodiversity, conservation and history.* NSW National Parks and Wildlife Service, Hurstville.

Speight JG (2009). *Landform*. Pages 15-72 in *Australian Soil and Land Survey Field Handbook. Third Edition.* The National Committee on Soil and Terrain. CSIRO Publishing.

Thackway R and Cresswell ID (eds) (1995). *An Interim Biogeographic Regionalisation for Australia: a framework for establishing the national system of reserves.* Version 4.0. Australian Nature Conservation Agency: Canberra

Wall J (2004). *Biodiversity Surrogates - Vegetation. NSW Western Regional Assessments.* Project No. Nand06. NSW Department of Environment and Conservation for the NSW Resource and Conservation Assessment Council. Sydney.

APPENDIX A

FLORA SPECIES LIST ACCORDING TO VEGETATION COMMUNITIES ON THE STUDY AREA

Scientific Name	Common Name	Vegetation Community													Opp.
		1	2	2a	3	3a	4	4a	5	5a	7	8	8a	DL	
CLASS FILICOPSIDA															
Marsileaceae															
Marsilea costulifera											●				
Marsilea drummondii	Common Nardoo		●								●				
Pteridaceae															
Cheilanthes distans	Bristly Cloak Fern					●	●	●	●	●					
Cheilanthes sieberi	Poison Rock Fern			●		●	●	●	●	●					
CLASS CONIFEROPSIDA															
Cupressaceae															
Callitris glaucophylla	White Cypress Pine				●	●	●	●	●	●					
CLASS MAGNOLIOPSIDA															
SUBCLASS MAGNOLIIDAE															
Acanthaceae															
Brunoniella australis	Blue Trumpet		●		●		●		●						
Rostellularia adscendens	Pink Tongues				●		●		●						
Aizoaceae															
**Galenia pubescens*	Galenia						●	●	●	●					
Glinus lotoides											●				
Trianthema triquetra	Red Spinach	●	●	●	●										
Zaleya galericulata	Hogweed		●	●									●	●	
Amaranthaceae															
Alternanthera denticulata	Lesser Joyweed										●				
Alternanthera nana	Hairy Joyweed										●				
**Alternanthera pungens*	Khaki Weed		●	●								●	●	●	
Alternanthera sp. *A*		●	●	●	●	●	●	●	●	●	●	●			
Amaranthus macrocarpus var. *macrocarpus*	Dwarf Amaranth		●									●	●		
**Amaranthus powellii*	Powell's Amaranth		●									●			
**Gomphrena celosioides*	Gomphrena Weed	●	●		●		●	●	●	●				●	
Apiaceae															
**Ammi majus*	Bishop's Weed												●		●
**Conium maculatum*	Hemlock											●			
Daucus glochidiatus	Native Carrot								●						
Apocynaceae															
Alstonia constricta	Quinine Bush						●								
Marsdenia australis	Doubah						●								
Parsonsia lanceolata	Rough Silkpod						●								
Asteraceae															
**Aster subulatus*	Wild Aster										●				
**Bidens subalternans*	Greater Beggar's Ticks						●					●			
Brachyscome dentata			●												
Calotis lappulacea	Yellow Burr-daisy		●		●	●	●	●	●	●				●	

Scientific Name	Common Name	Vegetation Community													Opp.
		1	2	2a	3	3a	4	4a	5	5a	7	8	8a	DL	
Calotis scabiosifolia	Rough Burr-daisy										●				
**Carthamus lanatus*	Saffron Thistle		●	●	●	●	●	●		●				●	
Cassinia laevis	Cough Bush						●		●						
**Centaurea melitensis*	Maltese Cockspur	●	●	●	●	●	●	●	●	●	●			●	
Centipeda sp.														●	
Centipeda thespidioides	Desert Sneezeweed			●							●				
**Chondrilla juncea*	Skeleton Weed							●	●	●					
Chrysocephalum apiculatum	Common Everlasting				●		●		●	●					
**Cichorium intybus*	Chicory		●												
**Cirsium vulgare*	Spear Thistle	●												●	
**Conyza bonariensis*	Flaxleaf Fleabane		●											●	
Cotula australis	Carrot Weed										●				
Cymbonotus lawsonianus	Bears Ear		●												
Eclipta platyglossa		●									●				
Euchiton involucratus	Common Cudweed	●		●							●				
Euchiton sphaericus	Star Cudweed						●	●							
Glossocardia bidens	Cobbler's Tack						●	●	●	●					
**Hedypnois rhagadioloides* subsp. *cretica*	Cretan Weed	●	●		●	●	●	●		●	●			●	
**Hypochaeris glabra*	Smooth Catsear					●		●	●	●					
**Hypochaeris microcephala* var. *albiflora*	White Flatweed		●	●	●		●				●				
**Hypochaeris radicata*	Catsear		●				●		●						
**Lactuca saligna*	Willow-leaved Lettuce		●	●								●			
**Lactuca serriola*	Prickly Lettuce		●			●		●	●						
Leiocarpa leptolepis	Pale Plover-daisy			●						●					
Leiocarpa panaetioides	Woolly Buttons			●							●				
Leptorhynchos squamatus			●												
Minuria integerrima	Smooth Minuria										●				
**Schkuhria pinnata* var. *abrotanoides*										●					●
**Senecio madagascariensis*	Fireweed						●								
Senecio quadridentatus	Cotton Fireweed						●	●							
**Silybum marianum*	Variegated Thistle		●								●				
**Sonchus oleraceus*	Common Sowthistle	●	●	●	●	●	●	●	●		●	●			
Vittadinia cervicularis var. *cervicularis*							●								
Vittadinia cervicularis var. *subcervicularis*		●		●	●		●	●	●				●		
Vittadinia cuneata var. *cuneata*			●												
Vittadinia cuneata var. *hirsuta*	Fuzzweed	●	●	●	●	●	●			●				●	
Vittadinia muelleri	A Vittadinia	●				●		●	●	●				●	
Vittadinia pterochaeta	Winged New Holland Daisy		●								●				
Vittadinia pustulata					●	●		●		●				●	
Vittadinia sp.				●			●		●						
**Xanthium occidentale*	Noogoora Burr										●				
**Xanthium spinosum*	Bathurst Burr										●	●			

Scientific Name	Common Name	Vegetation Community													Opp.
		1	2	2a	3	3a	4	4a	5	5a	7	8	8a	DL	
Xerochrysum bracteatum	Golden Everlasting				●	●	●	●	●	●				●	
Bignoniaceae															
Pandorea pandorana	Wonga Wonga Vine						●								
Boraginaceae															
**Buglossoides arvensis*	Sheepweed		●												
**Echium plantagineum*	Paterson's Curse					●	●	●	●					●	
Ehretia membranifolia	Peach Bush								●						
**Heliotropium amplexicaule*	Blue Heliotrope						●								
**Brassicaceae*															
**Capsella bursa-pastoris*	Shepherd's Purse		●								●				
**Lepidium africanum*	A Peppercress	●	●	●	●	●	●	●	●	●	●		●	●	
**Lepidium bonariense*					●										
**Rapistrum rugosum*	Turnip Weed	●	●	●	●		●	●	●	●	●	●	●		
**Sisymbrium irio*	London Rocket	●	●		●		●	●	●						
**Sisymbrium officinale*	Hedge Mustard											●			
**Sisymbrium orientale*	Indian Hedge Mustard		●		●		●	●	●						
**Cactaceae*															
**Opuntia aurantiaca*	Tiger Pear		●												
**Opuntia stricta* var. *stricta*	Common Prickly Pear	●			●		●	●	●						●
**Campanulaceae*															
Wahlenbergia communis	Tufted Bluebell		●	●	●	●	●	●	●	●				●	
Wahlenbergia gracilis	Australian Bluebell		●		●				●					●	
Wahlenbergia luteola									●						
Wahlenbergia sp.															●
**Capparaceae*															
Capparis mitchellii	Wild Orange						●		●						●
**Caryophyllaceae*															
**Arenaria serpyllifolia*	Thyme-leaved Sandwort						●		●						
Gypsophila tubulosa	Annual Chalkwort						●	●	●						
**Petrorhagia nanteuilii*	Proliferous Pink				●	●	●	●	●	●					
**Polycarpon tetraphyllum*	Four-leaved Allseed				●		●	●	●						
**Silene gallica*	French Catchfly							●	●	●					
**Silene nocturna*	Mediterranean Catchfly							●							
**Spergularia rubra*	Sandspurry		●		●	●	●		●		●				
**Casuarinaceae*															
Allocasuarina luehmannii	Bulloak						●								●
Casuarina cristata	Belah														●
Casuarina cunninghamiana	River Sheoak														●
**Celastraceae*															
Denhamia cunninghamii									●						
**Chenopodiaceae*															
Atriplex leptocarpa	Slender-fruit Saltbush	●	●	●											

Scientific Name	Common Name	Vegetation Community													Opp.
		1	2	2a	3	3a	4	4a	5	5a	7	8	8a	DL	
Atriplex spinibractea	Spiny-fruit Saltbush	●	●	●										●	
Chenopodium carinatum	Keeled Goosefoot		●		●		●		●						
Chenopodium desertorum subsp. *microphyllum*			●												
**Chenopodium murale*	Nettle-leaf Goosefoot		●									●			
Dysphania pumilio				●							●				
Einadia hastata	Red Berry Saltbush	●	●	●	●		●	●	●		●	●	●	●	
Einadia nutans	Climbing Saltbush		●	●		●			●						
Einadia nutans subsp. *linifolia*			●		●		●		●			●			
Einadia nutans subsp. *nutans*	Climbing Saltbush	●	●	●	●	●	●	●	●	●		●	●		
Einadia polygonoides	Knotweed Goosefoot		●		●	●	●	●	●	●			●	●	
Einadia sp.		●													
Einadia trigonos	Fishweed				●										
Enchylaena tomentosa	Ruby Saltbush			●											
Maireana enchylaenoides	Wingless Bluebush				●	●	●		●	●					
Maireana microphylla	Small-leaf Bluebush	●	●	●	●	●	●	●	●	●					
Salsola australis	Soft Roly Poly		●	●		●	●		●			●	●		
Sclerolaena birchii	Galvanized Burr	●	●	●	●	●	●	●	●	●	●			●	
Sclerolaena muricata	Black Rolypoly	●	●	●	●	●	●	●	●	●	●	●	●	●	
Commelinaceae															
Commelina cyanea	Native Wandering Jew	●	●				●		●			●			
Convolvulaceae															
Convolvulus angustissimus	Blushing Bindweed	●	●		●	●	●	●		●				●	
Convolvulus graminetinus		●		●	●	●		●		●					
Dichondra repens	Kidney Weed		●		●	●	●	●	●	●				●	
Dichondra sp. *A*									●	●					
Evolvulus alsinoides var. *decumbens*					●	●	●	●	●	●					
Cucurbitaceae															
**Citrullus lanatus*	Camel Melon													●	
**Cucumis myriocarpus* subsp. *leptodermis*	Paddy Melon		●									●			
Euphorbiaceae															
Beyeria viscosa	Sticky Wallaby Bush						●		●						
Euphorbia dallachyana	Mat Spurge										●				
Euphorbia drummondii	Caustic Weed	●	●	●	●	●	●	●	●	●				●	
Fabaceae - Caesalpinioideae															
Senna artemisioides subsp. *zygophylla*							●		●						
Senna barclayana	Smooth Senna						●					●			
Fabaceae - Faboideae															
Cullen tenax	Tough Scurf-pea										●				
Desmodium brachypodum	Large Tick-trefoil						●		●						
Desmodium varians	Slender Tick-trefoil						●	●	●						
Glycine canescens	Silky Glycine									●					

Scientific Name	Common Name	Vegetation Community												Opp.
		1	2	2a	3	3a	4	4a	5	5a	7	8	8a	DL	
Glycine clandestina	Love Creeper		●				●	●	●						
Glycine stenophita			●												
Glycine tabacina	A Glycine		●		●		●	●	●	●					
**Medicago laciniata*	Cut-leaved Medic		●		●		●	●	●						
**Medicago minima*	Woolly Burr Medic	●		●	●	●	●		●	●					
**Medicago orbicularis*	Button Medic		●												
**Medicago polymorpha*	Burr Medic		●								●				
**Medicago sativa*	Lucerne		●											●	
**Medicago* sp.					●						●				
**Medicago truncatula*	Barrel Medic		●				●								
Rhynchosia minima								●							
Swainsona galegifolia	Smooth Darling-pea						●		●						
**Trifolium arvense*	Haresfoot Clover		●			●	●	●	●	●				●	
**Trifolium campestre*	Hop Clover				●	●	●	●	●						
**Trifolium glomeratum*	Clustered Clover		●		●	●	●	●	●	●				●	
Zornia dyctiocarpa	Zornia							●							
Fabaceae - Mimosoideae															
Acacia cheelii	Motherumbah														●
Acacia decora	Western Silver Wattle				●		●		●						●
Acacia deanei	Dean's Wattle						●	●	●						
Acacia excelsa	Ironwood								●						
Acacia oswaldii	Umbrella Wattle		●		●										
Acacia pendula	Weeping Myall	●													
Neptunia gracilis	Native Sensitive Plant	●	●								●		●		
**Prosopis velutina*	Velvet Mesquite											●			
Gentianaceae															
Schenkia australis	Spike Centaury					●		●						●	
Geraniaceae															
**Erodium cicutarium*	Common Storksbill										●				
Erodium crinitum	Blue Storksbill										●				
Geranium solanderi	Native Geranium						●								
Geranium sp.			●												
Goodeniaceae															
Goodenia fascicularis		●	●		●	●		●		●	●			●	
Goodenia hederacea	Forest Goodenia						●		●						
Velleia paradoxa	Spur Velleia														●
Lamiaceae															
Ajuga australis	Austral Bugle								●						
**Lamium amplexicaule*	Dead Nettle		●												
**Marrubium vulgare*	White Horehound		●				●		●						
Oncinocalyx betchei							●		●						
Spartothamnella juncea	Bead Bush						●		●						

Scientific Name	Common Name	Vegetation Community													Opp.
		1	2	2a	3	3a	4	4a	5	5a	7	8	8a	DL	
**Stachys arvensis*	Stagger Weed		●												
Teucrium sp. *A*				●											
Linaceae															
Linum marginale	Native Flax					●		●							
Lobeliaceae															
Pratia concolor											●				
Loranthaceae															
Amyema miquelii									●						
Amyema quandang		●													
Lysiana subfalcata															●
Lythraceae															
Lythrum hyssopifolia	Hyssop Loosestrife										●				
Malvaceae															
Abutilon fraseri	Dwarf Lantern-flower							●							
Abutilon oxycarpum	Straggly Lantern-bush		●		●		●		●						
**Malva parviflora*	Small-flowered Mallow	●	●												
**Modiola caroliniana*	Red-flowered Mallow		●												
Sida corrugata	Corrugated Sida		●	●	●	●	●	●	●	●					
Sida cunninghamii	Ridged Sida				●	●	●	●	●	●					
Sida hackettiana	Golden Rod		●						●					●	
**Sida rhombifolia*	Paddy's Lucerne				●										
**Sida* sp.			●	●			●	●	●	●		●			
**Sida spinosa*		●	●	●	●	●	●	●	●	●	●	●	●	●	
Sida trichopoda	Hairy Sida	●	●	●	●	●			●		●	●	●		
Myrsinaceae															
**Anagallis arvensis*	Scarlet Pimpernel						●	●	●					●	
Myrtaceae															
Angophora floribunda	Rough-barked Apple														●
Eucalyptus albens	White Box						●		●						
Eucalyptus blakelyi	Blakely's Red Gum		●						●						●
Eucalyptus camaldulensis	River Red Gum											●			●
Eucalyptus crebra	Narrow-leaved Ironbark								●						
Eucalyptus melanophloia	Silver-leaved Ironbark						●		●						
Eucalyptus melliodora	Yellow Box		●												●
Eucalyptus microcarpa	Grey Box														●
Eucalyptus pilligaensis	Narrow-leaved Grey Box		●		●				●						●
Eucalyptus populnea	Poplar Box		●		●									●	
Melaleuca bracteata	Black Tea-tree														●
Nyctaginaceae															
Boerhavia dominii	Tarvine	●	●	●	●	●	●	●	●	●		●	●	●	
Oleaceae															
Jasminum suavissimum			●				●					●			

Scientific Name	Common Name	Vegetation Community													Opp.
		1	2	2a	3	3a	4	4a	5	5a	7	8	8a	DL	
Notelaea microcarpa	Native Olive				●		●		●						
Notelaea microcarpa var. *microcarpa*	Velvet Mock Olive								●						
**Olea europaea*	Common Olive				●										
Oxalidaceae															
Oxalis chnoodes									●						
Oxalis exilis					●			●		●					
Oxalis perennans		●	●	●	●		●	●	●	●	●	●	●	●	
Oxalis thompsoniae												●			
Papaveraceae															
**Argemone ochroleuca*	Mexican Poppy										●				
Phyllanthaceae															
Phyllanthus virgatus					●	●	●	●	●	●					
Phyrmaceae															
Mimulus gracilis	Slender Monkey-flower										●				
Pittosporaceae															
Pittosporum angustifolium	Weeping Pittosporum								●			●			
Plantaginaceae															
Plantago cunninghamii		●			●	●	●		●						
Polygonaceae															
Persicaria prostrata	Creeping Knotweed												●		
**Polygonum arenastrum*	Wireweed											●			
**Polygonum aviculare*	Wireweed													●	
Polygonum plebeium	Small Knotweed										●				
Rumex brownii	Swamp Dock		●	●	●		●		●			●	●		
Rumex crystallinus	Shiny Dock										●				
Rumex tenax	Shiny Dock														●
Portulacaceae															
Portulaca oleracea	Pigweed	●	●	●	●	●	●	●	●	●	●		●	●	
Ranunculaceae															
Clematis microphylla	Small-leaved Clematis						●		●						
Ranunculus pumilio var. *pumilio*			●												
Rhamnaceae															
Pomaderris queenslandica	Scant Pomaderris								●						
Rubiaceae															
Asperula conferta	Common Woodruff		●												
Asperula cunninghamii	Twining Woodruff		●				●								
Asperula subulifolia							●								
**Galium aparine*	Goosegrass											●			
Psydrax odorata	Shiny-leaved Canthium								●						
Rutaceae															
Geijera parviflora	Wilga		●		●		●		●						
Zieria sp.									●						

Scientific Name	Common Name	Vegetation Community													Opp.
		1	2	2a	3	3a	4	4a	5	5a	7	8	8a	DL	
Salicaceae															
**Salix babylonica*	Weeping Willow														●
Santalaceae															
Santalum lanceolatum	Northern Sandalwood														●
Sapindaceae															
Alectryon oleifolius	Western Rosewood		●		●										●
Alectryon oleifolius subsp. *elongatus*	Western Rosewood	●	●				●		●						
Dodonaea sinuolata							●		●						
Dodonaea viscosa subsp. *angustifolia*	Sticky Hop-bush						●		●						●
Scrophulariaceae															
Eremophila debilis	Amulla	●	●		●		●	●	●						
Eremophila mitchellii	False Sandalwood						●								
**Misopates orontium*	Lesser Snapdragon				●	●	●	●	●	●				●	
Myoporum montanum	Western Boobialla				●		●		●						●
Solanaceae															
**Datura stramonium*	Common Thornapple											●			
**Lycium ferocissimum*	African Boxthorn	●	●		●		●	●	●			●		●	
Nicotiana suaveolens	Native Tobacco								●						
**Solanum chenopodioides*	Whitetip Nightshade								●						
Solanum cinereum	Narrawa Burr						●		●						
Solanum esuriale	Quena	●	●	●	●	●	●	●	●	●	●		●	●	
**Solanum nigrum*	Black-berry Nightshade		●						●			●			
Solanum parvifolium subsp. *parvifolium*							●		●					●	
**Solanum pseudocapsicum*	Madeira Winter											●			
Stackhousiaceae															
Stackhousia muricata	Western Stackhousia				●		●	●	●						
Thymelaeaceae															
Pimelea micrantha	Silky Rice-flower						●	●	●						
Pimelea neo-anglica	Poison Pimelea						●		●						
Urticaceae															
Urtica incisa	Stinging Nettle											●			
Verbenaceae															
**Phyla nodiflora*	Lippia	●	●	●							●	●	●		●
**Verbena caracasana*												●			
Verbena gaudichaudii		●	●	●		●		●	●	●					
**Verbena rigida*	Veined Verbena				●		●	●							
Zygophyllaceae															
Tribulus micrococcus	Yellow Vine		●	●	●	●	●	●	●	●				●	
**Tribulus terrestris*	Cat-head		●	●	●				●			●	●		
SUBCLASS LILIIDAE															
Amaryllidaceae															
Calostemma purpureum	Garland Lily										●				●

Scientific Name	Common Name	Vegetation Community													Opp.
		1	2	2a	3	3a	4	4a	5	5a	7	8	8a	DL	
Anthericaceae															
Arthropodium minus					●		●		●						
Arthropodium sp. B									●						
Dichopogon fimbriatus	Nodding Chocolate Lily				●	●	●		●						
Tricoryne elatior	Yellow Rush-lily						●	●							●
Aspholdelacea															
Bulbine semibarbata	Native Leek	●	●		●				●						
Cyperaceae															
Baumea sp.											●				
Carex inversa	Knob Sedge		●	●	●	●	●	●	●		●		●		
Cyperus bifax	Downs Nutgrass			●						●	●		●		
Cyperus difformis			●		●		●		●						
**Cyperus rotundus*	Nutgrass	●		●								●			
Eleocharis pallens	Pale Spike-sedge	●	●	●							●				
Eleocharis plana	Flat Spike-sedge		●								●				
Eleocharis pusilla			●								●				
Fimbristylis dichotoma	Common Fringe-sedge					●	●			●					
Juncaceae															
Juncus filicaulis									●						
Juncus flavidus											●				
Juncus radula						●									
Juncus sp.	A Rush		●			●			●						
Juncus subglaucus						●		●							
Juncus subsecundus	Finger Rush					●		●	●						
Lomandraceae															
Lomandra filliformis subsp. *coriacea*									●						
Lomandra filiformis subsp. *filiformis*	Wattle Mat-rush				●		●		●						
Lomandra filiformis subsp. *flavoir*					●										
Lomandra multiflora	Many-flowered Mat-rush		●		●		●		●						
Lomandra multiflora subs. *multiflora*	Many-flowered Mat-rush		●												
Lomandra sp.					●										
Orchidaceae															
Cymbidium canaliculatum	Tiger Orchid						●								
Phormiaceae															
Dianella porracea	Riverine Flax-lily		●												
Poaceae															
Anthosachne scabra	Wheatgrass		●												
Aristida blakei										●					
Aristida calycina var. *calycina*						●	●	●	●	●					
Aristida leptopoda	White Speargrass								●						
Aristida personata	Purple Wire-grass		●	●	●	●	●	●	●	●					
Aristida ramosa	Purple Wiregrass		●		●	●	●	●	●	●				●	

Scientific Name	Common Name	Vegetation Community													Opp.
		1	2	2a	3	3a	4	4a	5	5a	7	8	8a	DL	
Aristida vagans	Threeawn Speargrass								●						
Austrostipa aristiglumis	Plains Grass	●	●	●	●						●		●		
Austrostipa scabra	Speargrass		●	●	●	●	●	●	●	●					
Austrostipa setacea	Corkscrew Grass		●		●	●	●		●						
Austrostipa verticillata	Slender Bamboo Grass		●	●	●		●		●	●				●	
**Avena fatua*	Wild Oats		●												
**Avena* sp.				●		●		●		●					
Bothriochloa decipiens	Red Grass		●	●	●		●	●	●	●				●	
**Bromus catharticus*	Prairie Grass		●						●			●			
**Bromus molliformis*	Soft Brome			●	●			●	●	●		●	●		
**Chloris gayana*	Rhodes Grass									●					
Chloris truncata	Windmill Grass	●	●	●	●	●	●	●	●	●			●	●	
Chloris ventricosa	Plump Windmill Grass		●		●	●	●		●						
Cymbopogon refractus	Barbwire Grass						●	●	●						
Cynodon dactylon	Couch	●	●	●		●			●			●	●	●	
**Cynodon incompletus*							●								
Dactyloctenium radulans	Button Grass														●
Dichanthium sericeum	Queensland Bluegrass			●		●		●	●	●					
Dichelachne micrantha	Shorthair Plumegrass							●	●						
Digitaria brownii	Cotton Panic Grass			●		●	●	●	●	●				●	
Digitaria divaricatissima	Umbrella Grass			●		●	●			●	●			●	
**Digitaria eriantha* subsp. *eriantha*														●	
Echinochloa colona	Awnless Barnyard Grass		●			●		●		●		●		●	
Elymus scaber			●		●		●	●	●						
Enneapogon gracilis	Slender Bottle-washers					●	●	●	●						
Enneapogon nigricans	Niggerheads				●	●	●	●	●	●					
Enteropogon acicularis	Curly Windmill Grass	●	●	●	●	●	●	●	●	●	●		●	●	
Eragrostis alveiformis		●		●	●	●	●	●	●	●					
**Eragrostis cilianensis*	Stinkgrass			●											
Eragrostis elongata	Clustered Lovegrass							●		●					
Eragrostis lacunaria	Purple Love-grass				●		●		●						
Eragrostis leptostachya	Paddock Lovegrass					●	●			●				●	
Eragrostis sp.														●	
Eriochloa pseudoacrotricha	Early Spring Grass		●	●	●	●	●	●	●	●	●	●		●	
Eulalia aurea	Silky Browntop								●						
**Festuca* sp.														●	
Hemarthria uncinata	Matgrass								●	●					
**Hordeum leporinum*	Barley Grass	●	●	●			●		●						
Lachnagrostis filiformis							●				●				
Leptochloa asthenes							●								
Leptochloa divaricatissima			●			●									
**Lolium perenne*	Perennial Ryegrass										●				

Scientific Name	Common Name	Vegetation Community													Opp.
		1	2	2a	3	3a	4	4a	5	5a	7	8	8a	DL	
**Lolium rigidum*	Wimmera Ryegrass	●	●	●	●	●	●	●	●					●	
Panicum buncei	Rice Grass		●	●								●			
Paspalidium constrictum	Knottybutt Grass		●												
Panicum decompositum	Native Millet					●		●			●			●	
Panicum effusum	Hairy Panic			●		●	●			●					
**Panicum schinzii*														●	
Panicum simile	Two Coloured Panic							●		●					
Paspalidium constrictum	Knottybutt Grass		●	●	●				●	●					
Paspalidium distans			●									●	●		
Paspalidium gracile	Slender Panic	●	●	●	●		●	●	●	●					
Paspalidium jubiflorum	Warrego Grass		●								●	●	●		
**Phalaris minor*	Lesser Canary Grass			●					●		●				
Poa labillardierei	Tussock								●						
Poa sieberiana							●		●						
Rytidosperma bipartitum	Wallaby Grass		●	●	●		●		●	●			●	●	
Rytidosperma caespitosum	Ringed Wallaby Grass				●	●	●	●	●						
Rytidosperma carphoides	Short Wallaby Grass							●							
Rytidosperma fulvum	Wallaby Grass	●	●	●	●		●				●				
Rytidosperma racemosum var. *obtusatum*							●		●						
Rytidosperma sp.			●				●		●					●	
Sporobolus caroli	Fairy Grass	●	●	●	●	●		●	●	●	●			●	
Sporobolus creber	Slender Rat's Tail Grass						●	●							
Sporobolus mitchellii	Rat's Tail Couch		●												
Sporobolus sp.							●								
Themeda triandra	Kangaroo Grass								●	●					
Tragus australianus	Small Burrgrass					●	●		●	●				●	
Tripogon loliiformis	Fiveminute Grass	●		●						●					
**Urochloa panicoides*	Urochloa Grass		●												
**Vulpia muralis*						●	●	●	●						
**Vulpia myuros*	Rat's Tail Rescue	●					●		●						
**Vulpia* sp.						●		●	●						
TOTAL ALL NATIVE SPECIES	**271**	**43**	**99**	59	**83**	**67**	**127**	**77**	**140**	**68**	**49**	**24**	**25**	**44**	
TOTAL ALL INTRODUCED SPECIES	**103**	**18**	**47**	20	**29**	**20**	**38**	**34**	**41**	**21**	**20**	**26**	**8**	**22**	
GRAND TOTAL ALL SPECIES	**374**	**61**	**146**	79	**112**	**87**	**165**	**111**	**181**	**89**	**69**	**50**	**33**	**66**	

* Introduced species

Opp. = Opportunistically observed species and additional species observed on disturbed land.

APPENDIX B

PLOT DATA FOR BIODIVERSITY ASSESSMENT REPORT AND BIODIVERSITY OFFSET STRATEGY

Table B1
Plot Data for Biodiversity Assessment Report and Biodiversity Offset Strategy

Community	BVT	Vegetation Type	Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
1	NA219	Woodland	Q4	25	18	0	2	0	14	6	0	0	0	229246	6590333	56
1	NA219	Woodland	Q5	18	16.5	0	12	0	30	6	2	1	22	229009	6590601	56
1	NA219	Woodland	Q6	21	10	0	14	0	40	4	0	0	20	229321	6590155	56
2	NA185	Woodland	Q7	28	25	0	8	0	24	6	4	1	16	229260	6590858	56
2	NA185	Woodland	Q10	23	18.5	0	10	8	36	12	4	1	22	231368	6589470	56
2	NA185	Woodland	Q13	36	20	0	44	0	18	2	2	1	16	227875	6596183	56
2	NA185	Woodland	Q19	13	25.5	0	4	0	38	6	8	1	67	228185	6592382	56
2	NA185	Woodland	Q59	28	35	0	14	12	12	0	0	0	11	228469	6587559	56
2	NA185	Woodland	Q62	31	14	0	12	6	42	2	3	1	17	228650	6599823	56
2	NA185	Woodland	Q87	26	32	0	10	0	22	48	2	0.3	4	227212	6587586	56
2	NA185	Woodland	Q88	21	14	0	28	0	52	16	3	1	91	223552	6587527	56
2	NA185	Woodland	Q89	13	16	0	4	0	6	70	1	0	82	225750	6587451	56
2	NA185	DNG	Q60	21	19	0	8	12	38	2	6	1	1	228716	6587816	56
2a	NA185	DNG	Q8	13	0	0	36	36	6	0	0	0	0	229136	6589941	56
2a	NA185	DNG	Q9	15	0	0	54	12	4	2	0	0	2	229106	6590114	56
2a	NA185	DNG	Q61	24	0	0	24	4	42	2	0	0	0	228791	6587983	56
2a	NA185	DNG	Q81	22	0	0	28	10	14	0	0	0	0	227368	6596255	56
2a	NA185	DNG	Q82	23	0	0	26	2	4	0	0	0	0	229282	6590472	56
3	NA324	Woodland	Q11	37	27	0	8	2	32	0	2	1	1	229215	6589709	56
3	NA324	Woodland	Q20	37	17	0	38	4	16	0	6	1	6	228195	6595499	56
3	NA324	Woodland	Q24	34	20.5	0	24	2	20	2	0	1	17	229034	6595873	56
3	NA324	Woodland	Q43	31	7.5	3	14	12	10	0	0	1	10	228024	6595857	56
3	NA324	Woodland	Q44	42	20	0	32	0	20	2	1	1	12	229090	6595989	56
3	NA324	Woodland	Q83	21	39	0.5	20	8	16	0	3	0	45	233789	6590077	56
3	NA324	Woodland	WR1	31	27	0	4	0	6	22	3	1	1	226558	6594329	56

Community	BVT	Vegetation Type	Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
3a	NA324	DNG	Q27	25	0	0	62	2	16	10	0	0	0	227582	6595834	56
3a	NA324	DNG	Q29	22	0	0	30	2	6	4	0	0	0	230038	6590680	56
3a	NA324	DNG	Q30	31	0	0	40	0	8	0	0	0	0	230367	6589947	56
3a	NA324	DNG	Q41	29	0	0	38	0	2	4	0	0	0	228318	6594886	56
3a	NA324	DNG	Q42	27	0	0	46	4	2	4	0	0	0	227693	6595216	56
3a	NA324	DNG	Q72	31	0	0	62	2	12	0	0	0	0	228008	6595148	56
3a	NA324	DNG	Q69	28	0	0	48	0	8	8	0	0	0	230182	6590890	56
4	NA349	Woodland	Q14	37	17.5	0.5	6	14	44	0	4	1	17	227710	6593587	56
4	NA349	Woodland	Q15	33	20	0	30	0	24	12	5	1	32	227679	6593225	56
4	NA349	Woodland	Q16	40	23	3	26	0	18	0	1	1	5	227475	6593017	56
4	NA349	Woodland	Q17	46	22.5	9	26	0	12	0	3	1	25	227742	6593013	56
4	NA349	Woodland	Q18	34	9	12	16	0	24	0	8	1	44	228017	6594121	56
4	NA349	Woodland	Q21	34	8	0	36	0	22	6	1	1	6	230735	6595275	56
4	NA349	Woodland	Q22	40	16.5	0	28	0	26	0	0	1	0	230470	6595213	56
4	NA349	Woodland	Q26	33	34	0	36	0	24	12	1	1	2	227313	6595785	56
4	NA349	Woodland	Q67	51	22	4	24	0	46	0	1	1	24	227779	6593991	56
4	NA349	Woodland	Q68	50	16	8.5	20	0	22	2	2	1	30	227948	6593854	56
4	NA349	Woodland	Q76	57	30	10.5	42	0	46	2	2	1	6	228006	6593187	56
4	NA349	Woodland	WR6	14	6	0	20	6	6	2	3	1	2	226973	6594581	56
3a	NA324	DNG	Q23	25	14	0	30	6	4	20	0	0	0	230395	6595581	56
4a	NA349	DNG	Q32	24	0	0	36	0	0	12	0	0	0	227784	6594485	56
4a	NA349	DNG	Q33	20	0	0	36	4	14	10	0	0	0	228285	6593984	56
4a	NA349	DNG	Q34	13	0	0	60	0	0	6	0	0	0	226754	6593732	56
4a	NA349	DNG	Q40	30	0	0	44	0	6	30	0	0	0	227417	6595763	56
4a	NA349	DNG	Q45	25	0	0	32	0	22	0	0	0	0	227183	6593348	56
4a	NA349	DNG	Q46	21	0	0	40	0	4	32	0	0	0	228177	6592857	56
4a	NA349	DNG	Q47	30	0	0	48	2	4	4	0	0	0	231340	6595118	56
4a	NA349	DNG	Q48	30	0	0	52	0	0	10	0	0	0	231335	6595233	56

Community	BVT	Vegetation Type	Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
5	NA311	Woodland	Q1	36	5	18.5	22	0	4	0	0	1	12	233589	6591969	56
5	NA311	Woodland	Q2	38	10.5	6	22	4	6	2	1	1	15	233837	6592096	56
5	NA311	Woodland	Q3	32	29.5	8.5	12	0	30	8	3	1	27	233907	6590770	56
5	NA311	Woodland	Q12	28	24.5	0	22	0	14	28	2	1	2	229382	6591931	56
5	NA311	Woodland	Q28	36	12.5	0	36	0	16	2	1	1	14	230977	6590511	56
5	NA311	Woodland	Q36	33	10	0	32	0	8	0	0	1	4	229163	6591928	56
5	NA311	Woodland	Q37	30	12.5	0	36	2	4	2	1	1	2	229329	6591500	56
5	NA311	Woodland	Q39	18	19.5	0	20	2	44	0	0	1	4	231717	6590745	56
5	NA311	Woodland	Q70	26	28	0	22	4	22	0	1	1	5	230588	6590264	56
5a	NA311	DNG	Q31	22	0	0	36	0	4	22	0	0	0	231309	6590304	56
5a	NA311	DNG	Q35	26	0	0	18	0	4	14	0	0	0	231882	6591103	56
5a	NA311	DNG	Q38	24	0	0	58	0	6	4	0	0	0	230576	6590581	56
5a	NA311	DNG	Q71	31	0	0	42	0	18	0	0	0	0	231180	6590660	56
5a	NA311	DNG	Q73	30	0	0	32	6	12	0	0	0	0	229222	6591631	56
5a	NA311	DNG	Q74	31	0	0	64	0	26	4	0	0	0	229042	6592050	56
5a	NA311	DNG	Q75	28	0	0	46	0	8	0	0	0	0	231635	6590614	56
7	NA201	Sedgeland	Q84	25	0	0	34	16	2	6	0	0	0	232388	6588961	56
7	NA201	Sedgeland	Q85	13	0	0	0	0	82	0	0	0	0	232340	6588582	56
7	NA201	Sedgeland	Q86	14	0	0	42	6	8	52	0	0	0	232996	6589449	56
8	NA193	Woodland	Q54	19	42	0	22	2	6	12	1	0	28	228120	6587580	56
8	NA193	Woodland	Q57	13	30	0	20	0	12	6	1	1	22	228158	6587674	56
8	NA193	Woodland	Q58	17	34	0	14	0	0	2	2	1	40	228323	6587381	56
8a	NA193	DNG	Q55	13	0	0	24	0	8	40	0	0	3	227950	6587542	56
8	NA193	Woodland	Q80	17	0	0	28	0	14	20	0	0	0	228252	6587698	56

Note: Green highlighted data was used in the credit calcualtors.

NPS = Native Plant Species Richness

NOS = Native Overstorey Cover (%)

NMS = Native Midstorey Cover (%)

NGCG = Native Groundcover Grasses (%)

NGCS = Native Groundcover Shrubs (%)

NGCO = Native Groundcover Other (%)

EPC = Exotic Plant Cover

NTH = Number of Trees with Hollows

OR = Overstorey Regeneration

FL = Total Length of Fallen Logs (m)

ATTACHMENT D
VICKERY EXTENSION PROJECT THREATENED FAUNA SURVEY REPORT

FUTURE ECOLOGY
ABN 20 117 362 311
546 Bellingen Rd
Missabotti NSW 2449
M. 0423 981 786
E. garon@futureecology.com.au

VICKERY EXTENSION PROJECT
THREATENED FAUNA SURVEY REPORT

Prepared for Whitehaven Coal Limited

July 2018

PROJECT NUMBER	2016-01		
PROJECT NAME	The Vickery Extension Project Threatened Fauna Survey Report		
PROJECT ADDRESS	Boggabri – Blue Vale NSW		
PREPARED FOR	Whitehaven Coal Limited		
AUTHOR/S	Garon Staines, Adam Greenhalgh, Tony Saunders, Ross Wellington		
VERSION	**Version**	**Draft/Final**	**Date to client**
	1.0	Draft V1	19/01/2016
		Draft V1A	11/03/2016
		Draft V1B	07/04/2016
	2.0	Draft V2	20/01/2017
		Draft V2A	24/01/2017
		Draft V2B	26/1/2017
	3.0	Draft V3	6/9/2017

This report should be cited as: '*Future Ecology (2018) Vickery Extension Project Threatened Fauna Survey Report. Report prepared for Whitehaven Coal Limited*.

Disclaimer

This report has been prepared by Future Ecology for Whitehaven Coal Limited and may only be used for the purpose agreed between these parties, as described in this report. The opinions, conclusions and recommendations set out in this report are limited to those set out in the scope of works and agreed between these parties. Future Ecology accepts no responsibility or obligation for any third party that may use this information or for conclusions drawn from this report that are not provided in the scope of works or following changes occurring subsequent to the date that the report was prepared.

The recommendations provided in this report are based on the results from currently accepted and naturally limited ecological survey techniques. Every effort is made and reasonable care taken to detect all threatened species that may have potential to occur in the locality.

Any representation, statement, opinion or advice expressed or implied in this report is made in good faith on the basis that Future Ecology Pty Ltd, its agents and employees are not liable (whether by reason of negligence, lack of care or otherwise) to any person for any damage or loss whatsoever which has occurred or may occur in relation to that person taking or not taking (as the case may be) action in respect of any representation, statement or advice referred to above.

Abbreviations

ABBR./TERM	DESCRIPTION
BARBOS	Biodiversity Assessment Report and Biodiversity Offset Strategy
CAMBA	China and Australia Migratory Bird Agreement
CEEC	Critically endangered ecological community
CHPP	Coal Handling and Preparation Plant
CL	Coal Lease
DA	Development Application
DBH	Diameter at Breast Height
DEE	Department of the Environment and Energy
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EL	Exploration Licence
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
ha	Hectares
IBRA	Interim Biogeographical Regionalisation of Australia
JAMBA	Japan and Australia Migratory Bird Agreement
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
LGA	Local Government Area
mm/cm/m/km/ha	Millimetres/Centimetres/Metres/Kilometres/Hectares
masl	Metres Above Sea Level
ML	Mining Lease
NSW	New South Wales
OEH	Office of Environment and Heritage - NSW
BC Act	NSW *Biodiversity Conservation Act 2016*
*	Denotes Exotic Species

Contents

Figures

Tables

Charts

Executive Summary

The Vickery Coal Mine (Approved Mine) is an approved, but yet to be constructed, coal mining operation situated some 25 kilometres (km) north of Gunnedah and 18 km south-east of Boggabri, in New South Wales. The Vickery Extension Project (the Project) would involve the extension of approved open cut mining operations.

This threatened fauna survey report has been prepared by Future Ecology for the Project. This report provides a summary of previous fauna surveys as well as the methods and results of additional fauna surveys undertaken for the Project.

The study area was inclusive of the proposed additional surface development areas associated with the mine and a rail spur investigation corridor (to the south-west). The study area was larger than the proposed additional surface development areas. For example, surveys were undertaken in the south-west corner of Vickery State Forest (despite no proposed disturbance to the Vickery State Forest).

There have been a number of fauna surveys previously undertaken partly within and/or adjacent to the study area. The most notable are those undertaken for the Approved Mine in 2011 and 2012 by Cenwest Environmental Surveys and Niche Environment and Heritage. These previous reports provide a good background on the fauna likely to be present in the study area.

Additional fauna surveys were completed by Future Ecology in October 2015 (7 days), February 2016 (6 days) and August 2017 (2 days) using a team of one to five ecologists including specialists in birds, reptiles, amphibians and mammals.

A total of 22 survey sites were surveyed within the study area using a variety of techniques in accordance with relevant NSW and national guidelines. Threatened fauna species listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) and/or Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) which are known or likely to occur in the study area were specifically targeted during the surveys.

Four broad fauna habitat types were observed within the study area (Woodland/Open Forest, Native Grassland, Cleared Land and watercourses and dams). The majority of survey sites were located within the Woodland/Open Forest broad fauna habitat type. Most habitat patches showed evidence of historic and ongoing disturbance from a range of agricultural and other human induced factors. Most survey sites were relatively small, fragmented and lacked structural diversity in terms of subcanopy and understorey layers. Connectivity between remnant Woodland/Open Forest habitats was generally poor across the study area. However, some fauna habitat features such as hollow bearing trees, hollow logs, fallen timber, were present at most survey sites.

A total of 201 fauna species were recorded in the study area during the surveys including 10 amphibian, 22 reptile, 131 bird and 38 mammal species. This number also includes a number of incidental records obtained in the field but outside of defined survey sites.

Site 4 which is located within Vickery State Forest which has the least disturbed, largest and structurally complex vegetation of all the survey sites within the study area, also had the largest number of species recorded (90).

A total of 14 threatened fauna species listed under the BC Act (all listed as vulnerable) were recorded in the study area during the surveys by Future Ecology (Table ES-1).

Table ES-1 Threatened Species Recorded within the Study Area

Species	Recorded by Future Ecology		Previously Recorded by Other Specialist*	
	Inside NSW Assessment Footprint	Outside NSW Assessment Footprint	Inside NSW Assessment Footprint	Outside NSW Assessment Footprint
Spotted Harrier (*Circus assimilis)*	X	✓	X	✓
Turquoise Parrot (*Neophema pulchella*)	X	✓	X	✓
Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*)	X	✓	X	✓
Speckled Warbler (*Chthonicola sagittata*)	✓	✓	✓	✓
Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*)	✓	✓	X	✓
Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*)	✓	✓	✓	✓
Gilbert's Whistler (*Pachycephala inornata*)	X	✓	X	✓
Dusky Woodswallow (*Artamus cyanopterus*)	X	✓	X	✓
Diamond Firetail (*Stagonopleura guttata*)	✓	✓	X	✓
Koala (*Phascolarctos cinereus*)	X	✓	✓	✓
Squirrel Glider (*Petaurus norfolcensis*)	X	✓	✓	✓
Yellow-bellied sheath-tailed bat (*Saccolaimus flaviventris*)	✓	✓	✓	✓
Eastern Bentwing-bat (*Miniopterus orianae oceanensis*)	✓	X^	X	✓
Eastern Cave Bat (*Vespadelus troughtoni*)	X	✓	X	X

Note: The NSW Assessment Footprint is described in Section 1.2 (and shown on Figure 3a and 3b) of the *Vickery Extension Project Biodiversity Assessment Report and Biodiversity Offset Strategy* (Resource Strategies, 2018). The study area referred to throughout this report covers the extent of the NSW Assessment Footprint as well as land outside (i.e. species recorded in this report do not all occur within the NSW Assessment Footprint).

* Refer to Section 1.2.6.

^ possible/probable recording via bat recording devices

Of the threatened fauna species identified in Table ES-1, only the Koala is listed under the EPBC Act.

Calls of the following threatened bat species were also possibly detected, however, the calls could not be distinguished from other non-threatened bat species or were not distinctive enough to be identified to species level:

- Corben's Long-eared Bat (*Nyctophilus corbeni*) (this species cannot be identified to species level based on call data alone);
- Large-eared Pied Bat (*Chalinobolus dwyeri*) (identified to genus level only, calls couldn't be distinguished from other potentially occurring bat species); and
- Beccari's Free-tailed Bat (*Mormopterus lumsdenae*) (calls couldn't be distinguished from other potentially occurring bat species).

The Corben's Long-eared Bat and Large-eared Pied Bat are also listed under the EPBC Act.

An additional three threatened species listed under the BC Act have been previously recorded in the study area, but were not recorded by Future Ecology, namely, the Little Eagle (*Hieraaetus morphnoides*), Painted Honeyeater (*Grantiella picta*) (also listed under the EPBC Act) and Eastern Freetail-bat (*Mormopterus norfolkensis*).

1 Introduction

The former Vickery Coal Mine and the former Canyon Coal Mine are located approximately 25 kilometres (km) north of Gunnedah, in New South Wales (NSW) (**Figure 1**). Open cut and underground mining activities were conducted at the former Vickery Coal Mine between 1986 and 1998. Open cut mining activities at the former Canyon Coal Mine ceased in 2009. The former Vickery and Canyon Coal Mines have been rehabilitated following closure.

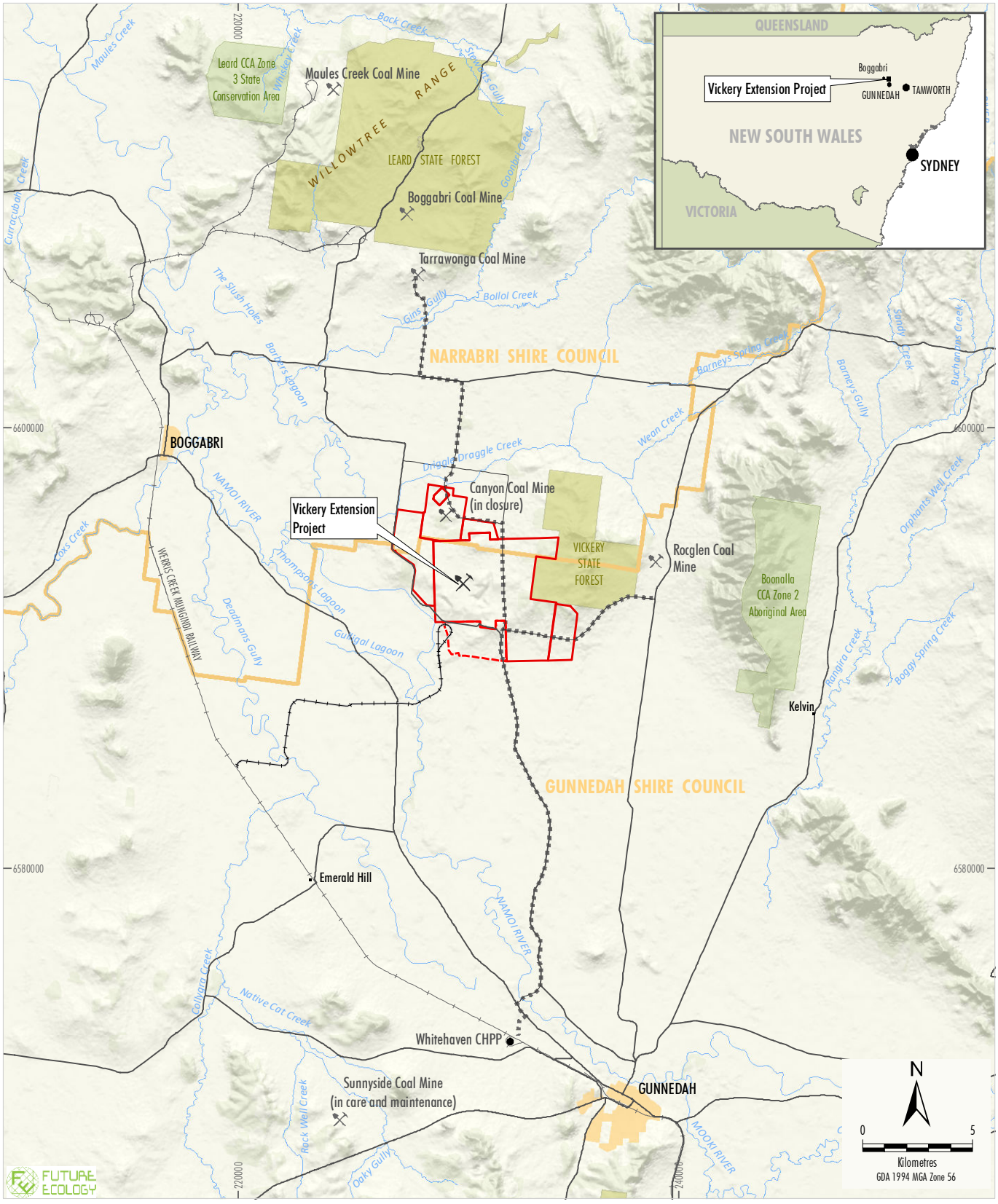
The approved Vickery Coal Project (the Approved Mine) is an approved, but yet to be constructed, project involving the development of an open cut coal mine and associated infrastructure, and would facilitate a run-of-mine (ROM) coal production rate of up to approximately 4.5 million tonnes per annum (Mtpa) for a period of 30 years.

Whitehaven Coal Limited (Whitehaven) is seeking a new Development Consent for extension of open cut mining operations at the Approved Mine (herein referred to as the Vickery Extension Project [the Project]). This would include a physical extension to the Approved Mine footprint to gain access to additional ROM coal reserves, an increase in the footprint of waste rock emplacement areas, an increase in the approved ROM coal mining rate and construction and operation of a Project Coal Handling and Preparation Plant (CHPP), train load-out facility and rail spur. This infrastructure will be used for the handling, processing and transport of coal from the Project, as well as other Whitehaven mines.

The Project involves mining the coal reserves associated with the Approved Mine, as well as accessing additional coal reserves within the Project area. ROM coal would be mined by open cut methods at a rate up to approximately 10 Mtpa, over a mine life of approximately 25 years.

Figure 2 illustrates the general arrangement of the Project. A detailed description of the Project is provided in Section 2 in the Main Report of the Environmental Impact Statement (EIS).

This assessment forms part of an EIS which has been prepared to accompany a Development Application made for the Project in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act).



WHC-15-33_App BAR BOS AnD_201F

LEGEND

- Mining Tenement Boundary (ML and CL)
- Mining Lease Application (MLA)
- Local Government Boundary
- NSW State Forest
- State Conservation Area, Aboriginal Area
- Major Road
- Railway
- Approved Road Transport Route
- Indicative Rail Spur Alignment

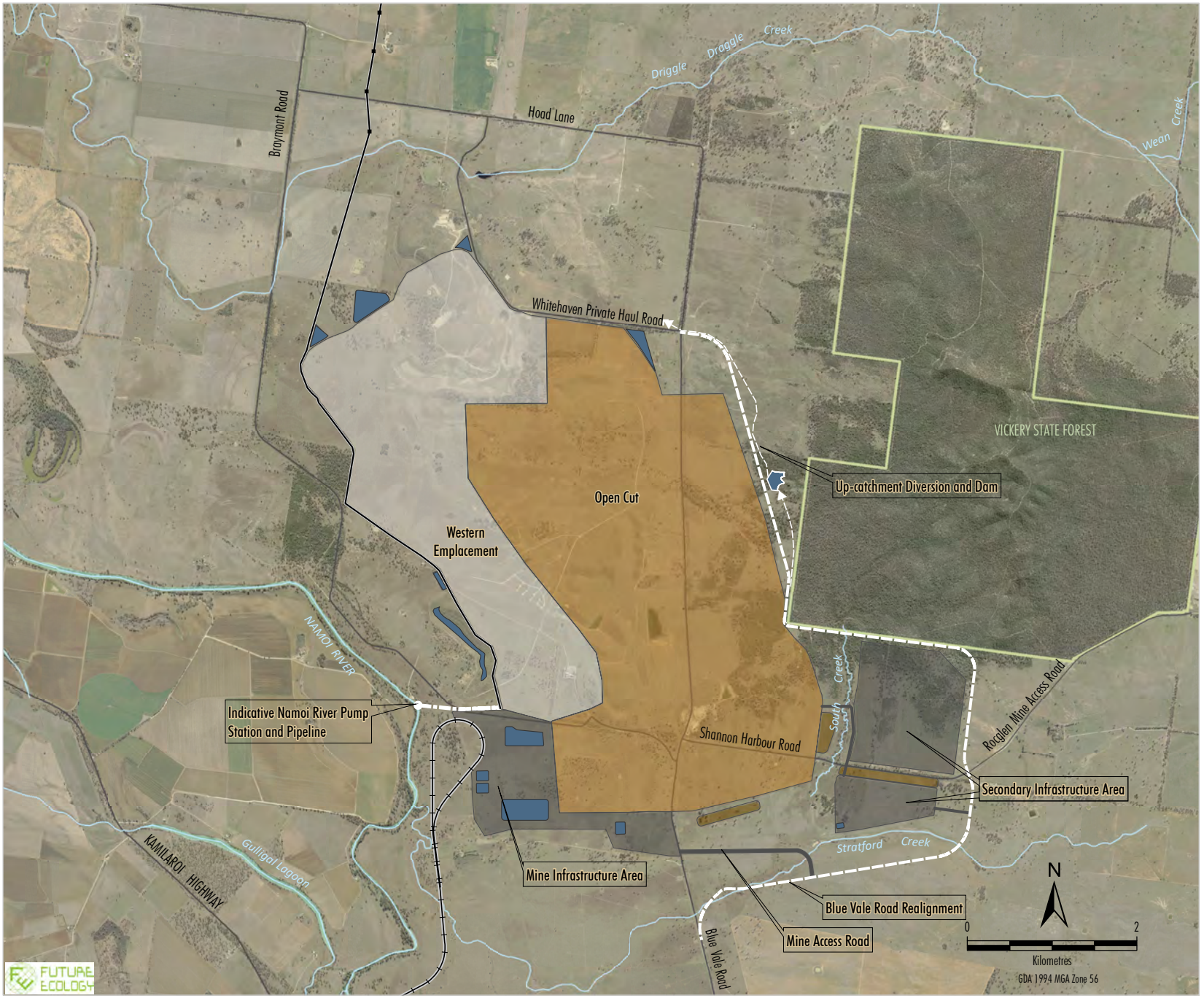
WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Project Location

Source: LPMA - Topographic Base (2010); NSW Department of Industry (2015)

Figure 1



LEGEND

State Forest

Project Components

- Indicative Extent of Open Cut
- Indicative Extent of Out of Pit Waste Rock Emplacement
- Indicative Extent of Infrastructure Area
- Indicative Extent of Soil Stockpile
- Indicative Extent of Water Storage
- Indicative Mine Access Road Alignment
- Indicative Namoi River Pump Station and Pipeline
- Indicative Road Realignment
- Indicative Up-catchment Diversion and Dam Location
- Indicative Rail Spur Alignment
- Indicative Location of Groundwater Bores and Pipeline

Source: Orthophoto - Department of Land and Property Information, Aerial Photography (July 2011); Department of Industry (2015); Essential Energy (2015)

WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Project General Arrangement - Project Mining Area

Figure 2

1.1 Purpose of Report

The purpose of the fauna survey and report is to:

- survey and document potentially occurring threatened fauna species listed under the NSW *Biodiversity Conservation Act, 2016* (BC Act) in the study area in accordance with relevant survey guidelines;
- survey and document potentially occurring threatened and protected migratory fauna species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) present in the study area in accordance with relevant survey guidelines; and
- document broad fauna habitats of the study area.

The Project is a State Significant Development under the EP&A Act and the NSW *Biodiversity Offset Policy for Major Projects* (Office of the Environment and Heritage [OEH], 2014) applies to the Project. This report provides the results of threatened fauna species targeted surveys to inform the Project Biodiversity Assessment Report and Biodiversity Offset Strategy (BARBOS) (being prepared separately by Resource Strategies, 2018).

1.2 Site Description

1.2.1 Study Area

Figure 3a identifies the study area in the context of the Project mining area. **Figure 3b** identifies the study area in the context of the indicative rail spur investigation corridor.

The study area consists of mainly agricultural land (grazing and/or cropping) together with the south-west corner of Vickery State Forest. The agricultural land is mostly heavily cleared with only small pockets of scattered and isolated remnant and/or regenerating vegetation. Vickery State Forest by comparison is mainly heavily vegetated.

1.2.2 Regional Setting

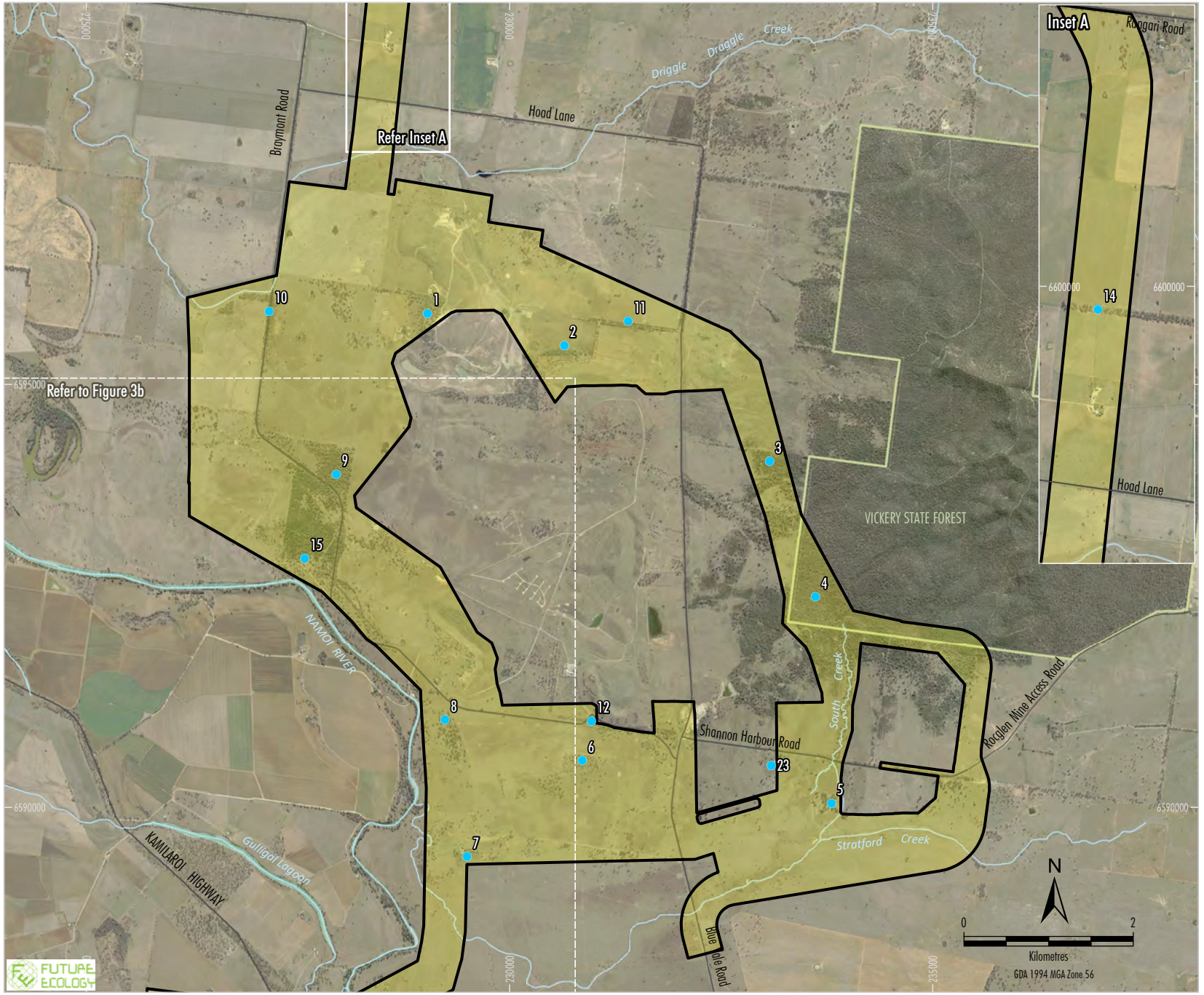
The study area is located within the following regions:

- North-west Local Land Service area (formally the Namoi Catchment Management Authority [CMA], Liverpool Plains (Part B) CMA sub-region);
- the Brigalow Belt South Region Interim Biogeographic Regionalisation for Australia (IBRA) Bioregion and Liverpool Plains IBRA sub-region; and
- the Narrabri and Gunnedah Local Government Areas.

1.2.3 Landform and Hydrology

The topography of the central part of the study area comprises rolling hills (partly due to the landform associated with the previous mining activities associated with the former Canyon Coal Mine), with flatter areas to the north and south.

The study area is situated within the Namoi River Catchment. The Namoi River is located in the south-western extent of the study area and is crossed by the proposed rail alignment (**Figure 3a**). It generally flows in a north-westerly direction from its headwaters in the Great Dividing Range.



LEGEND

- State Forest
- Study Area
- Fauna Survey Site

Source: Orthophoto - Department of Land and Property Information, Aerial Photography (July 2011)

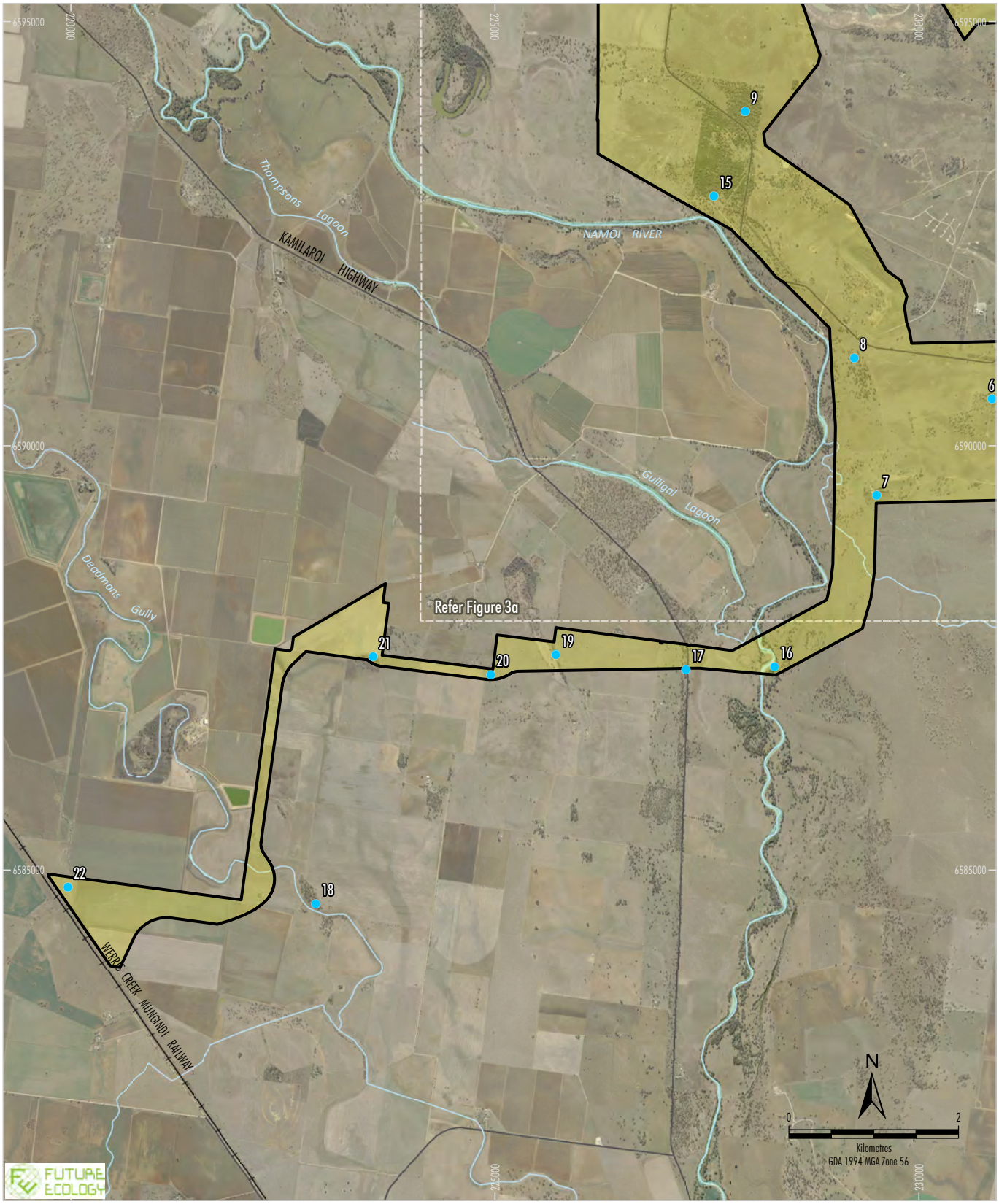
WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Study Area and Fauna Survey Sites
Project Mining Area

Figure 3a

WHC-15-33_App BAR BOS AttD_203G



WHC-15-33_App BAR BOS AttD_2046

LEGEND

Study Area

Fauna Survey Site

Source: Orthophoto - Department of Land and Property Information, Aerial Photography (July 2011)

WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Study Area and Fauna Survey Sites
Project Rail Spur

Figure 3b

There are several named ephemeral drainage lines in the study area, namely, Driggle Draggle Creek, South Creek, Stratford Creek, Thompsons Lagoon, Gulligal Lagoon and Deadmans Gully.

The headwaters of Driggle Draggle Creek and a number of other unnamed ephemeral streams originate in the slopes of the Vickery State Forest and flow through the north of the study area (**Figure 3b**). As they descend onto the flatter areas they become less well defined drainage paths which become expansive, ponded, overland flow areas during and following heavy rainfall. These flows slowly move down gradient and merge with the Namoi River.

1.2.4 Land Use

The majority of the study area is located within previously cleared agricultural areas. Dryland cropping and grazing of cattle is conducted to the north, west and south of the study area on the flatter lands near the Namoi River and its tributaries.

The Vickery State Forest is located within the east of the study area.

Open cut and underground mining activities were previously conducted in the study area. Three areas associated with former open cuts and associated waste rock emplacements (the Red Hill Pit and Greenwood/Shannon Hill Pit) are located within the Project area. In addition, part of the final void associated with the former Canyon Coal Mine (mining ceased in 2009) occurs in the north-west portion of the study area.

1.2.5 Vegetation

FloraSearch (2018) undertook flora surveys across the study area in 2015, 2016 and 2017. The study area was found to comprise predominantly cleared land with remnants of seven naturally occurring vegetation communities and native grasslands derived from them (FloraSearch, 2018). The most predominant woody vegetation communities within the study area include:

- Poplar Box Woodland on Alluvial Clay Soils;
- White Box – Silver-leaved Ironbark Shrubby Open Forest; and
- Narrow-leaved Ironbark – White Box Shrubby Forest.

The vegetation within the study area has been historically cleared and highly disturbed by grazing and cropping (FloraSearch, 2018). Much of the vegetation within the study area is highly fragmented. It is considered that much of the vegetation within the study area once appeared similar to the vegetation that is now protected within the Vickery State Forest (east of the study area), however due to agriculture activities it is now highly disturbed and modified from its original condition (FloraSearch, 2018).

1.2.6 Summary of Previous Threatened Species recorded in the Study Area

As detailed in Section 2.1, a literature and database review was undertaken to identify threatened fauna species which are known or likely to occur in the study area. The following ten threatened fauna species have previous survey or database records in the study area (**Table 1**):

- Little Eagle (*Hieraaetus morphnoides*) (inside NSW Assessment Footprint);
- Turquoise Parrot (*Neophema pulchella*) (outside NSW Assessment Footprint);
- Speckled Warbler (*Chthonicola sagittata*) (inside NSW Assessment Footprint);
- Painted Honeyeater (*Grantiella picta*) (inside NSW Assessment Footprint);
- Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*) (inside NSW Assessment Footprint);
- Diamond Firetail (*Stagonopleura guttata*) (inside NSW Assessment Footprint);
- Koala (*Phascolactos cinereus*) (inside NSW Assessment Footprint);
- Squirrel Glider (*Petaurus norfolcensis*) (inside NSW Assessment Footprint);
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) (inside NSW Assessment Footprint); and
- Eastern Freetail-bat (*Mormopterus norfolkensis*) (inside NSW Assessment Footprint).

The Large-eared Pied Bat (*Chalinolobus dwyeri*) has also been possibly recorded in the study area (Niche, 2013). This species was identified to genus level only in that study as the calls couldn't be distinguished from other potentially occurring bat species.

An additional 18 threatened species are known to occur (or predicted to occur by the EPBC Act Protected Matters Search [Commonwealth Department of the Environment and Energy [DEE], 2017]) in the surrounding locality as listed in **Table 1** but these threatened species have not been previously recorded in the study area.

Records of the species listed in **Table 1** are shown on figures in Section 3.1.4. Unconfirmed records (those which are possible or probable) are not shown on the figures.

Table 1: Threatened Fauna Species Known or Predicted to Occur in the Locality

Scientific Name	Common Name	Conservation Status		Database Records			Previous Survey Records[6]	Previously Recorded in the Study Area
		EPBC Act[1]	BC Act[2]	EPBC Act Protected Matters Search[3]	OEH Atlas of NSW Wildlife[4]	Birdlife Australia[5]		
Litoria booroolongensis	Booroolong Frog	E	E	Predicted	-	-	-	No
Underwoodisaurus sphyrurus (also known as: *Uvidicolus sphyrurus*)	Border Thick-tailed Gecko	V	V	Predicted	●	-	-	No
Aprasia parapulchella	Pink-tailed Legless Lizard	V	V	Predicted	●	-	-	No
Hoplocephalus bitorquatus	Pale-headed Snake	-	V	-	●	-	-	No
Leipoa ocellata	Malleefowl	V	E	Predicted	●	-	-	No
Oxyura australis	Blue-billed Duck	-	V	-	●	-	H	No
Calidris ferruginea	Curlew Sandpiper	CE	E	Predicted	-	-	-	No
Falco hypoleucos	Grey Falcon	-	E	-	●	-	B, C	No
Falco subniger	Black Falcon	-	V	-	●	●	-	No
Erythrotriorchis radiates	Red Goshawk	V	CE	Predicted	-	-	-	No
Lophoictinia isura	Square-tailed Kite	-	V	-	●	-	-	No
Circus assimilis	Spotted Harrier	-	V	-	●	●	A	No
Hieraaetus morphnoides	Little Eagle	-	V	-	●	●	H	Yes
Grus rubicunda	Brolga	-	V	-	●	-	J	No
Rostratula australis	Australian Painted Snipe	E	E	Predicted	●	-	-	No
Calyptorhynchus lathami	Glossy Black-Cockatoo	-	V	-	●	-	A	No
Glossopsitta pusilla	Little Lorikeet	-	V	-	●	●	J, K	No
Neophema pulchella	Turquoise Parrot	-	V	-	●	●	B, H	Yes
Lathamus discolor	Swift Parrot	CE	E	Predicted	●	-	-	No
Tyto novaehollandiae	Masked Owl	-	V	-	●	●	K	No
Ninox connivens	Barking Owl	-	V	-	●	●	J	No
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	-	V	-	●	●	K	No
Chthonicola sagittata	Speckled Warbler	-	V	-	●	●	C, H, I	Yes
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	-	V	-	●	●	-	No
Anthochaera phrygia	Regent Honeyeater	CE	CE	Predicted	●	-	-	No
Grantiella picta	Painted Honeyeater	V	V	Predicted	●	●	J	Yes
Artamus cyanopterus	Dusky Woodswallow	-	V	-	●	●	C, H	No

Table 1 (Continued): Threatened Fauna Species Known or Predicted to Occur in the Locality

Scientific Name	Common Name	Conservation Status		Database Records			Previous Survey Records6	Previously Recorded in the Study Area
		EPBC Act[1]	BC Act[2]	EPBC Act Protected Matters Search[3]	OEH Atlas of NSW Wildlife[4]	Birdlife Australia[5]		
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	-	V	-	●	●	B, H	No
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	-	V	-	●	●	A, B, C, D, E, F, G, H, I, J	Yes
Daphoenositta chrysoptera	Varied Sittella	-	V	-	●	●	C, H	No
Pachycephala inornata	Gilbert's Whistler	-	V	-	-	-	C	No
Stagonopleura guttata	Diamond Firetail	-	V	-	●	●	C, H, I, K	Yes
Dasyurus maculatus maculatus (south-eastern mainland population)	Spotted-tailed Quoll	E	V	Predicted	●	-	-	No
Phascolarctos cinereus	Koala	V	V	Predicted	●	-	J	Yes
Petauroides volans	Greater Glider	V	-	Predicted	-	-	-	No
Petaurus norfolcensis	Squirrel Glider	-	V	-	●	-	H, J	Yes
Petrogale penicillata	Brush-tailed Rock-wallaby	V	E	Predicted	●	-	-	No
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Predicted	-	-	-	No
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	-	V	-	●	-	A, B, C, D, E, F, G, H, I, K*	Yes
Mormopterus lumsdenae	Beccari's Freetail-bat[#]	-	V	-	-	-	B, C	No
Mormopterus norfolkensis	Eastern Freetail-bat	-	V	-	●	-	-	Yes
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	-	V	-	●	-	I*	No
Nyctophilus corbeni	Corben's Long-eared Bat	V	V	Predicted	●	-	B^, D^, E^, G^	No
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Predicted	●	-	I*	Yes

Table 1 (Continued): Threatened Fauna Species Known or Predicted to Occur in the Locality

Scientific Name	Common Name	Conservation Status		Database Records			Previous Survey Records6	Previously Recorded in the Study Area
		EPBC Act[1]	BC Act[2]	EPBC Act Protected Matters Search[3]	OEH Atlas of NSW Wildlife[4]	Birdlife Australia[5]		
Chalinolobus picatus	Little Pied Bat	-	V	-	●	-	A	No
Vespadelus troughtoni	Eastern Cave Bat	-	V	-	●	-	-	No

[#] The Beccari's Free-tailed Bat (*Mormopterus lumsdenae*) is unlikely to occur as the known distribution of this species in NSW does not overlap with the Study area (OEH, 2017b). The survey records are from call recordings not sightings.

^ Bat calls recorded via bat recording devices and this species cannot be identified to species level based on call data alone.

* Bat calls recorded via bat recording devices identified to genus level only and calls could not be distinguished from other potential occurring bat species.

[1] Threatened species status under the EPBC Act (current as at (27 July 2018).

[2] Threatened species status under the BC Act (current as at 27 July 2018)

[3] Department of the Environment and Energy (2017).

[4] Office of Environment and Heritage (2017a).

[5] Birdlife Australia (2015).

[6] Previous survey references:

A = Countrywide Ecological Service (2004).
B = Countrywide Ecological Service (2007b).
C = RPS Harper Somers O'Sullivan (2010).
D = Countrywide Ecological Service (2009a).
E = Countrywide Ecological Service (2009b).
F = Countrywide Ecological Service (2007a).
G = Countrywide Ecological Service (2006).
H = Cenwest Environmental Services (2011).
I = Niche Environment and Heritage (2013).
J = Kendall and Kendall (2011)
K = Parsons Brinkerhoff (2010)

2 Methods

2.1 Literature and Database Review

A literature and database review was undertaken prior to undertaking the field surveys (Section 2.3) to identify known or potentially occurring threatened fauna species or their habitats.

The following databases were reviewed:

- Atlas of NSW Wildlife (OEH, 2017a);
- Protected Matters Search Tool (DEE, 2017); and
- Birdlife Australia (2015).

The following mapping sources were reviewed:

- *SIX Maps Vegetation Viewer* (NSW Land and Property Information, 2015);
- *Border Rivers Gwydir / Namoi Regional Native Vegetation Map Version 2.0* (OEH, 2015); and
- *NSW Planning Viewer* (NSW Department of Planning and Environment [DP&E], 2015).

The following reports for local survey were also reviewed:

- Surveys undertaken for the Canyon Coal Mine (Geoff Cunningham Natural Resource Consultants Pty Ltd, 2004; Countrywide Ecological Service, 2004);
- Monitoring reports undertaken for the Canyon Coal Mine (Geoff Cunningham Natural Resource Consultants Pty Ltd, 2006; 2007; 2008; 2009; 2010; Countrywide Ecological Service, 2006; 2007a; 2009a; 2009b);
- Surveys undertaken for the Approved Mine (Niche Environment and Heritage [Niche], 2013; Cenwest Environmental Services, 2011);
- Surveys undertaken for the Rocglen Coal Mine (formally known as the Belmont Coal Project) (RPS Harper Somers O'Sullivan, 2010; Countrywide Ecological Service, 2007b; 2007c);
- Surveys undertaken for the Boggabri Offset Area (Niche, 2014); and
- Unpublished reports (Kendall and Kendall, 2011).

2.1.1 Surveys Undertaken for the Canyon Coal Mine

Countrywide Ecological Service (2004) undertook a fauna survey of Canyon Coal Mine extension area from 15 to 16 July 2003, and 17 to 20 April 2004. Survey techniques included: bird surveys, pitfall traps, call playback, Elliott traps, hair tubes, diurnal and nocturnal ground searches, targeted area searches, bat surveys, driving spotlighting surveys and secondary evidence.

Countrywide Ecological Service (2004) recorded the Grey Falcon, Spotted Harrier, Glossy Black-Cockatoo, Grey-crowned Babbler (eastern subspecies), Yellow-bellied Sheathtail-bat and Little Pied Bat (**Table 1**).

2.1.2 Monitoring Reports Undertaken for the Canyon Coal Mine

Countrywide Ecological Service (2006; 2007a; 2009a; 2009b) have undertaken annual fauna monitoring of the Canyon Coal Mine rehabilitation area (within the Approved Mine boundary).

Ten permanent fauna survey plots were established and monitored annually for signs of fauna activity. Survey methods included area searches, spotlighting transects, bat surveys, reptile surveys and recording of secondary evidence). Threatened fauna species recorded during the monitoring period included the Grey-crowned Babbler (eastern subspecies) and the Yellow-bellied Sheathtail-bat (**Table 1**).

2.1.3 Surveys Undertaken for the Approved Mine

Cenwest Environmental Services (2011) undertook fauna surveys of the Approved Mine area from 28 March to 2 April 2011 which were complimented by additional fauna surveys conducted by Niche (2013) from 12 to 26 November 2011. Survey techniques included bird surveys, herpetological surveys, pitfall traps, call playback, camera traps, Elliott traps, hair tubes, diurnal and nocturnal ground searches, targeted area searches, bat surveys, spotlighting surveys and secondary evidence.

Cenwest Environmental Services (2011) and Niche (2013) recorded the Blue-billed Duck, Little Eagle, Turquoise Parrot, Speckled Warbler, Hooded Robin (south-eastern form) Grey-crowned Babbler (eastern subspecies), Varied Sittella, Diamond Firetail, Squirrel Glider, Yellow-bellied Sheathtail-bat and the Large-eared Pied Bat (**Table 1**).

2.1.4 Surveys Undertaken for the Rocglen Coal Mine

Countrywide Ecological Service (2007b) conducted fauna surveys over the area from 10 to 14 December 2001; 11 to 14 July 2002; 19 to 22 September 2002; 28 October to 2 November 2006; and 21 to 22 March 2007. In addition, RPS Harper Somers O'Sullivan (2010) conducted fauna surveys of the Rocglen Coal Mine area from 8 to 12 February 2010.

Survey techniques consisted of bird surveys, herpetological surveys, pitfall traps, call playback, camera traps, Elliott traps, hair tubes, diurnal and nocturnal ground searches, targeted area searches, bat surveys, spotlighting surveys and secondary evidence (Countrywide Ecological Service, 2007b; 2007c; RPS Harper Somers O'Sullivan, 2010).

Countrywide Ecological Service (2007b) and RPS Harper Somers O'Sullivan (2010) recorded the Grey Falcon, Turquoise Parrot, Speckled Warbler, Grey-crowned Babbler (eastern subspecies), Varied Sittella, Gilbert's Whistler, Diamond Firetail, Hooded Robin (south-eastern form), Yellow-bellied Sheathtail-bat and the Beccari's Freetail-bat (**Table 1**).

2.1.5 Surveys Undertaken for the Boggabri Offset Area

Niche (2014) prepared an independent audit of the Biodiversity Offset Areas for the Boggabri Coal Mine. Fauna surveys were conducted from 5 to 12 November 2013.

Vegetation mapping field validation was undertaken, along with the collection of fauna habitat data (e.g. presence of tree hollows) to determine the suitability of the offset area to the Boggabri Coal Mine disturbance area. The fieldwork verified the suitability of the offset area to provide potential habitat for the Regent Honeyeater, Swift Parrot and Corben's Long-eared Bat.

No threatened fauna species were detected during any of these surveys.

2.1.6 Unpublished Reports

Kendall and Kendall (2011) conducted fauna surveys to the south of the study area from 3 to 4 February 2011, 9 to 14 March 2011 and 19 to 26 October 2011. A range of survey techniques were implemented to survey for threatened species with the report concluding that the survey techniques implemented along with opportunistic observations provides a comprehensive effort enabling achievement of a general baseline terrestrial fauna survey.

Threatened fauna species recorded by Kendall and Kendall (2011) include the Barking Owl, Brolga, Grey-crowned Babbler (eastern subspecies), Painted Honeyeater, Little Lorikeet, Koala and Squirrel Glider (**Table 1**).

2.2 Relevant Survey Guidelines

Relevant guidelines that were followed during fauna surveys are as follows:

- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft)* (Department of Environment and Conservation, 2004).
- *Threatened Species Survey and Assessment Guidelines: Field Survey Methods For Fauna – Amphibians* (DECC, 2009).
- *Survey Guidelines for Australia's Threatened Frogs* (DEWHA, 2010a).
- *Survey Guidelines for Australia's Threatened Bats* (DEWHA, 2010b).
- *Survey Guidelines for Australia's Threatened Birds* (DEWHA, 2010c).
- *Survey Guidelines for Australia's Threatened Mammals* (SEWPaC, 2011a).
- *Survey Guidelines for Australia's Threatened Reptiles* (SEWPaC, 2011b).
- *Hygiene Protocol for The Control of Disease in Frogs. Information Circular Number 6* (DECC, 2008).

2.3 Field Survey

2.3.1 Weather, Climate and Astronomical Conditions

Fauna surveys took place in three separate periods:

1. October 2015 from the afternoon of 14 October to mid-morning of the 20 October;
2. February 2016 from the morning of 8 February to early morning of 13 February; and
3. August 2017 from the morning of 23 August to late afternoon of 24 August.

Rainfall and temperature records during the surveys were taken from the Approved Mine Automatic Weather Station.

It can be seen that during the October surveys, the temperatures ranged from a minimum of just over 14 degrees Celsius (°C) to a maximum of just under 33°C; temperatures during the February surveys ranged from just over 16°C to just under 35°C; and temperatures during the August 2017 surveys ranged from 23.5°C to just under 4°C (**Table 2**). No rain fell during any survey period (**Table 2**).

Table 2: Weather Records during Survey Period

Date	Minimum Temperature (°C)	Maximum Temperature (°C)	Rainfall (mm)
14/10/2015	16.8	29.7	0
15/10/2015	17.8	29.1	0
16/10/2015	15.9	30.2	0
17/10/2015	16.1	32.7	0
18/10/2015	20.1	29.1	0
19/10/2015	14.7	29.7	0
20/10/2015	15.3	31	0
8/02/2016	17.1	32.9	0
9/02/2016	17.3	31.9	0
10/02/2016	17.7	32.2	0
11/02/2016	16.1	35.1	0
12/02/2016	20.5	33.9	0
13/02/2016	18.6	34.9	0
23/8/2017	3.4	23.5	0
24/8/2017	3.7	20.0	0

Source: Whitehaven (2017).

2.3.2 Techniques

Stratification of the study area and site selection

The study area was initially assessed through interpretation of digital aerial imagery and from literature generated from previous studies. The landscape is mostly cleared agricultural lands and therefore remnant patches of vegetation within the study area were used as a basis for the initial stratification. Further stratification considered previous threatened and/or protected migratory fauna records within the study area and the spacing of survey sites.

Ten survey sites were initially selected for the October 2015 survey period including one site (Site 4) within Vickery State Forest. Some of the survey sites (Sites 2, 4, 5, 9) had been previously surveyed by Cenwest Environmental Services (2011) and/or Niche (2013). **Table 3** and **Figure 3a** provide additional detail on these sites.

The initial 10 survey sites were located in the field and then surveyed by vehicle and on foot. A further two survey sites were selected during field survey (Sites 11 and 12) as they appeared to contain different vegetation communities than the initial 10 sites and/or they contained specific habitats or fauna observations which warranted selection (**Table 3; Figure 3a**).

Site 7 which was initially selected due to some nearby previous NSW Wildlife Atlas records of the threatened Squirrel Glider (*Petaurus norfolcensis*) (OEH, 2017a), however, was found during field survey to be a mainly cleared landscape with rural buildings, a few scattered trees, no shrub layer and poor connectivity. As such, Site 7 received lesser sampling effort (including a nocturnal inspection of an old rural building for roosting microbats).

Site 8 was extended to the west to include the banks of the nearby Namoi River which contained good potential threatened fauna habitat including old River Red Gums with hollows.

A similar approach was taken when selecting sites to survey along the rail spur investigation corridor in February 2016 and August 2017 (**Table 3; Figure 3b**). Four additional sites were surveyed in February 2016 and six additional sites in August 2017 including the proposed Namoi River crossing and an additional small area associated with the main mine site (**Figures 3a and 3b**).

Table 3: Fauna Survey Sites for the Study Area (October 2015, February 2016, January 2017)

Site	Location (Lat/Long GDA)	Estimated Size of Treed Veg Remnant (ha)	Survey Period
1	30^{0}44'22"S 150^{0}10'12"E	16	October 2015
2	30^{0}44'40"S 150^{0}11'23"E	9	October 2015
3	30^{0}45'27"S 150^{0}12'41"E	>100*	October 2015
4	30^{0}46'14"S 150^{0}12'58"E	>100*	October 2015
5	30^{0}47'32"S, 150^{0}13'04"E	7	October 2015
6	30^{0}47'19"S, 150^{0}11'07"E	18	October 2015
7	30^{0}47'40"E 150^{0}10'25"E	3	October 2015
8	30^{0}47'03"S, 150^{0}10'11"E	40	October 2015
9	30^{0}45'33"S, 150^{0}09'31"E	24	October 2015
10	30^{0}44'29"S, 150^{0}11'46"E	13	October 2015
11	30^{0}44'29"S, 150^{0}11'46"E	7	October 2015
12	30^{0}46'59"S 150^{0}11'20"E	4	October 2015
14	30^{0}42'12"S 150^{0}09'59"E	17	February 2016
15	30^{0}45'50"S 150^{0}09'15"E	67	February 2016
16	30^{0}48'51"S 150^{0}09'33"E	54	February 2016
17	30^{0}49'09"S 150^{0}08'57"E	13	February 2016
18	30^{0}48'50"S 150^{0}08'14"E	0^	August 2017
19	30^{0}48'49"S 150^{0}07'59"E	34#	August 2017
20	30^{0}48'56"S 150^{0}07'30"E	1	August 2017
21	30^{0}48'48"S 150^{0}06'38"E	5	August 2017
22	30^{0}50'13"S 150^{0}04'20"E	0^	August 2017
23	30^{0}47'49"S 150^{0}12'39"E	0^	August 2017

* Sites 3 and 4 are connected to Vickery State Forest.

^ Vegetation remnant size cannot be estimated as these sites are mostly cleared land with few or no scattered trees

Site 19 is well connected to a larger remnant that extends north outside of study area

Habitat Surveys

Fauna habitat searches were conducted for potential foraging, roosting, breeding or nesting habitat of nocturnal and diurnal species. This includes inspection for the presence of tree hollows, stags, bird nests, possum dreys, decorticating bark, rock shelters, rock outcrops/crevices, mature/old growth trees, food trees (*Banksia* spp., *Allocasuarina spp*., and winter-flowering eucalypts), culverts, dens, dams, riparian areas and refuge habitats of man-made structures.

The quality of the fauna habitat was assessed and categorised (low, medium or high) by the presence or absence of components of the ecosystems used by different fauna groups, e.g. large hollow bearing trees for hollow dependent species, presence of understorey and composition of understorey for reptile, mammals and woodland birds.

One or more photos representing the habitat types on each site were taken at the beginning of the first survey of each of the sites. The structure of the canopy, shrub cover and ground cover was recorded for each site along with up to five of the most abundant plant species for each vegetation layer. Fauna habitat types were characterised in the study area in consideration of the vegetation mapping undertaken by FloraSearch (2018).

Habitat data was gathered by FloraSearch (2018) for the Flora Baseline Report and BARBOS (Resource Strategies, 2018).

Diurnal Bird Survey

Diurnal bird surveys were carried out at each site as follows:

- Sites 1 to 12 from the 14th to the 20th of October 2015;
- Sites 14 to 17 from the 8th to the 12th February 2016; and
- Sites 18 to 23 from the 23rd to the 24th August 2017.

Each site (except for Site 7 which is located in cleared agricultural land) was surveyed using a 500 metre (m) area search around a central point.

Diurnal bird surveys were conducted in four survey timing blocks as follows:

- 6:00 to 10:00.
- 10:00 to 14:00.
- 14:00 to 18:00.
- >18:00.

Survey sites that were very open, poorly connected and simple in structure were surveyed for less time (a minimum of 0.5 hours) so that survey effort could be concentrated on survey sites that were structurally more diverse and less isolated as these sites were more likely to support threatened bird species (a maximum of 11.99 hours). Similarly those sites that provided the best bird habitat potential were surveyed at prime detection times being 6:00 to 10:00 and > 18:00. The >18:00 survey block extended into nocturnal surveys at some sites.

No nocturnal surveys were conducted during the August 2017 survey period.

Owl pellets were searched for under some hollow-bearing trees with hollows large enough to accommodate species.

Ground Elliott Trapping

Elliott traps targeting small to medium sized ground-dwelling mammals were set out for a minimum of three consecutive nights in October 2015 and February 2016. A total of 25 “A” Elliott traps (measuring 33 centimetres (cm) x 10 cm x 9 cm) were placed at Sites 4, 9, and 10; 19 traps at Site 15 and 20 traps at Site 16. . A total of ten “B” Elliott traps (15 cm x 15 cm x 56 cm) were placed at Site 9 and nine at Site 10. Traps were placed at approximately 10-20 m spacing.

No ground trapping was carried out in August 2017 as the two previous survey events had achieved only limited captures (<5) and no native species.

Trap lines typically traversed areas of diverse vegetation or habitat features as identified from the habitat search as likely areas to support the target mammal. Each trap was baited with a standard bait mix of peanut butter, honey and rolled oat balls. Elliott A traps at Site 14 were baited with peanut butter, honey, molasses, rolled oats, vanilla essence, almond essence and fish sauce.

In order to provide shade and shelter, all traps were covered with plastic and shade material and placed in a shady or sheltered position (e.g. beneath logs). Dry bedding material (leaves or coconut husk) was placed in each trap. Traps were checked early each morning for captures, with any captured animals identified and immediately released.

Arboreal Elliott Trapping

Elliott traps targeting arboreal species identified from the literature review, namely the Squirrel Glider (*Petaurus norfolcensis*), were placed in habitat with large trees, a midstorey and vegetated ground cover.

Ten “B” Elliott traps (15 cm x 15 cm x 56 cm) were deployed at Sites 4, 8 to 11, and 14 to 17. The traps were placed greater than two meters off the ground on a platform fixed to the trunk of the tree at approximately 30-50 m spacing.

No arboreal trapping was carried out in August 2017 as the two previous survey events had achieved only limited captures (<5) and no native species.

All traps for the October 2015 survey were baited with a standard mixture of peanut butter, honey, rolled oat and sardines. All traps for the February 2016 surveys were baited with peanut butter, honey, molasses, rolled oats, vanilla essence, almond essence and fish sauce.

Dry bedding material (leaves or coconut husk) was placed in each Elliott trap and the traps were covered in plastic bags if wet weather threatened. Traps were checked early each morning for captures, with any captured animals identified and immediately released.

Cage Trapping

Cage traps targeting medium mammals were deployed at Sites 4, 9, and 14 to 16, in areas of suitable habitat containing habitat features such as fallen hollow logs, near sources of water and deep drainage lines.

Cages were Mascot steel traps measuring 20 cm x 20 cm x 56 cm with a 12.5 x 50 mm mesh. Cages were baited with chicken carcasses and or sardines. Cages were deployed at each relevant site for 3 nights as follows:

- 5 cages at Site 4;
- 2 cages at Site 9, 15 and 16;and
- 1 cage at Site 14.

No cage trapping was carried out in August 2017 as the two previous survey events had achieved only limited captures (<5).

Hair Tubes

Hair tube surveys, targeting small to medium-sized arboreal and terrestrial mammals, were deployed for three to six consecutive evenings depending on the site:

- Site 3 – 19 tubes over 3 nights.
- Site 4 – 10 tubes over 3 nights.
- Site 10 – 20 tubes over 5 nights.
- Sites 11 and 16 – 20 tubes over 4 nights.
- Site 14 and 15 – 20 tubes over 3 nights.
- Site 17 – 10 tubes over 4 nights.

Five sizes of hair tubes were used, 90 mm diameter (large), 50 mm diameter (small), 40 mm diameter (extra small), 30 mm diameter (extra extra small) and Faunatech funnels. Double-sided tape is placed at the entrance on the upper side of the tube to collect hairs of animals attracted to the bait.

Hair tubes were mostly set on the ground at Sites 3, 4, 10 and 11, however at least two tubes at each of these sites were fixed onto the trunk of a tree with grey duct tape, at a height approximately 1.5 m above the ground.

At Sites 14 and 16 all hair tubes were fixed onto the trunk of a tree or on the platforms used for the arboreal Elliott B traps.

No hair tube trapping was carried out during the August 2017 survey period.

All tubes for the October 2015 survey were baited with a standard mixture of peanut butter, honey, rolled oat and sardines. All tubes for the February 2016 and January 2017 surveys were baited with peanut butter, honey, molasses, rolled oats, vanilla essence, almond essence and fish sauce.

Hairs collected were sent to an expert in hair analysis (Barbara Triggs, Genoa Victoria) for analysis.

Camera Trapping

Wildlife cameras were deployed in areas of suitable habitat on visible runways and/or around water sources where present. Several types of cameras were used including Scout Guard SG562C White Flash, Scout Guard SG570-10mHD, Scout Guard SG550V, Reconyx HC600, Reconyx PC850, Reconyx PC900 and Reconyx PC90.

The Reconyx models take still photographs only while the Scoutguard models used can be set to take either still photographs or short video sequences.

Cameras were deployed as follows:

- Site 4: 5 cameras placed for 3 nights (2 Reconyx PC850 and 3 Reconyx PC900).
- Site 8: 2 cameras placed for 3 nights (1 Reconyx PC850 and 1 Reconyx PC900).
- Sites 9, 14 and 18: 1 camera placed for 3 nights (Reconyx PC900).
- Site 15: 3 cameras for 3 nights (Scoutguard SG550V: 1 camera in video mode and 2 cameras in still photograph mode).
- Site 16: 2 cameras placed for 3 nights (Scoutguard SG550V: 1 camera in video mode and other in still photograph mode).

Cameras were either deployed horizontally (Sites 4, 8, 9 and 18) or vertically (Sites 14 and 15). At Site 16 cameras were deployed horizontally and vertically.

No camera trapping was carried out during the August 2017 survey period.

Camera locations were baited with a lure of sardines, chicken necks and/or hair tubes baited with peanut butter, honey, molasses, rolled oats, vanilla essence, almond essence and fish sauce or were used in conjunction with a cage trap baited with chicken carcasses and or sardines to record any animal investigations.

The use of camera traps is an additional survey technique to those described in DEC (2004).

Harp Trapping

Harp trapping for insectivorous bats was carried out at Sites 4, 9, 14 to 16 for a minimum of two consecutive nights and were inspected for captures early each morning.

Harp traps were set at the above sites due to the availability of suitable habitat for trapping being potential flyways that insectivorous bats would use for foraging and moving through areas that are vegetated.

Ultrasonic detection was also employed and covered most of the other survey sites during the first two survey periods.

No harp trapping was carried out during the August 2017 survey period.

Any captured bats are identified to species level and either released immediately or held through the day and released after sunset. Care was taken not to release bats during the day to reduce the potential exposure to predatory birds.

Nocturnal Call Playback

The playback of pre-recorded calls of threatened nocturnal species was carried out at dusk or after dark on at least one night at Sites 1, 3 to 6, 8, 9, 11, and 14 to 16, using digital mp3 players coupled to loudhailers or portable speakers.

No nocturnal playback was carried out during the August 2017 survey period.

After an initial listening period of ten minutes, each call was played (for a total of five minutes, followed by a five minute listening period, with the last listening period followed by ten minutes of spotlighting.

Species targeted were the Koala, Squirrel Glider, Masked Owl, Barking Owl and Bush Stone-curlew. Any fauna responding were identified either by characteristic call or direct observation using spotlights.

Spotlighting

Spotlighting was undertaken at all survey sites (except Site 12 and Sites 18 to 23) on at least one occasion for all fauna groups, particularly arboreal mammals. Spotlighting was conducted on foot by two observers using powerful LED hand-held torches (2600 lumens), head torches and 50-Watt hand-held spotlights powered by 12-volt batteries.

Koala Scat Searches

Three preferred food species listed in NSW State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) Schedule 2 Koala feed trees occur in the study area, namely the River Red Gum (*Eucalyptus camaldulensis*), which was recorded within the riparian zone of the Namoi river (near Site 8 and at Sites A to D), White Box (*E. albens*) which was present predominately on the more hilly sites, and Poplar Box (*E. populnea*) which was also present within most of the woodland areas although more common on the flatter sites.

Additional Koala food species to that scheduled in SEPP 44 as listed in the *NSW State Recovery Plan for the Koala* (DECC, 2008). According to the DECC (2008), the Project is located within the Western Slopes and Plains Koala Management Area where the primary food tree species include River Red Gum (*E. camaldulensis*) and Coolabah (*E. coolabah*).

Koala scat searches were undertaken at Sites 8 and 16 along the eastern bank of the Namoi River generally as per the Spot Assessment Technique (Phillips and Callaghan, 2011). This involved a thorough search for koala scats in litter within 1 m of the base of 10 River Red Gum trees closest to the nominated centre of the scat survey site. Each tree base was searched for scats for around 2 minutes and any scats observed were collected and later sent to expert Barbara Triggs (Genoa, Victoria) for species verification. Only trees with a diameter at breast height of 10 cm or greater were searched.

Ultrasonic Bat Detection - Anabat

Electronic detectors were used to collect ultrasonic calls of microbat species. Detectors used included: Anabat SD1, SD2 and Express detectors (Titley Scientific, Brisbane QLD), and SMBAT2+ Songmeters (Wildlife Acoustics, Maynard, MA, USA). During the October 2015 surveys detectors were used both statically (i.e. set and left in one location overnight) and actively (carried around) when undertaking nocturnal searches. During the February 2016 survey detectors were only used statically.

For static recording detectors used were placed in an area of habitat, left for a minimum of two nights, placed at ground level or off the ground aiming along potential microbat flyways that microbats use to forage and navigate their way through woodland areas. For active recording Anabats were carried when spotlighting surveys were undertaken recording as the surveyor passes through habitat.

In addition, a hand-held Anabat SD2 was used to help determine if an old rural building (a cookhouse) at Site 7 was being used a roost.

Electronic bat call recording units were deployed as follows:

- Sites 1, 2, 5, 6 and 11: 1 unit deployed for 1 night.
- Sites 3, 8, and 14 to 17: 1 unit for 2 nights.
- Sites 4, 9 and 10: 1 unit for 3 nights.
- Site 7: 1 unit for part 1 night.

No ultrasonic detection was carried out during the August 2017 survey period.

Habitat Searches for Reptiles and Amphibians

Habitat searches were undertaken at the following survey sites for at least 30 minutes over two separate days or nights as follows:

- Sites 1, 4, 6, 9 and 10: 1 diurnal and 1 nocturnal search;
- Sites 2, 5, 7, 11 and 12: 1 diurnal search;
- Sites 3 and 14 to 17: 2 diurnal and 1 nocturnal search;
- Site 8: 1 diurnal and 2 nocturnal searches;

Active searches extending to areas in the vicinity of the each survey site were also undertaken.

No habitat searches for reptiles and amphibians were carried out during the August 2017 survey period.

Habitat searches were conducted at selected/preferred sites located at representative habitat components across the site; potential shelter, refuge, foraging, over-wintering and breeding microhabitat features habitat across the range of potential species identified and searched for. This includes inspection of ground logs/timber, surface rock, rock shelters, rock outcrops/crevices, decorticating bark, mature/old growth trees and stags with accessible crevices/fissures/hollows, culverts, dams, riparian zones (ponded sections of creeks and creek banks), soaks and man-made refuge habitats, where present, at each survey site.

Further opportunistic searches including searches of other suitable microhabitat features encountered whilst traversing between survey plots – this approach targeted species known to have specific habitat/micro-habitat preferences not apparent within the survey plots chosen. Similarly, during road/track traverses (diurnal and nocturnal) scans were made for species that were active or more active at certain times of the day.

The October 2015 and February 2016 surveys were undertaken by two experienced herpetologists with over 60 years in combined experience.

Surveys for frogs undertaken utilising an appropriate Frog Hygiene protocol devised for the survey in accordance with/applying the OEH Frog Hygiene Protocol (DECC, 2008b).

Tadpole Surveys

Where suitable habitat in the form of water bodies was present searches were conducted for tadpoles. Any tadpoles observed would be caught in a small net and then identified using Nasties (2013).

Opportunistic Observations

All fauna observed or heard opportunistically during the field surveys (including travelling between sites in the broader area) were recorded. Characteristic signs, tracks, trails and other indirect evidence of fauna species from all fauna groups were also recorded. Any observed predator scats and/or owl pellets containing bone and fur material were collected and sent for analysis to expert Barbara Triggs (Genoa, VIC).

2.3.3 Effort

Table 4 provides a summary of the survey techniques and effort employed at each of the survey sites.

The Project is a State Significant Development under the EP&A Act and the NSW *Biodiversity Offset Policy for Major Projects* (OEH, 2014) applies to the Project. This report provides the results of threatened fauna species targeted surveys to inform the Project BARBOS (Resource Strategies, 2018).

2.3.4 Nomenclature

Primary sources of literature accessed for nomenclature includes:

- Birds - *Systematics and Taxonomy of Australian Birds* (Christakis and Boles, 2008);
- Mammals - *The Mammals of Australia, Third Edition*, (Van Duck and Strahan, 2008);
- Bats - *Australian Bats, Second Edition*, (Churchill, 2009) and *A current taxonomic list of Australian Chiropteran* (Reardon, Armstrong, and Jackson, 2015); and
- Amphibians/Reptiles - *Reptiles and Amphibians of Australia, Seventh Edition*, (Cogger, 2014).

Table 4: Summary of Survey Techniques Used at Each Site within the Study Area

Site	Location (Lat/Long GDA)	Approx. Size of Treed Veg Remnant (ha)	Habitat Survey	Diurnal Bird Survey	Ground "A" Elliott Trapping (small)	Ground "B"Elliott Trapping (large)	Arboreal "B" Elliott Trapping	Cage Trapping	Hair Tubes	Camera Trapping	Harp Trapping	Nocturnal Call Playback	Spotlighting	Koala Scat Searches	Ultrasonic Bat Detection - Anabat	Habitat Searches for Reptiles
1	30^{0}44'22"S 150^{0}10'12"E	16	2	1.25	-	-	-	-	-	-	-	1	1.5	-	1 unit 1 night	4.67
2	30^{0}44'40"S 150^{0}11'23"E	9	2	7.25	-	-	-	-	-	-	-	-	2	-	1 unit 1 night	1
3	30^{0}45'27"S 150^{0}12'41"E	>100*	2	2.5	-	-	-	-	19 tubes 3 nights	-	-	2	3.5	-	1 unit 2 nights	4
4	30^{0}46'14"S 150^{0}12'58"E	>100*	2	8.75	25 traps 3 nights	-	10 traps 3 nights	5 traps 3 nights	10 tubes 3 nights	5 cameras 3 nights	3 traps 3 nights	2	2	-	1 unit 3 nights	1.83
5	30^{0}47'32"S, 150^{0}13'04"E	7	2	1.67	-	-	-	-	-	-	-	1	2	-	1 unit 1 night	1.5
6	30^{0}47'19"S, 150^{0}11'07"E	18	2	1.67	-	-	-	-	-	-	-	1	4.5	-	1 unit 1 night	4.33
7	30^{0}47'40"E 150^{0}10'25"E	3	2	0	-	-	-	-	-	-	-	-	1.5	-	1 unit part night	2.67
8	30^{0}47'03"S, 150^{0}10'11"E	40	2	7.17	-	-	10 traps 3 nights	-	-	2 cameras 3 nights	-	2	4	0.5	1 unit 2 nights	7.17
9	30^{0}45'33"S, 150^{0}09'31"E	24	2	9.87	25 traps 3 nights	10 traps 3 nights	10 traps 3 nights	2 traps 3 nights	-	1 camera 3 nights	1 trap 3 nights	1	4	-	1 unit 3 nights	1.83
10	30^{0}44'29"S, 150^{0}11'46"E	13	2	7.43	25 traps 3 nights	9 traps 3 nights	10 traps 3 nights	-	20 tubes 5 nights	-	-	-	3	-	1 unit 3 nights	3.83
11	30^{0}44'29"S, 150^{0}11'46"E	7	2	2.7	-	-	10 traps 3 nights	-	20 tubes 4 nights	-	-	1	2	-	1 unit 1 night	3.33
12	30^{0}46'59"S 150^{0}11'20"E	4	2	1.37	-	-	-	-	-	-	-	-	-	-		1.83

Table 4 (Continued): Summary of Survey Techniques Used at Each Site within the Study Area

Site	Location (Lat/Long GDA)	Approx. Size of Treed Veg Remnant (ha)	Habitat Survey	Diurnal Bird Survey	Ground "A" Elliott Trapping (small)	Ground "B"Elliott Trapping (large)	Arboreal "B" Elliott Trapping	Cage Trapping	Hair Tubes	Camera Trapping	Harp Trapping	Nocturnal Call Playback	Spotlighting	Koala Scat Searches	Ultrasonic Bat Detection - Anabat	Habitat Searches for Reptiles
14	30^{0}42'12"S 150^{0}09'59"E	17	2	4.75	-	-	10 traps 3 nights	1 cage 3 nights	20 tubes 3 nights	1 camera 3 nights	1 harp trap 2 nights	1	2	-	1 unit 2 nights	3.5
15	30^{0}45'50"S 150^{0}09'15"E	67	2	11.99	19 traps 3 night	-	10 traps 3 nights	2 cages 3 nights	20 tubes 3 nights	3 cameras 3 nights	1 harp trap 2 nights	1	3	-	1 unit 2 nights	5.67
16	30^{0}48'51"S 150^{0}09'33"E	54	2	10.5	20 traps 3 nights	-	10 traps 3 nights	2 cages 3 nights	20 tubes 4 nights	2 cameras 3 nights	1 harp trap 2 nights	1	3	0.5	1 unit 2 nights	5.33
17	30^{0}49'09"S 150^{0}08'57"E	13	2	5.17	-	-	10 traps 3 nights	-	10 tubes 4 nights	-	-	-	3	-	1 unit 2 nights	4.5
18	30^{0}48'50"S 150^{0}08'14"E	0^	0.5	0.5	-	-	-	-	-	-	-	-	-	-	-	-
19	30^{0}48'49"S 150^{0}07'59"E	34#	0.5	0.5	-	-	-	-	-	-	-	-	-	-	-	-
20	30^{0}48'56"S 150^{0}07'30"E	1	0.5	0.5	-	-	-	-	-	-	-	-	-	-	-	-
21	30^{0}48'48"S 150^{0}06'38"E	5	0.5	0.5	-	-	-	-	-	-	-	-	-	-	-	-
22	30^{0}50'13"S 150^{0}04'20"E	0^	1	4	-	-	-	-	-	-	-	-	-	-	-	-
23	30^{0}47'49"S 150^{0}12'39"E	0^	1	4.5	-	-	-	-	-	-	-	-	-	-	-	-
Total			36 hrs	93.53 hrs	492 trap nights	57 trap nights	270 trap nights	36 trap nights	507 trap nights	42 trap nights	18 trap nights	14 hrs	41 hrs	1 hr	26.5 hrs	56.99 hrs

* Sites 3 and 4 are connected to Vickery State Forest.

^ Vegetation remnant size cannot be estimated as these sites are mostly cleared land with few or no scattered trees

Site 19 is well connected to a larger remnant that extends north outside of study area

2.3.5 Targeted Searches for Threatened Fauna

Threatened fauna species listed under the BC Act and/or EPBC Act which are known or likely to occur in the study area were specifically targeted during the surveys. Threatened fauna species were targeted in accordance with the survey timing, techniques and effort described within the relevant survey guidelines listed in Section 2.2.

Table 5 provides a list of threatened fauna species specifically targeted during the surveys (although the surveys were designed to obtain an inventory of all native and introduced fauna species present not only the threatened species listed in **Table 5**). The threatened fauna species known or predicted to occur in the locality (Table 1) were targeted and are therefore listed in **Table 5**.

In addition to the species in **Table 1**, the surveys also targeted the following threatened species that may occur in the Liverpool Plains (Part B) CMA Subregion but have not been previously recorded, or predicted to occur, in the locality (**Table 5**):

- Freckled Duck (*Stictonetta naevosa*);
- Magpie Goose (*Anseranas semipalmata*);
- Black-breasted Buzzard (*Hamirostra melanosternon*);
- Black-necked Stork (*Ephippiorhynchus asiaticus*);
- Australian Bustard (*Ardeotis australis*);
- Bush Stone-Curlew (*Burhinus grallarius*);
- Scarlet Robin (*Petroica boodang*);
- Brush-tailed Phascogale (*Phascogale tapoatafa*);
- Stripe-faced Dunnart (*Sminthopsis macroura*);
- Eastern Pygmy-possum (*Cercartetus nanus*);
- Rufous Bettong (*Aepyprymnus rufescens*); and
- Black-striped Wallaby (*Macropus dorsalis*).

Migratory species under the EPBC Act were also targeted such as (DEE, 2017):

- Great Egret (*Ardea modesta*);
- Cattle Egret (*Ardea ibis*);
- Osprey (*Pandion cristatus*);
- Latham's Snipe, Japanese Snipe (*Gallinago hardwickii*);
- Fork-tailed Swift (*Apus pacificus*);
- White-throated Needletail (*Hirundapus caudacutus*);
- Rainbow Bee-eater (*Merops ornatus*);
- Rufous Fantail (*Rhipidura rufifrons*);
- Satin Flycatcher (*Myiagra cyanoleuca*); and
- Yellow Wagtail (*Motacilla flava*).

The fauna surveys were conducted in October, February and January and therefore outside the detection period for the Swift Parrot (i.e. March to July [DEWHA, 2010c]) which is a migrant to NSW from Tasmania. As detailed in Section 2.1, previous fauna surveys undertaken within the locality have been within the detection period for the Swift Parrot, including:

- Countrywide Ecological Service (2004, 2007b);
- Cenwest Environmental Services (2011); and
- Kendall and Kendall (2011).

Despite these surveys, the Swift Parrot has not been recorded within the locality. In addition to the species listed in **Table 5**, Niche (2013) considered that there was a moderate likelihood of the Powerful Owl and Superb Parrot occurring in the locality, however, neither of these species have been recorded nearby (despite targeted surveys), there are few NSW Wildlife Atlas records within the broader region (i.e. Gunnedah and Narrabri LGAs) and there is a low likelihood of occurrence if any.

Table 5: Targeted Searches for Conservation Significant Fauna Species

Scientific Name	Common Name	Conservation Status[1]		Survey Guideline Requirements	Survey Techniques and Effort undertaken by Future Ecology
		EPBC Act	BC Act		
Litoria booroolongensis	Booroolong Frog	E	E	Using a combination of tadpole surveys, call surveys and nocturnal searches between December-February (DECC, 2009; DEWHA, 2010a). Diurnal searches along rocky streams may also be useful, particularly in summer (DECC, 2009; DEWHA, 2010a).	Potential habitat for this species (i.e. rocky streams) is not present within the study area and the nearest database record is approximately 60 km north of the study area. The Namoi River is the only permanent watercourse in the study area. Diurnal habitat searches, spotlighting searches and tadpole surveys were undertaken at the Namoi River (Sites 8 and 16) in the recommended survey timing (Section 2.2). Call playback was not considered necessary given rocky streams are not present within the study area.
Underwoodisaurus sphyrurus (also known as: *Uvidicolus sphyrurus*)	Border Thick-tailed Gecko	V	V	Diurnal habitat searches and spotlighting in the first three hours of darkness between November and February (SEWPaC, 2011b). The *BioNet Threatened Species Profile Database* (OEH, 2017b) indicates that this species can be surveyed at any time of year.	Diurnal habitat searches for reptiles (which included the overturning of rocks) were undertaken at each survey site for at least 30 minutes over two separate days (except Sites 18 to 23). Spotlighting was also undertaken at all sites, except Site 12 and Sites 18 to 23). The survey timing (October and February) was considered suitable because of the warm weather conditions experienced during the survey periods. In addition, there are no rocky areas (in which this species is usually associated).
Hoplocephalus bitorquatus	Pale-headed Snake	-	V	No species specific requirement defined. Diurnal habitat searches for reptiles would be appropriate for this species. The *BioNet Threatened Species Profile Database* (OEH, 2017b) indicates that this species can be surveyed between October and April (inclusive).	Diurnal and nocturnal habitat searches for reptiles (which targeted woodland habitat in close proximity to watercourses) were undertaken at each survey site for at least 30 minutes over two separate days/nights (except Sites 18 to 23). Spotlighting was also undertaken at all sites, except Site 12 and Sites 18 to 23). The survey timing (October and February) was within the recommended survey period.
Aprasia parapulchella	Pink-tailed Legless Lizard	V	V	Diurnal habitat searches (which included the overturning of rocks) in spring and early summer (SEWPaC, 2011b). The *BioNet Threatened Species Profile Database* (OEH, 2017b) indicates that this species can be surveyed between September and February (inclusive).	Diurnal habitat searches for reptiles (which included the overturning of rocks) were undertaken at each survey site for at least 30 minutes over two separate days (except Sites 18 to 23). Spotlighting was also undertaken at all sites, except Site 12 and Sites 18 to 23). The survey timing (October and February)was within the recommended survey period.

Table 5 (Continued): Targeted Searches for Conservation Significant Fauna Species

Scientific Name	Common Name	Conservation Status[1]		Survey Guideline Requirements	Survey Techniques and Effort undertaken by Future Ecology
		EPBC Act	BC Act		
Leipoa ocellata	Malleefowl	V	E	Area searches in suitable habitat for active mounds, tracks and sightings (DEWHA, 2010c).	Habitat surveys (to identify potential mounds and tracks) and diurnal bird surveys were undertaken. Potential habitat for this species (i.e. mallee or woodlands with heavy understorey) is not present within the study area and the nearest database record is approximately 30 km south-west of the study area.
Stictonetta naevosa	Freckled Duck	-	V	No species specific requirement defined. Diurnal bird surveys would be appropriate for these species.	Diurnal bird surveys were undertaken in areas of suitable habitat..
Oxyura australis	Blue-billed Duck	-	V		
Anseranas semipalmata	Magpie Goose	-	V		
Falco hypoleucos	Grey Falcon	-	E	No species specific requirement defined. Diurnal bird surveys within woodland habitat in close proximity to watercourses would be appropriate for this species.	Diurnal bird surveys (which targeted woodland habitat in close proximity to watercourses) were undertaken.
Falco subniger	Black Falcon	-	V	No species specific requirement defined. Diurnal bird surveys would be appropriate for these species.	Diurnal bird surveys were undertaken.
Lophoictinia isura	Square-tailed Kite	-	V		
Circus assimilis	Spotted Harrier	-	V		
Hamirostra melanosternon	Black-breasted Buzzard	-	V	No species specific requirement defined. Diurnal bird surveys within woodland habitat in close proximity to watercourses would be appropriate for this species.	Diurnal bird surveys (which targeted woodland habitat in close proximity to watercourses) were undertaken.
Hieraaetus morphnoides	Little Eagle	-	V	No species specific requirement defined. Diurnal bird surveys would be appropriate for these species.	Diurnal bird surveys were undertaken.
Erythrotriorchis radiatus	Red Goshawk	V	CE		
Grus rubicunda	Brolga	-	V		
Ephippiorhynchus asiaticus	Black-necked Stork	-	E	No species specific requirement defined. Diurnal bird surveys in close proximity to wetlands would be appropriate for these species.	Diurnal bird surveys were undertaken however there were no wetlands within the study area..

Table 5 (Continued): Targeted Searches for Conservation Significant Fauna Species

Scientific Name	Common Name	Conservation Status[1]		Survey Guideline Requirements	Survey Techniques and Effort undertaken by Future Ecology
		EPBC Act	BC Act		
Rostratula australis	Australian Painted Snipe	E	E	Area searches or transects; targeted stationary observations at dawn and dusk of suitable foraging locations within wetlands (DEWHA, 2010c).	Habitat surveys (to identify suitable foraging locations) and diurnal bird surveys were undertaken. Targeted stationary observations were generally not undertaken as no habitat for this species (e.g. wetlands, lakes, swamps and clay pans) is present within the study area..
Calidris ferruginea	Curlew Sandpiper	CE	E	No species specific requirement defined. Diurnal bird surveys would be appropriate for these species.	Diurnal bird surveys were undertaken.
Ardeotis australis	Australian Bustard	-	E	No species specific requirement defined. Diurnal bird surveys would be appropriate for these species.	Diurnal bird surveys were undertaken.
Burhinus grallarius	Bush Stone-Curlew	-	E	No species specific requirement defined. Diurnal bird surveys, spotlighting and call playback would be appropriate for this species.	Diurnal bird surveys were undertaken at all sites, spotlighting and call playback were undertaken at most sites.
Calyptorhynchus lathami	Glossy Black-Cockatoo	-	V	No species specific requirement defined. Diurnal bird surveys would be appropriate for these species.	Diurnal bird surveys were undertaken.
Glossopsitta pusilla	Little Lorikeet	-	V		
Neophema pulchella	Turquoise Parrot	-	V		
Tyto novaehollandiae	Masked Owl	-	V		
Ninox connivens	Barking Owl	-	V		
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	-	V		
Chthonicola sagittata	Speckled Warbler	-	V		
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	-	V		

Table 5 (Continued): Targeted Searches for Conservation Significant Fauna Species

Scientific Name	Common Name	Conservation Status[1]		Survey Guideline Requirements	Survey Techniques and Effort undertaken by Future Ecology
		EPBC Act	BC Act		
Anthochaera phrygia	Regent Honeyeater	CE	CE	Diurnal bird surveys undertaken for 20 hours over 10 days in areas of less than 50 ha (DEWHA, 2010c). The species is most conspicuous in the breeding season (primarily between September and November) (DEWHA, 2010c). The *BioNet Threatened Species Profile Database* (OEH, 2017b) indicates that this species can be surveyed at any time of year. Targeted searches of woodland patches with heavily flowering trees may be useful as well as call playback (DEWHA, 2010c).	Habitat surveys (36 hours over 13 days) and diurnal bird surveys (93.53 hours over 13 days) were undertaken in October, February and August. Call playback was not undertaken for the species as additional effort was undertaken during bird surveys and the habitats were easily searched. No areas of heavily flowering Eucalypts were observed during the surveys.
Grantiella picta	Painted Honeyeater	V	V	No species specific requirement defined. Diurnal bird surveys would be appropriate for these species.	Diurnal bird surveys were undertaken.
Artamus cyanopterus	Dusky Woodswallow	-	V		
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	-	V		
Petroica boodang	Scarlet Robin	-	V		
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	-	V		
Daphoenositta chrysoptera	Varied Sittella	-	V		
Pachycephala inornata	Gilbert's Whistler	-	V		
Stagonopleura guttata	Diamond Firetail	-	V		
Phascogale tapoatafa	Brush-tailed Phascogale	-	V	No species specific requirement defined. Trapping, hair tubes, camera traps and spotlighting would be appropriate for this species.	Trapping, hair tubes, camera traps and spotlighting were undertaken.
Sminthopsis macroura	Stripe-faced Dunnart	-	V		

Table 5 (Continued): Targeted Searches for Conservation Significant Fauna Species

Scientific Name	Common Name	Conservation Status[1]		Survey Guideline Requirements	Survey Techniques and Effort undertaken by Future Ecology
		EPBC Act	BC Act		
Dasyurus maculatus maculatus (south-eastern mainland population)	Spotted-tailed Quoll	E	V	Habitat surveys (for potentially suitable habitat resources and signs of activity, scats and latrines), hair tubes and camera trapping (SEWPaC, 2011a). May to August is the optimal survey period for this species (SEWPaC, 2011a).	Habitat surveys (including searches for signs of activity such as scratches and scats), hair tubes and camera trapping were undertaken. The surveys were undertaken outside of the optimal survey period for this species. However, the habitat in the study area is suboptimal for the species (except the more intact habitat within Vickery State Forest), there are few records within the broader locality and the species is considered unlikely to occur.
Phascolarctos cinereus	Koala	V	V	Direct observations (e.g. spotlighting, call playback and remote sensor activated cameras) between August and January or indirect observations year round (e.g. searches for scratchings and scats) (Department of the Environment, 2014). The *BioNet Threatened Species Profile Database* (OEH, 2017b) indicates that this species can be surveyed at any time of year.	Habitat surveys (including searches for signs of activity such as scratches and scats), spotlighting, call playback and camera trapping were undertaken in October, February and August. Specific Koala scat searches were undertaken using the Spot Assessment Technique (Phillips and Callaghan, 2011) at two sites along the Namoi River (8 & 16) where a preferred Eucalypt browse species (River Red Gum) dominates.
Petaurus norfolcensis	Squirrel Glider	-	V	No species specific requirement defined. Trapping, hair tubes, camera traps and spotlighting would be appropriate for this species.	Trapping, hair tubes, camera traps, call playback and spotlighting were undertaken.
Cercartetus nanus	Eastern Pygmy-possum	-	V	No species specific requirement defined. Trapping, hair tubes, camera traps and spotlighting would be appropriate for this species.	Trapping, hair tubes, camera traps and spotlighting were undertaken.
Aepyprymnus rufescens	Rufous Bettong	-	V		
Macropus dorsalis	Black-striped Wallaby	-	E	No species specific requirement defined. Active searches and camera traps would be appropriate for this species.	There is no suitable habitat for this species in the study area. Opportunistic observations and camera traps were undertaken.
Petrogale penicillata	Brush-tailed Rock-wallaby	V	E	Daytime searches for potentially suitable habitat resources and signs of activity, including tracks, scats and rock shelters worn smooth from resting (SEWPaC, 2011a). Possibly the collection of predator scats, and baited camera traps (SEWPaC, 2011a).	There is no suitable habitat for this species in the study area. Opportunistic observations and camera traps were undertaken.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Daytime field surveys for camps, surveys of vegetation communities and food plants and night time surveys (SEWPaC, 2011a).	Habitat surveys (including searches for camps and identification of food plants) and spotlighting were undertaken.

Table 5 (Continued): Targeted Searches for Conservation Significant Fauna Species

Scientific Name	Common Name	Conservation Status[1]		Survey Guideline Requirements	Survey Techniques and Effort undertaken by Future Ecology
		EPBC Act	BC Act		
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	-	V	No species specific requirement defined. Bat detection devices and harp trapping would be appropriate for this species.	Bat detection devices were used in conjunction with harp trapping.
Mormopterus lumsdenae	Beccari's Freetail-bat	-	V		
Mormopterus norfolkensis	Eastern Freetail-bat	-	V		
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	-	V		
Nyctophilus corbeni	Corben's Long-eared Bat	V	V	Bat detection devices and harp trapping between October and April (DEWHA, 2010a).	Bat detection devices were used in conjunction with harp trapping within the recommended survey timing.
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Bat detection devices and harp trapping/mist netting between October and March (DEWHA, 2010a). The *BioNet Threatened Species Profile Database* (OEH, 2017b) indicates that this species can be surveyed between September and April (inclusive).	Bat detection devices were used in conjunction with harp trapping within the recommended survey timing, however, suitable roosting habitat resources (e.g. cliffs, caves, old mine shafts) were not present within the study area.
Chalinolobus picatus	Little Pied Bat	-	V	No species specific requirement defined. Bat detection devices and harp trapping would be appropriate for this species.	Bat detection devices were used in conjunction with harp trapping.
Vespadelus troughtoni	Eastern Cave Bat	-	V		

[1] Threatened species status under the BC Act and EPBC Act (current as of 9 April 2018).

V = Vulnerable. E = Endangered. CE = Critically Endangered. M = Migratory

3 Survey Results

3.1.1 Fauna Habitat Types

Native vegetation within the study area was described and mapped by FloraSearch (2018) according to the NSW OEH Vegetation Information System (OEH, 2016). Broad fauna habitat types in the study area have been described and mapped on **Figures 4a** and **4b** based on the vegetation mapping by FloraSearch (2018). The following four broad fauna habitat types are described below:

- Woodland/Open Forest;
- Native Grassland;
- Cleared Land; and
- Watercourses and dams.

A summary of habitat features, habitat types and dominant flora species observed at each survey site is presented in **Appendix B**.

Woodland/Open Forest

The Woodland/Open Forest habitat type consists of remnant patches of native dominated vegetation containing a Eucalypt dominated canopy. Structurally it is present in a woodland formation (canopy trees well spread out from each other) or open forest (tree canopies touching or almost touching).

The common canopy species include Poplar Box (*Eucalyptus populnea)*, White Box (*Eucalyptus albens*), White Cypress Pine (*Callitris glaucophylla*) and Narrow-leaved Ironbark (*Eucalyptus crebra*). Yellow Box (*Eucalyptus melliodora*) and River Red Gum (*Eucalyptus camaldulensis*) occur along river / creek edges and floodplains.

If a sub-canopy is present it is generally patchy and dominated by White Cypress Pine.

If a shrub layer is present it is usually patchy to sparse and typically co-dominated by a variety of species depending on the site. Common shrub species include Hopbush (*Dodonaea viscosa*), Waterbush (*Myoporum montanum*), Wilga (*Geijera parviflora*) and the weed species African Boxthorn (*Lycium ferocissimum*).

The groundcover layer is usually present and typically medium to dense. It is typically co-dominated by a variety of grass and forb species depending on the site. Common species include Purple Wire-grass (*Aristida personata*), Slender Bamboo Grass (*Austrostipa verticillata*) and Spiny-fruit Saltbush (*Atriplex spinibractea*).

Generally this habitat type contained the greatest number of fauna habitat features such as leaf litter, fallen timber, hollow logs, hollow-bearing trees, dead trees, and areas of more complex vegetation.

Dead trees (stags) and hollow-bearing trees were present at most sites and appeared to be more abundant at Sites 4, 8, 11 and 16.

Nearly all sites within this habitat type showed some degree of disturbance including clearing, grazing, removal of fallen timber, removal or thinning of shrub and sub-canopy layers.

Generally the connectivity for this habitat type was low across the study area which has been heavily cleared for agricultural.

The majority of fauna survey sites were selected in this habitat type as it provides the greatest potential for detecting most fauna species.

This habitat type was found at Sites 1 to 6, 8 to 12, 14, 16, 17, 19, 20, and21.

Less disturbed and larger patches of woodland areas with intact native shrubs and groundcover layers are largely absent except for Vickery State Forest (Site 4) and some ungrazed or less grazed remnants (Sites 9, 10, 11 and 15).

Native Grassland

This habitat type consists of open grassy areas between patches of Woodland/Open Forest. Cover is sparse to moderately dense. Typical species include Australian Finger Grass (*Chloris truncata*), Slender Bamboo Grass, Purple Wire-grass, Climbing Saltbush (*Einadia nutans),* Galvanised Burr (*Sclerolaena birchii*), Grey Tussock-grass (*Poa sieberiana*) and Spiny-fruit Saltbush (*Atriplex spinibractea*).

Fauna habitat features are generally poor with this habitat type only providing open areas for some species which prefer this. Generally fallen timber, hollow logs etc. are absent.

This habitat type is probably formed by and subject to ongoing disturbance from grazing and other agricultural practices.

Connectivity in this habitat type is generally moderate to high as it forms large connected areas across the study area landscape.

Scattered or remnant trees (paddock trees) are present in this broad fauna habitat type.

This habitat type was found at Site 8.

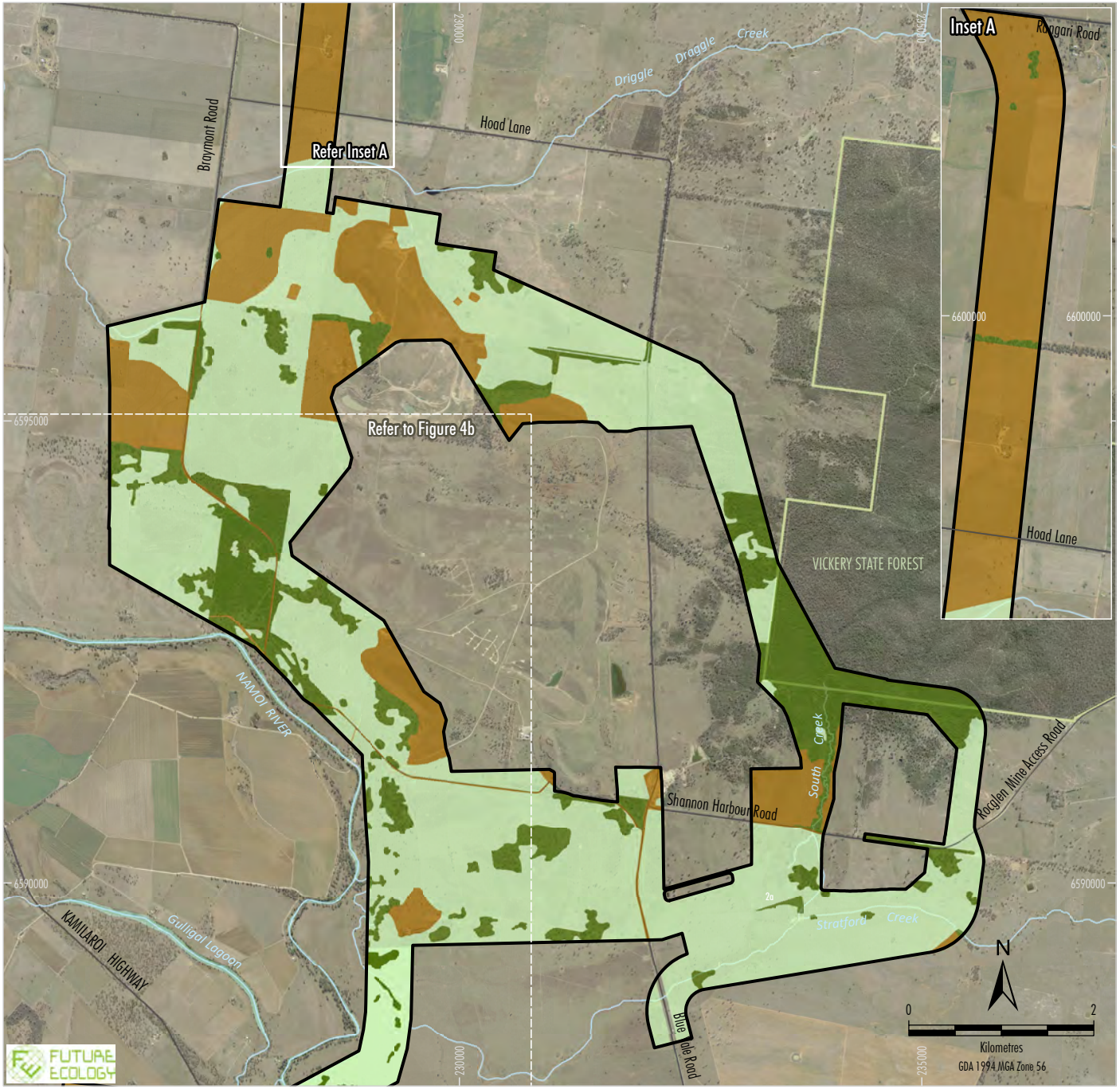
Cleared Land

In this habitat type trees and shrubs are generally absent and the grass and forb layer is either greatly reduced or non-existent or is dominated by exotic rather than native species. These areas have been or are still subject to intensive disturbance events including mining activities, agricultural cropping and infrastructure such as buildings and roads.

It provides little in the way of fauna habitat except perhaps movement and foraging habitat for more mobile species and possibly foraging habitat within temporary irrigation channels, etc. in some cropped areas.

Connectivity is generally low to moderate across the landscape.

This habitat type was found at Sites 7, 18, 22 and 23.



LEGEND

- Study Area
- State Forest
- Cleared Land
- Native Grassland
- Woodland/Open Forest

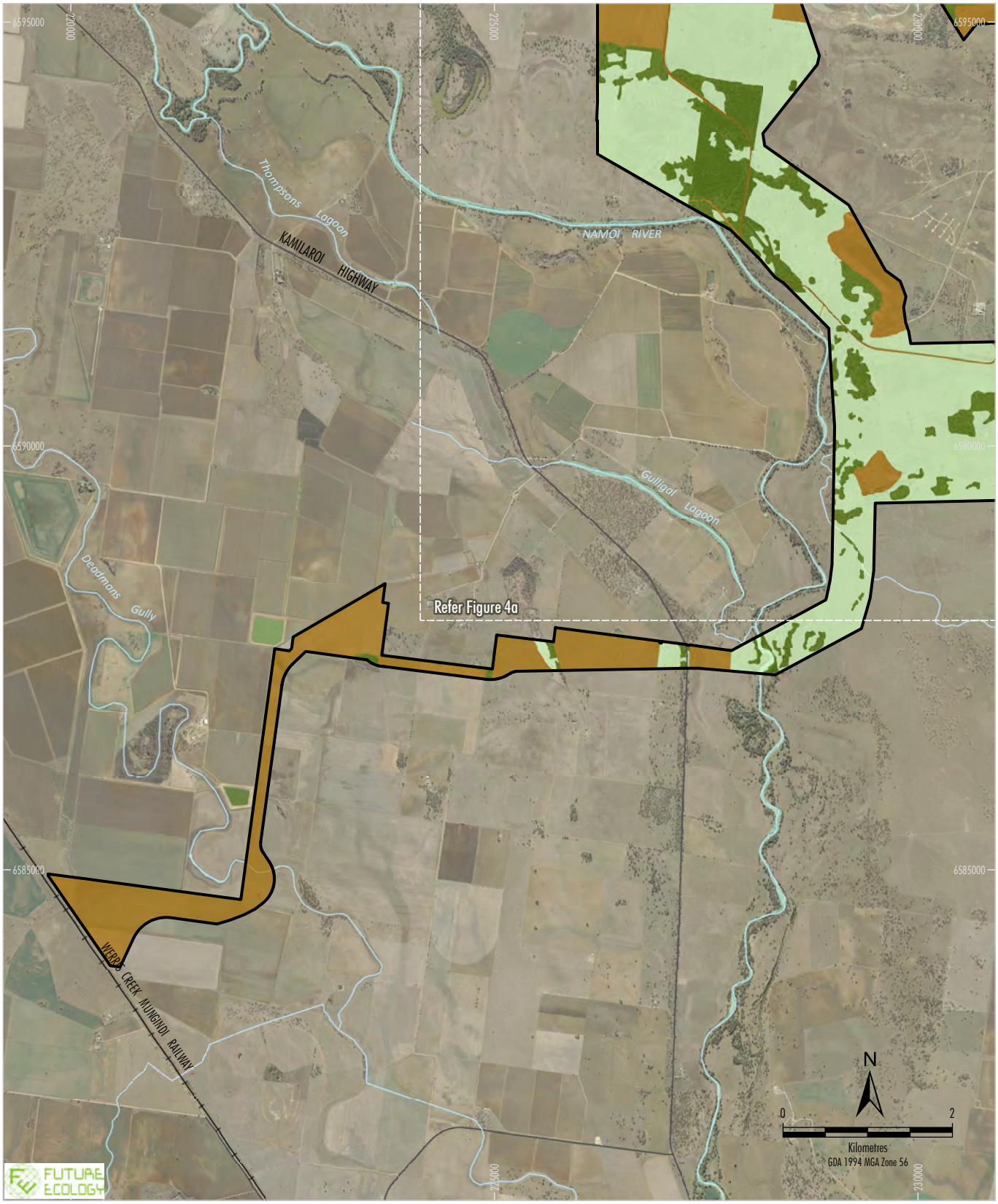
Source: Orthophoto - Department of Land and Property Information, Aerial Photography (July 2011); Department of Industry (2015)

WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Broad Fauna Habitat Types
Project Mining Area

Figure 4a



LEGEND

- Study Area
- Cleared Land
- Native Grassland
- Woodland/Open Forest

Source: Orthophoto - Department of Land and Property Information, Aerial Photography (July 2011); Department of Industry (2015)

WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Broad Fauna Habitat Types
Indicative Rail Spur Investigation Corridor

Figure 4b

Watercourses and Dams

There are several named ephemeral drainage lines in the study area, namely, Merrygowen Creek, Gins Gully, Bollol Creek, Driggle Draggle Creek, South Creek, Stratford Creek, Thompson's Lagoon, Gulligal Lagoon and Deadmans Gully.

The Namoi River is a permanent watercourse adjacent to Sites 8 and A to D.

Site D is located in a billabong adjacent to the Namoi River.

There are various farm dams in the study area including a stock dam near the eastern boundary of Site 23. Some farm dams appeared to be dry or very low during October 2015 survey period but more water appeared to be present in February 2016.

3.1.2 Fauna Species

A total of 201 fauna species were recorded in the study area during the surveys including 10 amphibian, 22 reptile, 131 bird and 38 mammal species. This number also includes a number of incidental records obtained in the field but outside of defined survey sites.

At least nine (9) of the recorded species are exotics and included two (2) bird and seven (7) mammal species (further discussion in **Section 3.1.6**)**.** Hair samples from a rat species were collected in October 2015 but identification to species level was not possible. It is therefore uncertain whether this detection represents an exotic and/or native species of rat

The results were notable for the very low numbers of small to medium-sized terrestrial native mammal species despite terrestrial Elliott and cage trapping, hair tubes and camera traps with no apparent captures. This may be due to a long history of disturbance of vegetation at some sites, their relative isolation, lack or sparseness of shrub and groundcover layers and/or high levels of predation pressure. The introduced Red Fox (*Vulpes vulpes*) which is a known predator on this size range of native mammals (NSW National Parks and Wildlife Service, 2001) was frequently detected during field surveys at a number of sites as well as generally within the study area.

A relatively low number of amphibian species were detected and this could be due to lack of habitat and the lack of rainfall during the initial two survey periods In October 2015 and February 2016 when this fauna group were targeted.

Appendix A contains the full list of fauna species recorded during the survey periods.

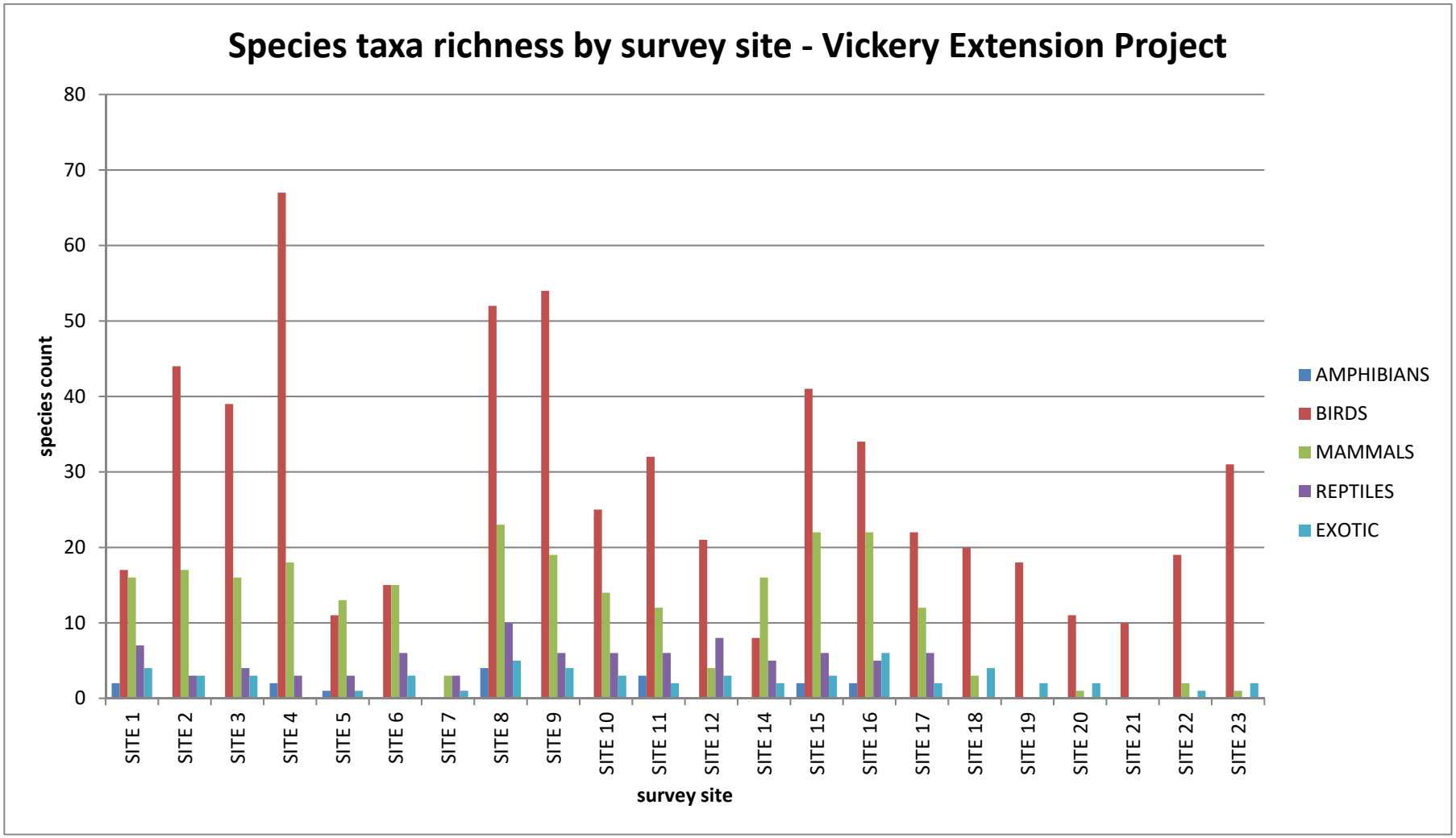


Chart 1: Species Taxa Richness by Survey Site

3.1.3 Species Richness across Survey Sites

Chart 1 below shows the species richness broken down into taxa (i.e. fauna groups). Birds were the dominant fauna group at most sites with the exception of Sites 5 (second to mammals), Site 6 (equal with mammals), Site 7 (no birds recorded but it should be noted that no bird surveys were conducted here due to lack of habitat) and Site 14 (second to mammals).

The highest number of bird species was recorded at Site 4 (67) followed by Sites 9 (54) and 8 (52).

It should be noted that only targeted bird and incidental diurnal fauna surveys were carried out at Sites 18 to 23 and this explains the predominance of bird species at these sites compared to other fauna groups.

The highest number of mammal species was recorded at Site 8 (23) followed by Sites 15 (22) and 16 (22).

Site 8 (10) had the most reptile species recorded, followed by Sites 12 (8) and 1 (7).

Site 8 (4) had the most amphibian species recorded followed by Site11 (3), Sites 8 is adjacent to the Namoi River and Site 11 contains a farm dam.

Chart 2 displays the total species richness per site. This shows that three sites: Site 4 (90 species) followed by Site 8 (89) and then Site 9 (79), had the highest total number of species recorded.

Site 4 is located in Vickery State Forest which has the least disturbed, largest and structurally complex vegetation of all the survey sites within the study area. Site 8 is located immediately adjacent to the Namoi River which has some very old large trees, a strip of River Red Gum dominated riparian vegetation and a patch of Poplar Box dominated vegetation. Site 9 is also a relatively large vegetation remnant and is adjacent to an even larger vegetation remnant (Site 15) but only separated by Braymont Road (gravel road at this location).

Site 7 (6), Site 21 (10) and Site 20 (12) had the lowest total number of species, although it is noted that Site 7 did not receive much survey effort due to lack of fauna habitat. It should be noted that only targeted bird and incidental diurnal fauna surveys were carried out at Sites 18 to 23 and this explains the lower number of total species at these sites compared to some other sites.

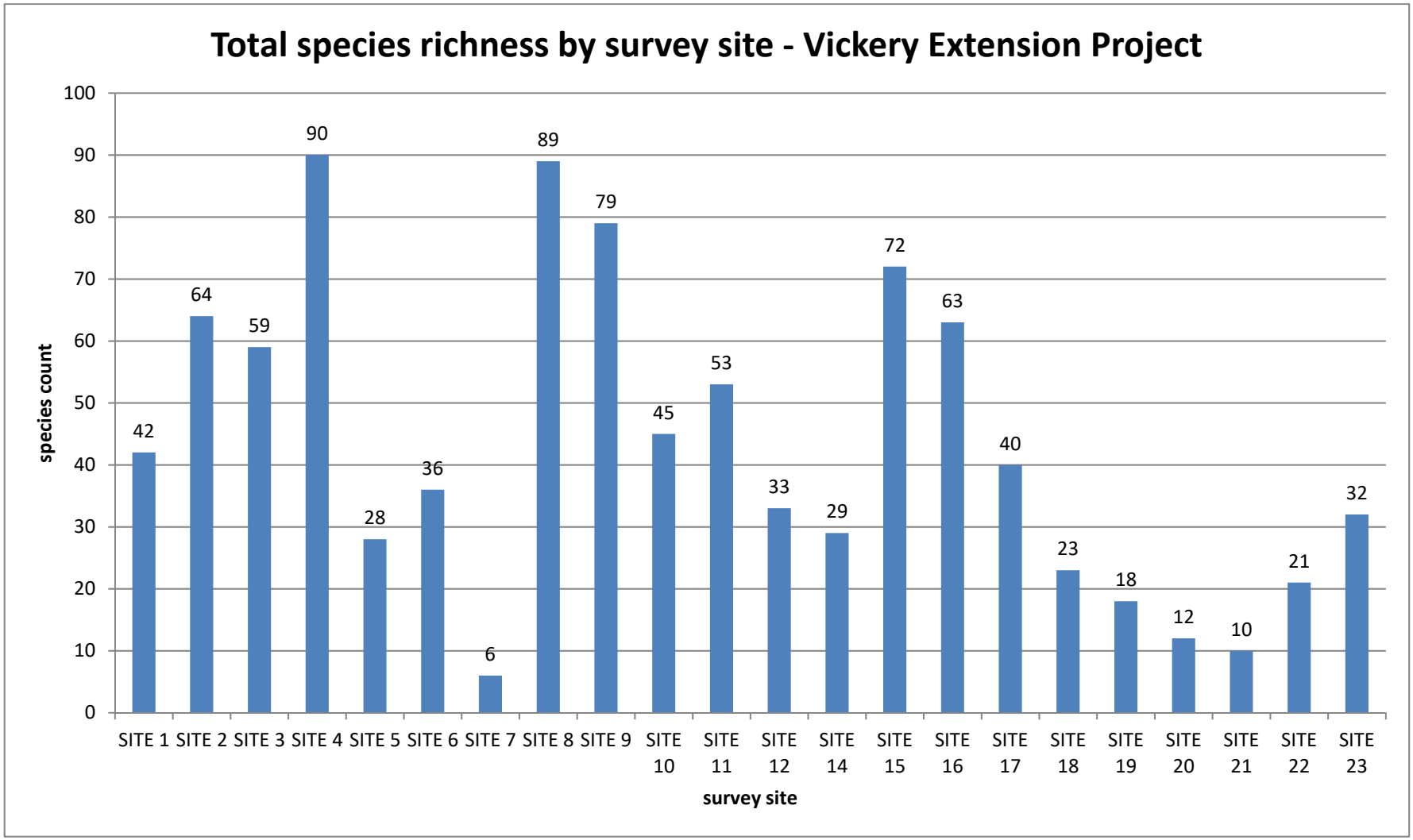


Chart 2: Total Species Richness by Survey Site

3.1.4 NSW Listed Threatened Fauna Species

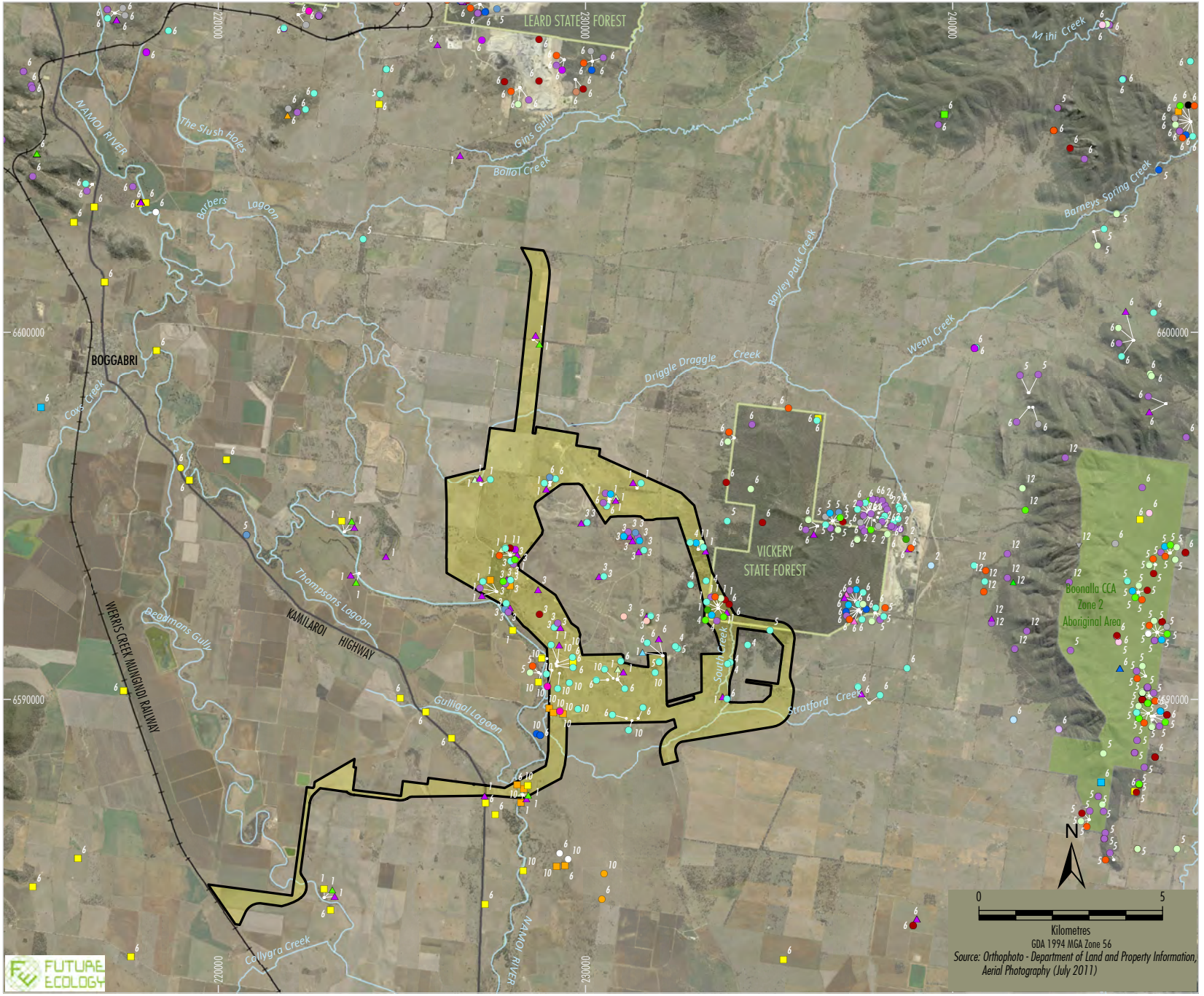
Figures 5, 6a and **6b** show the locations of threatened fauna species records (based on the surveys detailed in this report, previous surveys and database records) within the study area and surrounds. Unconfirmed records (those which are possible or probable) are not shown on the figures.

A total of 14 threatened fauna species listed under the BC Act (all listed as vulnerable) were recorded in the study area during the surveys by Future Ecology (**Table 6**; **Figures 6a** and **6b**).

Table 6: Threatened Species Recorded within the Study Area

Species	Recorded by Future Ecology		Previously Recorded by Other Specialist*	
	Inside NSW Assessment Footprint	Outside NSW Assessment Footprint	Inside NSW Assessment Footprint	Outside NSW Assessment Footprint
Spotted Harrier (*Circus assimilis)*	X	✓	X	✓
Turquoise Parrot (*Neophema pulchella*)	X	✓	X	✓
Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*)	X	✓	X	✓
Speckled Warbler (*Chthonicola sagittata*)	✓	✓	✓	✓
Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*)	✓	✓	X	✓
Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*)	✓	✓	✓	✓
Gilbert's Whistler (*Pachycephala inornata*)	X	✓	X	✓
Dusky Woodswallow (*Artamus cyanopterus*)	X	✓	X	✓
Diamond Firetail (*Stagonopleura guttata*)	✓	✓	X	✓
Koala (*Phascolarctos cinereus*)	X	✓	✓	✓
Squirrel Glider (*Petaurus norfolcensis*)	X	✓	✓	✓
Yellow-bellied sheath-tailed bat (*Saccolaimus flaviventris*)	✓	✓	✓	✓
Eastern Bentwing-bat (*Miniopterus orianae oceanensis*)	✓	X^	X	✓
Eastern Cave Bat (*Vespadelus troughtoni*)	X	✓	X	X

Note: The NSW Assessment Footprint is described in Section 1.2 (and shown on Figures 3a and 3b) of the *Vickery Extension Project Biodiversity Assessment Report and Biodiversity Offset Strategy* (Resource Strategies, 2018). The study area referred to throughout this report covers the extent of the NSW Assessment Footprint as well as land outside (i.e. species recorded in this report do not all occur within the NSW Assessment Footprint).
* Refer to Section 1.2.6.
^ possible/probable recording via bat recording devices



LEGEND

State Forest
Aboriginal Area
Study Area

Threatened Fauna

- Blue-billed Duck
- Grey Falcon
- Black Falcon
- Square-tailed Kite
- Spotted Harrier
- Little Eagle
- Brolga
- Little Lorikeet
- Turquoise Parrot
- Masked Owl
- Barking Owl
- Brown Treecreeper (eastern subspecies)
- Speckled Warbler
- Regent Honeyeater
- Painted Honeyeater
- Hooded Robin (south-eastern form)
- Grey-crowned Babbler (eastern subspecies)
- Varied Sittella
- Gilbert's Whistler
- Dusky Woodswallow
- Diamond Firetail
- Black-chinned Honeyeater (eastern subspecies)
- Spotted-tailed Quoll
- Koala
- Squirrel Glider
- Brush-tailed Rock-wallaby
- Yellow-bellied Sheathtail-bat
- Eastern Freetail-bat
- Eastern Bentwing-bat
- Corben's Long-eared Bat
- Large-eared Pied Bat
- Little Pied Bat
- Eastern Cave Bat

Note: The Masked Owl, Black Falcon, Little Lorikeet, Brown Treecreeper, Diamond Firetail and Yellow-bellied Sheathtail-bat were also recorded within the locality however coordinates were not provided.

Source

(1) Future Ecology (2018)
(2) RPS (2010)
(3) Cenwest (2011)
(4) Niche (2013)
(5) Birdlife (2018)
(6) OEH (2018)
(10) Kendall&Kendall Ecological Services (2011)
(12) AMBS (2017)

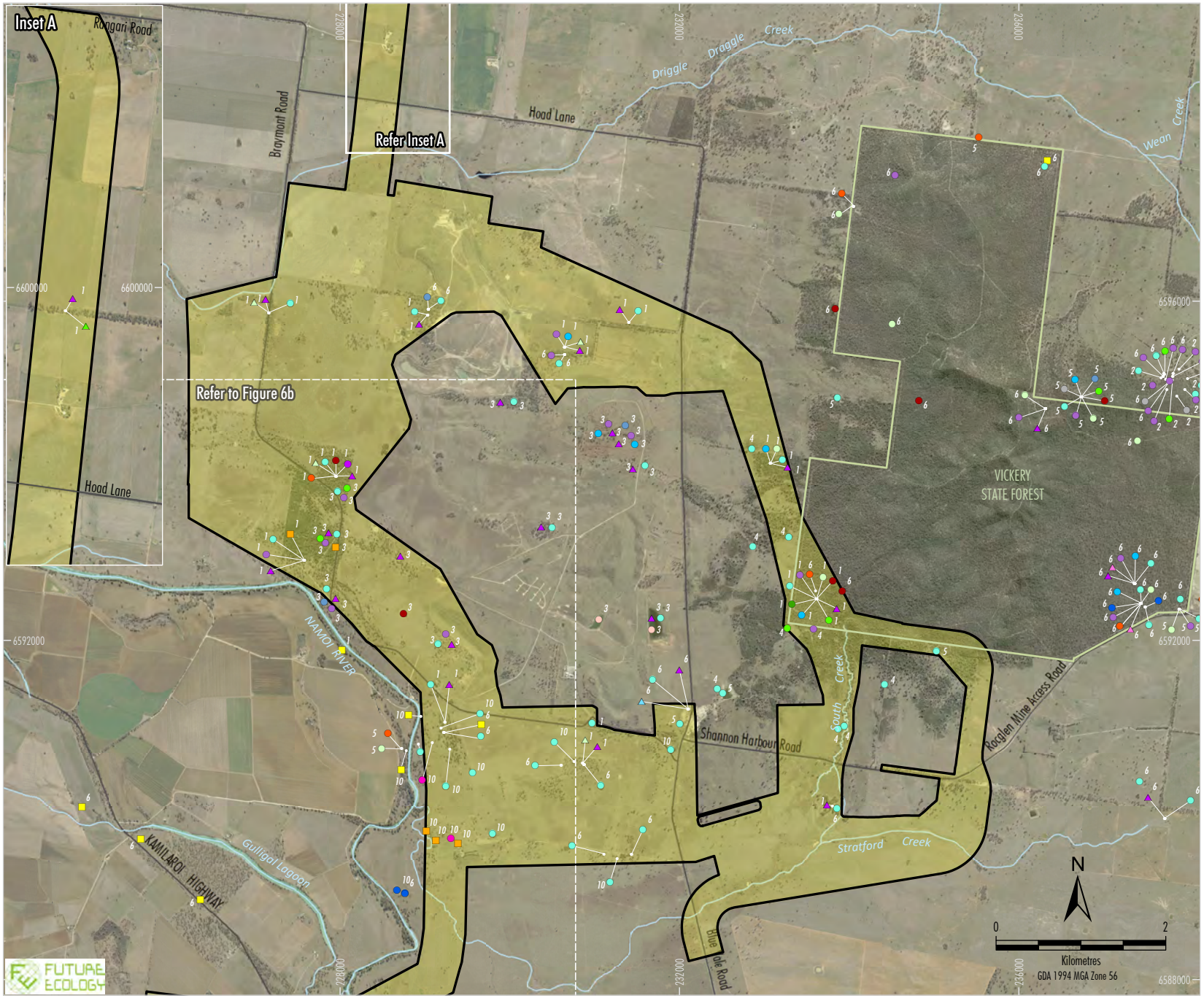
Note: Sources 7, 8, 9 and 11 are not shown on this figure

WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Threatened Fauna Records
Wider Locality

Figure 5



LEGEND

State Forest

Study Area

Threatened Fauna

- Blue-billed Duck
- Spotted Harrier
- Little Eagle
- Little Lorikeet
- Turquoise Parrot
- Brown Treecreeper (eastern subspecies)
- Speckled Warbler
- Painted Honeyeater
- Hooded Robin (south-eastern form)
- Grey-crowned Babbler (eastern subspecies)
- Varied Sittella
- Gilbert's Whistler
- Dusky Woodswallow
- Diamond Firetail
- Koala
- Squirrel Glider
- Yellow-bellied Sheathtail-bat
- Eastern Freetail-bat
- Eastern Bentwing-bat
- Little Pied Bat
- Yellow-bellied Sheathtail-bat
- Eastern Freetail-bat
- Eastern Bentwing-bat
- Little Pied Bat
- Eastern Cave Bat

Note: The Black Falcon was also recorded within the locality however coordinates were not provided.

Source

(1) Future Ecology (2018)
(2) RPS (2010)
(3) Cenwest (2011)
(4) Niche (2013)
(5) Birdlife (2018)
(6) OEH (2018)
(10) Kendall&Kendall Ecological Services (2011)

Note: Sources 7, 8 and 9 are not shown on this figure.

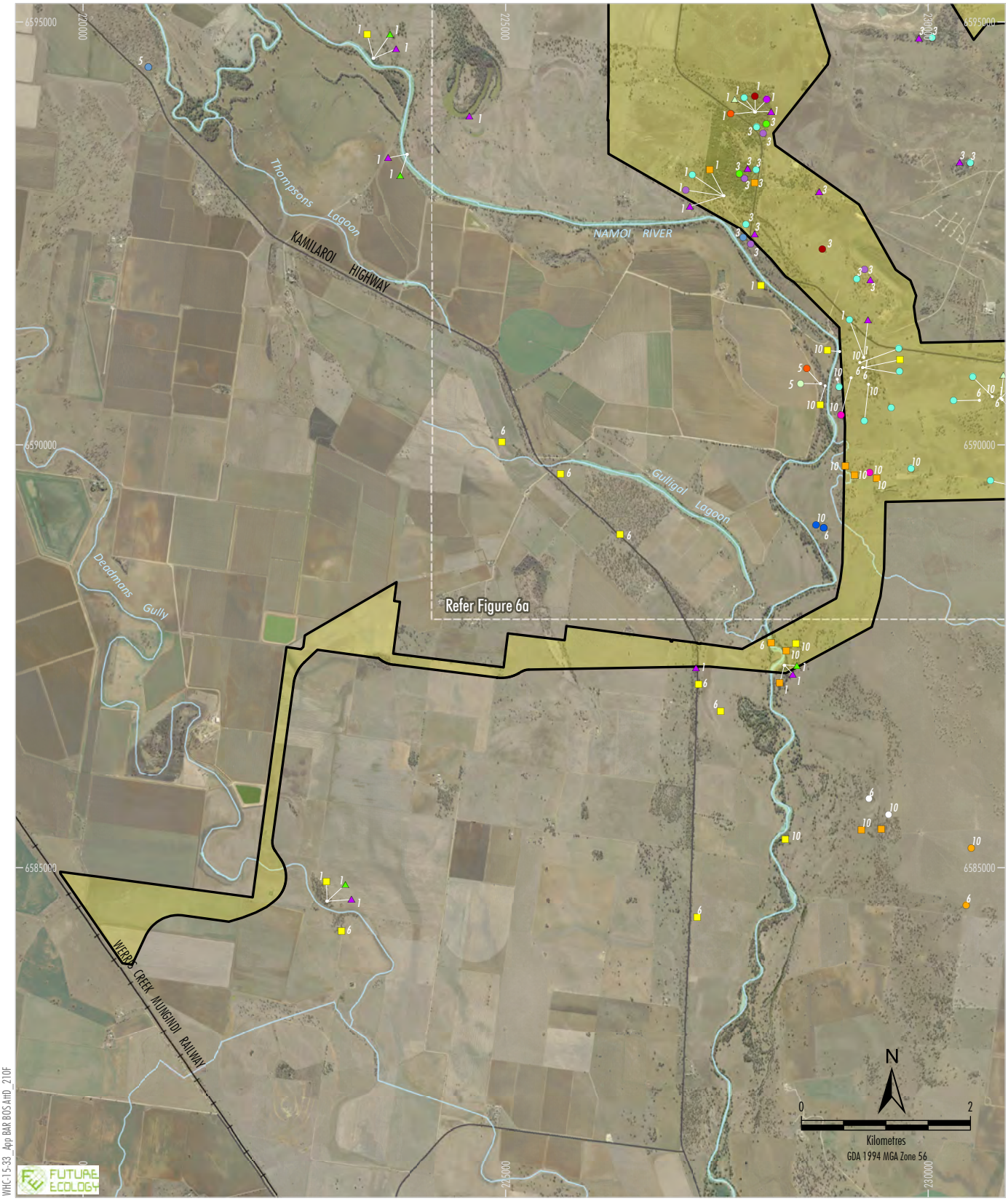
Source: Orthophoto - Department of Land and Property Information, Aerial Photography (July 2011)

WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Threatened Fauna Records
Project Mining Site

Figure 6a



WHC-15-33_App BAR BOS Attb_210F

LEGEND

Study Area

Threatened Fauna

- Black Falcon
- Square-tailed Kite
- Spotted Harrier
- Little Eagle
- Little Lorikeet
- Turquoise Parrot
- Barking Owl
- Brown Treecreeper (eastern subspecies)
- Speckled Warbler
- Painted Honeyeater
- Grey-crowned Babbler (eastern subspecies)
- Varied Sittella
- Diamond Firetail
- Dusky Woodswallow
- Koala
- Yellow-bellied Sheathtail-bat
- Eastern Bentwing-bat
- Corben's Long-eared Bat
- Large-eared Pied Bat
- Eastern Cave Bat

Note: The Masked Owl, Little Lorikeet, Brown Treecreeper, Diamond Firetail and Yellow-bellied Sheathtail-bat were also recorded within the locality however coordinates were not provided.

Source: Orthophoto - Department of Land and Property Information, Aerial Photography (July 2011)

Source

(1) Future Ecology (2018)
(3) Cenwest (2011)
(5) Birdlife (2018)
(6) OEH (2018)
(10) Kendall&Kendall Ecological Services (2011)

Note: Sources 2, 4, 7, 8 and 9 are not shown on this figure.

WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Threatened Fauna Records
Indicative Rail Spur Investigation Area

Figure 6b

Table 7: Listed Threatened Fauna Species Recorded in the Study Area during Field Surveys in October 2015, February 2016 & August 2017

Species Group	Scientific Name	Common Name	Confidence Level of Detection	Status		Site # Detected (individuals detected)
				BC Act[1]	EPBC Act[2]	
Aves	*Circus assimilis*	Spotted Harrier	Definite	V	-	Site 9 (1)
Aves	*Neophema pulchella*	Turquoise Parrot	Definite	V	-	Site 4 (7), Site 9 (2)
Aves	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	Definite	V	-	Site 3 (1), Site 4 (2)
Aves	*Chthonicola sagittata*	Speckled Warbler	Definite	V	-	Site 2 (5), Site 4 (2), Site 15 (5)
Aves	*Melanodryas cucullata cucullata*	Hooded Robin (south-eastern form)	Definite	V	-	Site 2 (3), Site 3 (3), Site 4 (4)
Aves	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler (eastern subspecies)	Definite	V	-	Site 1 (5), Site 3 (21), Site 4(7), Site 8 (8), Site 9 (16), Site 10 (11), Site 11 (12), Site 12 (14), Site 15 (8)
Aves	*Pachycephala inornata*	Gilbert's Whistler	Definite	V	-	Site 4 (1)
Aves	*Artamus cyanopterus*	Dusky Woodswallow	Definite	V	-	Site 9 (1)
Aves	*Stagonopleura guttata*	Diamond Firetail	Definite	V	-	Site 4 (4)
Mammalia	*Phascolarctos cinereus*	Koala	Definite	V	V	Site 8 (1)
Mammalia	*Petaurus norfolcensis*	Squirrel Glider	Definite	V	-	Site 15 (3), Site 16 (1)
Mammalia	*Saccolaimus flaviventris*	Yellow-bellied sheath-tailed bat	Definite	V	-	Sites 1-6, Sites 8-11, Sites 14-17 *
Mammalia	*Miniopterus orianae oceanensis*	Eastern Bentwing-bat	Possible^	V	-	Site 1, Site 4, Site 8, Sites 15-17*
			Definite	V	-	Sites 2, 6, 9 and 10*
Mammalia	*Nyctophilus corbeni*	Corben's Long-eared Bat	Possible^	V	V	Sites 1- 10, 14-17*
Mammalia	*Chalinobolus dwyeri*	Large-eared Pied Bat	Possible^	V	V	Site 15
Mammalia	*Vespadelus troughtoni*	Eastern Cave Bat	Possible^	V	-	Sites 5, 6, 8,15*
			Definite	V	-	Sites 14, 16*

^ = possible/probable recording via bat recording devices.

[1] Threatened species status under the BC Act (current as at 27 July 2018).

[2] Threatened species status under the EPBC Act (current as at 27 July 2018).

* As identification of these threatened microbats was based on ultrasonic call detection the number of individuals present is unknown.

Five threatened fauna species were recorded that were previously not known to occur in the study area; namely the Spotted Harrier, Brown Treecreeper (eastern subspecies), Hooded Robin (south-eastern form), Gilberts Whistler and Eastern Cave Bat (Section 1.2.6 and **Table 7**). All of these species were previously known from the locality (**Table 1**).

Calls of the following threatened bat species were also possibly detected, however, the calls could not be distinguished from other non-threatened bat species or were not distinctive enough to be identified to species level:

- Corben's Long-eared Bat (*Nyctophilus corbeni*) (this species cannot be identified to species level based on call data alone);
- Large-eared Pied Bat (*Chalinobolus dwyeri*) (identified to genus level only, calls couldn't be distinguished from other potentially occurring bat species); and
- Beccari's Free-tailed Bat (*Mormopterus lumsdenae*) (calls couldn't be distinguished from other potentially occurring bat species).

The Corben's Long-eared Bat and Large-eared Pied Bat are also listed under the EPBC Act.

At least one (1) threatened species was detected (or potentially detected) at Sites 1 to 17 within the study area. No threatened species were detected at Sites 18 to 23 but it should be noted that a lower level of survey effort was carried out at those sites. The highest number of threatened species (10) was detected at Site 4 within Vickery State Forest, followed by Sites 15 (10), 8 (6), 9 (6) and C (6).

Yellow-bellied Sheath-tailed Bat was the most commonly detected threatened fauna species being detected at 14 sites with a definite confidence level via call analysis.

A short discussion is presented below on each of the threatened species detected. **Figure 5** shows the mapped locations of each detected species.

Spotted Harrier (*Circus assimilis*)

One Spotted Harrier individual was seen whilst driving past Site 9 during the February 2016 survey period, which left the side of Braymont Road and then flew north-east into Site 9 (**Figure 6a**).

Site 9 has been mapped as White Box – Silver-leaved Ironbark Shrubby Open Forest (FloraSearch, 2018).

Turquoise Parrot (*Neophema pulchella*)

Turquoise Parrots were recorded during diurnal bird surveys as follows (**Figure 6a**):

- Site 4: seven (7) birds seen and heard in total during one survey session in October 2015.
- Site 9: two (2) birds seen and heard in total during one survey session in October 2015.

Sites 4 and 9 have been mapped as Narrow-leaved Ironbark – White Box Shrubby Forest and White Box – Silver-leaved Ironbark Shrubby Open Forest respectively (FloraSearch, 2018).

Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*)

The Brown Treecreeper was not identified within the NSW Assessment Footprint, however was recorded within the study area (**Table 6**) (Resource Strategies, 2018).

Brown Treecreepers (eastern subspecies) were recorded during diurnal bird surveys as follows (**Figure 6a**):

- Site 3: one (1) bird seen and heard in total during 1 survey session in October 2015.
- Site 4: two (2) birds seen and heard in total during 2 survey sessions in October 2015.

Sites 3 and 4 have been mapped as Narrow-leaved Ironbark – White Box Shrubby Forest (FloraSearch, 2018).

Speckled Warbler (*Chthonicola sagittata*)

Speckled Warblers were recorded during diurnal bird surveys as follows (**Figure 6a**):

- Site 2: five (5) birds seen and heard in total during 2 survey sessions in October 2015.
- Site 4: two (2) birds seen and heard in total during 1 survey session in October 2015.
- Site 15: five (5) birds seen and heard in total during 2 surveys sessions in February 2016.

Sites 2 and 15 have been mapped as White Box – Silver-leaved Ironbark Shrubby Open Forest, while Site 4 has been mapped as Narrow-leaved Ironbark – White Box Shrubby Forest (FloraSearch, 2018).

Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*)

Hooded Robins were recorded during diurnal bird surveys as follows (**Figure 6a**):

- Site 2: three (3) birds seen and heard in total during 1 survey session in October 2015.
- Site 3: three (3) birds seen and heard in total during 1 survey session in October 2015.
- Site 4: four (4) birds seen and heard in total during 2 survey session in October 2015.

During the surveys the behaviour the species was exhibiting would indicate that individuals were preparing to mate, with males engaging in displays in front of females.

Site 2 has been mapped as White Box – Silver-leaved Ironbark Shrubby Open Forest, while Sites 3 and 4 have been mapped as Narrow-leaved Ironbark – White Box Shrubby Forest (FloraSearch, 2018).

Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*)

Grey-crowned Babblers (eastern subspecies) were recorded during diurnal bird surveys as follows (**Figure 6a**):

- Site 1: five (5) birds seen and heard in total during 1 survey session in October 2015.
- Site 3: twenty-one (21) birds seen and heard in total during 2 survey sessions in October 2015.
- Site 4: seven (7) birds seen and heard in total during 1 survey session in October 2015.
- Site 8: eight (8) birds seen and heard in total during 1 survey session in October 2015.

- Site 9: sixteen (16) birds seen and heard in total during 2 survey sessions in October 2015.
- Site 10: eleven (11) birds seen and heard in total during 2 survey sessions in October 2015.
- Site 11: twelve (12) birds seen and heard in total during 1 survey session in October 2015.
- Site 12: fourteen (14) birds seen and heard in total during 2 survey sessions in October 2015.
- Site 15: eight (8) birds seen and heard in total during 1 survey session in February 2016.

A total of 102 individual Grey-crowned Babblers (eastern subspecies) were detected.

The Grey-crowned Babbler (eastern subspecies) was recorded in the following vegetation communities mapped by FloraSearch (2018):

- Narrow-leaved Ironbark – White Box Shrubby Forest;
- Poplar Box Woodland on Alluvial Clay Soils;
- Poplar Box Woodland on Alluvial Clay Soils (derived grassland);
- White Box – Silver-leaved Ironbark Shrubby Open Forest; and
- Pilliga Box – Poplar Box Shrubby Woodland.

Gilbert's Whistler (*Pachycephala inornata*)

The Gilbert's Whistler was not identified within the NSW Assessment Footprint, however was recorded within the study area (Table 6).

One individual Gilbert's Whistler was seen during one diurnal bird survey session at Site 4 during the October 2015 survey period (**Figure 6a**).

Site 4 has been mapped as Narrow-leaved Ironbark – White Box Shrubby Forest (FloraSearch, 2018).

Dusky Woodswallow (*Artamus cyanopterus*)

The Dusky Woodswallow was not identified within the NSW Assessment Footprint, however was recorded within the study area (Table 6).

The Dusky Woodswallow was recorded during diurnal bird surveys as follows (**Figure 6a**):

- Site 9: one (1) bird seen and heard during one survey session in October 2015.

Site 9 has been mapped as White Box – Silver-leaved Ironbark Shrubby Open Forest (FloraSearch, 2018).

Diamond Firetail (*Stagonopleura guttata*)

The Diamond Firetail was not identified within the NSW Assessment Footprint, however was recorded within the study area (Table 6).

Four individual Diamond Firetail were seen during one diurnal bird survey session at Site 4 during the October 2015 survey period (**Figure 6a**).

Site 4 has been mapped as Narrow-leaved Ironbark – White Box Shrubby Forest (FloraSearch, 2018).

Koala (*Phascolarctos cinereus*)

The Koala was not identified within the NSW Assessment Footprint (Table 6).

Consistent with SEPP 44, the occurrence of preferred food species for the koala in the study area has been described by FloraSearch (2018). Three preferred food species listed in SEPP 44 Schedule 2 Koala feed trees occur in the study area, namely the River Red Gum (*Eucalyptus camaldulensis*), which was recorded within the riparian zone of the Namoi river (near Sites 8 and 16), White Box which was present predominately on the more hilly sites, and Poplar Box which was also present within most of the woodland areas although more common on the flatter sites.

River Red Gum is listed as a primary food tree species for the Koala in the western slopes while White Box (*E. albens*), Poplar Box (*E. populnea*), Pilliga Box (*E. pilligaensis*), Yellow Box (*E. melliodora*) and Blakely's Red Gum (*E. blakelyi*) are all listed as secondary food trees (DECC, 2008).

Under SEPP 44, Core koala habitat means *an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population*.

The Koala was recorded during nocturnal surveys opposite Site 8 on the Namoi River (western bank) (River Red Gum Riparian Tall Woodland). An individual male responded to call playback during the October 2015 survey period from the southern side of the Namoi River, where there is a remnant stand of River Red Gums. Scat searches were undertaken at Site 8 adjacent to where the individual was recorded; some scats were found but none were attributable to the Koala.

River Red Gum Riparian Tall Woodland along the Namoi River in the study area is considered likely to be core habitat for the koala under the definition of SEPP 44, considering:

- the riparian vegetation contains River Red Gum which is listed as a 'primary' feed tree; and
- recent sightings and records of Koalas occur in the riparian strip along the Namoi River north and south of the study area.

Squirrel Glider (*Petaurus norfolcensis*)

The Squirrel Glider was identified within the Biodiversity Assessment Report Footprint.

Squirrel Gliders were detected via their distinctive call as well as observed via spotlighting at Sites 15 and 16 during nocturnal surveys in the February 2016 survey period (**Figures 6a** and **6b**).

They did not respond to call-playback at either site but were only detected once call-playback had ceased.

At site 15, this species was also recorded within the Braymont Road road reserve and at Site 16, which is located along the banks of the Namoi River, it was also observed partly exiting a hollow in a large old River Red Gum.

Sites 15 and 16 have been mapped as White Box – Silver-leaved Ironbark Shrubby Open Forest and River Red Gum Riparian Tall Woodland respectively (FloraSearch, 2016b).

Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris*)

Yellow-bellied Sheathtail-bats were recorded by ultrasonic call analysis at 14 sites (**Figures 6a** and **6b**).

As identification was based on ultrasonic call detection the number of individuals present is unknown.

The Yellow-bellied Sheathtail-bat was recorded in the following vegetation communities mapped by FloraSearch (2018):

- Pilliga Box – Poplar Box Shrubby Woodland;
- White Box – Silver-leaved Ironbark Shrubby Open Forest;
- Narrow-leaved Ironbark – White Box Shrubby Forest;
- Poplar Box Woodland on Alluvial Clay Soils;
- Poplar Box Woodland on Alluvial Clay Soils (derived grassland); and
- River Red Gum Riparian Tall Woodland.

Eastern Bentwing-bat (*Miniopterus orianae oceanensis*)

The Eastern Bentwing-bat was recorded via ultrasonic call recording analysis at Sites 2, 6, 9 and 10 (**Figure 6a**). This species was also possibility recorded by ultrasonic call analysis at Sites 1, 4, 8, 13, 15, 16 and 17 however the calls could not be distinguished from other potentially occurring bat species (**Figure 3a**).

As identification was based on ultrasonic call detection the number of individuals present is unknown.

The Eastern Bentwing-bat was recorded in the following vegetation communities mapped by FloraSearch (2016b):

- Pilliga Box – Poplar Box Shrubby Woodland;
- White Box – Silver-leaved Ironbark Shrubby Open Forest; and
- Narrow-leaved Ironbark – White Box Shrubby Forest.

This is a cave roosting species and it can also roost in human made structures which mimic caves such as stormwater culverts. No such features were apparent at any site.

Corben's Long-eared Bat (*Nyctophilus corbeni*)

Corben's Long-eared Bats were potentially recorded via ultrasonic call recording analysis from Sites 1-10 and14-17. This species cannot be identified to species level based on call data alone.

It should be noted that in regard to the possible detection of Corben's Long-eared Bat that the species belonging to this genus (*Nyctophilus*) cannot be reliably identified to species level on call basis alone as they all have similar call structure and frequency.

This means that despite the detection of this genus via call recording at some sites, the calls could be attributable to any locally occurring member of this genus. This includes the non-threatened *Nyctophilus geoffroyi* and *Nyctophilus gouldi* which were caught via harp trap at Site 4. The inclusion of *Nyctophilus corbeni* as a detected threatened fauna species in this study is therefore only given a possible level of confidence.

The Corben's Long-eared Bat was not recorded with a definite level of confidence in any vegetation communities mapped by FloraSearch (2018).

Large-eared Pied Bat (*Chalinobolus dwyeri*)

The Large-eared Pied Bat was possibility recorded by ultrasonic call analysis at Site 15 (**Figure 3a**) however the calls could not be distinguished from other potentially occurring bat species. The Large-eared Pied Bat was also possibility recorded in the study area by Niche (2013).

The Large-eared Pied Bat was not recorded with a definite level of confidence in any vegetation communities mapped by FloraSearch (2018).

This is a cave roosting species but no cave features were present in the study area or adjoining areas.

Eastern Cave Bat (*Vespadelus troughtoni*)

The Eastern Cave Bat was not identified within the NSW Assessment Footprint, however was recorded within the study area in vegetation which continues into the NSW Assessment Footprint (Table 6).

The Eastern Cave Bat was recorded via ultrasonic call recording analysis at Sites 14 and 16 (**Figure 6b**). This species was also recorded by ultrasonic call analysis at Sites 5, 6, 8 and 15 but the calls could not be distinguished from other potentially occurring bat species (**Figure 3a**).

The Eastern Cave Bat was recorded (with a definite level of confidence) in the following vegetation communities mapped by FloraSearch (2018):

- Poplar Box Woodland on Alluvial Clay Soils; and
- River Red Gum Riparian Tall Woodland.

This is a cave roosting species but no cave features were observed in the study area or adjoining areas.

Other Species

An additional three threatened species listed under the BC Act have been previously recorded in the study area, but were not recorded or potentially recorded by Future Ecology, namely, the Little Eagle, Painted Honeyeater (also listed under the EPBC Act) and Eastern Freetail-bat.

3.1.5 Nationally Listed Threatened and/or Protected Migratory Fauna Species

The Koala is the only threatened fauna species listed under the EPBC Act which was definitely recorded in the study area (**Section 3.1.4**; **Table 7**; **Figure 6a**). This species was previously known to occur in the study area (**Section 1.2.6**; **Figure 5**).

Two additional threatened fauna species listed under the EPBC Act were possibly recorded, the Large-eared Pied Bat and Corben's Long-eared Bat, although the calls could not be distinguished from other potentially occurring bat species (**Section 3.1.4**).

An additional threatened species listed under the EPBC Act have been previously recorded in the study area, but was not recorded by Future Ecology, namely, the Painted Honeyeater (also listed under the EPBC Act). This species was recorded by Kendall and Kendall (2011) to the south of survey site 7 (**Figure 3a**). Sighting information for each species is provided above in **Section 3.1.4**.

3.1.6 Exotic Fauna Species

A total of nine exotic species were recorded (**Table 8**). This included two birds (Common Myna and Common Starling), and seven mammal species. The Fox was the most recorded of the exotic species being recorded from 11 sites followed by Common Starling (9 sites), Cow (7 sites) and Brown Hare (7 sites).

Table 8: Exotic Fauna Species Detected

Species Group	*Scientific Name*	Common Name
Aves	*Sturnus tristis*	Common Myna
Aves	*Sturnus vulgaris*	Common Starling
Mammalia	*Sus scrofa*	Pig
Mammalia	*Felis catus*	Cat
Mammalia	*Bos taurus*	Cow
Mammalia	*Lepus capensis*	Brown Hare
Mammalia	*Vulpes vulpes*	Fox
Mammalia	*Mus musculus*	House Mouse
Mammalia	*Oryctolagus cuniculus*	Rabbit

4 Conclusion

There have been a number of fauna surveys previously undertaken partly within and/or adjacent to the study area. The most notable are those undertaken for the Approved Mine in 2011 and 2012 by Cenwest Environmental Surveys and Niche Environment and Heritage. These previous reports provide a good background on the fauna likely to be present in the study area.

Additional fauna surveys were completed by Future Ecology in October 2015 (7 days), February 2016 (6 days) and August 2017 (2 days) using a team of one to five ecologists including specialists in birds, reptiles, amphibians and mammals.

Four broad fauna habitat types were observed within the study area (Woodland/Open Forest, Native Grassland, Cleared Land and watercourses and dams). The majority of survey sites were located within the broad fauna habitat type Woodland/Open Forest. Most habitat patches showed evidence of historic and ongoing disturbance from a range of agricultural and other human induced factors. Most survey sites were relatively small, fragmented and lacked structural diversity in terms of subcanopy and understorey layers. Connectivity between remnant Woodland/Open Forest habitats was generally poor across the study area. However, some fauna habitat features such as hollow bearing trees, hollow logs, fallen timber were present at most survey sites.

A total of 201 fauna species were recorded in the study area during the surveys including 10 amphibian, 22 reptile, 131 bird and 38 mammal species. Site 4 which is located within Vickery State Forest which has the least disturbed, largest and structurally complex vegetation of all the survey sites within the study area, also had the largest number of species recorded (90).

A total of 14 threatened fauna species listed under the BC Act (all listed as vulnerable) were recorded in the study area during the surveys by Future Ecology (**Table 9**).

Table 9: Threatened Species Recorded within the Study Area

Species	Recorded by Future Ecology		Previously Recorded by Other Specialist*	
	Inside NSW Assessment Footprint	Outside NSW Assessment Footprint	Inside NSW Assessment Footprint	Outside NSW Assessment Footprint
Spotted Harrier (*Circus assimilis)*	X	✓	X	✓
Turquoise Parrot (*Neophema pulchella*)	X	✓	X	✓
Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*)	X	✓	X	✓
Speckled Warbler (*Chthonicola sagittata*)	✓	✓	✓	✓
Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*)	✓	✓	X	✓
Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*)	✓	✓	✓	✓

Table 9 (Continued): Threatened Species Recorded within the Study Area

Species	Recorded by Future Ecology		Previously Recorded by Other Specialist*	
	Inside NSW Assessment Footprint	Outside NSW Assessment Footprint	Inside NSW Assessment Footprint	Outside NSW Assessment Footprint
Gilbert's Whistler (*Pachycephala inornata*)	X	✓	X	✓
Dusky Woodswallow (*Artamus cyanopterus*)	X	✓	X	✓
Diamond Firetail (*Stagonopleura guttata*)	✓	✓	X	✓
Koala (*Phascolarctos cinereus*)	X	✓	✓	✓
Squirrel Glider (*Petaurus norfolcensis*)	X	✓	✓	✓
Yellow-bellied sheath-tailed bat (*Saccolaimus flaviventris*)	✓	✓	✓	✓
Eastern Bentwing-bat (*Miniopterus orianae oceanensis*)	✓	X^	X	✓
Eastern Cave Bat (*Vespadelus troughtoni*)	X	✓	X	X

Note: The NSW Assessment Footprint is described in Section 1.2 (and shown on Figures 3a and 3b) of the *Vickery Extension Project Biodiversity Assessment Report and Biodiversity Offset Strategy* (Resource Strategies, 2018). The study area referred to throughout this report covers the extent of the NSW Assessment Footprint as well as land outside (i.e. species recorded in this report do not all occur within the NSW Assessment Footprint). * Refer to Section 1.2.6.
^ possible/probable recording via bat recording devices

Of the threatened fauna species identified in **Table 9**, only the Koala is listed under the EPBC Act.

Calls of the following threatened bat species were also possibly detected; however, the calls could not be distinguished from other non-threatened bat species:

- Corben's Long-eared Bat (*Nyctophilus corbeni*) (this species cannot be identified to species level based on call data alone);
- Large-eared Pied Bat (*Chalinobolus dwyeri*) (identified to genus level only, calls couldn't be distinguished from other potentially occurring bat species); and
- Beccari's Free-tailed Bat (*Mormopterus lumsdenae*) (calls couldn't be distinguished from other potentially occurring bat species).

The Corben's Long-eared Bat and Large-eared Pied Bat are also listed under the EPBC Act.

An additional three threatened species listed under the BC Act have been previously recorded in the study area, but were not recorded by Future Ecology, namely, the Little Eagle, Painted Honeyeater (also listed under the EPBC Act) and Eastern Freetail-bat.

5 References

Anstis, M. (2002) **Tadpoles of south-eastern Australia: a guide with keys**. Reed New Holland, Sydney.

Anstis, M. (2013) **Tadpoles and frogs of Australia. Chatswood, NSW**: New Holland Publishers

Birdlife Australia (2015) **Birdlife Australia database search within the following area: -30.7, 150.2; -30.7, 150.4; -30.9, 150.2; -30.9, 150.4**. Data Received: 16 November 2015.

Cenwest Environmental Services (2011) **Vickery Coal Project Fauna Report**.

Christidis, L and Boles, W. (2008) **Systematics and Taxonomy of Australian Birds**, CSIRO Publishing, Clayton, VIC. ISBN: 9780643065116

Churchill S. (2009) **Australian Bats**, 2nd Edition, Jacana Books Allen and Unwin, Crows Nest NSW.

Cogger, H. (2014) **Reptiles and Amphibians of Australia, 7th edition**, CSIRO Publishing, Clayton VIC, ISBN: 9780643100350

Countrywide Ecological Service (2004) **Fauna Study and Assessment of the Proposed Canyon Extension Whitehaven Coal Mine near Gunnedah, NSW**.

Countrywide Ecological Service (2006) **Whitehaven Coal Mine Canyon Extension: Pre-start Survey Early Autumn 2006**.

Countrywide Ecological Service (2007a) **Whitehaven Coal Mine Canyon Extension: Pre-start Survey Late-summer 2007**.

Countrywide Ecological Service (2007b) **Belmont Coal Project via Gunnedah Fauna Assessment**.

Countrywide Ecological Service (2007c) **Belmont Coal Project via Gunnedah Flora Assessment.**

Countrywide Ecological Service (2009a) **Fauna Monitoring Whitehaven Summer 2008-09**.

Countrywide Ecological Service (2009b) **Fauna Monitoring Whitehaven Early Spring 2009**.

Department of Environment and Conservation (2004) **Threatened Biodiversity Survey and Assessment: Guidelines for developments and activities (working draft)**, Biodiversity Conservation Unit, Department of Environment and Conservation, Sydney South NSW, November 2004.

Department of Environment and Climate Change (2008a) **NSW State Recovery Plan for the Koala.**

Department of Environment and Climate Change (2008b) **Hygiene protocol for the control of disease in frogs**. Information Circular Number 6. DECC (NSW), Sydney South.

Department of Environment and Climate Change (2009) **Threatened species survey and assessment guidelines: field survey methods for fauna Amphibians**. Sydney South, DECC 2009/213

Department of Environment Water Heritage and Arts (2010a) **Survey guidelines for Australia's threatened frogs.** Guidelines for detecting frogs listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999, Australian Govt. Barton, ACT.

Department of Environment Water Heritage and Arts (2010b) **Survey guidelines for Australia's threatened bats.** Guidelines for detecting bats listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999, Australian Govt. Barton, ACT.

Department of Environment Water Heritage and Arts (2010c) **Survey guidelines for Australia's threatened birds: Guidelines for detecting birds.** listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999, Australian Govt. Barton, ACT.

Department of Planning and Environment (2015) **NSW Planning Viewer**.

Department of Sustainability, Environment, Water, Population and Communities (2011a) **Survey guidelines for Australia's threatened mammals.** Guidelines for detecting mammals listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999. Australian Govt. Barton, ACT.

Department of Sustainability, Environment, Water, Population and Communities (2011b) **Survey guidelines for Australia's threatened reptiles.** Guidelines for detecting reptiles listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999. Australian Govt. Barton, ACT.

Department of the Environment (2014) **EPBC Act Referral Guidelines for the Vulnerable Koala**.

Department of the Environment and Energy (2017) **Protected Matters Search within the following area: -30.7, 150.2; -30.7, 150.4; -30.9, 150.2; -30.9, 150.4**. Data Received: June 2016.

FloraSearch (2018) **Vickery Extension Project Baseline Flora Survey Report**. Report prepared for Whitehaven Coal Limited.

Geoff Cunningham Natural Resource Consultants (2004) **Flora Study of 'The Canyon' Area Extension Whitehaven Coal Mine via Gunnedah NSW.**

Geoff Cunningham Natural Resource Consultants (2006) **Whitehaven Coal Mine, Gunnedah Third Monitoring Report – May, 2006.**

Geoff Cunningham Natural Resource Consultants (2007) **Whitehaven Coal Mine, Gunnedah Fourth Monitoring Report – May, 2007**.

Geoff Cunningham Natural Resource Consultants (2008) **Flora Monitoring Report Whitehaven Coal Mine – 2008**.

Geoff Cunningham Natural Resource Consultants (2009) **Flora Monitoring Report Canyon Coal Mine – 2009**.

Geoff Cunningham Natural Resource Consultants (2010) **Flora Monitoring Report Canyon Coal Mine – 2010**.

Kendall and Kendall (2011) **Vickery South Coal Project Fauna Assessment Briefing Note.**

Lo Cascio, A., (2017) **Identification of echolocation call sequences recorded at Boggabri January 2017**. Unpublished report for Future Ecology, 19 January 2017.

Niche Environment and Heritage (2013) **Vickery Coal Project Ecological Assessment**.

Niche Environment and Heritage (2014) **Boggabri Coal Mine Biodiversity Offsets Audit**.

New South Wales Land and Property Information (2015) **Six Maps Vegetation Viewer***.*

NSW National Parks and Wildlife Service (2001) **Threat Abatement Plan for Predation by the Red Fox (Vulpes vulpes)**. NSW National Parks and Wildlife Service, Hurstville.

Office of Environment and Heritage (2014) **NSW Biodiversity Offset Policy for Major Projects.**

Office of Environment and Heritage (2015). **Border Rivers Gwydir/Namoi Regional Native Vegetation Map Version 2.0**. OEH, Sydney, 5 May 2015.

Office of Environment and Heritage (2016) **Vegetation Information System.**

Office of Environment and Heritage (2017a) **NSW Wildlife Atlas records for project locality.** Data downloaded by Future Ecology under licence by OEH Sydney.

Office of Environment & Heritage NSW (OEH), (2017b), **Profiles for threatened species, endangered populations, endangered ecological communities, key threatening processes and recovery actions listed under the NSW Threatened Species Conservation Act 1999.** Office of Environment & Heritage NSW (OEH), Sydney,

Parsons Brinkerhoff (2010) **Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment.**

Phillips, S and Callaghan, J. (2011) The Spot Assessment Technique: a tool for determining localised levels of habitat use by Koalas *Phascolarctos cinereus*. **Australian Zoologist** volume 35(3).

Reardon, T.B., Armstrong, K.N. and Jackson, S.M. (2015). ***A current taxonomic list of Australian Chiroptera***. Australasian Bat Society. Version 2015-05-15.

Resource Strategies (2018) ***Vickery Extension Project Biodiversity Assessment Report and Biodiversity Offset Strategy****. Report Prepared for Whitehaven Coal Limited.*

RPS Harper Somers O'Sullivan (2010) **Flora and Fauna Assessment for Proposed Rocglen Coal Mine Extension Project.**

Van Dyck, S. and Strahan, R. (2008) **The Mammals of Australia**, **3rd ed**. Edited by Steve van Dyck and Ronald Strahan. New Holland Publishers, Sydney NSW.

Appendix A Fauna Species Detected

Sites 1 to 9

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 1	Observation	Confidence Level	Site 2	Observation	Confidence Level	Site 3	Observation	Confidence Level	Site 4	Observation	Confidence Level	Site 5	Observation	Confidence Level	Site 6	Observation	Confidence Level	Site 7	Observation	Confidence Level	Site 8	Observation	Confidence Level	Site 9	Observation	Confidence Level
Amphibia	*Cyclorana verrucosa*	Rough Burrowing Frog	Native																													
Amphibia	*Limnodynastes dumerilii*	Eastern pobblebonk	Native																													
Amphibia	*Limnodynastes fletcheri*	Fletcher's frog	Native																								x	W				
Amphibia	*Limnodynastes tasmaniensis*	Spotted marsh Frog	Native																													
Amphibia	*Litoria caerulea*	Green Tree Frog	Native			x	O								x	W											x	W				
Amphibia	*Litora fallax*	Eastern Dwarf Tree Frog	Native																													
Amphibia	*Litoria latopalmata*	Broad-palmed rocket frog	Native																								x	W				
Amphibia	*Litoria peronii*	Emerald-spotted Tree Frog	Native			x	O								x	W		x	W								x	W				
Amphibia	*Litoria rubella*	Desert Tree Frog	Native																													
Amphibia	*Uperoleia laevigata*	Smooth Toadlet	Native																													
Aves	*Acanthagenys rufogularis*	Spiny-cheeked Honeyeater	Native						x	OW		x	OW		x	OW											x	OW		x	OW	
Aves	*Acanthiza apicalis*	Inland Thornbill	Native																													

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 1	Observation	Confidence Level	Site 2	Observation	Confidence Level	Site 3	Observation	Confidence Level	Site 4	Observation	Confidence Level	Site 5	Observation	Confidence Level	Site 6	Observation	Confidence Level	Site 7	Observation	Confidence Level	Site 8	Observation	Confidence Level	Site 9	Observation	Confidence Level
Aves	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill	Native						x	OW		x	OW		x	OW														x	OW	
Aves	*Acanthiza lineata*	Striated Thornbill	Native												x	OW																
Aves	*Acanthiza nana*	Yellow Thornbill	Native						x	OW		x	OW																		x	OW	
Aves	*Acanthiza pusilla*	Brown Thornbill	Native																												x	OW	
Aves	*Acanthiza reguloides*	Buff-rumped Thornbill	Native																														
Aves	*Acanthiza uropygialis*	Chestnut-rumped Thornbill	Native						x	OW		x	OW																		x	OW	
Aves	*Aegotheles cristatus*	Australian Owlet-nightjar	Native						x	W					x	OW												x	W		x	W	
Aves	*Alisterus scapularis*	Australian King-Parrot	Native												x	OW																	
Aves	*Anas gracilis*	Grey Teal	Native																														
Aves	*Anas superciliosa*	Pacific Black Duck	Native																									x	OW				
Aves	*Anhinga novaehollandiae*	Australasian Darter	Native																														
Aves	*Anthus novaeseelandiae*	Australasian Pipit	Native																														
Aves	*Aphelocephala leucopsis*	Southern Whiteface	Native						x	OW					x	OW																	
Aves	*Aprosmictus erythropterus*	Red-winged Parrot	Native												x	OW												x	OW		x	OW	

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 1	Observation	Confidence Level	Site 2	Observation	Confidence Level	Site 3	Observation	Confidence Level	Site 4	Observation	Confidence Level	Site 5	Observation	Confidence Level	Site 6	Observation	Confidence Level	Site 7	Observation	Confidence Level	Site 8	Observation	Confidence Level	Site 9	Observation	Confidence Level
Aves	*Ardea modesta*	Eastern Great Egret	Native																													
Aves	*Ardea pacifica*	White-necked Heron	Native																								x	OW				
Aves	***Artamus cyanopterus***	**Dusky Woodswallow**	**Native**	**V**																										**x**	**OW**	
Aves	*Artamus superciliosus*	White-browed Woodswallow	Native									x	OW																			
Aves	*Aythya australis*	Hardhead	Native																													
Aves	*Barnardius zonarius*	Australian Ringneck	Native						x	OW					x	OW														x	OW	
Aves	*Cacatua galerita*	Sulphur-crested Cockatoo	Native			x	OW					x	OW								x	OW					x	OW		x	OW	
Aves	*Cacatua sanguinea*	Little Corella	Native			x	OW		x	OW					x	OW											x	OW		x	OW	
Aves	*Cacomantis pallidus*	Pallid Cuckoo	Native									x	OW																			
Aves	*Chalcites lucidus*	Shining Bronze-Cuckoo	Native									x	W		x	OW																
Aves	*Chenonetta jubata*	Australian Wood Duck	Native																								x	OW		x	OW	
Aves	***Chthonicola sagittata***	**Speckled Warbler**	**Native**	**V**					**X**	**OW**					**X**	**OW**																
Aves	*Cincloramphus cruralis*	Brown Songlark	Native																													
Aves	*Cincloramphus mathewsi*	Rufous Songlark	Native						x	OW																						

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 1	Observation	Confidence Level	Site 2	Observation	Confidence Level	Site 3	Observation	Confidence Level	Site 4	Observation	Confidence Level	Site 5	Observation	Confidence Level	Site 6	Observation	Confidence Level	Site 7	Observation	Confidence Level	Site 8	Observation	Confidence Level	Site 9	Observation	Confidence Level
Aves	***Circus assimilis***	**Spotted Harrier**	**Native**	**V**																										**X**	**O**	
Aves	***Climacteris picumnus***	**Brown Treecreeper**	**Native**	**V**								**X**	**OW**		**X**	**OW**																
Aves	*Colluricincla harmonica*	Grey Shrike-thrush	Native									x	OW		x	OW														x	OW	
Aves	*Coracina maxima*	Ground Cuckoo-shrike	Native																		x	OW										
Aves	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	Native			x	OW		x	OW					x	OW											x	OW		x	OW	
Aves	*Corcorax melanorhamphos*	White-winged Chough	Native			x	OW		x	OW		x	OW		x	OW		x	OW		x	OW					x	OW		x	OW	
Aves	*Cormobates leucophaea*	White-throated Treecreeper	Native												x	OW																
Aves	*Corvus coronoides*	Australian Raven	Native			x	OW		x	OW		x	OW		x	OW		x	OW		x	OW					x	OW		x	OW	
Aves	*Corvus mellori*	Little Raven	Native																											x	OW	
Aves	*Coturnix ypsilophora*	Brown Quail	Native																													
Aves	*Cracticus nigrogularis*	Pied Butcherbird	Native			x	OW					x	OW		x	OW					x	OW					x	OW		x	OW	
Aves	*Cracticus tibicen*	Australian Magpie	Native			x	OW		x	OW		x	OW		x	OW		x	OW		x	OW					x	OW		x	OW	
Aves	*Cracticus torquatus*	Grey Butcherbird	Native						x	OW		x	OW		x	OW														x	OW	
Aves	*Cygnus atratus*	Black Swan	Native																													
Aves	*Dacelo novaeguineae*	Laughing Kookaburra	Native						x	OW		x	OW															x	OW		x	OW	

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 1	Observation	Confidence Level	Site 2	Observation	Confidence Level	Site 3	Observation	Confidence Level	Site 4	Observation	Confidence Level	Site 5	Observation	Confidence Level	Site 6	Observation	Confidence Level	Site 7	Observation	Confidence Level	Site 8	Observation	Confidence Level	Site 9	Observation	Confidence Level
Aves	*Dendrocygna eytoni*	Plumed Whistling-Duck	Native																													
Aves	*Dicaeum hirundinaceum*	Mistletoebird	Native												x	OW											x	OW				
Aves	*Egretta novaehollandiae*	White-faced Heron	Native						x	OW					x	OW											x	OW				
Aves	*Elanus axillaris*																															
Aves	*Elseyornis melanops*	Black-fronted Dotterel	Native																													
Aves	*Entomyzon cyanotis*	Blue-faced Honeyeater	Native																								x	OW				
Aves	*Eolophus roseicapillus*	Galah	Native			x	OW		x	OW		x	OW		x	OW		x	OW		x	OW					x	OW		x	OW	
Aves	*Eopsaltria australis*	Eastern Yellow Robin	Native						x	OW					x	OW														x	OW	
Aves	*Eurystomus orientalis*	Dollarbird	Native																								x	OW				
Aves	*Falco berigora*	Brown Falcon	Native																													
Aves	*Falco cenchroides*	Nankeen Kestrel	Native																								x	OW				
Aves	*Falco longipennis*	Australian Hobby	Native																		x	O										
Aves	*Fulica atra*	Eurasian Coot	Native																													
Aves	***Gallinago hardwickii***	**Latham's Snipe**	**Native**		**M**																											
Aves	*Gallinula tenebrosa*	Dusky Moorhen	Native																													

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 1	Observation	Confidence Level	Site 2	Observation	Confidence Level	Site 3	Observation	Confidence Level	Site 4	Observation	Confidence Level	Site 5	Observation	Confidence Level	Site 6	Observation	Confidence Level	Site 7	Observation	Confidence Level	Site 8	Observation	Confidence Level	Site 9	Observation	Confidence Level
Aves	*Geopelia humeralis*	Bar-shouldered Dove	Native									x	OW		x	OW																
Aves	*Geopelia striata*	Peaceful Dove	Native												x	OW																
Aves	*Gerygone fusca*	Western Gerygone	Native						x	OW		x	OW		x	OW														x	OW	
Aves	*Glossopsitta concinna*	Musk Lorikeet	Native																													
Aves	*Grallina cyanoleuca*	Magpie-lark	Native			x	OW		x	OW		x	OW		x	OW		x	OW								x	OW		x	OW	
Aves	*Haliastur sphenurus*	Whistling Kite	Native																								x	O				
Aves	*Himantopus himantopus*	Black-winged Stilt	Native																													
Aves	*Hirundo neoxena*	Welcome Swallow	Native																								x	OW				
Aves	*Lalage sueurii*	White-winged Triller	Native						x	OW		x	OW		x	OW											x	OW		x	OW	
Aves	*Lichenostomus chrysops*	Yellow-faced Honeyeater	Native												x	OW																
Aves	*Lichenostomus fuscus*	Fuscous Honeyeater	Native												x	OW																
Aves	*Lichenostomus penicillatus*	White-plumed Honeyeater	Native						x	OW		x	OW		x	OW											x	OW		x	OW	
Aves	*Lichenostomus virescens*	Singing Honeyeater	Native												x	OW																
Aves	*Malacorhynchus membranaceus*	Pink-eared Duck	Native																													

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 1	Observation	Confidence Level	Site 2	Observation	Confidence Level	Site 3	Observation	Confidence Level	Site 4	Observation	Confidence Level	Site 5	Observation	Confidence Level	Site 6	Observation	Confidence Level	Site 7	Observation	Confidence Level	Site 8	Observation	Confidence Level	Site 9	Observation	Confidence Level
Aves	*Malurus cyaneus*	Superb Fairy-wren	Native						x	OW		x	OW		x	OW												x	OW		x	OW	
Aves	*Malurus lamberti*	Variegated Fairy-wren	Native												x	OW																	
Aves	*Malurus leucopterus*	White-winged Fairy-wren	Native																														
Aves	*Manorina melanocephala*	Noisy Miner	Native			x	OW		x	OW		x	OW					x	OW		x	OW					x	OW		x	OW	
Aves	***Melanodryas cucullata***	**Hooded Robin**	**Native**	**V**					**X**	**OW**		**X**	**OW**		**X**	**OW**																	
Aves	*Melithreptus brevirostris*	Brown-headed Honeyeater	Native												x	OW												x	OW				
Aves	*Microcarbo melanoleucos*	Little Pied Cormorant	Native																														
Aves	*Microeca fascinans*	Jacky Winter	Native						x	OW		x	OW		x	OW												x	OW		x	OW	
Aves	*Milvus migrans*	Black Kite	Native																														
Aves	*Myiagra inquieta*	Restless Flycatcher	Native						x	OW																							
Aves	*Myiagra rubecula*	Leaden Flycatcher	Native												x	OW															x	OW	
Aves	***Neophema pulchella***	**Turquoise Parrot**	**Native**	**V**											**X**	**OW**															**X**	**OW**	
Aves	*Ninox novaeseelandiae*	Southern Boobook	Native																								x	W		x	W	
Aves	*Northiella haematogaster*	Blue Bonnet	Native												x	OW											x	OW		x	OW	
Aves	*Nycticorax caledonicus*	Nankeen Night-Heron	Native																								x	O				

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 1	Observation	Confidence Level	Site 2	Observation	Confidence Level	Site 3	Observation	Confidence Level	Site 4	Observation	Confidence Level	Site 5	Observation	Confidence Level	Site 6	Observation	Confidence Level	Site 7	Observation	Confidence Level	Site 8	Observation	Confidence Level	Site 9	Observation	Confidence Level
Aves	*Nymphicus hollandicus*	Cockatiel	Native						x	OW											x	OW					x	OW		x	OW	
Aves	*Ocyphaps lophotes*	Crested Pigeon	Native			x	OW		x	OW		x	OW		x	OW		x	OW		x	OW					x	OW		x	OW	
Aves	*Oriolus sagittatus*	Olive-backed Oriole	Native												x	W																
Aves	***Pachycephala inornata***	**Gilbert's Whistler**	**Native**	**V**											**X**	**O**																
Aves	*Pachycephala pectoralis*	Golden Whistler	Native												x	OW																
Aves	*Pachycephala rufiventris*	Rufous Whistler	Native						x	OW		x	OW		x	OW											x	OW		x	OW	
Aves	*Pardalotus punctatus*	Spotted Pardalote	Native												x	OW																
Aves	*Pardalotus striatus*	Striated Pardalote	Native						x	OW		x	OW		x	OW											x	OW		x	OW	
Aves	*Passer domesticus*	House Sparrow	Native																													
Aves	*Pelecanus conspicillatus*	Australian Pelican	Native																								x	O				
Aves	*Petrochelidon ariel*	Fairy Martin	Native												x	OW											x	O				
Aves	*Petrochelidon nigricans*	Tree Martin	Native																													
Aves	*Petroica goodenovii*	Red-capped Robin	Native						x	OW		x	OW		x	OW																
Aves	*Phalacrocorax sulcirostris*	Little Black Cormorant	Native																								x	O				
Aves	*Phaps chalcoptera*	Common Bronzewing	Native						x	OW		x	OW		x	OW														x	OW	
Aves	*Philemon*	Little	Native						x	OW																	x	OW		x	OW	

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 1	Observation	Confidence Level	Site 2	Observation	Confidence Level	Site 3	Observation	Confidence Level	Site 4	Observation	Confidence Level	Site 5	Observation	Confidence Level	Site 6	Observation	Confidence Level	Site 7	Observation	Confidence Level	Site 8	Observation	Confidence Level	Site 9	Observation	Confidence Level
	citreogularis	Friarbird																														
Aves	*Philemon corniculatus*	Noisy Friarbird	Native												x	OW					x	OW					x	OW		x	OW	
Aves	*Platycercus eximius*	Eastern Rosella	Native			x	OW		x	OW		x	OW		x	OW		x	OW		x	OW					x	OW		x	OW	
Aves	*Plectorhyncha lanceolata*	Striped Honeyeater	Native						x	OW		x	OW		x	OW											x	OW		x	OW	
Aves	*Plegadis falcinellus*	Glossy Ibis	Native																													
Aves	*Podargus strigoides*	Tawny Frogmouth	Native												x	W											x	W				
Aves	*Poliocephalus poliocephalus*	Hoary-headed Grebe	Native																													
Aves	***Pomatostomus temporalis***	**Grey-crowned Babbler**	**Native**	**V**		**X**	**OW**					**X**	**OW**		**X**	**OW**											**X**	**OW**		**X**	**OW**	
Aves	*Psephotus haematonotus*	Red-rumped Parrot	Native			x	OW		x	OW																	x	OW				
Aves	*Rhipidura albiscapa*	Grey Fantail	Native						x	OW		x	OW		x	OW														x	OW	
Aves	*Rhipidura leucophrys*	Willie Wagtail	Native			x	OW		x	OW		x	OW		x	OW											x	OW		x	OW	
Aves	*Scythrops novaehollandiae*	Channel-billed Cuckoo	Native												x	W														x	OW	
Aves	*Sericornis frontalis*	White-browed Scrubwren	Native												x	OW											x	OW				
Aves	*Smicrornis brevirostris*	Weebill	Native						x	OW		x	OW		x	OW														x	OW	
Aves	***Stagonopleura***	**Diamond**	**Native**	**V**											**X**	**OW**																

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 1	Observation	Confidence Level	Site 2	Observation	Confidence Level	Site 3	Observation	Confidence Level	Site 4	Observation	Confidence Level	Site 5	Observation	Confidence Level	Site 6	Observation	Confidence Level	Site 7	Observation	Confidence Level	Site 8	Observation	Confidence Level	Site 9	Observation	Confidence Level
	guttata	**Firetail**																														
Aves	*Struthidea cinerea*	Apostlebird	Native			x	OW		x	OW		x	OW		x	OW		x	OW		x	OW					x	OW		x	OW	
Aves	*Sturnus tristis*	Common Myna	Exotic																													
Aves	*Sturnus vulgaris*	Common Starling	Exotic			x	OW											x	OW		x	OW					X	OW		X	OW	
Aves	*Tachybaptus novaehollandiae*	Australasian Grebe	Native																													
Aves	*Taeniopygia bichenovii*	Double-barred Finch	Native						x	OW		x	OW		x	OW														x	OW	
Aves	*Threskiornis molucca*	Australian White Ibis	Native																													
Aves	*Threskiornis spinicollis*	Straw-necked Ibis	Native						x	O								x	O								x	OW		x	O	
Aves	*Todiramphus sanctus*	Sacred Kingfisher	Native												x	OW											x	OW		x	OW	
Aves	*Turnix varius*	Painted Button-quail	Native												x	O																
Aves	*Tyto javanica*	Eastern Barn Owl	Native																													
Aves	*Vanellus miles*	Masked Lapwing	Native																													
Aves	*Zosterops lateralis*	Silvereye	Native												x	OW																
Mammalia	*Austronomus australis*	White-striped Freetail-bat	Native						x	U	D	x	U	D	x	U	D				x	U	D				X	U	D	x	U	D
Mammalia	*Bos taurus*	Cow	Exotic																		x	O					X	O				

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 1	Observation	Confidence Level	Site 2	Observation	Confidence Level	Site 3	Observation	Confidence Level	Site 4	Observation	Confidence Level	Site 5	Observation	Confidence Level	Site 6	Observation	Confidence Level	Site 7	Observation	Confidence Level	Site 8	Observation	Confidence Level	Site 9	Observation	Confidence Level
Mammalia	***Chalinobolus dwyeri***	**Large-eared Pied Bat**	**Native**	**V**	**V**																											
Mammalia	*Chalinolobus gouldii*	Gould's wattled bat	Native			x	U	D	x	U	D	x	U	D	x	U	D	x	U	D	x	U	D				X	U	D	x	U	D
Mammalia	*Chalinolobus morio*	chocolate wattled bat	Native			x	U	D	x	U	D	x	U	D	x	U	D	X	U	Po	x	U	D				X	U	D	x	U	D
Mammalia	*Felis catus*	Cat	Exotic																													
Mammalia	*Lepus capensis*	Brown Hare	Exotic																								X	O		X	O	
Mammalia	*Macropus giganteus*	Eastern Grey Kangaroo	Native			x	O		x	O		x	O		x	O		X	O		x	O					X	O		x	O	
Mammalia	*Macropus robustus*	Common Wallaroo	Native			x	O		x	O					x	O														x	O	
Mammalia	*Macropus rufogriseus*	Red-necked Walaby	Native												x	O																
Mammalia	***Miniopterus australis***	**Little Bentwing-bat**	**Native**	**V**																												
Mammalia	***Miniopterus orianae oceanensis***	**Eastern Bentwing-bat**	**Native**	**V**		**X**	**U**	**Po**	**X**	**U**	**D**				**X**	**U**	**PO**				**X**	**U**	**D**				**X**	**U**	**PO**	**X**	**U**	**D**
Mammalia	***Mormopterus lumsdenae***	**Beccari's Free-tailed Bat**	**Native**	**V**																												
Mammalia	***Mormopterus eleryi***	**Bristle-faced free-tailed bat**	**Native**	**E**																												
Mammalia	*Mormopterus petersi*	Inland free-tailed bat	Native			x	U	Po	x	U	D	x	U	D	x	U	D	x	U	D	x	U	D				X	U	PO	x	U	D
Mammalia	*Mormopterus planiceps*	little mastiff-bat	Native			x	U	D	x	U	D	x	U	D	x	U	D	x	U	D	x	U	Po				X	U	D	x	U	D

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 1	Observation	Confidence Level	Site 2	Observation	Confidence Level	Site 3	Observation	Confidence Level	Site 4	Observation	Confidence Level	Site 5	Observation	Confidence Level	Site 6	Observation	Confidence Level	Site 7	Observation	Confidence Level	Site 8	Observation	Confidence Level	Site 9	Observation	Confidence Level
Mammalia	*Mormopterus ridei*	Eastern free-tailed bat	Native			x	U	D	x	U	Po	x	U	D	x	U	D	x	U	D	x	U	D				X	U	D	x	U	D
Mammalia	*Mormopterus spp.*	A Free-tailed Bat	Native																													
Mammalia	*Mus musculus*	House Mouse	Exotic																					x	O							
Mammalia	*Nyctophilus geoffroyi*	lesser long-eared bat	Native												x	T																
Mammalia	*Nyctophilus gouldi*	Gould's long-eared bat	Native												x	T																
Mammalia	*Nyctophilus species*	A long-eared bat species	Native	V	V	X	U	D	X	U	D	X	U	D	X	U	D	X	U	PO	X	U	PO	X	U	PO	X	U	D	X	U	D
Mammalia	*Oryctolagus cuniculus*	Rabbit	Exotic			x	O		x	O		x	O														X	O		X	O	
Mammalia	***Petaurus norfolcensis***	**Squirrel Glider**	**Native**	**V**																												
Mammalia	***Phascolarctos cinereus***	**Koala**	**Native**	**V**	**V**																						**X**	**W**				
Mammalia	*Pseudocheirus peregrinus*	Common Ringtail Possum	Native																								X	O				
Mammalia	*Rattus fuscipes*	Bush Rat	Native																													
Mammalia	*Rattus sp.*	A rat species	?																								X	H	PR			
Mammalia	***Saccolaimus flaviventris***	**Yellow-bellied sheath-tailed bat**	**Native**	**V**		**X**	**U**	**D**	**X**	**U**	**D**	**X**	**U**	**D**	**X**	**U**	**D**	**X**	**U**	**D**	**X**	**U**	**D**				**X**	**U**	**D**	**X**	**U**	**D**
Mammalia	*Scotorepens balstoni*	inland broad-nosed bat	Native			x	U	D				x	U	D	x	U	D	x	U	D				x	U	D	X	U	D	X	U	D

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 1	Observation	Confidence Level	Site 2	Observation	Confidence Level	Site 3	Observation	Confidence Level	Site 4	Observation	Confidence Level	Site 5	Observation	Confidence Level	Site 6	Observation	Confidence Level	Site 7	Observation	Confidence Level	Site 8	Observation	Confidence Level	Site 9	Observation	Confidence Level
Mammalia	*Scotorepens greyii / S. sp (central-eastern)*	little broad-nosed bat	Native			x	U	D	x	U	D	x	U	D	x	U	D	x	U	D	x	U	D				X	U	D	X	U	D
Mammalia	*Sus scrofa*	Pig	Exotic			x	O		x	O		x	O																	X	O	
Mammalia	*Tachyglossus aculeatus*	Short-beaked Echidna	Native																													
Mammalia	*Trichosurus vulpecula*	Common Brushtail Possum	Native															x	O								X	O		X		
Mammalia	***Vespadelus troughtoni***	**Eastern Cave Bat**	**Native**	**V**														**X**	**U**	**PO**	**X**	**U**	**PO**				**X**	**U**	**PO**			
Mammalia	*Vespadelus vulturnus*	little forest bat	Native			X	U	D	X	U	D	X	U	D	X	U	D	x	U	Pr	X	U	D				X	U	D	X	U	D
Mammalia	*Vulpes vulpes*	Fox	Exotic			X	O		X	O		X	P								X	P					X	O				
Mammalia	*Wallabia bicolor*	Swamp Wallaby	Native						X	O		X	O		X	O											X	O		X		
Reptilia	*Chelodina longicollis*	Long Necked Turtle	Native																								X	O				
Reptilia	*Cryptoblepharus pulcher*	Elegant snake-eyed skink	Native			X	O		X	O								X	O					X	O		X	O		X	O	
Reptilia	*Ctenotus robustus*	Robust Striped-skink	Native			X	O		X	O														X	O		X	O		X	O	
Reptilia	*Demansia psammophis*	Yellow-faced Whip Snake	Native																		X	O					X	O				
Reptilia	*Diporiphora australis*	Tommy Roundhead	Native																													
Reptilia	*Egernia striolata*	Tree Skink	Native			X	O					X	O					X	O		X	O								X	O	

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 1	Observation	Confidence Level	Site 2	Observation	Confidence Level	Site 3	Observation	Confidence Level	Site 4	Observation	Confidence Level	Site 5	Observation	Confidence Level	Site 6	Observation	Confidence Level	Site 7	Observation	Confidence Level	Site 8	Observation	Confidence Level	Site 9	Observation	Confidence Level
Reptilia	*Eulamprus quoyii*	Eastern Water-skink	Native																								X	O				
Reptilia	*Furina diadema*	Red-naped Snake	Native			X	O																									
Reptilia	*Gehyra lazelli*	Lazell's Tree Dtella	Native																		X	O					X	O		X	O	
Reptilia	*Intellagama lesueurii*	Eastern Water Dragon	Native																								X	O				
Reptilia	*Lerista timida*	Timid Slider	Native																		X	O										
Reptilia	*Lophognathus burnsi*	Burn's Dragon	Native									X	O		X	O																
Reptilia	*Lygisaurus foliorum*	Iridescent litter-skink	Native																		X	O										
Reptilia	*Menetia greyii*	Common Dwarf Skink	Native			X	O																									
Reptilia	*Morethia boulengeri*	Boulenger's Skink	Native			X	O		X	O		X	O					X	O		X	O		X	O		X	O		X	O	
Reptilia	*Nebulifera robusta*	Robust Velvet Gecko	Native																													
Reptilia	*Pogona barbata*	Bearded Dragon	Native			X	O								X	O														X	O	
Reptilia	*Pseudechis porphyriacus*	Red-bellied Black Snake	Native																													
Reptilia	*Pseudonaja textilis*	Eastern Brown Snake	Native																								X	O				
Reptilia	*Suta suta*	Curl Snake	Native																													
Reptilia	*Tiliqua scincoides*	Common Blue-tongue	Native																													
Reptilia	*Varanus varius*	Lace Monitor	Native									X	O		X	O											X	O				

Sites 10 to 19

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 10	Observation	Confidence Level	Site 11	Observation	Confidence Level	Site 12	Observation	Confidence Level	Site 14	Observation	Confidence Level	Site 15	Observation	Confidence Level	Site 16	Observation	Confidence Level	Site 17	Observation	Confidence Level	Site 18	Observation	Confidence Level	Site 19	Observation	Confidence Level
Amphibia	*Cyclorana verrucosa*	Rough Burrowing Frog	Native															X	O													
Amphibia	*Limnodynastes dumerilii*	Eastern pobblebonk	Native																													
Amphibia	*Limnodynastes fletcheri*	Fletcher's frog	Native						x	W																						
Amphibia	*Limnodynastes tasmaniensis*	Spotted marsh Frog	Native																													
Amphibia	*Litoria caerulea*	Green Tree Frog	Native																													
Amphibia	*Litora fallax*	Eastern Dwarf Tree Frog	Native																													
Amphibia	*Litoria latopalmata*	Broad-palmed rocket frog	Native						x	W											X	W										
Amphibia	*Litoria peronii*	Emerald-spotted Tree Frog	Native						x	W											X	W										
Amphibia	*Litoria rubella*	Desert Tree Frog	Native															X	O													
Amphibia	*Uperoleia laevigata*	Smooth Toadlet	Native																													
Aves	*Acanthagenys rufogularis*	Spiny-cheeked Honeyeater	Native						x	OW		x	OW					X	OW													
Aves	*Acanthiza apicalis*	Inland Thornbill	Native															X	OW													
Aves	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill	Native						x	OW								X	OW		x	OW		x	OW		X	O				

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 10	Observation	Confidence Level	Site 11	Observation	Confidence Level	Site 12	Observation	Confidence Level	Site 14	Observation	Confidence Level	Site 15	Observation	Confidence Level	Site 16	Observation	Confidence Level	Site 17	Observation	Confidence Level	Site 18	Observation	Confidence Level	Site 19	Observation	Confidence Level
Aves	*Acanthiza lineata*	Striated Thornbill	Native																													
Aves	*Acanthiza nana*	Yellow Thornbill	Native															X	OW													
Aves	*Acanthiza pusilla*	Brown Thornbill	Native															X	OW													
Aves	*Acanthiza reguloides*	Buff-rumped Thornbill	Native															X	OW													
Aves	*Acanthiza uropygialis*	Chestnut-rumped Thornbill	Native															X	OW													
Aves	*Aegotheles cristatus*	Australian Owlet-nightjar	Native															X	OW													
Aves	*Alisterus scapularis*	Australian King-Parrot	Native									x	OW																			
Aves	*Anas gracilis*	Grey Teal	Native																		x	OW										
Aves	*Anas superciliosa*	Pacific Black Duck	Native																		x	OW										
Aves	*Anhinga novaehollandiae*	Australasian Darter	Native																		x	O										
Aves	*Anthus novaeseelandiae*	Australasian Pipit	Native																													
Aves	*Aphelocephala leucopsis*	Southern Whiteface	Native																													
Aves	*Aprosmictus erythropterus*	Red-winged Parrot	Native			x	OW					x	OW					X	OW		x	OW		x	OW					X	O	
Aves	*Ardea modesta*	Eastern Great Egret	Native																		x	O										
Aves	*Ardea pacifica*	White-necked	Native						x	O																						

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 10	Observation	Confidence Level	Site 11	Observation	Confidence Level	Site 12	Observation	Confidence Level	Site 14	Observation	Confidence Level	Site 15	Observation	Confidence Level	Site 16	Observation	Confidence Level	Site 17	Observation	Confidence Level	Site 18	Observation	Confidence Level	Site 19	Observation	Confidence Level
		Heron																														
Aves	***Artamus cyanopterus***	**Dusky Woodswallow**	**Native**	**V**																												
Aves	*Artamus superciliosus*	White-browed Woodswallow	Native																													
Aves	*Aythya australis*	Hardhead	Native																													
Aves	*Barnardius zonarius*	Australian Ringneck	Native															X	OW													
Aves	*Cacatua galerita*	Sulphur-crested Cockatoo	Native			x	OW					x	OW					X	OW		x	OW		x	OW		X	O		X	O	
Aves	*Cacatua sanguinea*	Little Corella	Native			x	OW		x	OW								X	OW		x	OW								X	O	
Aves	*Cacomantis pallidus*	Pallid Cuckoo	Native						x	OW																						
Aves	*Chalcites lucidus*	Shining Bronze-Cuckoo	Native																													
Aves	*Chenonetta jubata*	Australian Wood Duck	Native			x	OW		x	OW								X	OW		x	OW					X	O				
Aves	***Chthonicola sagittata***	**Speckled Warbler**	**Native**	**V**														X	OW													
Aves	*Cincloramphus cruralis*	Brown Songlark	Native																													
Aves	*Cincloramphus mathewsi*	Rufous Songlark	Native																													
Aves	***Circus assimilis***	**Spotted Harrier**	**Native**	**V**																												

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 10	Observation	Confidence Level	Site 11	Observation	Confidence Level	Site 12	Observation	Confidence Level	Site 14	Observation	Confidence Level	Site 15	Observation	Confidence Level	Site 16	Observation	Confidence Level	Site 17	Observation	Confidence Level	Site 18	Observation	Confidence Level	Site 19	Observation	Confidence Level
Aves	***Climacteris picumnus***	**Brown Treecreeper**	**Native**	**V**																												
Aves	*Colluricincla harmonica*	Grey Shrike-thrush	Native																													
Aves	*Coracina maxima*	Ground Cuckoo-shrike	Native																													
Aves	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	Native						x	OW		x	OW								x	OW		x	OW							
Aves	*Corcorax melanorhamphos*	White-winged Chough	Native			x	OW		x	OW		x	OW								x	OW		x	OW		X	O				
Aves	*Cormobates leucophaea*	White-throated Treecreeper	Native																													
Aves	*Corvus coronoides*	Australian Raven	Native			x	OW											X	OW		x	OW		x	OW		X	O		X	O	
Aves	*Corvus mellori*	Little Raven	Native															X	OW													
Aves	*Coturnix ypsilophora*	Brown Quail	Native																													
Aves	*Cracticus nigrogularis*	Pied Butcherbird	Native			x	OW		x	OW		x	OW		x	OW		X	OW		x	OW		x	OW		X	O		X	O	
Aves	*Cracticus tibicen*	Australian Magpie	Native			x	OW		x	OW		x	OW		x	OW		X	OW		x	OW		x	OW		X	O		X	O	
Aves	*Cracticus torquatus*	Grey Butcherbird	Native			x	OW		x	OW		x	OW		x	OW					x	OW										
Aves	*Cygnus atratus*	Black Swan	Native																													
Aves	*Dacelo novaeguineae*	Laughing Kookaburra	Native									x	OW					X	OW		x	OW		x	OW					X	O	
Aves	*Dendrocygna eytoni*	Plumed Whistling-	Native																													

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 10	Observation	Confidence Level	Site 11	Observation	Confidence Level	Site 12	Observation	Confidence Level	Site 14	Observation	Confidence Level	Site 15	Observation	Confidence Level	Site 16	Observation	Confidence Level	Site 17	Observation	Confidence Level	Site 18	Observation	Confidence Level	Site 19	Observation	Confidence Level
		Duck																														
Aves	*Dicaeum hirundinaceum*	Mistletoebird	Native																													
Aves	*Egretta novaehollandiae*	White-faced Heron	Native			x	OW														x	OW										
Aves	*Elanus axillaris*																															
Aves	*Elseyornis melanops*	Black-fronted Dotterel	Native																													
Aves	*Entomyzon cyanotis*	Blue-faced Honeyeater	Native									x	OW								x	OW		x	OW							
Aves	*Eolophus roseicapillus*	Galah	Native			x	OW		x	OW		x	OW		x	OW		X	OW		x	OW		x	OW		X	O		X	O	
Aves	*Eopsaltria australis*	Eastern Yellow Robin	Native															X	OW													
Aves	*Eurystomus orientalis*	Dollarbird	Native															X	OW													
Aves	*Falco berigora*	Brown Falcon	Native			x	OW		x	O											x	O										
Aves	*Falco cenchroides*	Nankeen Kestrel	Native															X	OW								X	O		X	O	
Aves	*Falco longipennis*	Australian Hobby	Native																													
Aves	*Fulica atra*	Eurasian Coot	Native																													
Aves	***Gallinago hardwickii***	**Latham's Snipe**	**Native**		**M**																											
Aves	*Gallinula tenebrosa*	Dusky Moorhen	Native																													
Aves	*Geopelia*	Bar-shouldered	Native																													

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 10	Observation	Confidence Level	Site 11	Observation	Confidence Level	Site 12	Observation	Confidence Level	Site 14	Observation	Confidence Level	Site 15	Observation	Confidence Level	Site 16	Observation	Confidence Level	Site 17	Observation	Confidence Level	Site 18	Observation	Confidence Level	Site 19	Observation	Confidence Level
	humeralis	Dove																														
Aves	*Geopelia striata*	Peaceful Dove	Native																													
Aves	*Gerygone fusca*	Western Gerygone	Native						x	OW																						
Aves	*Glossopsitta concinna*	Musk Lorikeet	Native																					x	OW							
Aves	*Grallina cyanoleuca*	Magpie-lark	Native			x	OW		x	OW											x	OW		x	OW							
Aves	*Haliastur sphenurus*	Whistling Kite	Native																		x	O										
Aves	*Himantopus himantopus*	Black-winged Stilt	Native																													
Aves	*Hirundo neoxena*	Welcome Swallow	Native																								X	O		X	O	
Aves	*Lalage sueurii*	White-winged Triller	Native						x	OW																						
Aves	*Lichenostomus chrysops*	Yellow-faced Honeyeater	Native																													
Aves	*Lichenostomus fuscus*	Fuscous Honeyeater	Native																													
Aves	*Lichenostomus penicillatus*	White-plumed Honeyeater	Native						x	OW																						
Aves	*Lichenostomus virescens*	Singing Honeyeater	Native																													
Aves	*Malacorhynchus membranaceus*	Pink-eared Duck	Native																													
Aves	*Malurus cyaneus*	Superb Fairy-wren	Native															X	OW		x	OW										

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 10	Observation	Confidence Level	Site 11	Observation	Confidence Level	Site 12	Observation	Confidence Level	Site 14	Observation	Confidence Level	Site 15	Observation	Confidence Level	Site 16	Observation	Confidence Level	Site 17	Observation	Confidence Level	Site 18	Observation	Confidence Level	Site 19	Observation	Confidence Level
Aves	*Malurus lamberti*	Variegated Fairy-wren	Native																													
Aves	*Malurus leucopterus*	White-winged Fairy-wren	Native																								X	O				
Aves	*Manorina melanocephala*	Noisy Miner	Native			x	OW		x	OW		x	OW		x	OW		X	OW		x	OW		x	OW		X	O		X	O	
Aves	***Melanodryas cucullata***	**Hooded Robin**	**Native**	**V**																												
Aves	*Melithreptus brevirostris*	Brown-headed Honeyeater	Native																													
Aves	*Microcarbo melanoleucos*	Little Pied Cormorant	Native																													
Aves	*Microeca fascinans*	Jacky Winter	Native																													
Aves	*Milvus migrans*	Black Kite	Native																													
Aves	*Myiagra inquieta*	Restless Flycatcher	Native																													
Aves	*Myiagra rubecula*	Leaden Flycatcher	Native																													
Aves	***Neophema pulchella***	**Turquoise Parrot**	**Native**	**V**																												
Aves	*Ninox novaeseelandiae*	Southern Boobook	Native																													
Aves	*Northiella haematogaster*	Blue Bonnet	Native			x	OW					x	OW					X	OW													
Aves	*Nycticorax caledonicus*	Nankeen Night-Heron	Native																		x	O										
Aves	*Nymphicus hollandicus*	Cockatiel	Native			x	OW					x	OW					X	OW					x	OW							

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 10	Observation	Confidence Level	Site 11	Observation	Confidence Level	Site 12	Observation	Confidence Level	Site 14	Observation	Confidence Level	Site 15	Observation	Confidence Level	Site 16	Observation	Confidence Level	Site 17	Observation	Confidence Level	Site 18	Observation	Confidence Level	Site 19	Observation	Confidence Level
Aves	*Ocyphaps lophotes*	Crested Pigeon	Native			x	OW		x	OW		x	OW					X	OW		x	OW					X	O				
Aves	*Oriolus sagittatus*	Olive-backed Oriole	Native																													
Aves	***Pachycephala inornata***	**Gilbert's Whistler**	**Native**	**V**																												
Aves	*Pachycephala pectoralis*	Golden Whistler	Native																													
Aves	*Pachycephala rufiventris*	Rufous Whistler	Native						x	OW								X	OW													
Aves	*Pardalotus punctatus*	Spotted Pardalote	Native																													
Aves	*Pardalotus striatus*	Striated Pardalote	Native			x	OW		x	OW		x	OW					X	OW					x	OW		X	O		X	O	
Aves	*Passer domesticus*	House Sparrow	Native																													
Aves	*Pelecanus conspicillatus*	Australian Pelican	Native																													
Aves	*Petrochelidon ariel*	Fairy Martin	Native																													
Aves	*Petrochelidon nigricans*	Tree Martin	Native																													
Aves	*Petroica goodenovii*	Red-capped Robin	Native															X	OW													
Aves	*Phalacrocorax sulcirostris*	Little Black Cormorant	Native																													
Aves	*Phaps chalcoptera*	Common Bronzewing	Native															X	OW													
Aves	*Philemon citreogularis*	Little Friarbird	Native															X	OW					x	OW							
Aves	*Philemon*	Noisy	Native																					x	OW							

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 10	Observation	Confidence Level	Site 11	Observation	Confidence Level	Site 12	Observation	Confidence Level	Site 14	Observation	Confidence Level	Site 15	Observation	Confidence Level	Site 16	Observation	Confidence Level	Site 17	Observation	Confidence Level	Site 18	Observation	Confidence Level	Site 19	Observation	Confidence Level
	corniculatus	Friarbird																														
Aves	*Platycercus eximius*	Eastern Rosella	Native			x	OW		x	OW		x	OW		x	OW		X	OW		x	OW		x	OW		X	O		X	O	
Aves	*Plectorhyncha lanceolata*	Striped Honeyeater	Native						x	OW								X	OW													
Aves	*Plegadis falcinellus*	Glossy Ibis	Native																													
Aves	*Podargus strigoides*	Tawny Frogmouth	Native			x	OW								x	OW					x	W										
Aves	*Poliocephalus poliocephalus*	Hoary-headed Grebe	Native																													
Aves	***Pomatostomus temporalis***	**Grey-crowned Babbler**	**Native**	**V**		**X**	**OW**		**X**	**OW**		**X**	**OW**					**X**	**OW**													
Aves	*Psephotus haematonotus*	Red-rumped Parrot	Native			x	OW		x	OW		x	OW					X	OW								X	O		X	O	
Aves	*Rhipidura albiscapa*	Grey Fantail	Native															X	OW													
Aves	*Rhipidura leucophrys*	Willie Wagtail	Native						x	OW								X	OW		x	OW		x	OW		X	O		X	O	
Aves	*Scythrops novaehollandiae*	Channel-billed Cuckoo	Native			x	OW		x	OW																						
Aves	*Sericornis frontalis*	White-browed Scrubwren	Native																		x	OW										
Aves	*Smicrornis brevirostris*	Weebill	Native						x	OW								X	OW													
Aves	***Stagonopleura guttata***	**Diamond Firetail**	**Native**	**V**																												
Aves	*Struthidea*	Apostlebird	Native			x	OW		x	OW		x	OW		x	OW		X	OW		x	OW		x	OW							

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 10	Observation	Confidence Level	Site 11	Observation	Confidence Level	Site 12	Observation	Confidence Level	Site 14	Observation	Confidence Level	Site 15	Observation	Confidence Level	Site 16	Observation	Confidence Level	Site 17	Observation	Confidence Level	Site 18	Observation	Confidence Level	Site 19	Observation	Confidence Level
	cinerea																															
Aves	*Sturnus tristis*	Common Myna	Exotic																								X	O		X	O	
Aves	*Sturnus vulgaris*	Common Starling	Exotic			X	OW		X	OW											x	OW		x	OW		X	O		X	O	
Aves	*Tachybaptus novaehollandiae*	Australasian Grebe	Native																													
Aves	*Taeniopygia bichenovii*	Double-barred Finch	Native															X	OW													
Aves	*Threskiornis molucca*	Australian White Ibis	Native																													
Aves	*Threskiornis spinicollis*	Straw-necked Ibis	Native						x	O											x	O					X	O		X	O	
Aves	*Todiramphus sanctus*	Sacred Kingfisher	Native						x	O																						
Aves	*Turnix varius*	Painted Button-quail	Native																													
Aves	*Tyto javanica*	Eastern Barn Owl	Native																													
Aves	*Vanellus miles*	Masked Lapwing	Native																		x	OW										
Aves	*Zosterops lateralis*	Silvereye	Native																													
Mammalia	*Austronomus australis*	White-striped Freetail-bat	Native						x	U	D				X	W/U	D	X	W/U	D	X	W/U	D	X	U	D						
Mammalia	*Bos taurus*	Cow	Exotic									X	O								X	O/Q										
Mammalia	***Chalinobolus dwyeri***	**Large-eared Pied Bat**	**Native**	**V**	**V**													**X**	**U**	**PO**												

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 10	Observation	Confidence Level	Site 11	Observation	Confidence Level	Site 12	Observation	Confidence Level	Site 14	Observation	Confidence Level	Site 15	Observation	Confidence Level	Site 16	Observation	Confidence Level	Site 17	Observation	Confidence Level	Site 18	Observation	Confidence Level	Site 19	Observation	Confidence Level
Mammalia	*Chalinolobus gouldii*	Gould's wattled bat	Native			x	U	D	x	U	D				X	T/U	D	X	T/U	D	X	U	D	X	U	D						
Mammalia	*Chalinolobus morio*	chocolate wattled bat	Native			x	U	D	x	U	D				X	U	D	X	U	D	X	U	D	X	U	PR						
Mammalia	*Felis catus*	Cat	Exotic			X	O											X	H	D												
Mammalia	*Lepus capensis*	Brown Hare	Exotic									X	O		X	O		X	O		X	O		X	O		X	O				
Mammalia	*Macropus giganteus*	Eastern Grey Kangaroo	Native			x	O		x	O		x	O					X	O		X	O/Q					X	O				
Mammalia	*Macropus robustus*	Common Wallaroo	Native															X	O													
Mammalia	*Macropus rufogriseus*	Red-necked Walaby	Native																													
Mammalia	***Miniopterus australis***	**Little Bentwing-bat**	**Native**	**V**																												
Mammalia	***Miniopterus orianae oceanensis***	**Eastern Bentwing-bat**	**Native**	**V**		**X**	**U**	**D**										**X**	**U**	**PR**	**X**	**U**	**PR**	**X**	**U**	**PR**						
Mammalia	***Mormopterus lumsdenae***	**Beccari's Free-tailed Bat**	**Native**	**V**														**X**	**U**	**PO**												
Mammalia	***Mormopterus eleryi***	**Bristle-faced free-tailed bat**	**Native**	**E**																												
Mammalia	*Mormopterus petersi*	Inland free-tailed bat	Native			x	U	D	x	U	D				X	U	PR	X	U	PR	X	U	PR									
Mammalia	*Mormopterus planiceps*	little mastiff-bat	Native			x	U	D	x	U	PO				X	U	D	X	T/U	D	X	U	D									
Mammalia	*Mormopterus ridei*	Eastern free-tailed bat	Native			x	U	D	x	U	D				X	U	D	X	U	D	X	U	D	X	U	D						

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 10	Observation	Confidence Level	Site 11	Observation	Confidence Level	Site 12	Observation	Confidence Level	Site 14	Observation	Confidence Level	Site 15	Observation	Confidence Level	Site 16	Observation	Confidence Level	Site 17	Observation	Confidence Level	Site 18	Observation	Confidence Level	Site 19	Observation	Confidence Level
Mammalia	*Mormopterus spp.*	A Free-tailed Bat	Native																													
Mammalia	*Mus musculus*	House Mouse	Exotic																		X	T										
Mammalia	*Nyctophilus geoffroyi*	lesser long-eared bat	Native																													
Mammalia	*Nyctophilus gouldi*	Gould's long-eared bat	Native																													
Mammalia	*Nyctophilus species*	A long-eared bat species	Native	V	V	X	U	D							X	U	D	X	U	PO	X	U	PO	X	U	D						
Mammalia	*Oryctolagus cuniculus*	Rabbit	Exotic			X	O														X	O										
Mammalia	***Petaurus norfolcensis***	**Squirrel Glider**	**Native**	**V**														X	O/W		X	O/W										
Mammalia	***Phascolarctos cinereus***	**Koala**	**Native**	**V**	**V**																											
Mammalia	*Pseudocheirus peregrinus*	Common Ringtail Possum	Native																													
Mammalia	*Rattus fuscipes*	Bush Rat	Native																													
Mammalia	*Rattus sp.*	A rat species	?																													
Mammalia	***Saccolaimus flaviventris***	**Yellow-bellied sheath-tailed bat**	**Native**	**V**		**X**	**U**	**D**	**X**	**U**	**D**				**X**	**U**	**D**	**X**	**U**	**D**	**X**	**U**	**D**	**X**	**U**	**D**						
Mammalia	*Scotorepens balstoni*	inland broad-nosed bat	Native			X	U	D	X	U	D				X	U	D	X	T/U	D	X	U	D	X	U	D						
Mammalia	*Scotorepens greyii / S. sp (central-*	little broad-nosed bat	Native			X	U	D	X	U	D				X	T/U	D	X	T/U	D	X	U	D	X	U	D						

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 10	Observation	Confidence Level	Site 11	Observation	Confidence Level	Site 12	Observation	Confidence Level	Site 14	Observation	Confidence Level	Site 15	Observation	Confidence Level	Site 16	Observation	Confidence Level	Site 17	Observation	Confidence Level	Site 18	Observation	Confidence Level	Site 19	Observation	Confidence Level
	eastern)																															
Mammalia	*Sus scrofa*	Pig	Exotic																													
Mammalia	*Tachyglossus aculeatus*	Short-beaked Echidna	Native												X	O																
Mammalia	*Trichosurus vulpecula*	Common Brushtail Possum	Native												X	O		X	O/Q		X	O		X	XX	D						
Mammalia	***Vespadelus troughtoni***	**Eastern Cave Bat**	**Native**	**V**											**X**	**U**	**D**	**X**	**U**	**PR**	**X**	**U**	**D**										
Mammalia	*Vespadelus vulturnus*	little forest bat	Native			X	U	D	X	U	D				X	U	D	X	U	D	X	U	D	X	U	D						
Mammalia	*Vulpes vulpes*	Fox	Exotic						X			X			X	O		X	O		X	O/Q					X	O				
Mammalia	*Wallabia bicolor*	Swamp Wallaby	Native																		X	O										
Reptilia	*Chelodina longicollis*	Long Necked Turtle	Native																													
Reptilia	*Cryptoblepharus pulcher*	Elegant snake-eyed skink	Native									X	O		X	O		X	O		X	O		X	O							
Reptilia	*Ctenotus robustus*	Robust Striped-skink	Native			X	O		X	O		X	O		X	O		X	O													
Reptilia	*Demansia psammophis*	Yellow-faced Whip Snake	Native									X	O																			
Reptilia	*Diporiphora australis*	Tommy Roundhead	Native																		X	O		X	O							
Reptilia	*Egernia striolata*	Tree Skink	Native			X	O		X	O		X	O		X	O		X	O													
Reptilia	*Eulamprus quoyii*	Eastern Water-skink	Native																													

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 10	Observation	Confidence Level	Site 11	Observation	Confidence Level	Site 12	Observation	Confidence Level	Site 14	Observation	Confidence Level	Site 15	Observation	Confidence Level	Site 16	Observation	Confidence Level	Site 17	Observation	Confidence Level	Site 18	Observation	Confidence Level	Site 19	Observation	Confidence Level
Reptilia	*Furina diadema*	Red-naped Snake	Native									X	O								X	O		X	O							
Reptilia	*Gehyra lazelli*	Lazell's Tree Dtella	Native			X	O		X	O		X	O																			
Reptilia	*Intellagama lesueurii*	Eastern Water Dragon	Native																													
Reptilia	*Lerista timida*	Timid Slider	Native																													
Reptilia	*Lophognathus burnsi*	Burn's Dragon	Native																													
Reptilia	*Lygisaurus foliorum*	Iridescent litter-skink	Native									X	O					X	O													
Reptilia	*Menetia greyii*	Common Dwarf Skink	Native			X	O		X	O											X	O		X	O							
Reptilia	*Morethia boulengeri*	Boulenger's Skink	Native			X	O		X	O		X	O		X	O		X	O					X	O							
Reptilia	*Nebulifera robusta*	Robust Velvet Gecko	Native															X	O													
Reptilia	*Pogona barbata*	Bearded Dragon	Native												X	O																
Reptilia	*Pseudechis porphyriacus*	Red-bellied Black Snake	Native																													
Reptilia	*Pseudonaja textilis*	Eastern Brown Snake	Native																					X	O							
Reptilia	*Suta suta*	Curl Snake	Native																													
Reptilia	*Tiliqua scincoides*	Common Blue-tongue	Native																		X	O										
Reptilia	*Varanus varius*	Lace Monitor	Native			X	O		X	O																						

Sites 20 to 23

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 20	Observation	Confidence Level	Site 21	Observation	Confidence Level	Site 22	Observation	Confidence Level	Site 23	Observation	Confidence Level	Incidentals	Observation	Confidence Level
Amphibia	*Cyclorana verrucosa*	Rough Burrowing Frog	Native															X	O	
Amphibia	*Limnodynastes dumerilii*	Eastern pobblebonk	Native															X	W	
Amphibia	*Limnodynastes fletcheri*	Fletcher's frog	Native															X	W	
Amphibia	*Limnodynastes tasmaniensis*	Spotted marsh Frog	Native															X	W	
Amphibia	*Litoria caerulea*	Green Tree Frog	Native															X	W	
Amphibia	*Litora fallax*	Eastern Dwarf Tree Frog	Native															X	W	
Amphibia	*Litoria latopalmata*	Broad-palmed rocket frog	Native															X	W	
Amphibia	*Litoria peronii*	Emerald-spotted Tree Frog	Native															X	W	
Amphibia	*Litoria rubella*	Desert Tree Frog	Native															X	O	
Amphibia	*Uperoleia laevigata*	Smooth Toadlet	Native															X	W	
Aves	*Acanthagenys rufogularis*	Spiny-cheeked Honeyeater	Native																	
Aves	*Acanthiza apicalis*	Inland Thornbill	Native															X		
Aves	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill	Native												X	O				
Aves	*Acanthiza lineata*	Striated Thornbill	Native																	
Aves	*Acanthiza nana*	Yellow Thornbill	Native																	
Aves	*Acanthiza pusilla*	Brown Thornbill	Native																	
Aves	*Acanthiza reguloides*	Buff-rumped Thornbill	Native															X		
Aves	*Acanthiza uropygialis*	Chestnut-rumped Thornbill	Native																	
Aves	*Aegotheles cristatus*	Australian Owlet-nightjar	Native																	
Aves	*Alisterus scapularis*	Australian King-Parrot	Native																	
Aves	*Anas gracilis*	Grey Teal	Native									X	O		X	O				
Aves	*Anas superciliosa*	Pacific Black Duck	Native												X	O				
Aves	*Anhinga novaehollandiae*	Australasian Darter	Native																	
Aves	*Anthus novaeseelandiae*	Australasian Pipit	Native									X	O		X	O				

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 20	Observation	Confidence Level	Site 21	Observation	Confidence Level	Site 22	Observation	Confidence Level	Site 23	Observation	Confidence Level	Incidentals	Observation	Confidence Level
Aves	*Aphelocephala leucopsis*	Southern Whiteface	Native																	
Aves	*Aprosmictus erythropterus*	Red-winged Parrot	Native																	
Aves	*Ardea modesta*	Eastern Great Egret	Native																	
Aves	*Ardea pacifica*	White-necked Heron	Native																	
Aves	***Artamus cyanopterus***	**Dusky Woodswallow**	**Native**	**V**																
Aves	*Artamus superciliosus*	White-browed Woodswallow	Native																	
Aves	*Aythya australis*	Hardhead	Native																	
Aves	*Barnardius zonarius*	Australian Ringneck	Native																	
Aves	*Cacatua galerita*	Sulphur-crested Cockatoo	Native			X	O		X	O										
Aves	*Cacatua sanguinea*	Little Corella	Native												X	O				
Aves	*Cacomantis pallidus*	Pallid Cuckoo	Native																	
Aves	*Chalcites lucidus*	Shining Bronze-Cuckoo	Native																	
Aves	*Chenonetta jubata*	Australian Wood Duck	Native									X	O		X	O				
Aves	***Chthonicola sagittata***	**Speckled Warbler**	**Native**	**V**																
Aves	*Cincloramphus cruralis*	Brown Songlark	Native									X	O							
Aves	*Cincloramphus mathewsi*	Rufous Songlark	Native												X	O				
Aves	***Circus assimilis***	**Spotted Harrier**	**Native**	**V**																
Aves	***Climacteris picumnus***	**Brown Treecreeper**	**Native**	**V**																
Aves	*Colluricincla harmonica*	Grey Shrike-thrush	Native																	
Aves	*Coracina maxima*	Ground Cuckoo-shrike	Native												X	O				
Aves	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	Native																	
Aves	*Corcorax melanorhamphos*	White-winged Chough	Native			X	O								X	O				
Aves	*Cormobates leucophaea*	White-throated Treecreeper	Native																	
Aves	*Corvus coronoides*	Australian Raven	Native			X	O		X	O		X	O		X	O				
Aves	*Corvus mellori*	Little Raven	Native									X	O		X	O				

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 20	Observation	Confidence Level	Site 21	Observation	Confidence Level	Site 22	Observation	Confidence Level	Site 23	Observation	Confidence Level	Incidentals	Observation	Confidence Level
Aves	*Coturnix ypsilophora*	Brown Quail	Native															X	OW	
Aves	*Cracticus nigrogularis*	Pied Butcherbird	Native			X	O		X	O		X	O		X	O				
Aves	*Cracticus tibicen*	Australian Magpie	Native			X	O		X	O		X	O		X	O				
Aves	*Cracticus torquatus*	Grey Butcherbird	Native																	
Aves	*Cygnus atratus*	Black Swan	Native																	
Aves	*Dacelo novaeguineae*	Laughing Kookaburra	Native						X	O					X	O				
Aves	*Dendrocygna eytoni*	Plumed Whistling-Duck	Native																	
Aves	*Dicaeum hirundinaceum*	Mistletoebird	Native																	
Aves	*Egretta novaehollandiae*	White-faced Heron	Native									X	O		X	O				
Aves	*Elanus axillaris*											X	O		X	O				
Aves	*Elseyornis melanops*	Black-fronted Dotterel	Native															X	OW	
Aves	*Entomyzon cyanotis*	Blue-faced Honeyeater	Native																	
Aves	*Eolophus roseicapillus*	Galah	Native			X	O		X	O		X	O		X	O				
Aves	*Eopsaltria australis*	Eastern Yellow Robin	Native																	
Aves	*Eurystomus orientalis*	Dollarbird	Native																	
Aves	*Falco berigora*	Brown Falcon	Native																	
Aves	*Falco cenchroides*	Nankeen Kestrel	Native			X	O		X	O		X	O		X	O				
Aves	*Falco longipennis*	Australian Hobby	Native																	
Aves	*Fulica atra*	Eurasian Coot	Native																	
Aves	***Gallinago hardwickii***	**Latham's Snipe**	**Native**		**M**													**X**	**OW**	
Aves	*Gallinula tenebrosa*	Dusky Moorhen	Native																	
Aves	*Geopelia humeralis*	Bar-shouldered Dove	Native																	
Aves	*Geopelia striata*	Peaceful Dove	Native																	
Aves	*Gerygone fusca*	Western Gerygone	Native																	
Aves	*Glossopsitta concinna*	Musk Lorikeet	Native															X	OW	

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 20	Observation	Confidence Level	Site 21	Observation	Confidence Level	Site 22	Observation	Confidence Level	Site 23	Observation	Confidence Level	Incidentals	Observation	Confidence Level
Aves	*Grallina cyanoleuca*	Magpie-lark	Native									X	O							
Aves	*Haliastur sphenurus*	Whistling Kite	Native																	
Aves	*Himantopus himantopus*	Black-winged Stilt	Native																	
Aves	*Hirundo neoxena*	Welcome Swallow	Native									X	O		X	O				
Aves	*Lalage sueurii*	White-winged Triller	Native																	
Aves	*Lichenostomus chrysops*	Yellow-faced Honeyeater	Native																	
Aves	*Lichenostomus fuscus*	Fuscous Honeyeater	Native																	
Aves	*Lichenostomus penicillatus*	White-plumed Honeyeater	Native																	
Aves	*Lichenostomus virescens*	Singing Honeyeater	Native																	
Aves	*Malacorhynchus membranaceus*	Pink-eared Duck	Native																	
Aves	*Malurus cyaneus*	Superb Fairy-wren	Native									X	O							
Aves	*Malurus lamberti*	Variegated Fairy-wren	Native																	
Aves	*Malurus leucopterus*	White-winged Fairy-wren	Native									X	O							
Aves	*Manorina melanocephala*	Noisy Miner	Native			X	O		X	O					X	O				
Aves	***Melanodryas cucullata***	**Hooded Robin**	**Native**	**V**																
Aves	*Melithreptus brevirostris*	Brown-headed Honeyeater	Native																	
Aves	*Microcarbo melanoleucos*	Little Pied Cormorant	Native									X	O		X	O				
Aves	*Microeca fascinans*	Jacky Winter	Native																	
Aves	*Milvus migrans*	Black Kite	Native															X	OW	
Aves	*Myiagra inquieta*	Restless Flycatcher	Native																	
Aves	*Myiagra rubecula*	Leaden Flycatcher	Native																	
Aves	***Neophema pulchella***	**Turquoise Parrot**	**Native**	**V**																
Aves	*Ninox novaeseelandiae*	Southern Boobook	Native																	
Aves	*Northiella haematogaster*	Blue Bonnet	Native																	
Aves	*Nycticorax caledonicus*	Nankeen Night-Heron	Native																	

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 20	Observation	Confidence Level	Site 21	Observation	Confidence Level	Site 22	Observation	Confidence Level	Site 23	Observation	Confidence Level	Incidentals	Observation	Confidence Level
Aves	*Nymphicus hollandicus*	Cockatiel	Native									X	O		X	O				
Aves	*Ocyphaps lophotes*	Crested Pigeon	Native												X	O				
Aves	*Oriolus sagittatus*	Olive-backed Oriole	Native																	
Aves	***Pachycephala inornata***	**Gilbert's Whistler**	**Native**	**V**																
Aves	*Pachycephala pectoralis*	Golden Whistler	Native																	
Aves	*Pachycephala rufiventris*	Rufous Whistler	Native																	
Aves	*Pardalotus punctatus*	Spotted Pardalote	Native																	
Aves	*Pardalotus striatus*	Striated Pardalote	Native																	
Aves	*Passer domesticus*	House Sparrow	Native																	
Aves	*Pelecanus conspicillatus*	Australian Pelican	Native												X	O				
Aves	*Petrochelidon ariel*	Fairy Martin	Native												X	O				
Aves	*Petrochelidon nigricans*	Tree Martin	Native															X	OW	
Aves	*Petroica goodenovii*	Red-capped Robin	Native																	
Aves	*Phalacrocorax sulcirostris*	Little Black Cormorant	Native																	
Aves	*Phaps chalcoptera*	Common Bronzewing	Native																	
Aves	*Philemon citreogularis*	Little Friarbird	Native																	
Aves	*Philemon corniculatus*	Noisy Friarbird	Native																	
Aves	*Platycercus eximius*	Eastern Rosella	Native			X	O		X	O					X	O				
Aves	*Plectorhyncha lanceolata*	Striped Honeyeater	Native																	
Aves	*Plegadis falcinellus*	Glossy Ibis	Native																	
Aves	*Podargus strigoides*	Tawny Frogmouth	Native																	
Aves	*Poliocephalus poliocephalus*	Hoary-headed Grebe	Native																	
Aves	***Pomatostomus temporalis***	**Grey-crowned Babbler**	**Native**	**V**																
Aves	*Psephotus haematonotus*	Red-rumped Parrot	Native												X	O				
Aves	*Rhipidura albiscapa*	Grey Fantail	Native																	

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 20	Observation	Confidence Level	Site 21	Observation	Confidence Level	Site 22	Observation	Confidence Level	Site 23	Observation	Confidence Level	Incidentals	Observation	Confidence Level
Aves	*Rhipidura leucophrys*	Willie Wagtail	Native			X	O		X	O		X	0							
Aves	*Scythrops novaehollandiae*	Channel-billed Cuckoo	Native																	
Aves	*Sericornis frontalis*	White-browed Scrubwren	Native																	
Aves	*Smicrornis brevirostris*	Weebill	Native																	
Aves	***Stagonopleura guttata***	**Diamond Firetail**	**Native**	**V**																
Aves	*Struthidea cinerea*	Apostlebird	Native																	
Aves	*Sturnus tristis*	Common Myna	Exotic												X	O		X		
Aves	*Sturnus vulgaris*	Common Starling	Exotic			X	O								X	O				
Aves	*Tachybaptus novaehollandiae*	Australasian Grebe	Native																	
Aves	*Taeniopygia bichenovii*	Double-barred Finch	Native																	
Aves	*Threskiornis molucca*	Australian White Ibis	Native																	
Aves	*Threskiornis spinicollis*	Straw-necked Ibis	Native												X	O				
Aves	*Todiramphus sanctus*	Sacred Kingfisher	Native																	
Aves	*Turnix varius*	Painted Button-quail	Native																	
Aves	*Tyto javanica*	Eastern Barn Owl	Native															X	OW	
Aves	*Vanellus miles*	Masked Lapwing	Native												X	O				
Aves	*Zosterops lateralis*	Silvereye	Native																	
Mammalia	*Austronomus australis*	White-striped Freetail-bat	Native																	
Mammalia	*Bos taurus*	Cow	Exotic																	
Mammalia	***Chalinobolus dwyeri***	**Large-eared Pied Bat**	**Native**	**V**	**V**													**X**	**U**	**PO**
Mammalia	*Chalinolobus gouldii*	Gould's wattled bat	Native																	
Mammalia	*Chalinolobus morio*	chocolate wattled bat	Native																	
Mammalia	*Felis catus*	Cat	Exotic																	
Mammalia	*Lepus capensis*	Brown Hare	Exotic			X	O					X	O							
Mammalia	*Macropus giganteus*	Eastern Grey Kangaroo	Native									X	O		X	O				

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 20	Observation	Confidence Level	Site 21	Observation	Confidence Level	Site 22	Observation	Confidence Level	Site 23	Observation	Confidence Level	Incidentals	Observation	Confidence Level
Mammalia	*Macropus robustus*	Common Wallaroo	Native																	
Mammalia	*Macropus rufogriseus*	Red-necked Walaby	Native																	
Mammalia	***Miniopterus australis***	**Little Bentwing-bat**	**Native**	**V**														**X**	**U**	**PO**
Mammalia	***Miniopterus orianae oceanensis***	**Eastern Bentwing-bat**	**Native**	**V**																
Mammalia	***Mormopterus lumsdenae***	**Beccari's Free-tailed Bat**	**Native**	**V**														**X**	**U**	**PO**
Mammalia	***Mormopterus eleryi***	**Bristle-faced free-tailed bat**	**Native**	**E**														**X**	**U**	**PO**
Mammalia	*Mormopterus petersi*	Inland free-tailed bat	Native																	
Mammalia	*Mormopterus planiceps*	little mastiff-bat	Native																	
Mammalia	*Mormopterus ridei*	Eastern free-tailed bat	Native																	
Mammalia	*Mormopterus spp.*	A Free-tailed Bat	Native															X	U	PO
Mammalia	*Mus musculus*	House Mouse	Exotic																	
Mammalia	*Nyctophilus geoffroyi*	lesser long-eared bat	Native																	
Mammalia	*Nyctophilus gouldi*	Gould's long-eared bat	Native																	
Mammalia	*Nyctophilus species*	A long-eared bat species	Native	V	V															
Mammalia	*Oryctolagus cuniculus*	Rabbit	Exotic															X		
Mammalia	***Petaurus norfolcensis***	**Squirrel Glider**	**Native**	**V**														**X**	**OW**	
Mammalia	***Phascolarctos cinereus***	**Koala**	**Native**	**V**	**V**													**X**	**O / P**	**D**
Mammalia	*Pseudocheirus peregrinus*	Common Ringtail Possum	Native																	
Mammalia	*Rattus fuscipes*	Bush Rat	Native															X	X	D
Mammalia	*Rattus sp.*	A rat species	?																	
Mammalia	***Saccolaimus flaviventris***	**Yellow-bellied sheath-tailed bat**	**Native**	**V**																
Mammalia	*Scotorepens balstoni*	inland broad-nosed bat	Native																	
Mammalia	*Scotorepens greyii / S. sp (central-eastern)*	little broad-nosed bat	Native																	
Mammalia	*Sus scrofa*	Pig	Exotic																	
Mammalia	*Tachyglossus aculeatus*	Short-beaked Echidna	Native																	

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 20	Observation	Confidence Level	Site 21	Observation	Confidence Level	Site 22	Observation	Confidence Level	Site 23	Observation	Confidence Level	Incidentals	Observation	Confidence Level
Mammalia	*Trichosurus vulpecula*	Common Brushtail Possum	Native																	
Mammalia	***Vespadelus troughtoni***	**Eastern Cave Bat**	**Native**	**V**																
Mammalia	*Vespadelus vulturnus*	little forest bat	Native																	
Mammalia	*Vulpes vulpes*	Fox	Exotic																	
Mammalia	*Wallabia bicolor*	Swamp Wallaby	Native																	
Reptilia	*Chelodina longicollis*	Long Necked Turtle	Native																	
Reptilia	*Cryptoblepharus pulcher*	Elegant snake-eyed skink	Native																	
Reptilia	*Ctenotus robustus*	Robust Striped-skink	Native																	
Reptilia	*Demansia psammophis*	Yellow-faced Whip Snake	Native															X	O	
Reptilia	*Diporiphora australis*	Tommy Roundhead	Native															X	O	
Reptilia	*Egernia striolata*	Tree Skink	Native															X	O	
Reptilia	*Eulamprus quoyii*	Eastern Water-skink	Native																	
Reptilia	*Furina diadema*	Red-naped Snake	Native															X	O	
Reptilia	*Gehyra lazelli*	Lazell's Tree Dtella	Native																	
Reptilia	*Intellagama lesueurii*	Eastern Water Dragon	Native																	
Reptilia	*Lerista timida*	Timid Slider	Native																	
Reptilia	*Lophognathus burnsi*	Burn's Dragon	Native															X	O	
Reptilia	*Lygisaurus foliorum*	Iridescent litter-skink	Native																	
Reptilia	*Menetia greyii*	Common Dwarf Skink	Native															X	O	
Reptilia	*Morethia boulengeri*	Boulenger's Skink	Native															X	O	
Reptilia	*Nebulifera robusta*	Robust Velvet Gecko	Native																	
Reptilia	*Pogona barbata*	Bearded Dragon	Native															X	O	
Reptilia	*Pseudechis porphyriacus*	Red-bellied Black Snake	Native															X	O	
Reptilia	*Pseudonaja textilis*	Eastern Brown Snake	Native															X	O	
Reptilia	*Suta suta*	Curl Snake	Native															X	O	

Class	*Scientific Name*	Common Name	Native/Exotic	BC	EPBC	Site 20	Observation	Confidence Level	Site 21	Observation	Confidence Level	Site 22	Observation	Confidence Level	Site 23	Observation	Confidence Level	Incidentals	Observation	Confidence Level
Reptilia	*Tiliqua scincoides*	Common Blue-tongue	Native															X	O	
Reptilia	*Varanus varius*	Lace Monitor	Native															X	O	

Key

X: detected
O: observed
W: heard
U: ultrasonic call recorded (microbats)
H: hair sample
Q: captured on camera
T: trapped
XX: in a scat

D: Definite detection (for identification via hair or ultrasonic call)
Pr: Probable detection (for identification via hair or ultrasonic call)
Po: Possible detection (for identification via hair or ultrasonic call)
Bold type: listed threatened and/or protected migratory species
V: listed as vulnerable under the BC and/or EPBC Act

Appendix B Fauna Survey Site Descriptions

Site No	1	Estimated size in ha: 16
Lat/ Long	30˚044'22"S 150^{0}010'12"E	
Description	Open grassy woodland with some clearing for grazing, with some scattered fallen logs on a sloping to level site. Site immediately adjacent to disturbed areas and spoil piles associated with previous open cut mining.	
Habitat Type	Woodland/Open Forest	
Habitat Quality	Low	
Connectivity	Low	
Vegetation Community (FloraSearch, 2018)	Pilliga Box – Poplar Box Shrubby Woodland	
Dominant Species	*Eucalyptus populnea, Eucalyptus pilligaensis, Eucalyptus melanophloia, Callitris glaucophylla*	
Sub-canopy	*Callitris glaucophylla* regeneration	
Shrub Cover	Sparse and mostly absent with some regeneration.	
Shrub Species	*Geijera parviflora, Myoporum montanum, Callitris glaucophylla*	
Ground Cover	Sparse grass cover with some forbs present. Many bare areas with little cover of leaf litter.	
Ground Cover Species	*Aristida personata, Astrostipa scabra, Myoporum debile, Triptilodiscus pygmaeus*	

Site No	2	Estimated size in ha: 9
Lat/ Long	30^{0}44'40"S 150^{0}11'23"E	
Description	Partially cleared open woodland from which Cypress Pine regrowth has been removed, bordered by an area of dense Cypress Pine regrowth on a flat site.	
Habitat Type	Woodland/Open Forest	
Habitat Quality	Moderate	
Connectivity	Moderate	
Vegetation Community (FloraSearch, 2018)	White Box – Silver-leaved Ironbark Shrubby Open Forest	
Dominant Species	*Eucalyptus populnea, Eucalyptus melanophloia, Callitris glaucophylla*	
Sub-canopy	None	
Shrub Cover	Very sparse	
Shrub Species	*Callitris glaucophylla, Geijera parviflora, Myoporum montanum, Lycium ferocissimum*	
Ground Cover	Highly variable across site with mostly bare ground and sparse leaf litter under Cypress Pine regrowth, and good grass/forb cover in woodland.	
Ground Cover Species	*Aristida personata, Astrostipa scabra, Atriplex spinibractea, Xerochrysum bracteatum, Wahlenbergia communis*	

Site No	3	Estimated size in ha: >100
Lat/ Long	30^{0}45'27"S 150^{0}12'41"E	
Description	Mostly cleared grassy open woodland with patches of dense regrowth of Cypress Pine on a gentle slope to the south.	
Habitat Type	Woodland/Open Forest	
Habitat Quality	High	
Connectivity	High (connected to Vickery State Forest)	
Vegetation Community (FloraSearch, 2018)	Narrow-leaved Ironbark – White Box Shrubby Forest	
Dominant Species	*Eucalyptus crebra, Eucalyptus albens, Eucalyptus populnea, Eucalyptus pilligaensis, Eucalyptus melanophloia, Callitris glaucophylla*	
Sub-canopy	Cypress Pine Regrowth	
Shrub Cover	Sparse over much of site with some dense small patches in small patches of trees.	
Shrub Species	*Geijera parviflora, Myoporum montanum, Notelaea microcarpa, Eremophila mitchellii*	
Ground Cover	Mainly sparse cover of grasses with some forbs.	
Ground Cover Species	*Aristida personata, Austrostipa scabra, Xerochrysum bracteatum, Eremophila debilis, Atriplex spinibractea*	

Note: Site 3 is connected to Vickery State Forest

Site No	4	Estimated size in ha: >100
Lat/ Long	30^{0}46'14"S 150^{0}12'58"E	
Description	Dry forest with diverse shrub layer on a gentle slope to the west. One good ephemeral watercourse with gully and pond.	
Habitat Type	Woodland/Open Forest	
Habitat Quality	High	
Connectivity	High	
Vegetation Community (FloraSearch, 2018)	Narrow-leaved Ironbark – White Box Shrubby Forest	
Dominant Species	*Eucalyptus albens, Eucalyptus crebra, Callitris glaucophylla*	
Sub-canopy	Some Cypress Pine and tall Acacia.	
Shrub Cover	Sparse over much of site with some dense small patches in small patches of trees.	
Shrub Species	*Dodonaea viscosa, Dodonaea sinuolata, Eromophila mitchellii, Myoporum montanum, Acacia decora*	
Ground Cover	Sparse cover of grass and forbs with patches of bare ground and sparse leaf litter.	
Ground Cover Species	*Aristida personata, Astrostipa scabra, Xerochrysum bracteatum, Eremophila debilis, Wahlenbergia communis*	

Note: Site 4 is within the Vickery State Forest

Site No	5	Estimated size in ha: 7
Lat/ Long	30^{0}47'32"S, 150^{0}13'04"E	
Description	Small patch of open grassy woodland in middle of open grazed paddock.	
Habitat Type	Woodland/Open Forest	
Habitat Quality	Low	
Connectivity	Low	
Vegetation Community (FloraSearch, 2018)	Pilliga Box – Poplar Box Shrubby Woodland	
Dominant Species	*Eucalyptus populnea*	
Sub-canopy	Absent	
Shrub Cover	Absent	
Shrub Species	-	
Ground Cover	Very sparse and grazed, mostly bare ground.	
Ground Cover Species	*Triptilodiscus pygmaeus, Aristida personata, Vittadinia cuneata*	

Site No	**6**	**Estimated size in ha: 18**
Lat/ Long	$30^0$47'19"S, $150^0$11'07"E	
Description	Mostly cleared open grassy woodland on hilltop with evidence of recent grazing.	
Habitat Type	Woodland/Open Forest	
Habitat Quality	Low	
Connectivity	Low	
Vegetation Community (FloraSearch, 2018)	Narrow-leaved Ironbark – White Box Shrubby Forest	
Dominant Species	*Eucalyptus crebra, Eucalyptus albens, Callitirs glaucophylla*	
Sub-canopy	Absent	
Shrub Cover	Very sparse	
Shrub Species	*Callitris glaucophylla, Geijera parviflora, Myoporum montanum, Lycium ferocissimum*	
Ground Cover	Mainly grasses	
Ground Cover Species	*Triptilodiscus pygmaeus, Aristida personata, Vittadinia cuneata, Lomandra multiflora*	

Site No	7	Estimated size in ha: 3
Lat/ Long	30^{0}47'40"E 150^{0}10'25"E	
Description	Mostly cleared agricultural land with farm buildings associated with "Kurrumebede" station and occasional native trees on flat to gently sloping land.	
Habitat Type	Cleared Land	
Habitat Quality	Very Low	
Connectivity	Low	
Vegetation Community (FloraSearch, 2018)	Disturbed Land	
Dominant Species	Mostly absent	
Sub-canopy	Absent	
Shrub Cover	Mostly absent	
Shrub Species	n/a	
Ground Cover	Medium cover of grass.	
Ground Cover Species	*Aristida personata, Austrostipa verticillata, Poa sieberiana, Atriplex spinibractea ,Triptilodiscus pygmaeus*	

Site No	8	Estimated size in ha: 40
Lat/ Long	30^{0}47'03"S, 150^{0}10'11"E	
Description	Large patch of open forest in open cleared grazed area bordered by River Red Gum riparian woodland along Namoi River adjacent to western edge of site. Some flood terraces and gullies (dry) leading into river and then gentle slope towards east away from river.	
Habitat Type	Woodland/Open Forest (part) and Native Grasslands (part)	
Habitat Quality	Moderate	
Connectivity	Moderate	
Vegetation Community (FloraSearch, 2018)	Poplar Box Woodland on Alluvial Clay Soils (part) and Poplar Box Woodland on Alluvial Clay Soils (derived grassland) (part)	
Dominant Species	*Eucalyptus populnea, Callitris glaucophylla, Eucalyptus pilligaensis*	
Sub-canopy	Absent	
Shrub Cover	Shrub cover is sparse at the survey location There is also a small patch of Weeping Myall and some isolated large shrubs along river (to the west and south) and in forest patch.	
Shrub Species	*Acacia pendula, Geijera parviflora, Myoporum montanum, Eremophila mitchellii*	
Ground Cover	Sparse cover of grass and forbs.	
Ground Cover Species	*Aristida personata, Austrostipa verticillata, Poa sieberiana, Atriplex spinibractea , Triptilodiscus pygmaeus*	

Site No	**9**	**Estimated size in ha: 24**
Lat/ Long	$30^0$45'33"S, $150^0$09'31"E	
Description	Large remnant patch of open woodland	
Habitat Type	Woodland/Open Forest	
Habitat Quality	High	
Connectivity	Moderate	
Vegetation Community (FloraSearch, 2018)	White Box – Silver-leaved Ironbark Shrubby Open Forest	
Dominant Species	*Eucalyptus albens, Callitirs glaucophylla, Eucalyptus melanophloia*	
Sub-canopy	Regeneration of Cypress Pine	
Shrub Cover	Dense in small scattered patches throughout forest and woodland.	
Shrub Species	*Geijera parviflora, Myoporum montanum, Eremophila mitchellii, Dodonaea viscosa*	
Ground Cover	Highly variable across site with patches of bare ground and small patches of sparse leaf litter, but mainly with sparse cover of grasses and forbs.	
Ground Cover Species	*Aristida personata, Astrostipa scabra, Xerochrysum bracteatum , Eremophila debilis, Wahlenbergia communis*	

Site No	10	Estimated size in ha: 13
Lat/ Long	30^{0}44'29"S, 150^{0}11'46"E	
Description	Road verge remnant of grassy woodland on flats and then gently sloping to north.	
Habitat Type	Woodland/Open Forest	
Habitat Quality	Moderate	
Connectivity	Low	
Vegetation Community (FloraSearch, 2018)	Pilliga Box – Poplar Box Shrubby Woodland	
Dominant Species	*Eucalyptus populnea, Callitris glaucophylla*	
Sub-canopy	Regenerating Cypress Pine woodland.	
Shrub Cover	Moderate shrub cover with good species diversity.	
Shrub Species	*Geijera parviflora, Myoporum montanum, Eremophila mitchellii, Dodonaea viscosa, Acacia decora*	
Ground Cover	Sparse cover of grass and forbs with small patches of leaf litter.	
Ground Cover Species	*Aristida personata, Astrostipa scabra, Xerochrysum bracteatum , Eremophila debilis, Wahlenbergia communis*	

Site No	11	Estimated size in ha: 7
Lat/ Long	30^{0}44'29"S, 150^{0}11'46"E	
Description	Remnant forest along road verge with canopy extending across road at the west edge of site, becoming more open to the east with scattered trees and tall shrubs. Flat land.	
Habitat Type	Woodland/Open Forest	
Habitat Quality	Moderate	
Connectivity	Moderate	
Vegetation Community (FloraSearch, 2018)	Pilliga Box – Poplar Box Shrubby Woodland	
Dominant Species	*Eucalyptus populnea, Callitris glaucophylla, Eucalyptus pilligaensis*	
Sub-canopy	Regenerating Cypress Pines to the east along road verge.	
Shrub Cover	Scattered patches of tall shrubs.	
Shrub Species	*Geijera parviflora, Myoporum montanum, Eremophila mitchellii*	
Ground Cover	Mainly grasses.	
Ground Cover Species	*Austrostipa verticillata, Poa sieberiana, Atriplex spinibractea, Lomandra longifolia, Aristida personata*	

Site No	12	Estimated size in ha: 4
Lat/ Long	30^{0}46'59"S 150^{0}11'20"E	
Description	Some planted rows of trees of mixed species, some not local to site, with patch of mixed Acacias and Cypress Pine regeneration to the east of the road. Gentle slope to west.	
Habitat Type	Woodlands/Open Forests	
Habitat Quality	Low	
Connectivity	Low	
Vegetation Community (FloraSearch, 2018)	Narrow-leaved Ironbark – White Box Shrubby Forest	
Dominant Species	*Eucalyptus crebra, Eucalyptus albens, Callitris glaucophylla*	
Sub-canopy	Regenerating Cypress Pine woodland.	
Shrub Cover	Absent for most of site, but dense small patches in eastern section.	
Shrub Species	*Acacia decora Geijera parviflora, Myoporum montanum, Eremophila mitchellii*	
Ground Cover	Sparse in planted western section, with sparse cover of grasses and forbs in eastern section. Road verge with thick cover of introduced Coolatai Grass.	
Ground Cover Species	*Aristida personata, Atriplex spinibractea, Lomandra longifolia. Xerochrysum bracteatum, Eremophila debilis*	

Site No	14	Estimated size in ha: 17
Lat/ Long	30^{0}42'12"S, 150^{0}09'59"E	
Description	Open woodland in undeveloped road reserve between cleared grazing and cropping areas.	
Habitat Type	Woodland/Open Forest	
Habitat Quality	Low	
Connectivity	Low	
Vegetation Community (FloraSearch, 2018)	Poplar Box Woodland on Alluvial Clay Soils	
Dominant Species	*Eucalyptus populnea, Eucalyptus pilligaensis., Callitris glaucophylla*	
Sub-canopy	Absent	
Shrub Cover	Very sparse	
Shrub Species	*Acacia oswaldii, Myoporum montanum, Geijera parviflora, Dodonea viscosa, Acacia decora, Lycium ferocissimum*	
Ground Cover	Dense cover of grasses, forbs and saltbush present.	
Ground Cover Species	*Chloris ventricosa, Dichelachne micrantha, Chloris truncata, Austrostipa verticillata, Sclerolaena birchi*	

Site No	15	Estimated size in ha: 67
Lat/ Long	30^{0}45'50"S, 150^{0}09'15"E	
Description	Open Eucalypt/Callitris woodland with patches of dense Callitris regrowth and some cleared section on a gentle slope towards Namoi River to the south.	
Habitat Type	Woodland/Open Forest	
Habitat Quality	Moderate to high	
Connectivity	High	
Vegetation Community (FloraSearch, 2018)	White Box – Silver-leaved Ironbark Shrubby Open Forest	
Dominant Species	*Callitris glaucophylla, Eucalyptus albens*	
Sub-canopy	Cypress Pine Regrowth	
Shrub Cover	Sparse over much of site with some dense small patches.	
Shrub Species	*Myoporum montanum, Eremophila mitchellii , Geijera parviflora, Ehretia membranifolia, Alectryon oleifolius*	
Ground Cover	Mainly sparse cover of grasses with some forbs.	
Ground Cover Species	*Aristida personata, Austrostipa scabra, Xerochrysum bracteatum, Eremophila debilis, Wahlenbergia communis*	

Site No	16	Estimated size in ha: 54
Lat/ Long	30^{0}48'51"S, 150^{0}09'33"E	
Description	Grazed open area with only a few patches of open woodland away from river and remnant River Red Gum Forest along river.	
Habitat Type	Woodland/Open Forest	
Habitat Quality	Moderate	
Connectivity	High – part of Namoi River riverine corridor	
Vegetation Community (FloraSearch, 2018)	River Red Gum Riparian Tall Woodland	
Dominant Species	*Eucalyptus camadulensis, E. melliodora, E. populnea, Salix babylonica, Casuarina cunninghamiana*	
Sub-canopy	Mostly absent, but some small regrowth of Eucalyptus camadulensis.	
Shrub Cover	Mostly absent with some dense small patches of woody weeds.	
Shrub Species	*Datura stramonium, Solanum nigrum, Sida spinosa*	
Ground Cover	Dense cover of grasses, forbs and saltbush.	
Ground Cover Species	*Austrostipa ramosissima, Enchylaena tomentosa, Chloris truncata, Phyla nodiflora, Solanum ferocissimum*	

Site No	17	Estimated size in ha: 13
Lat/ Long	30^{0}49'09"S, 150^{0}08'57"E	
Description	Wide road verge with open grassy woodland with some partial clearing in patches.	
Habitat Type	Woodland/Open Forest	
Habitat Quality	Moderate	
Connectivity	Moderate	
Vegetation Community (FloraSearch, 2018)	Poplar Box Woodland on Alluvial Clay Soils	
Dominant Species	*Eucalyptus melliodora, Angophora floribunda, Eucalyptus populnea, Callitris glaucophylla*	
Sub-canopy	Absent	
Shrub Cover	Very sparse and only in small isolated patches.	
Shrub Species	*Callitris glaucophylla, Acacia oswaldii, Pavonia hastata*	
Ground Cover	Dense cover over most of site with grasses and saltbush.	
Ground Cover Species	*Sclerolaena birchii , Austrostipa verticillata, Aristida vagans, Eremophila debilis, Tribulus terrestris*	

Site No	18	Estimated size in ha: 0^
Lat/ Long	30^{0}48'50"S 150^{0}08'14"E	
Description	Flat grazed area with planted introduced pasture grasses.	
Habitat Type	Cleared Land	
Habitat Quality	Very Low	
Connectivity	Very Low	
Vegetation Community (FloraSearch, 2018)	Disturbed Land	
Dominant Species	Absent	
Sub-canopy	Absent	
Shrub Cover	Absent	
Shrub Species	Absent	
Ground Cover	Dense cover over most of site with pasture grasses and some remnant chenopod habitat along fencelines.	
Ground Cover Species	*Sclerolaena muricata, Sclerolaena birchii,* and pasture grasses.	

^ Vegetation remnant size can not be estimated as these sites are mostly cleared land with few or no scattered trees

Site No	19	Estimated size in ha: 34#
Lat/ Long	30^{0}48'49"S 150^{0}07'59"E	
Description	Long narrow remnant patch of woodland running north-south across site with cleared areas either side planted with pasture grasses.	
Habitat Type	Woodland/Open Forest	
Habitat Quality	Low	
Connectivity	Moderate	
Vegetation Community (FloraSearch, 2018)	Poplar Box Woodland on Alluvial Clay Soils	
Dominant Species	*Eucalyptus populnea, Eucalyptus blakelyi, Eucalyptus melliodora, Angophora floribunda*	
Sub-canopy	Absent	
Shrub Cover	Absent	
Shrub Species	Absent	
Ground Cover	Sparse cover	
Ground Cover Species	*Sclerolaena muricata, Sclerolaena birchii,* and pasture grasses e.g. *Vulpia myuros*	

Site 19 is well connected to a larger remnant that extends north outside of study area

Site No	**20**	**Estimated size in ha:** 1
Lat/ Long	$30^0$48'56"S $150^0$07'30"E	
Description	Small isolated patch of open woodland adjacent to cleared grazing areas and cropping.	
Habitat Type	Woodland/Open Forest	
Habitat Quality	Low	
Connectivity	Low	
Vegetation Community (FloraSearch, 2018)	Poplar Box Woodland on Alluvial Clay Soils	
Dominant Species	*Eucalyptus populnea, Eucalyptus melliodora*	
Sub-canopy	Absent	
Shrub Cover	Sparse	
Shrub Species	*Geijera parviflora*	
Ground Cover	Dense cover	
Ground Cover Species	*Sclerolaena muricata, Einadia hastata, Austrostipa verticillata, Aristida personata*	

Site No	**21**	**Estimated size in ha:** 5
Lat/ Long	30^{0}48'48"S 150^{0}06'38"E	
Description	Small isolated patch of open woodland along a boundary fence and in the middle of extensive area of cropping.	
Habitat Type	Woodland/Open Forest	
Habitat Quality	Low	
Connectivity	Low	
Vegetation Community (FloraSearch, 2018)	Poplar Box Woodland on Alluvial Clay Soils	
Dominant Species	*Eucalyptus populnea, Eucalyptus microcarpa, Allocasuarina luehmannii*	
Sub-canopy	Absent	
Shrub Cover	Sparse	
Shrub Species	*Lycium ferocissimum*	
Ground Cover	Dense cover	
Ground Cover Species	*Sclerolaena muricata, Sclerolaena birchii, Enchylaena tomentosa, Elymus scaber*	

Site No	22	Estimated size in ha: 0^
Lat/ Long	30^{0}50'13"S 150^{0}04'20"E	
Description	Two thirds of site is cleared cropping land with a canal, but the southwest corner of the site has an undisturbed area which has a mixture of weeds, grasses and chenopods.	
Habitat Type	Cleared Land / Native Grassland	
Habitat Quality	Low /Moderate	
Connectivity	Low	
Vegetation Community (FloraSearch, 2018)	Disturbed Land	
Dominant Species	Absent	
Sub-canopy	Absent	
Shrub Cover	Absent	
Shrub Species	Absent	
Ground Cover	Dense ground cover of grasses, weeds and chenopods	
Ground Cover Species	*Sisymbrium orientale, Sclerolaena muricata, Xanthium spinosum, Swainsona galegifloia*	

^ Vegetation remnant size can not be estimated as these sites are mostly cleared land with few or no scattered trees

Site No	23	Estimated size in ha: 0^
Lat/ Long	30^{0}47'49"S 150^{0}12'39"E	
Description	Mostly cleared area with a few scattered trees and a stock dam near the eastern boundary used for current livestock.	
Habitat Type	Cleared Land / Woodland/Open Forest	
Habitat Quality	Low	
Connectivity	Low	
Vegetation Community (FloraSearch, 2018)	Poplar Box Woodland on Alluvial Clay Soils	
Dominant Species	*Eucalyptus populnea, Eucalyptus microcarpa, Acacia pendula*	
Sub-canopy	Absent	
Shrub Cover	Absent	
Shrub Species	Absent	
Ground Cover	Moderate	
Ground Cover Species	*Aristida personata, Sclerolaena muricata, Sclerolaena birchii, Rytidosperma bipartitum*	

^ Vegetation remnant size can not be estimated as these sites are mostly cleared land with few or no scattered trees

ATTACHMENT E
BIODIVERSITY CREDIT REPORT (PROJECT MINING AREA)

Biodiversity credit report

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

Date of report: 9/07/2018 Time: 10:17:41AM Calculator version: v4.0

Major Project details

Proposal ID:	0056/2018/4751MP
Proposal name:	VEP (Mine)
Proposal address:	Blue Vale Road Gunnedah NSW 2380
Proponent name:	Whitehaven Coal Limited
Proponent address:	Blue Vale Road Gunnedah NSW 2380
Proponent phone:	0267497821
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
Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion	163.00	4,025.00
Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion	285.00	6,831.00
Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion	61.10	2,159.00
Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains	2.00	46.00
Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion	40.00	1,795.00
Total	551.10	14,856

Credit profiles

1. Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion, (NA324)

Number of ecosystem credits created	6,831
IBRA sub-region	Liverpool Plains (Part B)

Offset options - Plant Community types	Offset options - IBRA sub-regions
Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion, (NA324) Dirty Gum - Buloke - White Cypress Pine - ironbark shrubby woodland on deep sandy soils in the Liverpool Plains region of the Brigalow Belt South Bioregion, (NA135) Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion, (NA179) Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion, (NA189) White Cypress Pine - Bulloak - ironbark woodland of the Pilliga area of the Brigalow Belt South Bioregion, (NA227) Buloke - White Cypress Pine woodland on outwash plains in the Pilliga Scrub and Narrabri regions, Brigalow Belt South Bioregion, (NA265)	Liverpool Plains (Part B) and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion, (NA349)

Number of ecosystem credits created	1,795
IBRA sub-region	Liverpool Plains (Part B)

Offset options - Plant Community types	Offset options - IBRA sub-regions
Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion, (NA349) Narrow-leaved Ironbark grassy woodland of the Brigalow Belt South bioregion, (NA164) Silvertop Stringybark - Orange Gum shrubby open forest of the central parts of the Nandewar Bioregion, (NA206) White Box - Red Stringybark shrubby woodlands on basalt slopes of the Nandewar Bioregion and Brigalow Belt South Bioregion, (NA222) White Box - White Cypress Pine shrubby open forest of the Nandewar Bioregion and Brigalow Belt South Bioregion, (NA225) White Cypress Pine - White Box - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion, (NA232) Semi-mesic woodland on basalt hills of the dry subtropical climate zone, north western slopes of NSW, (NA242) Rough-barked Apple - Yellow Box grass/shrub footslope open forest, Brigalow Belt South Bioregion, (NA343) White Cypress Pine - Poplar Box - Silver-leaved Ironbark viney shrub woodland of the Brigalow Belt South Bioregion, (NA407) White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion, (NA397) Mugga Ironbark - stringybark shrubby open forest of the far southern Nandewar Bioregion and New England Tableland Bioregion, (NA305) White Box - Silvertop Stringybark +/- White Cypress Pine grass shrub open forest of the southern Nandewar Bioregion and New England Tableland Bioregion, (NA393) White Cypress Pine - Silver-leaved Ironbark - Caley's Ironbark open forest of the central Nandewar Bioregion and western New England Tableland Bioregion, (NA408) White Box - White Cypress Pine shrubby hills open forest mainly in the Nandewar Bioregion, (NA398) White Box - cypress pine - Silver-leaved Ironbark shrub grass open forest / woodland of the northern Brigalow Belt South Bioregion and Nandewar Bioregion, (NA396) Silver-leaved Ironbark - White Box - White Cypress Pine viney scrub woodland in the Nandewar Bioregion and Brigalow Belt South Bioregion, (NA347)	Liverpool Plains (Part B) and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

3. Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion, (NA311)

Number of ecosystem credits created	4,025
IBRA sub-region	Liverpool Plains (Part B)

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

Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion, (NA311)

Black Cypress Pine - Narrow-leaved Stringybark heathy woodland of the southern Brigalow Belt South Bioregion, (NA106)

Black Cypress Pine shrubby woodland of the Brigalow Belt South Bioregion, (NA109)

Blue-leaved Ironbark heathy woodland of the southern part of the Brigalow Belt South Bioregion, (NA116)

Brown Bloodwood - cypress - ironbark heathy woodland in the Pilliga region of the Brigalow Belt South Bioregion, (NA124)

Mugga Ironbark - Buloke - Pillga Box - White Cypress Pine shrubby woodland on sandstone in the Dubbo region, south-western Brigalow Belt South Bioregion, (NA160)

Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South bioregion, (NA165)

White Box - White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion, (NA224)

White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion, (NA228)

White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar Bioregion and Brigalow Belt South Bioregion, (NA229)

White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion, (NA231)

White Cypress Pine - Narrow-leaved Ironbark - White Bloodwood - red gum shrub grass woodland of the Pilliga - Coonabarabran region, Brigalow Belt South Bioregion, (NA405)

Narrow-leaved Ironbark - White Cypress Pine - Buloke tall open forest on lower slopes and flats in the Pilliga Scrub and surrounding forests in the central north Brigalow Belt South Bioregion, (NA314)

Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region, (NA338)

Mugga Ironbark - White Cypress Pine - gum tall woodland on flats in the Pilliga forests and surrounding regions, Brigalow Belt South Bioregion, (NA307)

Dapper Mugga Ironbark - Western Grey Box - Blakely's Red Gum - Black Cypress Pine grass shrub hill woodland (southern Brigalow Belt South Bioregion), (NA306)

White Mallee - Dwyer's Red Gum mallee heath on sands in the Goonoo - Pilliga region, Brigalow Belt South Bioregion, (NA411)

Red Stringybark - Rough-barked Apple +/- Nortons Box open forest on hillslopes in the Warrumbungle NP - Coolah regions, (NA329)

Blue-leaved Ironbark - Black Cypress Pine - Rough-barked Apple woodland mainly in the east Pilliga forests, Brigalow Belt South Bioregion, (NA259)

Motherumbah - Dwyer's Red Gum - White Cypress Pine tall shrubland of the Narrabri to Warialda region, Brigalow Belt South Bioregion, (NA298)

Red Stringybark - Narrow-leaved Ironbark - Black Cypress Pine - hill red gum sandstone woodland of southern NSW Brigalow Belt South Bioregion,

Liverpool Plains (Part B)

and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

(NA328) Rough-barked Apple - Red Stringybark - Black Cypress Pine - red gum sand valley woodland of the Garawilla region, Brigalow Belt South Bioregion, (NA340) Narrow-leaved Ironbark - White Bloodwood - Red Stringybark woodland of the Garawilla - Liverpool Plains region, Brigalow Belt South Bioregion, (NA313) White Bloodwood - Red Ironbark - Black Cypress Pine woodland on sandstone hills in the Garawilla - Liverpool Plains region, Brigalow Belt South Bioregion, (NA391) Dwyer's Red Gum - White Cypress Pine - Motherumbah open forest / woodland on sandstone hillcrests in the Liverpool Plains region, Brigalow Belt South Bioregion, (NA283) White Cypress Pine - red gum grass-shrub woodland on sandstone hills of the Caroona region, Liverpool Plains, Brigalow Belt South Bioregion, (NA404) Tumbledown Red Gum - Dwyer's Red Gum - Wallaby Bush shrubby woodland of the Nandewar Bioregion, (NA373) Narrow-leaved Ironbark - cypress pine - White Box shrubby open forestin the Brigalow Belt South Bioregion and Nandewar Bioregion, (NA316)	

4. Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion, (NA185)

Number of ecosystem credits created	2,159
IBRA sub-region	Liverpool Plains (Part B)

Offset options - Plant Community types	Offset options - IBRA sub-regions
Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion, (NA185) Brigalow - Belah open forest / woodland on alluvial often gilgaied clay from Pilliga Scrub to Goondiwindi, Brigalow Belt South Bioregion, (NA117)	Liverpool Plains (Part B) and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

5. Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains, (NA201)

Number of ecosystem credits created	46
IBRA sub-region	Liverpool Plains (Part B)

Offset options - Plant Community types	Offset options - IBRA sub-regions
Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains, (NA201) Warrego Grass - Nardoo wet grassland of the Brigalow Belt South Bioregion, (NA217) Water Couch marsh grassland wetland of frequently flooded inland watercourses, (NA218) Sedgeland - forbland wetland in depressions on valley flats of the NSW North-western Slopes, (NA345)	Liverpool Plains (Part B) 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
Regent Honeyeater	Anthochaera phrygia	43.60	3,357
Squirrel Glider	Petaurus norfolcensis	72.50	1,595
Koala	Phascolarctos cinereus	44.60	1,160

ATTACHMENT F
BIODIVERSITY CREDIT REPORT (PROJECT RAIL SPUR)

Biodiversity credit report

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

Date of report: 9/07/2018 Time: 10:19:33AM Calculator version: v4.0

Major Project details

Proposal ID:	0056/2018/4749MP
Proposal name:	VEP (Rail)
Proposal address:	Blue Vale Road Gunnedah NSW 2380
Proponent name:	Whitehaven Coal Limited
Proponent address:	Blue Vale Road Gunnedah NSW 2380
Proponent phone:	0267497821
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
Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion	4.00	124.00
Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion	22.00	1,381.00
River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion	2.70	40.00
Total	28.70	1,545

Credit profiles

1. Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion, (NA324)

Number of ecosystem credits created	124
IBRA sub-region	Liverpool Plains (Part B)

Offset options - Plant Community types	Offset options - IBRA sub-regions
Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion, (NA324) Dirty Gum - Buloke - White Cypress Pine - ironbark shrubby woodland on deep sandy soils in the Liverpool Plains region of the Brigalow Belt South Bioregion, (NA135) Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion, (NA179) Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion, (NA189) White Cypress Pine - Bulloak - ironbark woodland of the Pilliga area of the Brigalow Belt South Bioregion, (NA227) Buloke - White Cypress Pine woodland on outwash plains in the Pilliga Scrub and Narrabri regions, Brigalow Belt South Bioregion, (NA265)	Liverpool Plains (Part B) and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion, (NA185)

Number of ecosystem credits created	1,381
IBRA sub-region	Liverpool Plains (Part B)

Offset options - Plant Community types	Offset options - IBRA sub-regions
Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion, (NA185) Brigalow - Belah open forest / woodland on alluvial often gilgaied clay from Pilliga Scrub to Goondiwindi, Brigalow Belt South Bioregion, (NA117)	Liverpool Plains (Part B) and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

3. River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion, (NA193)

Number of ecosystem credits created	40
IBRA sub-region	Liverpool Plains (Part B)

Offset options - Plant Community types	Offset options - IBRA sub-regions
River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion, (NA193)	Liverpool Plains (Part B) 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
Regent Honeyeater	Anthochaera phrygia	4.50	346
Koala	Phascolarctos cinereus	5.70	148
Squirrel Glider	Petaurus norfolcensis	2.20	48

ATTACHMENT G
POTENTIAL OFFSET AREAS (LOT AND DP NUMBERS)

Table G1
Potential Offset Areas (Lot and DP Numbers)

Lot	Deposited Plan Number	Tenure Type	Owner
Potential Offset Area 6			
36	DP754929	Freehold	Whitehaven Coal Limited
Potential Offset Area 7			
2	DP1102940	Freehold	Whitehaven Coal Limited
Potential Offset Area 8			
18	DP754951	Freehold	Whitehaven Coal Limited
Private Property			
105	DP754953	Freehold	Privately-owned
82	DP754953	Freehold	
16	DP754942	Freehold	
Mount Somner Property			
65	DP755532	Freehold	Whitehaven Coal Limited

ATTACHMENT H
BIODIVERSITY CREDIT REPORT (COMMONWEALTH ASSESSMENT FOOTPRINT – MINING AREA)

Biodiversity credit report

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

Date of report: 9/07/2018 Time: 10:18:36AM Calculator version: v4.0

Major Project details

Proposal ID:	0056/2018/4801MP
Proposal name:	VEP Mine (EPBC Act)
Proposal address:	Blue Vale Road Gunnedah NSW 2380
Proponent name:	Whitehaven Coal Limited
Proponent address:	Blue Vale Road Gunnedah NSW 2380
Proponent phone:	0267497821
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
Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion	208.50	5,600.00
Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion	362.00	8,692.00
Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion	70.20	2,505.00
Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains	4.00	110.00
Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion	55.00	2,186.00
Total	699.70	19,093

Credit profiles

1. Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion, (NA324)

Number of ecosystem credits created	8,692
IBRA sub-region	Liverpool Plains (Part B)

Offset options - Plant Community types	Offset options - IBRA sub-regions
Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion, (NA324) Dirty Gum - Buloke - White Cypress Pine - ironbark shrubby woodland on deep sandy soils in the Liverpool Plains region of the Brigalow Belt South Bioregion, (NA135) Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion, (NA179) Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion, (NA189) White Cypress Pine - Bulloak - ironbark woodland of the Pilliga area of the Brigalow Belt South Bioregion, (NA227) Buloke - White Cypress Pine woodland on outwash plains in the Pilliga Scrub and Narrabri regions, Brigalow Belt South Bioregion, (NA265)	Liverpool Plains (Part B) and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion, (NA349)

Number of ecosystem credits created	2,186
IBRA sub-region	Liverpool Plains (Part B)

Offset options - Plant Community types	Offset options - IBRA sub-regions
Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion, (NA349) Narrow-leaved Ironbark grassy woodland of the Brigalow Belt South bioregion, (NA164) Silvertop Stringybark - Orange Gum shrubby open forest of the central parts of the Nandewar Bioregion, (NA206) White Box - Red Stringybark shrubby woodlands on basalt slopes of the Nandewar Bioregion and Brigalow Belt South Bioregion, (NA222) White Box - White Cypress Pine shrubby open forest of the Nandewar Bioregion and Brigalow Belt South Bioregion, (NA225) White Cypress Pine - White Box - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion, (NA232) Semi-mesic woodland on basalt hills of the dry subtropical climate zone, north western slopes of NSW, (NA242) Rough-barked Apple - Yellow Box grass/shrub footslope open forest, Brigalow Belt South Bioregion, (NA343) White Cypress Pine - Poplar Box - Silver-leaved Ironbark viney shrub woodland of the Brigalow Belt South Bioregion, (NA407) White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion, (NA397) Mugga Ironbark - stringybark shrubby open forest of the far southern Nandewar Bioregion and New England Tableland Bioregion, (NA305) White Box - Silvertop Stringybark +/- White Cypress Pine grass shrub open forest of the southern Nandewar Bioregion and New England Tableland Bioregion, (NA393) White Cypress Pine - Silver-leaved Ironbark - Caley's Ironbark open forest of the central Nandewar Bioregion and western New England Tableland Bioregion, (NA408) White Box - White Cypress Pine shrubby hills open forest mainly in the Nandewar Bioregion, (NA398) White Box - cypress pine - Silver-leaved Ironbark shrub grass open forest / woodland of the northern Brigalow Belt South Bioregion and Nandewar Bioregion, (NA396) Silver-leaved Ironbark - White Box - White Cypress Pine viney scrub woodland in the Nandewar Bioregion and Brigalow Belt South Bioregion, (NA347)	Liverpool Plains (Part B) and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

3. Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion, (NA311)

Number of ecosystem credits created	5,600
IBRA sub-region	Liverpool Plains (Part B)

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

Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion, (NA311)

Black Cypress Pine - Narrow-leaved Stringybark heathy woodland of the southern Brigalow Belt South Bioregion, (NA106)

Black Cypress Pine shrubby woodland of the Brigalow Belt South Bioregion, (NA109)

Blue-leaved Ironbark heathy woodland of the southern part of the Brigalow Belt South Bioregion, (NA116)

Brown Bloodwood - cypress - ironbark heathy woodland in the Pilliga region of the Brigalow Belt South Bioregion, (NA124)

Mugga Ironbark - Buloke - Pillga Box - White Cypress Pine shrubby woodland on sandstone in the Dubbo region, south-western Brigalow Belt South Bioregion, (NA160)

Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South bioregion, (NA165)

White Box - White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion, (NA224)

White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion, (NA228)

White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar Bioregion and Brigalow Belt South Bioregion, (NA229)

White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion, (NA231)

White Cypress Pine - Narrow-leaved Ironbark - White Bloodwood - red gum shrub grass woodland of the Pilliga - Coonabarabran region, Brigalow Belt South Bioregion, (NA405)

Narrow-leaved Ironbark - White Cypress Pine - Buloke tall open forest on lower slopes and flats in the Pilliga Scrub and surrounding forests in the central north Brigalow Belt South Bioregion, (NA314)

Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region, (NA338)

Mugga Ironbark - White Cypress Pine - gum tall woodland on flats in the Pilliga forests and surrounding regions, Brigalow Belt South Bioregion, (NA307)

Dapper Mugga Ironbark - Western Grey Box - Blakely's Red Gum - Black Cypress Pine grass shrub hill woodland (southern Brigalow Belt South Bioregion), (NA306)

White Mallee - Dwyer's Red Gum mallee heath on sands in the Goonoo - Pilliga region, Brigalow Belt South Bioregion, (NA411)

Red Stringybark - Rough-barked Apple +/- Nortons Box open forest on hillslopes in the Warrumbungle NP - Coolah regions, (NA329)

Blue-leaved Ironbark - Black Cypress Pine - Rough-barked Apple woodland mainly in the east Pilliga forests, Brigalow Belt South Bioregion, (NA259)

Motherumbah - Dwyer's Red Gum - White Cypress Pine tall shrubland of the Narrabri to Warialda region, Brigalow Belt South Bioregion, (NA298)

Red Stringybark - Narrow-leaved Ironbark - Black Cypress Pine - hill red gum sandstone woodland of southern NSW Brigalow Belt South Bioregion,

Liverpool Plains (Part B)

and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

(NA328) Rough-barked Apple - Red Stringybark - Black Cypress Pine - red gum sand valley woodland of the Garawilla region, Brigalow Belt South Bioregion, (NA340) Narrow-leaved Ironbark - White Bloodwood - Red Stringybark woodland of the Garawilla - Liverpool Plains region, Brigalow Belt South Bioregion, (NA313) White Bloodwood - Red Ironbark - Black Cypress Pine woodland on sandstone hills in the Garawilla - Liverpool Plains region, Brigalow Belt South Bioregion, (NA391) Dwyer's Red Gum - White Cypress Pine - Motherumbah open forest / woodland on sandstone hillcrests in the Liverpool Plains region, Brigalow Belt South Bioregion, (NA283) White Cypress Pine - red gum grass-shrub woodland on sandstone hills of the Caroona region, Liverpool Plains, Brigalow Belt South Bioregion, (NA404) Tumbledown Red Gum - Dwyer's Red Gum - Wallaby Bush shrubby woodland of the Nandewar Bioregion, (NA373) Narrow-leaved Ironbark - cypress pine - White Box shrubby open forestin the Brigalow Belt South Bioregion and Nandewar Bioregion, (NA316)	

4. Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion, (NA185)

Number of ecosystem credits created	2,505
IBRA sub-region	Liverpool Plains (Part B)

Offset options - Plant Community types	Offset options - IBRA sub-regions
Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion, (NA185) Brigalow - Belah open forest / woodland on alluvial often gilgaied clay from Pilliga Scrub to Goondiwindi, Brigalow Belt South Bioregion, (NA117)	Liverpool Plains (Part B) and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

5. Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains, (NA201)

Number of ecosystem credits created	110
IBRA sub-region	Liverpool Plains (Part B)

Offset options - Plant Community types	Offset options - IBRA sub-regions
Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains, (NA201) Warrego Grass - Nardoo wet grassland of the Brigalow Belt South Bioregion, (NA217) Water Couch marsh grassland wetland of frequently flooded inland watercourses, (NA218) Sedgeland - forbland wetland in depressions on valley flats of the NSW North-western Slopes, (NA345)	Liverpool Plains (Part B) 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
Koala	Phascolarctos cinereus	75.20	1,955
Regent Honeyeater	Anthochaera phrygia	70.70	5,444

ATTACHMENT I
OFFSET AREAS 6, 7 AND 8 BIOBANKING ASSESSMENT REPORT

OFFSET AREAS 6, 7 AND 8 BIOBANKING ASSESSMENT REPORT

July 2018

PREPARED BY
HUNTER ECO
Dr Colin Driscoll
BioBanking Accredited Assessor #0011

PO Box 1047, Toronto, NSW 2283 P +61 2 4959 8016 M 0438 773 029 E cd_enviro@bigpond.com

CONTENTS

TABLES

FIGURES

Cover photo: Offset Area 8 NA311 Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion.

EXECUTIVE SUMMARY

A flora and vegetation survey was conducted across three sites having potential to offset activities associated with the Vickery Coal Mine, approximately 25 kilometres north of Gunnedah. The sites were designated as Offsets 6, 7 and 8. Field surveys were conducted in accordance with the requirements of the NSW OEH *BioBanking Assessment Methodology 2014.*

Offset Area 6 is located on a low rise from the Namoi River flood plain and consists of 57 hectares (ha) of woodland dominated by regrowth White Cypress Pine (*Callitris glaucophylla*) with scattered White Box (*Eucalyptus albens*) and Silver-leaved Ironbark (*Eucalyptus melanophloia*); there is a sparse ground and shrub layer. There are also 4 ha of cleared grassland.

Offset Area 7 is located against the western side of Vickery State Forest with two boundaries in common. The land is low undulating with several ephemeral drainage lines. There are 66.5 ha of woodland dominated by regrowth White Cypress Pine (*Callitris glaucophylla*) with scattered White Box (*Eucalyptus albens*) and Narrow-leaved Ironbark (*Eucalyptus crebra*). There is a sparse to moderately dense ground and shrub layer. Scattered throughout are Wilga (*Geijera parviflora*), Native Peach (*Ehretia membranifolia*) and Red Ash (*Alphitonia excelsa*). There are also 5.9 ha of cleared grassland.

Offset Area 8 is located on the eastern side of Vickery State Forest with two boundaries in common. Whitehaven's Rocglen Coal Mine is located immediately to the south-east. The elevated portion is dominated by scattered White Box (*Eucalyptus albens*) and Narrow-leaved Ironbark (*Eucalyptus crebra*) with a moderate to dense shrub layer primarily consisting of *Beyeria viscosa*.

Field surveys for Offset Area 6 were conducted by FloraSearch in November 2015 and February 2016; those for Offset Area 7 were conducted by Hunter Eco in May 2016, January and May 2017; and for Offset Area 8 by Hunter Eco in May 2016.

The *BioBanking Assessment Methodology 2014* requires the use of an online program (the *Credit Calculator for Major Projects and BioBanking*) to assess the number of credits which could be generated by the study area if an application for a BioBanking Agreement were to be prepared and the study area were to be accepted as an Offset area.. Table ES-1 summaries the number of credits generated by each of the offset sites.

Table ES-1: Summary of the Credits Generated at Each Offset Site

Offset	Ecosystem Credits	Species Credits
6	533	1,194
7	856	11,384
8	3,958	3,543

Fauna species credits were generated on all three offset sites for the Regent Honeyeater, Koala and Squirrel Glider. Flora species credits were generated on Offset Area 7 for *Tylophora linearis* (9,940 credits) and *Pomaderris queenslandica* (28 credits).

1 INTRODUCTION

1.1 Background

The three locations subject to this report (i.e. Offset Areas 6, 7 and 8 [herein referred to as the study areas]) are located approximately 25 kilometres (km) north of Gunnedah and 12 km south-east of Boggabri (Figure 1). The land within the study areas is owned Whitehaven Coal Limited. The title details for the study areas are: Offset Area 6 Lot 36 DP754929; Offset Area 7 Lot 2 DP1102940; and Offset Area 8 Lot 18 DP754951.

This report has been prepared in accordance with the NSW OEH *BioBanking Assessment Methodology 2014* (OEH, 2014a) and describes the biodiversity characteristics of the study areas for the purpose of determining their suitability as biodiversity offsets.

1.2 Flora and Vegetation Survey Objectives

Objectives of the flora and vegetation surveys were to:

- document plant species growing across the study areas by drawing on the results of past surveys and augmenting this information with that from the current survey;
- classify and map the distribution of vegetation communities across the study areas; and
- target species, communities and populations listed as threatened both in the NSW *Biodiversity Conservation Act, 2016* (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act).

The following guidelines and policies were used to inform the methodology and outcomes of the surveys:

- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft* (Department of Environment and Conservation [DEC], 2004).
- *NSW Guide to Surveying Threatened Plants* (State of NSW and NSW Office of Environment and Heritage [OEH], 2016).
- *Survey Guidelines for Australia's Threatened Orchids* (Commonwealth of Australia, 2013).
- Profiles and guidelines specific to threatened species and communities (e.g. BioNet [OEH, 2017a] and the Vegetation Information System Classification 2.1 [OEH, 2017b]).
- *Guidelines for Threatened Species Assessment* (DEC and Department of Primary Industries [DPI], 2005).
- *BioBanking Assessment Methodology 2014* (OEH, 2014a).

Figure 1 The Offsets in a Regional Context

2 Study Areas

2.1 Regional Setting

The study areas are located approximately 25 km north of Gunnedah and 12 km south-east of Boggabri, in the following regions:

- Gunnedah Local Government Area;
- North-west Local Land Service area (LLSA) (formerly the Namoi Catchment Management Authority [CMA], Liverpool Plains [Part B] CMA sub-region);
- Brigalow Belt South Interim Biogeographic Regionalisation for Australia (IBRA) region, Liverpool Plains IBRA subregion; and
- North Western Slopes Botanical Division.

2.2 Topography and Drainage

Elevation across Offset Area 6 rises from 260 metres Australian Height Datum (m AHD) to 290 m AHD from south to north. The land is a low side slope with no marked drainage lines.

The range of elevation on Offset Area 7 is 313 m AHD to 330 m AHD. There are several incised ephemeral drainage lines receiving stormwater from the more elevated ridges within Vickery State forest to the east. Sediment deposits indicate that water from these drainage lines disperses across the lower flat land to the west.

On Offset Area 8 the land rises from predominantly cleared and grassy low slopes (285 m AHD) in the north east to a woodland ridge along the south western boundary (400 m AHD). Shallow gullies direct stormwater to the north across the lower slopes with no major creek lines present.

See Figure 2 for an overview of topography and drainage across the study areas.

2.3 Mitchell Landscapes

Mitchell Landscapes (Mitchell, 2002) are areas of land with relatively homogenous geomorphology, soils and broad vegetation types which have been mapped at 1:250,000 scale. Each Mitchell Landscape includes an estimate of the percent of native vegetation that has been cleared within the landscape. Table 1 describes the Mitchell Landscapes for each offset.

2.4 Geography and Physiography

The study areas are located in the vicinity of the Approved Vickery Coal Mine (the Approved Mine). Offset Areas 7 and 8 adjoin Vickery State Forest on the eastern side of the Approved Mine while Offset Area 6 is on the western side of the Approved Mine. Table 1 provides details of the geographic location of each of the proposed offsets and Table 2 provides the edaphic and geological attributes.

Offset Area 6 is located on a low rise from the Namoi River flood plain and consists of 57 ha of woodland dominated by regrowth White Cypress Pine (*Callitris glaucophylla*) with scattered White Box (*Eucalyptus albens*) and Silver-leaved Ironbark (*Eucalyptus melanophloia*); there is a sparse ground and shrub layer. There are also 4 ha of cleared grassland.

Offset Area 7 is located against the western side of Vickery State Forest with two boundaries in common. The land is low undulating with several ephemeral drainage lines. There are 66.5 ha of woodland dominated by regrowth White Cypress Pine (*Callitris glaucophylla*) with scattered White Box (*Eucalyptus albens*) and Narrow-leaved Ironbark (*Eucalyptus crebra*). There is a sparse to moderately dense ground and shrub layer. Scattered throughout are Wilga (*Geijera parviflora*), Native Peach (*Ehretia membranifolia*) and Red Ash (*Alphitonia excelsa*). There are also 5.9 ha of cleared grassland.

Offset Area 8 is located on the eastern side of Vickery State Forest with two boundaries in common. Whitehaven's Rocglen Coal Mine is located immediately to the south-east. The elevated portion is dominated by scattered White Box (*Eucalyptus albens*) and Narrow-leaved Ironbark (*Eucalyptus crebra*) with a moderate to dense shrub layer primarily consisting of *Beyeria viscosa*.

2.5 Land-use History

While being mostly wooded, the dense Cypress Pine regrowth on Offset Areas 6 and 7, along with the maturity of the scattered eucalypts and other tree species indicated that these properties were regenerating from past clearing. The lower slopes on Offset Area 8 were predominately cleared gazing grassland while the mid slopes to ridges were forested, with evidence of past timber harvesting.

Table 1 The Geographic Location of the Offsets

Offset	Local Government Area	IBRA[1] Region	IBRA Sub-region	Mitchell Landscape	LLSA[2]
Offset Area 6	Gunnedah	Brigalow Belt South	Liverpool Plains	Part Liverpool Alluvial Plains; Mooki – Namoi Channels and Floodplains	North West
Offset Area 7	Narrabri	Brigalow Belt South	Liverpool Plains	Bugaldie Uplands	North West
Offset Area 8	Narrabri	Brigalow Belt South	Liverpool Plains	Bugaldie Uplands	North West

[1] Interim Biogeographic Regionalisation for Australia

[2] Local Land Services Area

Table 2 Edaphic and geological attributes of the proposed offsets

Offset	Soil[1]	Geological age	Lithology
Offset Area 6	Northern 75% Chromosols Southern 25% Sodosols	Permian	Claystone and sandstone
Offset Area 7	Sodosols	Permian	Claystone and sandstone
Offset Area 8	Sodosols	Elevated wooded area Permian Lower open grassland Quaternary	Claystone and sandstone Polymictic sand and gravel

[1] The Australian Soil Classification (Isbell, 2016)

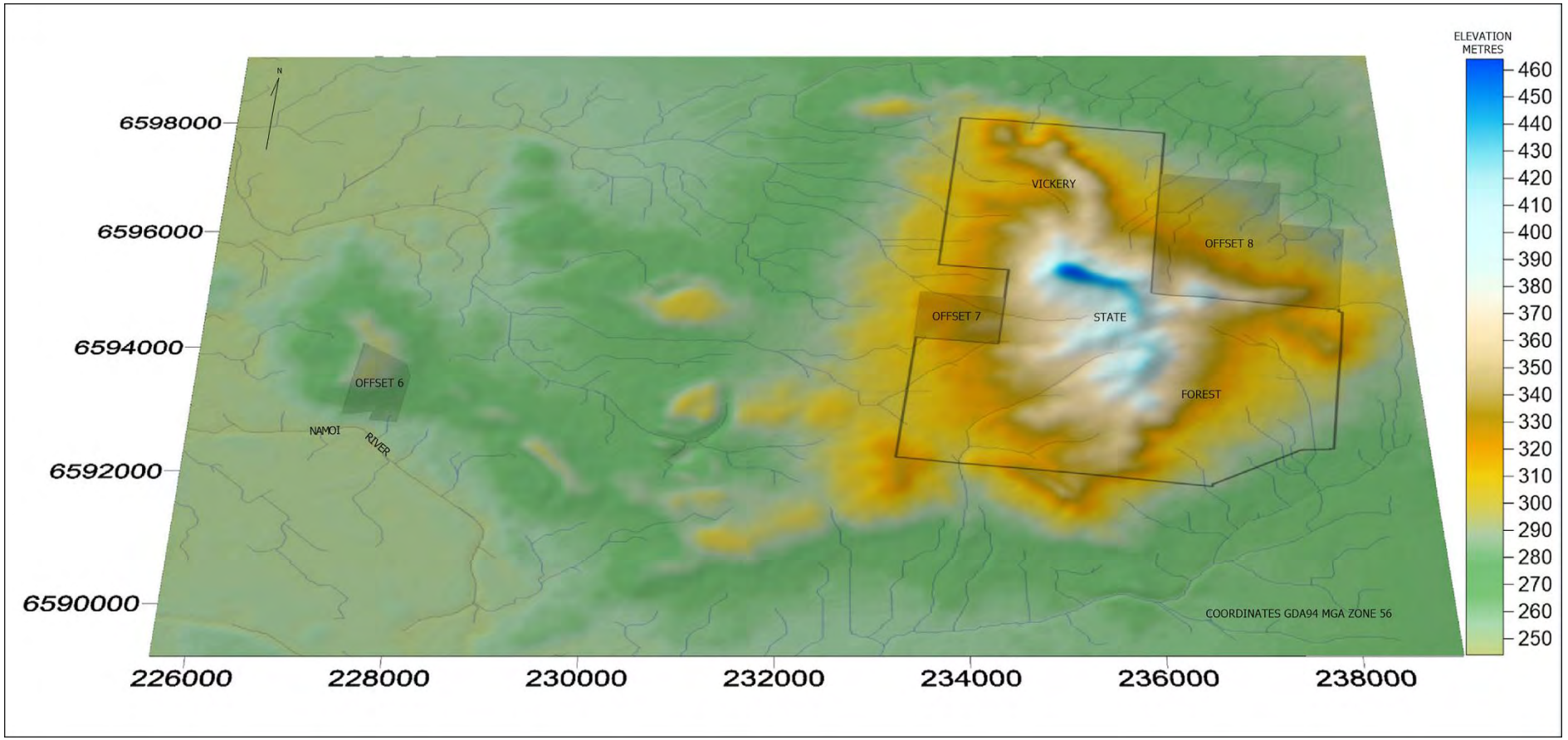


Figure 2 The Topography and Drainage in and Around the Study Areas

3 BACKGROUND INFORMATION

3.1 Local Flora and Fauna Surveys

Flora surveys of Offset Area 6 were conducted by FloraSearch (2018). The vegetation surveys included sampling of floristic plots, collection of Biometric data (OEH, 2017c) and targeted searches for threatened species and ecological communities listed under the BC Act and EPBC Act that could potentially occur.

Fauna surveys within the Study area and surrounds (including targeted searches for potentially occurring threatened species listed under the BC Act and EPBC Act) have been undertaken by Future Ecology (2018), Countrywide Ecological Service (2004; 2007b), Geoff Cunningham Natural Resource Consultants Pty Ltd (2006; 2007; 2008; 2009; 2010), Countrywide Ecological Service (2006; 2007a; 2009a, 2009b, 2009c), Cenwest Environmental Services (2011), Niche (2013; 2014), RPS Harper Somers O'Sullivan (2010), Parsons Brinckerhoff (2010) and Kendall and Kendall (2011). A description of the methodology employed during each of these surveys is provided in Future Ecology (2018).

4 METHODS

4.1 Vegetation Community Mapping and Classification

Several processes are involved in preparing a ground-truthed vegetation community classification and map and these were used to prepare the community classification and map for this study:

- Collection of field data at numerous points on the dominant species present in the canopy, shrub and ground structural layers. These records are referred to as Rapid Data Points (RDP) and provide an understanding of floristic variation across the survey area.
- RDP are initially coded according to an assumed community type and that data extrapolated across the survey area to create a draft vegetation community map. Aerial photo interpretation is used to assist with determining likely community boundaries where changes in vegetation patterns are visible.
- Detailed data are then collected from standard 0.04 ha (generally 20 m x 20 m) plots. The presence and projected foliage cover of all vascular species in each plot were recorded using a modified Braun-Blanquet cover abundance scale: 1 = <1%, 2 = 1–5%, 3 = 5–25%, 4 = 25–50%, 5 = 50–75% and 6 = 75–100%. The overall Study area is stratified according to the variation recorded in the RDP data and floristic plots are randomly placed in these stratified units. The number of plots in each unit is determined in accordance with the requirements of the NSW Framework for Biodiversity Assessment (OEH, 2014b).

These procedures for ground-truthed vegetation mapping were first published by S. Bell and C. Driscoll in 2008 (DECC, 2008), and further elaborated in Bell (2013).

Vegetation communities were first classified at the local level of the immediate region from which the sample data were drawn. Using the floristic composition of these communities, they were matched to the NSW vegetation classification hierarchy as follows:

1. Local classification;
2. NSW BioMetric Vegetation Types (BVTs);
3. NSW Plant Community Types (PCTs);
4. NSW Vegetation Classes (Keith, 2004); and
5. NSW Vegetation Formations (Keith, 2004).

4.2 Biometric Data

In addition to collecting floristic cover abundance data, biometric data were collected at each plot location; Biometric data provides input into the NSW BioBanking credit calculator. Collecting biometric data includes an extension to the 20 m x 20 m floristic plot to form a 20 m x 50 m plot. Data collected are:

- Total number of native plant species 20 m x 20 m
- Native overstorey cover % 50 m transect
- Native mid-storey cover % 50 m transect
- Native ground cover grasses % 50 m transect
- Native ground cover shrubs % 50 m transect
- Native ground cover other % 50 m transect
- Exotic plant cover % 50 m transect
- Number of trees with hollows 20 m x 50 m
- Overstorey regeneration % entire stratified unit
- Length of fallen logs 20 m x 50 m

Floristic data were also scored according to the requirements of Table 1 Section 5.2.1.7 of the *BioBanking Assessment Methodology 2014* (OEH, 2014a).

4.3 Threatened Ecological Communities

Threatened ecological communities likely to occur in the region were extracted from BioNet (OEH, 2017a) and the Commonwealth Protected Matters search tool (Department of the Environment [DotE], 2017) (Table 1). Following vegetation community classification and mapping from field survey results, the floristic content of communities was compared with descriptions in the listed community determinations.

The following threatened ecological communities (listed in the BC Act) were listed as occurring in the Namoi/Liverpool Plains subregion:

- Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions;
- Carbeen Open Forest Community in the Darling Riverine Plains and Brigalow Belt South Bioregions;
- Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregion;
- Native Vegetation on Cracking Clay Soils of the Liverpool Plains;
- Semi-evergreen Vine Thicket in the Brigalow Belt South and Nandewar Bioregions;
- White Box Yellow Box Blakely's Red Gum Woodland;
- Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions; and
- Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions

4.4 Threatened Flora

As a guide to field searches, threatened flora species known or predicted to occur in the Namoi Liverpool Plains sub-zone, and limited to those known or predicted to occur in the BVTs identified on the offsets, were assessed for likelihood of occurring in the proposed offsets (Table 3).

Table 3 Threatened Species Possibly Occurring in the Proposed Offsets

Scientific Name	Common Name	Likelihood of Occurrence
Acacia pubifolia	Velvet Wattle	Outside of the species' geographic range, and unsuitable geology - grows on granite.
Bertya opponens	Coolabah Bertya	Unsuitable. Grows in mallee.
Chiloglottis platyptera	Barrington Tops Ant Orchid	Outside of the species' geographic range
Commersonia procumbens	Commersonia procumbens	**Suitable habitat**
Cyperus conicus	Cyperus conicus	Outside of the species' geographic range
Dichanthium setosum	Bluegrass	**Suitable habitat**
Diuris tricolor	Pine Donkey Orchid	**Suitable habitat.** Only detectable in late September/early October
Eucalyptus nicholii	Narrow-leaved Black Peppermint	Outside of the species' geographic range
Euphrasia arguta	Euphrasia arguta	Unsuitable habitat. Grows in grassy areas near rivers.
Monotaxis macrophylla	Large-leafed Monotaxis	**Suitable habitat.** A fire ephemeral species present for a short time following fire
Philotheca ericifolia	Philotheca ericifolia	Unsuitable. Grows on damp sandy soil in heath.
Polygala linariifolia	Native Milkwort	**Suitable habitat**
Pomaderris queenslandica	Scant Pomaderris	**Suitable habitat**
Prasophyllum sp. Wybong	Prasophyllum sp. Wybong	Outside of the species' geographic range.
Pterostylis cobarensis	Greenhood Orchid	Outside of the species' geographic range
Thesium australe	Austral Toadflax	Unsuitable habitat.
Tylophora linearis	Tylophora linearis	**Suitable habitat**

Discovery of a threatened flora species would trigger a process of determining the size and extent of the population. The locality of the initial discovery would be searched in an ever widening pattern to determine the number and extent of the plants. A habitat assessment would be made and areas of similar habitat searched. If the species was restricted to a small area all individuals would be counted. If the species was more widespread transect searches would be conducted in a way that overall distribution and density could be estimated.

Flora surveys were undertaken in consideration of the following guidelines:

- *BioBanking Assessment Methodology and Credit Calculator Operational Manual* (Department of Environment, Climate Change and Water [DECCW], 2009);
- *Draft NSW Biodiversity Offsets Policy for Major Projects* (and underlying *Framework for Biodiversity Assessment*) (OEH 2014c, 2014b);
- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft* (DEC, 2004); and *EPBC Act Policy Statement - Draft Survey Guidelines for Australia's Threatened Orchids* (DotE, 2014).

4.5 Threatened Fauna

Table 4 provides a list of all threatened fauna species under the BC Act and EPBC Act as predicted to occur by the Archived Biometric and Threatened Species Profiles Datasets (OEH, 2017c) within the mapped vegetation communities. Appendix 2 indicates the suitability of vegetation as habitat for each species and its subsequent use in the calculator.

Table 4 Potentially Occurring Threatened Fauna Species

Scientific Name	Common Name	Conservation Status[1]	
		BC Act	EPBC Act
BIRDS			
Anthochaera phrygia	Regent Honeyeater	CE	CE
Burhinus grallarius	Bush Stone-curlew	E	V
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-
Chthonicola sagittata	Speckled Warbler	V	-
Circus assimilis	Spotted Harrier	V	-
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-
Daphoenositta chrysoptera	Varied Sittella	V	-
Glossopsitta pusilla	Little Lorikeet	V	-
Grantiella picta	Painted Honeyeater	V	V
Hieraaetus morphnoides	Little Eagle	V	-
Lathamus discolor	Swift Parrot	E	CE
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	-
Lophoictinia isura	Square-tailed Kite	V	-

Table 4 (Continued) Potentially Occurring Threatened Fauna Species

Scientific Name	Common Name	Conservation Status[1]	
		BC Act	EPBC Act
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	-
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-
Neophema pulchella	Turquoise Parrot	V	-
Ninox connivens	Barking Owl	V	-
Pachycephala inornata	Gilbert's Whistler		
Petroica boodang	Scarlet Robin	V	-
Petroica phoenicea	Flame Robin		
Polytelis swainsonii	Superb Parrot	V	V
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-
Stagonopleura guttata	Diamond Firetail	V	-
Tyto novaehollandiae	Masked Owl	V	-
MARSUPIALS			
Aepyprymnus rufescens	Rufous Bettong	V	-
Cercartetus nanus	Eastern Pygmy-possum	V	-
Dasyurus maculatus	Spotted-tailed Quoll	V	E
Macropus dorsalis	Black-striped Wallaby	E	-
Petaurus norfolcensis	Squirrel Glider	V	-
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V
Phascogale tapoatafa	Brush-tailed Phascogale	V	-
Phascolarctos cinereus	Koala	V	V
RODENTS			
Pseudomys pilligaensis	Pilliga Mouse	V	-
BATS			
Chalinolobus dwyeri	Large-eared Pied Bat	V	V
Chalinolobus picatus	Little Pied Bat	V	-
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-
Nyctophilus corbeni	Corben's Long-eared Bat	V	V
Pteropus poliocephalus	Grey-headed Flying-fox	V	V
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-
Vespadelus troughtoni	Eastern Cave Bat	V	-
REPTILES			
Aprasia parapulchella	Pink-tailed Legless Lizard	V	V
Hoplocephalus bitorquatus	Pale-headed Snake	V	-
Uvidicolus sphyrurus	Border Thick-tailed Gecko	V	V

[1] Threatened fauna species status under the BC Act and/or EPBC Act (current as at July 2018).
V = Vulnerable; E = Endangered.

4.6 Endangered Populations

No endangered flora populations were known to occur in the Liverpool Plains subregion.

4.7 Summary of Survey Effort

Table 5 provides a summary of the surveys conducted across the study areas.

Table 5 Summary of Survey Effort

Task	Survey Timing	Floristic Plots and Transects	Surveyed by
OFFSET AREA 6			
Field survey dates	19 November 2015 10 February 2016	5	FloraSearch (2018)
OFFSET AREA 7			
Field survey dates	3 May 2016, 4 May 2016, 24 January 2017, 2 May 2017, 3 May 2017, 15 May 2017	8	Hunter Eco
OFFSET AREA 8			
Field survey dates	4 May 2016, 5 May 2016, 6 May 2016,	23	Hunter Eco

5 RESULTS

5.1 Vegetation Communities

Appendix 1 provides details of the vegetation communities classified and mapped across the study areas and Appendix 4 provides typical photographs of the woodland communities. Figures 3, 4 and 5 show the mapped vegetation communities.

They are summarised here:

Offset Area 6

Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion

Canopy
Dominated by Silver-leaved Ironbark (*Eucalyptus melanophloia*) and White Box (*Eucalyptus albens)* with a moderate to dense mid-storey of White Cypress Pine (*Callitris glaucophylla*).

Shrubs
Alstonia constricta, Swainsona galegifolia, Geijera parviflora, Alectryon oleifolius, Eremophila mitchellii, Myoporum montanum and *Pimelea neo-anglica.*

Grasses
24 grass species among which were *Aristida personata, Aristida ramosa, Austrostipa scabra, Bothriochloa decipiens, Rytidosperma bipartitum, Rytidosperma caespitosum* and *Sporobolus creber.*

Herbs
42 species of herb among which were *Brunoniella australis, Rostellularia adscendens, Arthropodium minus, Tricoryne elatior, Calotis lappulacea, Glossocardia bidens, Vittadinia cuneata var. hirsuta, Einadia hastata, Phyllanthus virgatus, Geranium solanderi, Goodenia hederacea* and *Boerhavia dominii.*

Sedges
Three sedges *Carex inversa, Cyperus gracilis* and *Lomandra multiflora*.

Vine and Twiners
Eight species *Parsonsia lanceolata, Marsdenia australis, Evolvulus alsinoides var. decumbens, Desmodium brachypodum, Desmodium varians, Glycine clandestina, Glycine tabacina* and *Clematis microphylla.*

Offset Area 7

Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion

Canopy
Narrow-leaved Ironbark (*Eucalyptus crebra*) and White Boc (*Eucaluptus albens*) with a dense mid-storey of White Cypress Pine (*Callitris glaucophylla*).

Shrubs
Ehretia membranifolia, Acacia deanei, Beyeria viscosa, Alphitonia excelsa, Indigofera australis, Notelaea microcarpa, Psydrax odorata, Geijera parviflora and *Pimelea glauca*.

Grasses
Thirteen grass species including *Aristida ramosa, Austrostipa scabra, Austrostipa verticillata, Chloris ventricosa, Cymbopogon refractus* and *Eragrostis megalosperma*.

Herbs
Twelve species of herb including *Brunoniella australis, Xerochrysum bracteatum, Lepidium sagittulatum, Einadia hastata, Hypericum gramineum, Dichondra repens, Chamaesyce drummondii* and Plantago varia.

Sedges
Carex inversa and *Lomandra multiflora*

Vines and Twiners
Parsonsia eucalyptophylla, Tylophora linearis, Evolvulus alsinoides var. *decumbens* and *Glycine clandestina*.

Offset Area 8

Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion

Canopy
Narrow-leaved Ironbark (*Eucalyptus crebra*) and White Boc (*Eucaluptus albens*) with a mid-storey of White Cypress Pine (*Callitris glaucophylla*).

Shrubs
Thirteen shrub species including *Spartothamnella juncea, Beyeria viscosa, Acacia deanei, Acacia decora, Acacia leiocalyx subsp. leiocalyx, Notelaea microcarpa, Geijera parviflora, Dodonaea viscosa subsp. angustifolia* and *Myoporum montanum*.

Grasses
Eleven grass species including *Aristida ramosa, Austrostipa scabra, Austrostipa verticillata, Cymbopogon refractus* and *Eragrostis megalosperma*.

Herbs
Eleven herb species including *Brunoniella australis, Arthropodium milleflorum, Chrysocephalum semipapposum, Chamaesyce drummondii, Sida corrugata* and *Oncinocalyx betchei.*

Sedges
Lomandra filiformis subsp. *coriacea* and *Lomandra multiflora*

Vines and Twiners
Parsonsia eucalyptophylla, Parsonsia straminea, Marsdenia viridiflora, Evolvulus alsinoides var. decumbens, Desmodium brachypodum and *Glycine clandestina.*

Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion

Canopy
Pilliga Box (*Eucalyptus pilligaensis*) and Poplar Box (*Eucalyptus populnea* subsp*. bimbil*).

Shrubs
Allocasuarina luehmannii, Maireana microphylla, Geijera parviflora, Eremophila mitchellii and *Myoporum montanum.*

Grasses
Austrostipa scabra, Austrostipa verticillata, Chloris ventricosa, Enteropogon ramosus, Eragrostis megalosperma, Rytidosperma erianthum, and *Sporobolus caroli.*

Herbs
Eight species of herb including *Einadia hastata, Abutilon oxycarpum, Boerhavia dominii, Eremophila debilis* and *Solanum parvifolium.*

Sedges
Carex inversa, Lomandra bracteata, Lomandra filiformis subsp. coriacea and *Lomandra multiflora.*

Vines and Twiners
Parsonsia straminea.

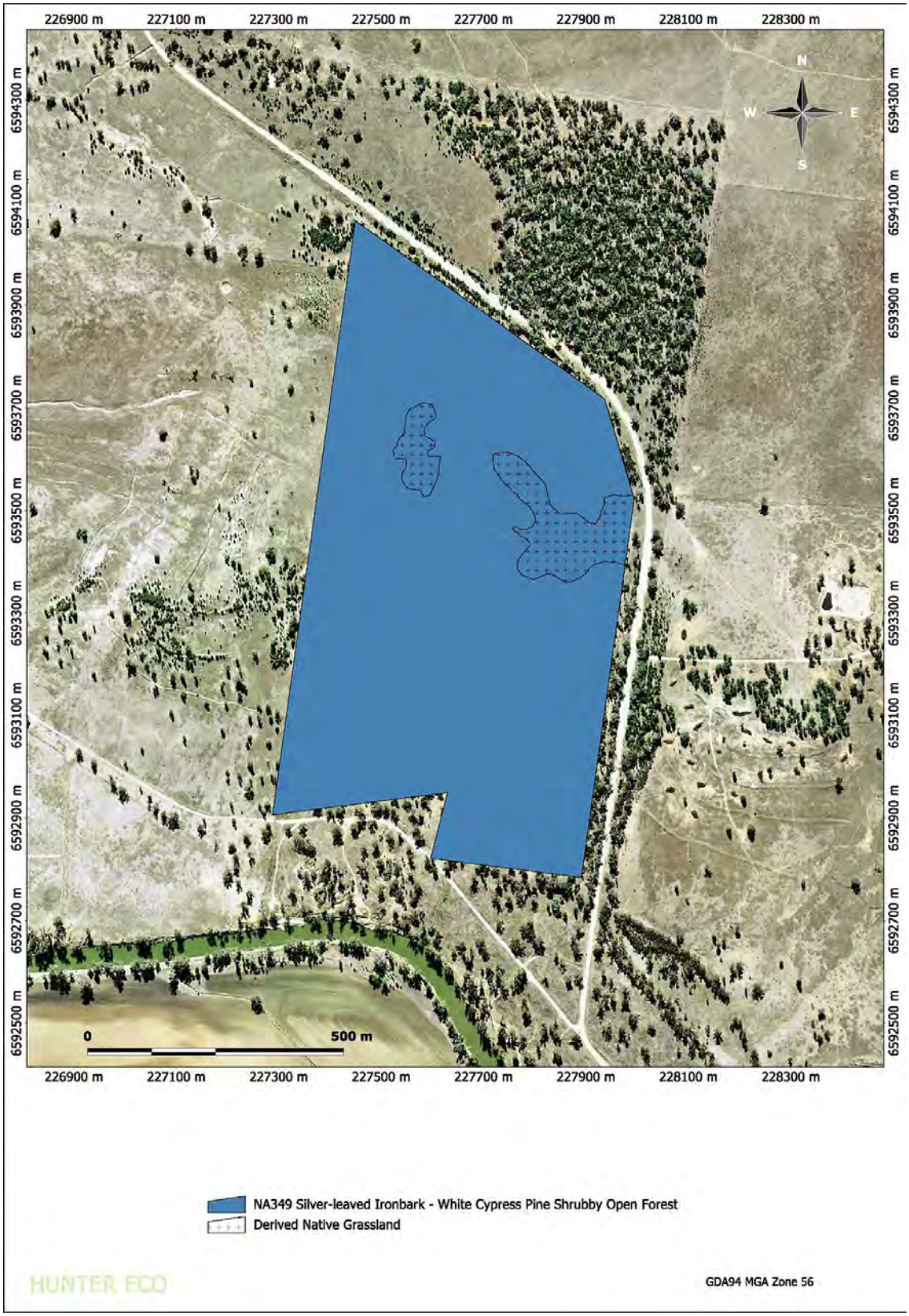


Figure 3 Vegetation Communities Mapped Across Offset Area 6

Figure 4 Vegetation Communities Mapped Across Offset Area 7

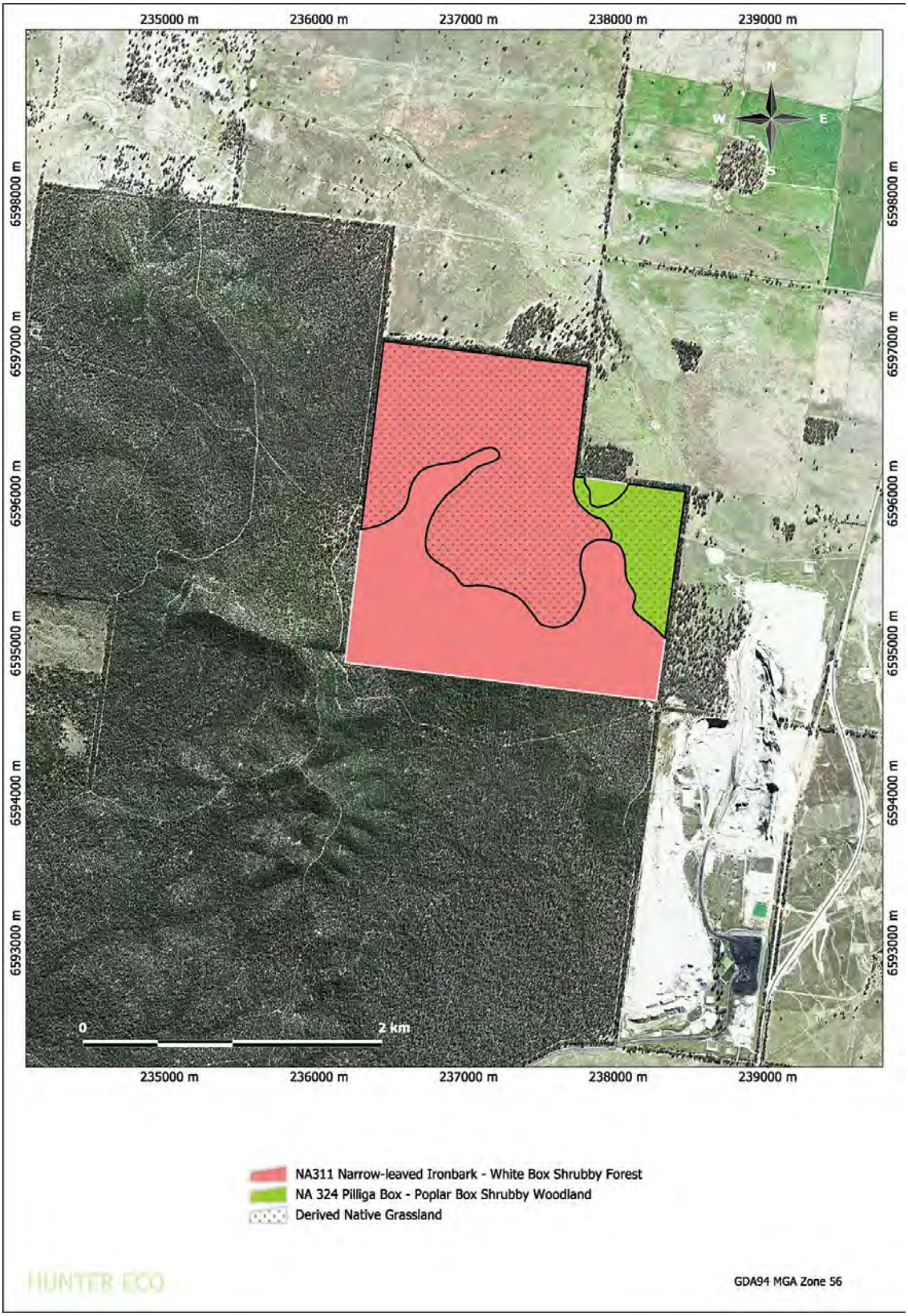


Figure 5 Vegetation Communities Mapped Across Offset Area 8

5.2 Threatened Species Populations and Ecological Communities

No threatened populations or ecological communities were recorded. Two threatened flora species were recorded in Offset Area 7, *Tylophora linearis* (Vulnerable under the BC Act and Endangered under the EPBC Act) and *Pomaderris queenslandica* (Endangered under the BC Act).

Following the initial discovery of these species a comprehensive transect survey was conducted involving 24 km of walking over two days (Figure 6). Fourteen individual groups of *Tylophora linearis* containing a total 462 stems (ranging from 4 to 107 stems in a group) were recorded. During this survey three locations with *Pomaderris queenslandica* were also recorded containing a total of four plants.

As can be seen on Figure 6, a large part of Offset Area 7 was not inspected and it is expected that more *Tylophora linearis* will be present; 15% of the target area was inspected. To estimate the total population size, the offset area was subdivided in a Geographic Information System (GIS) into a grid of 4 m x 4 m cells. Each cell represented an area in which the target species could reliably have been detected no matter from where within the cell. There was just over 3 ha of cleared land that was unsuitable habitat for either species so the cells covering that land were removed from the assessment leaving a total 42,984 potential habitat cells. Cells inspected were 6,476 leaving 36,238 cells that were not inspected. With 14 of the inspected cells each containing a single *Tylophora linearis* record, this means there would be a 1:482 probability that the species would be present in any one of the uninspected cells. Thus there is the potential for an additional 75 plant groups.

The median number of stems across the 14 recorded groups was 12.5 stems so the final population estimate is 14 groups recorded (462 stems) and 75 additional groups estimated (937 stems) giving a total of 89 groups and 1,399 stems; a large population.

The majority of the *Tylophora linearis* groups had one or more individuals that were multi-stemmed from 1 - 3 m tall (Figure 7). No flowering or fruiting was found.

The number of *Pomaderris queenslandica* was too few for a wider estimate to be made. Furthermore those recorded were in shallow drainage lines typical of preferred habitat for the species so it would not be possible to extrapolate across the entire Offset Area 7. There could well be a substantial *Pomaderris queenslandica* seed bank with any previous populations having senesced as a consequence of the lack of recent fire.

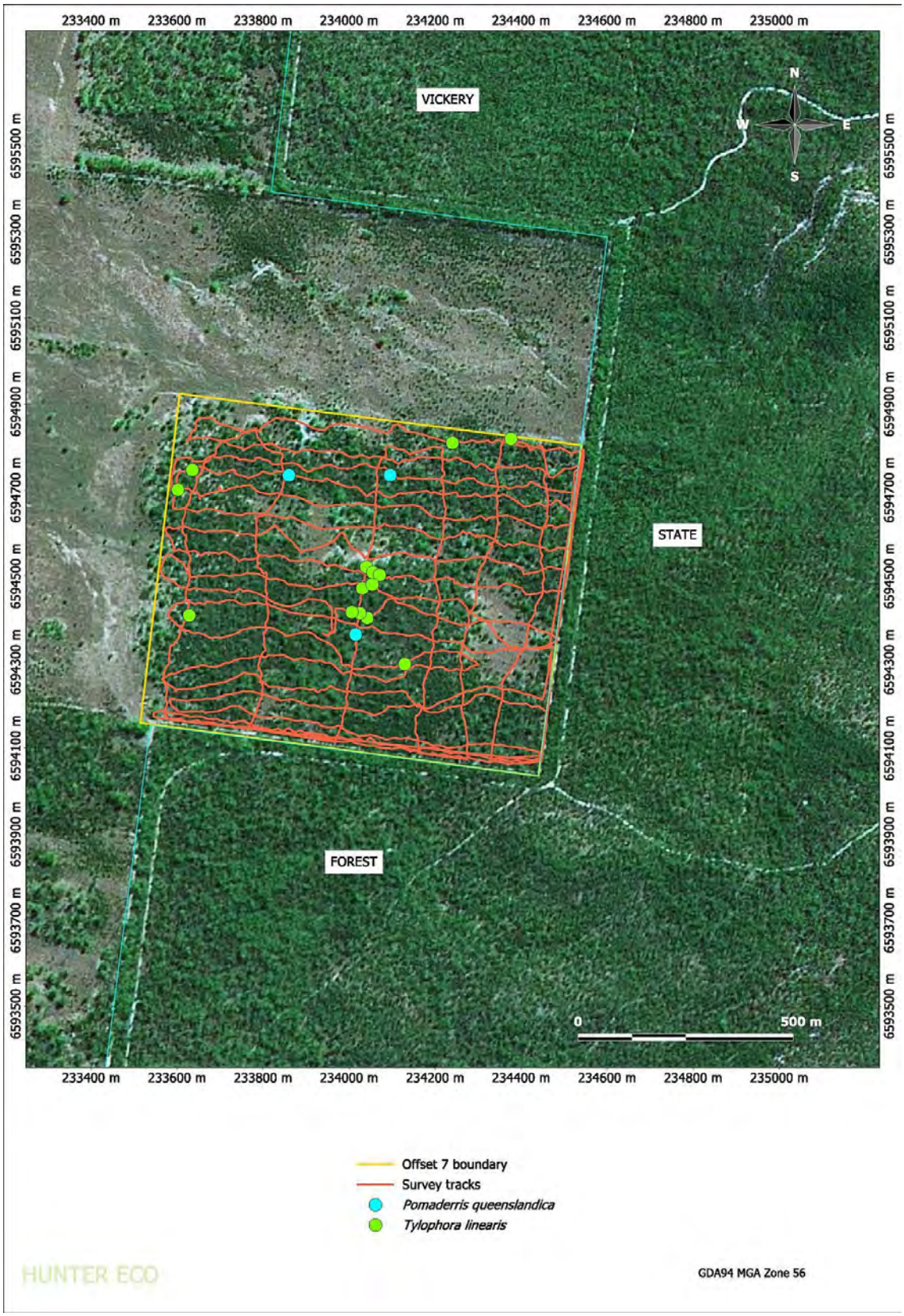


Figure 6 Details of the Offset Area 7 survey for *Tylophora linearis* and *Pomaderris queenslandica*

Figure 7 A typical Complex Twining *Tylophora linearis* Plant.

5.3 Biodiversity

Table 6 provides a summary of the diversity recorded in each vegetation community for the study areas. Attributes are the number of weed and native species, number of families and genera. The dominant families for Offset Area 6 (NA349 woodland) were Poaceae (grasses) 24, followed by Asteraceae (Daisies) 10; Offset Area 7 (NA311 woodland) Poaceae 13, and Chenopodiaceae (Chenopods) 5; Offset Area 7 (NA311 DNG) Poaceae 11, and Asteraceae 6; Offset Area 8 (NA311 woodland) Poaceae 11, and Chenopodiaceae 4; Offset Area 8 (NA311 DNG) Poaceae 15, and Asteraceae 5; Offset Area 8 (NA324 woodland) Poaceae 7, and Chenopodiaceae 4; Offset Area 8 (NA324 DNG) Poaceae 15, and Chenopodiaceae 6.

Table 6 Floristic Diversity for the Study Areas

	Offset Area 6	Offset Area 7		Offset Area 8			
	NA349 woodland	**NA311 woodland**	**NA311 DNG**	**NA311 woodland**	**NA311 DNG**	**NA324 woodland**	**NA324 DNG**
Weeds	18	3	2	3	9	2	5
Natives	95	55	40	56	26	31	31
Families	41	30	18	31	14	17	13
Genera	70	47	35	44	24	24	26

5.4 Flora Species

Appendix 3 provides a list of flora species recorded within the study areas (drawn from floristic plot data and random meanders). In summary, 191 species were recorded (including 28 weed species). Two threatened flora species were also recorded, namely *Tylophora linearis* and Scant Pomaderris (*Pomaderris queenslandica).* These two species would generate species credits within the study areas.

5.5 Fauna Species

Appendix 2 provides a list of all threatened fauna species predicted to occur by the Archived Biometric and Threatened Species Profiles Datasets (OEH, 2017c) within the mapped vegetation communities. A total of 35 threatened fauna species listed under the BC Act are predicted to occur based on the vegetation communities present within the study areas. Ten threatened fauna species have been recorded within the study areas during previous surveys. These include the Little Eagle, Turquoise Parrot, Brown Treecreeper (eastern subspecies), Speckled Warbler, Hooded Robin, Grey-crowned Babbler (eastern subspecies), Varied Sittella, Diamond Firetail, Squirrel Glider and Yellow-bellied Sheathtail-bat.

Of these, the Koala and Squirrel Glider would generate species credits within the study areas. In addition, the flora surveys confirmed that the study areas provide potential habitat which the Regent Honeyeater is likely to use, and therefore would also generate species credits for this species.

6 Improving Biodiversity at a BioBank Site

The *BioBanking Assessment Methodology 2014* (OEH, 2014a) requires the use of an online program (the *Credit Calculator for Major Projects and BioBanking* [the Credit Calculator]) to assess the number of credits which could be generated by the study areas if an application for a BioBanking Agreement were to be prepared and the study areas were to be accepted as Offset areas.

This section has been prepared in accordance with Section 12 of the *BioBanking Assessment Methodology 2014* (OEH, 2014a).

6.1 Change in Site Value Score

Table 7 identifies the change in site value score of each vegetation zone mapped within the study area as a result of the management actions proposed to be carried out over the BioBank site (Section 6.3). There are no sections of the study area which are currently subject to any legal impediment (e.g. covenant or easement) or existing obligations (as outlined in Section 12.10 of the *BioBanking Assessment Methodology 2014* [OEH, 2014a]) that would restrict the implementation of the management actions set out in Section 6.5

Table 7 Vegetation Zones

Vegetation Zone Number	Vegetation Community	BVT	Condition Class and Sub-category	Current Site Value Score	Future Site Value Score	Change in Site Value Score
Offset Area 6						
North-west Slopes Dry Sclerophyll Woodlands						
1	Silver-leaved Ironbark - White Cypress Pine shrubby open forest	**NA349**	Moderate/Good	89.93	96.88	6.95
Offset Area 7						
Western Slopes Dry Sclerophyll Forests						
1	Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland	**NA311**	Moderate/Good	46.88	74.48	27.6
2	Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland - DNG		Moderate/Good_DNG	18.75	39.84	21.09
Offset Area 8						
Western Slopes Dry Sclerophyll Forests						
1	Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland	**NA311**	Moderate/Good	46.01	73.26	27.25
2	Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland - DNG		Moderate/Good_DNG	9.38	24.22	14.84

Table 7 (Continued) Vegetation Zones

Vegetation Zone Number	Vegetation Community	BVT	Condition Class and Sub-category	Current Site Value Score	Future Site Value Score	Change in Site Value Score
Pilliga Outwash Dry Sclerophyll Forests						
1	Poplar Box - White Cypress Pine shrub grass tall woodland	**NA324**	Moderate/Good	54.17	79.43	25.26
2	Poplar Box - White Cypress Pine shrub grass tall woodland - DNG		Moderate/Good_DNG	9.38	24.22	14.84

6.2 Change in Landscape Value Score

The Landscape Value Scores for the study areas were:

- Offset Area 6 13.5
- Offset Area 7 13.8
- Offset Area 8 16.0

6.3 Averted Loss

The Averted Loss Scores for the study areas were:

- Offset Area 6 16.93
- Offset Area 7 NA311 6.86; NA311 DNG 1.56
- Offset Area 8 NA311 6.69; NA311 DNG 1.05
- Offset Area 8 NA324 8.08; NA324 DNG 1.05

6.4 Credits Generated at the Potential Offset Sites

The credit report (output of the Credit Calculator) is provided in Appendix 5. The credit report provides the credit profile for each ecosystem credit BVT.

The result of running the Credit Calculator is that the study areas would generate a combined total of 5,347 ecosystem credits (Table 8). In addition, Table 9 provides a summary of the species credit requirements which would be generated by the study areas. The species credit requirements can overlap the ecosystem credit requirements (i.e. the requirements are not mutually exclusive).

Table 8 Ecosystem Credits Generated Across the Study Areas

Vegetation Community	BVT	Offset Area 6	Offset Area 7	Offset Area 8	Total
Silver-leaved Ironbark – White Cypress pine shrubby open forest	NA349	533			533
Narrow-leaved Ironbark – Black Cypress Pine – White box shrubby woodland	NA311		856	3,625	4,481
Poplar Box – White Cypress Pine shrub grass tall woodlands	NA324			333	333
					5,347

Table 9 Species Credits Generated Across the Study Areas

Species	Offset Area 6	Offset Area 7	Offset Area 8	Total
Regent Honeyeater (*Anthochaera phrygia*)	398	472	1,181	**2,051**
Koala (*Phascolarctos cinereus*)	398	472	1,181	**2,051**
Squirrel Glider (*Petaurus norfolcensis*)	398	472	1,181	**2,051**
Tylophora linearis		9940		**9,940**
Scant Pomaderris (*Pomaderris queenslandica)*		28		**28**
				16,121

6.5 Proposed Management Actions

If an application for a BioBanking Agreement were to be made over the study areas, a Biodiversity Management Plan would be prepared, which would detail the proposed management actions for the sites.

Notwithstanding the above, the proposed management actions would include (Appendix 5):

- excluding feral pests;
- slashing;
- excluding commercial apiaries;
- feral and/or over-abundant native herbivore control; and
- fox control.

7 CONCLUSION

Flora and vegetation surveys were conducted on land designated as potential Offset Areas 6, 7 and 8, located north-east of Gunnedah. Field data were collected in accordance with the NSW *BioBanking Assessment Methodology 2014* (OEH, 2014a).

No threatened populations or ecological communities were recorded. Two threatened flora species were recorded in Offset Area 7, *Tylophora linearis* (Vulnerable under the BC Act and Endangered under the EPBC Act) and *Pomaderris queenslandica* (Endangered under the BC Act).

Suitable habitat was recorded in the study areas for Regent Honeyeater (Critically Endangered under BC Act and the EPBC Act), Koala (Vulnerable under the BC Act the EPBC Act) and Squirrel Glider (Vulnerable under the BC Act).

The *BioBanking Assessment Methodology 2014* (OEH, 2014a) requires the use of the Credit Calculator to assess the number of credits which could be generated by the study area if an application for a BioBanking Agreement were to be prepared and the study area were to be accepted as a Offset areas.

Across the study areas, 5,347 ecosystem credits and 16,121 species credits were generated.

8 REFERENCES

Bell, S.A.J. (2013). *Defining and mapping rare vegetation communities: Improving techniques to assist land-use planning and conservation*. Unpublished PhD Thesis, University of Newcastle.

Cenwest Environmental Services (2011) *Vickery Coal Project Baseline Fauna Survey*, Cenwest Environmental Services, Bathurst New South Wales, September 2011.

Commonwealth of Australia (2013). *Survey Guidelines for Australia's Threatened Orchids.*

Countrywide Ecological Service (2004) *Flora Study of 'The Canyon' Area Extension Whitehaven Coal Mine via Gunnedah NSW.* Countrywide Ecological Service (2006) *Whitehaven Canyon Extension: Pre-start Fauna Survey Early Autumn 2006.*

Countrywide Ecological Service (2007a) *Whitehaven Coal Mine Canyon Extension Pre-start Survey Late-Summer 2007.*

Countrywide Ecological Service (2007b) *Belmont Coal Project, via Gunnedah, Flora Assessment*. Prepared for Whitehaven Coal Limited, Brisbane Queensland, August 2007.

Countrywide Ecological Service (2009a) *Flora Monitoring Report Canyon Coal Mine – 2009.*

Countrywide Ecological Service (2009b) Fauna Monitoring Whitehaven Summer 2008-09.

Countrywide Ecological Service (2009c) Fauna Monitoring Whitehaven Early Spring 2009.

Department of Environment, Climate Change and Water (2009) Biobanking Assessment Methodology and Credit Calculator Operation Manual.

Department of the Environment (2014) *EPBC Act Policy Statement - Draft Survey Guidelines for Australia's Threatened Orchids*.

Department of the Environment (2017) *EPBC Protected Matters Report for Search Area: -32.21, 149.71; 32.2, 150.03; -32.47, 150.04; -32.48, 149.72*.
Date received: September 2017.

Department of Environment and Conservation (2004) *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft*.

Department of Environment and Conservation and Department of Primary Industries (2005). *Draft Guidelines for Threatened Species Assessment.*

Department of Environment and Climate Change (2008) *Vegetation of the Cessnock-Kurri Region, Survey, Classification & Mapping, Cessnock LGA, New South Wales*, Department of Environment and Climate Change (NSW), Sydney.

FloraSearch (2018). Vickery Extension Project Baseline Flora Report. July 2018.

Future Ecology (2018) *Vickery Extension Project Threatened Fauna Survey Report*. Prepared for Whitehaven Coal Limited.

Geoff Cunningham Natural Resource Consultants (2006) *Whitehaven Coal Mine, Gunnedah Third Monitoring Report – May, 2006.*

Geoff Cunningham Natural Resource Consultants (2007) *Whitehaven Coal Mine, Gunnedah Fourth Monitoring Report – May, 2007*.

Geoff Cunningham Natural Resource Consultants (2008) *Flora Monitoring Report Whitehaven Coal Mine – 2008*.

Geoff Cunningham Natural Resource Consultants (2009) *Flora Monitoring Report Canyon Coal Mine – 2009.*

Geoff Cunningham Natural Resource Consultants (2010) *Flora Monitoring Report Canyon Coal Mine – 2010.*

Isbell (2016) *The Australian Soil Classification*. The National Committee on Soil and Terrain. CSIRO Publishing January 2016.

Keith, D. (2004). *Ocean shores to desert dunes: the native vegetation of New South Wales and the ACT.* NSW Government.

Kendall and Kendall (2011) *Vickery South Coal Project - Fauna Assessment Briefing Note.* Unpublished report prepared for R.W. Corkery & Co. Pty Limited.

Mitchell, P. (2002) NSW Landscapes Mapping: Background and Methodology. Report prepared for the NSW National Parks and Wildlife Service.

Niche Environment and Heritage (2013) *Vickery Coal Project Environmental Impact Statement. Appendix E: Ecological Assessment.* Whitehaven Coal, Sydney.

Niche Environment and Heritage (2014) *Boggabri Coal Mine - Biodiversity Offsets Audit*. Report to Boggabri Coal Pty Ltd.Office of Environment and Heritage (2014a) *BioBanking Assessment Methodology 2014.* September 2014.

Office of Environment and Heritage (2014b) *Framework for Biodiversity Assessment*. Website: http://www.environment.nsw.gov.au/resources/biodiversity/140675fba.pdf Accessed: September 2017.

Office of Environment and Heritage (2014c) *Draft NSW Biodiversity Offsets Policy for Major Projects.*

Office of Environment and Heritage (2016). *NSW Guide to Surveying Threatened Plants.* Website:http://www.environment.nsw.gov.au/resources/threatenedspecies/160129-threatened-plants-survey-guide.pdf

Office of Environment and Heritage (2017a) *NSW BioNet the Website for the Atlas of NSW Wildlife.*

Office of Environment and Heritage (2017b) NSW Vegetation Information System: Classification.

Office of Environment and Heritage (2017c) *Archived BioMetric and Threatened Species Profiles Datasets*.

Parsons Brinckerhoff (2010) *Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment.*

RPS Harper Somers O'Sullivan (2010) *Flora and Fauna Assessment for Proposed Rocglen Coal Mine Extension Project.*

Sahukar R Gallery C Smart J and Mitchell P (2003). *The Bioregions of New South Wales – Their biodiversity, conservation and history.* NSW National Parks and Wildlife Service, Hurstville.

APPENDIX 1 Vegetation Communities

Offset Area 6					
Area (ha)	**PCT**	**BVT**	**PCT Name**	**Condition**	**Class**
Dry Sclerophyll Forests (Shrub/Grass Sub-formation)					
57	594	NA349	Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion	Woodland/Open Forest	North-west Slopes Dry Sclerophyll Woodlands;
4	594	NA349	Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion	Native Grassland	North-west Slopes Dry Sclerophyll Woodlands;
Offset Area 7					
Area (ha)	**PCT**	**BVT**	**PCT Name**	**Condition**	**Class**
Dry Sclerophyll Forests (Shrubby sub-formation);					
66.5	459	NA311	Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion	Woodland/Forest	Western Slopes Dry Sclerophyll Forests;
5.9	459	NA311	Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion	Native Grassland	Western Slopes Dry Sclerophyll Forests;

Offset Area 8					
Are (ha)	**PCT**	**BVT**	**PCT Name**	**Condition**	**Class**
Dry Sclerophyll Forests (Shrubby sub-formation);					
162.7	459	NA311	Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion	Woodland/Forest	Western Slopes Dry Sclerophyll Forests;
199	459	NA311	Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion	Native Grassland	Western Slopes Dry Sclerophyll Forests;
Dry Sclerophyll Forests (Shrub/grass sub-formation);					
3.7	349	NA324	Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion	Woodland/Forest	Pilliga Outwash Dry Sclerophyll Forests;
36	349	NA324	Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion	Native Grassland	Pilliga Outwash Dry Sclerophyll Forests;

APPENDIX 2 Fauna Species Known or Predicted to Occur

Scientific Name	Common Name	Likelihood of Occurrence
NA311 Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion		
BIRDS		
Anthochaera phrygia	Regent Honeyeater	Suitable habitat
Calyptorhynchus lathami	Glossy Black-Cockatoo	Unsuitable habitat. No *Casuarina* or *Allocasuarina* feed tree species.
Chthonicola sagittata	Speckled Warbler	Suitable habitat
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Suitable habitat
Daphoenositta chrysoptera	Varied Sittella	Suitable habitat
Glossopsitta pusilla	Little Lorikeet	Suitable habitat
Grantiella picta	Painted Honeyeater	Suitable habitat
Hieraaetus morphnoides	Little Eagle	Suitable habitat
Lathamus discolor	Swift Parrot	Suitable habitat
Lophochroa leadbeateri	Major Mitchell's Cockatoo	Outside of the species' geographic range
Lophoictinia isura	Square-tailed Kite	Suitable habitat
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	Suitable habitat
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	Suitable habitat
Neophema pulchella	Turquoise Parrot	Suitable habitat
Ninox connivens	Barking Owl	Suitable habitat
Pachycephala inornata	Gilbert's Whistler	Suitable habitat
Petroica boodang	Scarlet Robin	Suitable habitat
Petroica phoenicea	Flame Robin	Suitable habitat
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	Suitable habitat
Stagonopleura guttata	Diamond Firetail	Suitable habitat
Tyto novaehollandiae	Masked Owl	Suitable habitat
MARSUPIALS		
Aepyprymnus rufescens	Rufous Bettong	Unsuitable habitat. Sparse grassy ground cover.
Cercartetus nanus	Eastern Pygmy-possum	Unsuitable habitat. Sparse ground layer with no potential food source flowering shrubs.
Dasyurus maculatus	Spotted-tailed Quoll	Suitable habitat
Macropus dorsalis	Black-striped Wallaby	Unsuitable habitat with open sparse shrub and ground cover.
Petaurus norfolcensis	Squirrel Glider	Suitable habitat

Scientific Name	Common Name	Likelihood of Occurrence
Petrogale penicillata	Brush-tailed Rock-wallaby	Unsuitable habitat. No rocky escarpments.
Phascogale tapoatafa	Brush-tailed Phascogale	Suitable habitat
Phascolarctos cinereus	Koala	Suitable habitat
BATS		
Chalinolobus dwyeri	Large-eared Pied Bat	Suitable habitat
Chalinolobus picatus	Little Pied Bat	Suitable habitat
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	Suitable habitat
Nyctophilus corbeni	Corben's Long-eared Bat	Suitable habitat
Pteropus poliocephalus	Grey-headed Flying-fox	Suitable habitat
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Suitable habitat
Vespadelus troughtoni	Eastern Cave Bat	Suitable habitat
REPTILES		
Aprasia parapulchella	Pink-tailed Legless Lizard	Potentially suitable habitat on Offset Area 8 only.
Hoplocephalus bitorquatus	Pale-headed Snake	Unsuitable habitat with no nearby riparian areas.
Uvidicolus sphyrurus	Border Thick-tailed Gecko	Potentially suitable habitat on Offset Area 8 only.

Scientific Name	Common Name	Likelihood of Occurrence
NA324 Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion		
BIRDS		
Burhinus grallarius	Bush Stone-curlew	Suitable habitat
Calyptorhynchus lathami	Glossy Black-Cockatoo	Unsuitable habitat. No *Casuarina* or *Allocasuarina* feed tree species.
Chthonicola sagittata	Speckled Warbler	Suitable habitat
Circus assimilis	Spotted Harrier	Suitable habitat
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Suitable habitat
Daphoenositta chrysoptera	Varied Sittella	Suitable habitat
Glossopsitta pusilla	Little Lorikeet	Suitable habitat
Grantiella picta	Painted Honeyeater	Suitable habitat
Hieraaetus morphnoides	Little Eagle	Suitable habitat
Lathamus discolor	Swift Parrot	Suitable habitat
Lophochroa leadbeateri	Major Mitchell's Cockatoo	Outside of the species' geographic range
Lophoictinia isura	Square-tailed Kite	Suitable habitat
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	Suitable habitat
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	Suitable habitat
Neophema pulchella	Turquoise Parrot	Suitable habitat
Ninox connivens	Barking Owl	Suitable habitat
Pachycephala inornata	Gilbert's Whistler	Suitable habitat
Polytelis swainsonii	Superb Parrot	Suitable habitat
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	Suitable habitat
Stagonopleura guttata	Diamond Firetail	Suitable habitat
Tyto novaehollandiae	Masked Owl	Suitable habitat
MARSUPIALS		
Cercartetus nanus	Eastern Pygmy-possum	Unsuitable habitat. Sparse ground layer with no potential food source flowering shrubs.
Macropus dorsalis	Black-striped Wallaby	Unsuitable habitat with open sparse shrub and ground cover.
Petaurus norfolcensis	Squirrel Glider	Suitable habitat
Petrogale penicillata	Brush-tailed Rock-wallaby	Unsuitable habitat. No rocky escarpments.
Phascolarctos cinereus	Koala	Suitable habitat

Scientific Name	Common Name	Likelihood of Occurrence
RODENTS		
Pseudomys pilligaensis	Pilliga Mouse	Outside of the species' geographic range
BATS		
Chalinolobus dwyeri	Large-eared Pied Bat	Suitable habitat
Chalinolobus picatus	Little Pied Bat	Suitable habitat
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	Suitable habitat
Nyctophilus corbeni	Corben's Long-eared Bat	Suitable habitat
Pteropus poliocephalus	Grey-headed Flying-fox	Suitable habitat
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Suitable habitat
Vespadelus troughtoni	Eastern Cave Bat	Suitable habitat
REPTILES		
Hoplocephalus bitorquatus	Pale-headed Snake	Unsuitable habitat with no nearby riparian areas.

Scientific Name	Common Name	Likelihood of Occurrence
NA349 Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion		
BIRDS		
Anthochaera phrygia	Regent Honeyeater	Suitable habitat
Calyptorhynchus lathami	Glossy Black-Cockatoo	Unsuitable habitat. No *Casuarina* or *Allocasuarina* feed tree species.
Chthonicola sagittata	Speckled Warbler	Suitable habitat
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Suitable habitat
Daphoenositta chrysoptera	Varied Sittella	Suitable habitat
Glossopsitta pusilla	Little Lorikeet	Suitable habitat
Grantiella picta	Painted Honeyeater	Suitable habitat
Hieraaetus morphnoides	Little Eagle	Suitable habitat
Lathamus discolor	Swift Parrot	Suitable habitat
Lophochroa leadbeateri	Major Mitchell's Cockatoo	Outside of the species' geographic range
Lophoictinia isura	Square-tailed Kite	Suitable habitat
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	Suitable habitat
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	Suitable habitat
Neophema pulchella	Turquoise Parrot	Suitable habitat
Ninox connivens	Barking Owl	Suitable habitat
Petroica boodang	Scarlet Robin	Suitable habitat
Polytelis swainsonii	Superb Parrot	Suitable habitat
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	Suitable habitat
Stagonopleura guttata	Diamond Firetail	Suitable habitat
Tyto novaehollandiae	Masked Owl	Suitable habitat
MARSUPIALS		
Aepyprymnus rufescens	Rufous Bettong	Unsuitable habitat. Sparse grassy ground cover.
Cercartetus nanus	Eastern Pygmy-possum	Unsuitable habitat. Sparse ground layer with no potential food source flowering shrubs.
Dasyurus maculatus	Spotted-tailed Quoll	Suitable habitat
Macropus dorsalis	Black-striped Wallaby	Unsuitable habitat with open sparse shrub and ground cover.
Petaurus norfolcensis	Squirrel Glider	Suitable habitat
Petrogale penicillata	Brush-tailed Rock-wallaby	Unsuitable habitat. No rocky escarpments.
Phascogale tapoatafa	Brush-tailed Phascogale	Suitable habitat
Phascolarctos cinereus	Koala	Suitable habitat

Scientific Name	Common Name	Likelihood of Occurrence
RODENTS		
Pseudomys pilligaensis	Pilliga Mouse	Outside of the species' geographic range
BATS		
Chalinolobus dwyeri	Large-eared Pied Bat	Suitable habitat
Chalinolobus picatus	Little Pied Bat	Suitable habitat
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	Suitable habitat
Nyctophilus corbeni	Corben's Long-eared Bat	Suitable habitat
Pteropus poliocephalus	Grey-headed Flying-fox	Suitable habitat
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Suitable habitat
Vespadelus troughtoni	Eastern Cave Bat	Suitable habitat
REPTILES		
Aprasia parapulchella	Pink-tailed Legless Lizard	Unsuitable habitat.
Hoplocephalus bitorquatus	Pale-headed Snake	Unsuitable habitat with no nearby riparian areas.
Uvidicolus sphyrurus	Border Thick-tailed Gecko	Unsuitable habitat.

APPENDIX 3 Floristic List for all Offset areas

Family	NA349	NA311		NA311 DNG		NA324	NA324 DNG
Species	Offset Area 6	Offset Area 7	Offset Area 8	Offset Area 7	Offset Area 8	Offset Area 8	Offset Area 8
Acanthaceae							
Brunoniella australis	✓	✓	✓				
Rostellularia adscendens	✓						
Adiantaceae							
Cheilanthes distans	✓			✓			
Cheilanthes sieberi	✓	✓	✓	✓	✓	✓	✓
Amaranthaceae							
**Gomphrena celosioides*	✓						
Alternanthera denticulata				✓			
Alternanthera species A	✓						
Anthericaceae							
Arthropodium milleflorum		✓	✓				
Arthropodium minus	✓						
Dichopogon fimbriatus	✓						
Tricoryne elatior	✓						
Apocynaceae							
Alstonia constricta	✓						
Parsonsia eucalyptophylla		✓	✓				
Parsonsia lanceolata	✓			✓			
Parsonsia straminea			✓			✓	
Asclepiadaceae							
Marsdenia australis	✓						
Marsdenia viridiflora			✓	✓			

Family	NA349	NA311		NA311 DNG		NA324	NA324 DNG
Species	Offset Area 6	Offset Area 7	Offset Area 8	Offset Area 7	Offset Area 8	Offset Area 8	Offset Area 8
Tylophora linearis		✓					
Asteraceae							
**Carthamus lanatus*				✓	✓		✓
**Centaurea melitensis*	✓						
**Chondrilla juncea*					✓		
**Conyza sp.*					✓		
**Sonchus oleraceus*	✓						
Calotis lappulacea	✓			✓	✓		
Chrysocephalum apiculatum	✓						
Chrysocephalum semipapposum			✓	✓			
Euchiton sphaericus	✓						
Glossocardia bidens	✓	✓					
Olearia elliptica			✓				
Senecio quadridentatus	✓						
Vittadinia cervicularis var. cervicularis			✓				
Vittadinia cervicularis var. subcervicularis	✓						
Vittadinia cuneata var. hirsuta	✓						
Vittadinia muelleri				✓			
Vittadinia pterochaeta				✓			
Vittadinia sp.		✓	✓		✓	✓	✓
Xerochrysum bracteatum	✓	✓		✓			
Boraginaceae							
**Echium plantagineum*					✓		✓

Family	NA349	NA311		NA311 DNG		NA324	NA324 DNG
Species	Offset Area 6	Offset Area 7	Offset Area 8	Offset Area 7	Offset Area 8	Offset Area 8	Offset Area 8
**Heliotropium amplexicaule*	✓				✓		
Brassicaceae							
**Lepidium africanum*	✓						
**Lepidium bonariense*		✓					
**Sisymbrium irio*	✓						
**Sisymbrium orientale*	✓						
Lepidium pseudohyssopifolium				✓			
Lepidium sagittulatum		✓	✓			✓	
Lepidium sp.					✓		✓
Cactaceae							
**Opuntia stricta*	✓	✓	✓		✓	✓	
Casuarinaceae							
Allocasuarina luehmannii						✓	
Chenopodiaceae							
Chenopodium carinatum	✓						
Einadia hastata	✓	✓	✓			✓	✓
Einadia nutans				✓			
Einadia nutans subsp. linifolia	✓	✓	✓			✓	
Einadia nutans subsp. nutans	✓						
Einadia polygonoides	✓		✓				✓
Enchylaena tomentosa				✓			✓
Maireana enchylaenoides	✓						
Maireana microphylla	✓	✓	✓	✓	✓	✓	✓
Salsola australis	✓						

Family	NA349	NA311		NA311 DNG		NA324	NA324 DNG
Species	Offset Area 6	Offset Area 7	Offset Area 8	Offset Area 7	Offset Area 8	Offset Area 8	Offset Area 8
Salsola kali							✓
Sclerolaena birchii	✓	✓		✓	✓	✓	✓
Sclerolaena parviflora		✓					
Chloanthaceae							
Spartothamnella juncea		✓	✓				
Clusiaceae							
Hypericum gramineum		✓					
Convolvulaceae							
Convolvulus angustissimus subsp. angustissimus	✓				✓		
Convolvulus erubescens				✓			
Dichondra repens	✓	✓					
Dichondra species A		✓	✓				
Evolvulus alsinoides var. decumbens	✓	✓	✓				
Crassulaceae							
**Bryophyllum x houghtonii*			✓				
Cupressaceae							
Callitris glaucophylla	✓	✓	✓	✓	✓		✓
Cyperaceae							
Carex inversa	✓	✓	✓	✓	✓	✓	
Fimbristylis dichotoma				✓			
Cyperus gracilis	✓						
Euphorbiaceae							
Beyeria viscosa		✓	✓				

Family	NA349	NA311		NA311 DNG		NA324	NA324 DNG
Species	Offset Area 6	Offset Area 7	Offset Area 8	Offset Area 7	Offset Area 8	Offset Area 8	Offset Area 8
Chamaesyce drummondii	✓	✓	✓				
Euphorbia drummondii				✓			
Phyllanthus virgatus	✓						
Fabaceae (Caesalpinioideae)							
Senna artemisioides subsp. zygophylla			✓		✓		
Fabaceae (Faboideae)							
**Medicago laciniata*	✓						
**Medicago minima*	✓						
**Trifolium arvense*	✓						
**Trifolium glomeratum*	✓						
Desmodium brachypodum	✓	✓	✓				
Desmodium varians	✓			✓			
Glycine clandestina	✓	✓	✓	✓			
Glycine tabacina	✓						
Indigofera australis		✓	✓				
Swainsona galegifolia	✓						
Fabaceae (Mimosoideae)							
Acacia deanei		✓	✓				
Acacia decora	✓		✓				
Acacia leiocalyx subsp. leiocalyx			✓				
Acacia oswaldii				✓			
Goodeniaceae							
Goodenia sp.		✓					

Family	NA349	NA311		NA311 DNG		NA324	NA324 DNG
Species	Offset Area 6	Offset Area 7	Offset Area 8	Offset Area 7	Offset Area 8	Offset Area 8	Offset Area 8
Goodenia hederacea	✓						
Lomandraceae							
Lomandra bracteata						✓	
Lomandra filiformis subsp. coriacea			✓			✓	
Lomandra multiflora	✓	✓	✓			✓	
Loranthaceae							
Amyema quandang			✓				
Malvaceae							
**Sida rhombifolia*				✓	✓		✓
Abutilon malvifolium			✓				
Abutilon oxycarpum	✓	✓		✓		✓	
Sida corrugata	✓	✓	✓	✓			
Sida cunninghamii	✓	✓	✓				✓
Sida hackettiana				✓			
Sida sp.	✓				✓		✓
Sida spinosa	✓						
Myrtaceae							
Eucalyptus albens	✓	✓	✓				
Eucalyptus crebra		✓	✓				
Eucalyptus melanophloia	✓						
Eucalyptus pilligaensis						✓	✓
Eucalyptus populnea subsp. bimbil						✓	

Family	NA349	NA311		NA311 DNG		NA324	NA324 DNG
Species	Offset Area 6	Offset Area 7	Offset Area 8	Offset Area 7	Offset Area 8	Offset Area 8	Offset Area 8
Nyctaginaceae							
Boerhavia dominii	✓					✓	
Oleaceae							
Notelaea microcarpa		✓	✓				
Oxalidaceae							
Oxalis sp.		✓					
Oxalis perennans	✓						
Plantaginaceae							
Plantago varia		✓					
Plantago cunninghamii	✓						
Poaceae							
**Eragrostis curvula*		✓	✓		✓		✓
**Vulpia myuros*	✓						
Aristida jerichoensis var. subspinulifera		✓					
Aristida personata	✓						
Aristida ramosa	✓	✓	✓	✓	✓		✓
Austrostipa platychaeta							✓
Austrostipa scabra	✓	✓	✓			✓	
Austrostipa scabra subsp. falcata			✓	✓	✓		✓
Austrostipa scabra subsp. scabra				✓			
Austrostipa setacea	✓						
Austrostipa verticillata	✓	✓	✓	✓	✓	✓	

Family	NA349	NA311		NA311 DNG		NA324	NA324 DNG
Species	Offset Area 6	Offset Area 7	Offset Area 8	Offset Area 7	Offset Area 8	Offset Area 8	Offset Area 8
Bothriochloa decipiens	✓				✓		✓
Chloris truncata	✓			✓			
Chloris ventricosa	✓	✓				✓	
Cymbopogon refractus		✓	✓	✓	✓		✓
Digitaria brownii	✓			✓	✓		
Digitaria sp.					✓		
Elymus scaber	✓	✓					
Enneapogon gracilis	✓	✓	✓		✓		✓
Enneapogon sp.				✓			
Enteropogon acicularis	✓						
Enteropogon ramosus		✓		✓	✓	✓	✓
Eragrostis alveiformis	✓						
Eragrostis benthamii				✓			
Eragrostis lacunaria	✓						
Eragrostis leptostachya	✓						
Eragrostis megalosperma		✓	✓			✓	✓
Eragrostis parviflora		✓			✓		✓
Eragrostis sp.					✓		
Panicum effusum			✓		✓		✓
Paspalidium constrictum				✓			
Paspalidium gracile	✓						
Paspalidium sp.		✓	✓				
Poa sieberiana	✓						
Rytidosperma bipartitum	✓						✓

Family	NA349	NA311		NA311 DNG		NA324	NA324 DNG
Species	Offset Area 6	Offset Area 7	Offset Area 8	Offset Area 7	Offset Area 8	Offset Area 8	Offset Area 8
Rytidosperma caespitosum	✓						
Rytidosperma erianthum						✓	
Rytidosperma fulvum	✓						
Rytidosperma racemosum var. obtusatum	✓		✓				
Rytidosperma sp.	✓						
Sporobolus caroli						✓	✓
Sporobolus creber	✓				✓		✓
Tripogon loliiformis					✓		✓
Portulacaceae							
Portulaca oleracea		✓		✓		✓	✓
Rhamnaceae							
Pomaderris andromedifolia subsp. andromedifolia			✓				
Pomaderris sp.			✓				
Rubiaceae							
Asperula subulifolia	✓						
Psydrax odorata		✓					
Rutaceae							
Geijera parviflora	✓	✓	✓		✓	✓	
Sapindaceae							
Alectryon oleifolius	✓						
Dodonaea viscosa subsp. angustifolia			✓				
Scrophulariaceae							

Family	NA349	NA311		NA311 DNG		NA324	NA324 DNG
Species	Offset Area 6	Offset Area 7	Offset Area 8	Offset Area 7	Offset Area 8	Offset Area 8	Offset Area 8
**Misopates orontium*	✓						
**Verbascum thapsus*					✓		
Eremophila debilis	✓					✓	✓
Eremophila mitchellii	✓					✓	
Myoporum montanum	✓		✓			✓	✓
Solanaceae							
**Lycium ferocissimum*	✓					✓	
Solanum esuriale	✓	✓		✓		✓	
Solanum parvifolium		✓	✓			✓	
Solanum cinereum	✓						
Thymelaeaceae							
Pimelea glauca		✓	✓				✓
Pimelea neo-anglica	✓			✓			
Verbenaceae							
**Verbena officinalis*							✓
Oncinocalyx betchei			✓				
Caryophyllaceae							
**Arenaria serpyllifolia*	✓						
**Polycarpon tetraphyllum*	✓						
Gypsophila tubulosa	✓						
Capparaceae							
Capparis mitchellii	✓						
Ranunculaceae							
Clematis microphylla	✓						

Family	NA349	NA311		NA311 DNG		NA324	NA324 DNG
Species	Offset Area 6	Offset Area 7	Offset Area 8	Offset Area 7	Offset Area 8	Offset Area 8	Offset Area 8
Commelinaceae							
Commelina cyanea	✓						
Orchidaceae							
Cymbidium canaliculatum	✓						
Geraniaceae							
Geranium solanderi	✓						
Lamiaceae							
**Marrubium vulgare*	✓						
Stackhousiaceae							
Stackhousia muricata	✓						
Campanulaceae							
Wahlenbergia communis	✓						

APPENDIX 4 Vegetation Community Photographs

Offset Area 6 NA349 Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion (Photo FloraSearch).

Offset Area 7 NA311 Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion (Photo Hunter Eco).

Offset Area 8 NA311 Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion (Photo Hunter Eco).

Offset Area 8 NA324 Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion (Photo Hunter Eco).

APPENDIX 5 Credit Calculator Reports

BioBanking credit report

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

Date of report: 14/06/2017 Time: 9:18:36AM Calculator version: v4.0

Biobank details

Proposal ID:	0011/2017/4416B
Proposal name:	Vickery Extension Project - Offset 6
Proposal address:	Braymont Road Boggabri VIC 2382
Proponent name:	Whitehaven Coal
Proponent address:	Conadilly Street Gunnedah
Proponent phone:	02 6741 9301
Assessor name:	Colin Driscoll
Assessor address:	PO Box 1047 Toronto NSW 2783
Assessor phone:	02 4959 8016
Assessor accreditation:	0011

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
Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion	57.00	533.00
Total	57.00	533

Credit profiles

1. Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion, (NA349)

Number of ecosystem credits created	533
IBRA sub-region	Liverpool Plains (Part B)

Species credits summary

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Regent Honeyeater	Anthochaera phrygia	56.00	398
Koala	Phascolarctos cinereus	56.00	398
Squirrel Glider	Petaurus norfolcensis	56.00	398

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Koala	Exclude miscellaneous feral species
Koala	Slashing
Regent Honeyeater	Exclude miscellaneous feral species
Regent Honeyeater	Feral and/or over-abundant native herbivore control
Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion	Control of feral pigs
Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion	Exclude commercial apiaries
Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion	Exclude miscellaneous feral species
Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion	Feral and/or over-abundant native herbivore control
Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion	Fox control
Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion	Slashing
Squirrel Glider	Fox control
Squirrel Glider	Slashing

BioBanking Credit Calculator

Ecosystem credits

Proposal ID :	0011/2017/4416B
Proposal name :	Vickery Extension Project - Offset 6
Assessor name :	Colin Driscoll
Assessor accreditation number :	0011
Tool version :	v4.0
Report created :	14/06/2017 09:17

Assessment circle name	Landscape score	TS subzone number	Vegetation zone name	Vegetation type name	Condition	Management zone name	Management zone area	Current site value	Future site value	Gain in site value	Total credit created for management zone
Circle01	13.50	NA349_Moderate/Good_1	NA349_Moderate/Good	Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion	Moderate/Good	1	57.00	89.93	96.88	6.95	533

BioBanking Credit Calculator

Species credits

Proposal ID :	0011/2017/4416B
Proposal name :	Vickery Extension Project - Offset 6
Assessor name :	Colin Driscoll
Assessor accreditation number :	0011
Tool version :	v4.0
Report created :	14/06/2017 09:17

Scientific name	Common name	Species TG value	Biobank on identified population?	Number found?	Units	Number of credits
Petaurus norfolcensis	Squirrel Glider	2.20	No	56.00	ha	398
Phascolarctos cinereus	Koala	2.60	No	56.00	ha	398
Anthochaera phrygia	Regent Honeyeater	7.70	No	56.00	ha	398

BioBanking credit report

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

Date of report: 14/06/2017 Time: 9:22:02AM Calculator version: v4.0

Biobank details

Proposal ID:	0011/2017/4417B
Proposal name:	Vickery Extension Project - Offset 7
Proposal address:	Hoad Lane Boggabri NSW 2382
Proponent name:	Whitehaven Coal
Proponent address:	231 Conadilly Street Gunnedah NSW 2380
Proponent phone:	02 6741 9301
Assessor name:	Colin Driscoll
Assessor address:	PO Box 1047 Toronto NSW 2783
Assessor phone:	02 4959 8016
Assessor accreditation:	0011

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
Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion	72.40	856.00
Total	72.40	856

Credit profiles

1. Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion, (NA311)

Number of ecosystem credits created	856
IBRA sub-region	Liverpool Plains (Part B)

Species credits summary

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Tylophora linearis	Tylophora linearis	1,400.00	9,940
Scant Pomaderris	Pomaderris queenslandica	4.00	28
Squirrel Glider	Petaurus norfolcensis	66.50	472
Regent Honeyeater	Anthochaera phrygia	66.50	472
Koala	Phascolarctos cinereus	66.50	472

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Koala	Exclude miscellaneous feral species
Koala	Slashing
Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion	Control of feral pigs
Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion	Exclude commercial apiaries
Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion	Exclude miscellaneous feral species
Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion	Feral and/or over-abundant native herbivore control
Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion	Fox control
Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion	Slashing
Regent Honeyeater	Exclude miscellaneous feral species
Regent Honeyeater	Feral and/or over-abundant native herbivore control
Scant Pomaderris	Feral and/or over-abundant native herbivore control
Squirrel Glider	Fox control
Squirrel Glider	Slashing

BioBanking Credit Calculator

Ecosystem credits

Proposal ID :	0011/2017/4417B
Proposal name :	Vickery Extension Project - Offset 7
Assessor name :	Colin Driscoll
Assessor accreditation number :	0011
Tool version :	v4.0
Report created :	14/06/2017 09:21

Assessment circle name	Landscape score	TS subzone number	Vegetation zone name	Vegetation type name	Condition	Management zone name	Management zone area	Current site value	Future site value	Gain in site value	Total credit created for management zone
Circle01	13.80	NA311_Moderate/Good_1	NA311_Moderate/Good	Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion	Moderate/Good	1	66.50	46.88	74.48	27.60	802
Circle01	13.80	NA311_Moderate/Good_Derived grassland_1	NA311_Moderate/Good_Derived grassland	Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion	Moderate/Good_Derived grassland	2	5.90	18.75	39.84	21.09	54

BioBanking Credit Calculator

Species credits

Proposal ID :	0011/2017/4417B
Proposal name :	Vickery Extension Project - Offset 7
Assessor name :	Colin Driscoll
Assessor accreditation number :	0011
Tool version :	v4.0
Report created :	14/06/2017 09:21

Scientific name	Common name	Species TG value	Biobank on identified population?	Number found?	Units	Number of credits
Pomaderris queenslandica	Scant Pomaderris	1.50	No	4.00	indiv	28
Tylophora linearis	Tylophora linearis	7.70	No	1,400.00	indiv	9,940
Petaurus norfolcensis	Squirrel Glider	2.20	No	66.50	ha	472
Phascolarctos cinereus	Koala	2.60	No	66.50	ha	472
Anthochaera phrygia	Regent Honeyeater	7.70	No	66.50	ha	472

BioBanking credit report

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

Date of report: 14/06/2017 Time: 9:23:25AM Calculator version: v4.0

Biobank details

Proposal ID:	0011/2017/4418B
Proposal name:	Vickery Extension Project - Offset 8
Proposal address:	Wean Road Wean NSW 2382
Proponent name:	Whitehaven Coal
Proponent address:	231 Conadilly Street Gunnedah NSW 2380
Proponent phone:	02 6741 9301
Assessor name:	Colin Driscoll
Assessor address:	PO Box 1047 Toronto NSW 2783
Assessor phone:	02 4959 8016
Assessor accreditation:	0011

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
Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion	362.70	3,625.00
Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion	39.70	333.00
Total	402.40	3,958

Credit profiles

1. Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion, (NA324)

Number of ecosystem credits created	333
IBRA sub-region	Liverpool Plains (Part B)

2. Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion, (NA311)

Number of ecosystem credits created	3,625
IBRA sub-region	Liverpool Plains (Part B)

Species credits summary

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Squirrel Glider	Petaurus norfolcensis	166.40	1,181
Regent Honeyeater	Anthochaera phrygia	166.40	1,181
Koala	Phascolarctos cinereus	166.40	1,181

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Koala	Exclude miscellaneous feral species
Koala	Slashing
Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion	Control of feral pigs
Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion	Exclude commercial apiaries
Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion	Exclude miscellaneous feral species
Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion	Feral and/or over-abundant native herbivore control
Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion	Fox control
Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion	Slashing
Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion	Control of feral pigs
Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion	Exclude commercial apiaries
Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion	Exclude miscellaneous feral species
Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion	Feral and/or over-abundant native herbivore control
Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion	Fox control

Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion	Slashing
Regent Honeyeater	Exclude miscellaneous feral species
Regent Honeyeater	Feral and/or over-abundant native herbivore control
Squirrel Glider	Fox control
Squirrel Glider	Slashing

BioBanking Credit Calculator

Ecosystem credits

Proposal ID :	0011/2017/4418B
Proposal name :	Vickery Extension Project - Offset 8
Assessor name :	Colin Driscoll
Assessor accreditation number :	0011
Tool version :	v4.0
Report created :	14/06/2017 09:22

Assessment circle name	Landscape score	TS subzone number	Vegetation zone name	Vegetation type name	Condition	Management zone name	Management zone area	Current site value	Future site value	Gain in site value	Total credit created for management zone
Circle01	16.00	NA311_Moderate/Good_1	NA311_Moderate/Good	Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion	Moderate/Good	1	162.70	46.01	73.26	27.25	2,031
Circle01	16.00	NA311_Moderate/Good_Derived grassland_1	NA311_Moderate/Good_Derived grassland	Narrow-leaved Ironbark - Black Cypress Pine - White Box shrubby woodland in sedimentary hills of the Gunnedah region, Brigalow Belt South Bioregion	Moderate/Good_Derived grassland	2	200.00	9.38	24.22	14.84	1,594
Circle01	16.00	NA324_Moderate/Good_1	NA324_Moderate/Good	Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion	Moderate/Good	3	3.70	54.17	79.43	25.26	46
Circle01	16.00	NA324_Moderate/Good_Derived grassland_1	NA324_Moderate/Good_Derived grassland	Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion	Moderate/Good_Derived grassland	4	36.00	9.38	24.22	14.84	287

BioBanking Credit Calculator

Species credits

Proposal ID :	0011/2017/4418B
Proposal name :	Vickery Extension Project - Offset 8
Assessor name :	Colin Driscoll
Assessor accreditation number :	0011
Tool version :	v4.0
Report created :	14/06/2017 09:22

Scientific name	Common name	Species TG value	Biobank on identified population?	Number found?	Units	Number of credits
Petaurus norfolcensis	Squirrel Glider	2.20	No	166.40	ha	1,181
Phascolarctos cinereus	Koala	2.60	No	166.40	ha	1,181
Anthochaera phrygia	Regent Honeyeater	7.70	No	166.40	ha	1,181

ATTACHMENT J
MT SOMNER BIOBANKING ASSESSMENT REPORT

MT SOMNER BIOBANKING ASSESSMENT REPORT

July 2018

PREPARED BY
HUNTER ECO
Dr Colin Driscoll (Accredited BioBanking Assessor #0011)
Dr Stephen Bell (Eastcoast Flora Survey)

PO Box 1047, Toronto, NSW 2283 **P** +61 2 4959 8016 **M** 0438 773 029 **E** cd_enviro@bigpond.com

CONTENTS

TABLES

FIGURES

Cover photo: *Xanthorrhoea johnsonii* grass trees at Mt Somner. This species has been shown to grow at barely one centimetre per year (Bulow-Olsen et al., 1982) which would make the tallest plant in this group well over 200 years old. The full skirt of dead leaves indicates that there has been no fire for the life of these plants.

EXECUTIVE SUMMARY

A flora and vegetation community survey was conducted in June 2016 on the Mt Somner property (the study area) (totalling approximately 526 hectares [ha]) located approximately 20 kilometres south-west of Gunnedah, New South Wales (NSW).

Previous survey work was conducted within the survey area by Niche Environment and Heritage (2012) during September 2012. These surveys comprised of a desktop analysis and field surveys, including preliminary vegetation mapping using aerial photography; floristic plots; rapid data points (RDP); threatened flora random meanders; threatened fauna habitat assessment; targeted threatened fauna surveys (i.e. camera trapping, spotlighting, bat call recording, harp trapping, call playback, arboreal trapping, herpetological searches and bird census).

The more recent surveys, detailed in this report, comprised of vegetation classification and mapping (via RDP and sampling using the Braun-Blanquet cover scale), biometric data collection in accordance with the NSW *BioBanking Assessment Methodology 2014* and targeted threatened species meanders.

The surveys detailed in this report confirmed that two main vegetation communities are present within the study area, with one derived native grassland type: White Box Shrubby Forest (approximately 416 ha), White Box Shrubby Forest Derived Native Grassland (approximately 65 ha) and Semi-evergreen Vine Thicket (approximately 45 ha). The Semi-evergreen Vine Thicket community is listed as Endangered under the NSW *Biodiversity Conservation Act, 2016* and the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*.

While 170 flora species were recorded (including 20 weed species) there were no threatened flora species or populations identified, despite targeted survey work.

Almost 90% of the study area is uncleared and the vegetation is remarkable for being almost completely undisturbed, with large areas exhibiting old growth characteristics, however, there is evidence of a substantial pig and deer population that has a detrimental impact on ground cover in particular.

The *BioBanking Assessment Methodology 2014* requires the use of an online program (the *Credit Calculator for Major Projects and BioBanking* [the Credit Calculator]) to assess the number of credits which could be generated by the study area if an application for a BioBanking Agreement were to be prepared and the study area were to be accepted as a BioBanking site.

In summary, the result of running the Credit Calculator is that the study area would generate a total of 4,032 ecosystem credits and 3,415 species credits for both the Koala and the Regent Honeyeater.

1 INTRODUCTION

1.1 Background

The Mt Somner property (the study area) is located approximately 20 kilometres (km) south west of Gunnedah (Figure 1). The study area was purchased by Coal Works (a subsidiary of Whitehaven) in August 2012 and is approximately 526 hectares (ha) of mostly uncleared land. The study area title details are Lot 65 Deposited Plan Number 755532.

This report has been prepared in accordance with the New South Wales (NSW) Office of Environment and Heritage (OEH) *BioBanking Assessment Methodology 2014* (OEH, 2014) and describes the biodiversity characteristics of the study area for the purpose of determining its suitability as a biodiversity offset.

1.2 Flora and Vegetation Survey Objectives

Objectives of the flora and vegetation surveys were to:

- document plant species growing across the study area by drawing on the results of past surveys and augmenting this information with that from the current survey;
- classify and map the distribution of vegetation communities across the study area; and
- target species, communities and populations listed as threatened both in the NSW *Biodiversity Conservation Act 2016* (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The following guidelines and policies were used to inform the methodology and outcomes of the surveys:

- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft* (Department of Environment and Conservation [DEC], 2004).
- *NSW Guide to Surveying Threatened Pants* (OEH, 2016).
- *Survey Guidelines for Australia's Threatened Orchids* (Commonwealth of Australia, 2013).
- Profiles and guidelines specific to threatened species and communities (e.g. BioNet [OEH, 2017a] and the Vegetation Information System Classification 2.1 [OEH, 2017b]).
- *Guidelines for Threatened Species Assessment* (DEC and Department of Primary Industries [DPI], 2005).
- *BioBanking Assessment Methodology 2014* (OEH, 2014).

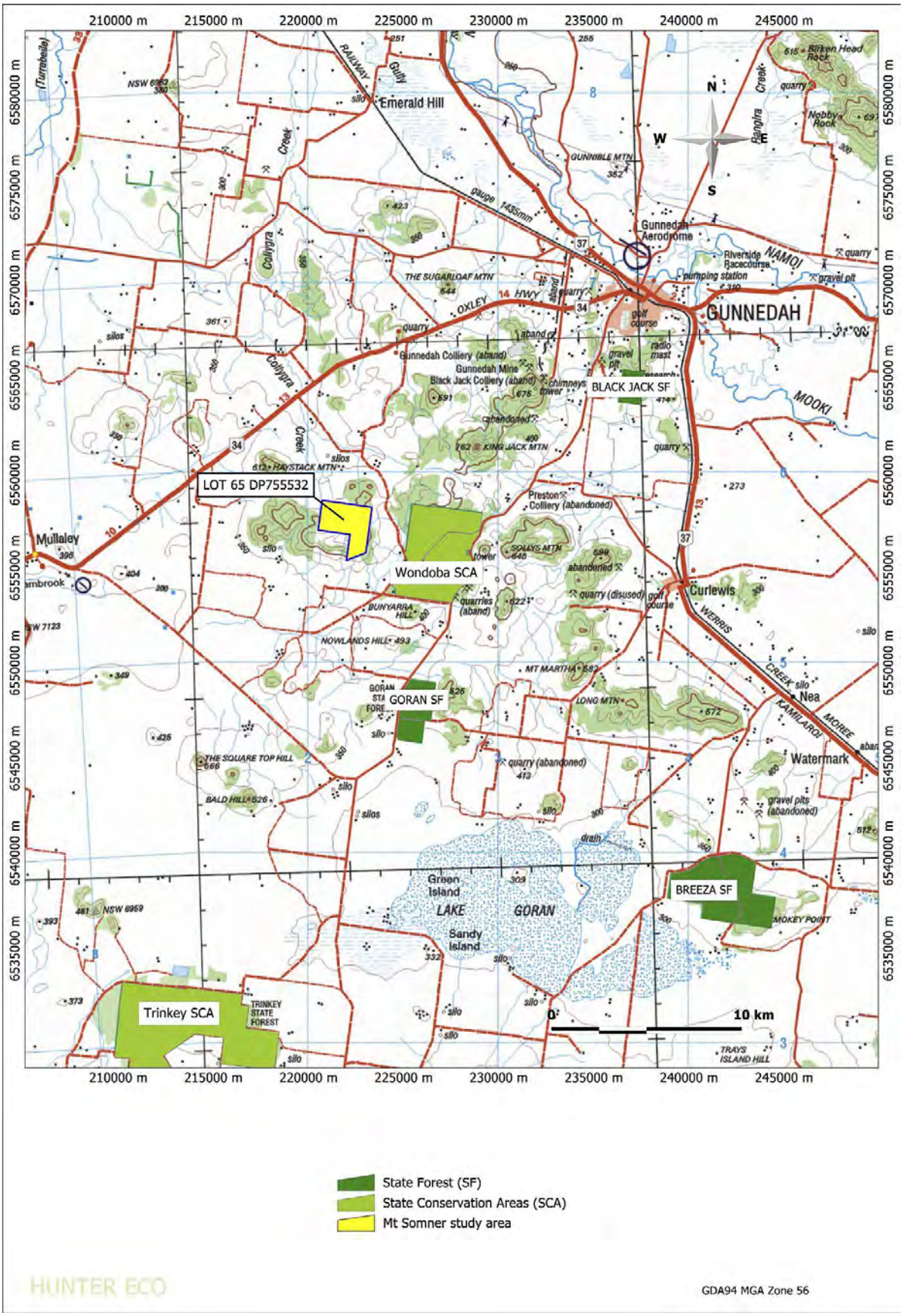


Figure 1 Regional Location

2 THE STUDY AREA

2.1 Regional Setting

The study area is located approximately 20 km south-west of Gunnedah, in the following regions:

- Gunnedah Local Government Area.
- North-west Local Land Service area (formerly the Namoi Catchment Management Authority [CMA], Liverpool Plains [Part B] CMA sub-region).
- Brigalow Belt South Interim Biogeographic Regionalisation for Australia (IBRA) region, Liverpool Plains IBRA subregion.
- North Western Slopes Botanical Division.

2.2 Mitchell Landscapes

Mitchell Landscapes (Mitchell, 2002) are areas of land with relatively homogenous geomorphology, soils and broad vegetation types which have been mapped at a 1:250,000 scale. Each Mitchell Landscape includes an estimate of the percent of native vegetation that has been cleared within the landscape.

The majority of the study area is located in the Breeza Hills Basalt Caps Landscape with a small portion at the northern side being Liverpool Alluvial Plains Landscape (Table 1).

Table 1 Mitchell Landscapes in the Study Area

Landscape Name	Percentage Cleared Estimate[1]
Liverpool Alluvial Plains	84
Breeza Hills Basalt Caps	36

[1] Sourced from the 'Over-cleared Landscapes Database' within the NSW Vegetation Information System (VIS) Classification Database (OEH, 2017b).

2.3 Topography and Drainage

The study area consists of broad low hills (Figure 2) at 600 – 700 metres Australian Height Datum (mAHD) falling to 450 mAHD in the north-west corner. There is a rocky escarpment approximately 300 metres (m) long with sharp clifflines near the southern boundary.

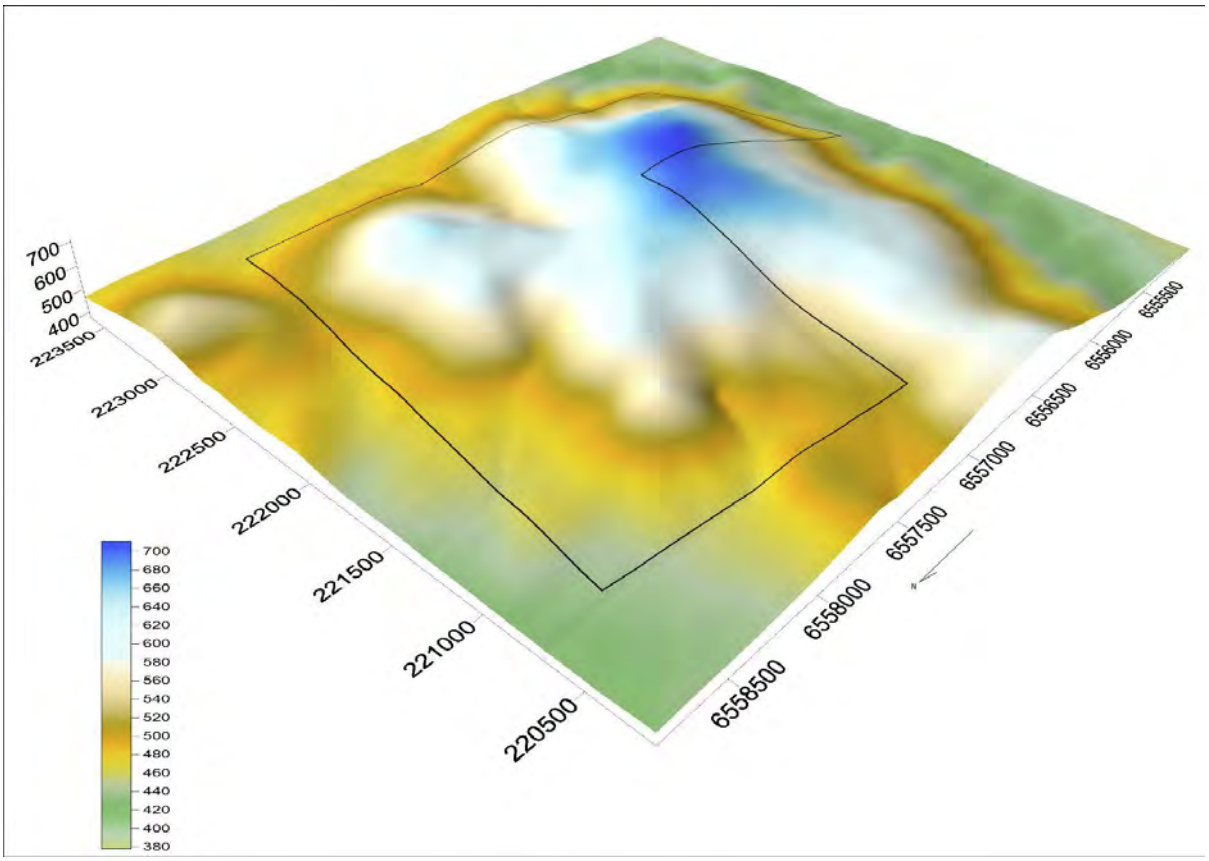


Figure 2 Mt Somner Topography Viewed from the North-West

The study area is located in the Namoi River catchment. There are ephemeral drainage lines which traverse the study area flowing north-west and east into Cox's Creek and Mooki River respectively.

2.4 Geology and Soils

The north and north-eastern slopes are comprised of Triassic period geology, Napperby Formation, being quartzose sandstone and conglomerate. The upper slopes and hills are comprised of Jurassic period geology, Glenrowan Intrusives, with exposed Dolerite fragmented rocks and small boulders frequently forming scree slopes.

Soils as described by the Australian Soil Classification (Isbell, 2016) consisted of Vertosols along the northern edge, a large area of Rudosols on the sideslopes and Ferrosols on the ridgetops.

2.5 Climate

Climate data were extracted from the Australian Bureau of Meteorology (BoM) website for Gunnedah.

Annual rainfall ranges from 247 millimetres (mm) to 1137 mm, with average annual rainfall being 620 mm (BOM, 2016). The average monthly rainfall (Figure 3) shows April to September to be the driest period with only around 40 mm per month. Rainfall increases through October to the wettest months of December and January (70 mm) after which it decreases through to April.

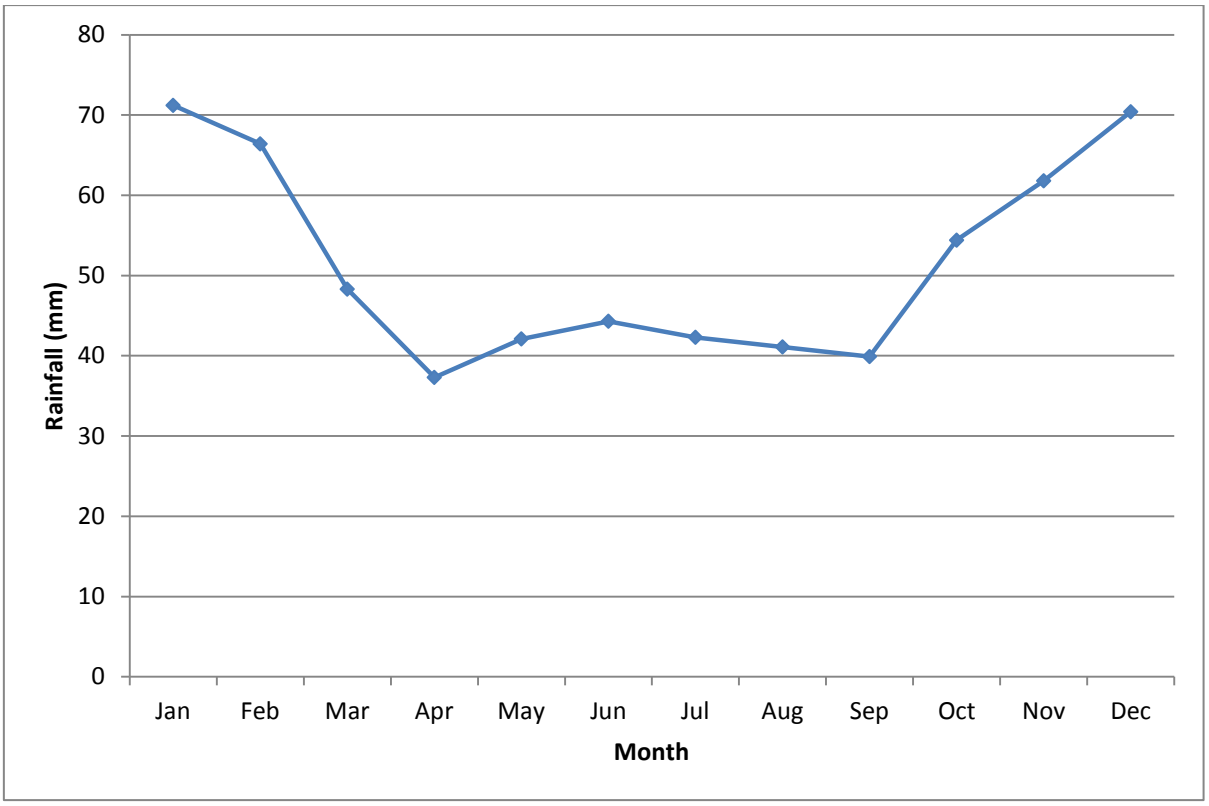


Figure 3 Average Monthly Rainfall in Gunnedah

Annual temperature has ranged from -8.6 °C to 48.7 °C (BOM, 2016). Figure 4 shows the mean monthly maximum and minimum temperatures at Gunnedah. Figure 4 shows that December and January are the warmest months with July being the coolest.

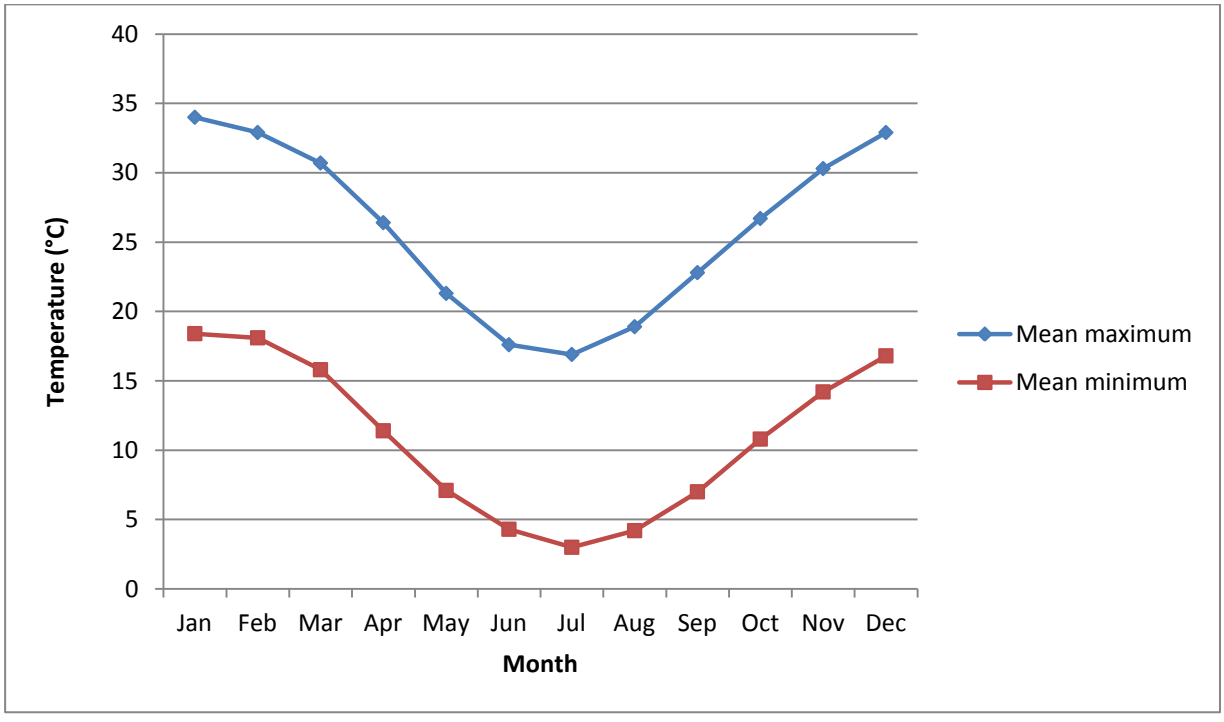


Figure 4 Average Monthly Temperatures in Gunnedah

2.6 Land-use History

The majority of the land within the study area is undisturbed woodland and vine thicket largely because of the abundance of rock. A small area in the north-west is cleared grazing land.

3 BACKGROUND INFORMATION

3.1 Local Flora and Fauna Surveys

Niche Environment and Heritage (Niche, 2012) conducted flora and fauna surveys of the study area during September 2012.

Desktop analysis and field surveys included preliminary vegetation mapping using aerial photography; floristic plots; rapid data points (RDP); threatened flora random meanders; threatened fauna habitat assessment; targeted threatened fauna surveys (i.e. camera trapping, spotlighting, bat call recording, harp trapping, call playback, arboreal trapping, herpetological searches and bird census).

Niche (2012) identified the following two vegetation communities within the study area:

- White Box - White Cypress Pine Shrubby Woodland; and
- Semi-evergreen Vine Thicket.

Niche (2012) identified 129 flora species (including 11 weed species) and 95 fauna species (including 66 bird species, two amphibian species, five reptile species, 12 species of mammals [of which five were introduced] and 10 species of bats).

Five threatened fauna species were recorded across the study area (Niche, 2012). These included four species of birds (the Brown Treecreeper [eastern subspecies] [*Climacteris picumnus*], Turquoise Parrot [*Neophema pulchella*], Little Lorikeet [*Glossopsitta pusilla*] and Scarlet Robin [*Petroica boodang*]) and the Koala. These species are all listed as threatened under the BC Act and the Koala is also listed as threatened under the EPBC Act.

3.2 Regional Surveys

The study area and surrounds are included in coverage of the *Border Rivers Gwydir and Namoi Regional Vegetation Map* (BRGN Vegetation Map [OEH, 2015; Roff et al., 2012]). Table 2 shows the communities predicted in the study area where it can be seen that the confidence levels are not high.

Table 2 Vegetation Communities Predicted in the Study Area by the BRGN Vegetation Mapping

PCT	PCT Name	Map Source	Confidence	Area (ha)
1	Candidate Native Grasslands	Manual Editing	Not Assessed	59
147	Mock Olive - Wilga - Peach Bush - Carissa semi-evergreen vine thicket (dry rainforest) mainly on basalt soils in the Brigalow Belt South Bioregion	Manual Editing	Not Assessed	3
393	White Box shrubby woodland of the western Liverpool Range, Warrumbungle Range and south-west Pilliga forests, Brigalow Belt South Bioregion	Vegetation Modelling	Low	38
433	White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub-region, BBS Bioregion	Vegetation Modelling	Medium	9

Table 2 (Continued) Vegetation Communities Predicted in the Study Area by the BRGN Vegetation Mapping

PCT	PCT Name	Map Source	Confidence	Area (ha)
435	White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion	Vegetation Modelling	Low	33
547	Wild Quince - Mock Olive - Rusty Fig - Iamboto - Sweet Pittosporum dry rainforest of rocky and scree areas of the Nandewar Bioregion and New England Tableland Bioregion	Vegetation Modelling	Medium	73
581	Tumbledown Red Gum - Dwyer's Red Gum - Wallaby Bush shrubby woodland of the Nandewar Bioregion	Vegetation Modelling	Not Assessed	28
592	Narrow-leaved Ironbark - cypress pine - White Box shrubby open forest in the Brigalow Belt South Bioregion and Nandewar Bioregion	Vegetation Modelling	Not Assessed	268
9992	Merged PCT's 387 and 515	Vegetation Modelling	Low	14

4 METHODS

4.1 Vegetation Classification and Mapping

All accessible tracks in the study area were driven and trackless areas were sampled by walking through patches of vegetation showing different structure in aerial photographs. Initial vegetation sampling was by way of RDP, where the dominant species present were recorded for canopy, shrub and ground structural layers. The variation recorded in the RDP was then sampled using standard 20 m x 20 m floristic plots within which each species was recorded and its cover/abundance scored using the Braun-Blanquet cover scale: 1 = <1%, 2 = 1 – 5%, 3 = 5 – 25%, 4 = 25 – 50%, 5 = 50 – 75% and 6 = 75 – 100%. Biometric data were also recorded (see Section 4.1.1). Similarity analysis (Primer 6, Clarke and Gorley, 2006) was used to classify the vegetation communities present.

Using the floristic composition of these communities, they were then matched to the NSW vegetation classification hierarchy as follows:

1. Local Classification.
2. NSW BioMetric Vegetation Types (BVTs).
3. NSW Plant Community Types (PCTs).
4. NSW Vegetation Class (Keith, 2004).
5. NSW Vegetation Formation (Keith, 2004).

4.1.1 BioMetric Data

In addition to collecting floristic cover abundance data, BioMetric data were collected at each plot location in accordance with the NSW *BioBanking Assessment Methodology 2014* [OEH, 2014]). BioMetric data provides input into the NSW BioBanking credit calculator. Collecting BioMetric data includes an extension to the 20 m x 20 m floristic plot to form a 20 m x 50 m plot. Data collected are:

- Total number of native plant species — 20 m x 20 m plot
- Native overstorey cover % — 50 m transect
- Native mid-storey cover % — 50 m transect
- Native ground cover grasses % — 50 m transect
- Native ground cover shrubs % — 50 m transect
- Native ground cover other % — 50 m transect
- Exotic plant cover % — 50 m transect
- Number of trees with hollows — 20 m x 50 m plot
- Overstorey regeneration % — entire stratified unit
- Length of fallen logs — 20 m x 50 m plot

Floristic data were also scored according to the requirements of Table 1 Section 5.2.1.7 of the *BioBanking Assessment Methodology 2014* (OEH, 2014).

4.2 Threatened Ecological Communities

Threatened ecological communities (TECs) listed under the BC Act and/or EPBC Act, recorded or deemed likely to occur in the locality were extracted from BioNet (OEH, 2017a) and the EPBC Protected Matters Search Tool (DotE, 2017) for a 30 km radius around the study area (Table 3).

Table 3 Threatened Ecological Communities Occurring or Likely to Occur Within a 30 km Radius of the Study Area

TEC	Conservation Status in the BC Act[1]
Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions	E
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	E
Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions	E
Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	E
Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	E
Native Vegetation on Cracking Clay Soils of the Liverpool Plains	E
Semi-evergreen Vine Thicket in the Brigalow Belt South and Nandewar Bioregions	E
White Box Yellow Box Blakely's Red Gum Woodland	E
TEC	**Conservation Status in the EPBC Act[1]**
Brigalow (Acacia harpophylla dominant and co-dominant)	E
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	E
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	E
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	E
Weeping Myall Woodlands	E
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	CE

[1] Threatened fauna species status under the BC/EPBC Act (current as at July 2018).

E = Endangered; CE = Critically Endangered.

4.3 Threatened Flora

Threatened flora records were extracted from BioNet (OEH, 2017a) for the Gunnedah Local Government Area (LGA) (Table 4), and were used as a guide to threatened flora possibly occurring in the study area. The flora field survey process involved traversing different habitats and recording all flora species encountered or collecting voucher specimens from those that couldn't immediately be identified. This ensured that any threatened flora species present within the survey areas would not be overlooked.

Table 4 Threatened Flora Species Recorded in the Gunnedah LGA

Family Name	Scientific Name	Conservation Status[1]	
		BC Act	EPBC Act
Apocynaceae	*Tylophora linearis*	V	E
Malvaceae	*Commersonia procumbens*	V	V*
Poaceae	*Dichanthium setosum*	V	V
Poaceae	*Digitaria porrecta*	E	-
Poaceae	*Homopholis belsonii*	E	V
Proteaceae	*Hakea pulvinifera*	E	E
Surianaceae	*Cadellia pentastylis*	V	V

[1] Threatened fauna species status under the BC Act and/or EPBC Act (current as at July 2018).

V = Vulnerable; E = Endangered.

* Listed under EPBC Act as *Androcalva procumbens*

4.4 Threatened Fauna

Table 5 provides a list of all threatened fauna species under the BC and EPBC Acts as predicted to occur by the Archived Biometric and Threatened Species Profiles Datasets (OEH, 2017c), within the mapped vegetation communities. Appendix 3 indicates the suitability of vegetation as habitat for each species.

Table 5 Potentially Occurring Threatened Fauna Species

Common Name	Scientific Name	Conservation Status[1]	
		BC Act	EPBC Act
Painted Honeyeater	*Grantiella picta*	V	V
Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	V	-
Speckled Warbler	*Chthonicola sagittata*	V	-
Diamond Firetail	*Stagonopleura guttata*	V	-
Masked Owl	*Tyto novaehollandiae*	V	-
Australian Brush-turkey population in the Nandewar and Brigalow Belt South Bioregions	*Alectura lathami* - endangered population	E	-
Little Eagle	*Hieraaetus morphnoides*	V	-
Varied Sittella	*Daphoenositta chrysoptera*	V	-
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V	-

Common Name	Scientific Name	Conservation Status[1]	
		BC Act	EPBC Act
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V	-
Swift Parrot	*Lathamus discolor*	E	CE
Square-tailed Kite	*Lophoictinia isura*	V	-
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	V	-
Turquoise Parrot	*Neophema pulchella*	V	-
Barking Owl	*Ninox connivens*	V	-
Superb Parrot	*Polytelis swainsonii*	V	V
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V	-
Regent Honeyeater	*Anthochaera phrygia*	CE	CE
Little Lorikeet	*Glossopsitta pusilla*	V	-
Scarlet Robin	*Petroica boodang*	V	-
Rufous Bettong	*Aepyprymnus rufescens*	V	-
Spotted-tailed Quoll	*Dasyurus maculatus maculatus*	V	E
Black-striped Wallaby	*Macropus dorsalis*	E	-
Brush-tailed Rock-wallaby	*Petrogale penicillata*	E	V
Eastern Pygmy-possum	*Cercartetus nanus*	V	-
Squirrel Glider	*Petaurus norfolcensis*	V	-
Brush-tailed Phascogale	*Phascogale tapoatafa*	V	-
Koala	*Phascolarctos cinereus*	V	V
Grey-headed-Flying-fox	*Pteropus poliocephalus*	V	V
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V
Little Pied Bat	*Chalinolobus picatus*	V	-
Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	V	-
Corben's Long-eared Bat	*Nyctophilus corbeni*	V	V
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	-
Eastern Cave Bat	*Vespadelus troughtoni*	V	-
Pink-tailed Legless Lizard	*Aprasia parapulchella*	V	V
Pale-headed Snake	*Hoplocephalus bitorquatus*	V	-
Border Thick-tailed Gecko	*Uvidicolus sphyrurus*	V	V

[1] Threatened fauna species status under the BC Act and/or EPBC Act (current as at July 2018).
V = Vulnerable; E = Endangered; CE = Critically Endangered

4.5 Sampling Effort

Field surveys were conducted from 6th to 10th of June 2016 during which the weather was mostly overcast with patchy sun and rain. Over 11 km of walking meanders and 9 km of driven tracks resulted in data from 112 RDP and 16 floristic plots being collected from within the study area (Figure 5).

Table 6 shows that the floristic plot sampling density implemented during the field surveys, and is in accordance with the requirements outlined in Section 5.3.2 of the *BioBanking Assessment Methodology 2014* (OEH, 2014).

Table 6 Plot Densities

Vegetation Community	Area (ha)[1]	Number of Plots Required by BBAM[2]	Number of plots Conducted
White Box Shrubby Forest	416	7	7
White Box Shrubby Forest – Derived Native Grassland	65	5	5
Semi-evergreen Vine Thicket	45	4	4

[1] Refer to Section 5.1.

[2] BioBanking Assessment Methodology (OEH, 2014).

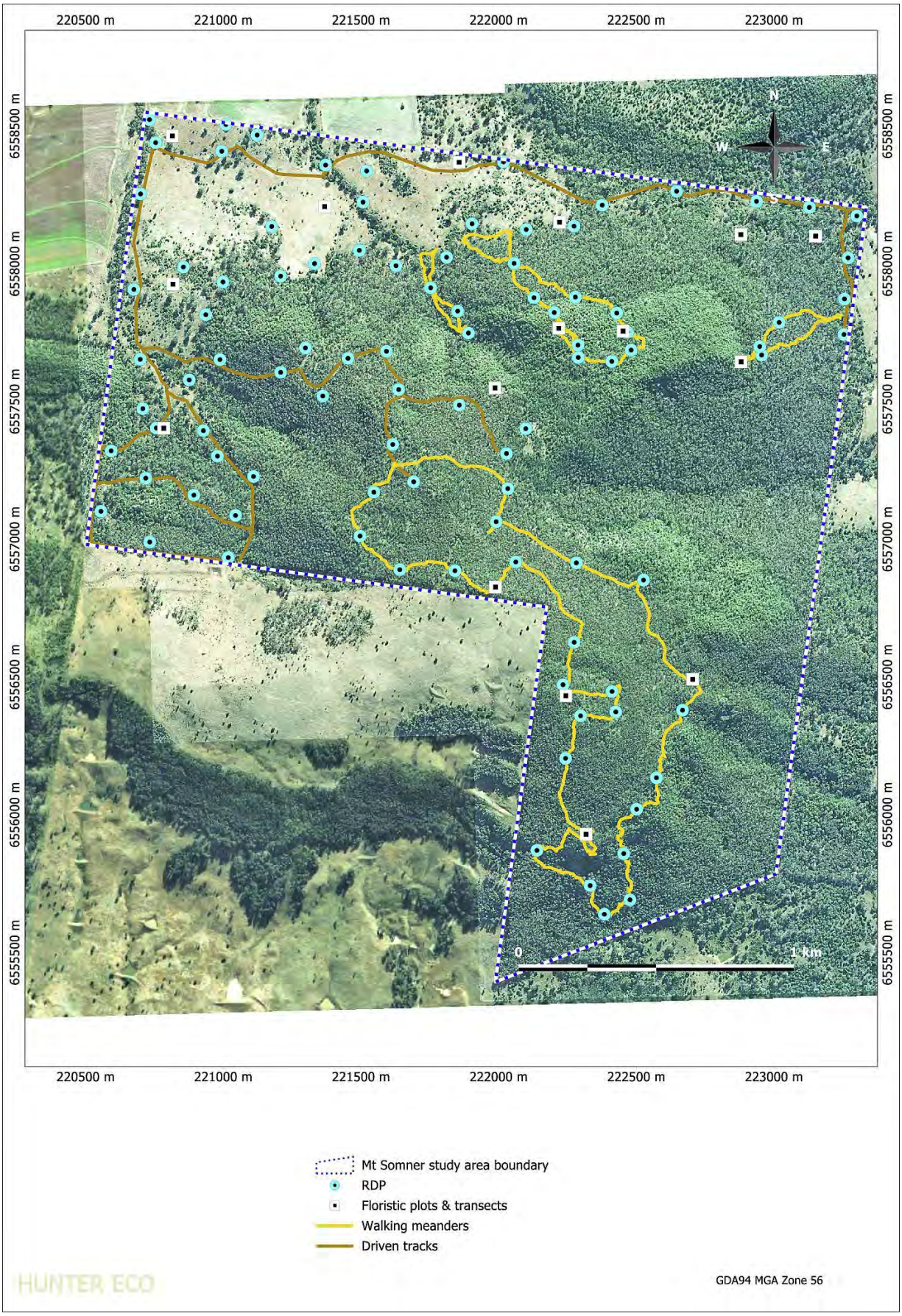


Figure 5 Survey effort

5 RESULTS

5.1 Vegetation Communities/Vegetation Types

Non-metric dimensional scaling (nMDS) similarity analysis of the 16 floristic plots using Primer 6 (Clarke and Gorley, 2006) showed three main groups (Figure 6). nMDS places collections of data (in this instance the lists of species and abundance scores for each plot) into groups that are most similar to each other. Within the White Box Shrubby Forest group, a single plot separates as it had few shrubs and contained a dominant grassy *Poa* species ground layer.

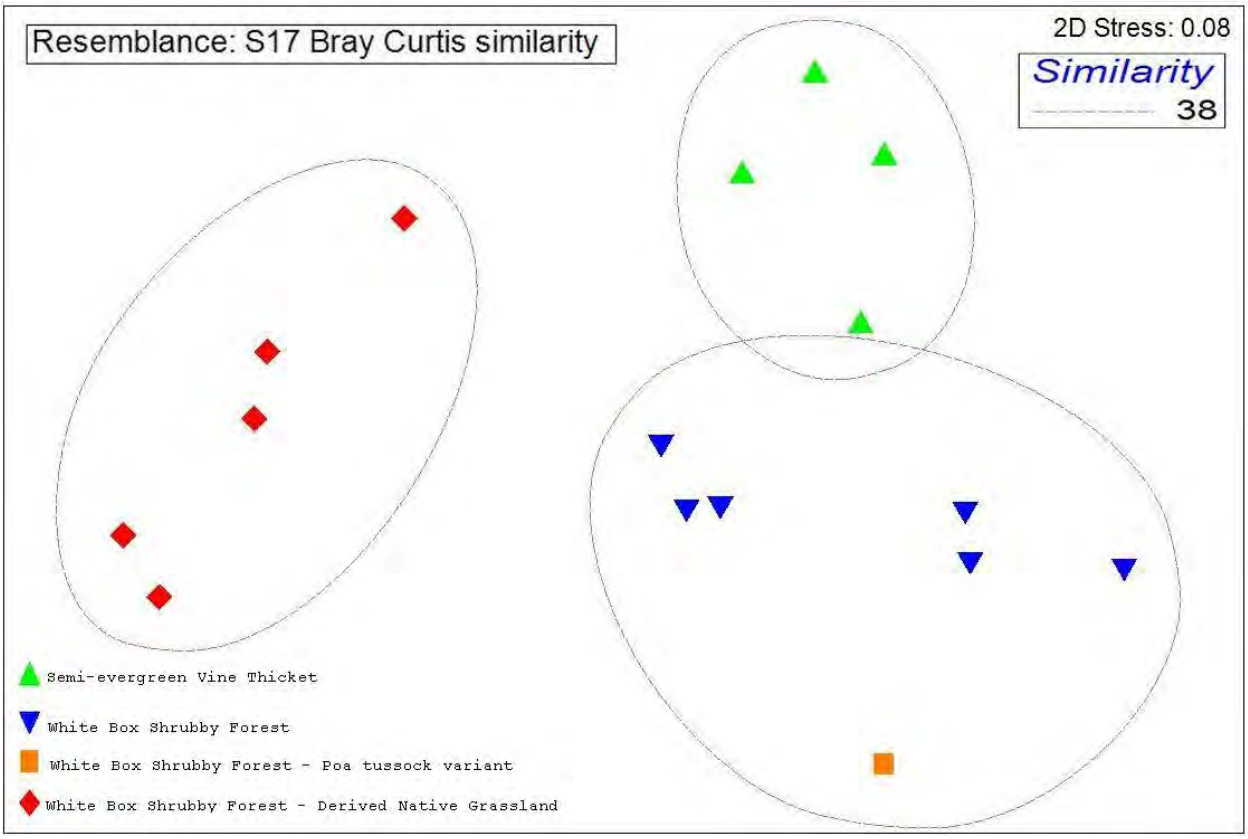


Figure 6 nMDS Plot of the 16 Floristic Plots

Two main vegetation communities were mapped within the study area, with one derived native grassland type (Table 7; Figure 6).

Referring back to the predicted vegetation communities in Table 2, it can be seen that the actual vegetation on the study area is much less complex than that predicted (Section 3.2).

Table 7 Vegetation Communities Mapped for the Study Area

Local Community	PCT	BVT	PCT Name	TEC
Dry Sclerophyll Forests (Shrub/Grass Formation)				
White Box Shrubby Forest (416 ha)	588	NA398	White Box - White Cypress Pine shrubby hills open forest mainly in the Nandewar Bioregion	None
White Box Shrubby Forest – Derived Native Grassland (65 ha)	588	NA398	White Box - White Cypress Pine shrubby hills open forest mainly in the Nandewar Bioregion	None
Rainforests				
Semi-evergreen Vine Thicket (45 ha)	147	NA199	Mock Olive - Wilga - Peach Bush - Carissa semi-evergreen vine thicket (dry rainforest) mainly on basalt soils in the Brigalow Belt South Bioregion	Listed as 'Endangered' under the BC Act as *Semi-evergreen vine thicket in the Brigalow Belt South and Nandewar Bioregions*. Listed as 'Endangered' under the EPBC Act as *Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions*

Almost 90% of the study area is uncleared and the vegetation is remarkable for being almost completely undisturbed, with large areas exhibiting old growth characteristics, however, there is evidence of a substantial pig and deer population that has a detrimental impact on ground cover in particular.

The communities mapped in this study were similar to those of Niche (2012) with the exception that the floristic content of the White Box Shrubby Forest was better described by BVT NA398 than NA225. Table 8 provides a list of the species characterising each BVT and the description for NA395 is more comprehensive and shows nearly double the listed species occurring in the study area than shown for NA225.

Table 8 Species Listed in the VIS Database for BVT NA225 and NA395

NA225	Occurrence	NA395	Occurrence
Species		**Species**	
Carissa ovata	Absent	*Bothriochloa macra*	Absent
Dodonaea viscosa subsp. angustifolia	Absent	*Breynia cernua*	Absent
Eucalyptus crebra	Absent	*Bulbine vagans*	Absent
Eucalyptus dealbata	Absent	*Cassinia laevis*	Absent
Eucalyptus melanophloia	Absent	*Dichelachne micrantha*	Absent
Eucalyptus melliodora	Absent	*Dichondra sp. A*	Absent
Eucalyptus viridis	Absent	*Dodonaea viscosa subsp. angustifolia*	Absent
Aristida ramosa	Present	*Eucalyptus dealbata*	Absent

Table 8 (Continued) Species Listed in the VIS Database for BVT NA225 and NA395

NA225	Occurrence	NA395	Occurrence
Species		**Species**	
Austrostipa verticillata	Present	*Eucalyptus melanophloia*	Absent
Beyeria viscosa	Present	*Eucalyptus melliodora*	Absent
Bursaria spinosa subsp. spinosa	Present	*Lysiana subfalcata*	Absent
Callitris glaucophylla	Present	*Olearia ramosissima*	Absent
Cheilanthes sieberi subsp. sieberi	Present	*Paspalidium gracile*	Absent
Cymbopogon refractus	Present	*Pittosporum angustifolium*	Absent
Desmodium brachypodum	Present	*Poa sieberiana*	Absent
Eucalyptus albens	Present	*Santalum acuminatum*	Absent
Notelaea microcarpa var. microcarpa	Present	*Senna form taxon filifolia*	Absent
Olearia elliptica	Present	*Senna form taxon zygophylla*	Absent
Angophora floribunda	Uncommon	*Sorghum leiocladum*	Absent
Brachychiton populneus subsp. populneus	Uncommon	*Swainsona galegifolia*	Absent
Cassinia quinquefaria	Uncommon	*Acacia decora*	Present
Species occurring in the study area	**14**	*Aristida ramosa*	Present
		Austrodanthonia racemosa var. racemosa	Present
		Austrostipa scabra subsp. scabra	Present
		Beyeria viscosa	Present
		Brunoniella australis	Present
		Callitris glaucophylla	Present
		Cassinia quinquefaria	Present
		Clematis microphylla var. leptophylla	Present
		Cymbopogon refractus	Present
		Cyperus gracilis	Present
		Desmodium brachypodum	Present
		Desmodium varians	Present
		Dodonaea sinuolata subsp. sinuolata	Present
		Elymus scaber var. scaber	Present
		Eucalyptus albens	Present
		Geijera parviflora	Present
		Indigofera adesmiifolia	Present
		Jasminum lineare	Present

Table 8 (Continued) Species Listed in the VIS Database for BVT NA225 and NA395

NA225 Species	Occurrence	NA395 Species	Occurrence
		Notelaea microcarpa var. microcarpa	Present
		Olearia elliptica	Present
		Psydrax odorata	Present
		Rostellularia adscendens subsp. adscendens	Present
		Scleria mackaviensis	Present
		Angophora floribunda	Uncommon
		Species occurring in the study area	**25**

Detailed descriptions of these three vegetation communities are provided in Sections 5.2.1 to 5.2.3 and a number of photographs taken from within the study area are provided in Appendix 4.

5.2 Threatened Ecological Communities

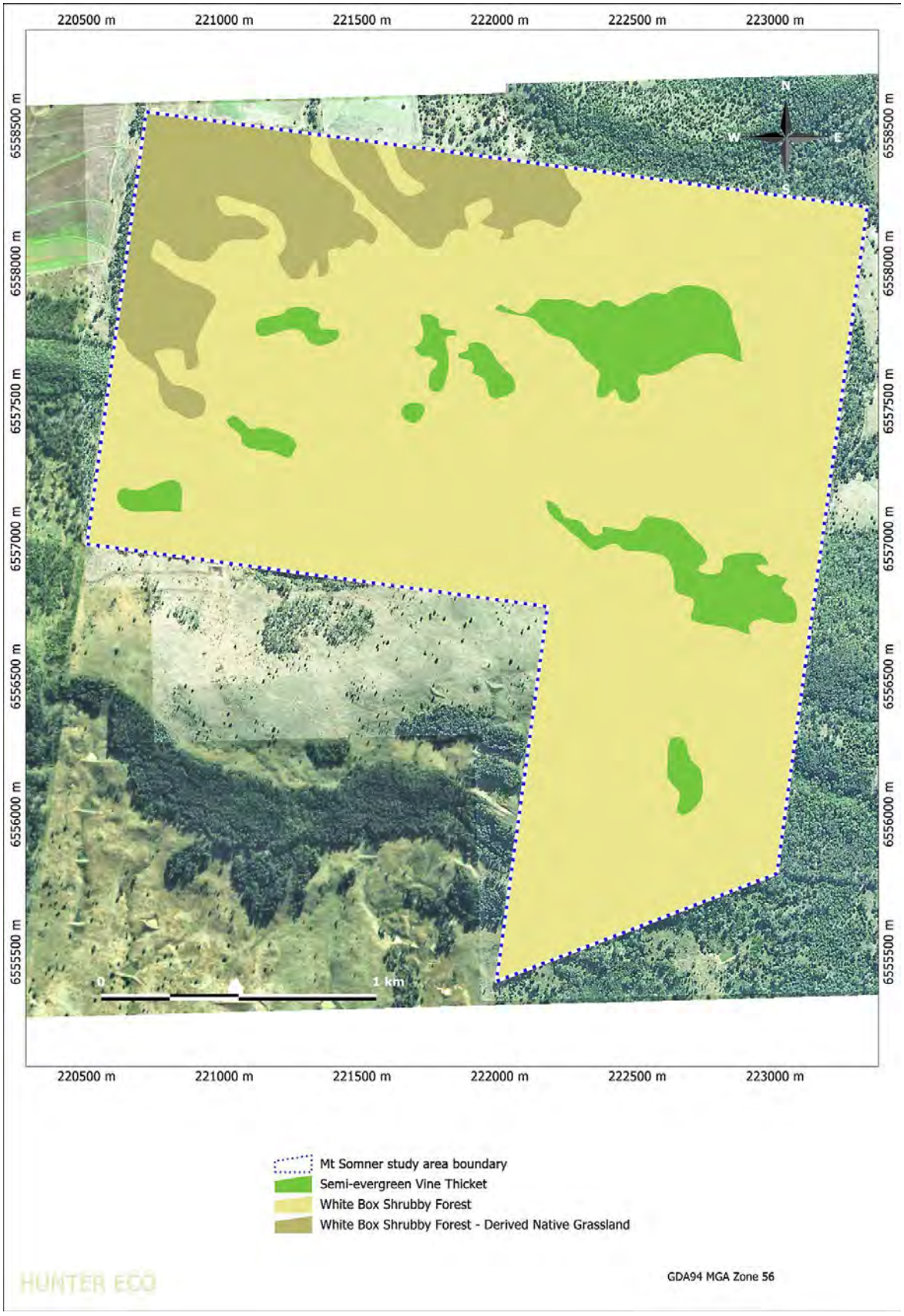


Figure 7 Mapped Vegetation Communities

5.2.1 Semi-evergreen Vine Thicket

Figure 8 Semi-evergreen vine thicket

Emergent canopy, sparse: *Eucalyptus albens*, *Eucalyptus dealbata* and *Callitris glaucophylla*.
Sub-canopy, dense low shrubs to four metres tall: *Notelaea microcarpa* var. *microcarpa, Ehretia membranifolia, Alstonia constricta, Croton phebalioides, Beyeria viscosa, Capparis mitchellii, Alphitonia excelsa*, *Psydrax odorata* subsp. *australiana.*
Herbs, scattered: *Calotis lappulacea, Vittadinia sulcata, Geranium solanderi* var. *solanderi, Abutilon oxycarpum, Hibiscus sturtii* var. *sturtii, Oncinocalyx betchei*.
Grasses, scattered: *Aristida ramosa, Rytidosperma racemosum* var. *racemosum, Cymbopogon refractus, Eragrostis megalosperma, Poa labillardierei* var. *labillardierei*.
Sedges, scattered: *Carex inversa, Cyperus gracilis, Scleria mackaviensis, Lomandra confertifolia* subsp. *pallida*.
Vines, abundant: *Pandorea pandorana, Jasminum lineare*.
Ferns, scattered: *Cheilanthes distans, Cheilanthes sieberi* subsp. *sieberi*.
Status, NSW EEC *Semi-evergreen Vine Thicket in the Brigalow Belt South and Nandewar Bioregions*. Commonwealth EEC *Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions*. The location of this community in the study area being on volcanic dolerite-derived soils in the Brigalow Belt South Bioregion is consistent with the description in the NSW and Commonwealth Scientific Committee determinations for this community. The species listed above are consistent with those described in the determinations, in particular *Notelaea microcarpa* var. *microcarpa, Ehretia membranifolia, Pandorea pandorana and Alstonia constricta.*

5.2.2 White Box Shrubby Woodland

Figure 9 White Box shrubby woodland

Canopy, mid-dense: *Eucalyptus albens, Callitris glaucophylla, Brachychiton populneus* subsp. *populneus, Angophora floribunda*.
Shrubs, mid-dense to dense: *Beyeria viscosa, Dodonaea viscosa* subsp. *angustifolia, Dodonaea sinuolata* subsp. *sinuolata, Solanum parvifolium* subsp. *parvifolium, Rhagodia parabolica, Spartothamnella juncea, Breynia oblongifolia, Indigofera adesmiifolia, Indigofera australis, Acacia deanei* subsp. *deanei, Acacia decora, Myoporum montanum, Notelaea microcarpa* var. *microcarpa, Geijera parviflora, Pimelea neo-anglica, Xanthorrhoea johnsonii.*
Herbs, sparse: *Abutilon oxycarpum, Arthropodium* sp. B sensu Harden (1993), *Brunoniella australis, Cymbonotus lawsonianus, Daucus glochidiatus, Dianella revoluta* var. *revoluta, Einadia hastata, Galium propinquum, Hibiscus sturtii* var. *sturtii, Malvastrum americanum, Mentha australis, Rostellularia adscendens* var. *adscendens, Scutellaria humilis, Veronica plebeia, Vittadinia sulcata*.
Grasses, sparse to dense: *Aristida ramosa, Austrostipa scabra subsp. falcata, Austrostipa verticillata, Chloris ventricosa, Digitaria diffusa, Poa labillardierei* var. *labillardierei, Rytidosperma racemosum* var. *racemosum*.
Sedges, sparse: *Carex inversa, Lomandra bracteata, Lomandra confertifolia* subsp. *pallida, Lomandra longifolia, Lomandra multiflora* subsp. *multiflora, Scleria mackaviensis*.
Vines, sparse: *Marsdenia viridiflora* subsp. *viridiflora, Pandorea pandorana, Parsonsia lanceolata*.
Ferns, sparse: *Cheilanthes distans, Cheilanthes sieberi* subsp. *sieberi*.
Parasites, sparse: *Amyema miquelii, Dendrophthoe glabrescens, Lysiana exocarpi subsp. tenuis, Korthalsella rubra* subsp. *geijericola*.
Weeds, scattered: *Lepidium africanum, Opuntia aurantiaca, Opuntia stricta* var. *stricta*.

Status, not threatened. The NSW and Commonwealth Scientific Committee determinations for the threatened Box-Gum community describe grassy woodland and specifically exclude shrubby woodland as was present in the study area.

5.2.3 White Box Shrubby Woodland Derived Native Grassland

Figure 10 White Box shrubby woodland – derived native grassland

Canopy, scattered: *Eucalyptus albens*.
Shrubs, scattered: *Ehretia membranifolia, Geijera parviflora, Notelaea microcarpa* var. *microcarpa*, *Chenopodium carinatum, Myoporum montanum, Sclerolaena birchii, Sclerolaena muricata* var. *muricata*.
Herbs, scattered: *Abutilon oxycarpum, Brunoniella australis, Chamaesyce drummondii, Daucus glochidiatus, Einadia polygonoides, Malvastrum americanum, Mentha australis, Mentha satureioides, Vittadinia cuneata* var. *cuneata*.
Grasses, dense: *Aristida ramosa, Austrostipa scabra* subsp. *falcata, Austrostipa verticillata, Bothriochloa decipiens* var. *decipiens, Chloris ventricosa, Enteropogon acicularis, Poa labillardierei* var. *labillardierei*.
Sedges, sparse: *Carex inversa*.
Vines, sparse: *Jasminum lineare, Parsonsia lanceolata*.
Weeds, plentiful: *Carthamus lanatus, Chondrilla juncea, Lepidium africanum, Opuntia aurantiaca, Opuntia stricta* var. *stricta, Opuntia tomentosa, Rapistrum rugosum, Sisymbrium orientale*.

Status, not threatened. The NSW and Commonwealth Scientific Committee determinations for the threatened Box-Gum community describe grassy woodland and specifically exclude shrubby woodland. The remnant shrubs in the study area grassland indicated that it was derived from shrubby woodland.

5.3 Flora Species

Appendix 1 provides a list of flora species recorded within each vegetation community (drawn from floristic plot data) while Appendix 2 provides a list of all species recorded within the study area (drawn from floristic plot data and random meanders). Despite there being only two main vegetation communities, the study area proved to be quite floristically diverse. In summary, 170 species were recorded (including 20 weed species) with 130 genera from 56 families.

5.4 Fauna Species

Appendix 3 provides a list of all threatened fauna species predicted to occur by the Archived Biometric and Threatened Species Profiles Datasets (OEH, 2017c) within the mapped vegetation communities. A total of 13 flora and 40 fauna species listed under the BC Act are predicted to occur based on the vegetation communities present within the study area. Of these, suitable habitat was considered to be present for five flora species although none were recorded. Two threatened fauna species were opportunistically recorded (Brown Tree-creeper and Koala) during this flora survey. Suitable habitat was considered to be present for 32 fauna species that have been assumed to be present on the study area (Appendix 3). Of these 32 fauna species, as detailed in Section 3.1, five threatened fauna species have been previously recorded across the study area by Niche (2012). These included four species of birds (the Brown Treecreeper [eastern subspecies], Turquoise Parrot, Little Lorikeet and Scarlet Robin) and the Koala.

The flora surveys confirmed that the 481 ha of White Box Shrubby Forest (NA398) provides potential habitat which the Koala and the Regent Honeyeater are likely to use, and therefore would generate species credits for these two species.

6 Improving Biodiversity at a BioBank Site

The *BioBanking Assessment Methodology 2014* (OEH, 2014) requires the use of an online program (the *Credit Calculator for Major Projects and BioBanking* [the Credit Calculator]) to assess the number of credits which could be generated by the study area if an application for a BioBanking Agreement were to be prepared and the study area were to be accepted as a BioBanking site.

This section has been prepared in accordance with Section 12 of the *BioBanking Assessment Methodology 2014* (OEH, 2014).

6.1 Change in Site Value Score

Table 7 identifies the change in site value score of each vegetation zone mapped within the study area as a result of the management actions proposed to be carried out over the BioBank site (Section 6.5). There are no sections of the study area which are currently subject to any legal impediment (e.g. covenant or easement) or existing obligations (as outlined in Section 12.10 of the *BioBanking Assessment Methodology 2014* [OEH, 2014]) that would restrict the implementation of the management actions set out in Section 6.5.

Table 9 Vegetation Zones

Vegetation Zone Number	Vegetation Community	BVT	Condition Class and Sub-category	Current Site Value Score	Future Site Value Score	Change in Site Value Score
Dry Sclerophyll Forests (Shrub/Grass Formation)						
1	White Box Shrubby Forest	NA398	Moderate/Good	69.27	80.38	11.11
2	White Box Shrubby Forest – Derived Native Grassland		Moderate/Good_DNG	13.54	30.47	16.93
Rainforests						
3	Semi-evergreen Vine Thicket	NA199	Moderate/Good	35.42	56.51	21.09

The study area does not contain any land which has a high risk of decline in site value score given:

- no land within the study area is zoned for residential, business or industrial uses in a Local Environmental Plan; and
- the land within the study area is zoned E3 Environmental Management under which extensive agriculture, environmental protection works, home occupation and roads are permitted without consent under the *Gunnedah Local Environment Plan 2012.*

6.2 Change in Landscape Value Score

The Landscape Value score for the Mt Somner offset was 13.9.

6.3 Averted Loss

The averted loss in site value has been calculated in accordance with Section 12.3 of the *BioBanking Assessment Methodology 2014* (OEH, 2014). For the White Box Shrubby Forest – Derived Native Grassland community only there was no averted loss due to its already degraded condition.

6.4 Credits Generated at the BioBank Site

The credit report (output of the Credit Calculator) is provided in Apendix 5. The credit report provides the credit profile for each ecosystem credit BVT. The result of running the Credit Calculator is that the study area would generate a total of 4,032 ecosystem credits (Table 8).

Table 10 Ecosystem Credits Generated

Vegetation Community	BVT	Credits Generated (Appendix 5)
White Box Shrubby Forest	NA398	3,603
Semi-evergreen Vine Thicket	NA199	429
	Total	**4,032**

In addition, Table 9 provides a summary of the species credit requirements which would be generated by the study area. The species credit requirements can overlap the ecosystem credit requirements (i.e. the requirements are not mutually exclusive).

Table 11 Species Credits Generated

Species	Credits Generated (Appendix 5)
Regent Honeyeater (*Anthochaera phrygia*)	3,415
Koala (*Phascolarctos cinereus*)	3,415

6.5 Proposed Management Actions

If an application for a BioBanking Agreement were to be made over the study area, a Biodiversity Management Plan would be prepared, which would detail the proposed management actions for the site.

Notwithstanding the above, the proposed management actions would include (consistent with Appendix 5):

- excluding feral pests;
- slashing;
- excluding commercial apiaries;
- feral and/or over-abundant native herbivore control; and
- fox control.

7 Conclusion

A flora and vegetation community survey was conducted in June 2016 on the study area (totalling approximately 526 ha) located approximately 20 km south-west of Gunnedah, NSW.

The recent survey work, detailed in this report, comprised of vegetation classification and mapping (via RDP and sampling using the Braun-Blanquet cover scale), biometric data collection in accordance with the NSW *BioBanking Assessment Methodology 2014* (OEH, 2014) and targeted threatened species meanders.

The surveys detailed in this report confirmed that two main vegetation communities are present within the study area, with one derived native grassland type: White Box Shrubby Forest (approximately 416 ha), White Box Shrubby Forest Derived Native Grassland (approximately 65 ha) and Semi-evergreen Vine Thicket (approximately 45 ha). The Semi-evergreen Vine Thicket community is listed as Endangered under the BC Act and the EPBC Act.

While 170 flora species were recorded (including 20 weed species) there were no threatened flora species or populations identified, despite targeted survey work.

Almost 90% of the study area is uncleared and the vegetation is remarkable for being almost completely undisturbed, with large areas exhibiting old growth characteristics, however there is evidence of a substantial pig and deer population that has a detrimental impact on ground cover in particular.

The *BioBanking Assessment Methodology 2014* (OEH, 2014) requires the use of the Credit Calculator to assess the number of credits which could be generated by the study area if an application for a BioBanking Agreement were to be prepared and the study area were to be accepted as a BioBanking site.

In summary, the result of running the Credit Calculator is that the study area would generate a total of 4,032 ecosystem credits and 3,415 species credits for both the Koala and the Regent Honeyeater.

8 REFERENCES

Bureau of Meteorology (2016) *Climate Data Online.* Website: www.bom.gov.au/climate/data/

Bulow-Olsen A, Just J and Liddle MJ (1982) Growth and flowering history of *Xanthorrhoea johnsonii* Lee (Liliaceae) in Toohey Forest. Queensland Botanical Journal of the Linnean Society Volume 84, Issue 3, pages 195−207, April 1982.

Clarke, K.R., Gorley, R.N., (2006). PRIMER v6: User Manual/Tutorial. PRIMER-E, Plymouth. 91 pp.

Commonwealth of Australia (2013) *Survey Guidelines for Australia's Threatened Orchids.*

Department of the Environment (2017) EPBC Act Protected Matters Search Tool. Website: http://www.environment.gov.au/epbc/pmst/

Department of Environment and Conservation and Department of Primary Industries (2005). *Draft Guidelines for Threatened Species Assessment.*

Department of Environment and Conservation (2004) *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft.*

Isbell (2016) The Australian Soil Classification. The National Committee on Soil and Terrain. CSIRO Publishing January 2016.

Keith D. (2004) *Ocean shores to desert dunes: the native vegetation of New South Wales and the ACT.* NSW Government.

Mitchell, P. (2002) NSW Landscapes Mapping: Background and Methodology. Report prepared for the NSW National Parks and Wildlife Service.

Niche (2012) Mt Somner Property Flora and Fauna Inventory. Report by Niche Environment and Heritage October 2012.

Office of Environment and Heritage (2014) *BioBanking Assessment Methodology 2014.* Website: http://www.environment.nsw.gov.au/resources/biobanking/140661BBAM.pdf

Office of Environment and Heritage (2015). BRG-Namoi Regional Native Vegetation Mapping. Technical Notes, NSW Office of Environment and Heritage, Sydney, Australia.

Office of Environment and Heritage (2016). *NSW Guide to Surveying Threatened Plants.* Website:http://www.environment.nsw.gov.au/resources/threatenedspecies/160129-threatened-plants-survey-guide.pdf

Office of Environment and Heritage (2016b) Biodiversity Assessment Tools Databases. Website:http://www.environment.nsw.gov.au/biobanking/vegtypedatabase.htm

Office of Environment and Heritage (2017a) *NSW BioNet the Website for the Atlas of NSW Wildlife.*

Office of Environment and Heritage (2017b) *Vegetation Information System: Classification*.

Office of Environment and Heritage (2017c) *Archived BioMetric and Threatened Species Profiles Datasets*.

Roff, A., Thonell, J., Day, M., Somerville, M. Turner, K., Huxtable, C., Sivertsen, D., and Denholm, B., 2012. *Namoi Native Vegetation Mapping, Geodatabase Guide v1.0*, Office of Environment and Heritage, Department of Premier and Cabinet, Sydney, Australia.

APPENDIX 1 Flora Species by Community

	Semi-evergreen Vine Thicket	White Box Shrubby Forest	White Box Derived Grassland
Acanthaceae			
Brunoniella australis		✓	✓
Rostellularia adscendens var. adscendens		✓	
Adiantaceae			
Cheilanthes distans	✓	✓	✓
Cheilanthes sieberi subsp. sieberi	✓	✓	✓
Anthericaceae			
Arthropodium sp. B sensu Harden (1993)	✓	✓	
Apiaceae			
Daucus glochidiatus		✓	✓
Apocynaceae			
Alstonia constricta	✓		
Parsonsia lanceolata		✓	✓
Asclepiadaceae			
Marsdenia viridiflora subsp. viridiflora		✓	✓
Asteraceae			
**Carduus spp.*			✓
**Carthamus lanatus*			✓
**Centaurea melitensis*			✓
**Chondrilla juncea*			✓
Calotis lappulacea	✓		
Cymbonotus lawsonianus	✓	✓	
Olearia elliptica	✓	✓	
Vittadinia cuneata var. cuneata			✓
Vittadinia muelleri			✓
Vittadinia sulcata	✓	✓	✓
Bignoniaceae			
Pandorea pandorana	✓	✓	
Boraginaceae			
Ehretia membranifolia	✓		✓
Brassicaceae			
**Lepidium africanum*	✓	✓	✓
**Rapistrum rugosum*			✓
**Sisymbrium orientale*			✓
Cactaceae			
**Opuntia aurantiaca*	✓	✓	✓
**Opuntia stricta var. stricta*	✓	✓	✓
**Opuntia tomentosa*			✓
Capparaceae			
Capparis mitchellii	✓	✓	
Chenopodiaceae			

	Semi-evergreen Vine Thicket	White Box Shrubby Forest	White Box Derived Grassland
Chenopodium carinatum			✓
Einadia hastata		✓	
Einadia nutans subsp. nutans		✓	
Einadia polygonoides		✓	✓
Maireana microphylla		✓	✓
Rhagodia parabolica		✓	
Sclerolaena birchii			✓
Sclerolaena muricata var. muricata			✓
Chloanthaceae			
Spartothamnella juncea	✓	✓	
Convolvulaceae			
Convolvulus erubescens			✓
Dichondra repens		✓	
Cupressaceae			
Callitris glaucophylla	✓	✓	
Cyperaceae			
Carex inversa	✓	✓	✓
Cyperus gracilis	✓	✓	
Scleria mackaviensis	✓	✓	
Euphorbiaceae			
Beyeria viscosa	✓	✓	
Breynia oblongifolia	✓	✓	
Chamaesyce drummondii			✓
Croton phebalioides	✓		
Phyllanthus gunnii		✓	
Fabaceae (Caesalpinioideae)			
Senna coronilloides	✓	✓	
Fabaceae (Faboideae)			
**Trifolium spp.*			✓
Desmodium brachypodum	✓	✓	✓
Desmodium gunnii		✓	
Desmodium varians		✓	
Glycine clandestina	✓		
Glycine stenophita		✓	
Glycine tabacina	✓		
Indigofera adesmiifolia	✓	✓	
Indigofera australis	✓	✓	
Fabaceae (Mimosoideae)			
Acacia deanei subsp. deanei		✓	✓
Acacia decora		✓	
Acacia doratoxylon		✓	
Acacia implexa	✓	✓	
Geraniaceae			

	Semi-evergreen Vine Thicket	White Box Shrubby Forest	White Box Derived Grassland
Geranium solanderi var. solanderi	✓	✓	
Lamiaceae			
Mentha australis		✓	✓
Mentha satureioides			✓
Scutellaria humilis		✓	
Lomandraceae			
Lomandra bracteata		✓	
Lomandra confertifolia subsp. pallida	✓	✓	
Lomandra longifolia		✓	
Lomandra multiflora subsp. multiflora		✓	
Loranthaceae			
Amyema miquelii		✓	
Dendrophthoe glabrescens		✓	
Lysiana exocarpi subsp. tenuis		✓	
Malvaceae			
Abutilon oxycarpum	✓	✓	✓
Hibiscus sturtii var. sturtii	✓	✓	
Malvastrum americanum	✓	✓	✓
Sida corrugata	✓	✓	
Sida subspicata		✓	
Myoporaceae			
Myoporum montanum		✓	✓
Myrtaceae			
Angophora floribunda		✓	
Eucalyptus albens	✓	✓	✓
Eucalyptus dealbata	✓		
Oleaceae			
Jasminum lineare	✓	✓	✓
Notelaea microcarpa var. microcarpa	✓	✓	✓
Orchidaceae			
Pterostylis spp.	✓	✓	
Oxalidaceae			
Oxalis perennans		✓	✓
Phormiaceae			
Dianella revoluta var. revoluta	✓	✓	
Pittosporaceae			
Bursaria spinosa	✓	✓	
Plantaginaceae			
Plantago debilis			✓
Poaceae			
**Urochloa panicoides*			✓
Aristida ramosa	✓	✓	✓

	Semi-evergreen Vine Thicket	White Box Shrubby Forest	White Box Derived Grassland
Austrostipa scabra subsp. falcata		✓	✓
Austrostipa verticillata	✓	✓	✓
Bothriochloa decipiens var. decipiens			✓
Chloris ventricosa		✓	✓
Cymbopogon refractus	✓	✓	✓
Digitaria brownii			✓
Digitaria diffusa		✓	✓
Elymus scaber var. scaber	✓		
Enneapogon spp.	✓		
Enteropogon acicularis			✓
Eragrostis megalosperma	✓		
Notodanthonia longifolia	✓	✓	✓
Panicum queenslandicum var. queenslandicum			✓
Paspalidium constrictum			✓
Poa labillardierei var. labillardierei	✓	✓	✓
Rytidosperma racemosum var. racemosum	✓	✓	
Walwhalleya proluta	✓		✓
Polygonaceae			
Rumex brownii			✓
Ranunculaceae			
Clematis microphylla		✓	
Rhamnaceae			
Alphitonia excelsa	✓		
Rubiaceae			
Galium propinquum		✓	
Psydrax odorata subsp. australiana	✓		
Rutaceae			
Geijera parviflora	✓	✓	✓
Santalaceae			
Exocarpos cupressiformis		✓	
Sapindaceae			
Alectryon oleifolius subsp. elongatus	✓		
Dodonaea sinuolata subsp. sinuolata		✓	
Dodonaea viscosa subsp. angustifolia	✓	✓	
Scrophulariaceae			
Veronica plebeia		✓	
Solanaceae			
Solanum parvifolium subsp. parvifolium	✓	✓	✓
Sterculiaceae			
Brachychiton populneus subsp. populneus		✓	

	Semi-evergreen Vine Thicket	White Box Shrubby Forest	White Box Derived Grassland
Thymelaeaceae			
Pimelea neo-anglica	✓	✓	
Verbenaceae			
Oncinocalyx betchei	✓	✓	
Xanthorrhoeaceae			
Xanthorrhoea johnsonii		✓	
Zygophyllaceae			
**Tribulus terrestris*			✓

APPENDIX 2 All Flora Species Recorded

Acanthaceae
Brunoniella australis
Rostellularia adscendens var. *adscendens*
Anacardiaceae
**Schinus areira*
Anthericaceae
Arthropodium sp. B
Apiaceae
Daucus glochidiatus
Apocynaceae
Alstonia constricta
**Gomphocarpus fruticosus*
Marsdenia viridiflora subsp. *viridiflora*
Parsonsia eucalyptophylla
Parsonsia lanceolata
Aspleniaceae
Asplenium flabellifolium
Pleurosorus subglandulosus
Asteraceae
**Bidens pilosa*
Calotis lappulacea
**Carduus* spp.
**Carthamus lanatus*
Cassinia quinquefaria
**Centaurea melitensis*
**Chondrilla juncea*
Cymbonotus lawsonianus
Euchiton gymnocephalus
Olearia elliptica
Senecio pinnatifolius var. *pinnatifolius*
Senecio quadridentatus
Vittadinia cuneata var. *cuneata*
Vittadinia muelleri
Vittadinia sulcata
**Xanthium spinosum*
Bignoniaceae
Pandorea pandorana
Boraginaceae
Ehretia membranifolia
Brassicaceae
**Lepidium africanum*
**Rapistrum rugosum*
**Sisymbrium orientale*

Cactaceae
**Opuntia aurantiaca*
**Opuntia stricta* var. *stricta*
**Opuntia tomentosa*
Campanulaceae
Wahlenbergia luteola
Capparaceae
Capparis mitchellii
Celastraceae
Denhamia cunninghamii
Chenopodiaceae
Chenopodium carinatum
Einadia hastata
Einadia nutans subsp. *nutans*
Einadia polygonoides
Maireana microphylla
Rhagodia parabolica
Sclerolaena birchii
Sclerolaena muricata var. *muricata*
Clusiaceae
Hypericum gramineum
Convolvulaceae
Convolvulus erubescens
Dichondra repens
Crassulaceae
Crassula sieberiana
Cupressaceae
Callitris glaucophylla
Cyperaceae
Carex inversa
Cyperus gracilis
Lepidosperma laterale
Scleria mackaviensis
Euphorbiaceae
Beyeria viscosa
Chamaesyce drummondii
Croton phebalioides
Fabaceae (Caesalpinioideae)
Senna artemisioides subsp. *zygophylla*
Senna coronilloides
Fabaceae (Faboideae)
Desmodium brachypodum
Desmodium gunnii
Desmodium varians
Glycine clandestina

Glycine stenophita
Glycine tabacina
Hardenbergia violacea
Hovea lanceolata
Indigofera adesmiifolia
Indigofera australis
Fabaceae (Mimosoideae)
Acacia cheelii
Acacia deanei subsp. *deanei*
Acacia decora
Acacia doratoxylon
Acacia flexifolia
Acacia implexa
Acacia lanigera var. *lanigera*
Acacia melvillei
Acacia neriifolia
Acacia paradoxa
Geraniaceae
Geranium solanderi var. *solanderi*
Haloragaceae
Haloragis serra
Lamiaceae
Ajuga australis
Marrubium vulgare
Mentha australis
Mentha satureioides
Oncinocalyx betchei
Scutellaria humilis
Spartothamnella juncea
Lomandraceae
Lomandra bracteata
Lomandra confertifolia subsp. *pallida*
Lomandra longifolia
Lomandra multiflora subsp. *multiflora*
Loranthaceae
Amyema miquelii
Dendrophthoe glabrescens
Lysiana exocarpi subsp. *tenuis*
Malvaceae
Abutilon oxycarpum
Abutilon tubulosum
Brachychiton populneus subsp. *populneus*
Gossypium sturtianum var. *nandewarense*
Hibiscus sturtii var. *sturtii*

**Malvastrum americanum*
**Modiola caroliniana*
Sida corrugata
Sida subspicata
Moraceae
Ficus rubiginosa
Myrtaceae
Angophora floribunda
Eucalyptus albens
Eucalyptus dealbata
Nyctaginaceae
Boerhavia dominii
Oleaceae
Jasminum lineare
Notelaea microcarpa var. *microcarpa*
Orchidaceae
Cymbidium canaliculatum
Pterostylis spp.
Oxalidaceae
Oxalis perennans
Phormiaceae
Dianella revoluta var. *revoluta*
Phyllanthaceae
Breynia oblongifolia
Phyllanthus gunnii
Pittosporaceae
Bursaria spinosa
Plantaginaceae
Plantago debilis
Veronica plebeia
Poaceae
Aristida ramosa
Austrostipa scabra subsp. *falcata*
Austrostipa verticillata
Bothriochloa decipiens var. *decipiens*
Chloris ventricosa
Cymbopogon refractus
Digitaria brownii
Digitaria diffusa
Elymus scaber var. *scaber*
Enneapogon spp.
Enteropogon acicularis
Eragrostis megalosperma
Notodanthonia longifolia
Panicum queenslandicum var. *queenslandicum*

Paspalidium constrictum
Poa labillardierei var. *labillardierei*
Rytidosperma racemosum var. *racemosum*
Themeda australis
**Urochloa panicoides*
Walwhalleya proluta
Polygonacea
Rumex brownii
Pteridaceae
Adiantum aethiopicum
Cheilanthes distans
Cheilanthes sieberi subsp. *sieberi*
Pellaea calidirupium
Ranunculaceae
Clematis microphylla
Rhamnaceae
Alphitonia excelsa
Rubiaceae
Galium migrans
Galium propinquum
Psydrax odorata subsp. *australiana*
Rutaceae
Geijera parviflora
Geijera salicifolia
Santalaceae
Exocarpos cupressiformis
Sapindaceae
Alectryon oleifolius subsp. *elongatus*
Atalaya hemiglauca
Dodonaea sinuolata subsp. *sinuolata*
Dodonaea viscosa subsp. *angustifolia*
Scrophulariaceae
Eremophila mitchellii
Myoporum montanum
Solanaceae
Solanum brownii
Solanum parvifolium subsp. *parvifolium*
Thymelaeaceae
Pimelea neo-anglica
Urticaceae
Urtica incisa
Viscaceae
Korthalsella rubra subsp. *geijericola*
Xanthorrhoeaceae
Xanthorrhoea johnsonii
Zygophyllaceae
**Tribulus terrestris*

Appendix 3 Flora and Fauna Species Predicted to Occur in the Mt Somner Vegetation Communities.

Vegetation Type NA199 Semi-evergreen Vine Thicket		
Scientific Name	**Common Name**	**Likelihood of Occurrence**
FLORA		
Homopholis belsonii	Belson's Panic	Unlikely, grows in woodland on poor soil
Asterolasia sp. 'Dungowan Creek'	Dungowan Starbush	Unsuitable habitat. Grows in rocky alluvial soil in riparian habitat with dominant *Casuarina cunninghamii*
BIRDS		
Grantiella picta	Painted Honeyeater	Unsuitable habitat.
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	Unsuitable habitat.
Chthonicola sagittata	Speckled Warbler	Unsuitable habitat.
Stagonopleura guttata	Diamond Firetail	Unsuitable habitat.
Tyto novaehollandiae	Masked Owl	Unsuitable habitat.
Alectura lathami - endangered population	Australian Brush-turkey population in the Nandewar and Brigalow Belt South Bioregions	No suitable habitat and outside the geographic range of the endangered population.
Hieraaetus morphnoides	Little Eagle	Unsuitable habitat.
Daphoenositta chrysoptera	Varied Sittella	Unsuitable habitat.
MARSUPIALS		
Aepyprymnus rufescens	Rufous Bettong	Unsuitable habitat.
Dasyurus maculatus	Spotted-tailed Quoll	Suitable habitat. Assumed present.
Macropus dorsalis	Black-striped Wallaby	Suitable habitat. Assumed present.
Petrogale penicillata	Brush-tailed Rock-wallaby	Unsuitable habitat.
MEGABATS		
Pteropus poliocephalus	Grey-headed Flying-fox	Suitable habitat feeding on blossom of emergent White Box. Assumed present.
MICROBATS		
Chalinolobus dwyeri	Large-eared Pied Bat	Marginal habitat.
Chalinolobus picatus	Little Pied Bat	Marginal habitat.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	Marginal habitat.
Nyctophilus corbeni	Corben's Long-eared Bat	Marginal habitat.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Marginal habitat.
Vespadelus troughtoni	Eastern Cave Bat	Marginal habitat.

Vegetation Type NA398 White Box - White Cypress Pine shrubby open forest and derived native grassland		
FLORA		
Tylophora linearis	Tylophora linearis	Suitable habitat
Dichanthium setosum	Bluegrass	Suitable habitat
Monotaxis macrophylla	Large-leafed Monotaxis	Suitable habitat
Thesium australe	Austral Toadflax	Suitable habitat
Euphrasia arguta	Euphrasia arguta	Unsuitable habitat. Grows in grassy areas near rivers.
Chiloglottis platyptera	Barrington Tops Ant Orchid	Unsuitable habitat. Grows in grassy tall forest.
Prasophyllum sp. Wybong *Prasophyllum petilum*	Prasophyllum sp. Wybong	Unsuitable. Recorded further south.
Acacia pubifolia	Velvet Wattle	Unsuitable. Grows in dry forest on granite.
Bertya opponens	Coolabah Bertya	Unsuitable. Grows in mallee.
Philotheca ericifolia	Philotheca ericifolia	Unsuitable. Grows on damp sandy soil in heath.
Pomaderris queenslandica	Scant Pomaderris	Suitable habitat
BIRDS		
Calyptorhynchus lathami	Glossy Black-Cockatoo	Unsuitable. No *Allocasuarina* or *Casuarina* feed tree species present. Excluded from calculator.
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Suitable habitat. Species recorded on site by Niche (2012) and in the current survey.
Grantiella picta	Painted Honeyeater	Suitable habitat. Feeds on fruit of mistletoe, particularly *Amyema* sp. Assumed present.
Lathamus discolor	Swift Parrot	Suitable habitat. Feeds on White Box blossom. Assumed present.
Lophoictinia isura	Square-tailed Kite	Suitable habitat as part of wider foraging range. Assumed present.
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	Suitable habitat. Assumed present.
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	Suitable habitat. Assumed present.
Neophema pulchella	Turquoise Parrot	Suitable habitat. Assumed present.
Ninox connivens	Barking Owl	Suitable habitat. Assumed present.
Polytelis swainsonii	[1]Superb Parrot	Potentially suitable habitat in White Box paddock trees. Assumed present.

Vegetation Type NA398 White Box - White Cypress Pine shrubby open forest and derived native grassland		
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	Suitable habitat in derived grassland and woodland edges. Assumed present.
Chthonicola sagittata	Speckled Warbler	Suitable habitat. Assumed present.
Stagonopleura guttata	Diamond Firetail	Suitable habitat. Assumed present.
Tyto novaehollandiae	Masked Owl	Suitable habitat. Assumed present.
Anthochaera phrygia	[2]Regent Honeyeater	Suitable foraging habitat in flowering White Box. Assumed present.
Glossopsitta pusilla	Little Lorikeet	Suitable habitat. Assumed present.
Hieraaetus morphnoides	Little Eagle	Suitable habitat. Assumed present.
Petroica boodang	Scarlet Robin	Suitable habitat. Assumed present.
Daphoenositta chrysoptera	Varied Sittella	Suitable habitat. Assumed present.
MARSUPIALS		
Aepyprymnus rufescens	[2]Rufous Bettong	Unsuitable habitat. Prefers tussock grassy woodland.
Cercartetus nanus	[2]Eastern Pygmy-possum	Suitable habitat. Assumed present.
Dasyurus maculatus	Spotted-tailed Quoll	Suitable habitat. Assumed present.
Macropus dorsalis	[1]Black-striped Wallaby	Suitable habitat. Assumed present.
Petaurus norfolcensis	[2]Squirrel Glider	Suitable habitat. Assumed present.
Petrogale penicillata	Brush-tailed Rock-wallaby	No suitable north-eastern facing rocky escarpment habitat.
Phascogale tapoatafa	[2]Brush-tailed Phascogale	Suitable habitat. Assumed present.
Phascolarctos cinereus	[2]Koala	Suitable habitat. Species recorded on site by Niche (2012) and in the current survey.
MEGABATS		
Pteropus poliocephalus	[1]Grey-headed Flying-fox	Suitable habitat. Assumed present.
MICROBATS		
Chalinolobus dwyeri	[2]Large-eared Pied Bat	Suitable habitat. Assumed present.
Chalinolobus picatus	Little Pied Bat	Suitable habitat. Assumed present.

Vegetation Type NA398 White Box - White Cypress Pine shrubby open forest and derived native grassland		
Miniopterus schreibersii oceanensis	[1]Eastern Bentwing-bat	Suitable habitat. Assumed present.
Nyctophilus corbeni	Corben's Long-eared Bat	Suitable habitat. Assumed present.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Suitable habitat. Assumed present.
Vespadelus troughtoni	[1]Eastern Cave Bat	Suitable habitat. Assumed present.
REPTILES		
Aprasia parapulchella	[2]Pink-tailed Legless Lizard	Suitable habitat. Assumed present.
Hoplocephalus bitorquatus	[1]Pale-headed Snake	Suitable habitat. Assumed present.
Uvidicolus sphyrurus	[2]Border Thick-tailed Gecko	Possible suitable habitat on scree slopes. Assumed present.

[1]Ecosystem credit species predicted for NA398 but not predicted by the calculator.

[2]Species credit fauna species.

Appendix 4 Photographs

A sampling of pictures from across the study area.

A Koala in White Box above the southern escarpment.

A typical area of scree.

Shrubby White Box forest.

View to the south east from the top of the southern escarpment

A panoramic view from the south east. The cleared foreground of a neighbouring property adjoins the Mt Somner boundary at the foot of the hills.

Appendix 5 BioBanking Credit Report

BioBanking credit report

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

Date of report: 16/06/2016 Time: 12:24:10PM Calculator version: v4.0

Biobank details

Proposal ID:	0011/2016/3708B
Proposal name:	VEP Mt Somner Offset
Proposal address:	Hennesy Road Gunnedah NSW 2380
Proponent name:	Whitehaven Coal
Proponent address:	231-233 Conadilly Street Gunnedah NSW
Proponent phone:	
Assessor name:	Colin Driscoll
Assessor address:	PO Box 1047 Toronto NSW 2783
Assessor phone:	02 4959 8016
Assessor accreditation:	0011

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
Mock Olive - Wilga - Peach Bush - Carissa semi-evergreen vine thicket (dry rainforest) mainly on basalt soils in the Brigalow Belt South Bioregion	45.00	464.00
White Box - White Cypress Pine shrubby hills open forest mainly in the Nandewar Bioregion	481.00	4,104.00
Total	526.00	4,568

Credit profiles

1. Mock Olive - Wilga - Peach Bush - Carissa semi-evergreen vine thicket (dry rainforest) mainly on basalt soils in the Brigalow Belt South Bioregion, (NA199)

Number of ecosystem credits created	464
IBRA sub-region	Liverpool Plains (Part B)

2. White Box - White Cypress Pine shrubby hills open forest mainly in the Nandewar Bioregion, (NA398)

Number of ecosystem credits created	4,104
IBRA sub-region	Liverpool Plains (Part B)

Species credits summary

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Koala	Phascolarctos cinereus	481.00	3,415
Regent Honeyeater	Anthochaera phrygia	481.00	3,415

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Koala	Exclude miscellaneous feral species
Koala	Slashing
Mock Olive - Wilga - Peach Bush - Carissa semi-evergreen vine thicket (dry rainforest) mainly on basalt soils in the Brigalow Belt South Bioregion	Exclude commercial apiaries
Mock Olive - Wilga - Peach Bush - Carissa semi-evergreen vine thicket (dry rainforest) mainly on basalt soils in the Brigalow Belt South Bioregion	Exclude miscellaneous feral species
Mock Olive - Wilga - Peach Bush - Carissa semi-evergreen vine thicket (dry rainforest) mainly on basalt soils in the Brigalow Belt South Bioregion	Feral and/or over-abundant native herbivore control
Mock Olive - Wilga - Peach Bush - Carissa semi-evergreen vine thicket (dry rainforest) mainly on basalt soils in the Brigalow Belt South Bioregion	Fox control
Regent Honeyeater	Exclude miscellaneous feral species
Regent Honeyeater	Feral and/or over-abundant native herbivore control
White Box - White Cypress Pine shrubby hills open forest mainly in the Nandewar Bioregion	Exclude commercial apiaries
White Box - White Cypress Pine shrubby hills open forest mainly in the Nandewar Bioregion	Exclude miscellaneous feral species
White Box - White Cypress Pine shrubby hills open forest mainly in the Nandewar Bioregion	Feral and/or over-abundant native herbivore control
White Box - White Cypress Pine shrubby hills open forest mainly in the Nandewar Bioregion	Fox control
White Box - White Cypress Pine shrubby hills open forest mainly in the Nandewar Bioregion	Slashing